**Developmental and professional activities of elite badminton players**

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## Introduction

The activities that athletes participate in during their development contribute significantly to skill acquisition and the attainment of expert performance (Ford et al., 2012). Athletes typically engage in three main activity types during their time in sport. First, *practice* is formal activity engaged in with the primary aim of improving performance, such as coach-led practice. A key practice activity in the development and improvement of expert performance is *deliberate practice*. Deliberate practice is designed to improve specific aspects of current competition performance, is effortful, may be less enjoyable than other activities, and the motivation to engage in it comes from its benefit to future performance (Ericsson, Krampe & Tesch-Römer, 1993). Second, *competition* is formal activity engaged in with the main intention of winning matches and tournaments. Third, *play* is informal activity engaged in with the primary aim of fun and enjoyment, such as playground basketball.

Most researchers have examined the developmental activities of athletes by having them retrospectively recall their engagement from their first exposure to the sport to the current time via interviews and questionnaires. Researchers have shown that variation in the amount of engagement in these activities by athletes across their development leads to related differences in acquired attainment and skill levels. Expert athletes accumulate more hours in sport-specific practice when compared to lesser-skilled athletes (for a review, see Baker & Young, 2014). Furthermore, soccer players who engaged in greater amounts of play activity in the sport during childhood possessed superior anticipation and decision making skills (Roca, Williams, & Ford, 2012; Williams, Bell-Walker, Ward, & Ford, 2011) and attained professional status (Ford, Ward, Hodges, & Williams, 2009; Hornig, Aust & Güllich, 2014) more so when compared to those who engaged in less of this activity. Moreover, successful elite Danish athletes in Olympic sports accumulated less practice in their sport up to early adolescence, but more practice in it from later adolescence, when compared to less-successful

elite athletes (Moesch, Elbe, Hauge, & Wikman, 2011). Findings from multiple studies have led researchers to forward an optimal developmental activity pathway for aspiring athletes. It involves a progression from engaging mainly in play activity during childhood towards engaging mainly in deliberate practice and competition from early adolescence onwards.

However, debate still exists as to the optimal time to specialize solely in deliberate practice activities in the sport, as well as whether childhood engagement should involve a variety of sports or not. The debate is reflected in two extreme positions or models, known as *early specialisation* and *early diversification*. Both models involve engagement from adolescence onwards mainly in deliberate practice and competition in a single sport. However, early specialisation involves childhood engagement solely in deliberate practice in a single sport so as to accumulate more hours than others by adulthood. In contrast, early diversification involves play activities across a variety of sports in childhood, with later specialisation in adolescence. The time point of specialisation and amount of early diversification required to become an expert athlete appears to be dependent on the sport. Factors that may influence them include the popularity of the sport, the attributes required to be an expert performer in the sport, the age when peak performance is typically reached, the culture of the sport, and the extent to which other performers accumulate practice in the domain. Variation between sports in these factors leads to related differences between sports in the time point of specialisation and amount of early diversification. For example, the developmental activities of Olympic gymnasts in Canada followed the early specialisation pathway, partly because peak performance is required from early adolescence (Law, Côté, & Ericsson, 2007). In contrast, Olympic team sport players in Canada followed the early diversification pathway, partly because peak performance is required later in early adulthood (Baker, Côté, & Abernethy, 2003). Another factor that influences the amount and type of activities engaged in is the country in which the athlete lives. For example, elite soccer players in Brazil engaged in twice as much soccer practice during adolescence compared to England (Ford et al., 2012). Therefore, there is a need to systematically examine developmental activities in single sports across multiple countries, not least because some pathways are less optimal than others, allowing sports to identify and improve them. To date, no research has been conducted examining the developmental activities of expert athletes in racket sports, including badminton.

The aim of this research is to examine the amount and types of developmental and professional activities engaged in by elite badminton players in European and Malaysia and the association to attainment and skill acquisition.

**Method**

Professional badminton players from Malaysia ($n = 17$; *males = 8*) and Europe ($n = 9$, *males = 3*; *Great Britain = 3*; *Italy = 4*; *Spain = 2*) completed a badminton-specific version of the Participation History Questionnaire (PHQ) in order to identify the activities they engaged in during their development and professional career. The test-retest reliability and the validity of the PHQ were shown in Ford et al. (2010). The PHQ contains three sections. The first section elicits information on badminton-specific milestones. These milestones include the age at which participants first took part in badminton, their start age in supervised badminton practice, first participation in an elite training academy, and competition performance, such as winning National Championships. The second section provides information on their engagement in three badminton activities: practice; competition; and play. The hours per week and months per year in each of the activities, as well as the weeks when players were injured per year, were recorded for each year from the current year back to the year in which participants began playing the sport. The third section provides information on engagement in other sport activities. It contained a list of other sports from which participants indicated those in which they had participated in regularly for at least a total minimum period of three months.

The hours accumulated in each of the three badminton activities in development during childhood (6 to 12 years of age) and adolescence (13-18 years of age), as well as the average hours per year in adulthood as a professional (19-25 years of age) were calculated for both groups. The number of other sports was calculated for each phase of development. Milestone data was collated as descriptive statistics.

**Results**

*Malaysian players*

Table 1 contains the ages at which Malaysian players reached badminton-specific milestones. Their current median world ranking was 124, with a range from the lowest rank of 41 to the highest of 954. Mean start age in badminton was 8.1 years ($SD = 1.2$), which is later than soccer players (Ford et al., 2012). Start of supervised training and competition occurred approximately two years later at the age of 9.9 years ($SD = 1.0$). First participation in youth national and international competitions was at 11.5 years ($SD = 1.7$) and 12.4 years ($SD = 3.7$), respectively. First participation at a senior national and international level was at 15.8 years ($SD = 1.9$) and 16.8 years ($SD = 1.8$), respectively. Five of the players first participated at a World Championships at 16 to 23 years age.

Table 1. Milestones in years of age achieved by elite badminton players from Malaysia.

| Milestone | Mean | SD |
|---|---|---|
| Chronological age | 20.4 | 3.1 |
| Start age | 8.2 | 1.2 |
| First supervised training | 9.3 | 1.4 |
| First competition | 9.9 | 1.0 |
| First compete at youth national level | 11.5 | 1.7 |
| First compete at youth international level | 12.4 | 3.7 |
| First compete senior national level | 15.8 | 1.9 |
| First compete senior international level | 16.8 | 1.8 |

**Developmental years.** Figure 1 shows the hours accumulated in the three badminton activities during the developmental years (childhood, adolescence). ANOVA revealed a significant age main effect, $F(1, 16) = 765.57$, $p < .01$, $\eta p^2 = .98$. Hours accumulated in badminton activities were greater in adolescence compared to childhood. There was also an activity main effect, $F(2, 32) = 354.92$, $p < .01$, $\eta p^2 = .96$. Hours accumulated in practice were greater compared to competition, as well as in practice and competition compared to play. There was a significant interaction between age and activity, $F(2, 32) = 109.07$, $p < .01$, $\eta p^2 = .87$. Hours accumulated in each activity type were not different during childhood, whereas hours accumulated in practice and competition were greater compared to play in adolescence, as well as practice being greater than competition. In childhood, the amount of badminton hours over the 5 years from mean start age of 8 years of age and over a 40-45 week season each year was 4-5 hrs a week in practice, 3 hrs a week in play, and less than 1 hr a week in competition. In adolescence, the amount of badminton hours equated over a 40-45 wk season each year to 16 hrs a week in practice, 7 hrs a week in competition, and less than 2 hrs a week in play.

The Malaysian players participated in a median of 1 other sport in childhood, with a range from 0 to 4 sports, although one player engaged in 8 other sports. In adolescence, nine of the players engaged in 1 other sport, whereas the rest did not participate in other sports. The number of other sports is relatively low compared to previous research with other athletes in different sports (Baker et al., 2003). There were five sports that players mainly participated in, including athletics (7 out of 17 players), running (6 out of 17 players), table tennis, basketball, and swimming (each 5 out of 17 players). Most played other sports at school-level, but three players participated at state-level.
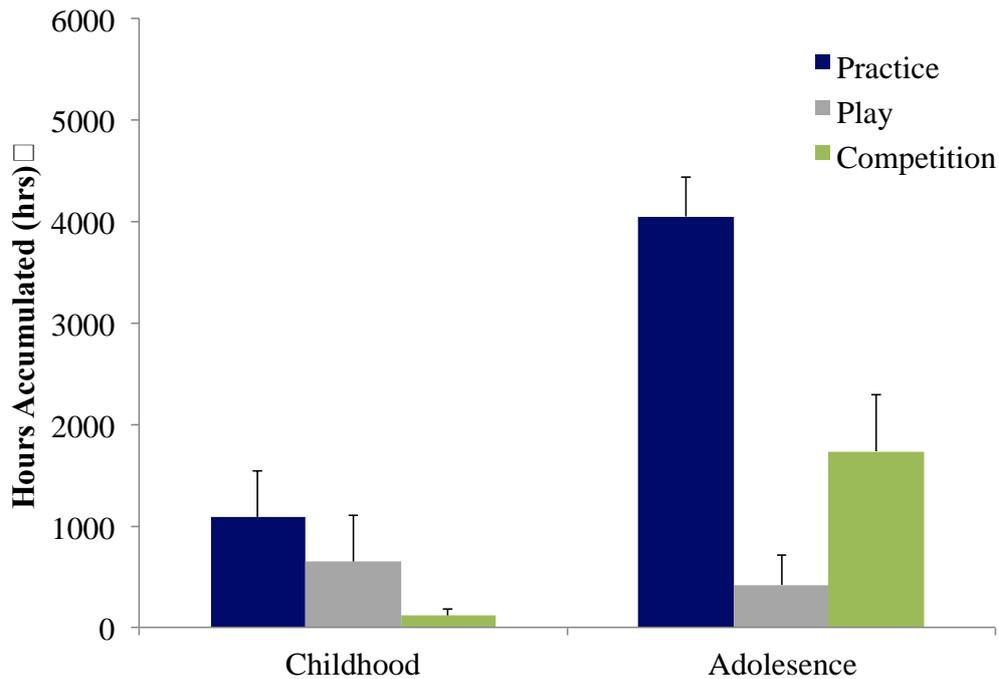
**Figure 1.** Hours accumulated by Malaysian players in the three badminton activities (practice, play, competition) during the two developmental phases (childhood, adolescence).

**Professional years.** Only six of the players were 20 years of age or older, whilst only three were 25 years of age or older. Players in early adulthood (19-21 years of age) engaged in 846 hrs per yr ($SD = 97$) of badminton practice (where a year equals 52 weeks), 446 hrs per yr ($SD = 73$) in competition, and 31 hrs per yr ($SD = 22$) in play. Between 19-21 years of age, the amount of badminton hours equated over a 40-45 wk season each year to 19-20 hrs a week in practice, 10-11 hrs a week in competition, and less than 1 hr a week in play. Players in middle adulthood (22-25 years of age) engaged in 963 hrs per yr ($SD = 32$) of badminton practice (where a year equals 52 weeks) and 423 hrs per yr ($SD = 33$) in competition, with no hours in play. Between 22-25 years of age, the amount of badminton hours equated over a 40-45 wk season each year to 22-23 hrs a week in practice and 10 hrs a week in competition. The players did not engage in any other sports in adulthood.

*European players*

Table 2 contains the ages at which European players reached badminton-specific milestones. Their current median world ranking was 354, with a range from the lowest rank of 1,747 to the highest of 21. Mean start age in badminton was 9.4 ($SD = 2.9$) years, which is later than Malaysian players. They began supervised training at the age of 10.5 ($SD = 2.5$) years and competition at the age of 11.5 ($SD = 2.1$) years. First participation in youth national

and international competitions was at 12.7 ($SD$ = 2.2) and 14.2 ($SD$ = 2.1) years of age, respectively. First participation at a senior national and international competition was 15.6 ($SD$ = 1.3) and 16.9 ($SD$ = 1.1) years of age, respectively. Six of the players first participated at a World Championships at 17 to 25 years age.

Table 2. Milestones in years of age achieved by elite badminton players from Europe.

| Milestone | Mean | SD |
|---|---|---|
| Chronological age | 20.9 | 4.1 |
| Start age | 9.4 | 2.9 |
| First supervised training | 10.5 | 2.5 |
| First competition | 11.5 | 2.1 |
| First compete at youth national level | 12.7 | 2.2 |
| First compete at youth international level | 14.2 | 2.0 |
| First compete senior national level | 15.6 | 1.3 |
| First compete senior international level | 16.9 | 1.1 |

**Developmental years.** Figure 2 shows the hours accumulated in the three badminton activities during the developmental years (childhood, adolescence). ANOVA revealed a significant age main effect, $F$ (1, 9) = 28.25, $p$ < .01, $\eta p^2$ = .76. Hours accumulated in badminton activities were greater in adolescence compared to childhood. There was also an activity main effect, $F$ (2, 18) = 18.96, $p$ < .01, $\eta p^2$ = .68. Hours accumulated in practice were greater compared to competition, as well as in practice and competition compared to play. There was a significant interaction between age and activity, $F$ (2, 18) = 18.71, $p$ < .01, $\eta p^2$ = .68. Hours accumulated in each activity type were not different during childhood, whereas hours accumulated in practice and competition were greater compared to play in adolescence, as well as practice being greater than competition. In childhood, the amount of badminton hours over the 4 years from mean start age of 9 years of age and over a 40-45 week season each year equated to 2-3 hrs a week in practice, and less than 1 hr a week in play and competition. In adolescence, the amount of badminton hours equated over a 40-45 wk season each year to 10-12 hrs a week in practice, 1-3 hrs a week in competition, and less than 1 hr a week in play. Hours in badminton during childhood and adolescence were lower for European compared to Malaysian players.

The European players participated in a median of 2 other sport in childhood, with a range from 0 to 9 sports. In adolescence, the players engaged in an average of 2 other sports. The number of other sports is higher compared to the Malaysian athletes, but lower compared to athletes in other sports (e.g., Baker et al., 2003). Swimming was the main sport in which 6

out of the 9 athletes participated. The regular other sports that the players participated in included athletics, running, soccer, gymnastics, weights and tennis (3 out of 9 players for each sport).
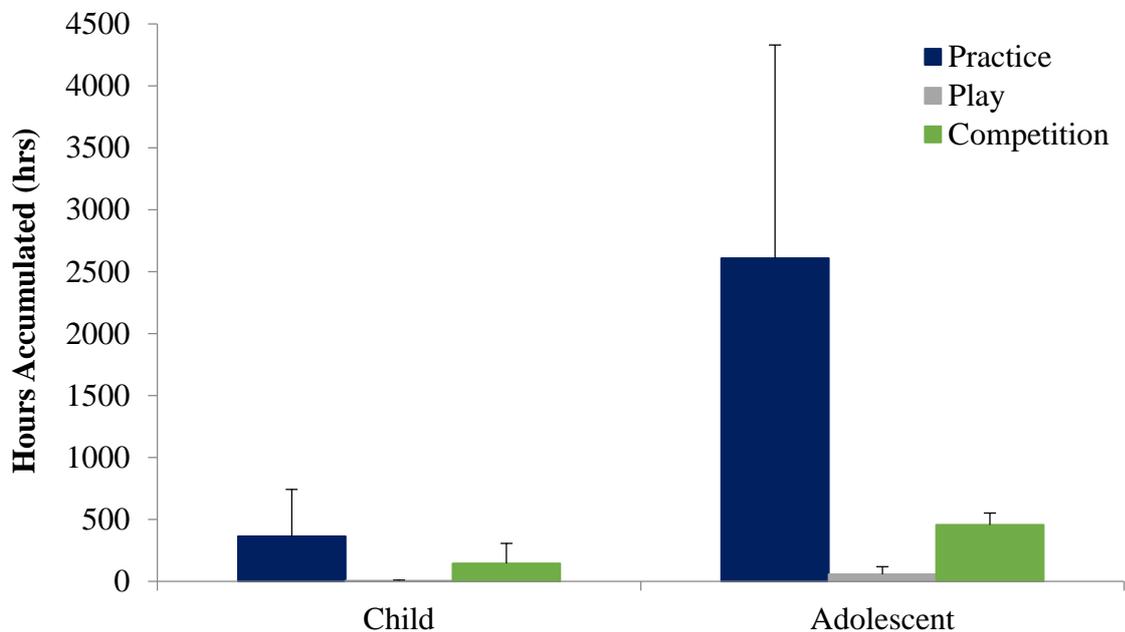


**Figure 2.** Hours accumulated by European players in the three badminton activities (practice, play, competition) during the two developmental phases (childhood, adolescence).

**Professional years.** Only 5 of the players were 20 years of age or older, whilst only 3 were 25 years of age or older. Players in early adulthood (19-21 years of age) engaged in 753 hrs per yr ($SD = 485$) of badminton practice (where a year equals 52 weeks), 93 hrs per yr ($SD = 52$) in competition, and 32 hrs per yr ($SD = 39$) in play. Between 19-21 years of age, the amount of badminton hours equated over a 40-45 wk season each year to 17-18 hrs a week in practice, 1-2 hrs a week in competition, and less than 1 hr a week in play. Players in middle adulthood (22-25 years of age) engaged in 1,031 hrs per yr ($SD = 388$) of badminton practice (where a year equals 52 weeks), 223 hrs per yr ($SD = 199$) in competition and 43 hrs per yr ($SD = 76$) in play. Between 22-25 years of age, the amount of badminton hours equated over a 40-45 wk season each year to 25 hrs a week in practice and 5-6 hrs a week in competition and 1 hr a week in play. which differed to the Malaysian players who did not participate in any play in middle adulthood. European players accumulated less hours in competition and more hours in play during their professional years when compared to the Malaysian players.

**Discussion**

The developmental activities of elite Malaysian badminton players followed the early specialisation or engagement pathway, whereas the activities of the elite European players followed the early engagement pathway. Players started in the sport at 8-9 years of age and engaged in badminton-specific practice and competition activities during childhood, with the Malaysian players accumulating more hours in these activities compared to the European players. Players engaged in a low number of other sports during childhood, similar to soccer players (Ford et al., 2012), demonstrating that their activities did not follow the early diversification pathway. The number of hours in badminton-specific practice and competition activities increased significantly in adolescence, and again in adulthood where it became a full-time job for the players. In general, the Malaysian players accumulated more hours in badminton activities during adolescence and adulthood when compared to the European players.

During childhood, the activities for the Malaysian players of badminton-specific practice (4-5 hrs/wk), play (3 hrs/wk) and competition (1 hrs/wk) would be considered to follow the early engagement pathway if the practice was *not* deliberate, whereas it would follow the early specialisation pathway if it were deliberate practice. In comparison, during childhood, the activities for the European players of badminton-specific practice (2-3 hrs/wk), play (<1 hr/wk) and competition (<1 hrs/wk) follow the early engagement pathway because the amounts of hours in these activities are relatively low. Further research is required to determine whether the practice in childhood contains the characteristics of deliberate practice. Data on the developmental activities of expert badminton players enables coaches to create optimal developmental pathways for aspiring players so that they acquire the necessary attributes to produce expert performance in adulthood.

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