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Original Article

Constituent year effect in international handball at high level

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ABSTRACT

The criterion used by the International Handball Federation for the admission of participants in the Championships at junior levels is based on the ascription of players born during two consecutive years in the same category, moving afterwards this period of two years have finished, all together to next category. The sample is composed of 2,117 handball players. The data collected for the analysis were taken in base to the gender, born date and the level of the competition. Differences among this two has been calculated through the binomial test, comparing equal proportion. There weren't significant differences found between male and female senior categories, although in all categories more players have been found, with very significant differences, born in even-numbered years than in odd years. **Key words:** CONSTITUENT YEAR EFFECT, HANDBALL, PERFORMANCE ANALYSIS

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INTRODUCTION

The study of the influence of the date of birth on the performance of a group of persons with similar characteristics begins with studies of Armstrong (1966) and Freyman (1965).

Many times the application of the concept *Relative Age Effect (*RAE) has been used in both educational and sport environments but there is a clear existence of differences between the organization of the educational systems and the sports competitions. The main difference is that the education system is organised by years of a yearly period where the pupils are mostly of the same age and that is why the difference between a three and a four month period are analysed. In the sports environment many situations are found that athletes born in two different years compete in the same sports category (for example, ice hockey in Canada or the lower categories in handball in countries assigned to IHF). The application of the RAE concept is difficult to apply in this context.

The study of Wattie, Cobley, and Baker, (2008) tries to solve this problem and establishes the use of the RAE concept when competitions are organised in a way that the athletes are divided into groups of individuals born in the same year. However, the concept of *Constituent Year Effect* (CYE) has been used as an extension of the RAE concept for periods longer than a year, where the interest does not focus on the differences in performance of individuals born in different periods of months in the same year but in the different years that make up the same sport category.

This way the studies made on the effect of age can be divided into two groups. Those that use the classic concept of studying the differences in the performance between athletes born in the same year. There are studies that analyze the RAE and have been conducted in many sports, for example, and only citing the most recent work, in football (Augste, & Lames, 2011; Delorme, Radel, & Raspaud, 2013; Deprez et al., 2013; Gil et al., 2014; Grossmann & Lames, 2013; Honert, 2012; Ostapczuk & Musch, 2013), basketball (Saavedra, Gutiérrez, Fernández, Fernández, & Eiras, in press; Schorer, Neumann, Cobley, Tietjens, & Baker, 2011) or hockey (Bruner, Macdonald, Pickett, & Côté, 2011; Gibbs, Jarvis, & Dufur, 2012; Hancock, Ste-Marie, & Young, 2013; Pierson, Addona, & Yates, 2014; Turnnidge, Hancock, & Cote, 2014).

Other studies analyze the RAE in broader samples, with populations of several countries or several sports (Carling, le Gall, Reilly, & Williams, 2009; Delorme, Boiche, & Raspaud, 2009; Larouche, Laurencelle, Gronding, & Trudeau, 2010).

Baker, Schorer, and Cobley (2010) reported that the maturation of the athletes is the most used to explain the RAE. The proposed solutions are normally attached to the variation of the cutoff date, which supposes that the RAE has to be modified, but it persists (Helsen, Starkes, & Van Wickel, 2000; Musch, & Hay, 1999; Simmons, & Paul, 2001). Other solutions assume an enormous administrative complexity, like the proposition from Barnsley, and Thompson (1988) which says that the participants must adapt to one preset distribution, or through the control of the average age of a whole team, as outline Helsen *et al.* (1988; 2000).

In handball there are not many researches that analyze RAE. Schorer, Baker, Lotz, and Büsch (2010) analyzed the existing relations between motivation, birthday and population, to predict the possibility to be chosen in a handball national talent program. They have not found any difference referred to motivation. Even though RAE was present in the entire sample, they have not found any distribution differences between the selected athletes and the ones not. Also they have not found any relation between motivation, age and the size of the population.

Schorer, Baker, Büsch, Wilhelm, and Pabst (2009) found the existence of RAE with a sample of young German handball players. However they have proved that there were no differences among height or weight, neither on the technical aspects between older and younger player, this is the reason why RAE cannot be attributed to these causes.

Schorer, Cobley, Büsch, Bräutigam, and Baker (2009) made an investigation with three objectives. The first is aimed at determining in a sample of 1,513 boys (13-16 years) and 1,734 girls (12-15 years) that could have influenced the gender of the players and the level of competition in the RAE, concluding that this effect decreases with increasing the level of competition, and that is more consistent in women than in men. The second research analyzed the participation in the elite group, the nationality of the athlete and their permanence in the adult stage. They have used a sample of 2,291 players of the German first league and 4,824 of the second league, among seasons 1998/99 and 2005/06. It seems that in foreign players exists higher RAE, this is explained by authors due to the selection process that players suffer to get into these leagues.

The third objective was to determine the influence of the RAE in laterality of the player and his playing position in a simple of 1298 players of the first German league among seasons 2004/05 and 2007/08.

In the second group of studies analyzing the influence of birth date performance are proposing research analysis periods longer than one year (Medic, Bradley, & Grove, 2013; Medic, Starkes, & Young, 2007; Medic, *et al.*, 2009; Medic, *et al.*, 2011), and therefore do not use RAE concept. In this second group Medic, *et al.* (2007) and Wattie, Cobley and Baker (2008) use the Constituent Year Effect (CYE) concept instead.

There are few studies done on the effect of the age in period superior than a year. Under this concept the study by Medic, Starkes, and Young (2007) in which two investigations were made, one in athletes in the "Master" category in athletics and another in swimming. In the same category there are athletes that are born in five different years. Among athletes the ratio of participation is higher in the first two years than in the last two years. In the study in swimmers, the probability of establishing a record is higher in the first year and lowest in the third, fourth and fifth year.

The investigation by Medic, *et al.*, (2009) establishes the differences by gender and by sport (athletics and swimming) in the CYE. A stronger effect of the age is found in men than in women. Also a stronger effect was found at the age in swimming than in athletics.

Medic, *et al.*, (2011) analysed a longitudinal study of the age effects in swimmers of the "Master" category finding that the probability of participating in the tournament during the first year, of the five that form the category, is twice more superior than finding athletes that belong to the fifth year.

No studies have been found on CYE in handball.

To establish membership in each category at the lower levels (junior and youth) the International Handball Federation (IHF) determines that the participants in World Championships are grouped so that so that players born in two consecutive years are in the same group, being the first year of cutting athletes born in an odd year. Thus, athletes who are in a class for two seasons remain the same, going around the block group to the next level after two seasons.

The aim of this investigation is to see whether the birth year influences on the chances of an athlete achieving the elite category in international handball when the biannual criteria is established for making the competition categories.

MATERIALS AND METHODS

Samples and variables

The sample is composed of 2,117 handball players (female and male), which have played in the World Championships at senior, U21´s and U18´s level. This World Championships were played between 2009 and 2011.

The registered variables were the birth date, gender and level of the competition. Data was obtained from the "team roster" existing in all championships and this was contrasted with the International Handball Federation web page (http://www.ihf.info/) and the official website of National Federations.

Data analysis

Normally CYE analysis is done due to the criterion used for the admission of contestants in World Championships, which is dictated by the International Handball Federation, it took as a reference if the athlete was born in even or in an odd year. This is because the ones born in even numbered years will be the oldest of the group during two years in the U21´s and U18´s category.

Differences between the quantities of athletes born in even or odd years have been calculated through the binomial test, contrasting the proportion of 50%. In a similar way to Lesma, Pérez-González, and Salinero (2011), CYE coefficient is defined as the quotient among the number of players born on the "advantage" period and the ones born on the "disadvantage" period (if the periods of time are the same, like in this research). On this research, CYE coefficient represents the number of players born in even numbered years ("advantage" period), that exists per athlete born in odd years ("disadvantage" period).

RESULTS

Making a global analysis of all the sample it has been found significant differences between the number of players born in even year and in an odd year ($p<0,001$), being significantly higher the proportion of players born in even-numbered years (61%) than the ones born in odd years (39%), like is shown in table 1.

Table 1.- CYE per gender.

	Male				Female		
Birth year	Even	Odd	Total	Birth year	Even	Odd	Total
n / %	676/63	392/37	1068/100	n / %	618/59	431/41	1049/100
C.Y.E. Coefficient.[1]		676/392=1.72		C.Y.E. Coefficient.[1]		618/431=1.43	
Signification*		**0.000**		Signification*		**0.000**	

*Binomial test signification.
[1]C.Y.E. Coefficient is the quotient among the number of playerborn on the "advantage" period and the ones born on the "disadvantage" period.

Differences per gender and per category

Analyzing the sample in order to the gender of participants, occurred that there were significant differences between genres. As it can be observed in table 2 more athletes born in even years (63%) than in odd year (37%) have been found among men, this means that there are 1,72 players born in even numbered years per each one born in an odd year. In the same way with women there are more players born in even years (59%) than the ones born in odd years (41%), this means having 1,43 players born in even numbered years per each player born in an odd year.

Table 2.- CYE per gender and per category..

Category	Male				Female			
	Birth year	Even	Odd	Total	Birth year	Even	Odd	Total
Senior	n / %	204/53	178/47	382/100	n / %	199/51	191/49	390/100
	C.Y.E. Coefficient.[1]	204/178=1.15			C.Y.E. Coefficient[1]	199/191=1.04		
	Signification*	0.201			Signification*	0.723		
U21	n / %	242/63	142/37	384/100	n / %	217/60	146/40	363/100
	C.Y.E. Coefficient.[1]	242/142=1.70			C.Y.E. Coefficient[1]	217/146=1.49		
	Signification*	**0.000**			Signification*	**0.000**		
U18	n / %	230/76	72/24	302/100	n / %	202/68	94/32	296/100
	C.Y.E. Coefficient.[1]	230/72=3.19			C.Y.E. Coefficient[1]	202/94=2.15		
	Signification*	**0.000**			Signification*	**0.000**		

*Binomial test signification (in **bold**, significant differences).
[1]C.Y.E. Coefficient is the quotient among the number of player born on the "advantage" period and the ones born on the "disadvantage" period.

DISCUSSION

RAE and CYE researches try to determinate which effect has the fact of cluster people taking as reference the birth dates of these ones. Generally, an analysis is made taking as reference the trimester where the athlete was born, this is due to the hypothesis that the ones born in the first's trimesters of the year have more advantages in order to a quicker maturation. In international handball it is different because players U21 and U18 are grouped, beginning through the ones born in even numbered years (this will be the old ones). In the same group, these ones born in even-numbered years, and the ones born in the consecutive year, stay during two seasons in the same category, moving all together in the next category when this two year period has finished.

The target of this method is that all the players get the same chances of success, trying to balance the competition (Helsen *et al.*, 2005), even though subsequent researches to this proposition, have proven that the target is not achieved (Malina, 1994; Musch, & Gronding, 2001).

In the sample analysis all the players (each one in their category) participated in the last handball World Championship, making a total of 2117 players. In Table 1 it can be seen that there is a big difference in favor of players born in even numbered years (n=1294). This means a 22% more than the percentage of players born in odd years, so there is a very significant difference with p<0,001.

When the sample is divided in order to the gender of contestants (table 2), it is possible to check that significant difference found before in chart 1 (p<0,001). In the option of male players the ones born in even numbered years (n=676) are a 26% more than the ones born in odd years (n=392). This occurs in female players too, were the ones born in even-numbered years (n=618) are an 18% more than the ones born in odd years (n=431).

If the analysis is made in order to categorize and distinguishing the gender of contestants (table 2) it is possible to see how in the U21´s and U18´s categories there is a much more significant difference in favor of players born in even numbered years, because in all the possibilities we get up p<0,001. U21´s male players born in even numbered years (n=242) are a 26% more than the ones born in odd years (n=142). U18´s male players born in even years (n=230) are a 52% more than the ones born in odd years (n=72). U21´s female players born in even years (n=217) are a 20% more than the ones born in odd years (n=146). U16´s female players born in even years (n=202) are a 36% more than the ones born in odd years (n=94).

There are several researches that have shown, in the same way as this research, the existence of the RAE on sport in the formation categories (Barnsley, Thompson, & Legault, 1992; Bäumler, 2000; Baxter-Jones, Helms, Maffull, Baines-Preece, & Preece, 1995; Gutiérrez *et al*., 2010; Helsen *et al*., 1998; Helsen *et al*., 2000; Vaeyens, Philippaerts, & Malina, 2005).

The fact that the IHF has adopted the criterion of cluster players on year blocks, makes the effect of CYE stronger and gets closer to the investigations that explains RAE by the maturation processes. (Fenzel, 1992; Helsen *et al*., 2000; Malina, 1994, 1999; Malina *et al*., 2004; Philippaerts *et al*., 2006; Reilly, 2000; Simmons, & Paull, 2001). Doing things like that Under senior´s categories national team head coaches, tend to choose players born in even years in order to have the maturation procedure more advanced, a better anthropometric, physical and cognitive development. This will mean an advantage over the players born in odd years.

In another way, in senior category there were no significant differences, in male or in female players, neither in the ones born in even or in odd years. The senior stage of a player runs over a period of time superior than the stages of the U21´s and U18´s (two years), and can last for over ten years. Players that have not been selected in the talent selection programs can also reach the elite. Furthermore all the possible causes to explain RAE and CYE that have been used in scientific literature, as it can be maturation procedures on the physical or cognitive advantage of a certain group of players due to the age (Fenzel, 1992; Helsen *et al*., 2000; Malina *et al*., 2004; Malina, 1994, 1999; Philippaerts *et al*., 2006; Reilly, 2000) does not exists, because all this have been already completed.

Between the solutions proposed by researchers for mitigate this effect these ones stand over the rest: to alternate the cutoff date (Hurley, Lior, & Tracze, 2001), to make competitions with younger age groups

(Glamser, & Vincent, 2004), or to divide players from the same category in order to their performance (Kaiserman, 2005). However, all these propose will bang against handball philosophy and against IHF. Another approach more accord to IHF mentality, and maintaining the criterion of using age as a cutoff reference to reduce the effect of the RAE in top handball international level in formation categories, will, as well as García, and Salvadores (2005) propose, allow players change of category at the end of the year, so at the end of the season the oldest of the group will be the ones born in even numbered years, but the next year, in the same category, will be the ones born in odd years.

CONCLUSIONS

The data collected show the existence of CYE in high level competitions for formation categories (U21 & U18). The International Handball Federation should change the method they use to select players, in a way that each year the older players of the group change category. Using this method, groups will renew, and the ones that in one season were the youngest will be the oldest on the next, so it is possible that the tendency from the head coaches of choosing more players born in even year decrease, because this does not seem to be a determinant criterion in the procedure of talent detection.

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