Title: Bio-banding in Academy Football: A Mixed Methods Investigation of Players Perceptions and Evaluations of a Maturity Matched Tournament

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Abstract

This study investigated perceptions of academy football players participating in a tournament bio-banded for player maturity status. Players completed a post-tournament questionnaire, comparing participants in bio-banded and age group format competitions. One sample means t-tests, magnitude-based inferences and ANOVA were used to examine differences between perceptions of bio-banded and age-group competitions, and differences across maturity groups. Thematic analysis was conducted on qualitative data generated by the open-ended questions. Quantitative and qualitative results showed two major benefits of bio-banding: first, early maturing boys perceived bio-banding as a greater physical and technical challenge, which provided new opportunities and challenges. Second, late maturing players perceived less physical and technical challenge, which permitted greater opportunity to demonstrate their technical and tactical abilities, and can potentially aid the retention of these players. Overall, players understood and enjoyed the bio-banded competitions, and also perceived less injury risk associated with this format. All maturity groups reported more opportunity to engage in leadership behaviours, to influence game-play and to express themselves on the ball in the bio-banded format. Overall, results of this study contribute to the current knowledge of bio-banding efforts in youth football and may facilitate the development of both early and late maturing academy players.

Key Words: Maturation, Puberty, Soccer, Adolescence, Timing

Introduction

Bio-banding is a strategy that groups athletes relative to attributes associated with growth or maturation (Cumming et al., 2017b). Maturation refers to progress towards the adult stature and can be defined in terms of status (state of maturation at the time of observation), tempo (rate), and timing (age at which a specific maturational event occurs). Youths of the same chronological age can vary considerably in maturity status. Bio-banding aims to reduce maturity-associated variation in size and athleticism, to create greater competitive equity and presents athletes with new challenges and opportunities (Baxter-Jones, 1995; Gallagher, 1969; Malina and Beunen, 1996; Seefeldt, 1981). Of note, the method serves as an adjunct to and not as a replacement for age group competition, and does not preclude the consideration of both psychological and technical factors.

The practice of bio-banding has particular relevance in sports were maturity-associated differences in size and function are related to athleticism. Biological maturity status is well-documented as a predictor of player fitness, performance, and selection in youth football (Meylan et al., 2010). A selection bias towards males who are advanced in maturity emerges in football at approximately 12-13 years of age, and increases with age and competitive level (Coelho-e-Silva et al., 2010; Figueiredo et al., 2009; Johnson, Farooq and Whiteley, 2017; Malina, 2011). Early maturing youth tend to be taller, heavier, and possess greater absolute and relative lean mass; they also show, on average, superior performances on tests of speed, strength and power, and, to a lesser degree, technical aptitude (Figueiredo et al., 2009; Malina et al., 2004; Malina et al., 2007b; Meylan et al., 2010). During competition, early maturing boys also reach higher peak speeds, cover greater distances at high speed, and are more frequently involved in high-intensity and repeated high-intensity actions (Buchheit and Mendez-Villanueva, 2014). It should be noted, however, that the preceding study employed the Mirwald maturity offset method for estimating maturity timing and the

reliability and validity of this method has been questioned (Malina and Koziel, 2014). Thus, these findings, though consistent with the contention that advance maturity affords an athletic advantage should be interpreted with caution.

Athletic advantages associated with early maturation increases the likelihood of these players being identified as talented, and in turn may provide greater access to specialist coaching and training resources (Malina, 2003; Bloom and Sosniak, 1985; Malina et al., 2015). Through participation in elite level programmes, early maturing players also benefit from exposure to higher standards of competition and challenge. In contrast, potentially talented late maturing youth are more likely to be overlooked, excluded, and subsequently denied such developmental opportunities (Cobley, 2016). Recent studies of Swiss, Qatari, and English junior footballers have demonstrated that late maturing players are underrepresented in the elite level programmes, and increasingly so with age (Johnson, Farooq and Whiteley, 2017; Zuber, Zibung and Conzelmann, 2016). This bias is of particular concern as talent can take several years to emerge (Simonton, 1999) and maturity associated differences in size and athleticism are typically attenuated or reversed in adulthood.

While early maturation affords an initial athletic advantage in sports such as football, it may, in the long-term prove counterproductive. The pressures to succeed and be retained within the academy system may encourage early maturing youth to play to their strengths, and perhaps encourage the development of physical rather than technical proficiency (Malina et al., 2015). Competing against smaller and physically less athletic youth, early maturing players may experience less challenge, which may, in turn, inhibit the development of the psychological, technical and tactical skills essential for success at higher levels of competition. Developmentally this lack of challenge may be a concern, as maturity-associated advantages in size and function are generally attenuated and/or reversed in adulthood (Lefevre, 1990; Malina et al., 2015). Although late maturing players may benefit in

the long-term from exposure to greater challenge, this argument only holds if these players are retained within the academy systems. As noted by Johnson and colleagues, late maturers represent less than 5 percent of an English academy cohort in the U15-U17 age groups.

The practice of bio-banding has been advanced as a strategy to address issues related to maturity-associated variation in size and athleticism. Although research on bio-banding is limited, emerging evidence suggests that it can benefit both early and late maturing players (Cumming et al., 2017b; Cumming et al., 2017a). The bio-banded football format was first evaluated in a Premier League tournament involving academy players from four professional teams who were grouped by biological maturity status rather than chronological age (Cumming et al., 2017a). Players 11 to 14 years who had attained 85.0% to 90.0% of predicted adult stature were grouped together for three competitive games. Experiences and perceptions of players in the bio-banded tournament were analysed using focus groups and qualitative methods. Early and late maturing players described their experiences as positive and noted that the bio-banding format presented unique challenges and more diverse learning experiences. Reasons for supporting the bio-banding format, however, varied relative to their maturity status. Early maturing players considered the bio-banded games to be more physically and technically challenging, requiring them to adopt a more team-oriented playing style, make decisions and release the ball more quickly, an opportunity to learn from, and be mentored by older, more skilled and experienced players, and better preparation for competing at the senior level. Late maturing players described their experience as less physically challenging, however, appreciated having more opportunity to adopt positions leadership, impact gameplay, and demonstrate a wider range of their physical, technical and tactical skills. Similar benefits of bio-banding were reported by academy stakeholders (i.e. staff, players and parents), in a recent evaluation of a seven-week training period where players were bio-banded by maturation at a premier league club (Reeves et al., 2018).

While the results of initial bio-banding competitions show promise, more research is required to better understand and validate the potential benefits and limitations of the format. With this in mind, the purpose of this study is to further examine players perceptions and evaluations of a series of bio-banded games, and the extent to which they vary relative to maturity timing. Using a mixed-methods approach, players were asked to rate their understanding of the bio-banding process and to describe their experiences of competing in a bio-banded tournament relative to regular age group competition.

Materials and Methods

Participants

Participants were U10 through U15 academy football players (N=115) from three English Premier League clubs (Bournemouth, Watford and Exeter City) who competed in a bio-banded tournament hosted by AFC Bournemouth. Though the process of registering with the three academies, individual players and their parents/guardians consent to the routine collection of data and the potential use of this data for research purposes. All measures were taken on a voluntary basis and participants had the right not to be assessed. The project and the right to use retrospective data was approved by the three clubs and the host institutions departmental Research Ethics Approval Committee.

Maturity Assessment

The maturity status of all players was estimated in the week prior to the tournament. Heights and weights of each player were taken by trained sports science staff. Heights of the biological parents of each player were self-reported and subsequently adjusted for over-estimation after Epstein et al. (1995). The chronological age, height and weight of the player and the average of his parents' heights (midparent height) were used to predict adult (mature)

height of the player using equations developed on middle-class youth in south-central Ohio in the United States (Khamis and Roche, 1994). The error associated with the method is 2.1%.

The height of each player was then expressed as a percentage of his predicted adult height, which was used as the indicator of maturity status at the time of the competition (Roche et al., 1983). Maturity classifications based on percentage of predicted adult height had moderate concordance with maturity classifications based on skeletal age in youth American football players 9-14 years (Malina et al., 2007a) and soccer players 11-15 years (Malina et al., 2012) players. The percentage of predicted adult stature of each player was subsequently converted to a z-score relative to age-specific reference values for males in the University of California, Berkeley, longitudinal study (Bayer and Bailey, 1959). The Premier Leagues PMA software was used to generate maturity classifications based Z-scores defined as average or on-time (Z-score between +0.5 and -0.5), early (Z-score >+0.5) or late (Z-score <-0.5). Of the 115 players, 68 were classified as on-time, 35 as early maturing, and 12 as late maturing.

Tournament

Players were grouped into three maturity bands based on percentage of predicted adult height attained at the time of the tournament: 80-85%; 86-90% and 91-95% of predicted adult stature. These bands were selected on the basis that they represent a developmental stage where maturity associated variance in size and function is at its greatest (Malina et al., 2004) and that they were broad enough to allow each club to field a full complement of players within each band.

Teams from the three clubs played each other across different match formats: 6v6; 7v7 and traditional 11v11. The club teams were split into two for the 6v6 and 7v7 formats; as such, six teams competed within these formats. The 6v6 and 7v7 teams of the respective clubs were combined into a single team for the 11v11 format. Details pertaining to the specific game formats are presented by maturity band in Table 1.

>>> Table 1 – Bio-banded Tournament format <<<

Questionnaire

After the tournament, all participants completed a questionnaire which included Likert scale (1-5) and open-ended questions:

1. Do you feel you understand the concept of bio-banding? (1 = Not at all; 5 = completely)
2. Did you enjoy the bio-banding tournament? (1 = Not at all; 5 = Yes, would like to do it again)
3. Did you feel more or less likely to get injured? (1 = Less; 5 = More)
4. Did you feel more or less of a leader than in your normal age group? (1 = Less; 5 = More)
5. Could you express yourself on the ball more or less than your normal age group? (1 = Less; 5 = More)
6. Did you feel like you were more or less of an influence on the games compared to your normal age group? (1 = Less; 5 = More)
7. Did you find the game more or less of a physical challenge compared to playing in your normal age group? (1 = Less; 5 = More)
8. Did you find the game more or less of a challenge technically compared to playing in your normal age group? (1 = Less; 5 = More)
9. Any further comments on why you did/did not like bio-banding?

The open-ended questions provided players with the option to provide any further qualitative comments regarding their perceptions and experiences of the bio-banded tournament and its various game formats.

Data analysis

All data were anonymised before post-tournament analysis. A series of univariate analyses (ANOVA) with a Bonferroni post hoc tests were conducted to examine maturity associated variance in players item responses. A series of one-sample t-test using the hypothesized mean of 3.0 was used to calculate confidence intervals and inferences from P-values (Hopkins, 2007). Cohen's d effect sizes were used in the "forest plot" where ±0.25 indicated the threshold for small effect sizes, to assess the degree to which the bio-banded tournament was viewed as beneficial, trivial or harmful compared to age group formats (Hopkins, 2007; Granacher and Büsch, 2017). The analyses were conducted within SPSS (Version 24); $p<0.05$ was set as significant.

An inductive thematic analysis was conducted on the qualitative data generated by the open-ended questions. In keeping with the six-phase guidelines established by Braun and Clarke (2006), this approach aims to identify, interpret and analyse common patterns within a dataset, and to generate a series of themes that enable further interpretation and elaboration of the statistical findings related to the research questions. One author initially examined the transcripts for general codes; subsequently, the research team reviewed and discussed the collation of preliminary themes. Through this process, the derivation of each theme was triangulated among four members of the research team to maximise accuracy and reliability (Braun et al, 2016). Key extracts were categorised into each of the identified themes.

Results

Descriptive statistics for the eight questions by maturity status of players are shown in Table 2. The corresponding effect sizes representing the magnitude of the perceived differences between the bio-banded and traditional age group formats for questions three through eight, are represented in Figure 1. Player responses suggest that they felt they understood the concept

of bio-banding; although late maturing players reported the highest level of understanding, the degree of understanding did not significantly vary among the maturity groups. All players perceived the bio-banding format as enjoyable and generally wished to engage in this format again. Early and on-time maturing players reported the highest levels of enjoyment, but enjoyment did not differ significantly among the three maturity groups.

>>> Table 2: Descriptive statistics (means and standard deviations) and ANOVA for each maturity status. <<<

Perceptions of injury risk did not differ significantly among maturity groups (Table 2). On-time and late maturing players perceived reduced injury likelihood in the bio-banded format, while perceptions of early maturing players were unclear (Figure 1). Players in all maturity groups reported, on average, greater feelings of leadership in the bio-banded format. Though not significantly different across maturity groups (Table 2), the extent of the differences varied from 'possibly more' (early maturers) to 'very likely more' (late maturers). Players in each maturity group reported they were more able to express themselves on the ball and felt they had more of an influence in bio-banded games (Figure 1). However, the perceptions did not significantly differ among maturity groups (Table 2).

Late maturing athletes perceived bio-banded games as presenting less of a physical challenge compared to chronological age group games; whereas, early maturing players reported greater physical challenge with the bio-banded format. Players maturing on-time reported no difference between the bio-banding format and chronological age group format regarding the physical challenge (Figure 1). Late maturing players also reported less of a technical challenge, whereas early maturing boys perceived bio-banded games as more technically challenging compared to age-group games. Differences among the three maturity

groups were statistically significant for both physical and technical challenge, and approximately 13% and 12% of the variance in perceived physical and technical challenge, respectively was attributed to variation in maturity status (Table 2).

>>> Figure 1: Graph to illustrate responses to each question regarding the bio-banded tournament split by maturity status- early, on-time and late. <<<

Four themes emerged from the qualitative analysis as central to player perceptions of the bio-banded tournament (Table 3): (1) *Overall experience* considered the player's general evaluation of the bio-banded tournament and individual experiences of the different game formats; (2) *Optimal Physical Challenge* reflected the perceptions of players regarding physical differences, benefits and challenges presented by the bio-banded tournament; (3) *Technical and Tactical Challenge* considered player experiences regarding the technical and tactical aspects of the bio-banded tournament, including benefits of playing with and against players of mixed age, opportunities to use, develop and demonstrate technical competence/excellence, and/or the tactical challenges and adaptations involved; and (4) *Psychosocial Challenge* represented player perceptions of the psychological aspects of the learning experience and the social benefits and challenges of the bio-banded tournament. Selected quotations from each theme are presented in Table 3.

>>> Table 3. *Qualitative perceptions and evaluations of the bio-banded tournament* <<<

Discussion

This study examined the perceptions and evaluations of Academy football players regarding a tournament bio-banded for biological maturity status. Most players believed that they understood the concept of bio-banding, but not all players were able to effectively differentiate between the concepts of growth and maturation. One player, reported some confusion as to "why other players within the same band were bigger", contending, "surely bio-banding is used to balance the physical area out" (OM). This observed misunderstanding was consistent with previous work (Reeves et al., 2018) and highlighted the importance of educating players, coaches and parents on inter-individual differences in biological maturation and the concept of bio-banding. Grouping players by maturity status is designed to attenuate but not to eliminate maturity-associated differences in size and function. Players of the same maturity status can still differ in size and function (strength, speed, power) due in large part to genotypic factors. Players who are genetically short in stature still must learn to play within their means as will their genetically taller peers. Nevertheless, bio-banding has the potential to reduce the degree to which individual differences in size and athleticism impact player development and success.

Consistent with previous research, players described their experience of competing in the bio-banded tournament as enjoyable (Cumming et al., 2017a). Players also described the bio-banding format as a "new and different experience" (OM) and as a welcomed change from age group competition - "liked it because it provided a different experience to playing in normal age group games" (EM). The experiences of players maturing early and on-time to the bio-banded tournament were reported as marginally more enjoyable than those of late maturers, though the differences were not statistically significant. It is possible that early and on-time players enjoyed the greater physical and technical challenge, and the opportunity to

play and compete with players who were older and more experienced. The older late maturing player, in contrast, may have perceived playing with younger, more mature and less experienced players as a stigma (also noted by Reeves et al., 2018), but playing down did not appear to adversely impact their enjoyment of the competition. Future research should seek to investigate specific sources of fun in academy football and how alternative game formats, such as bio-banding can contribute towards greater enjoyment of the sport (Visek et al., 2015).

Players maturing on-time and late perceived markedly less risk of injury in bio-banded compared to age group competitions, while early maturing players reported marginally less risk of injury in the bio-banded format although the difference was unclear (Figure 1). Nevertheless, the extent to which the bio-banded format can reduce injury risk in actual competition is unknown. Logically, parity in body size and athleticism should reduce the likelihood of injury, specifically injury associated with collision or physical contact. The association between size and injury, however, remains unclear. Age, height, weight and estimated maturity status based on percentage of predicted adult height were not associated with the risk of injury among youth American football players 9-14 years (Malina et al., 2006). Contrary to expectations, greater size was associated with an increased likelihood of injury in youth rugby (Quarrie et al., 2001). It is important to note, however, that this study involved older adolescences/ young adults and thus these findings may not generalize to younger populations. Larger players may be exposed to greater risk through more involvement in gameplay. Further research is required to fully understand the extent to which variance in maturation and size does, or does not, contribute towards injury risk in youth football; and if maturity or size based matching strategies can reduce injury risk in young athletes.

Consistent with previous research (Cumming et al., 2017a), players experienced greater feelings of leadership in the bio-banded format than in age group competition. Although greater feelings of leadership were reported by all maturity groups, the effect was greatest for late maturing players. Older late maturing players may perceive greater opportunity and expectations to assume positions of leadership when playing with and competing against physically matched yet chronologically younger players (Cumming et al., 2017a). Conversely, younger early maturing boys may have more opportunity to engage in and experience the process of being mentored by and learning from older peers.

The development of leadership is a key objective in the English Football Association's four-corner player development model and is also considered an important determinant for success at the adult level. Mixed-age game formats, such as bio-banding, may beneficially influence group dynamics by placing greater emphasis upon the use and development of social skills such as leadership, teamwork, and communication. Research addressing the social benefits of bio-banding *per se* and how it may differentially challenge players of varying maturity status is needed.

From a technical perspective, early and late maturing players reported, respectively, more and less challenge. Competing against older and more experienced players, early maturing players are no longer able to use their physical advantages and must use their technical and tactical skills to succeed. They must also adjust their game to a style of play that is faster and more sophisticated. This was reinforced in the qualitative data which highlighted additional challenges for early maturing players, e.g., "It gave me the chance to improve both technically and physically" (EM). While late maturing players considered the game less technically challenging, they reported greater opportunity to express themselves and influence the game. This was consistent with earlier observations (Cumming et al.,

2017a) which showed that late maturing players found bio-banded games less physically and technically challenging, but appreciated having more opportunity to both use and demonstrate their physical and technical competencies. On the other hand, the bio-banded tournament had only a trivial effect on technical challenges experienced by 'on-time' players, which suggested that the technical demands were generally similar to age group competitions. Although perceptions of technical challenge varied by maturity status in the present study, prior research has shown that bio-banding was associated with twice the frequency of dribbling and passing compared to age-group competition (Thomas et al., 2017).

Player perceptions of physical challenge varied with maturity status; early maturing boys described the bio-banded format as more physically challenging than age group competition, confirming previous observations (Cumming et al., 2017a). Challenge has long been recognized as a requisite successful athletic development (Gould, et al., 2002; Toering, et al., 2009). Due to physical and athletic advantages, early maturing players may not be experiencing optimal levels of challenge in age group competitions. Bio-banded competitions may help address this issue by allowing the early maturing player to benefit from the same challenges that are believed to give late maturers an edge in adulthood (Korgman 1959; Cumming et al. 2017b). The qualitative data suggested that early maturity players appreciated such opportunities; relishing the chance "to play with older and physically more mature players" (EM). Players maturing 'on-time', in contrast, reported little to no differences in physical challenges between the bio-banded and age group formats, whereas late maturing players considered the bio-banded tournaments to be less physically challenging. The preceding observations were consistent with previous observations of the bio-banded format (Cumming et al., 2017a). Less challenge does not, however, imply less opportunity for development. Late maturing players have previously described bio-banded formats as affording greater opportunity to both use and demonstrate their physical and technical/tactical

skills, adopt positions of leadership and exert greater command over the game. Such formats also enable coaches and scouts to evaluate late maturing players in an alternative environment and look beyond individual differences in physical maturity. Greater physical equity may allow academies to maintain more late-maturing players and judge the players on their current level of physical development as reflected in a player's comment that he felt "more physically matched" (LM) within the bio-banded games.

Although interesting and consistent with previous research, limitations of this study should be noted. The results are limited to players from three professional academies who competed in the specific tournament format. The results may thus not generalize to children of different ages and levels of maturation, to grassroots football, or to athletes competing in other sports. Consistent with observations on skeletal ages of youth soccer players (Johnson et al., 2017; Malina et al., 2018), the proportion of late maturing players involved in the tournament was relatively small. Moreover, despite most players finding the bio-banding games of benefit and enjoyable, a small minority of players described their experiences negatively, "I didn't enjoy the tournament as I felt we didn't learn anything throughout the day" (EM). Further questions that merit future attention include: (1) at what stages ages is bio-banding more or less effective; (2) coaches' perceptions of the advantages and disadvantages of bio-banding; (3) how bio-banding impacts in technical and physical parameters during game performance.

In summary, this study investigated the evaluations of professional academy football players of a tournament in which they were grouped by maturity status rather than chronological age. The findings indicated that players both understood and enjoyed the bio-banded format and that the strategy was perceived as affording more opportunity for players to express themselves, adopt positions of leadership, and influence gameplay. Early maturing players perceived the bio-banded games as more physically and technically challenging,

whereas, late maturing players found them less so. This study supports the contention bio-banding, as an adjunct to age group competition, can contribute positively to the holistic development of young football players.

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Declaration of interest statement:

The authors express no conflicts of interest.

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Tables:

Table 1: Bio-banded Tournament game formats.

		Percentage of Predicted Adult Stature Bands		
		80-85%	86-90%	91-95%
6v6	Pitch Size (Meters)	45 x 30	48 x 36	48 x 36
	Ball Size	4	5	5
	Match Duration/ Rest (Mins)	4 / 4-5	4 / 4-5	4 / 4-5
	Goal Size (Meters)	2 x 4	2 x 4	2 x 4
7v7	Pitch Size (Meters)	53.8 x 31.6	53.8 x 31.6	60.2 x 39.6
	Ball Size	4	5	5
	Match Duration (Mins)	8	8	8
	Goal Size (Meters)	1.95 x 3.75	1.95 x 3.75	2.25 x 5.5
11v11	Pitch Size (Meters)	72.5 x 49	98.6 x 61.8	98.6 x 61.8
	Ball Size	4	5	5
	Match Duration (Mins)	20	20	20
	Goal Size (Meters)	2.2 x 6.55	2.59 x 7.5	2.59 x 7.5

	Early (n=35)		On Time (n=68)		Late (n=12)		F statistic	Eta Squared
	Mean	SD	Mean	SD	Mean	SD		
Do you feel you understand the concept of bio-banding?	4.09	0.82	3.88	1.09	4.42	0.67	1.72	0.03
Did you enjoy the bio-banded tournament?	4.23	1.03	4.22	0.93	3.92	0.52	0.59	0.01
Did you feel more or less likely to be injured?	2.66	0.87	2.57	1.00	2.17	1.12	1.16	0.02
Did you feel more or less of a leader than in your normal age group?	3.26	0.85	3.37	0.95	3.58	0.67	0.61	0.01
Could you express yourself more or less than in your normal age-group?	3.69	0.76	3.49	0.97	3.58	0.90	0.57	0.01
Did you feel you were able to have more or less of an influence compared to your normal age group?	3.46	0.82	3.51	0.87	3.42	0.90	0.10	0.00
Did you find the games more or less of a physical challenge compared to age groups?	3.29[a]	0.86	3.01[b]	1.15	1.83[ab]	0.94	8.65*	0.13
Did you find the games more or less of a technical challenge compared to age groups?	3.66[ac]	0.73	3.10[c]	0.96	2.67[a]	0.78	7.28*	0.12

*P<0.001
[a] = Significant difference between Early and Late Maturers
[b]= Significant difference between On-Time and Late Maturers
[c]= Significant difference between Early and On-Time Maturers

Table 2: Descriptive statistics (means and standard deviations) and ANOVA for each maturity status. Place title above the table.

Table 3. *Qualitative perceptions and evaluations of the bio-banded tournament.*

Theme	Qualitative Evidence
1. OVERALL EXPERIENCE	
General Enjoyment	I liked it because it was a new and different experience (OM) I liked it because it provided a different experience to playing in normal age group games (EM) It was a fun experience (EM) It was well-organized and fun (EM)
2. OPTIMAL PHYSICAL CHALLENGE	It gave me the chance to feel what it was like playing against other players of similar physicality (EM) It was a fun experience and physically challenging (EM) I liked that I got the chance to play with older and physically more mature players (EM) I liked it because we were better matched physically and was therefore challenging (OM) I liked it because you got to play with people both older and younger than you but of the same physicality (OM) I enjoyed playing others of similar physicality (OM) I felt we were more physically matched (LM) I liked it because I found it more competitive compared to the normal GPs (EM) I liked it because I could physically compete against the others (OM) It was a good test of strength, more so than what I experience in my normal age group (OM) I liked it because it was challenging (OM)
3. TECHNICAL AND TACTICAL CHALLENGE	
Opportunities to use, develop and demonstrate technique	Playing in the bio-bands enabled me to focus more on my technical game rather than worrying about the physicality (OM) It gave me the chance to improve both technically and physically (EM)
Tactical Adaptation	I felt that those I played within the bio-banded team didn't make the runs like those in my normal age group; restricted my ability to play through balls like I usually do (OM)
4. PSYCHOSOCIAL CHALLENGE	
Self-confidence and growth	I felt that those I played within the bio-banded team didn't make the runs like those in my normal age group; restricted my ability to play through balls like I usually do (OM) I liked the bio-banding as it enabled me to express myself (OM) It resulted in me being more confident in myself (EM) I felt more able to express myself (LM)
Peer pressure	I didn't like the bio-banding as I felt under pressure from the older ones in the group meaning I couldn't try things (OM)

NB: EM = Early Maturer, OM = On-time Maturer, LM = Late Maturer

Figure 1: Graph to illustrate responses to each question regarding the bio-banded tournament split by maturity status- early, on-time and late. Data points represent Cohen's d effect size and confidence interval for each maturity status for six questions. Dotted vertical lines represent threshold for smallest worthwhile effect size (Cohens d effect size of 0.2 to-0.2=small). Data labels illustrate the percentage likelihood of bio-banding being positive or negative for each question (% More/ Trivial/ Lower).