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1 **Coaches' Perceptions of Long-Term Potential are Biased by Maturational Variation.**

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7

8 **ABSTRACT**

9 Talent identification and development programs seek to recognise and promote athletes with
10 long-term potential in a particular sport. Coaches involved in these programs are often
11 required to make inclusions or exclusion decisions based on their perceptions of an athlete's
12 long-term potential. However, biological maturity can influence physical capabilities of
13 adolescent athletes and may bias coaches' perceptions of long-term potential. This study
14 explored the relationship between coaches' perceptions of long-term potential and variations
15 in athlete's biological maturity. Talented adolescent male Australian footballers from nine
16 (n= 264) different teams were recruited to provide basic anthropometric information for
17 estimates of biological maturity. Coaches from each team were recruited to provide a rating
18 of their own player's long-term potential. Coaches perceived late maturing athletes to have a
19 significantly lower long-term potential than their average ($\chi^2=9.42$, $p<0.01$) and early
20 ($\chi^2=5.86$, $p=0.04$) maturing counterparts. Of the late maturing athletes, 72% were predicted
21 to go no further than adolescent competition. No concurrent bias was evident between the
22 average or early maturing athletes. The findings of this study demonstrate coaches
23 perceptions of long-term potential can be biased by maturational variation in adolescent

24 athletes. Such perceptual bias may impact on coaches selection decisions and result in
25 talented but late maturing athletes missing selection into development pathways.

26 **Key Words:** Australian Football, Talent Pathway, Adolescent Athletes

27

28 INTRODUCTION

29 The identification and subsequent development of talented young athletes is paramount in
30 ensuring athletes attain their full potential and provide continuous elite athletes through to
31 senior competition [1]. However, development pathways are typically expensive to run [2]
32 and are associated with poor athlete retention into senior professional competition [3-5].

33 Development pathway coaches play a critical role in talent identification and the athlete
34 development processes [1]. Coaches often select or de-select athletes from development
35 pathways based on their perceptions of an athlete's long-term sporting potential [6].

36 Understanding factors that affect coaches' perceptions of athletes would enable greater
37 coaching education and potentially modify selection outcomes in the interests of improving
38 development pathway efficiency.

39 Coaches of young athletes have the difficult task of assessing athlete's long-term potential
40 and make subsequent selecting decisions for inclusion or exclusion into development
41 pathways [7]. However, in adolescent athletes, variations in biological maturity can be large
42 [8] which, directly impact on match [9, 10] and physical performance outcomes [11, 12].

43 Early maturing athletes are at a significant performance advantage over their later maturing
44 counterparts, with advanced vertical jump, sprint, strength and aerobic capacities seen in
45 athletes of greater biological age [13-15]. Advantages associated with greater maturational
46 age have also been linked to match running performance in both adolescent Soccer [9] and
47 Australian Football [10], demonstrating that physical advantages translate to performance

48 benefits in matches. However, these maturational advantages reduce with age, as variations in
49 biological maturity becoming less pronounced and completely diminish once full adult status
50 is attained [8]. Adolescent differences in stature and performance due to maturational
51 variation may confound coaches' perceptions of an athlete's long-term potential.

52 Coaches' perceptions of athletes may be biased by factors associated with size or
53 maturational advantage. In adolescent competition where stature (height and weight) and
54 physical performance is influenced by maturity [8], coaches may develop biased perceptions
55 of long-term potential due to the advantages associated with greater biological age.

56 Previously, it has been shown that stature can influence perceptions of athletic ability [16].
57 However, this study was limited to soccer players rating the perceived athletic prowess of a
58 size adjusted image of a goalkeeper, and so may lack practical and coaching application.

59 Despite perceptions of potential guiding coaches' selection decisions in adolescent
60 development pathways, no research has yet explored the link between perceptions of
61 potential and maturational variation. This study aimed to examine if maturational variation in
62 youth Australian Footballers influenced coaches' perceptions of long-term potential.

63 **METHODS**

64 Athletes ($n= 264$, age 15.62 ± 0.28 years) and coaches ($n= 9$, age 40.88 ± 7.59 . years,
65 coaching experience 12.50 ± 3.74 years) recruited for this study were from nine teams
66 involved in the semi-elite, under 16s (U16s) Western Australian Football League (WAFL)
67 competition. Athlete participants attended a screening day where the basic anthropometric
68 variables of height, sitting height and weight were measured. Height measures and mass
69 were assessed to the nearest 0.001 m and 0.1 kg using a stadiometer (PE, Sportforce,
70 Australia) and electric scales (Model UC-321, A&D Mercury Pty. Ltd., Australia). Sitting
71 height was measured by sitting participants on a 0.42 m seat with their buttocks and shoulders

72 against the stadiometer. These variables were then input into a regression equation to estimate
 73 maturity, using the predicted age at peak height velocity (PHV) method developed by
 74 Mirwald et al. [17]. The equation used was as followed.

$$75 \text{ Age at PHV} = -9.326 + (0.002708 \times [\text{leg length} \times \text{sitting height}]) - (0.001663 \times [\text{age} \\ 76 \quad \times \text{leg length}]) + (0.007216 \times [\text{age} \times \text{sitting height}]) + 0.02292 \\ 77 \quad \times (\text{weight}/\text{height})$$

78 This method provides a reliable and non-invasive means of assessing biological maturation,
 79 with a coefficient of determination 0.92, a standard error of measurement 0.49 years, and a
 80 mean difference of 0.24 ± 0.65 years between a verified sample of actual and predicted boys
 81 [17]. Years from PHV (Y-PHV) were calculated by subtracting age at PHV from
 82 chronological age. Players were then classified as late (Y-PHV below 1.16 years, n=58)
 83 average (Y-PHV between 1.17 and 2.15 years, n=154) or early (Y-PHV above 2.16 years,
 84 n=52) maturing. These groups were constructed by adding or subtracting 0.50 years from the
 85 average Y-PHV (1.66 ± 0.62 years), resulting in at least one year maturational difference
 86 between late and early maturing groups [18].

87 The coaches were asked to rate the perceived long-term potential of athletes in their team, via
 88 a questionnaire. The questionnaire asked what level of competition they thought the athlete
 89 would ultimately attain (1, semi-elite adolescent competition; 2, semi-elite senior
 90 competition; 3, professional senior competition).

91 Anthropometric variables were reported using mean and standard deviation. Perceptions of
 92 long-term potential were examined using chi-squared (χ^2) analysis. Statistical analyses were
 93 carried out using SPSS software (Version 22.0, SPSS Inc., USA). Statistical significance was
 94 set at $p < 0.05$.

95 RESULTS

96 At the time of assessment, the average years from PHV was 1.66, with a range of 0.27 years
97 before peak height velocity to 3.73 years after PHV, resulting in a biological age differential
98 of 4 years. Anthropometric information collected is reported in Table 1.

99 *****Table 1 near here*****

100 Fisher's exact chi-squared test was used as both the late and early maturing groups had less
101 than 5 athletes with perceived AFL potential. The chi-squared analysis revealed a significant
102 between group difference when comparing maturational groups and perceived potential
103 ($\chi^2=9.99$, $p=0.04$). As show in Figure 1, the differences appeared to be between the late-
104 maturing group compared to both the average and early-maturing groups. A sub-group chi-
105 squared analysis confirmed this, with the late-maturing group having a significantly different
106 distribution compared to the average ($\chi^2=9.42$, $p<0.01$) and early ($\chi^2=5.86$, $p=0.04$) groups.
107 No significant difference was evident between the average and late-maturing groups.

108 *****Figure 1 near here*****

109 The proportional breakdown of maturational groups and coaches' perceptions of long-term
110 potential can be seen in Figure 1. Of those in the late-maturing group, 42 (72.4%) were
111 expected to progress no further than adolescent selection, 14 (24%) were expected to make
112 senior teams, and 2 (4%) were predicted to make professional teams. Coaches' perceptions of
113 the average-maturing group were; 76 (49%), 69 (45%), and 9 (6%), respectively. Coaches'
114 perceptions of the early-maturing group were 26 (50%), 23 (44%) and 3 (6%); for adolescent,
115 senior, and professional competition respectively.

116 **DISCUSSION**

117 The aim of this study was to explore if coaches' perceptions of an athlete's long-term
118 potential are associated with variations in biological maturity. Results from this study
119 demonstrate that coaches perceive late-maturing athletes to have a lower long-term potential,

120 than their more biologically mature counterparts. No concurrent bias was evident between the
121 average and early-maturing groups.

122 Development pathways are tasked with the role of ensuring the development of talented
123 junior individuals for senior competition. Within these pathways, it often falls to coaches to
124 make inclusion or exclusion decisions of athletes, based on both objective data collected (i.e.
125 anthropometric measures, fitness testing and match statistics) and subjective opinions of skill
126 and potential. However, research has consistently shown that maturational variation can
127 significantly impact on objective measures commonly used, with those of advanced
128 maturation likely to perform better in testing [15] and match situations [9, 10]. This study
129 demonstrates that subjective bias also occurs, with coaches' perceiving late-maturing athletes
130 to have a lower long-term potential than their average and late-maturing counterparts.

131 Previously it has been shown that stature can influence perceptions of athletic ability [16].
132 However, the results of this study lack application to real-world coaching environments
133 because it used soccer players to rate the hypothetical goalkeeping ability when viewing
134 several size adjusted images of a goal keeper. To the authors' knowledge, this is the first
135 study to explore how coaches' perceptions of athletes within their own team can be
136 influenced by maturational variation.

137 The results of this study have direct implications for coaches of development pathways,
138 especially those who coach athletes around 15-16 years of age. For instance, since selection
139 and de-selection decisions are often based on coaches' perceptions of long-term potential, the
140 lower perceptions coaches have of late maturing athlete's long-term potential may reduce
141 their likelihood of selection into development pathways. Whilst the selection of more mature
142 athletes may contribute to success in adolescent competition [19], such selection biases may
143 prove erroneous longitudinally as performance advantages associated with maturational

144 variations diminish once full adult status is attained [20]. Coaches should therefore be aware
145 that when assessing the long-term potential of athletes, maturational variation within the
146 playing population can greatly affect performances. Acknowledgment of these maturational
147 and subsequent performance variations may then serve to moderate opinions and reduce
148 perceptual biases.

149 A limitation of this study was that actual long-term potential of the athletes used in this study
150 was not undertaken, to validate coaches' perceptions. Further, the results of this study are
151 also limited to Australian Football. Future research is required to establish if such perceptual
152 biases exist in sports with different physical demands. Future research should also seek to
153 longitudinally explore how accurate coaches' perceptions of an athlete's potential are and
154 what factors contribute to athletes attaining or fail to reach these expectations.

155 **CONCLUSION**

156 The findings of this study demonstrate that coaches' perceptions of athlete long-term
157 potential are associated with maturational variation. Coaches in this study perceived late
158 maturing athletes to have a lower long-term potential, when compared to their early and
159 average-maturing counterparts. Maturational differences in age matched athletes can be as
160 large as 4 years, which is likely to contribute to performance variations. Coaches should be
161 aware that performance variations associated with delayed maturity can impact the perception
162 coaches have on an athlete's long-term potential. Given that coaches' selection and de-
163 selection decisions are likely to be based on their perceptions of an athlete's long-term
164 potential, late-maturing athletes may be at an increased risk of de-selection. Coaches should
165 therefore seek to moderate their perceptions of an athlete's potential, by at least considering
166 the athletes maturity in reference to other age matched athletes.

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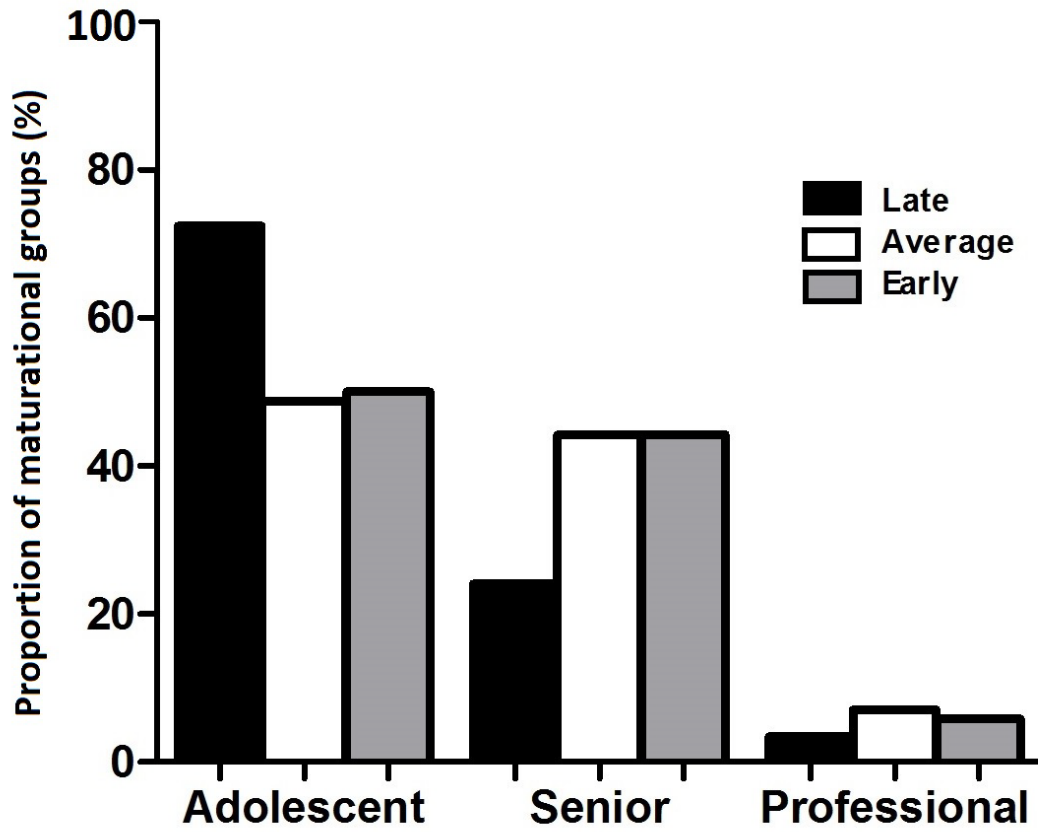
226 Table 1. Anthropometric variables for each of the different maturational groups (mean \pm
227 standard deviation).

	Maturational Status		
	Late	Average	Early
Height (m)	1.71 \pm 0.05	1.78 \pm 0.05	1.86 \pm 0.05
Sitting Height (m)	0.85 \pm 0.02	0.91 \pm 0.02	0.96 \pm 0.02
Weight (kg)	59.54 \pm 5.65	68.15 \pm 7.04	76.68 \pm 7.78

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229

230 Figure 1. Proportional breakdown (%) of each maturational group and the coaches'
 231 perceptions of the athlete's potential.



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