Sliding benchmarks might prevent de-selection of talented badminton players

Los criterios de referencia variables podrían evitar la deselección de jugadores de bádminton talentosos

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Abstract

Despite potential advantages of talent identification practices, the degree of bias in decision-making due to relative age and maturity timing remains a concern. To investigate the impact of relative age and maturity on selection processes, and to examine the possible influence of an intervention aimed at minimizing the impact of relative age and maturity biases, thirty-three boys (M_{age} = 12.43y ± 0.36y) invited to compete for Badminton Malaysia, completed three anthropometrical measures, eight physical performance assessments, and five motor coordination tests. These players were tracked throughout their career to determine pathway progression (i.e., dropout or continuation) and their level of success (i.e., season-end rankings). With regards to the relative age of athletes and the initial selection to the U13 team, findings revealed that younger and less mature players were disadvantaged, since their morphology, physical fitness, and motor capacities were less developed than their peers. A sliding benchmark intervention was applied, where raw scores were adjusted. Although, the dropout rate from the U13 team was high (24/33 players, 73%), 6 of 9 remaining players of the national team achieved exceptional results, which were evident six years later. As a result of the sliding benchmark intervention, two relatively younger, late maturers with superior motor competence scores, were selected to the elite sport school. Without this intervention, both players might never have won the BWF Junior World Championships. This paper examines the pathway of these competitive badminton athletes and discusses the potential value of applying a sliding benchmark intervention in competitive sport selection settings.

Keywords: *Talent identification, athlete selection, talent selection, relative age, maturity.*

Resumen

A pesar de las posibles ventajas de las prácticas de identificación de talento, el grado de sesgo en la toma de decisiones debido a la edad relativa y el momento de madurez sigue siendo motivo de preocupación. Para investigar el impacto de la edad relativa y la madurez en los procesos de selección, y examinar la posible influencia

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de una intervención destinada a minimizar el impacto de los sesgos de edad relativa y madurez, treinta y tres jóvenes (edad promedio = 12,43a ± 0,36a) invitados a competir para Bádminton Malasia completaron tres medidas antropométricas, ocho evaluaciones de rendimiento físico y cinco pruebas de coordinación motora. Se realizó un seguimiento a estos jugadores a lo largo de su carrera para determinar la progresión de su trayectoria (i.e, abandono o continuación) y su nivel de éxito (i.e, clasificación al final de la temporada). En lo que respecta a la edad relativa de los atletas y la selección inicial para el equipo sub-13, los resultados revelaron que los jugadores más jóvenes y menos maduros se encontraban en desventaja, ya que su morfología, condición física y capacidades motoras estaban menos desarrolladas que las de sus compañeros. Se aplicó una intervención de puntos de referencia variables, en la que se ajustaron las puntuaciones brutas. Aunque la tasa de abandono del equipo sub-13 fue elevada (24/33 jugadores, 73 %), 6 de los 9 jugadores que permanecieron en la selección nacional obtuvieron resultados excepcionales, que se hicieron evidentes seis años después. Como resultado de la intervención con puntos de referencia variables, dos jugadores relativamente más jóvenes y de maduración tardía, con puntuaciones superiores en competencia motora, fueron seleccionados para la escuela deportiva de élite. Sin esta intervención, es posible que ninguno de los dos jugadores hubiera ganado el Campeonato Mundial Sub-21. Este artículo examina la trayectoria de estos atletas de bádminton de competición y analiza el valor potencial de aplicar una intervención con puntos de referencia variables en entornos de selección deportiva de competición.

Palabras clave: *Identificación de talento, selección de atletas, selección de talentos, edad relativa, madurez.*

INTRODUCTION

Talent identification and selection have long been of great interest to coaches, researchers, communities, and governments. Talent identification (TID) is the process of finding the most talented individuals within a specific domain in a homogeneous talented population, a process, at least in theory, that should play a major role in sport (Pion et al., 2015). Similarly, talent selection (TS) is the process of making decisions on which athletes continue to progress in each system, and which ones are removed from the system. As international competition across many sports has improved and intensified, there has been a growing importance on identifying and selecting athletes at younger and younger ages who might be capable of top performance (Williams & Reilly, 2000).

Despite being an integral part of the selection process for elite-level athletes, TID programs remain a controversial topic in research. On the one hand, sports scientists advise against early TID due to its potential in leading to burnout and sport withdrawal (Güllich et al., 2023). On the other hand, some researchers argue that early investments are necessary to nurture athletes years before they reach peak performance (Hohmann, 2009; Pion et al., 2015; Woods et al., 2016; Lemoyne et al., 2022). Numerous studies (Matthys et al., 2011; Pion et al., 2015; Norjali et al., 2017; Robertson et al., 2022; Hohmann & Siener, 2021; Chapelle et al., 2023) have convincingly demonstrated that the identification of certain characteristics in young children can provide a strong foundation for identifying those most likely to excel at the international competition level. Many countries have adopted TID and talent development (the process of nurturing an athlete to help them flourish) programs in sport to increase their success on the global stage (Balyi et al., 2013; Gulbin et al., 2014). Some specific studies have generated valuable data that outlines the factors distinguishing athletes across various levels, providing a scientific basis for talent development programs (Faber et al., 2014), as well as the underlying performance characteristics that relate to international success (Robertson et al., 2018). While this area of study is important and helpful for athlete selection and development approaches, the evidence to date, is that there is much room for improvement.

One of the major concerns with the identification process for athlete selection, is the degree of bias that informs decision-making due to the athletes' relative age and maturity timing. In this sense, the highest ranked players are often those who are born earlier in the year and/or are early maturers, at least in some sports like football and badminton (Sweeney et al, 2023). With earlier born children outperforming their later-born peers (Jakobsson et al, 2021), biological maturity status and timing have large implications for (de)selection decisions (Hill et al, 2023). In the context of badminton, for example, this system affects all de-selected players, since they will not have the chance to further develop at the highest level. Furthermore, relative age and maturity may remain a delayed risk of dropout for the selected players. In the end, the risk to de-select all the tested players is extremely large and costly.

In addition, despite the widespread use of TID programs by sports organizations, there is no clear set of variables that consistently predicts future success (Johnston et al., 2018). Many existing models overemphasize early identification rather than focusing on the long-term development of potentially talented athletes (Abbott et al., 2005). This imbalance may lead to suboptimal outcomes and missed opportunities to support athletes with latent potential. To enhance the development of athletes, well-founded decisions are critical, especially given the substantial financial investments in elite sports. Reliable benchmarks and a valid selection process are essential to optimize these investments and to identify individuals with the highest potential for long-term success.

A clear understanding of key priorities is needed to develop long-term plans for young athletes, rather than pushing them towards early success at the risk of burnout or attrition in sports. Importantly, many characteristics and skills can change through training, maturation, or good coaching. The criteria for elite performance appear to be idiosyncratic and may make up for deficiencies in a specific area and with strengths in another (i.e., compensation) (Simonton, 1999). Striking the right balance between broad-based development and targeted investments remains one of the core challenges in the field of TID. Ultimately, the effectiveness of TID programs depends on the implementation of reliable benchmarks that can accurately assess potential over time.

There are multiple strategies for determining reliable benchmarks, however on sucuh tool is the SportKompas. Characterised by a generic approach of anthropometric, physical, and motor competence measurements, the SporKompas has been recognized for being a helpful tool for determining benchmarks for a wide variety of sports (Pion, 2024). It offers possibilities to better understand the potential underlying performance characteristics of a given sport and allows for the tracking of young athletes across their developmental pathway. When comparing athlete data with benchmarks for heterogeneous populations, generic tests can be applied for the detection of the superior 'movers' in schools. When comparing an athlete's testing results with sport-specific benchmarks, this approach can help with the identification of superiorly performing athletes in clubs and sports associations.

Despite the SportKompas' potential benefits, there are limitations to establishing benchmarks. The common practice of placing children into age groups for sport will still acutely benefit those who are more developed physically, emotionally, and cognitively. Those born later in the year appear to be at a disadvantage because they are less developed than their peers (Malina et al., 2015; Cumming et al., 2017; Pion, 2024). Furthermore, it is difficult to copy a champion's profile. Collecting data from champions and drawing causal conclusions comes with limitations.

One such strategy to minimize the impact of those limitations, is to apply a 'sliding benchmark' approach to selection. To minimize the impact of an athlete's chronological and biological age-related, a sliding benchmark approach can be used to control for maturity and chronological age. For example, two 12-year-old boys can differ by nearly an entire year based on when their birthdays are relative to a cut-off date for selection. The difference of one year is a significant advantage requiring recalculation to the appropriate proportions. Moreover, the difference in biological age (maturity) also results in a physical advantage. The sliding benchmarks method can be compared to an equaliser to adjust music output; it is possible to slide the raw test scores along the benchmarks of both the age group and the maturity group to obtain adjusted scores for chronological and biological age. To compute these sliding benchmarks, the dataset must be recalculated for the younger and older players in the cohort as well as for the less mature players and the more mature players.

To date, however, there is no known study that empirically investigates a sliding benchmark approach within a high-performance sport context. To address this, the present study aims to critically examine the impact of a sliding benchmark approach in neutralising performance advantages and disadvantages due to relative age and maturity status. Specifically, the study explores the possibility of applying the sliding benchmark approach to a selected group of elite young badminton players. The research question is twofold, 1) is it possible to successfully draft 12-year-old late mature boys, born later in the year when applying sliding benchmarks? 2) what is the predictive value when looking years ahead?

MATERIALS AND METHODS

Participants

Every year Badminton Association of Malaysia (BAM) invites up to 60 of the best U13 players based on their competition ranking to participate in various test sessions. From these sessions a minimum of six girls and six boys are selected as feeders for the national squads at the national elite sports centre. The selection aims to improve the development of the most talented players, based on the assumption that early selection increases their chance to win medals at the major international tournaments and Olympic Games. A cross-sectional study was carried out with the 33 highest ranked U13 badminton boys in Malaysia (age range 11.87y – 13.19y). The badminton test battery applied as an entry test for the elite sport school in Flanders and which is related to the generic test of SportKompas (Pion et al., 2015; Robertson et al., 2022), has been conducted likewise to select the high potentials for further development in the elite sport school in Malaysia. All data were recorded in a de-identified data set. It should be indicated that the sample in this study is small (n=33), but it was replicated at the suggestion of the BWF because of its much higher quality than the sample tested in Flanders (n=189).

Measurements

The badminton test battery presented in this study was discussed at the 6th World Congress of Racket Sport

Science in Bangkok, Thailand in 2018. The participants started with the measurement of body height after which they moved on to the next station and completed three other anthropometrical tests, eight physical performance tests, and five motor coordination tests. All tests were examined on the same day by a team of eight experienced examiners who were trained to administer this generic test battery. Instruction and demonstration were standardised according to the test guidelines (see below for detailed explanation). The athletes performed all tests barefoot except the sprints, the counter movement jump, and the endurance shuttle run test, which were all performed with running shoes.

Anthropometry: Height (H) and sitting height (SH) (0.1 cm, Harpenden, portable Stadiometer, Holtain, UK) and body weight (BW) (0.1 kg, Tanita, BC-420SMA) were assessed according to previously described procedures (Lohmann et al., 1988) and manufacturer guidelines. Also, the height of the parents was collected to calculate the % of predicted adult height (Khamis & Roche, 1994). Using percentage of predicted adult stature, which is an estimate of maturing timing, it is possible to group athletes into maturity categories (Khamis & Roche, 1994; Cumming et al., 2017).

Physical Performance: Flexibility was assessed by the sit-and-reach test of the Eurofit test battery with an accuracy of 0.5 cm and 15 cm at the level of the feet (Council of Europe, 1988). Explosive leg power was measured with the standing broad jump of the Eurofit test battery with an accuracy of 1 cm (Council of Europe, 1988), and the counter-movement jump (CMJ) (0.1 cm) using Optojump, requiring the gymnasts to jump as high as possible from an upright position with the hands on the hips (Microgate, Bolzano, Italy), counting the highest of 3 jumps (Cometti & Cometti, 2007). Speed was evaluated by two maximal sprints of 30 meters with split time measured at five meters. The recovery time between each sprint was set at two minutes. The fastest time for the 5m sprint and 30m sprint was used for analysis (Matthys et al., 2011) The sprint tests were recorded with MicroGate Racetime2 chronometry and Polifemo Light photocells at an accuracy of 0.001s (MicroGate, Italy). The 10x5m shuttle run (SR) test (Council of Europe, 1988) was used to measure speed and agility. The time it took the athletes to run 5 times back and forth (equalling ten 5m sprints) as quickly as possible between two lines 5 meters apart, 10 times in a row, reflected their speed and agility. Upper body strength was determined by the performance of curl-ups according to the BOT2 procedures (Bruininks & Bruininks, 2016), requiring the athletes to execute as many repetitions as possible in 30 seconds. The beep test (endurance shuttle run), with the final 30 seconds that persisted (0.5 min), was used for evaluating the endurance of the participants (Council of Europe, 1988).

Motor Coordination: The assessment of motor coordination consisted of five test items 1) in the balance beam test; participants had to walk 3 times backwards along balance beams of decreasing width (6 cm; 4.5 cm and 3 cm respectively) (Kiphard & Schilling, 2007). 2) For the jumping sideways test; participants had to jump sideways with both feet over a wooden slat as fast as possible (2 x 15 s), with the final score being the sum of the number of jumps over the two trials (Kiphard & Schilling, 2007). 3) For the moving sideways test, participants had to move sideways on wooden platforms (2 x 20 s), summing the number of relocations over two trials (Kiphard & Schilling, 2007). 4) In the eye hand coordination test, children needed to throw a tennis ball at a rectangle target (height 137 cm, width 152.5 cm; positioned at 1 m from the ground) on a flat wall at 1 m distance with one hand and to catch the ball correctly with the other hand as many times as possible in 30 s. The best number of correct catches of two attempts was recorded as raw outcome score (Faber et al, 2014). 5) Finally, the overhead-throwing test with a badminton shuttle, also from the SportKompas, either was used to evaluate over- arm throwing competency (Mohamed et al., 2009). The goal of this test was to throw the shuttle as far and accurately (straight forward) as possible, holding the shuttle between thumb and index finger. Throwing a shuttle requires less strength than throwing coordination. The summed throwing distance of 5 trials was recorded in cm. (Mohamed et al., 2009).

Data Collection

To calculate the sliding benchmarks and to adjust the (dis)advantages for relative age and maturity, the athletes were subdivided in 3 relative age groups and 3 maturity groups. Using percentage of predicted adult stature at the time of observation (PAH) it is possible to group athletes into maturity categories (Khamis & Roche, 1994; Malina et al., 2015; Cumming et al., 2017). Relative age: 1) Players < 12.20y (n=10) 2) players aged between 12.20y and 12.60y (n=16) and 3) players aged > 12.60y (n=7). Maturity: 1) Players with PAH < 85% (n=11) 2) players with PAH between 85% and 89% (n=13) and 3) players with PAH > 89% (n=9).

Data were collected on October 10th, 2018. All players were tested under similar indoor conditions. Total testing time for all players was approximately two hours. Test leaders were physical education students instructed and trained to the same extent by an expert.

Statistical Analysis

Data was analysed using SPSS for Windows 25.0. Basic descriptive indicators (mean and standard deviation) were calculated for all variables. The raw scores were converted to normalized quotient scores i.e., ((z-score*15) +100) to better understand the advantages and disadvantages for each variable and to calculate the overall scores for physical and motor performance. The Kolmogorov Smirnov test revealed that some of the variables i.e., body height; shuttle run; sit-ups; plate tapping; endurance shuttle run; moving sideways and throwing shuttles, were not normally distributed (p<0.05). Consequently, the non-parametric Kruskal-Wallis Test was used to compare all test results across the three relative age groups and the three maturity groups. The standing broad jump and the eye-hand coordination test showed significant differences among the three relative age groups, while for stature, weight and standing broad jump significant differences were found between the three maturity groups. Subsequently all normalised scores were summed for physical and motor performance. All scores from physical performance tests were summed and divided by the number of physical performance tests (n=9) and for the overall motor performance score the sum of all motor quotient scores were summed and divided by the number of motor performance tests (n=5).

RESULTS

Basic descriptive statistics (Table 1) were used to benchmark the 12-year-old boys (n=33)

The individual results based on age-group benchmarks for physical (x-axis) and motor performance (y-axis) were plotted in the theoretical selection model proposed by Baker et al. (2018). The figure visually represents which players can be selected (Figure 1).

Players n° 1; 2; 3; 4 and 20 are categorized as obvious talented with above-average performance; players n° 5; 6 and 10 are high potentials that meet performance standards.

Unfortunately, RAE and maturity distort the results in Figure 1, since relatively younger players are disadvantaged by the age group benchmarks (Table 2).

When sliding the sum scores according to the relative age and maturity status (%PAH), the advantages and disadvantages become more visible, and the selection looks different (Figure 3).

Six years after the selection process, it was checked which players are still part of the national team. 9 players out of 33 are still competing for BAM.

DISCUSSION

This study sought to explore the value in using sliding benchmarking to help neutralise the advantages and disadvantages that certain athletes have due to relative age and maturity status (Pion, 2024). Performance benchmarks from the badminton test battery related to the SportKompas are an objective approach to selecting high potentials and to support coaches' decisions, albeit that the age group benchmarks are biased for relative age and maturity (Table 1). The relative younger boys (< 12.20y) are overall 3% smaller, and the relative older boys (> 12.60y) are 2% taller compared to the measurements for the complete cohort. Late mature boys (PAH <85%) are 5% smaller, and early mature boys (PAH > 89%) are 8% taller. Using these benchmarks within this age group, is making the mistake of comparing apples to oranges. When comparing Figures 2 and 4, it appears that the late mature (red dots) shift to the left, and the early mature (green dots) to the right. Comparing within the age group without considering RAE and PAH clearly shows why 12-year-old late-maturing boys, born later in the year can hardly be selected for the Malaysian U13 Badminton Organisation (Figure 2). When applying the sliding benchmarks approach, the selection probability increases (Figure 4).

Our findings revealed that relative age and maturity distort the selection process. In this study the coaches made a preliminary selection of U13 players (n=33) and the sport scientists used the data of the badminton test battery to support their decision for a final selection of nine players each. Shifting the benchmarks reveals advantages and disadvantages. Figure 3 shows what the disadvantage for late-maturing boys (PAH<85) and the advantage for precocious boys (PAH>89), combined with an estimate of the disadvantage for relatively younger boys (>12.20y) and the advantage for relatively older boys (>12.60y) looks like.

Younger and less mature players are being overlooked during the selection procedure, since their morphology, physical fitness and motor capacities are less developed than their peers (Cumming et al., 2017; Mann et al., 2017). Talent identification takes place at a certain moment in time and so far, the objective measurements refer to age group benchmarks. It is important to highlight the distinction between identification and development of high potential athletes.

For decades, RAE and maturity have a huge impact on 'here and now' assessments of young athletes for identification and selection purposes (Barnsley, 2025). In any case, one must consider adjustments for RAE and maturity whether to selection contains objective or subjective criteria? This is one of the first studies to show that it is possible and feasible to adjust strategies by using sliding benchmarks. In this respect, the article is also a model for many other sports. Although it is important to acknowledge some limitations of this study. Firstly, the sample size was small. This is mainly because the larger population of elite badminton players is relatively small, and the authors feel lucky enough to take part in the selection process of a very successful cohort of players. To provide context on the size of the sample, in 2018, 33 players were screened. The dropout rate of 73% is high (24/33 players). On the other hand, the 9 remaining players who are still members of the national team achieve exceptional results and became national U21

Table 1
Descriptive benchmarks for 12-year-old badminton players (boys), related to RAE and PAH

Benchmark	Age group 12y old boys (n= 33)	Age < 12.2(n=10)	12.2 > Age > 12.6 (n=16)	Age > 12.6 (n=7)	%PAH < 85 (n=11)	85 > %PAH > 89 (n=13)	%PAH > 89 (n= 9)
Age (y.)	12.43 ± 0.36	12.03 ± .12	12.44 ± 0.13	13.00 ± 0.24	12.24 ± 0.28	12.45 ± 0.33	12.58 ± 0.42
%PAH (%)	86.9 ± 3.3	84.8 ± 2.2	87.9 ± 2.9	87.7 ± 4.4	83.5 ± 1.3	86.8 ± 1.1	91.2 ± 1.3
Height (cm)	151.8 ± 9.3	146.5 ± 5.3	155.0 ± 8.7	155.1 ± 15.0	144.2 ± 5.2	150.4 ± 3.9	163.2 ± 7.6
Weight (kg)	43.6 ± 8.0	40.0 ± 6.6	46.2 ± 8.5	45.1 ± 10.0	37.3 ± 4.8	41.7 ± 3.8	54.0 ± 5.1
12.6	32 ± 6	31 ± 7	33 ± 6	33 ± 4	31 ± 5	32 ± 5	35 ± 6
Sprint 5m (s)	1.191 ± .079	1.213 ± .060	1.164 ± 0.022	1.221 ± .090	1.221 ± .061	1.195 ± .080	1.149 ± .074
Sprint 30m (s)	5.019 ± 0.291	5.117 ± 0.223	5.004 ± 0.356	4.914 ± 0.350	5.131 ± .240	5.032 ± .0.248	4.863 ± 0.355
Shuttle run 10x5m (s)	19.063 ± .1.020	19.320 ± .0.685	19.089 ± 1.109	18.636 ± .1.156	19.195 ± .0.725	19.268 ± .1.022	18.607 ± .1.260
Counter movement jump (cm)	43.1 ± 6.8	39.5 ± 5.4	43.9 ± 7.5	46.2 ± 5.4	40.2 ± 4.5	42.7 ± 5.5	47.0 ± 9.0
Standing broad jump (cm)	180 ± 23	169 ± 17	178 ± 23	200 ± 20	168 ± 14	178 ± 19	197 ± 29
Curl ups (N/30s)	33 ± 9	36 ± 8	29 ± 8	38 ± 9	33 ± 9	33 ± 10	33 ± 7
Plate tapping (s)	12.2 ± 2.4	12.8 ± 2.1	12.4 ± 2.4	9.5 ± 0.3	12.1 ± 2.5	12.7 ± 2.4	11.4 ± 2.1
Endurance shuttle run (min)	9 ± 2	9 ± 2	9 ± 1	9 ± 2	9 ± 1	10 ± 2	9 ± 2
Balance beam KTK	56 ± 9	58 ± 8	53 ± 11	62 ± 10	59 ± 8	54 ± 11	57 ± 12
Jumping sideways KTK	88 ± 18	94 ± 20	81 ± 17	97 ± 9	91 ± 13	88 ± 20	86 ± 20
Moving sideways KTK	38 ± 12	34 ± 6	37 ± 11	49 ± 16	35 ± 3	42 ± 12	38 ± 18
Eye-hand coordination (Faber)	53 ± 11	49 ± 8	51 ± 12	62 ± 5	52 ± 8	54 ± 14	51 ± 11
Throwing shuttles	37 ± 2	36 ± 2	37 ± 2	40 ± 5	37 ± 2	37 ± 2	38 ± 3

Figure 1
Individual scores for physical performance and motor performance based on age group benchmarks for 12-year-old boys (badminton), plotted in the theoretical selection model according with Baker et al. (2018).

Table 2
Overall scores for physical (PQ) and motor (MQ) tests related to RAE and PAH

Age group 12y old boys (n= 33)	Age < 12.2(n=10)	12.2 > Age > 12.6 (n=16)	Age > 12.6 (n=7)	%PAH < 85 (n=11)	85 > %PAH > 89 (n=13)	%PAH > 89 (n= 9)
PQ = 100.0 ± 8.0	PQ = 96.4 ± 7.2	PQ = 99.7 ± 8.1	PQ = 106.0 ± 5.8	PQ = 96.6 ± 6.6	PQ = 99.4 ± 5.9	PQ = 105 ± 10.1
MQ = 100.0 ± 8.7	MQ = 98.3 ± 5.4	MQ = 96.9 ± 8.5	MQ = 109.6 ± 7.2	MQ = 99.7 ± 5.0	MQ = 99.9 ± 88	MQ = 100.7 ± 12.3

Quotient score = (100 + (15* Z-score)).

Figure 2
Individual scores for physical performance and motor performance based on age group benchmarks for 12-year-old boys (badminton), plotted in the theoretical selection model of Baker et al. (2018). Red dots PAH >89; green dots PAH <85, yellow dots 85> PAH <89.

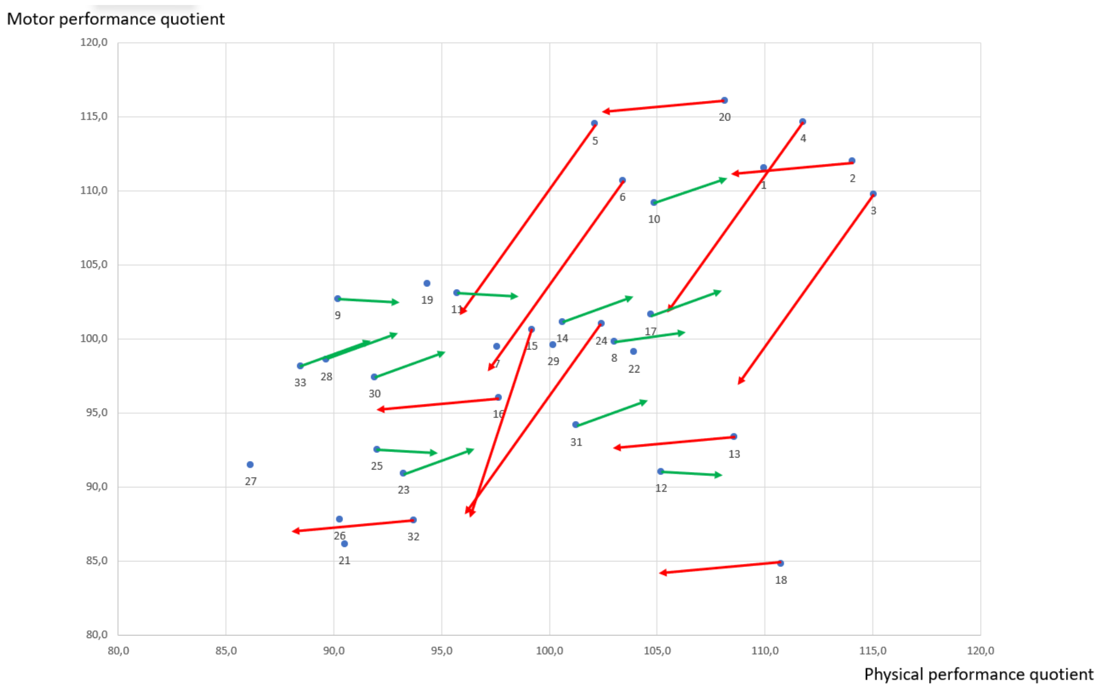

Figure 3
Sliding benchmark approach for 12-year-old boys (badminton).

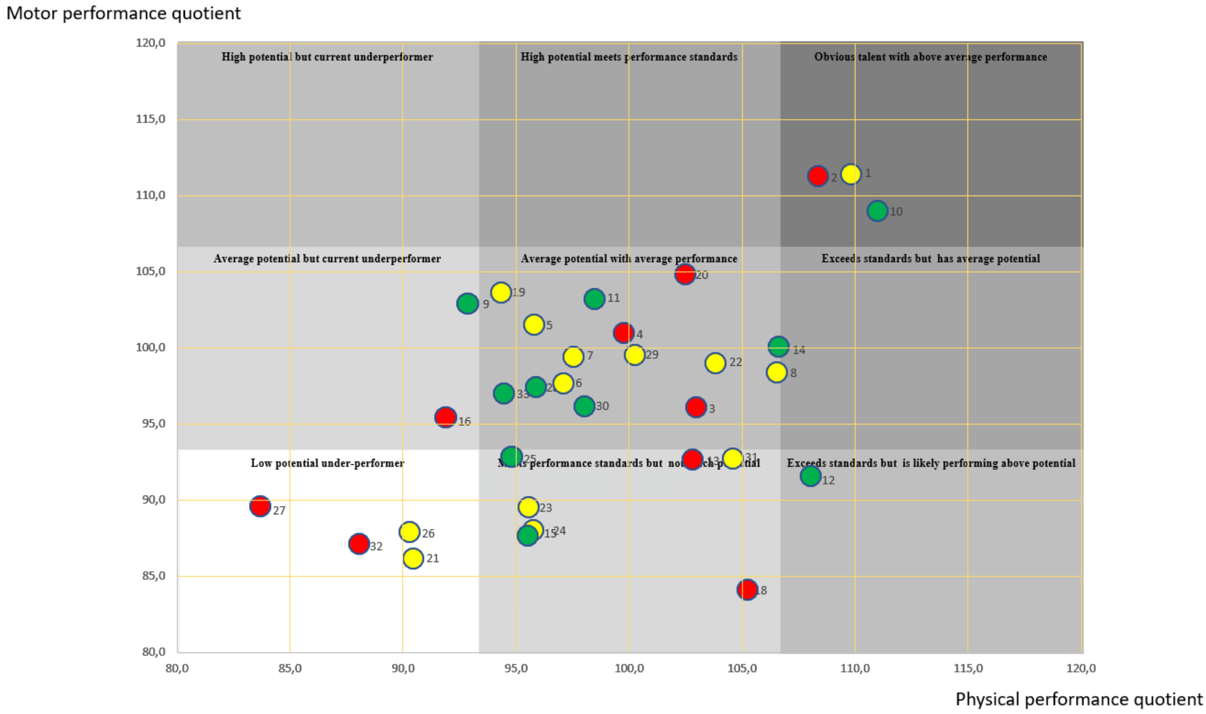

Figure 4
Individual scores for physical performance and motor performance adjusted with the sliding benchmarks for 12-year-old boys (badminton), plotted in the theoretical selection model Baker et al. (2018). Red dots PAH >89; green dots PAH <85, yellow dots 85> PAH <89.

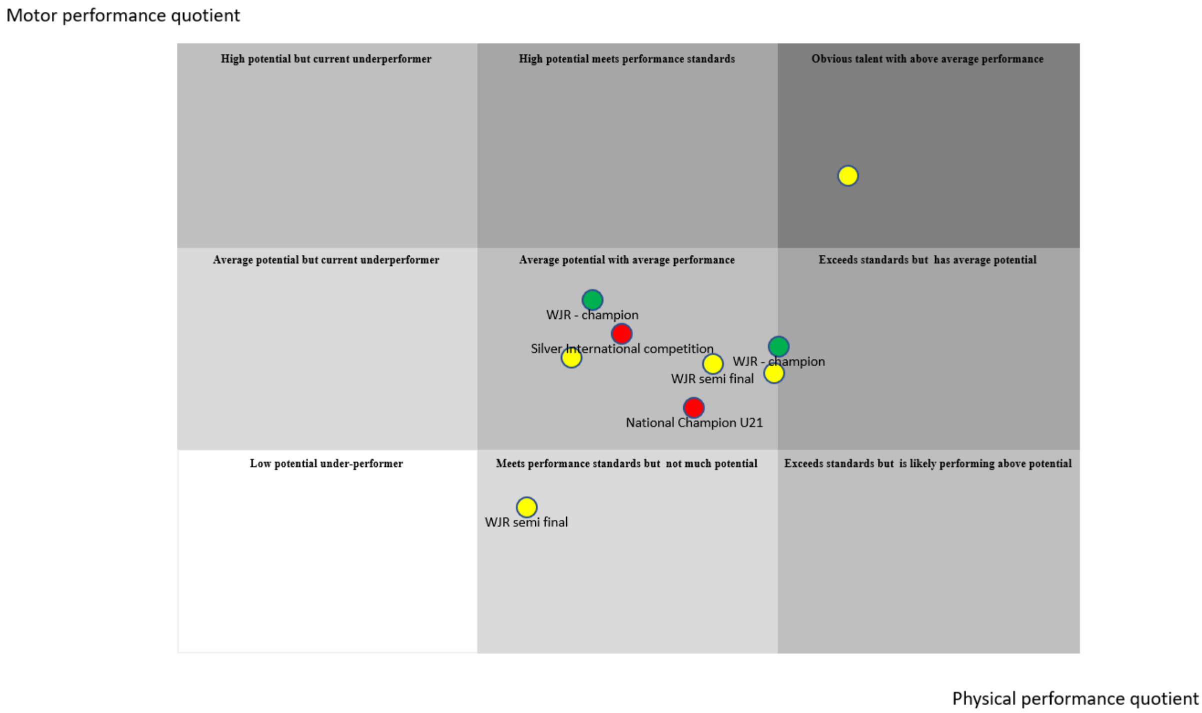

Figure 5
Active players after a 6-year development period. plotted in the theoretical selection model Baker et al. (2018). Red dots PAH >89; green dots PAH <85, yellow dots 85> PAH <89.

champions, international match silver, 2 BWF junior World Champions and 2 semi-finalists at the junior World Championships (Figure 5). The decision to include two late mature players with average physical scores but superior motor competence during the badminton draft in 2018 was successful. Without the sliding benchmark intervention, they would never have been selected. These players benefited from a specific development in the elite sport school and became junior world champions six years later.

Second, the sum scores for the physical and motor performance test were not weighed. With the data of a small sample, it is difficult to build accurate prediction models, but in the future, it will be possible with the big data collected during the talent identification sessions. Nevertheless, the benchmarks for age groups and especially during the growth spurt are biased and therefore the results should be equalised. A coach can equalise the (dis)advantage due to relative age and maturity in the same way as equalising the sound of the radio with a bit more bass or treble. To be able to make good predictions in the future, it is important to collect data year after year and to keep adjusting the benchmarks.

Morphology, physical fitness, and motor competence are much more common to measure than social and psychological characteristics. In this badminton identification tool only morphology, physical fitness and motor competence are included. In a holistic approach, also the technical, social, and psychological development should be considered to assess the potential of youth athletes (Faber et al., 2016; Nijenhuis et al., 2024; Schoof et al., 2024; Teunissen et al., 2024).

Coaches' decisions on talent selection in sport can be approached from two angles. On the one hand, a more objective approach is possible, in which coaches apply a multi-faceted formula for scoring as a means of predicting their future success. On the other hand, a subjective approach is possible, also known as the coach's eye, in which these professionals select or de-select athletes based on their personal observations and impressions (Bar-Eli et al., 2024). Both approaches are often seen as complementary. Selecting talented players is often a matter of feeling and expertise. Although, in the future, accurate prediction models, based on a combination of observations and performance tests can be applied to support the selection of the next cohorts.

CONCLUSIONS

The practical implications of this cross-sectional study conducted in a small sample of 12-year-old boys (n=33) shows that if relative age and maturity are not considered, talented players who are disadvantaged by this may be excluded early in their sport. Given athlete selection largely depends on the practical and scientific background of sport professionals, coaches may want to consider age group benchmarks, which can be made more objective by using accurate benchmarks related to chronological and biological age. This is the first known study that revealed that implementing sliding benchmarks can help to reduce the risk of de-selection of talented badminton players.

AUTHORS' CONTRIBUTIONS

Conceptualization: Johan Pion. Data curation: Johan Pion, Mohd Rozilee Wazir Norjali Wazir, Pieter Vansteenkiste. Formal analysis: Johan Pion, Mohd Rozilee Wazir Norjali Wazir. Funding acquisition: Tengku-Fadilah Kamalden. Investigation and Resources: Johan Pion, Mohd Rozilee Wazir Norjali Wazir, Tengku-Fadilah Kamalden. Methodology: Johan Pion. Project administration: Mohd Rozilee Wazir Norjali Wazir, Tengku-Fadilah Kamalden. Software: Johan Pion, Pieter Vansteenkiste. Supervision: Johan Pion. Validation: Irene Faber, Kathryn Johnston, Matthieu Lenoir. Visualization: Johan Pion, Pieter Vansteenkiste. Writing – original draft: Johan Pion. Writing – review & editing: Mohd Rozilee Wazir Norjali Wazir, Irene Faber , Kathryn Johnston , Pieter Vansteenkiste, Matthieu Lenoir, Tengku-Fadilah Kamalden.

STATEMENT ABOUT THE USE OF AI

In this article the authors did not use Artifical Inteligence tools.

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