Baltic Journal of Health and Physical Activity 2021; 13 (2): 37-45
Journal of Gdansk University of Physical Education and Sport
e-ISSN 2080-9999

ORIGINAL

doi: 10.29359/BJHPA.13.2.04

The relative age-related participation trends in European Badminton

Authors' Contribution:
A Study Design
B Data Collection
C Statistical Analysis
D Data Interpretation
E Manuscript Preparation
F Literature Search
G Funds Collection

Mert Bilgiç[1] ABCDEF, Erhan Devrilmez[2] BCDE

[1] Department of Coaching Education, Faculty of Sport Sciences, Akdeniz University, Antalya, Turkey

[2] Department of Physical Education and Sports Teaching, Faculty of Sport Sciences, Karamanoğlu Mehmetbey University, Karaman, Turkey

abstract

Background: The purpose of this study was to identify the relative age effect (RAE) in European youth badminton through examining participation trends.

Material and methods: The birthdate distributions of 1909 badminton players (males = 994, females = 915) participating in the last three consecutive European U15, U17 and Junior (U19) Badminton Championships were analysed. Chi-square (χ^2) goodness-of-fit tests were used to determine inter-quartile differences, and odds ratios (OR) and 95% confidence intervals were calculated in order to compare quartiles with each other.

Results: Statistically significant over-representation of players born shortly after the cut-off date was determined. Regarding gender, RAE was more notable in males compared to females, and the strongest results were determined in U15 compared to the other age categories. Moreover, striking trends were determined in Q1–Q4 comparisons, particularly as players in Q1 were more than twice for females and thrice for males as likely to participate in the European Badminton Championships.

Conclusions: Findings of this study confirm the presence of RAE in European youth badminton though decreasing its intensity with age. Certain precautions or different approaches should be taken into consideration to organize the age categories, such as biological markers, variations, rotations or age quota for equal opportunities.

Key words: relative age effect, badminton, youth, talent identification.

article details

Article statistics: **Word count:** 3,058; **Tables:** 2; **Figures:** 1; **References:** 29

Received: November 2020; **Accepted:** February 2021; **Published:** June 2021

Full-text PDF: http://www.balticsportscience.com

Indexation: Celdes, Clarivate Analytics Emerging Sources Citation Index (ESCI), CNKI Scholar (China National Knowledge Infrastructure), CNPIEC, DOAJ, EBSCO - Central & Eastern European Academic Source, EBSCO - SPORTDiscus, EBSCO Discovery Service, Google Scholar, Index Copernicus, J-Gate, Naviga (Softweco, Primo Central (ExLibris), ProQuest - Family Health, ProQuest - Health & Medical Complete, ProQuest - Illustrata: Health Sciences, ProQuest - Nursing & Allied Health Source, Summon (Serials Solutions/ProQuest, TDOne (TDNet), Ulrich's Periodicals Directory/ ulrichsweb, WorldCat (OCLC)

Funding: This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Conflict of interests: Authors have declared that no competing interest exists.

Corresponding author: Mert Bilgiç Akdeniz University, Faculty of Sport Sciences, Department of Coaching Education, Room No:216, Dumlupınar Boulevard, Campus, 07058, Antalya, Turkey; phone no.: +90 242 227 4535; e-mail: mertbilgic@akdeniz.edu.tr

INTRODUCTION

Annual age grouping is an organizational strategy constituting cohorts used in educational and sporting contexts. A specific cut-off date is applied in order to create more equal environments and fair opportunities for individuals' developmental processes. Often, January 1st is used for creating those cohorts [1, 2] in most European countries [3]. Traditionally, a child born at the beginning of a year and another born at the end of the same year belong to the same cohort and compete together in sporting events [3]. However, this chronological age grouping policy is insensitive to differences between members within a cohort and provides certain advantages to relatively older individuals while creating disadvantages for relatively younger individuals, since there might be up to 12 months between the youngest and oldest member in the same cohort. The Relative Age Effect (RAE) is a phenomenon referring to those differences and consequences based on several advantages and disadvantages [4, 5].

RAE has been studied in the sporting context in different aspects and sports at different levels, such as soccer [2], ice hockey [6, 7], basketball [8] and gymnastics [9]. Grondin et al. [6] were the first to search for a relationship between birth months and participation in sport. An advantage on behalf of those born in the first months of a year was discussed in this research, and a skewed distribution of participants' birth months was noted in the National Hockey League (NHL) and competitive youth hockey leagues in North America. Specifically, it was noted in the study that more individuals were born in the months shortly after the cut-off date, and this was the result of the age grouping policy.

Recently, a theoretical model has been proposed by Hancock, Adler and Côté [10] to explain why RAE is observed in sport. In this model, social agents were noted as having the largest influence on RAE. Social agents' – namely parents, coaches and athletes – interpretations of sport, success, talent and maturity create RAE. More specifically, RAE was affected by parents through Matthew effects, by coaches through Pygmalion effects and by athletes through Galatea effects in different ways. Based on this model, it was hypothesized that getting rid of pseudo realities or beliefs of Matthew effects and Pygmalion effects would be a key to eliminate RAE. Thus, it can be suggested that coaches play a great role in the presence of RAE through their approaches and attitudes.

In practice, RAE might be noted as a selection bias arising from coaches' decisions and evaluations in favour of relatively older athletes [11], which has a great impact on athletes' future careers in terms of selections at elite representative levels both nationally and internationally. Since relatively older individuals may perform better than their relatively younger peers because of their physical, physiological and/or psychological differences, coaches tend to pay more attention to them, and this leads to a selection bias. This bias may give them more opportunities to attain higher levels of coaching, training and competition, which possibly results in greater technical and tactical advantage in future over non-selected, relatively younger athletes. This situation may turn into an "accumulative advantage" [12] and lead to re-selection in future of those already well-known to the selectors [13].

The main purpose of this study was to identify the RAE in youth badminton players in the last three consecutive European U15, U17 and Junior (U19) Badminton Championships. Given the extensive research on RAE and sport, it is better to explain here how this research adds to the literature. Firstly, it would enrich the current literature with regard to RAE in individual sports considering the focus on team sports [1, 14]. Moreover, given the focus on the presence of RAE among youth athletes [15, 2, 14], youth badminton players would be evaluated, and to our knowledge, this gap would be addressed in this context for the first time. Finally, literature on RAE in female athletes would be enriched, a group mostly overlooked in previous studies. Cobley et al. [1] indicated that only 2% of the investigated samples in their meta-analytical review were females.

Therefore, in the sample in this study comprising European youth badminton players in three different categories, we hypothesize that:
(1) a strong RAE in participation trends will be present;
(2) continuation of RAE with increasing age categories will be present;
(3) RAE will differ between genders with regard to males having higher RAE.

MATERIAL AND METHODS

Participants

In order to avoid coincidental and deceptive outcomes and to attain more accurate and generalizable results, rather than looking at only one tournament for each age, last three tournaments of each age category were included in this study. 2,099 badminton players participated in the last three consecutive European U15, U17 and Junior (U19) Badminton Championships. However, in order to eliminate any manipulation in results, players who participated in more than one European Championship in the same age category were included only once in the study. Besides, there were 52 badminton players who also participated in one of the mentioned tournaments, yet they could not be included in this study because of the lack of required information, particularly birthdate information.

Ultimately, this study sample involved 1,909 badminton players (n = 915 females, n = 994 males) who represented their countries in the European Badminton Championships in their own age categories. Of 1909 participants, 442 (n = 222 females, n = 220 males) competed in one of European U15 Badminton Championships organized in 2014, 2016 and 2018; 767 of them (n = 375 females, n = 392 males) competed in one of European U17 Badminton Championships organized in 2014, 2016 and 2017; and, 700 of them (n = 318 females, n = 382 males) competed in one of European Junior (U19) Badminton Championships organized in 2013, 2015 and 2017. The analysed players were from 43 different countries.

Design and procedures

To examine RAE, birthdates of all participants were obtained from the official website of the Badminton World Federation (https://bwfbadminton.com/players/) and national badminton federations. In accordance with the relevant literature, players were categorised into four quartiles according to their birth months. Since the official cut-off date applied in badminton is January 1st, Quartile I included players born in January–March; Quartile II included players born in April–June; Quartile III included players born in July–September; Quartile IV included players born in October–December. This study was approved by Clinical Studies Ethics Committee of Akdeniz University.

Statistical methods

Each player's name, country, gender, birthdate and quartile according to her/his birth month were entered into the program. Two researchers double-checked the data to ensure their correctness. Chi-square (χ^2) goodness-of-fit tests were conducted to evaluate the significance of the obtained quartile profiles compared with theoretical expected distribution of birth months. Since birth months are stated as evenly distributed among quarters in Europe [16, 14], an equal distribution was applied in this study as the theoretically expected value in consistence with previous research [17, 2]. Cramer's V was used to calculate the effect size. According to Cramer [18], the categories for the effect size were as follows; small effect, medium effect and large effect, and their ranges were V = 0.06– 0.17, V = 0.18– 0.29 and V ≥ 0.30, respectively, for df3, which is the case in each comparison in our study. After statistically significant results were determined in χ^2 goodness-of-fit tests, odds ratios (OR) and 95% confidence intervals were calculated in order to compare Q1 to Q4, Q1 to Q3 and Q1 to Q2. SPSS 23.0 Package program was used for all statistical analyses, and the statistical significance was set at $p < 0.05$.

RESULTS

Table 1 and Figure 1 show the distribution of birthdates of badminton players in each age category by quarters and gender. In addition, results of χ^2 tests and Cramer's V are presented in each age category and gender with associated significance values.

Table 1. Distribution of birthdays in European U15, U17 and Junior (U19) Badminton Championships

		U15	U17	Junior (U19)	Total
Male	Q1 (%)	93 (42.3)	149 (38.0)	128 (33.5)	370 (37.2)
	Q2 (%)	50 (22.7)	103 (26.3)	111 (29.1)	264 (26.6)
	Q3 (%)	49 (22.3)	94 (24.0)	95 (24.9)	238 (23.9)
	Q4 (%)	28 (12.7)	46 (11.7)	48 (12.6)	122 (12.3)
	Total	220	392	382	994
	χ^2	40.618	54.551	37.204	125.211
	Sig.	.000	.000	.000	.000
	V	0.24 (Medium)	0.21 (Medium)	0.18 (Medium)	0.20 (Medium)
Female	Q1 (%)	87 (39.2)	115 (30.7)	102 (32.1)	304 (33.2)
	Q2 (%)	62 (27.9)	104 (27.7)	85 (26.7)	251 (27.4)
	Q3 (%)	46 (20.7)	105 (28.0)	80 (25.2)	231 (25.2)
	Q4 (%)	27 (12.2)	51 (13.6)	51 (16.0)	129 (14.1)
	Total	222	375	318	915
	χ^2	34.901	26.781	16.969	70.438
	Sig.	.000	.000	.001	.000
	V	0.23 (Medium)	0.15 (Small)	0.13 (Small)	0.16 (Small)
Total	Q1 (%)	180 (40.7)	264 (34.4)	230 (32.9)	674 (35.3)
	Q2 (%)	112 (25.3)	207 (27.0)	196 (28.0)	515 (27.0)
	Q3 (%)	95 (21.5)	199 (25.9)	175 (25.0)	469 (24.6)
	Q4 (%)	55 (12.4)	97 (12.6)	99 (14.1)	251 (13.1)
	Total	442	767	700	1909
	χ^2	73.783	75.529	52.811	191.499
	Sig.	.000	.000	.000	.000
	V	0.23 (Medium)	0.18 (Medium)	0.16 (Small)	0.18 (Medium)

Q1, Q2, Q3 and Q4= birth quarters; χ^2= Chi-square value; Sig.= significance; V= Cramer's V

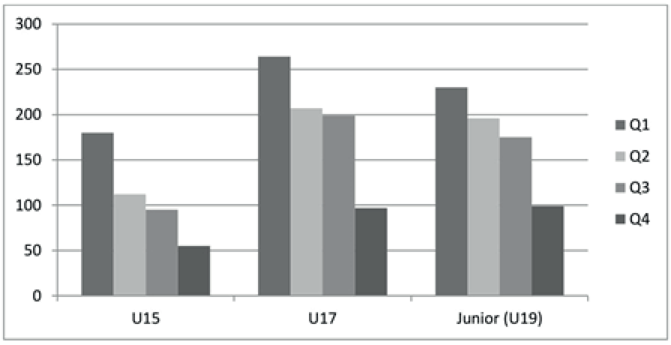

Fig. 1. Distribution of birthdays according to quartiles and tournaments

Statistically significant RAEs were determined in total (χ^2 = 191.499, p = 0.000, V = 0.18), in both males (χ^2 = 125.211, p = 0.000, V = 0.20) and females (χ^2 = 70.438, p = 0.000, V = 0.16), and in each age category (χ^2 = 73.783, p = 0.000, V = 0.23; χ^2 = 75.529, p = 0.000, V = 0.18; χ^2 = 52.811, p = 0.000, V = 0.16 for U15, U17 and U19, respectively). Specifically, both male and female Q1 players were significantly overrepresented while Q4 players were significantly underrepresented in each age category. The peak of RAEs was found in males of U15 group where 42.3% of the players were born in the first quarter of the year while only 12.7% of the players were born in the last quarter of the year (χ^2 = 40.618, p = 0.000, V = 0.24). On the other hand, the lowest RAE was found in females of the Junior (U19) group, where 32.1% of players were born in Q1 while 16.0% of players were born in Q4 (χ^2 = 16.969, p = .001, V = 0.13). Regarding gender, males always showed higher values in χ^2 tests, and the effect sizes pointed to stronger results favouring males in each age category. Moreover, when the shift between age categories was examined, decreasing effect size values were determined as players grew up.

Table 2. Odd ratios (and the 95% confidence interval) examinig birthday distrubutions between quartiles

		Q1 vs Q4	Q1 vs Q3	Q1 vs Q2
U15	Male	3.32 (1.89 - 5.84)*	1.9 (1.14 - 3.16)*	1.86 (1.12 - 3.09)*
	Female	3.22 (1.82 – 5.7)*	1.89 (1.13 – 3.17)*	1.4 (0.86 – 2.3)
	Total	3.27 (2.19 – 4.89)*	1.89 (1.32 – 2.72)*	1.61 (1.13 – 2.29)*
U17	Male	3.24 (2.1 - 5)*	1.59 (1.08 – 2.32)*	1.45 (0.99 – 2.11)
	Female	2.25 (1.46 – 3.49)*	1.1 (0.74 – 1.62)	1.11 (0.75 – 1.63)
	Total	2.72 (2 – 3.7)*	1.33 (1.01 – 1.74)*	1.28 (0.97 – 1.67)
Junior (U19)	Male	2.67 (1.72 – 4.13)*	1.35 (0.91 – 1.99)	1.15 (0.79 – 1.69)
	Female	2 (1.27 – 3.16)*	1.27 (0.83 – 1.95)	1.2 (0.79 – 1.83)
	Total	2.32 (1.69 – 3.18)*	1.31 (0.99 – 1.75)	1.17 (0.88 – 1.56)
Total	Male	3.03 (2.32 – 3.97)*	1.55 (1.22 – 1.98)*	1.4 (1.11 – 1.78)*
	Female	2.36 (1.79 – 3.1)*	1.32 (1.02 – 1.69)*	1.21 (0.95 – 1.55)
	Total	2.69 (2.21 – 3.26)*	1.44 (1.21 – 1.71)*	1.31 (1.1 – 1.55)*

* *Significance of odds ratio*

Along with significant RAEs and decreasing trend of the effect size, Table 2 shows significant odds ratios determined between quartiles. In U15 group, significant odds ratios occurred in Q1–Q4 and Q1–Q3 comparisons in both genders and total, while in Q1–Q2 comparison, significant odds ratio was determined only in males and total. In the U17 group, significant odds ratios were determined in Q1–Q4 comparison in both genders and total. Q1–Q3 comparison showed significant odds ratios in males and total, yet no other significance was determined in this age category. Lastly, in Juniors, only Q1–Q4 comparison suggested significant odds ratios. In total, significant odds ratios were determined in Q1–Q4 and Q1–Q3 comparisons in both genders; however, only males showed significant odds ratios in Q1–Q2 comparisons. It could be suggested that Q1 male players were more than thrice as likely to participate in the European Badminton Championships than Q4 male players, and Q1 female players were more than twice as likely to participate in the European Badminton Championships than Q4 female players.

DISCUSSION

The main purpose of this study was to investigate the RAE among European youth badminton players. According to this study results, the RAE was evident in favour of relatively older participants supporting the first hypothesis. Both male and female relatively older athletes were over-represented, and this trend has been held for the last three European U15, U17 and Junior (U19) Badminton Championships, spanning five years.

One of the explanations of this skewed distribution in favour of those born in the months shortly after the cut-off date can be physical, physiological and psychological differences caused by varied maturational time changes of each individual [5, 16]. In terms of physical and physiological aspects, greater weight, height, endurance, muscular strength, aerobic power and speed provide advantages in many sports [19], and specifically, adolescence is emphasised by Beunen and Malina [20] as the period of development of strength, change in absolute aerobic power and peak height velocity. Thus, our findings regarding overrepresentation of relatively older players might be based on their maturational advantage over relatively younger peers.

Along with the aforementioned physical and physiological attainments, psychological aspects and motor readiness may vary in relation with relative age [16, 21]. One of the benefits of being relatively older may be identified as being cognitively more mature than relatively younger peers, which may cause distinctive differences between them in decision-making, creativity and abstract thinking, and eventually a rather higher readiness level might be identified in relatively older athletes with regard to being more responsive to training and high level competitions. Furthermore, relatively older athletes may develop more positive feelings, such as competence and self-efficacy, while relatively younger athletes might have more negative feelings, such as low competence perception and motivation because of their already non-selected positions and lack of sufficient coaching, training and competition opportunities, which might greatly affect their sport performance [16]. Another main underlying reason for this phenomenon can be the possibility of coaches' misidentification of relatively older athletes as "talented" because of their early attainments and preferring to focus on them, although relatively younger athletes may have higher potentials for future achievements. So, coaches' talent identification processes and including some athletes in their teams while excluding others have a great influence on this undesirable circumstance and possible loss of great talents since talent is not a birthdate dependent phenomenon apparently [2]. Thus, the presence of RAE in European youth badminton players revealed in our study might be a result of many different factors.

Coaches' choices in favour of relatively older athletes might be due to the grouping policy of sporting events and their desire to achieve results "here and now" [22]. Considering that January 1st is determined as the cut-off date in badminton, a maximum of 12 months difference between the oldest and youngest athlete in the same category was expected, yet European Championships are generally organized in every two years. In U15, U17 and Junior categories – apparently no championship for each chronological age category – may cause up to 24 months difference between the oldest and youngest athlete in the same category. Thus, this policy may influence coaches' undesirable decisions in selecting relatively older athletes to their team in order to make the podium availing their early attainments. As a result of this attitude and several other factors, dropout of sport involvement could be one of the drastic consequences of RAE [11, 15].

As noted in our study, the continuation of RAE through ages is a significant point to highlight. Voluntary dropout of relatively younger peers in the sporting events was stated in several studies because of their already disadvantageous position in several aspects [11, 15]. On the other hand, this phenomenon creates more advantageous positions for relatively older athletes over their relatively younger peers in terms of attaining better training facilities, opportunities for training with better equipment and higher-level coaches, participating in higher level tournaments; in addition, it may lead to continuous reselection of the same athletes for national and international teams [13]. Such a reselection opportunity leads to an "accumulative advantage", thus the representation of relatively older athletes in elite levels invariably continues in the sporting context. In badminton, our study showed a statistically significant skewed distribution trend in favour of relatively older athletes in all three age categories, and from this point, it could be stated that our findings favour the idea of "accumulative advantage" with regard to relatively older athletes' ongoing overrepresentation, thus the second hypothesis of this study was supported. However, it should be noted that this advantage shows a decreasing trend regarding the strength of the effect. Similar results regarding the decreasing intensity of this phenomenon have been reported in the relevant literature [23].

Recent studies discussing gender differences in RAE found contradictory results, and particularly RAE among female athletes is rather less known [7, 16]. In our study, statistical significance was noted in both males and females, yet stronger in males. In the relevant literature, Goldschmied [24] and Delorme et al. [25] determined no statistically significant skewed distribution in female athletes. However, it could be stated that the strength of RAE among female athletes is rather weak compared to males. An explanation for this "supposed" gender differences in RAE might be physical and biological maturation time differences between females and males. Tanner et al. [26] discussed age differences between males and females with regard to peak height and weight changes, and determined that females mature earlier than males. Thus, our third hypothesis has its basis from this stance in terms of still continuing and rather late maturation process for males compared to females. As U15, U17 and Junior age categories were examined in this study, higher RAE was hypothesised in males, which was partially supported by the fact that statistically significant RAE was determined in all age categories and in both males and females, yet the χ^2 and effect size values were always higher in favour of males in each age category. Regarding the magnitude of difference, these results are in line with Cobley et al.'s [1] findings, and the presence of stronger RAE favouring male badminton players has been supported in our study.

In badminton, Nakata and Sakamoto [27, 28] discussed the presence of RAE and found no skew in distribution of players' birth months. Our results, on the other hand, showed statistically significant RAE among both male and female badminton players in each age category. This contrast could be explained through sample differences and the application of specific age categories in our study. The quoted studies were conducted in Japan, and they involved only Japanese badminton players; however, our sample comprised European badminton players. Moreover, there were no age criteria in the two previously mentioned studies, yet we only included badminton youth players and assessed them separately according to their age categories spanning adolescence which is known as the period of changes as discussed earlier.

CONCLUSIONS

The RAE has still been a matter of debate and has a great impact on the sporting context. Our findings suggest the presence of this phenomenon in European youth badminton players in three different age categories: U15, U17 and U19. However, its intensity decreases with age as apparently seen in effect size scores. A more comprehensive approach is required as a solution to eliminate the influence of RAE in sport. For instance, consideration of biological maturity instead of chronological age can be one of the basic solutions to eliminate RAE and to provide more equal opportunities to individuals in each cohort and age category [29]. As stated in the relevant literature, another solution could be variation [16] or rotation [6] of cut-off dates within the competition years. Furthermore, age quota practice [5] could be another suggestion to provide equal opportunity for each individual to be included in the team or to participate in higher-level competitions, to work with better equipment and higher-level coaches. Specifically, coaches are suggested to employ talent identification as a process rather than a point in time. Athletes should be assessed throughout a period in terms of their attainments and responses to trainings. To sum up, further studies are recommended to identify RAE in badminton with regard to age, gender, category, several performance variables, and to suggest new solutions bearing equal opportunities.

REFERENCES

[1] Cobley S, Baker J, Wattie N, Mckenna J. Annual age-grouping and athlete development. Sports Med. 2009;39:235–256. https://doi.org/10.2165/00007256-200939030-00005

[2] Helsen WF, Van Winckel J, Williams AM. The relative age effect in youth soccer across Europe. J Sports Sci. 2005;23:629–636. https://doi.org/10.1080/02640410400021310

[3] Gil SM, Badiola A, Bidaurrazaga-Letona I et al. Relationship between the relative age effect and anthropometry, maturity and performance in young soccer players. J Sports Sci, 2013;32:479–486. https://doi.org/10.1080/02640414.2013.832355

[4] Barnsley RH, Thompson A, Barnsley PE. Hockey success and birthdate: The relative age effect. Can Assoc Health Phys Educ Recreat. J 1985;51:23–28.

[5] Barnsley RH, Thompson AH. Birthdate and success in minor hockey: The key to the NHL. Can J Behav Sci. 1988;20:167–176. https://doi.org/10.1037/h0079927

[6] Grondin S, Deshaies P, Nault LP. Trimestre de naissance et participation au hockey et au volleyball. Le revue Quebecoise de l'activite physique, 1984; 2: 97–103.

[7] Weir PL, Smith KL, Paterson C, Horton S. Canadian women's ice hockey – evidence of a relative age effect. Talent Dev Excell, 2010; 2: 209–217.

[8] Delorme N, Raspaud M. The relative age effect in young French basketball players: A study on the whole population. Scand J Med Sci Spor. 2009;19:235–242. https://doi.org/10.1111/j.1600-0838.2008.00781.x

[9] Hancock DJ, Starkes JL, Ste-Marie DM. The relative age effect in female gymnastics: A flip-flop phenomenon. Int J Sport Psychol. 2015;46:714–725.

[10] Hancock DJ, Adler AL, Côté J. A proposed theoretical model to explain relative age effects in sport. Eur J Sport Sci. 2013;13:630–637. https://doi.org/10.1080/17461391.2013.775352

[11] Helsen WF, Starkes JL, Van Winckel J. The influence of relative age on success and dropout in male soccer players. Am J Hum Biol. 1998;10:791–798. https://doi.org/10.1002/(SICI)1520-6300(1998)10:6<791::AID-AJHB10>3.0.CO;2-1

[12] Gladwell M. Outliers: The Story of Success. New York: Little, Brown and Company, 2008.

[13] Vincent J, Glamser FD. Gender differences in the relative age effect among US Olympic development program youth soccer players. J Sports Sci. 2006;24:405–413. https://doi.org/10.1080/02640410500244655

[14] Raschner C, Müller L, Hildebrandt C. The role of a relative age effect in the first winter Youth Olympic Games in 2012. Br J Sports Med. 2012;46:1038–1043. https://doi.org/10.1136/bjsports-2012-091535

[15] Delorme N, Chalabaev A, Raspaud M. Relative age is associated with sport dropout: Evidence from youth categories of French basketball. Scand J Med Sci Spor. 2011;21:120–128. https://doi.org/10.1111/j.1600-0838.2009.01060.x

[16] Musch J, Grondin S. Unequal competition as an impediment to personal development: A review of the relative age effect in sport. Dev Rev. 2001;21:147–167. https://doi.org/10.1006/drev.2000.0516

[17] Baker J, Janning C, Wong H, Cobley S, Schorer J. Variations in relative age effects in individual sports: Skiing, figure skating and gymnastics. Eur J Sport Sci. 2012;14(1):183–190. https://doi.org/10.1080/17461391.2012.671369

[18] Cramer H. Mathematical methods of statistics. Champaign: Princeton University Press, 1999.

[19] Malina RM, Ribeiro B, Aroso J, Cumming SP. Characteristics of youth soccer players aged 13–15 years classified by skill level. Br J Sports Med. 2007;41:290–295. https://doi.org/10.1136/bjsm.2006.031294

[20] Beunen G, Malina RM. Growth and biologic maturation: Relevance to athletic performance. In: Hebestreit H, Bar-Or O, eds. The Young Athlete. Chichester: John Wiley & Sons; 2008, 3–17. https://doi.org/10.1002/9780470696255.ch1

[21] Baxter-Jones AD. Growth and Development of Young Athletes. Should competition levels be age related? Sports Med. 1995;20:59–64. https://doi.org/10.2165/00007256-199520020-00001

[22] Tedesqui RA, Glynn BA. "Focus on What?": Applying Research Findings on Attentional Focus for Elite-Level Soccer Coaching. J Sport Psychol Action, 2013; 4: 122–132. https://doi.org/10.1080/21520704.2013.785453

[23] Szwarc A, Dolanski B, Rompa P, Sitek M. Relative age effect in Polish National Football teams. Balt J Health Phys Act. 2019;11(3):19–26. https://doi.org/10.29359/BJHPA.11.3.03

[24] Goldschmied N. No Evidence for the Relative Age Effect in Professional Women's Sports. Sports Med. 2011;41:87–90. https://doi.org/10.2165/11586780-000000000-00000

[25] Delorme N, Boiché J, Raspaud M. The relative age effect in elite sport: The French case. Res Q Exercise Sport. 2009; 80: 336–344. https://doi.org/10.1080/02701367.2009.10599568

[26] Tanner JM, Whitehouse RH, Takaishi M. Standards from birth to maturity for height, weight, height velocity, and weight velocity: British children, 1965. II. Arch Disease Childhood. 1966;41:613–635. https://doi.org/10.1136/adc.41.220.613

[27] Nakata H, Sakamoto K. Relative Age Effect in Japanese Male Athletes. Percept Motor Skills. 2011;113:570–574. https://doi.org/10.2466/05.10.11.PMS.113.5.570-574

[28] Nakata H, Sakamoto K. Sex Differences in Relative Age Effects among Japanese Athletes. Percept Motor Skills. 2012;115:179–186. https://doi.org/10.2466/10.05.17.PMS.115.4.179-186

[29] Jones MA, Hitchen PJ, Stratton G. The importance of considering biological maturity when assessing physical fitness measures in girls and boys aged 10 to 16 years. Ann Hum Biol. 2000;27:57–65. https://doi.org/10.1080/030144600282389

Cite this article as:

Bilgic M, Devrilmez E.
The relative age-related participation trends in European Badminton
Balt J Health Phys Act. 2021;13(2):37-45
doi: 10.29359/BJHPA.13.2.04