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2 A case study comparison of objective and subjective evaluation methods of physical
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35 **A CASE STUDY COMPARISON OF OBJECTIVE AND SUBJECTIVE EVALUATION**
36 **METHODS OF PHYSICAL QUALITIES IN YOUTH SOCCER PLAYERS**

37 **Abstract**

38 Subjective and objective assessments may be used congruently when making decisions
39 regarding player recruitment in soccer, yet there have been few attempts to examine the
40 level of agreement between these methods. Therefore, we compare levels of agreement
41 between subjective and objective assessments of physical qualities associated with youth
42 soccer performance. In total, 80 male youth soccer players (13.2 ± 1.9 years), and 12
43 professional coaches volunteered to participate. Players were objectively assessed using five
44 fitness measures: Yo-Yo Intermittent Recovery Test Level 1; Countermovement vertical jump;
45 Functional Movement Screen™; 5/20m sprint; alongside anthropometric measures.
46 Additionally, coaches subjectively rated each player on the same five physical qualities using
47 5-point Likert scales. Inter-rater agreement between ratings from lead and assistant coaches
48 were established for each age group. Moreover, Bayesian regression models were fitted to
49 determine how well coach ratings were able to predict fitness test performance. Although
50 inter-rater agreement between lead and assistant coaches was moderate-to-substantial
51 ($\omega=0.48-0.68$), relationships between coaches subjective rating's and corresponding fitness
52 test performance were only highly related for the highest and lowest performing players. We
53 suggest that while ratings derived from objective and subjective assessment methods may be
54 related when attempting to differentiate between distinct populations, concerns exist when
55 evaluating homogeneous samples using these methods. Our data highlight the benefits of
56 using both types of measures in the talent identification process.

57 **Key words:** Coach ratings; fitness testing; talent identification; perception; adolescent.

58 Introduction

59 Identifying and developing talented young athletes is integral to the coach's role in soccer
60 (Larkin & O'Connor, 2017; Reeves, Roberts, McRobert, & Littlewood, 2018; Reilly, Williams,
61 Nevill, & Franks, 2000; Williams & Reilly, 2000). Traditionally, clubs have employed scouting
62 systems where coaches view players in a training or game scenario and assess them based on
63 their perceived performance and ability (Unnithan, White, Georgiou, Iga, & Drust, 2012;
64 Williams & Reilly, 2000). However, if used in isolation, these processes may lead to potentially
65 biased results (Meylan, Cronin, Oliver, & Hughes, 2010). During their development, youth
66 soccer players may encounter several coaches, each with varying conscious or unconscious
67 philosophical and cognitive biases (Unnithan *et al.*, 2012). Nonetheless, experiential
68 knowledge gathered from coaching, playing, and scouting continues to carry substantial
69 weight in decision making when prescribing training programmes and when players are
70 selected into (or deselected from) systematic training structures (Grossmann & Lames, 2015;
71 Musculus & Lobinger, 2018).

72 Scientists have attempted to better understand the potential attributes and strategies
73 used by coaches and recruiters during talent identification and development (Hendry,
74 Williams, & Hodges, 2018; Larkin & O'Connor, 2017; Reeves, McRobert, Lewis, & Roberts,
75 2019; Reeves, Roberts, *et al.*, 2018). From an Australian perspective, Larkin and O'Connor
76 (2017) reported a range of technical, tactical, physiological, and psychological parameters
77 perceived by experienced professional youth soccer coaches to be "key attributes" for entry
78 level recruitment. Similarly, Roberts, McRobert, Lewis, and Reeves (2019) presented a UK
79 perspective, exploring both generic and position-specific attributes that may be important to
80 progression in youth soccer. The results from these studies encourage the use of multi-
81 disciplinary and player-positional attributes during the talent identification process, while

82 acknowledging that physiological and anthropometric qualities may be less important to
83 coaches when selecting junior-elite youth players. In contrast to these studies, there is a
84 plethora of work spanning the last 20 years suggesting that objectively assessed physical
85 abilities may be an important contributing factor related to recruitment, selection, and
86 progression from youth to senior level in soccer.

87 For example, elite soccer players are greater in physical stature and mass, and perform
88 better on sprint, endurance, strength, and power assessments compared to players of a lower
89 playing standard (Dugdale, Arthur, Sanders, & Hunter, 2019; Gil, Ruiz, Irazusta, Gil, & Irazusta,
90 2007; Rebelo *et al.*, 2013). Similarly, physical qualities have been suggested to discriminate
91 between players retained or released within a soccer academy, and when evaluating
92 successful vs. unsuccessful academy graduation (Emmonds, Till, Jones, Mellis, & Pears, 2016;
93 Figueiredo, Gonçalves, Coelho e Silva, & Malina, 2009; le Gall, Carling, Williams, & Reilly,
94 2010). Consequently, physical and physiological testing have become common methods
95 within applied practice and field-based research in an effort to provide a more substantive
96 reference base of key physical qualities underpinning player development (Enright *et al.*,
97 2018; Pyne, Spencer, & Mujika, 2014), and talent identification in soccer (Dugdale *et al.*, 2019;
98 Murr, Raabe, & Höner, 2018). However, because of the complex and multifaceted nature of
99 soccer, these data may be limited in their prognostic ability (Bergkamp, Niessen, Den Hartigh,
100 Frencken, & Meijer, 2019; Murr, Raabe, *et al.*, 2018; Roberts *et al.*, 2019). The need to adopt
101 a more holistic approach to talent identification and development, accompanying objective
102 measures with traditional subjective decision making processes, has been widely endorsed in
103 youth soccer (Bergkamp *et al.*, 2019; Höner & Votteler, 2016; Murr, Feichtinger, Larkin,
104 O'Connor, & Höner, 2018; Sieghartsleitner, Zuber, Zibung, & Conzelmann, 2019; Unnithan *et*
105 *al.*, 2012).

106 Only a select number of researchers have examined both objective and subjective
107 measures congruently in soccer. Sieghartsleitner *et al.* (2019) examined both objective and
108 subjective assessment methods from multiple dimensions across a prognostic period of five
109 years (U14-U19) in an elite sample of players in Switzerland. Similarly, in their sample of highly
110 trained pre-adolescent youth soccer players, Fenner, Iga, and Unnithan (2016) examined
111 small-sided game assessments as a viable talent identification tool through the unification of
112 objective and subjective measurements. The results from these studies suggest that while
113 subjective coach assessments are likely to be holistic in nature involving the integration of
114 multiple game-based aspects simultaneously, the addition of objective data to support
115 subjective coach assessment methods may improve prognostic ability during talent
116 identification.

117 Despite the increasing interest in complementing subjective assessments with
118 objective data, when examining physical predictors within talent identification and
119 development in soccer, the majority of researchers have only estimated relationships
120 between physical qualities and performance criteria (Deprez, Fransen, Lenoir, Philippaerts, &
121 Vaeyens, 2015; Gonaus & Müller, 2012; Höner & Feichtinger, 2016; Höner & Votteler, 2016).
122 As a consequence, more empirical work is needed to better identify how subjective and
123 objective assessments of physical qualities in soccer players are related, and, the extent to
124 which the use of subjective judgements of physical qualities, in their own right, may be
125 justified.

126 In the current study, we had two aims. First, we examined the relationship between
127 subjective coach ratings for a range of physical qualities previously reported as relevant to
128 successful performance in soccer, with a corresponding objective measure of the same

129 component of physical fitness. Second, we examined the inter-rater agreement between two
130 coaches (lead vs. assistant) when subjectively rating youth players on a range of physical
131 abilities relative to successful performance in soccer.

132 **Methods**

133 Participants

134 *Players*

135 In total, 80 male youth soccer players aged 10.2 to 16.7 years (M: 13.2 ± 1.9) were recruited.
136 Player stature ranged from 130.1 to 185.3 cm (M: 160.3 ± 13.9), and player mass ranged from
137 27.4 to 83.7 kg (M: 49.3 ± 12.4). We used an exploratory case study design (Reeves *et al.*,
138 2019; Yin, 2009) using players affiliated to a junior-elite soccer academy playing at the highest
139 competitive level in Scotland. Participants were categorised into age groups as specified by
140 the Scottish Football Association (SFA): U11 (*n*=16); U12 (*n*=14); U13 (*n*=11); U14 (*n*=12); U15
141 (*n*=12); and U17 (*n*=15). We obtained informed assent from all participants, consent from
142 parents/guardians, and gatekeeper consent from the Academy Director prior to collecting
143 data. The study received institutional ethical approval (GUEP 533R).

144 *Coaches*

145 We recruited twelve male soccer coaches. The lead and assistant coach for each of the six age
146 groups listed above were recruited for the study. The Lead Coaches ranged from 29.6 to 55.8
147 years (M: 40.5 ± 10.2) of age, and their coaching experience ranged from 6.25 to 20.0 years
148 (M: 13.5 ± 5.7) with 0.5 to 4.0 years (M: 1.8 ± 1.4) coaching history with their current team.
149 Lead Coaches held either the SFA Advanced Children's or the UEFA Youth A licence coaching
150 qualifications. The Assistant Coaches ranged from 23.3 to 55.0 years (M: 37.8 ± 13.7) of age,
151 and their coaching experience ranged from 4.0 to 20.0 years (M: 13.3 ± 6.5) with 0.5 to 2.0
152 years (M: 1.3 ± 0.8) coaching history with their current team. The coaching qualifications held
153 by Assistant Coaches ranged from no formal coaching qualification to the UEFA Youth B

154 licence coaching qualification. We obtained informed consent from all coaches prior to data
155 collection.

156 Procedures

157 *Fitness Tests*

158 We collected objective data on five measures of physical fitness using established methods:
159 Yo-Yo Intermittent Recovery Test Level 1 (YYIRT L1) (Krustrup *et al.*, 2003); countermovement
160 vertical jump (CMJ) (Murtagh *et al.*, 2018); Functional Movement Screen™ (FMS) (Cook,
161 Burton, & Hoogenboom, 2006); and 5m/20m linear sprint tests (Enright *et al.*, 2018).
162 Moreover, we recorded body mass, stature, and seated height. A regression equation was
163 used to provide somatic maturity estimates, presented as maturity offset (years from age at
164 peak height velocity) (Mirwald, Baxter-Jones, Bailey, & Beunen, 2002). The fitness tests
165 selected are commonly used as generic physical fitness tests within a youth soccer population
166 (Paul & Nassis, 2015), as well as being appropriate for implementation across the entire age
167 range of the selected sample (Dugdale *et al.*, 2019; Gil, Gil, Ruiz, Irazusta, & Irazusta, 2007).
168 Also, the physical qualities measured have been reported to be desirable in elite adult players
169 (Dodd & Newans, 2018).

170 The testing sessions were completed a minimum of 48 hours following a competitive
171 game, and in absence of strenuous exercise within 24 hours prior. The testing sessions were
172 conducted indoors (~22°C) on a non-slip sports hall playing surface. Participants conducted a
173 standardised warm-up protocol consisting of light aerobic activity, dynamic stretching, and
174 progressive sprinting. Following the standardised warm-up, participants received verbal
175 instructions and demonstrations from the research team immediately prior to conducting
176 three familiarisation attempts for each test. Guidance and feedback were provided to

177 participants by the research team following each familiarisation attempt, however no
178 guidance was provided to participants between recorded attempts. Participants completed
179 three attempts of each test (with exception of the YYIRT L1) with the best attempt being
180 selected for analysis. We standardised recovery intervals at three minutes for each test.

181 *Coach ratings*

182 We collected subjective data on the qualities intended for assessment by the physical fitness
183 tests. The physical qualities rated by the coaches were: 'Endurance' – YYIRT L1; 'Power' – CMJ;
184 'Movement Quality' – FMS™; 'Physical Development' – maturity offset; 'Acceleration' – 5m
185 linear sprint; and 'Sprint Speed' – 20m linear sprint. Coaches used a 5-point Likert scale to
186 rate the physical abilities of each player: 1 – poor; 2 – below average; 3 – average; 4 – very
187 good; and 5 – excellent. Such coach-based rating methods have previously been adopted by
188 researchers and they demonstrate good reliability and validity (Ali, 2011; Hendry *et al.*, 2018;
189 Larkin & O'Connor, 2017; Unnithan *et al.*, 2012). The Lead and Assistant Coach for each age
190 group provided separate ratings for players from their squad at identical time points and using
191 an identical scale. The coaches completed their subjective ratings before a regular scheduled
192 training session, one week prior to players completing the fitness testing battery. Coach's
193 ratings were completed independently without confirmation with other coaches or support
194 staff.

195 Statistical Analysis

196 We present descriptive statistics of physical test performance associated with Lead and
197 Assistant Coach ratings of corresponding subjective qualities as means and standard
198 deviations (SD). Inter-rater agreement between the Lead and Assistant Coach is reported as
199 Sklar's ω and interpreted as: ($\omega \leq 0.2$) – slight agreement; ($0.21 < \omega \leq 0.4$) – fair agreement;

200 (0.41 < $\omega \leq 0.6$) – moderate agreement; (0.61 < $\omega \leq 0.8$) – substantial agreement; ($\omega > 0.81$)
201 – near-perfect agreement (Hughes, 2018). A series of Bayesian regression models were fitted
202 to determine how well coach ratings predict performance in measures assessing
203 corresponding physical qualities. Leave-One-Out cross-validation (LOO) was used to
204 determine the best model for predicting relationships between ratings and measured
205 variables. LOO is a method of estimating pointwise out-of-sample prediction accuracy from
206 fitted Bayesian models using log-likelihoods from posterior simulations of the parameter
207 values (Vehtari, Gelman, & Gabry, 2017). The best models, those with the lowest LOO
208 information criterion, were Bayesian monotonic ordinal regression models.

209 Bayesian monotonic ordinal regression models allow ordinal predictors to be
210 modelled without falsely treating them either as continuous or as unordered categorical
211 predictors, meaning predictors may be non-equidistant with respect to their relationship to a
212 response variable. For example, coach ratings on a 5-point scale (1 = poor to 5 = excellent)
213 cannot be considered interval level data. While they have a meaningful order, the intervals
214 between ratings may be uneven. Therefore, while a rating of four is higher than a rating of
215 one, two or three, it is not twice the value of two. Treating ordinal ratings as if they were on
216 an interval scale can lead to inaccurate predictions and inaccurate relationships. We present
217 estimates from the models along with 95% credible intervals and associated simplex
218 parameters. We analysed the data via R (R Core Team, 2018) using the sklarsomega package
219 to calculate Sklar’s ω and the brms package (Bürkner, 2018) to fit all the Bayesian models.
220 Brms uses Stan (Stan Development Team, 2018) to implement a Hamiltonian Markov Chain
221 Monte Carlo (MCMC) with a No-U-Turn Sampler. All models were checked for convergence (\hat{r}
222 = 1), with the graphical posterior predictive checks showing simulated data under the best

- 223 fitted models compared well to the observed data with no systematic discrepancies (Gabry,
224 Simpson, Vehtari, Betancourt, & Gelman, 2019).

225 **Results**

226 *Predictive ability of coach subjective ratings relative to fitness test performance*

227 The descriptive data from measured variables for the ratings provided by each coach and the
228 corresponding physical abilities are presented in **Table 1**. The Bayesian monotonic ordinal
229 regression models show the ratings awarded by both the Lead and Assistant Coaches are not
230 evenly assigned when compared to objectively measured performance (**Figure 1**). Visual
231 inspection shows the data are skewed for different rating categories across measures. The
232 marginal effects for the Bayesian monotonic ordinal regression models show that the ratings
233 by both the Lead and Assistant Coach have nonlinear relationships with the measured
234 variables predicted (**Figure 2**).

235 *(Table 1 about here)*

236 *(Figure 1 about here)*

237 *(Figure 2 about here)*

238 *Inter-rater reliability and accuracy of coach subjective ratings*

239 The Lead and Assistant Coach ratings displayed moderate ($0.41 < \omega \leq 0.6$) to substantial (0.61
240 $< \omega \leq 0.8$) agreement when rating physical abilities on a 5-point rating scale (**Table 2**). The
241 ratings provided by the Lead Coach explained a higher percentage of variance in performance
242 variables across models than those awarded by the Assistant Coach (**Table 2**). Variance
243 explained differed depending on the quality rated. The highest variance explained was the
244 Lead Coach's ratings for endurance which explained 23% of the variance in the YYIRT L1. The
245 lowest variance explained was 1% of the variance in FMS™, explained by the Assistant Coach's
246 ratings of movement quality (**Table 2**). The Lead Coach's highest ratings equated to the best

247 performances for YYIRT L1, CMJ, FMS, 5m and 20m sprint. The lowest ratings awarded by the
248 Lead Coach equated to the poorest performances for CMJ, 5m and 20m sprint. However, the
249 only variable where the Lead Coaches progressively higher ratings align with a progressively
250 better mean performance was for CMJ performance (**Table 1**). The Assistant Coaches highest
251 ratings equated to the best performances for CMJ, 5m and 20m sprint, and the lowest ratings
252 to the poorest performances for YYIRT L1, FMS and 5m sprint. The only variable where mean
253 performances increase with progressively higher ratings by the Assistant Coach is for 5m
254 sprint performance (**Table 1**).

255 *(Table 2 about here)*

256 **Discussion**

257 Our results indicate that levels of agreement between objective (fitness test performance)
258 and subjective (coach ratings) data on physical qualities were skewed in nature and displayed
259 different levels of variance across tests. Although coaches exhibited accuracy when providing
260 ratings for lowest/highest performers, explained variance between ratings scores (1-5)
261 fluctuated, with no consistent trend observed across physical qualities for Lead and Assistant
262 Coaches. Also, while Lead and Assistant Coaches displayed moderate-to-substantial
263 agreement in their ratings of perceived physical qualities of players, the levels of agreement
264 between them were the lowest (moderate) for 'endurance', and the highest (substantial) for
265 'power'.

266 Although coaches were particularly accurate when rating the highest and lowest
267 performers, a substantial amount of variance in fitness test performance was observed
268 between players allocated a moderate rating (2-4). The skewed nature of the data observed
269 between coach rating and fitness test performance potentially supports the method of using
270 coach-based rating/ranking procedures for talent identification processes, as coaches seem
271 to be able to correctly identify individuals at the extremities of a scale (lowest/highest)
272 (Fenner *et al.*, 2016; Reilly *et al.*, 2000; Unnithan *et al.*, 2012). However, our results highlight
273 the subjective and potentially biased nature of coach rating systems, as well as their
274 limitations, when trying to differentiate between performers of similar abilities (Meylan *et*
275 *al.*, 2010). Therefore, similar to emerging suggestions from relative age effect and maturation-
276 selection phenomenon research (Reeves, Enright, Dowling, & Roberts, 2018), we encourage
277 coaches and recruitment staff to be aware of this inability to differentiate between players at

278 the extremities of these rating scales, and acknowledge the potential oversight that may be
279 exhibited to those achieving “moderate” scores on objective and subjective measures.

280 Due to the complex and multi-faceted nature of soccer, researchers have suggested
281 that reductionist and decontextualised testing may be inappropriate and that assessment of
282 game-based activities may be more suitable (Bennett *et al.*, 2018; Bergkamp *et al.*, 2019;
283 Unnithan *et al.*, 2012). An argument could potentially be made to support this suggestion,
284 considering we observed no consistent trend across ratings for physical qualities provided by
285 Lead and Assistant Coaches. This questions the suitability of physical fitness tests to assess
286 the key characteristics associated with successful performance in soccer. In our study, we
287 acknowledge that disconnect may exist between the coaches perceptions of physical qualities
288 (retrospective from in-situ performance) and objective assessments in an isolated and
289 decontextualised setting. Therefore, we reiterate the importance of implementing contextual
290 and game-based assessments within the talent identification process. Nonetheless, physical
291 training and monitoring continues to be prioritised during the training process in soccer
292 (Enright *et al.*, 2018; Morgans, Orme, Anderson, & Drust, 2014). Considering the influence of
293 coach subjective opinion during programme design and selection/deselection in soccer, our
294 results suggest that coaches should consult objective data when making decisions regarding
295 isolated physical qualities.

296 The moderate agreement observed between Lead and Assistant Coach ratings for
297 “endurance” suggests that coaches may possess somewhat different perceptions of what
298 constitutes poor-excellent endurance capacities. This discrepancy may be due to the
299 intermittent nature of soccer and/or the multitude of exercise modalities and energy systems
300 utilised within competition (Buchheit, Mendez-Villanueva, Simpson, & Bourdon, 2010;

301 Saward, Morris, Nevill, Nevill, & Sunderland, 2016). It has been suggested that “endurance”
302 comprises of various facets including both aerobic and anaerobic capacities (Bangsbo, Mohr,
303 & Krstrup, 2006; Stølen, Chamari, Castagna, & Wisloff, 2005). Consequently, multiple
304 different procedures are implemented to assess the repeated and intermittent nature of
305 performance in soccer (Buchheit, 2008; Hill-Haas, Dawson, Impellizzeri, & Coutts, 2011;
306 Krstrup *et al.*, 2003, 2006). This ambiguity regarding endurance capacity could therefore
307 distract from a cohesive inter-rater perception and rating of this ability. We propose that the
308 term “endurance” may be too vague, and that in future, a range of different physical qualities
309 could be assessed capturing the multiple exercise modalities and energy systems exhibited
310 during soccer.

311 In contrast, perceptions of “power”, “acceleration”, and “speed” displayed substantial
312 agreement between coaches, suggesting that these qualities are more universally identifiable
313 during soccer game-based activity. Soccer players playing at a higher competitive level often
314 outperform those playing at a lower competitive level on tests related to “power” (eg.
315 Dugdale *et al.*, 2019), “acceleration” (eg. Coelho E Silva *et al.*, 2010), and “speed” (eg. le Gall
316 *et al.*, 2010). Furthermore, specific positions may favour such physical qualities resulting in
317 more obvious demonstrations of these qualities during performance for these players
318 (Roberts *et al.*, 2019). Our sample were recruited from a junior-elite academy and were likely
319 highly trained along with holding a greater understanding of position-specific criteria for their
320 stage of development (Roberts *et al.*, 2019). An awareness of the relationships between these
321 physical qualities and playing standard/position by coaches could, therefore, make them
322 easier to identify during game-based activity (Reeves, Enright, *et al.*, 2018; Roberts *et al.*,
323 2019). Lastly, these physical qualities largely rely on neuromuscular factors (Stølen *et al.*,
324 2005) and, as a result, are most affected by growth and maturation (Philippaerts *et al.*, 2006).

325 Those with an advanced maturity status may demonstrate vastly different abilities on these
326 qualities compared to late developers, which may be identified by coaches (Carling, Le Gall,
327 & Malina, 2012; Reeves, Enright, *et al.*, 2018). Our results suggest that these physical qualities
328 may be easily detectable during game-based activity, and we encourage coaches to be aware
329 of the potential influence that playing standard, playing position, and maturity status may
330 have on the accuracy of their ratings.

331 Finally, we must acknowledge that the Lead Coaches within our sample were older,
332 having gained more general coaching experience and accumulated more time coaching with
333 the players that they rated during our study. General and group-specific experience gathered
334 during a coach's career is suggested to influence quality of decision making and judgements
335 in youth soccer (Cushion, Ford, & Williams, 2012). However, in our sample, these differences,
336 when compared to the Assistant Coaches, were small. Nevertheless, we cannot rule out the
337 possibility that this additional coaching exposure may have improved the accuracy of coach
338 ratings for the Lead Coaches in our sample. We also observed that Lead Coaches held a higher
339 level of formal coaching qualification compared to Assistant Coaches, some of whom held no
340 formal coaching qualifications at all. While formal qualifications are rarely identified when
341 assessing attributes of importance for soccer coaching (Reeves, Roberts, *et al.*, 2018), they
342 are often a prerequisite when coaching in an academy setting when working with junior-elite
343 players. Given our study design, a more comprehensive knowledge of supplementary
344 attributes related to performance (such as physical qualities) may have been experienced
345 during more formal and structured learning, leading to more informed ratings by lead
346 coaches. In future, we encourage researchers to consider the impact that coach experience
347 and qualifications may have when collecting coach subjective ratings.

348 Our results should be considered in light of a number of limitations. First, this was
349 exploratory adopting a single club case study design. We suggest that results are treated with
350 appropriate caution given the design utilised. It has been established that clubs may adopt a
351 specific philosophy, favouring various styles of play (Cobb, Unnithan, & McRobert, 2018;
352 Williams & Reilly, 2000). Moreover, there is a tendency for coaches and practitioners to favour
353 physical and anthropometric characteristics rather than technical capacities of young players
354 (Reeves, Enright, *et al.*, 2018; Reeves, Roberts, *et al.*, 2018; Unnithan *et al.*, 2012).
355 Consequently, certain physical qualities, within our study, may have been rated by coaches
356 under the influence of conscious or unconscious bias. The physical qualities assessed within
357 our study develop at different times and rates throughout adolescence (Malina *et al.*, 2005)
358 and may be perceived to vary in importance across different playing positions (Roberts *et al.*,
359 2019). Therefore, specific playing position, age group or maturity status analysis may provide
360 a more comprehensive understanding of subjective ratings for these sub-groups. In future,
361 the use of larger samples, spanning multiple clubs, may help negate concerns and extend our
362 understanding of the complex relationships between subjective, coach-based ratings and
363 objective, empirical tests.

364 In summary, the translation between objective and subjective assessment methods of
365 physical qualities in youth soccer players may be effective when attempting to differentiate
366 between distinct population groups. However, when evaluating homogeneous samples, these
367 methods may lack sensitivity. A strong case exists to use both subjective and objective
368 assessments in an integrated manner when attempting to identify strengths and weaknesses
369 in youth soccer players.

370 **Disclosure statement**

371 The authors report no conflict of interest.

372

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560

561 **Table 1.** Descriptive statistics of raw data from measured variables for coach’s subjective ratings of players’ and corresponding objective
 562 physical performance.

563

		Coach's Subjective Rating				
		1 Poor	2 Below Average	3 Average	4 Above Average	5 Excellent
YYIRT L1 (m)	Lead	1387 ± 167 (n = 3)	1213 ± 551 (n = 16)	1374 ± 566 (n = 29)	1855 ± 577 (n = 24)	2234 ± 621 (n = 8)
	Assistant	920 ± 396 (n = 3)	1184 ± 409 (n = 5)	1613 ± 501 (n = 22)	1667 ± 711 (n = 41)	1329 ± 615 (n = 9)
CMJ (cm)	Lead	40.4 ± 5.2 (n = 3)	40.7 ± 5.7 (n = 14)	42.2 ± 7.7 (n = 33)	45.9 ± 7.1 (n = 23)	48.9 ± 5.6 (n = 7)
	Assistant	42.3 ± N/A (n = 1)	39.3 ± 3.7 (n = 10)	41.9 ± 7.2 (n = 33)	45.6 ± 7.3 (n = 24)	46.4 ± 7.8 (n = 12)
FMS (score)	Lead	16.3 ± 2.1 (n = 4)	15.8 ± 2.7 (n = 16)	17.0 ± 1.9 (n = 34)	17.2 ± 2.5 (n = 21)	17.6 ± 0.9 (n = 5)
	Assistant	15.5 ± 2.1 (n = 3)	16.5 ± 2.4 (n = 12)	17.3 ± 2.2 (n = 24)	16.5 ± 2.6 (n = 27)	16.9 ± 1.5 (n = 14)

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570 **Table 1. Cont.**

571

		Coach's Subjective Rating				
		1 Poor	2 Below Average	3 Average	4 Above Average	5 Excellent
Maturity offset (years)	Lead	-1.9 ± 1.6 (n = 7)	-2.4 ± 0.8 (n = 13)	-2.4 ± 1.1 (n = 30)	-1.8 ± 1.5 (n = 22)	-1.8 ± 1.3 (n = 8)
	Assistant	-1.3 ± 2.6 (n = 3)	-2.4 ± 1.0 (n = 6)	-2.3 ± 1.1 (n = 34)	-1.9 ± 1.4 (n = 18)	-2.2 ± 1.3 (n = 19)
5m sprint (s)	Lead	1.14 ± 0.05 (n = 7)	1.06 ± 0.11 (n = 10)	1.06 ± 0.08 (n = 36)	1.03 ± 0.08 (n = 22)	0.94 ± 0.07 (n = 4)
	Assistant	N/A	1.09 ± 0.06 (n = 14)	1.05 ± 0.10 (n = 34)	1.03 ± 0.08 (n = 27)	1.02 ± 0.11 (n = 5)
20 sprint (s)	Lead	3.50 ± 0.15 (n = 7)	3.30 ± 0.29 (n = 10)	3.34 ± 0.19 (n = 36)	3.18 ± 0.21 (n = 22)	3.01 ± 0.17 (n = 5)
	Assistant	3.31 ± 0.02 (n = 3)	3.45 ± 0.13 (n = 7)	3.33 ± 0.26 (n = 28)	3.24 ± 0.21 (n = 35)	3.21 ± 0.25 (n = 7)

572

573 **Table 2.** A Bayesian estimation of the coefficient of variation (R^2) with 95% credible intervals for each of the Bayesian monotonic ordinal
 574 regression models and Sklar's ω for agreement.

575

		Endurance	Power	Movement Quality	Physical Development	Acceleration	Sprint Speed
Lead Coach	R^2	0.23	0.11	0.05	0.03	0.17	0.2
	95% CI	0.08-0.37	0.01-0.23	0.00-0.16	0.00-0.12	0.04-0.32	0.06-0.33
Assistant Coach	R^2	0.03	0.09	0.01	0.02	0.06	0.07
	95% CI	0.00-0.11	0.00-0.22	0.00-0.07	0.00-0.08	0.00-0.18	0.00-0.19
Agreement	Sklar's ω	0.48	0.68	0.49	0.54	0.62	0.62
	Interpretation	Moderate	Substantial	Moderate	Moderate	Substantial	Substantial

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579 **Figure captions**

580 **Figure 1.** Raw data boxplots for lead and assistant coach ratings for: A) Yo-Yo test distance;
581 B) CMJ height; C) FMS score; D) maturity offset years; E) 5m sprint times, and; F) 20m sprint
582 times.

583 **Figure 2.** Marginal effects of the predictive Bayesian monotonic ordinal regression models
584 ($\pm 95\%CI$) for lead and assistant coach ratings at population level for: A) Yo-Yo test distance;
585 B) CMJ height; C) FMS score; D) maturity offset years; E) 5m sprint times, and; F) 20m sprint
586 times.