

1 Transformational Parenting and Coaching on Mental Toughness and Physical Performance in

2 Adolescent Soccer Players: The Moderating Effect of Athlete Age

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### Abstract

Both parent and coach leadership behaviours are instrumental to adolescent athlete development. Researchers, however, are yet to examine parent and coach leadership influences simultaneously, and at different stages of adolescents' psychological and physical development. Therefore, the purpose of this study was to understand if the effects of transformational parenting, and transformational coaching on mental toughness and performance varied at different ages during adolescence. Early adolescent (ages 10-14) and late adolescent (ages 15-18) soccer players ( $n = 334$ ) completed questionnaires assessing their perceptions of their mother's, father's, and coach's transformational leadership, as well as a questionnaire assessing mental toughness. Participants also completed a comprehensive battery of physical fitness tests relevant to soccer. Results indicated that transformational fathering was more strongly associated with levels of mental toughness for early adolescent athletes than it was for later adolescent athletes. Results also indicated that transformational coaching was more strongly associated with physical performance for later adolescent athletes than it was for early adolescents. Overall, these results can inform development models and provide support for future longitudinal studies to assess the impact of parent and coach transformational leadership across different stages of athlete development.

*Keywords:* Leadership, youth, mother, father, development

26           **Transformational Parenting and Coaching on Mental Toughness and Physical**  
27           **Performance in Adolescent Soccer Players: The Moderating Effect of Athlete Age**

28           Adolescence is an important time in the development of an athlete. During this period,  
29 many young athletes are competing for professional contracts that will dictate their future  
30 participation in sport and overall life course. While there are many factors that contribute to the  
31 success of athletes' careers, their psychological and physical development are of high  
32 importance. Compared to non-athletes and recreational athletes, athletes performing at a high  
33 level have been observed to be more mentally tough (Vaughan, Donncha, & Breslin, 2018) and  
34 record higher scores on physical performance tests (Dugdale, Arthur, Sanders, & Hunter, 2019).  
35 As such, understanding how athletes develop mental toughness and their physical performance  
36 can significantly contribute to strategies aimed at improving adolescent athlete development. To  
37 date, researchers have identified athletes' support networks, specifically parents and coaches, as  
38 an essential component of athletes' psychological and physical development (Rees & Hardy,  
39 2000). Specifically leadership behaviours from both parents and coaches, such as setting a  
40 positive example and inspiring motivation (i.e., transformational leadership behaviours), have  
41 been associated with both mental toughness and performance outcomes (Bell, Hardy, & Beattie,  
42 2013; Charbonneau, Barling, & Kelloway, 2001). Further, the impact of parents and coaches  
43 might differ as athletes' progress from early adolescence (around ages 10-14) into and through  
44 late adolescence (around ages 15-18). As athletes get older, for example, they may be less  
45 influenced by their parents, while at the same time more influenced by their coaches (Côté,  
46 1999). Therefore, the purpose of this study was to understand if the effects of transformational  
47 parenting and transformational coaching on mental toughness and physical performance varies as  
48 a function of age.

49 Bass (1995) defined a transformational leader as “someone who raised [followers’]  
50 awareness about issues of consequence, shifted them to higher-level needs, influenced them to  
51 transcend their own self-interests for the good of the group or organization, and to work harder  
52 than they originally had expected they would” (p.167). Transformational leadership is an  
53 important predictor of psychological and behavioural outcomes within many different contexts  
54 including sport (Bormann, Schulte-coerne, Diebig, & Rowold, 2016), military (Bass, Avolio,  
55 Jung, & Berson, 2003), school (Verma, Eklund, Arthur, Howle, & Gibson, 2019), and family  
56 (Morton et al., 2011). Within sport specifically, transformational leadership behaviours have  
57 been associated with higher levels of mental toughness and performance (Bell et al., 2013).

58 Transformational leadership can be manifested within parents (i.e., transformational  
59 parenting; Morton et al., 2011) and is likely associated with both mental toughness and physical  
60 performance. Mental toughness, “a personal capacity to produce consistently high levels of  
61 performance despite everyday challenges and stressors as well as significant adversities”  
62 (Gucciardi, Hanton, Gordon, Mallett, & Temby, 2015, p. 5), is believed to be fostered through  
63 parental supportiveness and parental belief in their child’s sporting capabilities (Connaughton et  
64 al., 2008). Although there is a dearth of research quantitatively examining parental influences  
65 that foster mental toughness in adolescents, Morton and colleagues’ conceptualization of  
66 transformational parenting aligns with the qualities needed to improve mental toughness. For  
67 example, Morton and colleagues suggest that transformational parenting involves  
68 communicating high expectations and optimism regarding what their children can achieve (i.e.,  
69 inspirational motivation). As such, transformational parenting is likely associated with higher  
70 levels of mental toughness in adolescent athletes. Further, the support and belief that is consistent  
71 with transformational parenting might also facilitate athletes’ physical performances. For

72 example, researchers have found that athletes typically perform better when fellow teammates  
73 demonstrate a strong belief in their abilities (Habeeb, Eklund, & Coffee, 2017). This research  
74 suggests that individuals' performance is significantly better when they perceive those around  
75 them believe in their abilities. Extending this beyond teammates, athletes who perceive that their  
76 parents believe in them (i.e., transformational parenting) likely demonstrate a stronger physical  
77 performance compared to athletes whose parents do not demonstrate a belief in them.

78         Alongside parents, transformational leadership behaviours displayed by coaches (i.e.,  
79 transformational coaching; Arthur, Woodman, Ong, Hardy, & Ntoumanis, 2011) can also have  
80 an impact on athletes' mental toughness and performance. Sport coaches are often seen as  
81 leaders to adolescents (Burgess & Naughton, 2010) and in this context, transformational  
82 coaching can positively impact athlete developmental outcomes such as athlete motivation (e.g.,  
83 Arthur et al., 2011). Indeed, coaches' abilities to motivate athletes through transformational  
84 coaching may be responsible for the positive impact transformational coaching has on both  
85 mental toughness and physical performance in adolescent followers (Bell et al., 2013). An  
86 intervention study on adolescent cricketers found that athletes report higher levels of mental  
87 toughness and perform better when their coaching staff demonstrate transformational coaching  
88 behaviours. As such, athletes exposed to transformational coaching are likely to report higher  
89 mental toughness and stronger physical performance.

90         Importantly, these effects of transformational parenting and coaching on mental  
91 toughness and performance likely evolve as athletes progress through adolescence. According to  
92 the Long Term Athlete Development model, adolescents progress through different stages within  
93 their psychological and physical development as an athlete (Balyi & Hamilton, 2004; Ford et al.,  
94 2011). Within this model, children's early sporting experiences should be focused on fun and

95 participation. It is not until athletes reach early adolescence (around ages 10-14) that they should  
96 participate in focused training (i.e., training to train) and then progress into training for  
97 competition (i.e., training to compete) during mid-to-late adolescence (around ages 14-18).  
98 Further, regarding skill development, researchers have noted important differences in how youth  
99 engage in sport as they progress through adolescence. For example, researchers noted the  
100 importance of deliberate play (e.g., street hockey with friends) during childhood and early  
101 adolescence (Ford, Ward, Hodges, & Williams, 2009), while deliberate practice (e.g., a team  
102 practice run by a coach) becomes more important into middle-to-late adolescence (Côté,  
103 Ericsson, & Law, 2007).

104         The changes in engagement in sport as young athletes grow older might have an  
105 important role in determining the strength and direction of psychological and behavioural  
106 relationships pertinent to athlete development. There is evidence that parents are more influential  
107 during childhood and early adolescence which coincides with the training to train and deliberate  
108 play stages of athlete development (Côté, 1999; Holt, 2016). Coaches, however, are believed to  
109 be more influential at middle-to-late adolescence and into young adulthood, which is closer to  
110 the training to compete and deliberate practice stages of athlete development (Côté, 1999; Holt,  
111 2016). These propositions, however, have not been tested in a leadership model in early  
112 adolescent and adolescent athletes.

113         Building on previous research, the current study was designed to test whether the effects  
114 of transformational parenting and coaching on athlete mental toughness and physical  
115 performance varied at different ages during adolescence. It was hypothesized that:

116 1. There would be a stronger positive relationship between transformational mothering/fathering  
117 and (a) mental toughness and (b) physical performance among athletes in early adolescence (i.e.,  
118 ages 10-14) compared to athletes in later adolescence (i.e., ages 15-18).

119 2. There would be a stronger positive relationship between transformational coaching and (a)  
120 mental toughness and (b) performance in athletes in later adolescence, compared to a weaker  
121 relationship in early adolescence.

## 122 **Method**

### 123 **Participants**

124 A total of 334 male Scottish soccer players from 49 teams participated in this study.  
125 Participants' age ranged from 10.0 years to 17.3 years ( $M = 13.6$ ,  $SD = 1.7$ ). Participants were  
126 recruited from 24 competitive adolescent soccer clubs from the 'Club Academy Scotland'  
127 infrastructure within the Scottish Football Association, across three levels; amateur ( $n = 115$ ),  
128 development ( $n = 97$ ), and performance ( $n = 122$ ). Data from 20 participants were removed from  
129 the final analysis because they participated in a team with less than three athletes participating in  
130 the study ( $n = 15$ ), they were a single parent child or reported information for only one parent ( $n$   
131  $= 4$ ), or failed to complete any of the performance measures ( $n = 1$ ). The final sample consisted  
132 of 314 athletes from 36 teams (11 amateur, 11 development, and 14 performance).

### 133 **Measures**

134 **Demographics and anthropometrics.** Height was assessed using a free-standing  
135 stadiometer (Seca, Birmingham, UK) and reported to the nearest 0.1cm, while weight was  
136 assessed using digital floor scales (Seca, Birmingham, UK) and reported to the nearest 0.1kg.  
137 Participants also reported their date of birth and current playing club.

138           **Transformational parenting.** Transformational mothering and transformational  
139 fathering was assessed using the Transformational Parenting Questionnaire (TPQ; Morton et al.,  
140 2011). The scale consists of 16-items assessing four dimensions: idealized influence,  
141 inspirational motivation, intellectual stimulation, and individualized consideration. All subscales  
142 were combined to achieve a composite measure of transformational mothering and  
143 transformational fathering. Participants answered items separately for each of their parental  
144 figures (i.e., whomever a participant deemed to fulfil the primary mother role and father role; not  
145 required to be a biological parent). Participants responded to all items on a six-point scale  
146 ranging from *strongly disagree* (0) to *strongly agree* (5). The internal consistency ( $\alpha$ ) of  
147 responses to the items was .84 for transformational mothering and .90 for transformational  
148 fathering within this sample of participants.

149           **Transformational coaching.** Transformational coaching was assessed using a modified  
150 version of the Differentiated Transformational Leadership Inventory (DTLI; Hardy et al., 2010).  
151 The scale consists of 27 items to assess seven dimensions: individual consideration, inspirational  
152 motivation, intellectual stimulation, high performance expectations, fostering acceptance of  
153 group goals, contingent reward, and appropriate role modelling<sup>1</sup>. All subscales were combined to  
154 create a composite measure of transformational coaching. Participants were instructed to answer  
155 items relative to their head coach and responded to all items on a five-point scale ranging from  
156 *not at all* (1) to *all the time* (5). The internal consistency ( $\alpha$ ) of responses to the items for  
157 transformational coaching was .89 within this sample of participants.

158           **Mental toughness.** Mental toughness was measured using the Mental Toughness Index  
159 (MTI; Gucciardi, Hanton, Gordon, Mallett, & Temby, 2015). This measure has been used across

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<sup>1</sup> Items within the individualised consideration and inspirational motivation subscales were different from the copyrighted items associated with this scale.



160 performance contexts and with youth samples (Mahoney, Ntoumanis, Gucciardi, Mallett, &  
161 Stebbings, 2016). The MTI consists of eight items that measure the extent to which athletes  
162 agree with statements pertaining to their perceptions of mental toughness (e.g., “I believe in my  
163 ability to achieve my goals). Items were rated on a scale of *100% false* (1) to *100% true* (7). The  
164 internal consistency ( $\alpha$ ) of responses to the items was .82 in this sample of participants.

165 **Physical performance.** Performance was measured using seven field-based fitness tests  
166 commonly used as physical performance measures within adolescent soccer (Paul & Nassis,  
167 2015); grip dynamometry, standing broad jump, countermovement vertical jump, 505 change of  
168 direction, T-drill, 10m sprint, and 20m sprint. All selected tests were identified to be appropriate  
169 for implementation across the entire age range of the selected sample, and relevant to the  
170 demands of adolescent soccer (Paul & Nassis, 2015). Tests of physical performance were  
171 conducted at two time points around one week apart. Validity and reliability of these measures  
172 has been demonstrated in previous research (Dugdale et al., 2019). The physical performance  
173 data for the 314 individuals in our analytic sample were also included in the 373 individuals  
174 analysed in Dugdale et al., (2019).

## 175 **Procedures**

176 The study received approval from an ethics committee at a university in the United  
177 Kingdom. Prior to data collection, and in compliance with the recommendations of the  
178 Declaration of Helsinki, participant and parental/guardian consent was gained alongside  
179 providing comprehensive written and oral explanations about the study. Upon obtained  
180 consent/assent, participants’ demographic and anthropometric measures were collected.  
181 Participants then completed the transformational leadership questionnaires (i.e., mother, father,  
182 and coach) and mental toughness questionnaire without the presence of coaches or parents.

183 Following completion of questionnaires, participants completed the seven physical performance  
184 tests. Follow up physical performance testing was completed within two weeks of the first  
185 testing session. Physical performance testing lasted approximately one hour in length for both  
186 testing sessions.

### 187 **Data Analysis**

188 Descriptive statistics, reliability coefficients, bivariate correlations, and intraclass  
189 correlation coefficients (ICC) of the outcome variables were calculated. ICC values were .19 for  
190 mental toughness and .24 for performance, indicating a meaningful amount of variance was  
191 present at the team level. Multilevel models were conducted to account for the interdependencies  
192 in the dataset (i.e., players nested within teams). However, the analytic focus remained on the  
193 individual level and therefore random intercepts and fixed slope models were used. The R  
194 package nlme (Bates, Machler, Bolker, & Walker, 2015) was used to compute separate  
195 multilevel models for mental toughness and performance. All transformational leadership  
196 variables were group mean centred while control (i.e., athlete height, weight, and club level) and  
197 moderating variables (i.e., age) were standardized. Test of homogeneity, linearity, and normality  
198 adhered to assumptions of residual normality. Little's (1988) MCAR statistic was not significant  
199  $\chi^2(585) = 576.02, p = .353$ , indicating that missing values were missing completely at random.  
200 The proportion of missing data was < 1% for all variables. All missing data were replaced using  
201 the individual's mean score for the subscale in which the item was missing. When participants  
202 missed one of the testing sessions (< 1.3%) their scores from the session in which they did attend  
203 were used as their physical performance scores.

204 To calculate an overall physical performance score, participants' scores on physical  
205 performance tests (e.g., agility, sprint, etc.) over two time points were averaged together and then

206 standardized. Timed scores were then multiplied by -1 so that positive scores indicated a better  
207 performance for all tests. Participants' standardized scores across all performance tests were  
208 averaged together to obtain a global performance score. Finally, in line with performance  
209 assessment criteria of the Scottish Football Association, we calculated athletes' relative  
210 performance scores by birth year so that performance scores represented athletes' physical  
211 abilities relative to athletes born in the same year. To achieve this end, the mean global  
212 performance score from each birth year was subtracted from each participants' global  
213 performance score.

214         For the multilevel analysis, athlete team was included as a random effect to account for  
215 group level nesting. Club level was included as a covariate to account for performance  
216 differences at different levels. Further, as a result of the substantial effect that advanced physical  
217 and biological maturation has upon fitness test performance (Lovell et al., 2015), athlete height  
218 and weight, were included as control variables in the performance model. Club level was  
219 included as a covariate in the mental toughness model; however, height and weight were not  
220 included as covariates in the mental toughness model. For both models, the interactions between  
221 transformational mothering and athlete age, transformational fathering and athlete age, as well as  
222 transformational coaching and athlete age were included as predictor variables at the individual  
223 level. These models were simplified using backwards stepwise deletion with the stepAIC  
224 function of the MASS library in R (Venables & Ripley, 2002). The best fitting model was  
225 selected as that with the lowest AIC value. Instances in which there was a significant interaction  
226 in the best fitting model were followed up using a simple slopes analysis with the simple slopes  
227 function in the reghelper package in R (Hughes, 2020). Slopes for the moderator variable (age)

228 were measured at -1 SD below the mean (11.86 years old) and 1 SD above the mean (15.34 years  
229 old).

## 230 **Results**

231 Descriptive statistics, and bivariate correlations are reported in Table 1. AIC values for  
232 each of the Multilevel Linear Models are presented in Table 2. As a preliminary analysis, a one-  
233 way ANOVA revealed no significant differences in mental toughness between club levels,  
234  $F(2,311) = 1.30, p = .27$ . There were, however, significant differences in physical performance  
235 between club levels  $F(2,311) = 20.75, p < .01$ . Post-hoc Tukey tests revealed that, compared to  
236 athletes on the amateur teams, athletes on the performance teams,  $p < .01$ , and development  
237 teams,  $p < .01$ , performed significantly better.

## 238 **Multilevel Models**

239 **Mental Toughness Model.** The best fitting model included the interaction and lower  
240 order terms associated with transformational fathering and athlete age, as well as the main effect  
241 of transformational coaching ( $\Delta$ AIC relative to the next best fitting model = 1.05). There was  
242 support for Hypothesis 1a as the interaction between transformational fathering and athlete age  
243 was included in the best fitting model,  $b = -.24, se = .06$ . As illustrated in Figure 1, follow up  
244 simple slopes analysis revealed a stronger positive relationship between transformational  
245 fathering and mental toughness among early adolescent athletes,  $b = .59, se = .12$ , compared to  
246 the relationship between transformational fathering and mental toughness among later adolescent  
247 athletes,  $b = .12, se = .07$ . The predicted interaction between transformational mothering and  
248 mental toughness, however, were not included in the best fitting model. Hypothesis 2a was not  
249 supported as the interaction between transformational coaching and athlete age was not included  
250 in the best fitting model. However, the main effect of transformational coaching was retained in

251 the best fitting model, indicating that transformational coaching is positively associated with  
252 mental toughness regardless of age,  $b = .44$ ,  $se = .09$ .

253 **Performance Model.** The best fitting model included control variables of height and  
254 club level, and the interaction between transformational coaching and athlete age ( $\Delta AIC$  relative  
255 to the next best model = 1.07). Height was positively associated with performance and athletes  
256 performing at a higher club level also demonstrated better performance. There was no evidence  
257 to support Hypothesis 1b as the interaction terms between transformational mothering and athlete  
258 age and transformational fathering and athlete age were not included in the best fitting model.  
259 Hypothesis 2b was supported as the interaction between transformational coaching and athlete  
260 age was included in the final model,  $b = .14$ ,  $se = .08$ . As illustrated in Figure 2, simple slopes  
261 analysis revealed a stronger positive relationship between coaches' transformational leadership  
262 and performance among later adolescent athletes,  $b = .19$ ,  $se = .11$ , compared to the weaker  
263 negative relationship among early adolescent athletes,  $b = -.11$ ,  $se = .11$ .

## 264 **Discussion**

265 The purpose of this study was to understand if the effects of transformational parenting  
266 and transformational coaching on mental toughness and performance vary as a function of age.  
267 As such, two hypotheses were tested. Hypothesis 1a was partially supported as transformational  
268 fathering appeared to be positively associated with mental toughness in early adolescence.  
269 However, this did not appear to be the case for transformational mothering. Hypothesis 1b was  
270 not supported however, as there were no relationships between transformational mothering or  
271 fathering and physical performance across adolescence. Hypothesis 2a was not supported as  
272 transformational coaching appeared to be associated with mental toughness regardless of age.  
273 Hypothesis 2b, however, was supported, as there was a positive association between

274 transformational coaching and physical performance in late adolescent athletes compared to  
275 early adolescent athletes.

276         Researchers (e.g., Knight, Berrow, & Harwood, 2017) have stated the complexity of  
277 parental involvement in sport and the current study helps shed some light into this area. As  
278 expected, coaches appeared to be less influential than parents on early adolescents. Interestingly,  
279 transformational fathering was more strongly associated with early adolescents' mental  
280 toughness than transformational mothering. This finding is similar to previous research findings  
281 in that fathers are typically more influential on perceived physical activity capabilities  
282 (Gustafson & Rhodes, 2006; Morton et al., 2011) compared to mothers, who are instrumental in  
283 developing nutritional competencies in adolescent offspring (Morton et al., 2011; Scaglioni,  
284 Salvioni, & Galimberti, 2008). These results may be explained by sociological factors such as  
285 cultural norms pertinent to mothers' and fathers' roles in youth athlete development. That is,  
286 while both mothers and fathers are often involved in their children's sporting experience, fathers  
287 typically become more involved with the performance development aspect of the sport, more  
288 often assuming coaching and officiating duties compared to mothers (Coakley, 2006). As such,  
289 adolescents become more influenced by the behaviours of their fathers (e.g., transformational  
290 fathering) compared to the behaviours of their mothers (e.g., transformational mothering), at  
291 least in sport. Although the current sample consisted of only male athletes, it is noteworthy that  
292 fathers get more involved in their daughters' performance development compared to mothers  
293 (Neferetiti & Bopp, 2011), and as such, the current results might also be applicable to adolescent  
294 girls. Further research is needed to understand these differences in parental roles and to examine  
295 whether these trends are reversed when mothers are more involved in the performance  
296 development of their sons' and daughters'.

297           A positive relationship between transformational coaching and physical performance was  
298 observed within later adolescent athletes (around 15-18 years old), but not early adolescent  
299 athletes (around 10-14 years old), indicating that transformational coaching might be more  
300 important during late adolescence. This supports previous findings that athletes who are in early  
301 adolescence are believed to be more receptive to influence by their parents, while those who are  
302 in late adolescence are believed to be more receptive to influence by coaches (Côté, 1999; Holt,  
303 2016). Understanding that transformational coaching might help improve physical performance  
304 at later stages of adolescent development advances our theoretical and applied understanding that  
305 coaches play an instrumental role in athlete development, particularly during the training to  
306 compete stage of the Long Term Athlete Development Model (Balyi & Hamilton, 2004).

307           Overall, these results are important as they help us understand more about the impact of  
308 adolescent athletes' support network. There has been a wealth of research conducted to examine  
309 the physical aspects of athlete development (Ford et al., 2011). The results of the current study  
310 build on this research by offering evidence that, as athletes get older, their mental and physical  
311 development appears to be more influenced by coaches than parents. This might be because, as  
312 adolescents get older, they rely on their coach for instruction rather than their parents (Côté,  
313 1999). Consequently, it might be that they are more attentive to the coach influence, and thus  
314 more receptive to their transformational leadership behaviours. These findings can be used to  
315 inform youth athlete performance development strategies. As athletes get older, the role of the  
316 coach appears to be more influential when it comes to performance development and, as such,  
317 interventions should be designed to facilitate performance development through instruction from  
318 the coach.

319           This aligns with the intervention conducted by Bell and colleagues (2013), who  
320 implemented a transformational leadership intervention through the coaching staff. Indeed, this  
321 intervention effectively improved mental toughness and performance in late adolescents. On the  
322 other hand, interventions aimed at developing early adolescent athletes' psychological skills  
323 should be developed through transformational parenting. Although Morton and colleagues  
324 observed that components of transformational parenting and authoritative parenting (Suldo &  
325 Huebner, 2004) are both positively correlated with positive outcomes such as adolescent  
326 satisfaction, transformational parenting offers a conceptually sound framework to implement  
327 interventions (Morton et al., 2011). This aligns well with recommendations by Harwood, Knight,  
328 Thrower, and Berrow (2019) who emphasized the importance of parental involvement in the  
329 development of young adolescent athletes. Moving forward, researchers should explore whether  
330 transformational parenting explains changes in developmental outcomes beyond that of other  
331 parenting styles and how parenting interventions might be an important element to facilitate  
332 adolescent athlete development.

333           The current study was cross-sectional in nature; thus, direction of causality could not be  
334 confirmed. While, Arthur, Bastardo, and Eklund (2017) argue that cross sectional designs  
335 should not be used unless in the very early stages of theory development, the current research is  
336 the first to simultaneously examine parent and coach influences across different ages of  
337 adolescence to understand the association mental toughness and performance. In light of the  
338 current results and in line with Arthur and colleagues' recommendations, further research could  
339 be conducted to understand causal associations between transformational parenting and  
340 coaching, mental toughness, and performance. Specifically, utilizing a longitudinal design to  
341 examine how transformational leadership influences mental toughness over time, and whether



342 changes in mental toughness are associated with performance improvements. Further research  
343 could also explore these effects within the context of different competition levels. While results  
344 indicated that physical performance was better at higher competition levels, no differences in  
345 mental toughness were observed. However, researchers using a heterogenous sample of adults  
346 from various sports as well as non-athletes observed that more competitive athletes reported  
347 higher levels of mental toughness (Vaughan et al., 2018). Future research should explore whether  
348 these inconsistent results are due to differences in the ages of the sample, the type of sport being  
349 assessed, differences between measures of mental toughness (i.e., the MTI vs MTQ48), or  
350 another unknown variable.

351         Variables in this study were measured at the individual level while controlling for the  
352 multilevel nature of the data. Team-level variables (e.g., on field team performance) were not  
353 measured, and therefore, future research might examine the observed relationships at the team  
354 level. Indeed, researchers have observed that transformational coaching facilitates working better  
355 with teammates (Cronin, Arthur, Hardy, & Callow, 2015) and that transformational coaching is  
356 associated with better basketball team performance (Bormann & Rowold, 2016). Therefore,  
357 while the current study provided evidence that transformational coaching is associated with  
358 individual physical performance in late adolescence, these effects may be stronger for on field  
359 team performance. As such, researchers should investigate whether transformational coaching  
360 improves team performance in later adolescence.

361         In summary, this research was the first to simultaneously examine the effects of parents  
362 and coaches' leadership on adolescent athletes. There was little evidence that parents influenced  
363 adolescents' performance on physical fitness tests. It may be instead, that parents, specifically  
364 fathers, are potentially more influential in fostering adolescents' psychological development such

365 as mental toughness while coaches might be more influential in developing performance  
366 outcomes. Finally, if the results of this study can be replicated using causal research designs, we  
367 can suggest that exposing late adolescent athletes to coaches who demonstrate transformational  
368 leadership behaviours might be an effective strategy to help them improve their physical  
369 performance.  
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488



Table 1. Descriptive statistics and bivariate correlations for study variables.

	Descriptive Statistics		Bivariate correlations							
	M	SD	1	2	3	4	5	6	7	
1. Height (cm)	161.37	12.86								
2. Weight (kg)	51.00	11.77	.74**							
3. Age (years)	13.11	1.79	.20**	.22**						
4. Transformational Mothering	4.58	.41	-.07	-.02	-.01					
5. Transformational Fathering	4.55	.54	-.07	-.08	.01	.64**				
6. Transformational Coaching	4.26	.37	-.04	-.04	.05	.36**	.29**			
7. Mental Toughness	6.10	.62	-.04	.02	.04	.30**	.29**	.39**		
8. Performance	0.00	.51	.40**	.27**	.14**	-.06	-.05	.02	-.06	

Note. Bivariate correlations are reported at the individual level while controlling for the nested nature of the data.

Table 2. Table of coefficients, standard errors and Akaike Information Criterion (AIC) values of models explaining variation in mental toughness and performance.

<b>Mental Toughness</b>		AIC
1. Club level, TM*Age, TF*Age, TC*Age		518.60
2. Club level, TM, TF*Age, TC*Age		516.66
3. Club level, TM, TF*Age, TC		515.28
4. TM, TF*Age, TC		513.95
5. TF*Age, TC		512.90
<b><u>Final model</u></b>	<b><u>B (SE)</u></b>	<b><u>R<sup>2</sup></u></b>
Transformational coaching	0.44 (.09)	.08
Transformational fathering	0.36 (.07)	.08
Age	-0.09 (.05)	.03
Transformational fathering * Age	-0.24 (.06)	.04
<b>Performance</b>		
1. Height, Weight, Club level, TM*Age, TF*Age, TC*Age		444.06
2. Height, Weight, Club level, TM, TF*Age, TC*Age		442.08
3. Height, Club level, TM, TF*Age, TC*Age		440.15
4. Height, Club level, TM, TF, TC*Age		438.48
5. Height, Club level, TM, TC*Age		436.48
6. Height, Club level, TC*Age		435.41
<b><u>Final model</u></b>	<b><u>B (SE)</u></b>	<b><u>R<sup>2</sup></u></b>
Height	0.02 (.003)	.17
Club level (development)	0.43 (.09)	.13
Club level (performance)	0.40 (.08)	.13
Transformational coaching	0.04 (.07)	.001
Age	-0.19 (.05)	.06
Transformational coaching * Age	0.14 (.08)	.01

*Note.* Multilevel linear models were used with team was included as a random effect. The amateur level was included as the reference group for Club level. TM = Transformational Mothering, TF= Transformational Fathering, TC= Transformational coaching, Age = Athlete Age.

### Figures

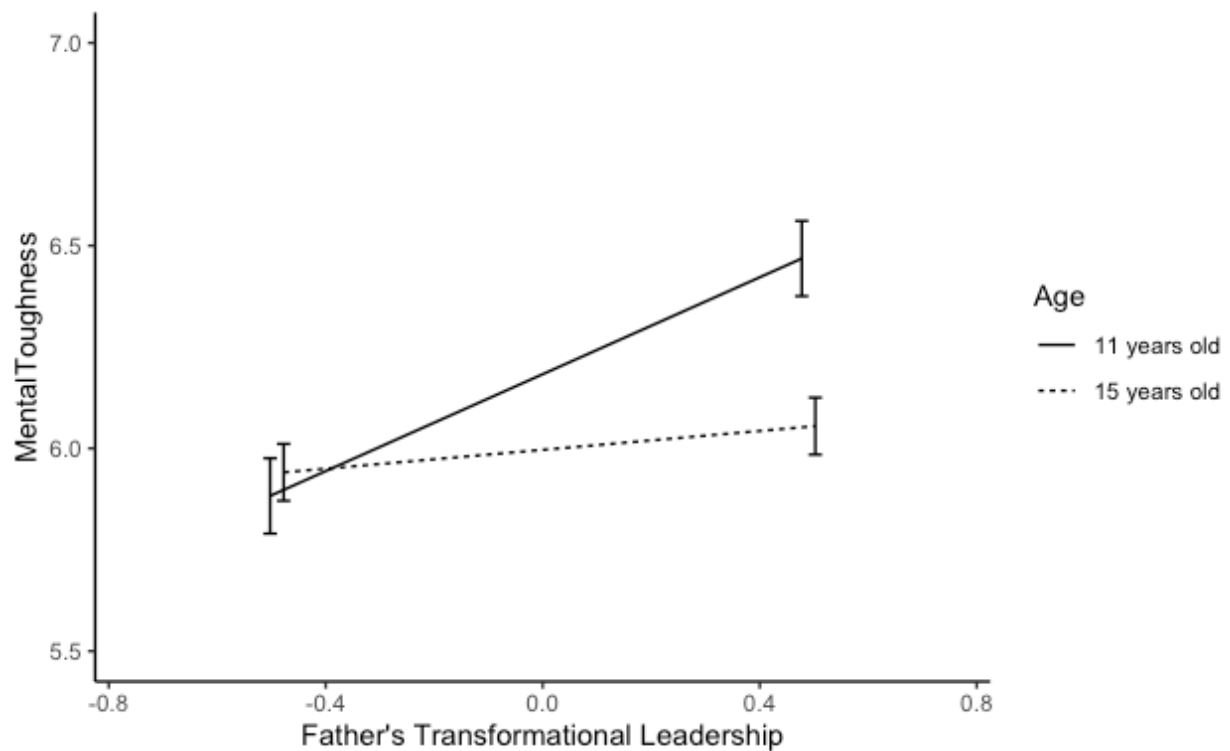


Figure 1. Interaction between transformational fathering and athlete age on athlete mental toughness. Age was plotted at -1 SD (11 years old) above the mean and 1 SD (15 years old) below the mean.

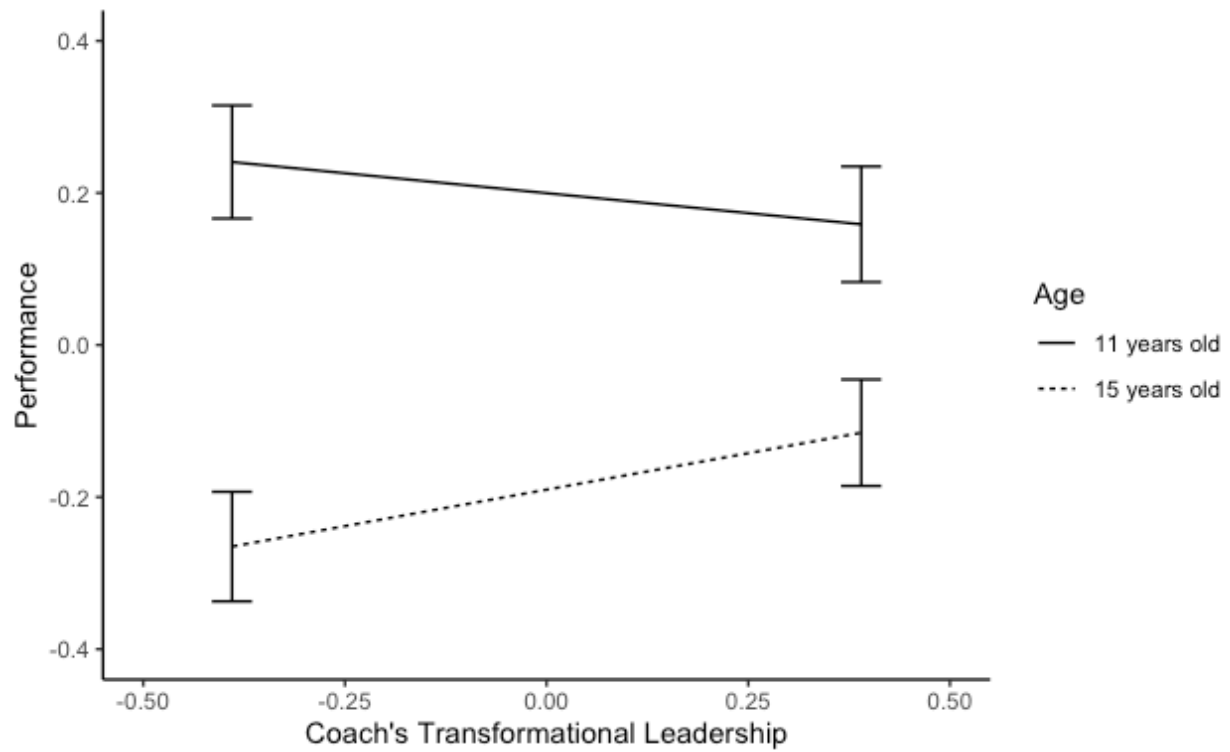


Figure 2. Interaction between transformational coaching and athlete age on athlete performance. Age was plotted at -1 SD (11 years old) above the mean and 1 SD (15 years old) below the mean.