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ORIGINAL

INFLUENCE OF RELATIVE AGE EFFECT IN BASIC PHYSICAL ABILITIES

INFLUENCIA DEL EFECTO DE LA EDAD RELATIVA EN LAS CAPACIDADES FÍSICAS BÁSICAS

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ABSTRACT

This paper focuses on the Relative Age Effect over the basic physical abilities of Compulsory Secondary School (ESO) students after a descriptive, cross-sectional, correlation study in context by incidental sampling in a Compulsory Secondary Education school. The tools applied were physical tests and a questionnaire. The results reveal that there are no significant differences ($p>0,05$) between the mean results in the physical tests taken by students born in the first and the second semesters. The highest marks belong to the students born in the early months of the year. This tendency is altered by sex, school year and after school physical activity. Students born towards the beginning of the year attained better school marks in PE. As a conclusion we can argue that the RAE is one more factor within the education process, it is present in basic physical abilities and must be taken into account in order to prevent unfavourable situations for students.

KEY WORDS: age difference, physical development, physical education, school entry age, achievement test, compulsory secondary education.

RESUMEN

Este trabajo se centra en el *Efecto de la Edad Relativa* (RAE) sobre las capacidades físicas básicas del alumnado de ESO, tras un estudio descriptivo correlacional transversal contextualizado mediante muestreo incidental en un Instituto de Educación Secundaria Obligatoria. Los instrumentos utilizados fueron pruebas físicas y un cuestionario. Los resultados muestran que no existen diferencias significativas ($p>0,05$) entre las medias de las pruebas físicas del alumnado nacido en el primer y segundo semestre. Las mejores marcas corresponden al alumnado nacido en los primeros meses del año. Esta tendencia se ve alterada en función del sexo, curso escolar y actividad física extraescolar. El alumnado nacido a principios de año obtuvo una mejor calificación numérica en Educación Física. Como conclusión podemos afirmar que el RAE es un factor más del proceso educativo, que está presente en las Capacidades Físicas Básicas y debe tenerse en cuenta para evitar situaciones desfavorables para el alumnado.

PALABRAS CLAVE: diferencia de edad, desarrollo físico, educación física, edad de ingreso en la escuela, test de rendimiento, Educación Secundaria Obligatoria

INTRODUCTION

The usual procedure of grouping people by age may be of utmost relevance for a person's future options when it is done during the developing and growing up stages, since it can upset his or her school progress. Therefore we may ask: Is a person born on 31st of December as developed as one born on 1st of January of the same year? This gap of up to twelve months is known as *Relative Age* and its consequences are known as *Relative Age Effect.* (Campbell, 2013; Dixon, Horton & Weir, 2011; Díaz del Campo, 2013; Wattie, 2013).

Due to management reasons, students are grouped by chronological age when they entry school, this makes differences among those belonging in the same stream more apparent since performance (i.e. school performance) is tightly linked to an individual's development (Thompson, Barnsley & Dick, 1999). The awareness of the problems that this fact brings in should prompt consideration of the consequences that in most cases give advantage to those students of higher relative age, because there will be a group of them, who will have more possibilities of success, although they will be unaware of their advantage. Conversely, those disadvantaged by the RAE (those born towards the end of the year) may suffer negative consequences (Sykes, Bell & Rodeiro, 2009). Being older within a stream of students depends on the cutoff entry date.

This phenomenon begun to be researched in the 60s. The term *relative age* has been used to name the age gap within a year group of students; its consequences lead to *relative age effect* (Barnsley, Thompson & Barnsley, 1985; Cobley, McKenna, Baker & Wattie, 2009). In the 80s these terms begun to be used in sport research, whereas in education other terms have been used, like *Birth-date Effect* and *Age-position Effect*. It is relevant to underline that, according to Hurley, Lior and Tracze (2001), research in the sport domain was spurred by research in the education domain.

RAE takes place where people are grouped by age, that is, where there are cutoff entry dates. Díaz del Campo (2013) suggests four hypotheses that may explain this phenomenon: *maturation hypothesis, experience hypothesis, self-concept hypothesis and parents' own enrolment hypothesis.*

RAE research in education has made progress in the last few decades. The first studies focused on the link between month of birth and school attainment, as for instance, Jinks (1964) and Bookbinder (1967), as cited by Wattie and Baker (2013). These studies tried to give evidence of what was known as *Birth-date Effect* and *Age-position Effect*. That is, how the link between month of birth and school attainment could be explained. Thereafter, other theories leading to explain this phenomenon have been developed, but to this date there is no consensus about a single theory that might settled a single correlation (Sykes et al., 2009) within the education domain. The theory that draws more attention and relevance with regard to education, according to the premises and conclusions reached by Bell and Daniels (1990) and Sykes et al. (2009) has to do with the Relative Age.

The existence of RAEs has been researched and demonstrated in cases of: school attainment (Bedard & Dhuey, 2006; Dixon et al., 2011; McPhilips & Jordan-Black, 2009; Sprietsma, 2010), post-compulsory education students (Bedard & Dhuey, 2006), diagnosis of special educational needs or learning disorders (Cobley et al., 2009; Goodman, Gledhill & Ford, 2003; Martin, Foels, Clanton & Moon, 2004; Wallingford & Prout, 2000 and Wilson, 2003), giftedness (Martin et al., 2004 and Elder & Lubotsky, 2009), potential group leaders (Dhuey & Lipscomb, 2008), self-perception and self-esteem (Dhuey & Limpscomb, 2008; Crawford, Dearden & Greaves, 2011; Pellegrini, 1992, Díaz del Campo, 2013 and Thompson et al., 1999), school sport (Cobley, Abraham & Baker, 2008; Glamser & Marciani, 1991; Horn & Okumura, 2011; Leite, Borges, Santos and Sampaio, 2013; Wilson, 2003).

On citing direct antecedent research of our study, we will quote firstly Physical Education research and, secondly, the one related to physical condition.

As far as PE goes, Cobley et al. (2008) studied RAE in the area of Compulsory Secondary Education and school sport participation. Their conclusions suggest that current entry age and grouping policies as well as assessment and selection processes in school sport may be worsening RAE in and out of the classroom. Likewise, Physical Education and school sport environments may be favouring pupils born in the early months of the year, whereas they place a high proportion of relatively younger pupils at a disadvantage.

Roberts and Fairclough (2012) studied the influence of RAE on PE assessment of Compulsory Secondary Education pupils in the UK. Their conclusions indicated clear advantage in favour of pupils born in the early months of the year to the disadvantage of those born towards the end of it. Another conclusion of that study suggested that PE assessment only based on physical aspects seriously disfavoured pupils born towards the end of the year.

Cervera Raga, Jiménez Saiz and Lorenzo Calvo (2013) found a RAE in tests of fitness and concluded that a great deal of physical tests given in PE classes may pose a disadvantage for those students born in the late months of the year.

With regard to studies on the RAE and fitness, Leite Portella, De Arruda and Cossio-Bolanos (2011) analysed physical performance of young footballers depending on chronological age and they reached the conclusion that chronological age significantly contributes to variation and performance in speed, flexibility, explosive power and aerobic power tests in 13 and 14 year-old footballers. Thereafter, it remains relatively stable up to age 18, inclusive.

Roberts, Boddy, Fairclough and Stratton (2012) examined the RAE in cardiorespiratory fitness results in 9-12 year-old children. They searched for those effects after verifying the maturity of the subjects. The results corroborated the presence of a RAE, which therefore may affect the cardiorespiratory fitness assessment of relatively younger children.

That is why we thought it was specially interesting to study the relationship between the RAE and the basic physical abilities. It should not be forgotten that it may have an impact on PE classes, since very often fitness plays an important role in them (Brito Ojeda, Ruiz Caballero, Navarro Valdivieso & García Manso, 2009), apart from the fact that research into this phenomenon within the curricular area of Physical Education is scanty.

Therefore, the research aims of our study were defined as follows:

1. To learn whether any Compulsory Secondary Education (ESO) year groups of students show any significant RAE difference between those born in the first half and those born in the second half of the year, with regard to the basic physical abilities.

2. To find any existing links between month of birth and basic physical abilities attainment scores.

3. To learn how the sex variable may affect and what interaction it may have with the RAE for basic physical abilities.

4. To learn whether after school sport and physical activity may affect and may have any relationship with the RAE for basic physical abilities.

5. To ascertain the relationship between Students' attainment in PE and each of the predictor variables (physical tests, after school physical activity and sport questionnaires), including month of birth.

MATERIAL AND METHODE

Design

Descriptive, cross-sectional, correlation study (Montero & León, 2007).

Participants

The sample included 173 Compulsory Secondary Education (ESO) students from a school located in the province of Toledo (Spain). It was non-randomly selected by incidental sampling, for the sole reason of easy access. The final distribution of the participants (frequency and percentage) is shown on table 1.

	1st GRADE	2nd GRADE	3rd GRADE	4th GRADE	TOTAL
BOYS	26 (63,41%)	24 (48,97%)	11 (36,66%)	31 (58,59%)	92 (53,17%)
GIRLS	15 (36,59%)	25 (51,03%)	19 (63,34%)	22 (41,41%)	81 (46,83%)
TOTAL	41 (23,69%)	49 (28,32%)	30 (17,34%)	53 (30,63%)	173 (100%)

Table 1. Sample distribution (frequency and percentage) depending on sex and grade.

The distribution of the total sample by sex was as follows.

- Boys: 53,17%
- Girls: 46,83%

By grade:

- 1st Grade: 23,69%
- 2nd Grade: 28,32%
- 3rd Grade: 17,34%
- 4th Grade: 30,63%

Tools and procedure

The tools applied were: on the one hand, physical tests to assess the basic physical abilities (table 2), because of the advantages they provide (Blázquez Sánchez, 1990, and Lamela, 2009); and on the other hand, questionnaires to assess levels of after school physical activity, because it is the most adequate tool for this kind of studies (Azofra, 1999).

Resistencia	→	Test de Cooper
Fuerza	→	Lanzamiento de balón medicinal
Velocidad	→	Test de 50 metros lisos
Flexibilidad	→	Test de flexion profunda

Table 2. Physical tests aplied to assess each of the physical skills studied.

Every class was given three periods of a school day to take the physical tests.Since the sample comprised eight classes (i. e. two per year group), a total of 24 periods were necessary to complete all the tests.

The first period was given to the Cooper test (endurance), with a previous and specific warm-up for the test. The class was split, by alphabetical order, into two halves, who took the test one after the other. Each non-participating member undertook to monitoring one participating partner. The test consisted of a single lap around the school playground.

The second period was given to flexibility and medicine ball throw tests, after the specific warm-up. A tape measure was used to give the strength test, as well as a 3 Kg medicine ball for the boys and a 2 Kg one for the girls. For the deep flexion test a box and a tape measure were used. For both tests, students were allowed two attempts to achieve their best scores.

On the third period a 50 meter dash test was given. The test was taken in pairs after a free choice of partner. Again two attempts were allowed to achieve the best scores.

In order to know which students were doing after school sport or physical activity, the following two items were borrowed from a questionnaire designed by Hernández Álvarez, J.L. and Martínez Gorroño, M.E. (2007):

1. After school, how often do you do physical activities like skating, cycling, skipping, cops and robbers, spud, informal football...?

2. After school, how often do you do any sport activity conducted by a coach or a manager like basketball, dancing, tennis, swimming, aerobics...?

One of the options was deleted from the response scale (“only on week-ends”) because it seemed rather similar to option number 2 (“once a week”). Therefore the result was a single answer scale with four options: 1. Never. 2. Once a week. 3. Two/three times a week. 4 More than three times a week.

Data analysis.

Data analysis was conducted using IBM SPSS Statistics v. 21.0 for Windows. Firstly, typical deviation, mean, and Student's *t* tests were carried out to identify any mean differences. Then, a correlation analysis was conducted (*Spearman's correlation*), including variables like year group or sex.

Ethical procedure

First, consent was required and obtained from the School Management team. Then teachers were briefed and access to their data was requested, granting an anonymous and confidential use of them. Once teachers gave their consent, students' voluntary participation was requested. Since they were under age, their parents were briefed on the project and their consent was obtained too.

Finally, following the prescriptions of the current law of Personal Data Protection (*Ley* 15/1999 and *Real Decreto* 1720/2007), the data was never at reach of people unrelated to this piece of research. Data have only been used for the study and scientific purposes of this research work.

RESULTS

In order to identify the presence of any RAE in each year group (Aim 1), the indices of central tendency in each physical test for those born in the first and the second semesters were estimated.

	TOTAL E.S.O.			
	First Semester		Second Semester	
	M	*TD*	*M*	*TD*
Cooper	2271,84 m	461,60 m	2268,75 m	496,961 m
50m dash	8,83s	0,95s	9,03	1,11s
Medicine ball	4,08 m	0,89 m	4,03 m	0,83 m
Deep flexion	29,47 cm	7,26 cm	27,91 cm	7,25 cm

Table 3. Mean and Typical Deviation in each of the physical tests from first and second semester students.

As table 3 shows, students born in the first semester attain better scores in the four physical tests. Then these differences were tested to identify any statistical significance (table 4).

TOTAL E.S.O.		
	Independent samples T-Test	
	Levene's test for equal variances	T-Test for equal means
	Sig.	Sig. (bilateral)
Cooper	,089	**p>0,05**
50m dash	,117	**p>0,05**
Medicine ball	,708	**p>0,05**
Deep flexion.	,874	**p>0,05**

Table 4. Independent samples T-Test (Total E.S.O. year groups, first and second semester). p<0,05 indicates significant difference**.**

Table 4 shows that mean differences do not have statistically significant values, therefore equality of variances between the two groups was assumed.

The next step was to find any relationship between month of birth and each of the physical tests (Aim 2), starting with the correlation analysis.

BIVARIATE CORRELATION		
	Spearman's correlation	
	Corr. Coef.	Sig.
Cooper	- ,041	**p>0,05**
50m dash	,120	**p>0,05**
Medicine ball	- ,021	**p>0,05**
Deep flexion	- ,047	**p>0,05**

Table 5. Bivariate correlation between month of birth and physical tests in all year groups.

p<0,05 indicates significant difference.

Results on table 5 revealed some important data. In the first place, they revealed negative relationship for the Cooper, medicine ball throw and deep flexion tests, that is, the higher the scores in those tests, the closer they come to the early months of the year. Conversely, the 50m test revealed a positive relationship. Although it may seem contradictory at first, in fact this test signals that the better the scores achieved (the shorter the time to complete the test), the closer we will be to the early months of the year. This is the only one out of the four tests in which the best scores are achieved by reducing the time of completion. On the other hand, the strength of association between physical tests and month of birth turned out to be very low or null (0-0,2) in all cases . Finally, none of the correlations proved to be significant (p>0,05).

A *Partial Correlation* to control the sex/gender variable was carried out to assess the degree of incidence that variable had in the RAE for the basic physical abilities (Aim no. 3).

PARTIAL CORRELATION that controlled the students' sex/gender variable		
	Corr. Coef.	Sig.
Cooper	- ,065	**p>0,05**
50m dash	,170	**p<0,05**
Medicine ball	- ,054	**p>0,05**
Deep flexion	- ,071	**p>0,05**

Table 6. Partial correlation between month of birth and physical tests in all year groups controlling students' sex/gender variable.
p<0,05 expresa diferencias significativas

It is clear from table 6 that the kind of relationship among the four correlations remains the same. Although the strength of association shows a slight increase in the four basic physical abilities, it is still very low or almost null (0-0,2). However, the 50m test yielded significant values between scores achieved and being born in the early months of the year. In order to further pursue our aim and for a better explanation of the latter results, in the second place, a *Spearman's correlation* was conducted dividing the data base by sex/gender. The results are shown on tables 7 (boys) and 8 (girls).

BOYS		
	Spearman's correlation	
	Corr. Coef.	Sig.
Cooper	- ,044	**p>0,05**
50m dash	,153	**p>0,05**
Medicine ball	- ,113	**p>0,05**
Deep flexion	- ,196	**p>0,05**

p<0,05 indicates significant difference.

Tabla 7. Bivariate correlation between month of birth and physical tests (boys).

Table 7 for all the ESO boys shows that the relationship among all the physical tests indicates that the better the scores, the closer to the early months of the year we are. The strength of association for the four variables was very low or almost null and none of them yielded statistically significant values.

GIRLS		
	Spearman's correlation	
	Corr. Coef.	Sig.
Cooper	- ,082	**p>0,05**
50m dash	,229	**p<0,05**
Medicine ball	,012	**p>0,05**
Deep flexion	,122	**p>0,05**

p<0,05 indicates significant difference.

Table 8. Bivariate correlation between month of birth and physical tests (girls).

Table 8 for all the ESO girls shows two aspects to be highlighted. On the one hand, the 50m test variable yields statistic significance and the strength is low (0,21-0,4) instead of null. On the other, the medicine ball and deep flexion tests had a positive correlation, that is, higher scores in these tests mean that girls born towards the end of the year obtained better results.

Finally, for the *Spearman's correlation* test, the data base was divided by year group, as well as by sex/gender, in order to ascertain which year groups yielded more outstanding results.

FIRST YEAR				
	Spearman's correaltion			
	Boys		Girls	
	Corr. Coef.	Sig.	Corr. Coef.	Sig.
Cooper	- ,389	**p<0,05**	- ,070	**p>0,05**
50m dash	,203	**p>0,05**	,230	**p>0,05**
Medicine ball	- ,320	**p>0,05**	- ,115	**p>0,05**
Deep flexion	- ,292	**p>0,05**	- ,027	**p>0,05**

p<0,05 indicates significant difference.

Table 9. Bivariate correlation between month of birth and physical tests by sex (First year).

Table 9 for the First Year group shows significant correlation in the Cooper test for boys. The other variables do not yield significant correlations, but they have the same kind of relationship, that is, the better the scores in the physical tests, the closer to the early months of the year students are. It is worth pointing out too that the strength of association has increased, particularly for the boys: it is low now (0,21-0,4).

SECOND YEAR				
	Spearman's correlation			
	Boys		Girls	
	Corr. Coef.	Sig.	Corr. Coef.	Sig.
Cooper	- ,194	**p>0,05**	,141	**p>0,05**
50m dash	,299	**p>0,05**	,245	**p>0,05**
Medicine ball	- ,037	**p>0,05**	,014	**p>0,05**
Deep flexion	- ,294	**p>0,05**	,165	**p>0,05**

p<0,05 indicates significant difference.

Table 10. Bivariate correlation between month of birth and physical tests by sex (Second year).

Table 10 for the Second year of ESO shows that the girls obtained positive correlations in the deep flexion, medicine ball and Cooper tests; that means that the better the scores, the closer to the late months of the year they were born. This datum is also similar to the results on table 8. The same as in the First Year, the strength of association has increased, particularly for the boys, moving from very low or almost null to low (0,21-0,4) in some physical tests.

THIRD YEAR				
	Spearman's correlation			
	Boys		Girls	
	Corr.Coef.	Sig.	Corr. Coef.	Sig.
Cooper	- ,233	**p>0,05**	- ,186	**p>0,05**
50m dash	,476	**p>0,05**	,209	**p>0,05**
Medicine ball	- ,606	**p<0,05**	- ,140	**p>0,05**
Deep flexion	- ,176	**p>0,05**	,234	**p>0,05**

p<0,05 indicates significant difference.

Table 11. Bivariate correlation between month of birth and physical tests by sex (Third year).

Table 11 for the Third Year of ESO shows significant correlation in medicine ball throw test for boys. For this gender, correlations in the rest of the tests, despite not being significant, indicate that the better the scores, the closer we come to the early months of the year. In the case of the girls, this is the same in all the tests, except for the flexibility test, in which correlation is positive, that is, the better the scores, the closer we are to the final months of the year. It is worth highlighting the strength of association in the 50m and medicine ball tests for boys, because it rises to moderate (0,41-0,6). In girls there is also a rise to low (0,21-0,4) in the deep flexion test.

FOURTH YEAR				
	Spearman's correlation			
	Boys		Girls	
	Corr. Coef.	Sig.	Corr. Coef.	Sig.
Cooper	,315	**p>0,05**	- ,308	**p>0,05**
50m dash	,238	**p>0,05**	,340	**p>0,05**
Medicine ball	- ,167	**p>0,05**	- ,215	**p>0,05**
Deep flexion	- ,101	**p>0,05**	- ,008	**p>0,05**

p<0,05 indicates significant difference.

Table 12. Bivariate correlation between month of birth and physical tests by sex (Fourth year).

Finally, table 12 for the Fourth Year reveals that correlations between the studied variables have better marks the closer we are to the early months of the year, exception made for the Cooper test for boys, which yields a positive correlation. The strength of association has increased, particularly for girls this time, since all the tests yield low strength (0,21-0,4), except for the deep flexion test, which has a very low or almost null strength (0-0,2). This year group does not yield any statistically significant correlation.

The next step was to ascertain whether the analyses carried out so far might be affected by students' after school sport or physical activity (aim 4). So, a *Partial Correlation* controlling that variable was conducted and, for the sake of accuracy, it was split into students who simply do physical activity and those who do sport after school hours. The data base was divided so and the answers to the questionnaire separated. A *Spearman's correlation* between month of birth and the physical tests depending on the answers given was conducted.

AFTER SCHOOL PHYSICAL ACTIVITY								
	Spearman's correlation							
	Never		Once a week		2/3 times a week		More than 3 times a week	
	Corr. Coef.	Sig.	Corr. Coef.	Sig.	Corr. Coef.	Sig.	Corr. Coef.	Sig.
Cooper	- ,028	**p>0,05**	- ,037	**p>0,05**	- ,226	**p>0,05**	,048	**p>0,05**
50m dash	- ,061	**p>0,05**	,279	**p>0,05**	,119	**p>0,05**	,108	**p>0,05**
Medicine ball	- ,171	**p>0,05**	- ,075	**p>0,05**	- ,328	**p<0,05**	,123	**p>0,05**
Deep flexion	,362	**p>0,05**	,260	**p>0,05**	,230	**p>0,05**	- ,333	**p<0,05**

p<0,05 indicates significant difference.

Table 13. Bivariate correlation between month of birth and physical tests depending on after school physical activity in all year groups.

As seen on table 13, two significant correlations were found. One of them concerns those who do after school physical activity 2/3 times a week (medicine ball test) and the other concerns those who do after school physical activity more than 3 times a week (deep flexion test). It is also apparent that in those groups who do physical activity only once a week or never, the relationship indicates that the students who achieve the highest scores were not born early in the year. With regard to strength of association, in most cases it rose up to low (0,21-0,4). None of the cases reached a moderate strength level.

AFTER SCHOOL SPORT								
	Spearman's correlation							
	Never		Once a week		2/3 times a week		More than 3 times a week	
	Corr. Coef.	Sig.	Corr. Coef.	Sig.	Corr. Coef.	Sig.	Corr. Coef.	Sig.
Cooper	,025	**p>0,05**	,085	**p>0,05**	,174	**p>0,05**	- ,153	**p>0,05**
50m dash	,126	**p>0,05**	- ,159	**p>0,05**	- ,025	**p>0,05**	,103	**p>0,05**
Medicine ball	,030	**p>0,05**	,303	**p>0,05**	- ,178	**p>0,05**	,123	**p>0,05**
Deep flexion	,135	**p>0,05**	,348	**p>0,05**	- ,072	**p>0,05**	- ,260	**p>0,05**

p<0,05 indicates significant difference.

Table 14. Bivariate correlation between month of birth and physical tests depending on after school sport in all year groups.

Table 14 shows that there were no significant correlations between month of birth and the physical tests scores for after school sport practise. Still, it must be underlined that, in those groups who do sport only once a week or never, the results indicate that being born in the months next to the cut-off entry date does not imply better scores in the physical tests. With regard to strength of association, the correlation coefficients were lower than those of after school physical activity (table 13), yielding null strength (0-0,2) virtually in all the relationships.

So, it is corroborated that doing physical activity or sport after school hours can affect the RAE existing in the basic physical abilities, either increasing it or reducing it, particularly after school physical activity.

Then, a *Spearman's correlation* test between students' end-of-year marks in PE and each of the predictor variables was conducted, including this time month of birth.

BIVARIATE CORRELATION		
	Spearman's correlation	
	Correlation coeficient	Sig. (Bilateral)
Month of birth	- ,257	**p<0,05**
Cooper test	,261	**p<0,05**
50m dash test	- ,176	**p<0,05**
Medicine ball throw test	- ,038	**p>0,05**
Deep flexion test	,054	**p>0,05**
After school physical activity	,156	**p<0,05**
After school sport	,222	**p<0,05**

p<0,05 indicates significant difference.

Table 15. Bivariate correlation between PE marks and month of birth, basic physical abilities and after school physical activity and sport.

Finally, as seen on table 15, the relationship between month of birth and end-of-year marks is negative and has low strength of association (0,21-0,4), but it is also significant. The same happens with the Cooper test and after school physical activity and sport: they have a positive and significant relationship with PE marks. The 50m test yields significant correlation, but negative relationship, because as said above it is the only test in which the best score matches the shorter time. Those variables that do not yield significant correlations are medicine ball, with negative relationship, and deep flexion, with positive relationship.

DISCUSSION

In respect of the aim of corroborating whether there was any significant mean difference –with regard to the basic physical abilities– between those born in the first semester and those born in the second semester, in any ESO year group, the results of this study were similar to previous ones conducted by other researchers, like Cervera Raga et al. (2013). Their study revealed a slight mean difference in physical tests between those born at the beginning and those born at the end of the year, in favour of those in the first semester.

The fact that the mean difference between both groups is very small is explained because the RAE is a factor that decreases with age. Lorenzo Calvo and Calleja González (2010) argue that although the differences that may occur in adulthood are hardly noticeable, they are much more apparent in early life. In other words, when maturation levels gradually even up, those differences between groups decrease until they reach an age when there are no more differences in favour of those born towards the beginning of the year. In this regard, some research carried out by, for instance, Verachtert et al. (2010), has demonstrated the presence of RAE in Nursery and Primary School, because pupils are still going through a high maturation development, which is reached much earlier by those born at the beginning of the year. It is, therefore, at that early stage when those differences may occur and, if they impact psychological features like perceived self-efficacy or self-esteem (Thompson et al., 2004), they may linger in later stages when maturation has levelled.

As concerns the relationship between month of birth and basic physical abilitie scores, these results keep similarities with those by Cervera Raga et al. (2013). Their study revealed the same relationship (the higher the physical test scores, the closer to the early months of the year students are) and strength of association between variables (very low or almost null) as those we have obtained in physical tests. Amongst all the tests those authors applied (some of them similar to ours), only one statistically significant correlation was found between physical test and month of birth: it was the speed test. Roberts et al. (2012) found statistical significance in the multi-stage fitness test, whereas in our research and in the work by Cervera Raga et al. (2013) the endurance test (Cooper test) did not yield those values.

The fact that the strength of association between those variables has been higher in the first ESO year group may be due to what Lorenzo Calvo and Calleja González (2010) argued with regard to differences in students' maturation: they may go unnoticed at this stage, but they may be more noticeable as we gradually move down to the early stages of compulsory education. Since ESO 1 is the first grade of our research, it seems consistent with those authors that this year group yields a higher strength of correlation between physical test scores and month of birth.

With regard to the impact and relationship that gender may have with the RAE in basic physical abilities, they match the findings by Cervera Raga et al. (2013) who describe a highly interactive effect between quartile of birth and students' sex.

The results obtained dividing the sample by year group and sex may be due to what Sánchez Bañuelos (1992), citing Corbin (1973), argues about physical development for both sexes. While boys' development goes on through the whole of the ESO years, girls' reach its highest point at 11-12 years, thereafter their development does not grow any further, it keeps the same level. That is, Boys presented higher RAE because they were in the midst of a full developing process in their physical condition –it is at that period when boys are going through their highest maturation. According to Díaz del Campo (2013) in his maturation hypothesis as a possible explanation for the RAE, students born earlier will reach that development stage sooner, which will give them advantage over their younger peers. By contrast, girls did not have such visible differences; as a result of having completed already that maturation stage, their differences had levelled. And so, that fact can explain why girls born towards the end of the year attained even better results.

An aspect that must be underlined is that, although in table 8 the girls speed test shows significant values, after a further analysis subdividing the sample into year groups, no differences were revealed. The explanation to this fact may be due to sample size. Dividing the data base reduces the size of the sample and so, data from the whole of ESO girls may present significant values, but that is not the case if it is split into year groups.

Nevertheless, it is also worth highlighting that this is a cross-section study, that is, students in every year group are all different, and their personal qualities vary. It should be interesting to examine whether a single group of students would keep the same values all the way, from the first through to the last school year, and see if that would give us some insight into their development with regard to RAEs and the basic physical abilities.

As regards the impact and relationship that after school physical activity and sport may have on the RAE for basic physical abilities, the results reveal that doing after school physical activity on a regular basis may intensify the RAE because it might alter the normal development of the human body and increase the possibilities of improving its basic physical abilities.

Focusing on the answers related to after school sport, they reveal that this variable does not have any influence on the results since none of the correlations had statistical significance. It should be interesting to learn why results related to mere physical activity present variations in physical tests, whereas sport practise —which at first sight may seem to be something more intense than physical activity— does not give any evidence of the same results. Therefore, this makes us consider the possibility that these results may not show any variation due to the complex meaning of the term *sport* for students when filling in the questionnaire, and so we should have put more emphasis on that question.

Finally, with regard to the relationship between students' attainment in PE and each of the predictor variables (aim 5), results indicate that the higher the levels of after school physical activity or sport, the more possibilities they will have to attain good marks in PE. This is consistent with the introduction to *Real Decreto 1631/2006*, (Royal Decree) which states that *that curricular subject deals with the education of the body and motion, meaning the improvement of physical and movement qualities and so the consolidation of healthy habits*. On the other hand, the fact that PE attainment is better the closer to the early months of the year the students are matches the study by Cobley et al. (2008), whose findings reveal better school attainment in PE by students born towards the beginning of the year.

However, differences due to age might have solutions. Wattie (2013) indicates *technical* and *human* solutions. The first group may include those mentioned by Díaz del Campo (2013) referring to: shifting cut-off dates, delaying grouping by ability, delaying sport specialization, making smaller age groups, grouping by weight and height, making a cut-off entry date rotary calendar, letting players move onto higher grades depending on birth date or designing selection tests adequately. With regard to human solutions, the proposals refer to changes within clubs as, for instance, making teams by semesters, or relieving the strain that competition outcomes bring on players.

But what can be done in the education domain and particularly within the curriculum of PE? The said author suggests the possibility of applying in the education domain the same proposals made for sport. Everyone, from the ordinary teacher up to the school principal, should become aware of the RAE, focusing on teacher training, as well as doing regular evaluations so that the RAE becomes one more factor to be taken into account when giving individual support.

Nevertheless, in order to specify which steps should be taken within the PE curriculum, let us underline those pointed out by Roberts and Fairclough (2012): to stagger the assessment process so that less mature students have a chance to reach the same level, and to rearrange class registers so as to place younger students at the beginning, doing away with alphabetic order, in an attempt to let teachers become aware of age gaps in their classes. Also, according to Musch and Grondin (2001), minority sports should be preferable in PE classes, because it has been proved that majority sports produce more RAE. Finally, beware of the *Pygmalion Effect* (to bring about higher expectations on those born towards the beginning of the year) since it can be one of the causes of these differences in students.

To sum up, we would like to highlight, referring to possible solutions to the RAE, in both the sport and the education domains, what we regard as most important, and which has been underlined already by Wattie (2013), who was in favour of human solutions: do not assume a single general solution as a panacea for all cases. This phenomenon does not occur in all groups in the same way, it must be put accurately in context, studying what happens and what are the causes, and then, based on specific premises, apply the best possible strategies. Still, it will always be a complex challenge.

CONCLUSSIONS

With regard to the planned research aims we can conclude that the difference between the mean marks obtained in both groups (students from the first and the second semesters), in the four physical tests, were slightly higher in those born in the first semester.

The relationship between month of birth and scores in the tested basic physical abilities revealed higher scores in each of the tests the closer students were to the early months of the year. The influence that the gender variable and the year group may have over the RAE as regards basic physical abilities revealed presence of the RAE in the boys, but not so in the girls. After school physical activity altered the results, but after school sport did not. Finally, the relationship between school marks and month of birth revealed higher marks in students born towards the beginning of the year.

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