ORIGINAL

ASSESSMENT OF MOTOR COORDINATION IN PRIMARY EDUCATION OF BARCELONA AND PROVINCE

EVALUACIÓN DE LA COORDINACIÓN MOTORA EN EDUCACIÓN PRIMARIA DE BARCELONA Y PROVINCIA

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ABSTRACT

The present study aims to assess motor coordination of primary-school students of Barcelona and its province. For evaluation we used the KTK test. 1254 people, 670 boys and 584 girls with ages between 7 and 10 years participated in the study. Descriptive analysis and the comparison between gender and age were performed. The results indicate that about 40% of the population studied presents results below normal, around 57% were classified

with normal coordination and only 4.6% has been above this rating. The boys have presented significantly better results than girls. The study data do not permit to generalize the results, however as a representative sample, it leads us to believe that the student population in elementary education from Barcelona and its province has a coordinative level below expected for their age.

KEY WORDS: Assessment; Motor coordination; KTK Test; Primary education; Barcelona.

RESUMEN

El presente estudio tiene por objetivo valorar la coordinación motora de estudiantes de primaria de Barcelona y provincia. Para la evaluación se ha utilizado el test KTK en el que participaron 1254 personas, 670 niños y 584 niñas, de edades entre 7 y 10 años. Se realizó el análisis descriptivo y la comparación entre género y edad. Los resultados indican que más del 40% de la población estudiada presenta una coordinación por debajo de la normalidad, cerca de un 57% de la muestra fue clasificado con coordinación normal y solamente el 4,6% lo ha sido por encima de esta clasificación. Los chicos han presentado resultados significativamente mejores que las chicas. Los datos del estudio no permiten generalizar los resultados, sin embargo como es una muestra representativa, nos lleva a creer que la población de alumnos en educación primaria de Barcelona y su provincia tiene un nivel coordinativo por debajo del esperado para su edad.

PALABRAS CLAVE: Evaluación; Coordinación motora; Test KTK; Educación primaria; Barcelona.

INTRODUCTION

The control of the body and its movement is one of the axes of the Physical Education curriculum for primary education. Content blocks "Body: image and perception" and "Motor Skills" (RD 1513/2006), this is reflected when selecting learning contents among those that refer to static and dynamic balance, or control and body control. Focusing our attention on the evaluation criteria we include some that refer directly to this content: "Moving and jumping in different ways, varying points of support, amplitudes and frequencies, with good coordination and orientation in space" (first cycle); "balancing the body adopting different postures, keeping tension control, relaxation and breathing" (first cycle),"moving and jumping, combining both skills in a coordinated and balanced manner, adjusting body movements to different changes in the conditions of the activity " (second cycle).

These evaluation criteria constitute dimensions of what we call "motor coordination" in our field of study. The term "motor coordination" has been used

with different connotations depending on the areas of knowledge, epistemological positions and models according to which research has been conducted on this topic (Gomes, 1996), which had in the second half of the last century its period of greatest growth. Thus, it can be confused with other terms such as agility, dexterity, motor control and motor skills (Newel, 1985).

To Meinel and Schnabel (1988) motor coordination is related to the following perspectives: a) teaching, which refers to the ordering of the phases of the movement or partial actions and learning new skills, b) physiological, this is related to the regulation of processes of muscular contraction; biomechanics c), this is related to the management of the pulses of power in motor actions and management of events in relation to two or three perpendicular axes.

Bernstein (1967) understands coordination as the management and organization of multiple motor actions according to a motor task or objective. He considers the degrees of freedom of the locomotor system conditioned by the context, as well as the modeling or "tuning" of coordinative structures by perceived information. Another definition to consider is the one by Kiphard (1976, p.9) who describes coordination as "Coordination is the harmonious interaction and economic effort of the muscles, nerves and senses, translate to accurate and balanced kinetic actions (voluntary motor) and fast reactions and adapted to the situation (motor reflex)".

According to Kiphard (1976), for an optimal interaction (coordination) it is required to satisfy the following conditions: an appropriate measure of force that determines the amplitude and speed of movement, an appropriate choice of the muscles that influence the conduct and direction of motion; an ability to rapidly alternate tension and muscle relaxation. On the other hand, several authors (Gorla, Araujo and Rodrigues, 2010; Kiphard and Schilling, 1974; Meinel and Schnabel, 1988) have linked the physical and conditional abilities, such as strength, speed and flexibility with coordinative-perceptual aspects. All these capabilities make possible the increasing improvement of executions of coordinated movements, which is the basis for a healthier life, and the basic school curriculum in terms of learning.

According to Kiphard (1976), the failure of coordination is a syndrome of general motor unsteadiness which is attributable to imperfect interaction of the functional, sensory, nerve and muscle structures. The number of different methods (scales, tests, surveys, batteries, tests, etc.) to identify difficulties in movement and coordination disorders in children is very broad. We can cite the Gesell scale, Bayley Scale, the Motor Efficiency Test of Bruininks-Oseretsk, the Test of Motor Global Ulrich, the Global Engine Development Test, Battery *Moviment - abc*, the Body Coordination Test for Children, among others (Rigal, 2003, Ruiz Perez, 1987).

A test to assess perceptual-motor skills should have validity and reliability. Therefore, in the present study we have used Kiphard and Schilling's battery (1974) which, although it is not a novel instrument, has been used

internationally. From empirical studies, by using an exploratory factor analysis, the authors, who are a reference in motor coordination, identified a motor coordination factor from four tests which constitute the current battery KTK Test (Körperkoordinationstest für Kinder).

The KTK Test has evolved from the Oseretsky Test and has a reliability level of 90% (r = 0.90) from the test/re-test correlation with the participation of 1,228 school-age children in Germany without any disabilities (Gorla, Araujo and Rodrigues, 2010; Kiphard and Schilling, 1974). The ultimate goal of the battery is to evaluate the gross motor coordination and finding insufficient coordination as age increases.

Although the KTK test was designed in 1974, it is still currently used and is being used for the assessment of coordination of large populations. It helps to carry out correlational studies and establish reference scales for children.

Other studies have been published since its design. The same battery have been used for these studies under different perspectives. Due to its latest development and diversity of populations we highlight the studies in Portugal (Andrade, 1996; Gomes, 1996; Lopes, Maia, Silva Seabra and Morais, 2003), Germany (Graf and Dordel, 2011; Kahl and Emmel, 2002), Norway (Mjaavatn, and Segberg Gundersen, 2003), Peru (Bustamante et al, 2008), the Netherlands (Casert and Gavere, 2010), Brazil (Carminate, 2010; Gorla, Araujo and Rodrigues, 2010) and Belgium (Vandorpe et al., 2011). However, we have only used as sources for discussion those studies methodologically similar to this.

Studies based on the KTK test as an evaluation tool are usually related to two objectives: to characterize a given population or sample according to the coordinative level, and analyze the effects of education in coordination.

Our study aims to assess the motor coordination of students in Barcelona province, organizing it according to age and sex. Then we will use other studies to establish comparisons from the values achieved.

MATERIAL AND METHODS

The present study is a quantitative and descriptive research, as classified by Thomas and Nelson (2007). It responds to a crossover design that studies a particular aspect of development, the coordination, by comparing different age groups observed during a single moment without any subsequent monitoring.

Primary schools students have participated in the study. Given that the University has an agreement with most schools, a letter of invitation was sent to them to participate in the study with relevant information on the protocol. Among those schools that accepted and the parents they were chosen those that had a fair territorial representation.

1254 students participated in the study, being 670 (53.4%) children and 584 (46.6%) girls. The age of the participants comprised from 7 to 10 years, which corresponds to students in first through fourth grade in the province of Barcelona.

According to the National Institute of Statistics, the total population enrolled in primary schools across the province of Barcelona's 326,696 students of both sex. Thus, our study sample is representative with a confidence level of 95% and estimation error of 3% (Garcia, 2005).

Chronological centesimal age, based on the date of the data collection and the date of birth, according to Ross and Marfell-Jones (2000) determined the organization of the groups. Therefore, students with 6.50 years to 7.49 belong to 7 years, 7.50 years to 8.49 belong to the group of 8, etc.. The Test KTK organizes its policy tables as exposed.

Table I shows the participants in the study, classified by age and separated by gender.

TABLE I. Sample of the study grouped by gender and age.

	Ages grouped				
	7	8	9	10	
Avarage	7,0	7,9	8,9	9,9	
Min.- Máx.	6,5 - 7,4	7,5 - 8,4	8,5 - 9,4	9,5 - 10,4	Total
Male	187	168	183	132	670
Female	171	162	141	110	584
Total	358	330	324	242	1254

Source: own.

Instrument

For the evaluation of motor coordination we used the KTK test battery, which is designed for children aged 5 to 14 years old and same tasks at all ages are used. The battery has a rating of increasing difficulty related to the success of the participant and is divided into four tests: backwards scrolling in balance; monkey jumps pedals, lateral jumps, and transposition on platform (Kiphard and Schilling, 1974).

The backwards scrolling in balance is to walk backwards over three bars of wood which are 3 meters long, 3 cm wide and 6 cm, 4.5 cm and 3 cm wide, counting the number of props made throughout the three attempts per bar. The steps performed without falling (up to a maximum of 8 steps) are counted in each attempt. We evaluate the dynamic equilibrium.

The monopedal jumps consist of jumping over blocks of foam, 50 cm long by 20 cm wide and 5 cm high, placed progressively on each other, with each of the legs (one leg). However, a participant may begin without foams, jumping over the width referred to a block (20 cm). 12 blocks The maximum number of blocks is 12 and the distance for the shift before the actual jump is 1.50 m that is covered with one leg. Coordination of the lower limbs and dynamic force / energy is evaluated.

The lateral jumps consist of jumping from one side to another in a 1m x 0.60 m platform and over a 2 cm high strip, with feet together and as quickly as possible for 15 seconds. The are two attempts in total. Speed is assessed on alternate jumps.

The transposition on platform consists of moving sideways onto two platforms arranged in the ground. The platforms have a width of 25x25 cm and are 5 cm high. The task consists of scrolling standing on platforms arranged laterally. After every shift, the platform released is taken with both hands and placed on the other side, moving towards it and so on. The number of transpositions made within 20 seconds time is counted, both platforms and body transpositions. Two attempts are carried out and it the total of the actions is made. In this test the laterality and the space-time structure is assessed.

Participants achieve a score in each task. The scores are confronted with the tabulated values provided by the Kiphard and Schilling manual (1974) (according to the age group), attributing a motor ratio for each task (cm1, cm2, cm3, cm4). The sum of the four ratios represent the motor ratio. In respect of the motor coefficient, it is compared with another tab where the score of the participants is.

From this score participants are ranked by the coordinative level. In addition to attributing a qualitative classification of the participant, the value of the score also attributes a quantitative value, ie, the coordinative percentage, concerning the minimum and maximum possible to achieve with the test. Thus, if a participant is qualified as "normal motor coordination", he will be able to know the margin to improve (Gorla, Araujo and Rodrigues, 2010). The values reported can be observed in table I b.

TABLE I b. Rating of the KTK Coordination Test

(*score* ≤ 70)	Insufficient coordination	(0 – 2%)
(71 ≤ *score* ≤ 85)	Disturbance in the coordination	(3 – 16%)
(86 ≤ *score* ≤ 115)	Standard coordination	(17 – 84%)
(116 ≤ *score* ≤ 130)	Good coordination	(85 – 98%)
(131 ≤ *score* ≤ 145)	Very good coordination	(99 – 100%)

Source: adapted from Gorla, Araújo and Rodrigues, 2010, p.159.

Procedure

Before beginning data collection, the assessors were familiarized with the instrument through an explanatory seminar and by having access to the manual, and moreover, tests were performed with experimental groups. At the time of application of the test, an specific task was assigned to each evaluator, avoiding a diversified way to assess participants. There was an observer during the tasks ratifying the measuring. The test was applied according to the Kiphard and Schilling manual (1974). Participants had two trials of practice to get used to the test. It was made in school sports courts, respecting the required area for the development of the tasks.

Statistical Analysis

Data were analyzed with SPSS, version 18.0. First, descriptive analyzes were performed. Normality and homogeneity of performance motor results were analyzed by the Kolmogorov-Smirnov test and Levene tests, respectively. The data were normal and homogeneous. As such, the parametric statistical tests *"t"* of *student* were used to verify gender difference, and analysis of variance (ANOVA), in order to verify the difference between the age groups. The significance level was assumed at 95% (p = 0.05).

RESULT

Chart I shows the frequency (in%) of classification of motor coordination (CM) reached by the participants in the test by gender. Although a similarity of the results (Figure I) is verified visually, the statistical analysis showed significant difference between gender (see Table III).

CHART I. KTK Test rating by gender.
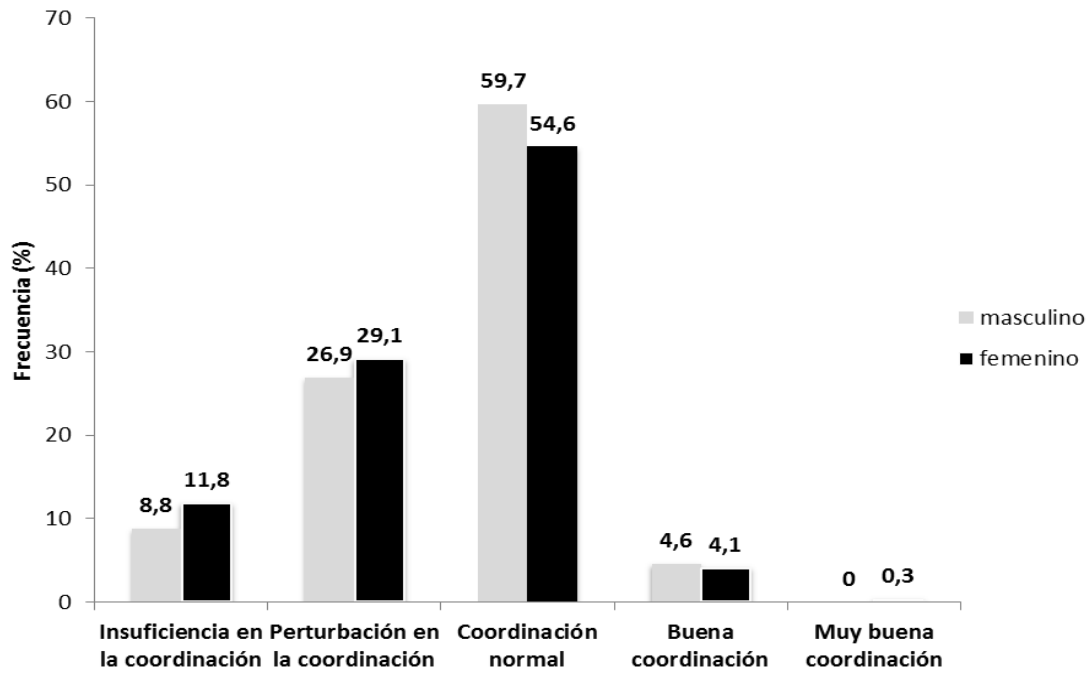
Source: own.

Table II shows the frequency (%) of classification of the participants (separated by gender and age group). The virtual absence of students classified as "very good coordination" is particularly striking. In fact, no boy reached this classification and only two girls did, one 7 and the other 8 years. The frequency of these results does not follow a sequence, actually, they are quite variable, showing that perhaps these students are much closer to the lower limit than to the upper limit of the classification.

TABLE II: Description of the classification of participants: number and percentage by age group and gender.

			Coordination insufficience	Disturbance in the coordination	Standard coordination	Good coordination	Very good coordination	Total
Male	Grouped ages	7 Count	14	61	104	8		187
		7 % by age	7,5%	32,6%	55,6%	4,3%		100,0%
		8 Count	13	40	109	6		168
		8 % by age	7,7%	23,8%	64,9%	3,6%		100,0%
		9 Count	19	42	112	10		183
		9 % by age	10,4%	23,0%	61,2%	5,5%		100,0%
		10 Count	13	37	75	7		132
		10 % by age	9,8%	28,0%	56,8%	5,3%		100,0%
	Total	Count	59	180	400	31		670
		% by age	8,8%	26,9%	59,7%	4,6%		100,0%
Female	Grouped ages	7 Count	23	53	85	9	1	171
		7 % by age	13,5%	31,0%	49,7%	5,3%	0,6%	100,0%
		8 Count	14	41	96	10	1	162
		8 % by age	8,6%	25,3%	59,3%	6,2%	0,6%	100,0%
		9 Count	16	37	85	3	0	141
		9 % by age	11,3%	26,2%	60,3%	2,1%	0,0%	100,0%
		10 Count	16	39	53	2	0	110
		10 % by age	14,5%	35,5%	48,2%	1,8%	0,0%	100,0%
	Total	Count	69	170	319	24	2	584
		% by age	11,8%	29,1%	54,6%	4,1%	0,3%	100,0%
Total		Total	128	350	719	55	2	1254
		% count	10,2%	27,9%	57,3%	4,4%	0,2%	100,0%

Source: own.

Table III shows the descriptive -overall and according to boys and girls age-results (minimum and maximum score, average and standard deviation). The results of the comparison between gender for the overall values and depending on the age are also exposed.

The standard deviation (SD) that indicates variation of individual values around the average is quite large, which means inter-individual difference in the groups. However, the SD was similar in all groups and ages, characterizing a homogeneous group.

As previously stated, significant differences between boys and girls for the CM in the general values were found. Later, when comparing the results according to age groups, it was felt that the real difference takes place in groups of 9 and

10 years of age. The average male group increases gradually from 7 to 8 and 9, and at 10 years of age the average value decreases to the least possible average. In the female group, an increase of 7 to 8 years of age takes place, decreasing in 9 years of age and even more in the 10 years of age.

TABLE III: Summary of cases by age and sex. Comparison between gender and age on motor performance and general comparison between gender and motor performance.

Age	Gender	N	Min-Max.	Average (SD)	"t"	gl	p–value
Total	Masc.	670	40-130	91,06 (14,86)	3,614	1252	<0,001*
	Fem.	584	42-141	88,01 (15,00)			
7	Masc.	187	60-130	90,06 (14,22)	1,616	356	0,107
	Fem.	171	50-132	87,57 (15,01)			
8	Masc.	168	55-123	91,79 (14,44)	0,549	328	0,583
	Fem.	162	55-141	90,88 (15,64)			
9	Masc.	183	54-125	92,19 (15,17)	2,783	322	0,006*
	Fem.	141	50-119	87,64 (13,77)			
10	Masc.	132	40-127	89,99 (15,81)	2,535	240	0,012*
	Fem.	110	42-119	84,94 (14,99)			

(*) Differences are significant at the 95% level (p ≤ 0.05).
Source: own.

DISCUSSION

The analysis of other studies in different countries allows us to interpret and compare our data.

In Germany, a study of 1283 students aged between 4.5 and 14.5 years shows that 14% of the sample have disturbance in the coordination, 2% have insufficient coordination, 68% have normal coordination,14 % have good coordination and 2% have very good coordination (Kiphard and Schilling, 1974). In another study, with a sample of 558 children aged 6 and 7 years old, it was found that 4.7% had insufficient coordination, 26% disturbance in coordination, 60% regular coordination, 7.9% good coordinaton and only 0.4% very good coordination (Graf et al., 2004).

In the study conducted in Portugal with 3742 children aged 6 to 10 years old, Lopes, Maia, Silva Seabra and Morais (2003) found significant differences in favor of boys compared with girls. However, they observed a decrease in the average values in terms of age. The boys results were always within the coordinative failure values from 6 to 10 years of age, while girls showed coordinative failure in 6, 7 and 8 and coordinative disturbance in the 9 and 10 years old.

In Brazil, by analyzing the CM of 931 children aged between 7 and 10 years of age, it was found that 70% of those tested had a coordination level below normal. However, these students did not receive physical education classes at

school, which was suggested as a likely cause of the outcome (carminate, 2010).

In Belgium, by evaluating 2470 children from 6 to 12 years, it was considered that 4.3% had failure coordination, 16.8% had disturbance in coordination, 70.2% had standard coordination, 8.3% were classified as good coordination and only 0.4% showed very good coordination (Vandorpe et al., 2010).

When taking other studies, we observed the low presence of participants rated "good coordination" or "very good coordination." We note that there is no evaluated participant that achieves that classification within the study carried out in Norway (Mjaavatn, and Segberg Gundersen, 2003),. In Portugal (Lopes, Maia, Silva Seabra and Morais, 2003), there is only one participant out of a total of 3742 that has been ranked "good coordination".

The results of studies using the KTK test and are especially relevant for the number of participants are described in the following tables. In the German study (Kiphard and Schilling, 1974) 1283 students were involved. In Portugal three main studies were carried out, two were conducted with 412 students (Andrade, 1996; Gomes, 1996) and another with 3742 students (Lopes, Maia, Silva Seabra and Morais, 2003). 4007 students participated in Peru (Bustamante et al., 2008). Vandorpe et al. (2011) 2470 students were observed in Belgium. Finally, the results of our study in Barcelona are described in order to expose the comparison of the achieved values. All test results are separated by age and sex.

In Table IV, which refers to male participants and demonstrates the average values and standard deviation of the tasks, it is possible to verify that in scrolling backwards in balance (ER), the students tested in Barcelona achieved worse results than in other studies, in all ages.

In monopedals jumps (SM) the 7 years old group underperformed in comparison with all other studies, while groups of 8, 9 and 10 years of age reached similar results to the study of Lopes, Maia, Silva Seabra and Morais (1996) and the study in Peru. Belgian and German students had higher results than the others.

In lateral jumps (SL), in all ages, students from Barcelona achieved good marks, being superior to all others, except for the Belgians, who achieved slightly better results.

In transposition on platform (TL), students in Barcelona were, in all ages, far superior to all Portuguese and Peruvians, who obtained the lowest results. The students of Barcelona reached similar results to the Belgians, however, the Germans were superior to all others in all ages.

TABLE IV. Boys Results (average and standard deviation) of KTK test by age and tasks in some studies and their comparison with those obtained in Barcelona.

Tasks	Studies	Age			
		7	8	9	10
ER	Kiphard y Schilling	39,90±13,90	46,90±13,60	51,10±15,30	54,30±13,00
	Andrade	47,81±9,59	48,68±12,77	54,26± 9,90	
	Gomes		45,10±12,00	50,01± 9,70	51,20±12,60
	Lopes et al.	35,40±13,03	40,64±13,47	45,13±13,36	49,64±13,50
	Bustamante et al.	34,83±13,56	38,87±13,19	43,02±12,95	45,30±13,97
	Vandorpe et al.	31,13±13,17	36,55±13,88	41,04±12,87	44,07±12,64
	BARCELONA	26,86±12,29	35,61±13,01	41,14±14,26	43,91±15,42
SM	Kiphard y Schilling	34,40±13,60	45,20±14,20	52,60±15,20	58,70±14,00
	Andrade	38,73±12,21	49,42±11,54	56,80±10,56	
	Gomes		37,90±13,10	47,00±10,20	48,90±12,60
	Lopes et al.	26,69±12,78	34,20±14,28	41,09±13,77	46,92±15,18
	Bustamante et al.	28,94±10,66	35,61±11,34	40,70±11,02	45,64±12,02
	Vandorpe et al.	42,30±11,33	50,09±11,96	58,18±11,69	63,15±11,34
	BARCELONA	24,71±13,09	34,90±13,26	41,18±14,62	47,42±14,58
SL	Kiphard y Schilling	36,50±10,00	45,80±11,70	50,40±13,20	59,40±11,60
	Andrade	40,52±8 ,83	44,52± 7,93	49,49±12,36	
	Gomes		48,30±12,50	52,50±10,30	54,50±11,00
	Lopes et al.	35,44± 9,44	41,70±11,93	46,98±12,37	51,33±12,59
	Bustamante et al.	29,51± 7,18	33,43± 8,76	40,07±10,05	42,71±11,18
	Vandorpe et al.	44,45±10,02	50,16±11,15	57,95±10,45	62,16± 9,91
	BARCELONA	40,90±12,08	49,16±13,63	56,01±14,62	59,47±13,68
TL	Kiphard y Schilling	35,50±6,60	40,60±6,20	43,00±7,70	46,40±6,00
	Andrade	18,73±2,64	20,24±2,90	22,02±3,06	
	Gomes		17,80±2,70	19,30±3,60	20,10±3,50
	Lopes et al.	15,83±3,17	17,55±3,36	19,07±3,58	20,64±3,48
	Bustamante et al.	15,34±3,06	17,22±2,91	18,62±2,96	19,63±3,62
	Vandorpe et al.	33,84±5,39	36,73±5,83	40,07±6,61	42,25±5,36
	BARCELONA	31,82±5,82	37,40±5,88	39,83±6,85	43,32±7,45

Source: Adapted from Lopes, Maia, Silva, Seabra and Morais, 2003.

Table V, concerning the girls, in which the average values and standard deviation of the tasks are observed, shows that in the ER task girls 7, 8 and 9 years of age have worse outcomes than those from other countries and girls 10 years of age are similar to those evaluated in other studies.

In the SM, in all ages, the students of Barcelona show better values than those collected by Lopes, Maia, Silva Seabra and Morais (1996) and the Peruvians, but still far from the others. In this task, the German, Belgian and Portuguese girls from the study of Andrade (1996) performed better but show a large swing in relation to age.

In the SL, Barcelona girls have better results than all Portuguese and Peruvian girls. Also, are close to the values found in the German and Belgian girls, who are the best performers.

In the TL, as well as in the previous task, the girls from Barcelona have better results than all Portuguese and Peruvian girls. Furthermore, the results are virtually the same as the ones obtained by the Belgian girls. German girls have higher values at all ages.

TABLE V. Girls Results (average and standard deviation) of KTK test by age and tasks in some studies and their comparison with those obtained in Barcelona.

Tasks	Studies	Age			
		7	8	9	10
ER	Kiphard y Schilling	42,70±13,10	48,20±13,90	52,10±13,20	58,50±20,10
	Andrade	45,68±11,02	54,20±11,31	58,50± 9,20	
	Gomes		44,00± 9,90	47,10± 9,90	47,30±12,00
	Lopes et al.	32,69±13,28	40,08±12,99	42,31±12,97	44,13±13,68
	Bustamante et al.	36,98±13,47	39,36±12,93	43,87±13,43	47,01±12,90
	Vandorpe et al.	34,99±11,62	39,82±12,54	43,81±13,73	46,15±12,46
	BARCELONA	30,18±12,80	36,30±13,94	43,82±11,99	45,13±13,37
SM	Kiphard y Schilling	37,30±11,80	42,60±13,10	54,80±14,30	63,10±10,10
	Andrade	35,92±13,98	46,82±11,31	53,43±10,30	
	Gomes		34,50±10,30	41,10±13,10	39,80±12,80
	Lopes et al.	23,44±11,69	31,11±11,24	35,41±13,75	40,83±14,33
	Bustamante et al.	22,44± 8,94	28,77± 8,94	34,26±10,22	38,89±10,98
	Vandorpe et al.	39,69±11,15	47,65±12,30	52,92±12,61	56,84±11,65
	BARCELONA	24,74±11,30	32,22±13,52	39,50±12,06	44,52±13,49
SL	Kiphard y Schilling	43,20±10,20	48,00±11,70	60,80±19,50	67,20±10,70
	Andrade	37,71±10,79	48,34± 9,40	55,02±10,00	
	Gomes		47,30± 9,80	54,00±11,80	55,50±12,50
	Lopes et al.	35,33±10,98	43,20±11,75	48,74±11,59	51,70±12,00
	Bustamante et al.	27,51± 6,70	33,46± 8,87	39,73±10,02	44,54±10,98
	Vandorpe et al.	44,49±10,81	52,19±10,07	57,17±11,04	61,13±10,86
	BARCELONA	42,82±13,56	50,38±13,66	56,59±14,18	60,45±12,59
TL	Kiphard y Schilling	36,20±5,90	38,80±5,80	44,30±6,20	47,90±5,90
	Andrade	17,44±3,28	19,57±3,12	21,97±3,82	
	Gomes		16,30±2,70	17,40±3,06	18,00±2,80
	Lopes et al.	14,95±3,08	16,81±2,94	18,05±3,22	18,79±3,22
	Bustamante et al.	14,09±2,92	15,88±2,81	17,05±2,71	19,00±3,40
	Vandorpe et al.	32,75±5,16	37,11±5,34	40,03±6,23	42,24±5,86
	BARCELONA	32,10±6,02	36,93±5,76	40,09±6,39	42,81±6,38

Source: adapted from Lopes, Maia, Silva Seabra and Morais, 2003.

Overall, when comparing the studies, it can be verified that in the ER task, both boys and girls of all ages who tool part in the study by Andrade (1996) of Portugal, had better results. Furthermore, it can be said that the results of

Barcelona and Belgium are very similar in boys and girls, however, both showed poorer results than those collected in the German study.

In the SM task the result is well below the studies presenting the best data, ie, Belgium, Portugal (Andrade, 1996) and Germany, in all ages and both genders.

In the SL task, the Belgian study shows very good results, being the best at all ages in the case of boys and 7 and 8 years of age for girls. The study of Barcelona, in this task, presents as good results as the Belgian study, promptly giving higher results than the Germans.

In the TL task, the Germans are unanimous, showing better results in all ages and both genders. Results from Barcelona and Belgium are very similar. The results achieved by the portuguese and peruvian studies are strange as both have almost half of the rating achieved by the others.

The results found in this study put us below the level of coordination expected, since it was observed that 40% of the population studied is below normal, unlike Germany with 16% (Kiphard and Schilling, 1974) and 20.7% (Graf et al., 2004) and Belgium with 21.1% (Vandorpe et al., 2011).

Other authors (Wright and Sugden, 1996), state that have found 16% of the population with coordination disorder during growth, being 12% with moderate damage and 4% seriously injured and need immediate care.

From studies on motor coordination, either using the KTK test or other test batteries, we note that the results obtained in this investigation are below average. Previous research (Rose, Larkin and Berger, 1997) indicate that children and adolescents with developmental motor coordination problems manifest significantly lower perceptions of motor competence that the students who do not have these difficulties. A deficiency in motor coordination is often accompanied by physical aspects such as lower capacity, low anaerobic power, movement efficiency reduction, lower motor control, reduced fitness, poor motor perceptual development, slow temporal control, among others (Drobnic et al., 2013). As a result, the risk of rejection towards sports and games due to coordination difficulties may be a factor that increases the sedentary lifestyle, thereby entering into a vicious circle

As Piek and Edward (1997) indicate if the diagnosis is made early, the physical education teacher can be very helpful in the intervention process for improvement.

CONCLUSIONS

The results of this research show that more than 40% of the evaluated population have an insufficient level of motor coordination or disturbance. In

addition, it was found that about 57% of the population are within the average coordination level. Only 4.6% is in the range of good to very good coordination.

Our study consisted of a local study, however, as a representative sample, it leads us to believe that the population of students in primary education in the Barcelona province has a coordinative level below expected for their age. This is worrying as it shows that motor coordination is evaluated below normal in a very high percentage. Moreover, when compared with other studies, we note that we are in a lower position, especially in the evaluation tests of dynamic balance, laterality and space-temporal structure. These negative results increase at ages 7 and 8 years old and in the female group.

All this makes us think about the need for coordination tests and control of motor learning in the physical education subject in school that allow tracking motor development in such an important age for the students formation. The use of these tests should not be regarded merely as a collection of quantitative data, but should help teachers to understand better the characteristics of the individuals, in order to optimize their teaching intervention.

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