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Original

Relative age effect on elite men's futsal according to region and playing position: A study of the FIFA Futsal World Cup Lithuania 2021

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ABSTRACT

Objective: To investigate the existence of relative age effect (RAE) in male futsal athletes that participated in the "FIFA Futsal World Cup Lithuania 2021", according to region and playing position.
Methods: The birthdates of 384 male futsal athletes participating in the competition were collected from official websites. Players were divided according to their continents and playing positions, and the chi-square goodness-of-fit tests ($\chi 2$) were performed to compare the expected and the observed birth-date absolute distributions for each group. Also, specific effect sizes (ω) were calculated for each of the chi-square tests performed. Additionally, Odds Ratio (ORs) and 95% confidence intervals were calculated for the first and the last quarters of the year, as for semesters.
Results: The overall analysis of the athletes indicated no presence of RAE in this sample, since an even distribution of birthdates was found ($\chi 2 = 5.949$; $p = 0.114$; $\omega = 0.124$). The regions analysed also indicated no presence of RAE. When playing positions were considered, once again analyses indicated no RAE to elite international futsal athletes, since no differences were found between the observed and expected birthdate distributions.
Conclusion: RAE is not prevalent on the international male elite futsal context. This effect was not associated with region or playing positions. From a practical perspective, it is important that selection processes consider the incidence of the RAE and give similar opportunities to athletes regardless of their birthdate.
Keywords: Age Effect; Sports; Team Sports, Birth Registration; Athletic Performance.

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Efecto de la edad relativa en el fútbol sala masculino de elite según la región y la posición de juego: Un estudio de la Copa Mundial de Fútbol Sala FIFA Lituania 2021

RESUMEN

Objetivo: Investigar la existencia del efecto de la edad relativa (EER) en atletas masculinos de fútbol sala que participaron en la "Copa Mundial de Fútbol Sala FIFA Lituania 2021", según región y posición de juego.
Métodos: Las fechas de nacimiento de 384 atletas masculinos de fútbol sala que participaron en la competencia fueron obtenidas de los sitios web oficiales. Se dividieron los jugadores de acuerdo con sus continentes y posiciones de juego, y se realizaron los testes de chi-cuadrado goodness-of-fit ($\chi 2$) para comparar las distribuciones absolutas de fecha de nacimiento esperada y observada para cada grupo. Así, se calcularon tamaños de efecto específicos (ω) para cada tests de chi-cuadrado Además, se calcularon Odds Ratio (OR) e intervalos de confianza del 95% para el primer y último trimestre del año, al igual que para los semestres.
Resultados: El análisis general de los atletas indicó que no existe EER en esta muestra, ya que se encontró una distribución uniforme de las fechas de nacimiento ($\chi 2 = 5.949$; $p = 0.114$; $\omega = 0.124$). Los análisis de regiones también no indicaron presencia de EER. Cuando se consideraron las posiciones de juego, una vez más los análisis no indicaron EER para los atletas, ya que no se encontraron diferencias entre las distribuciones de fechas de nacimiento observadas y esperadas.
Conclusiones: El EER no prevalece en el contexto internacional del fútbol sala de élite masculino. Este efecto no se asoció con la región o las posiciones de juego. En la práctica, es importante que en el proceso de selección considerérese la incidencia de EER y que hay oportunidades similares a los atletas independientemente de su fecha de nascimiento.
Palabras clave: Efecto Edad; Deportes; Deportes de Equipo; Registro de Nacimiento; Rendimiento Atlético.

Efeito da idade relativa no futsal de elite masculino de acordo com a região e posição de jogo: Um estudo da Copa do Mundo de Futsal FIFA Lituânia 2021

RESUMO

Objetivo: Investigar a existência de efeito de idade relativa (EIR) em atletas masculinos de futsal que participaram da "Copa do Mundo de Futsal FIFA Lituânia 2021", de acordo com a região e posição de jogo.
Métodos: As datas de nascimento de 384 atletas masculinos de futsal que participam da competição foram coletadas de sites oficiais. Os jogadores foram divididos de acordo com seus continentes e posições de jogo, e os testes qui-quadrado de aderência ($\chi 2$) foram realizados para comparar as distribuições absolutas esperadas e observadas de nascimento para cada grupo. Assim, foram calculados tamanhos de efeito específicos (ω) para cada um dos testes qui-quadrado realizados. Adicionalmente, foram calculados Odds Ratio (ORs) e intervalos de confiança de 95% para o primeiro e último trimestres do ano, assim como para os semestres.
Resultados: A análise geral dos atletas não indicou a presença de EIR nesta amostra, uma vez que foi encontrada uma distribuição uniforme das datas de nascimento ($\chi 2 = 5.949$; $p = 0.114$; $\omega = 0.124$). As análises das regiões também não indicaram a presença de EIR. Ao considerar as posições de jogo, mais uma vez as análises não indicaram EIR para atletas de elite do futsal internacional, uma vez que não foram encontradas diferenças entre as distribuições de datas de nascimento observadas e esperadas.
Conclusões: O EIR não é prevalente no contexto internacional de futsal de elite masculino. Este efeito não foi associado à região ou às posições de jogo. Na prática, é importante que o processo de seleção de talentos considere a incidência do EIR e forneça oportunidades similares aos atletas independentemente da sua data de nascimento.
Palavras-chave: Efeito idade; Esportes; Esportes de Equipe; Registro de Nascimento; Desempenho atlético.

Introduction

In team sports, it is common to use the date of birth to group athletes into age categories.[1] These age categories usually comprise intervals of 2 or 3 years each, in order to provide similar conditions for competitiveness.[2] However, this division generates advantages for athletes who were born in the first months of the year[3] as well as impair players born in the last months of the year, as they may compete with peers almost 3 years older. When the selection of these athletes occurs during childhood/adolescence, coaches are induced to choose older, apparently more skilled, taller, and stronger athletes.[4] Thus, the age grouping may devalue potentially talented younger athletes,[5] who will have fewer practice opportunities, and will be more likely to drop out of the sport.[6] This phenomenon is known as the relative age effect (RAE).

RAE is a broadly studied phenomenon and represents a potential talent selection bias in different sports.[7] RAE is modulated by many factors, such as gender, popularity, competitive level of the sport, as well as playing position.[5,8] Consequently, it is observed with greater frequency and magnitude in popular and more competitive sports[3,9] such as Olympic modalities. Evidence indicates that RAE occurs even in senior category in elite-level sports.[10,11] On the other hand, McCarthy et al.[12] suggests that RAE decreases when athletes attain the senior elite-level, which was also found by other investigations.[13,14] This can be justified by the rationale that as age advances, the differences induced by maturational processes decrease.[5,8]

Futsal is a sport practiced worldwide that has world level competitions. It can be classified as an intermittent high-intensity sport, and an elite futsal player needs to have a great repeated sprint ability, as well as agility, and power in lower limbs.[15] The Fédération Internationale de Football Association (FIFA) organizes the most important futsal tournament in the world, the "FIFA Futsal World Cup", once every four years. Despite its growing popularity, research on futsal is still scarce.[16] Considering the increasing popularity of futsal, as well as the specific characteristics of this sport, it is likely that coaches could be biased towards selecting athletes who present better developed physical attributes, similarly to what happens in other team sports, like soccer.[17]

In that sense, studies with elite male futsal athletes from different countries show controversial results. Castro et al.[18] and Penna and Moraes[19] found RAE in Brazilian male elite futsal athletes. Doncaster et al.[13] found RAE in U10 to U18 male futsal athletes from an elite Spanish club, but not in the senior category. On the other hand, Lago-Fuentes et al.[16] investigated 1873 male futsal players from the Spanish first division league between the 2006-2007 and 2014-2015 seasons and found a reversal RAE in all analyzed seasons. They also found a reversal RAE specifically for the pivot and goalkeeper position, indicating that in the

Spanish league younger players may have overcome the possible maturity disadvantages faced at the youth talent selection. Moreover, this study provides some evidence that RAE may be related to specific demands associated to playing positions, which requires further investigation.

In another study, Carraco et al.[20] verifyed RAE in the 2008, 2012 and 2016 editions of male FIFA Futsal World Cup. They found no RAE based on players' continent, playing positions or final rankings in the sample analyzed. To the best of author's knowledge, Carraco et al.[20] was the first study considering futsal players at international level. Considering the growing popularity of futsal and its demands, we believe that studying RAE and its mediating factors is important to understand how its presence changed by the years. Since this effect is influenced by competitiveness and popularity,[3,21] verifying RAE according to continents can also help to understand if it occurs in regions where this sport is most popular.

As observed, investigations of RAE pervasiveness on futsal are still scarce, and most of these studies portray the specificity of this phenomenon in a single country, as it was the case with Brazil[18,19] and Spain.[13,16] Therefore, a worldwide overview of the RAE phenomenon is still limited to the results of a single study.[20] Moreover, determining if RAE is more prevalent on specific playing positions is crucial, as it may elucidate the need for specific interventions in the selection of athletes from different playing positions. Evidence on this topic, however, is not only scarce but conflicting,[16,20] indicating the need for further investigations. By delving into these topics we hope to provide valuable and specific information to support talent selection policies of international futsal federations across the world, as well as methodological approaches used by futsal coaches.

Thus, this study aimed to investigate the existence of RAE in male elite futsal athletes that participated in the "FIFA Futsal World Cup Lithuania 2021", according to region and playing position. Based on previous results,[13,20] we expect not to find RAE at senior level, as well as playing position or world region, considering that futsal is a still developing sport, not as widespread as soccer.

Methods

Study design and setting

This is a retrospective and descriptive study with a cross-sectional design.[22]

Participants

This study's sample was composed of 384 male elite futsal athletes (mean age = 28.37 ± 4.59 years), equivalent to all athletes of the 24 National Teams that competed in the FIFA Futsal World Cup Lithuania 2021. The athletes were organized according to six regions: Africa (Angola, Egypt, Morocco); Asia (Iran, Japan, Kazakhstan, Thailand, Uzbekistan, and Vietnam); Europe (Czech Republic, Lithuania, Portugal, Russia, Serbia, and Spain); North America (Costa Rica, Guatemala, Panama, and United States); South America (Argentina, Brazil, Paraguay, and Venezuela); and Oceania (Solomon Islands). Each National Team was composed of 16 athletes. For categorization purposes, when a country was part of more than one region, it was assigned to the region that most of its territory is located. Athletes were also organized according to playing position, as follows: defender (n = 82); winger (n = 163); pivot (n = 67); and goalkeeper (n = 72). No exclusion criteria were adopted.

Data collection and procedures

Data were retrieved from the official championship document available by FIFA to the National Teams and FIFA Futsal World Cup Lithuania 2021 official website (https://www.fifa.com/tournaments/mens/futsalworldcup/lithuania2021) during September 2021. The information included date of birth, playing positions, and country. The names of the athletes were not disclosed, maintaining the confidentiality of data and research ethics. All information was kept confidential and was used specifically for this study.

For the purpose of this study, we defined the birth year as beginning on January 1st, as used by the others studies in sports.[5] Data were tabulated in a spreadsheet, and the variables analyzed included the quarters of the year the athletes were born, as used in previous studies in futsal:[16,18,20] Q1 (first quarter: January-March), Q2 (second quarter: April-June), Q3 (third quarter July-September), and Q4 (fourth quarter: October-December).

Statistical analysis

Data were presented as absolute and relative frequencies of the athletes' birthdate distribution. We performed chi-square goodness-of-fit tests (χ^2) to compare the expected and the observed birthdate absolute distributions according to playing position and continent. At present, various studies adopt the theoretical assumption that births are evenly distributed across quarters. This hypothesis should be taken as valid, since in most countries, dates of births are equally distributed throughout the year, and there are no significant seasonal variations. Therefore, a theoretical expected distribution was assumed in this study, considering the number of days in each quarter, as suggested by Edgar & O'Donoghue,[23] due to the impossibility of obtaining reliable birth records from all countries. For each of the chi-square tests performed specific effect sizes (ω) were calculated.[5] As a reference, Cohen[24] suggests that 0.1 is considered a small effect, 0.3 a medium effect and 0.5 a large effect size. Additionally, Odds Ratio (ORs) and 95% confidence intervals were calculated for both quarters (Q1 versus Q4) and semesters of the year (1st versus 2nd) based on playing position and continent. The analyses were performed in the Statistical Package for the Social Sciences (SPSS), version 20.0 (Chicago, USA). The statistical significance was set to $p < 0.05$.

Results

The overall analysis of the elite international futsal athletes indicated no presence of RAE in this sample (Figure 1), since an even distribution of birthdates was found ($\chi^2 = 5.949$; $p = 0.114$; $\omega = 0.124$). Even though no significant difference was reported between observed and expected frequencies, odds ratio indicated a trend of overrepresentation of athletes born in the last quarter of the year compared to the first one (OR-Q1:Q4 = 0.72; 95% IC = 0.53 to 1). This was also observed when athletes born in the second semester were compared to athletes born in the first one (OR- 1st:2nd = 0.86; 95% IC = 0.65 to 1.15).

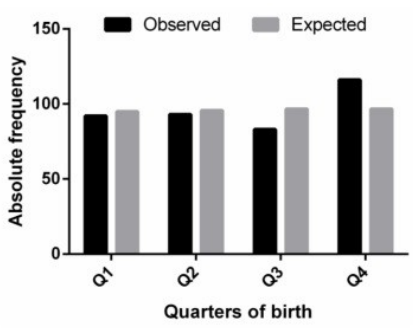

Figure 1. Absolute frequencies of observed and expected birthdates of elite international futsal athletes. Q1-Q4 = birth quarters.

Table 1. Absolute distribution of elite Futsal athletes' birthdates according to region and playing position.

		Q1 (Exp)	Q2 (Exp)	Q3 (Exp)	Q4 (Exp)	χ^2	p	ω	OR – Q1:Q4 (95% IC)	OR – 1st:2nd (95% IC)
Region	Africa	11 (11.9)	16 (12)	11 (12.1)	10 (12.1)	1.89	0.596	0.198	1.13 (0.43 to 2.94)	1.65 (0.73 to 3.7)
	Asia	23 (23.7)	21 (23.9)	23 (24.2)	29 (24.2)	1.395	0.707	0.12	0.73 (0.38 to 1.38)	0.72 (0.41 to 1.26)
	Europe	22 (28.7)	22 (28.9)	21 (29.2)	31 (29.2)	2.619	0.454	0.165	0.62 (0.33 to 1.18)	0.72 (0.41 to 1.26)
	North America	16 (15.8)	13 (15.9)	15 (16.1)	20 (16.1)	1.556	0.669	0.147	0.73 (0.34 to 1.58)	0.69 (0.34 to 1.38)
	South America	15 (15.8)	18 (15.9)	9 (16.1)	22 (16.1)	5.597	0.133	0.295	0.58 (0.27 to 1.26)	0.88 (0.44 to 1.76)
	Oceania	5 (-)	3 (-)	4 (-)	4 (-)	-	-	-	1.36 (0.3 to 6.15)	1 (0.25 to 3.98)
Playing position	Goalkeeper	17 (17.8)	22 (17.9)	14 (18.1)	19 (18.1)	1.941	0.585	0.164	0.86 (0.41 to 1.83)	1.39 (0.73 to 2.69)
	Winger	37 (40.3)	37 (40.6)	39 (41.1)	50 (41.1)	2.636	0.451	0.127	0.66 (0.41 to 1.09)	0.69 (0.45 to 1.07)
	Defender	21 (20.3)	18 (20.4)	18 (20.7)	25 (20.7)	1.57	0.666	0.138	0.78 (0.4 to 1.55)	0.82 (0.45 to 1.52)
	Pivot	17 (16.6)	16 (16.7)	12 (16.9)	22 (16.9)	3.005	0.391	0.211	0.69 (0.33 to 1.47)	0.94 (0.48 to 1.85)

Q1-Q4, birth quarter; (Exp), expected distribution; χ2, chi square; p, level of significance; ω, effect size; OR - Q1:Q4, odds ratio from Q1 to Q4; OR - 1st:2nd odds ratio from 1st semester to 2nd semester.

The regions analyses indicated no presence of RAE in elite international futsal athletes, regardless of their region (Table 1). It is noteworthy to point out that data from Oceania was not analyzed inferentially, since the small number of athletes in this region violates the assumptions of the chi-square goodness-of-fit test. Thus, we presented and analyzed data from Oceania players descriptively.

When playing positions were considered, once again analyses indicated no RAE in elite international futsal athletes, since no differences were found between the observed and expected birthdate distributions (Table 1). In general, odds ratios seem to indicate an overrepresentation of athletes born in the last quarter, when compared to athletes born in the first quarter. However, it is important to emphasize that this relationship was not statistically significant for any of the playing positions.

Discussion

To analyze the prevalence of RAE in international high-level adult male futsal players, this study investigated the existence of this phenomenon in male elite futsal athletes that participated in the "FIFA Futsal World Cup Lithuania 2021", according to region and playing position. The results revealed no presence of RAE in this sample, since an even distribution of birthdates was found in all analysis. Similar result was found in the study by Carraco et al.,[20] performed with 950 players of the FIFA Futsal World Cup from the three editions prior to this study (2008, 2012, and 2016), in which no significant differences were found in the distribution of birth date frequency based on players continent, playing positions or final rankings.

One possible explanation for these results could be the tendency of RAE decreasing (or even reversing) when athletes achieve the elite competitive level, as observed in other studies.[12,14,16] Doncaster et al.,[13] for example, evaluated the RAE in 761 male futsal players from ages U10 to senior level at FC Barcelona, and found the prevalence of RAE in male athletes from U10 to U18 age categories, but not in the senior category.

Although our results indicate a trend towards an overrepresentation of athletes born in the last quartile of the year (Q4) in overall analysis, this difference was not significant. In conformity, Lupo et al.[21] indicate that players born in the last semester of the year are less frequent even in the senior categories of team sports. Furthermore, these athletes have shorter careers than athletes who are born in the first semester (relatively older).[25] However, in the study of Lago-Fuentes et al.,[16] with 1873 male players from the First Division of the Spanish National Futsal League (seasons 2006-2007 to 2014-2015) an overrepresentation of players born close to the cut-off date was found in medium and high-level teams, especially for goalkeepers and pivot players.

On the other hand, Castro et al.[18] conducted a study with 411 male athletes from First Division of the Brazilian National Futsal League (BNFL) and found different results. The overall analysis of the sample indicated an overrepresentation of athletes born in Q1 and Q2 compared to those born in Q3 and Q4. In the playing position analysis, significant differences was found for wingers (overrepresentation of players born in Q1 and Q2 compared to Q3 and Q4) and defenders (overrepresentation of players born in Q1 compared to Q3 and Q4).[18] Two other studies that analyzed male elite Brazilian senior futsal athletes[19,26] found an overrepresentation of athletes born in first semester (Q1 and Q2) compared to the second (Q3 and Q4). In all of these cases, players born in the first semester of the year were more frequent than players born in the second semester,[21] which doesn't correspond to our results.

The present study has limitations. Even though our sample comprised some of the best male futsal athletes in the world, the limited number of players representing each country did not allow us to draw more specific conclusions regarding the RAE phenomenon in each country nor the playing positions of these athletes. Another limitation of our study is the absence of female athletes in our sample.

Considering the scarcity of studies that investigated RAE on futsal and the influence of multiple factors within each sports context (e.g. different popularity and competitive levels of the sport in different locations[3,5,8,9]), we suggest that future studies should be carried out in different countries. In addition, studies investigating RAE on high-level international female futsal athletes are needed. Finally, we suggest that future studies investigate RAE in futsal athletes according to the final classification in national and international competitions and selection for national teams in different countries, which would allow to identify whether there is a relationship between the RAE and competitive success.

In summary, RAE is not prevalent on the international male elite futsal context. This effect was not associated with region and playing positions, since even birthdate distributions were found in all analyses. As practical implications, it is important to instruct youth coaches regarding the consistent evidence that RAE is not prevalent in male international-level futsal players. Therefore, it is important that players in the lower categories have equal opportunities to develop in the sport, regardless of their quartile of birth. This is relevant because it may prevent the loss of potential talents, thus increasing the number of athletes available for national and elite senior teams.

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