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1 **A longitudinal investigation into the relative age effect in an English**
2 **professional football club: Exploring the ‘underdog hypothesis’**

3 Adam L. Kelly^{1,2,3}, Mark R. Wilson^{2,3}, Lewis A. Gough¹, Harry Knapman³, Paul
4 Morgan^{2,3,4}, Matthew Cole¹, Daniel T. Jackson¹, and Craig A. Williams²

5 *¹Faculty of Health, Education and Life Sciences, Birmingham City University, Birmingham,*
6 *West Midlands, United Kingdom; ²Children’s Health and Exercise Research Centre, College*
7 *of Life & Environmental Sciences, University of Exeter, Exeter, Devon, United Kingdom;*
8 *³Exeter City Football Club, Exeter, Devon, United Kingdom; ⁴College of Life & Environmental*
9 *Sciences, University of Birmingham, Birmingham, West Midlands, United Kingdom*

10 Correspondence: A. L. Kelly, Department of Sport & Exercise, Birmingham City University,
11 City South Campus, Westbourne Road, Edgbaston, B15 3TN, UK. E-mail:
12 Adam.Kelly@bcu.ac.uk

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14 **A longitudinal investigation into the relative age effect in an English**
15 **professional football club: Exploring the ‘underdog hypothesis’**

16 The relative age effect (RAE) refers to the bias influence of birthdate distribution, with
17 athletes born later in the selection year being under-represented in talent development
18 systems. However, the ‘underdog hypothesis’ suggests that younger birth quarter (BQ)
19 athletes are over-represented among those who successfully transition from youth
20 systems to senior professional status. Accordingly, the purpose of this study was twofold;
21 (1) to provide further test of the RAE over twelve seasons ($n=556$), and (2) to examine
22 the BQ of professional contracts awarded to academy graduates at an English
23 professional football club over eleven seasons ($n=364$). Significantly skewed ($P<0.001$)
24 birthdate distributions were found for academy players (BQ1 $n=224$; BQ2 $n=168$; BQ3
25 $n=88$; BQ4 $n=76$). The distribution from academy graduates was also significantly
26 skewed for professional contracts awarded ($P=0.03$), with greater BQ4 representation
27 ($n=8$) compared to other BQs (BQ1 $n=5$; BQ2 $n=8$; BQ3 $n=6$). These findings are
28 indicative that the RAE continues to manifest within an academy setting. Interestingly
29 however, the underdog hypothesis shows BQ4s were approximately four times more
30 likely to achieve senior professional status compared to BQ1s. Implications for talent
31 identification and development in football are discussed.

32 Keywords: Relative age effect; Underdog hypothesis; Youth football academy; Youth
33 soccer; Talent identification; Talent development

34

35 **Introduction**

36 The aim of a football academy is to recruit young players with the potential to be developed
37 into professional football players, in order to achieve both sporting and financial success
38 (Gonaus & Muller, 2012). It is therefore important to identify early predictors of long-term
39 success so that the most highly talented youth football players receive continued support from
40 a young age to achieve their potential (Stratton, Reilly, Williams, & Richardson, 2004).
41 However, the complex nature of the talent development process, coupled with the holistic
42 characteristics that are associated with superior development and the successful transition from
43 youth academy level to senior professional status, suggests that the application of early
44 predictors is often flawed and subject to biases which limits academies' success in meeting
45 their stated aims (Forsman, Blomqvist, Davids, Liukkonen, & Konttinen, 2016; Kelly, Wilson,
46 & Williams, 2018; Sarmiento, Anguera, Pereira, & Araujo, 2018).

47 One such bias is the influence of selection and progression through birthdate
48 distribution, known as the relative age effect (RAE; Barnsley, Thompson, & Barnsley, 1985).
49 The RAE signifies that children born in the first six months of the selection year are
50 significantly over-represented in youth team selection (Helsen, van Winckel, & Williams,
51 2012). Research has consistently shown that young athletes who are born early in the selection
52 year have a distinct advantage through being older, bigger, faster, stronger, and more mature,
53 and are therefore more likely to be perceived as 'talented' and subsequently selected for talent
54 development programmes (Baxter-Jones, 1995; Gil et al., 2014; Gil, Ruiz, Irazusta, Gil, &
55 Irazusta, 2007; Musch & Grondin, 2001; Wattie, Schorer, & Baker, 2015). The RAE is almost
56 ubiquitous in youth sport, having been demonstrated in athletics (Hollings, Hume, & Hopkins,
57 2014), Australian rules football (van Der Honert, 2012), baseball (Grondin & Koren, 2000;
58 Nakata & Sakamoto, 2013), basketball (Delorme & Raspaud, 2009), cricket (Edwards, 1994;
59 McCarthy, Collins, & Court, 2016), dance (van Rossum, 2006), ice hockey (Nolan & Howell,

60 2010; Turnnidge, Hancock, & Cote, 2014), rugby league (Till et al., 2010), rugby union
61 (McCarthy & Collins, 2014; McCarthy et al., 2016), swimming (Cobley et al., 2018), and tennis
62 (Dudink, 1994; Ulbricht, Fernandez-Fernandez, Mendez-Villanueva, & Ferrauti, 2015)
63 (amongst others).

64 In 'elite' youth football specifically, birthdate distribution has a significant impact on
65 player identification and development (Barnsley, Thompson, & Legault, 1992; Glamser &
66 Vincent, 2004; Gonzalez Bertomeu, 2018; Gonzalez-Villora, Pastor-Vicedo, Cordente, 2015;
67 Helsen et al., 2012; Helsen, Hodges, van Winckel, & Starkes, 2000; Helsen, van Winckel, &
68 Williams, 2005; Massa et al., 2014; Meylan, Cronin, Oliver, & Hughes, 2010; Musch & Hay,
69 1999; Padron-Cabo, Rey, Luis Garcia-Soidan, & Penedo-Jamardo, 2016; Votteler & Honer,
70 2014, 2017; Williams, 2010). For example, in a Europe-wide study, Helsen et al. (2005) found
71 an over-representation of players born in the first birth quarter (BQ) in both national and
72 professional youth selections across all age groups (cf. Doyle & Bottomley, 2018; Gonzalez-
73 Villora et al., 2015). In Brazil, Massa et al. (2014) found a similar effect in a single professional
74 football club. In fact, a strong RAE in youth football has been established in America,
75 Australia, Brazil, Germany, and Japan (amongst others), suggestive of a consistent global effect
76 that is independent of the specific cut-off dates used to define the sporting year across countries
77 (Votteler & Honer, 2014, 2017; Glamser & Vincent, 2004; Musch & Hay, 1999).

78 These research studies highlight the limitations of the selection process within youth
79 football, which restrict the opportunities for players born late in the sporting year (Meylan et
80 al., 2010). The potential cost of missing this talent may be hard to calculate accurately, but
81 what can be investigated is the degree to which late BQ players who do make it into an academy
82 make the successful transition into senior professional football. McCarthy and Collins (2014)
83 discovered that late-birth players actually achieved more senior professional contracts
84 compared to their older peers in a major English rugby union academy, subsequently

85 suggesting this may be due to the relatively younger players developing superior psychological
86 skills and technical expertise to compensate for their early physical disadvantage. This has been
87 further supported in professional cricket (McCarthy et al., 2016), professional ice hockey
88 (Gibbs, Jarvis, & Dufur; 2012; Fumarco, Gibbs, Jarvis, & Rossi, 2017), and professional rugby
89 league (Till, Cogley, Morley, O'Hara, Chapman, & Cooke, 2016). For instance, Till et al.
90 (2016) found that a higher percentage of chronologically younger rugby league academy
91 players attained professional status (BQ2 = 8.5% versus BQ4 = 25.5%). In professional ice
92 hockey, Fumarco et al. (2017) reported that players born in BQ4 score more and demand higher
93 salaries compared to those born in BQ1, whilst Gibbs et al. (2012) have also revealed that the
94 average career duration is longer for players born later in the selection year. Gibbs et al. (2012)
95 further proposed an 'underdog hypothesis', whereby being a younger BQ essentially facilitates
96 long-term development by necessitating them to overcome the odds of the RAE, through being
97 challenged by their older and more advanced peers.

98 From a football perspective, whilst the RAE has been extensively examined, research
99 often focuses on the older age groups within 'youth' settings (i.e., under-19) at top European
100 clubs or countries (cf. Doyle & Bottomley, 2018; Gonzalez-Villora et al., 2015; Padron-Cabo
101 et al., 2016). However, it is important to appreciate that professional status can be achieved at
102 lower league levels, whilst the recruitment of BQs throughout the development process (i.e.,
103 under-9 to under-18) must also be considered to examine the extent to which the RAE is rooted.
104 The status of professional football academies must also be acknowledged whilst examining the
105 RAE, as external validity from the existing research that often captures higher category
106 standings may be questioned for lower category equivalents. For instance, differences in BQ
107 recruitment may be apparent because of greater monetary outlay and the subsequent access and
108 opportunities that are provided to young players.

109 It is evident that there is a complicated relationship between the BQ a player is born in,
110 their opportunities to be selected into a talent development programme, and their chances of
111 successfully transitioning from such a programme. To the authors' knowledge, there are no
112 studies that have investigated the underdog hypothesis within a Category 3 academy and Tier
113 4 English professional football club. Therefore, the aim of this study was twofold; 1) to
114 examine the RAE in a Category 3 academy, and 2) to test the underdog hypothesis by
115 examining the BQ of academy graduates and the subsequent professional contracts awarded at
116 a Tier 4 English professional football club.

117 **Methods**

118 *Participants*

119 For Part 1, to examine the existence of the RAE, 556 participants were included who were
120 either current or previously registered academy players. The oldest players were born in 1989
121 and the youngest born in 2008, which includes data across twelve seasons. For Part 2, to
122 examine the possibility of the underdog hypothesis, 364 participants were included who were
123 previously registered academy players, to assess which graduates achieved a senior
124 professional contract at aged 18 years across eleven seasons, with the oldest academy alumni
125 born in 1989 and the youngest born in 1999. All the participants were recruited from the same
126 Tier 4 English professional football club and their Category 3 academy. This study was
127 approved by the Ethics Committee of Sport and Health Sciences at the University of Exeter.

128 *Procedure*

129 The twelve months of the year were divided into four BQs, conforming to the strategy used to
130 examine the RAE in other UK populated studies (Helsen et al., 2005), with September
131 classified as 'month 1' and August 'month 12'. To conform with previous studies of a similar

132 design (cf. McCarthy et al., 2016; McCarthy & Collins, 2014; Till et al., 2010), each player
133 was assigned a BQ in their selection year, which were compared to the expected distributions
134 from the calculated average national live births in England and Wales (Office for National
135 Statistics [ONS], 2015). For Part 2, as each player had graduated from the academy, the data
136 collection also examined who achieved senior professional status; defined as signing a full-
137 time professional contract for a minimum of one year. In addition to comparing the contracts
138 awarded distributions to the ONS (2015) expected distributions, they were also compared
139 against the academy distributions to gain a full understanding of any bias effects.

140 ***Data analysis***

141 Chi-square (χ^2) analysis was used to compare quartile distributions in the sample and against
142 population values (ONS, 2015), following procedures outlined by McHugh (2013). As this test
143 does not reveal the magnitude of difference between quartile distributions for significant chi-
144 square outputs, Cramer's V was also used. The Cramer's V was interpreted as per conventional
145 thresholds for correlation; a value of 0.06 or more would indicate a small effect size, 0.17 or
146 more would indicate a medium effect size, and 0.29 or more would indicate a large effect size
147 (Cohen, 1988). Odds Ratios and 95% confidence intervals were used to compare BQs for
148 achievement of academy and professional status. For all the tests, results were considered
149 statistically significant when $P < 0.05$. Data are presented as mean \pm SD unless otherwise
150 indicated. All statistical analyses were conducted using IBM SPSS Statistics Version 24.

151 **Results**

152 The academy quartile distributions were significantly skewed with a large effect size compared
153 to national norms (χ^2 (df = 3) = 103.57, $P < 0.001$, $V = 0.305$). Significant ORs were found
154 between BQ1 and BQ3 (OR: 2.46, 95% CI 1.73–3.46), BQ1 and BQ4 (OR: 2.94, 95% CI 2.08–
155 4.17), and BQ2 and BQ3 (OR: 1.92, 95% CI 1.36–2.73), and BQ2 and BQ4 (OR: 2.30, 95%

156 CI 1.60–3.29). Thus, both BQ1 and BQ2 players were more likely to be academy players than
157 BQ3 or BQ4 players were. Descriptive statistics demonstrate BQ1s ($n = 224$, 40.29%) were
158 over-represented compared to any other BQ (BQ2 $n = 168$, 30.22%; BQ3 $n = 88$, 15.83%; BQ4
159 $n = 76$, 13.66%). The academy data is presented in Figure 1.

160 ****Figure 1 near here****

161 When examining contracts awarded, the quartile distribution was not skewed compared to
162 national norms (χ^2 (df = 3) = 1.06, $P = 0.709$, $V = 0.08$). Interestingly however, BQ4s
163 represented a larger portion of professional contracts awarded for academy graduates ($n = 8$,
164 14.0%) compared to the other BQs (BQ1 $n = 5$, 3.5%; BQ2 $n = 8$, 7.4%; BQ3 $n = 6$, 11.1%).
165 Figure 2 presents the percentage of professional contracts awarded within each BQ based on
166 the total number of academy graduates within each BQ.

167 ****Figure 2 near here****

168 Whilst further examining contracts awarded, the quartile distributions were significantly
169 skewed with a large effect size when compared to the academy distributions (χ^2 (df = 3) = 8.91,
170 $P = 0.03$, $V = 0.41$). The only significant OR was found between BQ1 and BQ4 players, with
171 BQ4 more likely to attain professional status (OR: 4.72, 95% CI 1.50–14.85). This is also
172 highlighted in the almost twice as many observed (BQ4 $n = 8$) than expected (BQ4 $n = 4.23$)
173 contracts awarded. Figure 3 presents the total number of observed and expected professional
174 contracts awarded in each BQ. The descriptive statistics are also presented in Table 1.

175 ****Figure 3 near here****

176 ****Table 1 near here****

177 **Discussion**

178 Football academies are the primary talent development system for professional football in
179 England. The decisions made with regards to who is selected into these systems at an early age
180 constrains the subsequent outputs from that system. Therefore, it is important to better
181 understand why certain individuals might be more likely to selected into an academy, and also
182 why others might be more likely to successfully graduate. The current study sought not only to
183 offer further evidence of the RAE (a bias in early selection) within a Category 3 academy, but
184 to also provide an examination of the underdog hypothesis (a potential bias in late graduation)
185 within the same Tier 4 professional football club in England.

186 The results from Part 1 of this current study are consistent with similar RAE research
187 within elite youth football (Gonzalez-Villora et al., 2015; Helsen et al., 2005; Massa et al.,
188 2014; Williams, 2010). For instance, the distribution of BQ percentages are similar to those of
189 Takacs and Romann (2016), who found a significant RAE and medium effect size amongst
190 UEFA Youth League clubs, illustrating that BQ1s were 3.4 times more likely to be selected
191 compared to BQ4s. This study comparably found BQ1s were 2.9 times more likely to be
192 selected compared to BQ4s. Similarly, the BQ distributions of this current study are equivocal
193 to those from Massa et al. (2014), whose observational case study of the famed Sao Paulo
194 Football Club presented a 47.5% BQ1 distribution compared to an 8.8% BQ4 distribution
195 within their academy. Subsequently, this study does not only provide further evidence that the
196 RAE exists across countries and is independent of selection cut-off dates, it also offers a unique
197 interpretation that the RAE may be a deep-rooted phenomenon throughout the academy
198 pathway (under-9 to under-18), and is equally apparent at lower category status when compared
199 to their higher category counterparts. Therefore, despite over 25 years of research highlighting
200 this birthdate advantage (Barnsley et al., 1992), the RAE appears to continue to manifest within
201 elite youth football (cf. Helsen et al., 2012).

202 A number of previous studies that have identified a RAE within a youth football setting
203 have criticised its existence and supported the need for interventions to eliminate such observed
204 effects (Gonzalez-Villora et al., 2015; Helsen et al., 2012, 2005; Massa et al., 2014). For
205 example, Massa et al. (2014) stated the existence of the RAE needs to be considered during the
206 identification and development of young football players and should be analysed carefully in
207 order to minimise the loss of potential talent. Gonzalez-Villora et al. (2015) further suggest the
208 football federations of different countries should take responsibility for the RAE, and thus
209 adapt the rules of youth competitions for the best development of all players on equal terms.
210 Despite these calls, there have been few research studies examining modifications to the talent
211 development process.

212 Besides football, Cobley and colleagues have devised a method named ‘corrective
213 adjustments’ as a solution to remove RAEs in timed sports such as athletics and swimming (cf.
214 Cobley et al., 2019; Romann & Cobley, 2015). This is whereby regression equations are
215 applied through birthdate distribution and raw performance times, with the dissemination of
216 performance levels subsequently re-examined for greater chronological age equality. However,
217 the timed nature of this strategy would be inadequate for a team sport environment, thus further
218 mediating solutions are required for this particular cohort. Mann and van Ginneken (2017)
219 produced evidence for an intervention designed to reduce the RAE through applying an age-
220 ordered shirt numbering system. They found that supporting talent scouts with the knowledge
221 that the numbers on the playing shirts corresponded with the relative age of the players
222 eliminated age bias. Bennett, Vaeyens, and Fransen (2018) suggested a mitigating tool of
223 establishing a ‘selection quota’ whereby sporting organisations and talent development
224 programmes are required to select a minimum number of athletes from each BQ. Tribolet,
225 Watsford, Coutts, Smith, and Fransen (2018) proposed discouraging early deselection,
226 particularly during adolescence, to allow continued exposure to higher-level coaching and

227 resources without the option of being deselected. However, previous research has illustrated
228 that repeated incidences of selection and deselection may be more beneficial to achieving
229 senior professional status, thus further research is required to address whether the avoidance of
230 deselection within a talent pathway is beneficial for achieving long-term expertise. In addition,
231 future research should explore the implications of other strategies, such as the age-ordered shirt
232 numbering system and selection quota approaches, on moderating the RAE in youth football.

233 However, perhaps a cultural change is also required in talent identification. Professional
234 football clubs in England can begin to formally sign academy players at under-9, and ‘talent’
235 at this early stage tends to be identified as current ability in comparison to peers, leaving little
236 thought surrounding the characteristics that support the subsequent achievement of expertise
237 as a senior athlete (MacNamara & Collins, 2011). For instance, Muller, Gehmaier, Gonaus,
238 Raschner, and Muller (2018) illustrated a RAE in a cohort of 222 ‘international elite under-9s’
239 with over twice as many BQ1s ($n = 86$) representing academies at this particular high-level
240 tournament compared to BQ4s ($n = 39$), suggesting that the selection process at this age is bias
241 towards relatively older players. As these players will form the core of each successive age
242 group for the proceeding years, biases in selection into an academy (i.e., the RAE) will
243 subsequently manifest over a prolonged period. Therefore, since the purpose of an academy
244 should be to identify and then develop young football players towards future performance
245 abilities, attention should rather concentrate on those characteristics to manage the course of
246 development, rather than focussing on current performance abilities (Abbott & Collins, 2004).

247 The results from Part 2 of this current study are consistent with the suggestion of the
248 ‘underdog hypothesis’, with BQ4 players approximately four times more likely to achieve a
249 professional contract compared to BQ1 players. This is represented in the significant difference
250 in distributions and significant OR between BQ1 and BQ4 (although no other significant
251 differences were observed in other quartiles). As per Figure 3, when comparing the observed

252 and expected professional contracts awarded, there appears to be a form of RAE reversal;
253 similar to that observed by McCarthy and colleagues (cf. McCarthy & Collins, 2014; McCarthy
254 et al., 2016). BQ4s achieved almost double the number of expected professional contracts when
255 inspected against retrospective academy distributions. This is in contrast to the BQ1s, who
256 achieved less than half of their expected number of professional contracts. This may suggest a
257 reversal of the distribution bias in the youth to senior transition, indicative of the potential
258 advantage to those chronologically younger players within an English football academy.

259 One interesting issue raised by the Part 2 results of this current study is that eliminating
260 the RAE in academy football may also remove the potential ‘underdog’ benefits for later birth
261 quartiles, through consistently engaging with their older peers. For example, it has been
262 suggested that through playing against relatively older, more mature athletes within their
263 chronological age group, BQ3 and BQ4s have to develop certain technical proficiencies and/or
264 tactical awareness to be able to counteract this physical bias against BQ1 and BQ2s (Fumarco
265 et al., 2017; Gibbs et al., 2012; McCarthy & Collins, 2014; McCarthy et al., 2016; Schorer,
266 Cogley, Busch, Brautigam, & Baker, 2009). To simplify from an applied perspective, a larger,
267 stronger player may be able to easily dispossess a smaller, weaker opponent as a result of their
268 physical dominance, thus a smaller, weaker player must create a technical or tactical solution
269 to reduce this advantage. Ashworth and Heyndels (2007) highlight how these younger, smaller
270 players must overcome ‘a system that discriminates against them’, through being more talented
271 than their relatively larger counterparts to counteract their size advantage. Therefore, it may be
272 suggested that BQ3 and BQ4s are likely to be ‘positively’ selected, whereby they are chosen
273 from ‘the right tail of the ability distribution’ (Fumarco et al., 2017).

274 Furthermore, while a smaller, weaker player may be physically inferior throughout their
275 youth development as a result of their younger age, once they ‘catch-up’ towards adulthood,
276 they may have developed certain psychological characteristics that previously allowed them to

277 compete (Gonzalez Bertomeu, 2018). For example, Schorer et al. (2009) also demonstrated the
278 underdog hypothesis, where the initial disadvantage may eventually contribute to the later
279 superiority when early differences in size plateau towards adulthood. This is potentially
280 through learning to ‘work harder’, resulting in peer effects that facilitate resilience and
281 improved motivation (Schorer et al., 2009). Thus, these psychological benefits likely equip the
282 chronologically younger players, or ‘underdogs’, to overcome subsequent obstacles and
283 succeed at senior professional level (Fumarco et al., 2017; Roberts & Stott, 2015). Cumming
284 et al. (2018) provided further partial support for the underdog hypothesis, whereby relatively
285 younger players benefitted from competitive play with older peers, whilst identifying later
286 maturing players possessed a psychological advantage compared to their earlier maturing
287 equivalents. Jones, Lawrence, and Hardy (2018) also described this effect at ‘super-elite level’
288 as the resilient and mind-set that BQ3 and BQ4s acquire throughout their development process,
289 because of being younger and often less mature compared to BQ1 and BQ2s.

290 So how do academies get the ‘best of both worlds’ with regards to moderating the RAE
291 whilst also gaining the benefits of the underdog hypothesis (if at all possible)? Whilst current
292 strategies appear unexplored, future research could examine the effect of ‘playing-up’ a
293 chronological age group to facilitate greater early BQ player development by creating a ‘BQ4
294 effect’ in an older age group. In-turn, this may also mediate the widely reported high dropout
295 rates amongst later BQ players (cf. Figueiredo, Goncalves, Coelho-e-Silva, & Malina, 2009;
296 Helsen, Starkes, & van Winckel, 1998), whilst also providing a greater opening for more later
297 birth quartiles to be selected into an academy environment at an early age. Likewise, ‘playing-
298 down’ an age group may also offer a more suitable developmental setting for later BQ players
299 whilst they ‘catch-up’ with their chronologically older peers, whilst also providing a more
300 challenging environment for early birth quartiles in a younger age group. Thus, it is suggested
301 academies adopt a ‘flexible chronological approach’ to group young athletes by offering early

302 birth quartiles (i.e., BQ1s) and late birth quartiles (i.e., BQ4s) the opportunity to play-up and
303 play-down an annual age group respectively, as opposed to fixed chronological bandings.

304 In addition to the distribution of BQs in this current study, the total number of
305 professional contracts awarded across the eleven seasons was 27 out of 364 players that have
306 entered the academy. This figure demonstrates that only 7.4% of players graduated with a
307 professional contract following their academy involvement, thus offering a potential
308 benchmark to fellow Category 3 academies. Drawing upon this conversion value, it is essential
309 to acknowledge the limited opportunities for young players who enter an academy to
310 subsequently achieve professional status, thus emphasising the dual responsibility and
311 importance of coaches to develop players holistically as people, as well as young football
312 players, through positive youth development (cf. Strachan, Cote, & Deakin, 2011).

313 Furthermore, it is important to recognise the issues surrounding external validity. For
314 instance, the relatively newly formed under-23 league amongst Category 1 and 2 academies
315 indicates the conversion figures would be significantly higher, as the requirement to participate
316 at under-23 level for this status is mandatory when compared to Category 3 academies (The
317 Premier League, 2011). In addition, Category 3 academies may have traditionally been
318 acknowledged as a 'Centre of Excellence' prior to the reformed Elite Player Performance Plan
319 (EPPP) category system in 2011 (The Premier League, 2011), which may have provided
320 restricted opportunities to achieve professional status as a result of limited monetary resources
321 and organisational structure. Therefore, the retrospective nature of this data may not provide a
322 truly accurate insight of the opportunities that are apparent nowadays, thus coaches and
323 practitioners are suggested to act with caution when interpreting the outcomes within a modern
324 academy environment.

325 **Conclusion**

326 The holistic characteristics that have been discussed (i.e., technical, tactical, physical, and
327 psychological factors), have previously been associated with both greater development
328 outcomes and the successful transition from youth academy level to senior professional status
329 (Sarmiento et al., 2018). Therefore, these factors cannot be ignored whilst considering the socio-
330 environmental dynamics when incorporating new and innovative strategies to eliminate the
331 RAE within talent identification and development processes in academy football. As a result,
332 whilst BQ4s may be less likely to be identified as ‘talented’ during the early stages of the
333 development process, it appears they may be embarking on a long-term process that eventually
334 sees them catch-up, and in some cases overtake, their older counterparts in BQ1. Thus, it is
335 suggested that coaches and practitioners should act with caution when creating strategies to
336 eliminate the RAE, as doing so may also eradicate the underdog hypothesis. This is likely
337 achieved through removing the natural developmental outcomes occurring along the ‘rocky
338 road’ that is created for significantly younger players whilst playing within a chronological age
339 group (McCarthy & Collins, 2014). However, further research is required to fully understand
340 why early disadvantage may lead to greater opportunities. Furthermore, additional research
341 into the proposed solutions for the RAE is required, to ensure there is a continued emphasis on
342 creating the right environment for every player to develop to their full potential.

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348 **Disclosure statement**

349 The authors declare that they have no conflict of interest.

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