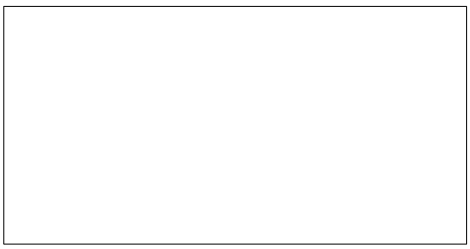

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Harder, better, faster, stronger? Mental toughness, the dark triad and physical activity

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Abstract

Mental toughness (MT) provides additional psychological resources important for achievement and health outcomes in sport. Previous research has highlighted complex relationships between the Dark Triad (DT; sub-clinical narcissism, Machiavellianism, and psychopathy) and MT, but with little focus on health-related behaviours – i.e., physical activity (PA). The aim of this study was twofold: to assess the relationship between these variables and determine any differences as a function of athlete expertise; and, to determine whether MT mediated the DT-PA relationship, and whether this relationship differed across athlete expertise. In total, 762 participants with varying levels of sports participation experience - elite (n = 222), amateur (n = 338), and non-athletes (n = 202) - completed questionnaires assessing DT, MT, and PA. Results indicated that elite athletes scored higher on all variables compared with amateur athletes who in turn scored higher than non-athletes. Moreover, positive relationships were found between narcissism and MT. Structural equation modelling indicated MT fully mediated the relationship between DT and PA, and this effect was more evident for elites and amateurs than non-athletes.

Key words: *Narcissism; Machiavellianism; Psychopathy; Mental toughness; Physical activity; Athletes*

1. Introduction

Mental toughness (MT) has been conceptualised as a multi-dimensional construct characterised by unshakeable beliefs, coping effectively with pressure and adversity, thriving under pressure, and being committed (Clough, Earle & Sewell, 2002). Research has postulated that high MT scores relate to competency in sport (Crust & Azadi, 2010; Nicholls, Polman, Levy & Blackhouse, 2008). Moreover, research suggests MT provides an advantage across domains including mental health. For example, MT may be directly related to stress reduction via increased exercise participation i.e., greater levels of physical activity (Lin, Mutz, Clough, & Papageorgiou, 2017). The Dark Triad (DT) encompasses subclinical narcissism, Machiavellianism, and psychopathy (Paulhus & Williams, 2002). This framework ostensibly describes socially-malevolent traits, however recent research has suggested that the DT may also have socially-desirable and facilitative effects across performance domains (Geukes, Mesagno, Hanrahan, & Kellmann, 2012; Roberts & Woodman, 2015; 2017; Roberts, Woodman, Lofthouse, & Williams, 2014).

Extant work has found that DT traits relate to both mental toughness and physical activity. Some work reports both positive (narcissism) and negative (Machiavellianism; psychopathy) relationships between DT and MT (Onley, Veselka, Schermer, & Vernon, 2013). Other findings suggest all three traits are positively correlated with MT, and that narcissism and Machiavellianism are positively related to moderate and vigorous physical activity (PA; Sabouri et al., 2016). The current study examined the relationship between DT components and MT with PA (Omorou, Erpelding, Escalon, & Vuillemin, 2013). Specifically, we considered the potential mediation effects of MT, due to its positive psychological advantage and differential relationship with DT traits on the DT-PA relationship and differences across athlete expertise.

1.1.Mental toughness

Clough et al.'s (2002) 4Cs model of MT adds confidence to the hardiness construct (Kobasa, 1979) in order to conceptualise the self-efficacy of MT. The 4Cs model characterises global and independent traits of MT: 'challenge' (i.e., the degree to which individuals view difficulties as personal development opportunities); 'commitment' (i.e., deep involvement in pursuits and activities); 'control', subdivided into 'emotions' (i.e., control of anxieties and arousal) and 'life' (i.e., the belief one is influential in determining outcomes); and 'confidence', subdivided into 'abilities' (i.e., a high sense of self-belief to achieve goals and low dependency on external influences) and 'interpersonal (i.e., the ability to be assertive when interacting with others).

Research has reported a positive relationship between MT and PA (Lin et al., 2017; Gerber et al., 2012). For example, this relationship differentiated those who engaged in no PA and those who engaged in moderate PA, five-seven days a week. The authors suggested that those who participated in higher level of PA (e.g., athletes) may exhibit higher levels of MT. Furthermore, research has suggested MT can buffer the negative effects of stress and depression through participation in sport (Gerber et al., 2013). Research has also reported a positive relationship between MT and vigorous PA, and a negative relationship between MT and exercise barriers; e.g., time expenditure, physical exertion and family discouragement (Stamp, Crust & Swann, 2015). Nonetheless, research has also reported no effect between MT and PA (Brand et al., 2016). However, the researchers suggested that that this may have been due to underestimation of PA.

1.2 The Dark Triad; physical and mental health

The DT are three interrelated but distinct traits: Narcissism, defined by grandiosity, entitlement, dominance, and superiority; Machiavellianism, defined by manipulation, self-service, amorality and deceit; and psychopathy, defined by impulsivity and thrill-seeking along with low empathy and anxiety (Paulhus & Williams, 2002). Taking all three together,

the models describes a "predominantly disagreeable, low conscientious, stable, extravert" (Furnham, Richards, Rangel, & Jones, 2014, p. 116). Debate remains surrounding the optimal structure of the DT, however we treat the DT as three distinct traits due to their conceptual uniqueness (Glenn & Sellbom, 2015; Furnham, Richards, & Paulhus, 2013). Research has suggested moderate positive correlations between DT components; examining mediation models regarding the DT and outcomes will help further clarify the framework, and individual traits' relationship with specific outcomes (Furnham et al., 2013).

Although the DT have historically been considered socially maladaptive (Veselka, Schermer & Vernon, 2012), recent research has reported both beneficial and adverse relationships with health-related variables (Jonason, Baughman, Carter, & Parker, 2015). For example, research has reported a negative relationship between narcissism and mental and physical ailments, suggesting it may provide a buffer from negative physical and mental health (Jonason et al.). Research has also suggested that narcissistic individuals' pride and self-worth assists them in motivation, performance, and optimism (Onley et al., 2013). Psychopathy and Machiavellianism, however, are associated with poorer psychological and physical health (Jonason et al.). Considering the relationships between DT traits and general health, it is possible that the DT will exhibit similar associations with PA, i.e., a positive relationship with narcissism and a negative relationship with psychopathy and Machiavellianism (Warburton, Nicol, & Bredin, 2006).

Onley and colleagues (2013) provided the first examination of the relationship between DT components and MT in a sample of 210 same-sex twin pairs. Results suggested negative correlations between MT and psychopathy and Machiavellianism, and a positive correlation between MT and narcissism. Additional research reflects the complex relationship between DT and MT. For example, Papageorgiou, Wong, and Clough (2017) demonstrated a non-significant relationship between MT and Machiavellianism, a negative relationship between

MT and psychopathy, and a positive relationship between MT and narcissism. Furthermore, mediation analyses indicated that narcissism exerted a significant negative indirect effect on psychopathy and Machiavellianism through MT (Papageorgiou et al., 2017).

1.3. Dark Triad, Mental Toughness, and Physical Activity

To date, only one study has examined the interplay between DT, MT and PA (Sabouri et al., 2016). Data from 341 athletes indicated a positive relationship between all DT components and MT: narcissism $r = .50$, Machiavellianism $r = .45$, and psychopathy $r = .20$. Results also highlighted a positive relationship between MT and vigorous PA. Sabouri et al. suggested that individuals with high dispositions towards DT and MT might be successful in domains such as sport as they can be both tough and ruthless at the same time. This may partly be explained by the relationship between DT traits and other attitudes. Narcissism is associated with goal striving and aspiration (Feist, 1993) – persistence in pursuing one's aims, and fortitude in spite of adversity. Similarly, individuals with higher levels of Machiavellianism are strongly committed to achieving personal targets (Paulhus & Williams, 2002), and highly psychopathic individuals are impulsive and risk-taking in pursuing their own agendas (Jones & Paulhus, 2011). Vigorous PA, which may be more demanding and reward-orientated than moderate (or no) PA may represent a socially-acceptable outlet for DT-related ambition, and both encourage and reward DT-typical behaviour.

Individuals with high levels of DT traits may therefore be both more motivated and more mentally well-equipped, via greater MT, in pursuing vigorous physical goals. In this way, MT may be an explanatory factor for the link between DT and PA. Individuals with high levels of DT traits might pursue PA and related goals, in part, as a result of their higher MT. This may, however, vary according to the DT trait in question. At present, the relationship(s) between DT, MT, and PA appears complicated: the findings of Sabouri et al. (2016) and Onley et al. (2013) conflict to some extent, and Sabouri et al. did not test for

mediation. The present study therefore seeks to further explore the directional and meditation aspects of these traits and behaviours.

1.4 The current study

To date, research investigating the relationship between DT, MT, and PA has been limited for several reasons, e.g., lack of statistical power due to small sample size; failure to consider the shared variance between DT components; and/or the potential mediation effect of MT on health-related behaviours. In this case, the issue is PA - whether individuals participate in competitive sport. Based on our review of the literature, we predict a bi-directional relationship between DT and MT; i.e., a positive relationship with narcissism and a negative relationship with psychopathy and Machiavellianism. Furthermore, we hypothesise that MT will mediate the DT-PA relationship, due to the bi-directional relationship between DT traits and MT. Finally, we predict this relationship will be stronger in elite athletes than amateurs and non-athletes.

2. Method

2.1 Participants

Seven-hundred and sixty-two participants with a range of athletic experience were recruited from English universities. The sample (355 males; 407 females) participated in a range of team and individual sports – athletics, boxing, hockey, netball, soccer, rugby, and tennis (M_{AGE} = 25.06; SD = 6.11). Participants were classified as non-athletes, amateurs, or elite, based on Swann, Moran and Piggott's (2015) review of 91 sport expertise studies. Swann and colleagues suggested criteria including highest level of competition played (regional–international level); global representation (non-Olympic/Olympic); and time spent at current level (fewer than two–more than eight years). For example, participation for less than two years classified non-athletes, whereas participation greater than eight years classified elite athletes (see Swann et al., 2015). This resulted in a final sample comprised

222 non-athletes, 338 amateurs, and 202 elite athletes. In order to determine mediation effects with bias-corrected bootstrapping, Fritz and MacKinnon (2007) recommend a minimum sample size of 462.

2.2 Materials

2.2.1 Mental toughness

The Mental Toughness Questionnaire 48 (MTQ48; Clough et al., 2002) was used to operationalise Clough and colleagues' conceptualisation of MT. Completion time ranges from 5-10 minutes with responses provided to 48 items on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Scores can be calculated for overall MT or subscale scores - confidence, commitment, challenge and control - with 22 reverse-coded items (e.g., "At times I expect things to go wrong"). Scores are polarised i.e., high scores represent higher levels of MT (Crust & Clough, 2005). Previous research has largely supported the scale's stability and factor structure, as well as its utility with athlete and non-athlete samples as a global measure of MT (e.g., Perry et al., 2013; Gerber et al., 2013).

2.2.2 The Dark Triad

The 27-item Short Dark Triad questionnaire (SD3; Jones & Paulhus, 2014) was used to assess the DT. Completion takes 5-10 minutes with 9 items for each component, on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree) with 5 reverse-scored items. Items assess narcissism (e.g., "People see me as a natural leader"), Machiavellianism (e.g., "I like to use clever manipulation to get my way"), and psychopathy (e.g., "It's true that I can be mean to others"). Research has supported the scale's reliability and validity and use within and outside of sport (Maples, Lamkin & Miller, 2014; Nicholls, Madigan, Backhouse & Levy, 2017).

2.2.3 Physical activity

The International Physical Activity Questionnaire Short Form (IPAQ; Booth, 2000) was used to gauge participants' PA levels over the preceding seven days. The nine-item scale measures the frequency and duration of vigorous and moderate-intensity activities, as well as sitting and walking, and takes approximately five minutes to complete (e.g., "During the last 7 days, on how many days did you do moderate physical activities like carrying light loads, bicycling at a regular pace, hiking? Do not include walking"). Specifically, we utilised the moderate and vigorous subscales to operationalise PA levels (Omorou et al., 2013). These scores are calculated as a result of minutes by days spent engaging in PA. Under the initiative of the World Health Organisation, the IPAQ was developed in Geneva and extensively psychometrically tested across 12 countries (Craig et al., 2003). The measure is considered reliable and valid measure for participants aged 18-59 years old (Booth, 2000; Craig et al., 2003; Fogelholm et al., 2006; Omorou et al., 2003).

2.3 Procedure

Ethical approval was granted via committee at a university in England. A request was made to sport coaches and lecturers for permission to attend training sessions and classes to ask for participants to take part. Data were collected at laboratories or training facilities using an online questionnaire battery gauging biographical information and the SD3, MTQ48, and IPAQ. Participants were briefed prior to data collection and informed of their ethical rights according to British Psychological Society guidelines. After completion, participants were debriefed and thanked. Data collection was discontinued once the a priori numbers of cases were collected. All analyses were conducted on the SPSSv23 and MPlus7.4 (Muthén & Muthén, 2014) software programs.

2.4 Design and data analysis

The study adopted a cross-sectional design with a purposive sampling technique (e.g., sports coaches were contacted as gatekeepers who distributed the survey to their athletes).

Data were screened for outliers and absent responses, and checked for normality. Only a small number of cases (3.1%) contained missing data; therefore listwise deletion was employed as recommended by Tabachnick and Fidell (2007). Box's M tests examined whether the variance–covariance matrices of male and female participants differed. Because Box's M test is highly sensitive to minor variations, it is assessed against a .001 significance level (Tabachnick & Fidell, 2007). Box's M was non-significant thus subsequent analyses were collapsed across gender. Age did not correlate significantly with either of the PA factors (vigorous r (760) = -.09, p = .11; moderate r (760) = .10, p = .08); it was therefore not entered as a covariate in subsequent analyses.

Descriptive statistics, data normality, and internal consistency via Omega (Brunsden, 2014) were computed for all necessary variables (per Tabachnick & Fidell, 2007). Once parametric assumptions were assessed (e.g., homogeneity of variance), bivariate correlations were used to explore relationships between variables. Next, MANOVA models were constructed to assess whether DT, MT, and PA differed by function of athletic expertise.

Structural equation modelling (SEM) was utilised to examine the mediating effect of MT on the relationship between the DT and PA across elite, amateur and non-athletes. The analysis was conducted using robust maximum likelihood estimation (Muthen & Muthen, 2014), where a measurement model was constructed utilising latent factors, followed by testing structural relationships. To assess mediation effects (partial and full mediation models), we used bias-corrected bootstrapping. The mean of 1,000 estimated indirect effects was calculated by creating 1,000 bootstrap samples via random sampling with replacement. If the 95% confidence intervals (CI) of the indirect effect did not include zero, significant mediation effect was inferred. Simulation studies comparing different mediation procedures have reported that bias-corrected bootstrapping is the optimum mediation procedure for

obtaining high statistical power and low Type I error rates (MacKinnon, Lockwood, & Williams, 2004).

Multigroup analysis was used to assess whether the mediation model differed across elite, amateur, and non-athletes. Group differences were explored per Muthen and Muthen (2014) whereby invariance is tested between the configural model (i.e., the same pattern of factors and loadings across groups), metric model (i.e., invariant loadings), and scalar model (i.e., invariant factor loadings and intercepts). To evaluate model fit, we adopted several incremental and absolute fit indices in combination with the likelihood ratio statistic - e.g., Chi-Square (X^2) - as recommended by Hu and Bentler (1999). A model is deemed acceptable if the Root Mean Square Error of Approximation (RMSEA) with 95% CI and Standardised Root Mean Residual (SRMR) is .06 or less, and each of the Comparative Fit Index (CFI) and Tucker Lewis Index (TLI) are .90 or greater (Marsh, Hau, & Grayson, 2005; Marsh, Hau, & Wen, 2004). Chen (2007) suggests that changes below .01 and .015 in the CFI and RMSEA, respectively, would be supportive of an invariant model in relation to the previous model.

3. Results

Measures of central tendency, distribution, and internal consistency were tabulated for the SD3, MTQ48 and IPAQ scales and subscales. Scores fell within upper percentiles of the scales, with no outliers and normal ranges of skewness and kurtosis (+/-2), meeting parametric assumptions (Tabachnick & Fidell, 2007). However, PA variables indicated higher levels of skewness and kurtosis. Nonetheless, non-normal distribution is to be expected with the IPAQ when comparing athlete and non-athlete groups (Fogelholm et al., 2006; Omorou et al., 2003). Moreover, Small's omnibus test of multivariate normality indicated that the data did not reflect multivariate normality, χ^2 (15) = 155.75, p = .002. Internal consistency for SD3 and MTQ48 scales and subscales ranged from Ω = .71 - .82, indicating good reliability (see Table 1). Internal consistency was not computed for IPAQ as

single-item indicators. Bivariate correlation results indicated linearity between variables. For example, a positive relationship between MT and narcissism, and a negative relationship between MT and psychopathy and Machiavellianism. Moreover, a positive relationship between DT subscales, a positive relationship between MT and vigorous and moderate PA, and a positive relationship between moderate PA and DT traits. However, psychopathy and Machiavellianism demonstrated a negative relationship with vigorous PA, whereas narcissism correlated positively.

Table 1.

Descriptive statistics and bivariate correlations for SD3, MTQ48, and IPAQ.

Scale	*M (SD)*				Ω	1	2	3	4	5
	Total	Elite	Amateur	Non-Athlete						
1.SD3-Narcissism	24.16 (5.92)	27.23 (6.13)	24.14 (5.49)	21.40 (4.95)	.75					
2.SD3-Psychopathy	18.94 (7.07)	23.02 (8.97)	18.41 (5.58)	16.04 (5.27)	.71	.57***				
3.SD3-Machiavellianism	25.77 (6.52)	27.95 (7.50)	25.26 (5.72)	24.58 (6.27)	.74	.48***	.66***			
4.MTQ48-Total	160.13 (23.19)	166.68 (23.86)	161.70 (21.74)	151.76 (22.38)	.82	.28**	-.26**	-.30**		
5.IPAQ-Vigorous	296.65 (586.68)	689.07 (902.79)	199.74 (291.90)	87.14 (338.85)	-	.12**	-.10*	-.15**	.43**	
6.IPAQ-Moderate	311.70 (468.94)	646.87 (502.28)	255.38 (437.73)	92.46 (282.43)	-	.37**	.45**	.24**	.18**	.38**

N = 762. SD3 = Short Dark Triad; MTQ48 = Mental Toughness Questionnaire 48; IPAQ = International Physical Activity Questionnaire.

* p <.05; **p <.01; *** p <.001

3.1 MANOVA

MANOVA indicated a significant multivariate difference between elite, amateur and non-athletes' DT (Wilks' $\lambda = .81$, F (6,1514) = 28.72, $p = .001$; $\eta\rho^2 = .19$). Individual effects were present for each DT subscale with small effect sizes for narcissism (F (2,759) = 59.01, $p = .001$, $\eta\rho^2 = .08$), Machiavellianism (F (2,759) = 16.64, $p = .001$, $\eta\rho^2 = .14$), and psychopathy (F (2,759) = 61.61, $p = .001$, $\eta\rho^2 = .15$).

A second MANOVA revealed a significant multivariate difference between elite, amateur and non-athletes' MT (Wilks' $\lambda = .87$, F (8,1512) = 13.36, $p = .001$; $\eta\rho^2 = .09$). Individual effects were also found for MT subscales with small effect sizes for challenge (F (2,759) = 34.08, $p = .001$, $\eta\rho^2 = .09$); commitment (F (2,759) = 11.72, $p = .001$, $\eta\rho^2 = .04$); control (F (2,759) = 7.08, $p = .001$, $\eta\rho^2 = .02$); and confidence (F (2,759) = 31.59, $p = .001$, $\eta\rho^2 = .08$).

A third MANOVA revealed a significant multivariate difference between elite, amateur and non-athletes' PA (Wilks' $\lambda = .71$, (F (4,1516) = 71.66, $p = .001$; $\eta\rho^2 = .19$). Individual effects with medium effect sizes were noted for vigorous (F (2,759) = 76.67, $p = .001$, $\eta\rho^2 = .18$) and moderate PA (F (2,759) = 98.33, $p = .002$, $\eta\rho^2 = .21$).

Bonferroni corrected post-hoc comparisons indicated elite athletes scored higher than amateur and non-athlete counterparts on all subscales; amateur athletes also demonstrated higher scores compared with non-athletes.

3.2 Mediation

A measurement model consisting of six inter-related latent variables DT traits, MT, vigorous PA, and moderate PA - was created using test items as indicators. PA variables were regressed on DT variables with MT as the mediator. The results of SEM on the whole sample indicated acceptable fit to the data χ^2 (6) = 28.76, $p = .002$, RMSEA = .058 90% CI (.056 - .060), SRMR = .051, TLI = .943, CFI = .952. Analysis of parameter estimates indicated all direct path coefficients were significant, suggesting MT may fully mediate the DT-PA

relationship. For example, direct paths between DT and MT indicated a bi-directional positive relationship with narcissism (β = .545, SE = .033, *p* = .004), and a negative relationship with Machiavellianism (β = -.193, SE = .091, *p* = .011) and psychopathy (β = -.208, SE = .062, *p* = .009). Furthermore, the link between MT and vigorous PA (β = .161, SE = .085, *p* = .015) and moderate PA (β = .168, SE = .079, *p* = .013) was positive (see Table 3).

To test mediation, we compared the partial mediation model with the direct paths not constrained against the full mediation model, with direct paths constrained to zero. Results indicated the full mediation model was a good fit - χ^2 (7) = 30.147, *p* = .001, RMSEA = .056 with 90% CI (.054 - .059), SRMR = .051, TLI = .948, CFI = .957 - and the partial mediation model was not a significantly better fit for the data Δ χ2 (2) = .313, *p* = .094. The significant mediating effect of MT was tested using bootstrapping procedure and indicated the DT components exerted indirect effects on vigorous and moderate PA through the simple mediating effect of MT (see Table 2).

Table 2

Bootstrapping indirect effects and 95% confidence intervals (CI) for the final mediation model.

Model Pathway	**Estimate**	**95% Confidence Interval**	
		Lower	**Upper**
Narcissism → MT → Vigorous PA	.211	.188	.247
Narcissism → MT → Moderate PA	.200	.165	.229
Psychopathy → MT → Vigorous PA	.183	.154	.219
Psychopathy → MT → Moderate PA	.177	.117	.231
Machiavellianism → MT → Vigorous PA	.185	.126	.220
Machiavellianism → MT → Vigorous PA	.157	.114	.202

Multigroup analyses were conducted to examine whether the mediation model differed across athlete expertise. Comparison of the configural model (e.g. all parameters allowed to be unequal across groups) against the metric model (e.g. holding loadings equal across groups) indicated significantly poorer fit χ^2 (12) = 10.851, p = .011 with decreases in both Δ RMSEA = .018 and Δ CFI = .019. Comparisons against the scalar model (e.g. constraining factor loadings and intercepts across groups) also produced poorer fit χ^2 (18) = 13.318, p = .029 with further decreases in both Δ RMSEA = .011 and Δ CFI = .012, thus providing evidence of non-invariance. Inspection of path coefficients in separate multigroup models highlighted differences in associations across elite, amateur and non-athlete groups. For example, associations between MT and narcissism, Machiavellianism, vigorous PA and moderate PA were strongest in the elite group whereas the association between MT and psychopathy was strongest in the non-athlete group (see Table 3).

Table 3

Parameter Estimates of invariance models across elite, amateur and non-athletes.

Path	**Elite**		**Amateur**		**Non-athletes**		**Total Sample**	
	β	**SE**	**β**	**SE**	**β**	**SE**	**β**	**SE**
Narcissism-MT	.415**	.043	.560**	.025	.563**	.027	.545**	.033
Psychopathy-MT	-.185*	.072	-.210*	.065	-.394**	.051	-.208**	.062
Machiavellianism-MT	-.266**	.063	-.179*	.076	-.128*	.080	-.193*	.091
MT-Vigorous PA	.314**	.046	.197*	.083	.118*	.093	.161*	.085
MT-Moderate PA	.212*	.059	.192*	.088	.109*	.098	.168*	.079

* p < .05 ** p < .01

4. Discussion

The aim of this paper was twofold: first, to assess the relationships between the DT, MT and PA; second, to gauge differences between elite, amateur and non-athletes. A secondary

aim was to examine whether MT mediated the relationship between DT and PA, and whether this relationship differed across athlete expertise. In general, results supported our predictions whereby elite athletes scored higher on all variables. Moreover, we found significant relationships - positive between MT and narcissism on one hand, and a negative relationship between MT and psychopathy and Machiavellianism. We also found a positive relationship between moderate PA and the DT, however psychopathy and Machiavellianism demonstrated a negative relationship with vigorous PA whereas narcissism correlated positively. Finally, mediation analyses indicated that MT fully mediates the DT-PA relationship. Specifically, this mediation effect was more pronounced for elite athletes than for non-athletes.

These findings align with previous research postulating a complex relationship between the DT and MT (Onley et al., 2013; Papageorgiou et al., 2017) and extend our understanding of the interplay between the DT, MT and PA (Sabouri et al., 2016) - specifically, the mediating effect of MT on the DT-PA relationship, and how this differed across athlete expertise. However, these findings only partially corroborate those of Sabouri et al. who reported a positive relationship between the DT and MT, whereas we found a bi-directional relationship. Similar to previous research (Jonason et al., 2015), narcissism displayed the strongest and only positive effect in our mediation analysis (compared with psychopathy and Machiavellianism). Thus, may be unique in capturing pro-social, adaptive elements of the DT (Onley et al., 2013; Papageorgiou et al., 2017). Additionally, this effect was more evident in the elite athlete sample, coinciding with previous research suggesting a link between performance and narcissism (Veselka et al., 2012).

Machiavellianism and psychopathy had a negative relationship with MT, which was more apparent in elite and non-athlete groups. Specifically, the negative psychopathy-MT relationship may be a result of differences in processing strategies, i.e. individuals high in psychopathy are often impulsive and irresponsible in stressful situations, whereas individuals

high in MT are typically confident and committed to achieving goals (Jonason et al., 2015; Onley et al., 2013). As athletes are typically higher in self-control, a defining MT feature, and individuals high in psychopathy possess limited self-control (Furnham et al., 2013), it is unsurprising that this effect was more apparent in non-athletes (Geukes et al., 2012; Onley et al., 2013). Furthermore, the inverse MT-Machiavellianism relationship albeit theoretically unusual given that both traits describe dedication to achieving personal goals, may be a result of the complexity of the constructs and the scope of individuals' operationalization e.g. the SD3 is a brief measure of DT and may not capture the breadth of the Machiavellianism concept focusing on the maladaptive aspects only. Thus, the negative relationship may be a consequence of this when correlated with a largely pro-social trait such as MT. However, it is possible that the stronger effect observed in elite athletes is due to the self-directed focus necessary to meet the demands of sport at the most competitive levels (Nicholls et al., 2017).

The mediating effect of MT and its positive relationship with both vigorous and moderate PA coincides with predictions and previous research (Clough et al., 2002; Gerber et al., 2012). Although the DT-PA link is not fully understood, the mediation effect of MT is plausible for several reasons. First, increased PA usually overlaps with outcomes associated with the DT and MT such as self-improvement (Gerber et al., 2012; Roberts & Woodman, 2015; 2017). Second, those who engage in sport are not only more physically active but are typically more self-confident, goal-orientated, and competitive, which correlate highly with the DT and MT (Crust & Azadi, 2010; Furnham et al., 2014). Third, increased PA may manifest in changes to DT and MT facets, including control and dominance (Sabouri et al., 2016). Finally, as previously mentioned, MT may provide additional psychological resources important for achievement and enabling high performance in challenging situations in sport (Lin et al., 2017).

Although the current research has several strengths, there are some limitations. For example, the cross-sectional design limits the ability to infer causality or direction of findings. Future research should examine mediation models over the course of a playing season, in longitudinal designs. Researchers may wish to examine the shared variance of the DT as a personality profile as opposed to separate components in future analyses. Furthermore, the study utilised self-report measures of the DT, MT and PA which may be subject to increases in error and biases (e.g. social desirability). For example, the suitability of the SD3 has not yet been assessed in athletic samples and some research questions the utility of the MTQ48 with elite athlete samples at the subscale level (Vaughan, Hanna, & Breslin, 2017). Future studies would also benefit from combining self-report and objective measures. Moreover, future research could use more robust measures of PA, including activity trackers in order to provide more accurate measures. Additional work could also extend models examining associations with performance and controlling for existing personality taxonomies (e.g. the Big Five). This would be useful for sport researchers and practitioners interested in the influence of personality in elite performance (Roberts & Woodman, 2015; 2017).

4.2 Conclusion

The findings of the current study support the notion that personality is complex and has utility in predicting health related behaviours (Gerber et al., 2012; Jonason et al., 2015; Warburton et al., 2006). Furthermore, it extends thinking that the DT possesses adaptive and maladaptive elements (Furnham et al., 2013). The findings indicated MT mediates the DT-PA relationship and that this effect is more apparent for elite athletes. The observed increases in PA may be a result of the DT-MT interplay, specifically regarding narcissism, which manifests as a driver to self-enhance – a requisite of successful and elite performance (Geukes et al., 2012). This may explain invariance across athletic expertise as individuals

high in MT and narcissism enjoy increased levels of competition and opportunities to improve performance status (Roberts et al., 2014). Taken together, our mediation model suggests MT training in athletes may help nullify the adaptive and maladaptive elements of the DT in relation to PA; we hope others will join with us and continue to explore this relationship.

References

Booth, M. (2000). Assessment of physical activity: an international perspective. *Research Quarterly for Exercise and Sport*, *71*, 114-120.

Brand, S., Kalak, N., Gerber, M., Clough, P. J., Lemola, S., Pühse, U., & Holsboer-Trachsler, E. (2016). During early and mid-adolescence, greater mental toughness is related to increased sleep quality and quality of life. *Journal of Health Psychology*, *21(6)*, 905-915.

Brunsden, V. (2014). From alpha to omega: A practical solution to the pervasive problem of internal consistency estimation. British Journal of psychology, 105(3), 399-412.

Chen, F. F. (2007). Sensitivity of goodness of fit indices to lack of measurement invariance. *Structural Equation Modeling, 14*, 464 – 504.

Clough, P., Earle, K., & Sewell, D. (2002). Mental toughness: the concept and its measurement. In I. Cockerill (ed.), *Solutions in Sport Psychology* (pp. 32 – 43). London: Thomson.

Craig, C. L., Marshall, A. L., Sjostrom, M., Bauman, A. E., Booth, M. L., Ainsworth, B. E., Pratt, M., Ekelund, U., Yngve, A., Sallis, J. F., & Oja, P. (2003). International Physical Activity Questionnaire: 12-Country Reliability and Validity. *Medicine Science in Sports & Exercise, 35(8),* 1381-1395.

Crust, L., & Azadi, K. (2010). Mental toughness and athletes' use of psychological strategies. *European Journal of Sports Science, 10,* 43 – 51.

Crust, L., & Clough, P. J. (2005). Relationship between mental toughness and physical endurance. *Perceptual and Motor Skills, 100,* 192 – 194.

Feist, G. J. (1993). A structural model of scientific eminence. *Psychological Science, 4,* 366–371.

Fogelholm, M., Malmberg, J., Suni, J., Santtila, M. A. T. T. I., Kyröläinen, H., Mäntysaari, M., & Oja, P. (2006). International physical activity questionnaire: Validity against fitness. *Medicine and Science in Sports and Exercise, 38(4),* 753-760.

Fritz, M. S., & MacKinnon, D. P. (2007). Required sample size to detect the mediated effect. *Psychological Science, 18(3),* 233-239.

Furnham, A., Richards, S., & Paulhus, D. (2013). The dark triad: A 10-year review. *Social & Personality Psychology Compass, 7,* 199-216.

Furnham, A., Richards, S., Rangel, L., & Jones, D. N. (2014). Measuring malevolence: Quantitative issues surrounding the Dark Triad of personality. *Personality and Individual Differences, 67,* 114-121.

Geukes, K., Mesagno, C., Hanrahan, S. J., & Kellmann, M. (2012). Testing an interactionist perspective on the relationship between personality traits and performance under public pressure. *Psychology of Sport and Exercise, 13(3),* 243-250.

Gerber, M., Kalak, N., Lemola, S., Clough, P. J., Perry, J. L., Puhse, U., Elliot, C., Holsboer-Trachsler, E., Brand, S. (2013). Are adolescents with high mental toughness levels more resilient against stress? *Stress & Health, 29(2),* 164-171.

Gerber, M., Kalak, N., Lemola, S., Clough, P. J., Puhse, U., Elliot, C., Holsboer-Trachesler, E., & Brand, S. (2012). Adolescents' exercise and physical activity are associated with mental toughness. *Mental Health and Physical Activity, 5(1),* 35-42.

Glenn, A. L., & Sellbom, M. (2015). Theoretical and empirical concerns regarding the Dark Triad as a construct. *Journal of Personality Disorders, 29,* 360-377.

Hu, L. T., & Bentler, P. M. (1999). Cut off criteria for fit indexes in covariance structural analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal, 6,* 1-55.

Jonason, P. K., Baughman, H. M., Carter, G. L., & Parker, P. (2015). Dorian Gray without his portrait: Psychological, social, and physical health costs associated with the Dark Triad. *Personality and Individual Differences, 78,* 5-13.

Jones, D. N., & Paulhus, D. L. (2011). The role of impulsivity in the Dark Triad of personality. *Personality and Individual Differences, 51,* 679-682.

Jones, D. N., & Paulhus, D. L. (2014). Introducing the Short Dark Triad (SD3): A brief measure of dark personality traits. *Assessment, 21(1),* 28-41.

Kobasa, S. C. (1979). Stressful life events, personality, and health: An inquiry into hardiness. *Journal of Personality and Social Psychology, 37(1),* 1–10.

Lin, Y., Mutz, J., Clough, P. J., & Papageorgiou, K. A. (2017). Mental Toughness and individual differences in learning, educational and work performance, psychological well-being, and personality: A systematic review. *Frontiers in Psychology, 8,* 1345. doi: 10.3389/fpsyg.2017.01345

Papageorgiou, K. A., Wong, B., & Clough, P. J. (2017). Beyond good and evil: Exploring the mediating role of mental toughness on the Dark Triad of personality traits. *Personality and Individual Differences, 119(1),* 19-23.

Paulhus, D. L., & Williams, K. M. (2002). The Dark Triad of personality: Narcissism, Machiavellianism, and psychopathy. *Journal of Research in Personality, 36(6),* 556-563.

Perry, J. L., Clough, P. J., Crust, L., Earle, K., & Nicholls, A. R. (2013). Factorial validity of the Mental Toughness Questionnaire-48. *Personality and Individual Differences, 54,* 587–592.

MacKinnon, D. P., Lockwood, C. M., & Williams, J. (2004). Confidence limits for the indirect effect: Distribution of the product and resampling methods. *Multivariate Behavioral Research, 39,* 99–128.

Maples, J. L., Lamkin, J., & Miller, J. D. (2014). A test of two brief measures of the dark triad: The dirty dozen and short dark triad. *Psychological Assessment, 26(1),* 326-331.

Marsh, H. W., Hau, K. T., & Grayson, D. (2005). Goodness of Fit Evaluation in Structural Equation Modelling. In A. Maydeu-Olivares & J. McArdle (Eds.), *Contemporary Psychometrics. A Festschrift for Roderick P. McDonald* (pp. 275-340). Mahwah, NJ: Erlbaum.

Marsh, H. W., Hau, K. T., & Wen, Z. (2004). In search of golden rules: Comment on hypothesis testing approaches to setting cut-off values for fit indexes and dangers in over-generalising Hu & Bentler's (1999) findings. *Structural Equation Modeling, 11,* 320–341.

Muthén, L. K. & Muthén, B. O. (2014). *Mplus User's Guide*. Los Angeles, CA: Muthén & Muthén.

Nicholls, A. R., Madigan, D. J., Backhouse, S. H., & Levy, A. R. (2017). Personality traits and performance enhancing drugs: The Dark Triad and doping attitudes among competitive athletes. *Personality and Individual Differences, 112,* 113-116.

Nicholls, A. R., Polman, R. C., Levy, A. R., & Backhouse, S. H. (2008). Mental toughness, optimism, and coping among athletes. *Personality and Individual Differences, 44,* 1182–1192.

Omorou, Y. A., Erpelding, M., Escalon, H., & Vuillemin, A. (2013). Contribution of taking part in sport to the association between physical activity and quality of life. *Quality of Life Research, 22(8),* 2021-2029.

Onley, M., Veselka, L., Schermer, J. A., & Vernon, P. A. (2013). Survival of the scheming: A genetically informed link between the Dark Triad and mental toughness. *Twin Research and Human Genetics, 16*(6), 1087-1095.

Roberts, R., & Woodman, T. (2015). Contemporary personality perspectives in sport psychology. In S. D. Mellalieu & S. Hanton (Eds.), *Contemporary advances in sport psychology: A review* (pp. 1-27). New York, NY: Routledge.

Roberts, R., & Woodman, T. (2017). Personality and performance: Moving beyond the Big 5. *Current Opinion in Psychology, 16,* 104-108.

Roberts, R., Woodman, T., Lofthouse, S., & Williams, L. (2014). Not all players are equally motivated: The role of narcissism. *European Journal of Sport Science, 15(6),* 536-542.

Sabouri, S., Gerber, M., Bahmani, D. S., Lemola, S., Clough, P. J., Kalak, N., Shamsi, M., Holsboer-Trachsler, E., & Brand, S. (2016). Examining Dark Triad traits in relation to mental toughness and physical activity in young adults. *Neuropsychiatric Disease and Treatment, 12,* 229-235.

Stamp, E., Crust, L., & Swann, C. (2015). Relationships between mental toughness, physical activity and barriers to exercise in undergraduate students. British Psychological Society Department of Sport and Exercise Science Conference, Leeds.

Swann, C., Moran, A., & Piggott, D. (2015). Defining elite athletes: Issues in the study of expert performance in sport psychology. *Psychology of Sport and Exercise 16(1),* 3-14.

Tabachnick, B.G., & Fidell, L.S. (2007). *Using multivariate statistics*. Boston, MA: Allyn and Bacon.

Vaughan, R., Hanna, D., & Breslin, G. (2017). Psychometric properties of the mental toughness questionnaire 48 (MTQ48) in elite, amateur and nonathletes. *Sport, Exercise, and Performance Psychology.* Advance online publication. http://dx.doi.org/10.1037/spy0000114

Veselka, L., Schermer, J. A., & Vernon, P. A. (2012). The Dark Triad and an expanded framework of personality. *Personality and Individual Differences, 53(4),* 417-425.

Warburton, D. E., Nicol, C. W., & Bredin, S. S. (2006). Health benefits of physical activity: The evidence. *Canadian Medical Association Journal, 174(6),* 801-809.