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## ORIGINAL

### PHYSICAL ACTIVITY, FITNESS AND ADIPOSITY: IMMIGRANTS VERSUS SPANISH SCHOLARS

### ACTIVIDAD FÍSICA, CONDICIÓN FÍSICA Y ADIPOSIDAD: INMIGRANTES VERSUS ESCOLARES ESPAÑOLES

**Pardo Arquero, V.P.<sup>1</sup>; Jimenez Pavon, D.<sup>2</sup>; Guillen del Castillo, M.<sup>3</sup> y Benitez Sillero, J.D.<sup>4</sup>**

<sup>1</sup> Doctoral student in for Sports and Physical Activity Sciences. Research Group CTS-468 JA. Faculty of Education Sciences. University of Córdoba (Spain). victorppa@gmail.com

<sup>2</sup> Doctor in for Sports and Physical Activity Sciences. Research Group GENUUD (Growth, Exercise, Nutrition and Development). Faculty of Health Sciences. University of Zaragoza (Spain) davidj@unizar.es

<sup>3</sup> Doctor in Medicine and Surgery. Research Group CTS-468 JA. Faculty of Education Sciences. University of Córdoba (Spain). eo1decam@uco.es

<sup>4</sup> Doctor in for Sports and Physical Activity Sciences. Research Group HUM-298 JA. Faculty of Education Sciences. University of Córdoba (Spain). jdbenitez@uco.es

**Spanish-English translator:** Luis Sánchez Vasco [pacollorentegento@hotmail.com](mailto:pacollorentegento@hotmail.com)

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## ABSTRACT

The objective was to analyse the associations of physical fitness and patterns of physical activity with adiposity in native and foreign. This study was performed with 612 school students (8-10 years). Anthropometric measurements, physical fitness and activity patterns were studied. The results showed that students who practiced more physical activity had lower body mass index and higher levels of fitness. Immigrants had lower adiposity and higher participation in sport activities than native students. No differences between native and foreign students in levels were found, except for immigrant girls, who showed greater lower body strength than the natives ones. In conclusion, immigrants from this study appear to have a healthier fitness, physical activity and adiposity than natives.

**KEY WORD:** physical activity, adiposity, physical fitness, immigrants, native health.

## RESUMEN

El objetivo fue analizar las asociaciones entre los niveles de condición física, patrones de actividad física y adiposidad del alumnado nativo e inmigrante. Se estudiaron 612 niños (8-10 años) de colegios públicos, valorándose mediante pruebas antropométricas, condición física y cuestionario de hábitos de actividad física. Se observó que el alumnado que realizaba mayor actividad física presentaba menor índice de masa corporal y mayor condición física. El alumnado inmigrante presentó menor adiposidad y mayor participación en actividades deportivas. No encontramos diferencias en condición física, salvo en chicas inmigrantes, con mayor fuerza del tren inferior. En conclusión, los inmigrantes del presente estudio parecen poseer un perfil más saludable de condición física, actividad física y adiposidad que los nativos.

**PALABRAS CLAVE:** actividad física, adiposidad, condición física, inmigrantes, nativos, salud.

## INTRODUCTION

In Spain, according to the National Institute of Statistics (INE, 2009), the number of immigrants constitutes a 6.3% of the population (5,598,700 people, and 15.2% out of them are under 16). Among the resident foreigners in Spain, almost half of them belong to the European Union, although there is also a part of non-community foreigners. Autonomous Communities, where a major increase has been produced during 2008, were Cataluña, Andalucía and Madrid (INE, 2009).

International migration is being considered to fundamentally modify health in worldwide population, as regards infectious and nutritional disorders (Dominguez et al., 2006; Pate et al., 2009). The influence of some healthy life style, such as nutrition and physical activity, over the present and future health condition of children and adolescents has been widely studied all over the world, although mainly in residents in each country (Akreshn et al., 2008; Jimenez-Pavon et al., 2010 & 2013; Sese et al., 2012). However, such influence has not been studied enough either in immigrant populations or in comparison to their native environment (Flores et al., 2002; Allen et al., 2007; Burgi et al., 2010). In USA, social health and behaviour profiles of immigrants are known to fundamentally differ from natives (Singh et al., 2002, 2004 & 2006), observing major levels of sedentary lifestyle and physical inactivity in immigrant children (Singh et al., 2008). In our country we can find surveys which highlight the healthy nutritional habits of children and adolescent immigrants (Ramos, 2007), although performances are being set aside for reducing obesity in this immigrant population (Estrategia NAOS. AESAN, 2009) However, little is known about the proceeding of this kind of population regarding other variables related to health such as physical activity and condition.

Physical activity seems to constitute an effective tool for reducing corporal adiposity (Hills et al., 2011), but also for moderating its negative influence on several cardiovascular disease risk factors in children and adolescents (Benitez-Sillero et al., 2011; Jimenez-Pavon et al., 2010; Rizzo et al., 2008; Ruiz & Ortega., 2009). Nowadays, physical activity is considered and used as the most successful strategy to prevent the main causes of morbimortality and related diseases (Jimenez-Pavon et al., 2010; Wen et al., 2011; U.S.D.H.H.S., 1996 & 2000). It is known that the physical activity pattern of children and adolescents may be conditioned by the socioeconomic family status and the social and demographic environment (Afable-Munsuz et al., 2010; Jimenez-Pavon et al., 2012), then the immigrant state could also be determinant. Because of this, surveys analysing the differences of physical activity patterns between natives and immigrants and their relationship to other health parameters such as corporal adiposity are necessary.

Fitness is considered as an important health marker in children and adolescents (Benitez-Sillero et al., 2011; Ortega et al., 2008). It has been found that cardio respiratory fitness is negatively associated to adiposity and several health

parameters such as insulin resistance, blood pressure, low degree inflammatory proteins and adipocitoquines (Martinez-Gomez et al., 2012; Jimenez-Pavon et al., 2011; Ruiz et al., 2007). However, no surveys have been found specifically analysing the relationship of fitness with basic health parameters such as adiposity in immigrant and native adolescents, and the differences between them.

The aim of the present study was to analyse the associations of fitness and patterns of physical activity with adiposity in native and immigrant scholar aged 8-10 in educational centres.

## **MATERIALS AND PROCEDURES**

### **Participants**

About thirty Primary Educational centres in Spain were invited to take part of this study, being finally selected 9 of them because of the presence of immigrant scholarship within the ages of the survey and becoming a sample survey because of convenience. Such sample does not have a representative character of the population subtract, but of a specific and well-defined one. The educational centres belong to the council of Benameji, Cabra and Lucena (province of Cordoba, 76% of the participants), Antequera (province of Malaga, 4%), and Madrid (20%); scholars' origin being distributed in 80% and 20% in South and Centre of Spain, respectively. As for the immigrant scholar's origin, 47.4 % were born in other European countries, 43.4 % were born in the American continent, 5.7 % born in Africa and 3.4 % born in Asia. 612 students being of a rate age of 9.6 years old took part in the final sample, out of which 281 were girls and 331 were boys, representing a total amount of 440 natives and 172 immigrants. To be considered as an immigrant or foreigner, some of these conditions must be complied: being born outside Spain, from foreigner parents or at least one of them came from other countries. This survey was approved by the Bioethics and Research Committee of Reina Sofia University Hospital in Cordoba, and carried out following the ethic recommendations in the 1964 Helsinki Declaration (Revised in Edinburgh, 2000). Individuals participated in the survey after being willingly accepted by the minor, and parental or by the legal responsible consent.

### **Anthropometric Measurements**

Weight and height in all the individuals were determined. Body mass index was calculated [weight (kg) / height<sup>2</sup> (m)]. Weight was measured by using SECA scales (SECA, Hamburg, Germany) with a 0.5 Kilogram precision. Height was measured by a SECA height measurer (SECA, Hamburg, Germany) with a 0.1 centimetre precision. All of the anthropometric measurements were made to the individuals when being barefoot and wearing underwear clothes. Measurements were made by one researcher with the teachers' collaboration, during the school days and always during the morning timetable in any of the educational centre.

## Physical Fitness

For assessing the physical fitness Eurofit battery tests (1992), 20 metres shuttle run test (Course Navette) were used for measuring the aerobic endurance and 3 tests for measuring the muscle strength: a) standing long jump test for assessing the explosive inferior train strength; b) handgrip strength test for measuring maximum grip strength in both hands, by using a Takei TTK 5101 manual dynamometer (5-100 kg interval, 0.1 kg precision), (Garcia-Artero et al., 2007) and c) sit-ups test, consisting of performing maximum number of complete sit-ups during a period of 30". All of these tests are included in the EUROFIT battery, validated and standardized by the European Council (1992), and recently most of them have also been validated in the new ALPHA battery (España-Romero et al., 2010; Cuenca-Garcia et al., 2011; Ruiz et al., 2011). Although the sit-ups test has not been included in this recent ALPHA battery, it was worth including as it has been widely used in the educational centres since it was included in the classical Eurofit battery.

## Physical Activity

Patterns and behaviours of physical activity were recorded by making several questions from a self-completed questionnaire by the children with the help of a teacher. Such questionnaire has been validated and widely used at international level by the "Health Behaviour in School-aged Children (HBSC) cross-sectional study" (Iannotti et al., 2013; Rintala et al., 2011; Dupuy et al., 2011; Currie et al., 2009). The following questions and answers chosen were:

1.- *Do you practice physical activity after your lesson timetable?*

a) Yes, often; b) Yes, every weekend; c) Yes, sometimes; d) Only at holidays; e) Hardly ever or never.

2.- *How many days a week do you usually do physical activity, with a certain intensity, out of lesson timetable?*

a) More than five; b) From 5 to 3; c) From 1 to 2; d) None.

3.- *How do you usually go to school?*

a) On foot, by bike or skating (Active); b) By car, motorbike or using the public transports (Passive),

4.- *Do you take part in your school sport activities (school or extra school)?*

a) Always; b) Often; c) Sometimes; d) Never.

5.- *Do you take part in your area sport activities?*

a) Always; b) Often; c) Sometimes; d) Never.

Answers were gathered in dichotomous variables in this way:

Answer 1: a), b) and c) as a 'High physical activity'; d) and e) as a 'Low activity'.

Questions 2, 4 and 5: a) and b) as a 'High physical activity'; d) and e) as a 'Low physical activity'.

Question 3 was not gathered since it had a dichotomous character.

### **Statistic Analysis**

Data statistic analysis was done by the SPSS v. 18.0 for Windows XP (SPSS Inc. Chicago II, USA). Significance level was fixed to 0.05. Data are presented as mean  $\pm$  standard deviation or average unless otherwise indicated. After exploring the normality of the different residues inserted through the Kolmogorov-Smirnoff test and the bar diagram, we observed that weight, body mass index and 20 m shuttle run test had an abnormal distribution; because of that they were logarithmically transformed to make such residues get normality. The rest of variables show a normal data distribution. Given the interactions between the assessed variables and the gender, analyses were separately performed for boys and girls.

The analysis variance of one factor (ANOVA) was used to study the differences between the characteristics of the full sample (height, weight, body mass index) and the levels of the physical condition according to the gender, and, moreover, to study the differences between the characteristics of the sample and the levels of the physical fitness of the participants according to the native or immigrant and to the gender.

The variances in the participants' physical activity patterns were analysed on the evidence of the frequency of answers in several questions about physical activity. Such patterns were studied separately in boys and girls, at the same time in natives and immigrants. The association of the sample characteristics and fitness levels with the physical activity levels (high or low) were studied in natives and immigrants. Chi-Square test was used to analyse the emerging differences between the different groups.

### **RESULTS**

Table I shows the descriptive characteristics of the sample in this research. Boys showed a highly significant performance in all the fitness tests better than girls (all  $p < 0.001$ ). Age, height, weight and body mass index showed no difference in gender at the overall sample. About 70 % of the overall sample was composed of native children. For this reason, the sample was separately studied in natives and immigrants so that we could precise the emerging differences.

**Table I.** Descriptive Characteristics of the participants in this research.

	Participants (n=612)	Girls (n=281)	Boys (n=331)	p- value*
Age (years)	9.6 ± 0.6	9.6 ± 0.6	9.7 ± 0.6	NS
Natives / Immigrants (%)	72/28	71/29	73/27	-
Height (m)	1.4 ± 0.1	1.4 ± 0.1	1.4 ± 0.1	NS
Weight (kg) <sup>a</sup>	36.3 ± 9.5	36.0 ± 10.1	36.6 ± 9.2	NS
Body Mass Index (kg/m <sup>2</sup> ) <sup>a</sup>	19.1 ± 3.8	19.1 ± 4.0	19.1 ± 3.7	NS
Sit-ups (n <sup>o</sup> /30s)	14.1 ± 5.2	12.9 ± 4.6	15.0 ± 5.5	<0.001
Handgrip (kg) <sup>b</sup>	26.5 ± 6.6	24.9 ± 6.0	27.8 ± 6.7	<0.001
Standing long jump (cm)	118.8 ± 22.2	111.8 ± 19.9	124.8 ± 22.5	<0.001
20 m shuttle run test (stage) <sup>a</sup>	3.2 ± 2.0	2.6 ± 1.6	3.7 ± 2.2	<0.001

All the values are mean ± Standard deviation, or average (Natives / Immigrants)

\* P-value for differences between genders (ANOVA).

Non transformed values are shown in this chart, but analyses were made over

<sup>a</sup> logarithmically transformed values. <sup>b</sup> Both hands results added up together

NS no significant differences

Table II shows the differences between the sample characteristics and the physical fitness levels in native and immigrant children. Native boys showed a highly significant performance in all the fitness tests better than girls (all  $p < 0.001$ ). Similarly, immigrant boys showed a better performance in all the fitness tests compared to girls, their classmates, although they got significant statistics in sit-ups tests ( $p < 0.05$ ) and in standing long jump ( $p < 0.01$ ). On the other hand, native boys significantly presented a higher weight and body mass index, compared to their immigrant classmate boys ( $p < 0.05$  y  $p < 0.01$  respectively). Whereas immigrant girls significantly performed better in the standing long jump test than their native classmates girls ( $p < 0.01$ ).

**Table II.** Differences between the sample characteristics and the fitness levels in native and immigrant children

	Natives			Immigrants			p- value <sup>c</sup>
	Girls (n=200)	Boys (n=240)	All (n=440)	Girls (n=81)	Boys (n=91)	All (n=172)	
Age (years)	9.6 ± 0.6	9.7 ± 0.6	9.6 ± 0.6	9.6 ± 0.6	9.6 ± 0.6	9.6 ± 0.6	NS
Height (m)	1.4 ± 0.1	1.4 ± 0.1	1.4 ± 0.1	1.4 ± 0.1	1.4 ± 0.1	1.4 ± 0.1	NS
Weight (kg) <sup>a</sup>	36.0 ± 10.1	37.4 ± 9.5	36.8 ± 9.8	35.6 ± 9.9	33.8 ± 8.6	34.7 ± 8.9	≤0.05 <sup>†</sup>
BMI (kg/m <sup>2</sup> ) <sup>a</sup>	19.3 ± 4.0	19.4 ± 3.8	19.4 ± 3.9	18.6 ± 3.9	17.9 ± 3.2	18.3 ± 3.6	≤0.01 <sup>†</sup>
Sit-ups (n <sup>o</sup> /30s)	13.0 ± 4.3	15.0 ± 5.6 <sup>***</sup>	14.1 ± 5.2	12.8 ± 5.5	15.0 ± 5.0 <sup>*</sup>	13.9 ± 5.3	NS
Handgrip (kg) <sup>b</sup>	24.8 ± 6.0	28.0 ± 6.5 <sup>***</sup>	26.6 ± 6.5	25.2 ± 6.0	27.1 ± 7.4	26.1 ± 6.8	NS

Standing long jump (cm)	109.8±18.5	123.7±23.8***	117.6 ± 22.1	117.4±22.7	128.3±21.2**	122.9 ± 22.5	≤0.01*
20 m shuttle run test (stage) <sup>a</sup>	2.5 ± 1.5	3.8 ± 2.2***	3.2 ± 2.0	2.7 ± 1.7	3.4 ± 2.2	3.1 ± 2.0	NS

All the values are mean ± Standard deviation, or average (Natives / Immigrants)

Non transformed values are shown in this chart, but analyses were made over

<sup>a</sup> logarithmically transformed values. <sup>b</sup> Both hands results added up together

<sup>c</sup> p value in differences between natives and immigrants (in gender). <sup>†</sup>Differences between boys; <sup>‡</sup>Differences between girls

\* p<0.05 \*\*, p<0.01 and \*\*\* p<0.001 differences between boys and girls in natives and immigrants. NS, no significant differences in comparing in pairs. BMI, Body Mass Index.

Physical activity patterns in native and immigrant children measured through questionnaire are shown in Table III. Boys, native or immigrant, presented higher levels of physical activity at extra school timetable than girls schoolmates (all p<0.05, questions 1 and 2). In question 3 we observed no significant differences between boys and girls sharing the same nationality or compared to those of different nationality (all p>0.1). Activity patterns registered in questions 4 and 5 are different between natives and immigrants. Referring to question 4, about children taking part in school sport activities, a higher average of native girls (~60%) registered a significant low participation, although we found no significant differences with the average of immigrant girls in the same category. Referring to the immigrants, a higher average of boys confirmed to highly take part in these activities (p<0.05) being this participation significantly higher than their native boys classmates (~75% vs ~60%; p<0.01). In question 5, about taking part in local sport activities, native girls seemed to be less active, with a higher average of participation (~80%, p<0.05), being at the same time significantly different from the highest average of high participation registered by their immigrant classmate girls (~65%) (p<0.05).

**Table III.** Physical activity patterns of native and immigrant children derived from questionnaire.

		Natives		Immigrants	
		Girls (n=200)	Boys (n=240)	Girls (n=81)	Boys (n=91)
		% (n)		% (n)	
1.- Do you practice physical activity after your lesson timetable?	Low	42 (78)	22 (48)	44 (34)	19 (16)
	High	58 (107)	<b>78 (172)</b>	56 (43)	<b>81 (70)</b>
2.- How many days a week do you usually do physical activity, with a certain intensity, out of lesson timetable?	Low	44 (81)	27 (58)	44 (34)	31 (27)
	High	56 (103)	<b>73 (158)</b>	56 (44)	<b>69 (60)</b>
3.- How do you usually go to school?	Passive	52 (96)	47 (103)	52 (40)	44 (39)
	Active	48 (89)	53 (117)	48 (37)	56 (49)

4.- Do you take part in your school sport activities (school or extra school)?	Low	<b>61 (111)</b>	42 (92)	57 (44)	26 (23)
	High	39 (72)	58 (128)	43 (33)	<b>74 (64)*</b>
5.- Do you take part in local sport activities?	Low	<b>78 (141)*</b>	51 (114)	34 (51)	47 (40)
	High	22 (39)	49 (110)	<b>66 (26)*</b>	53 (45)

All the values are % (n) averages and individuals number out of the total of the simple for each subgroup.

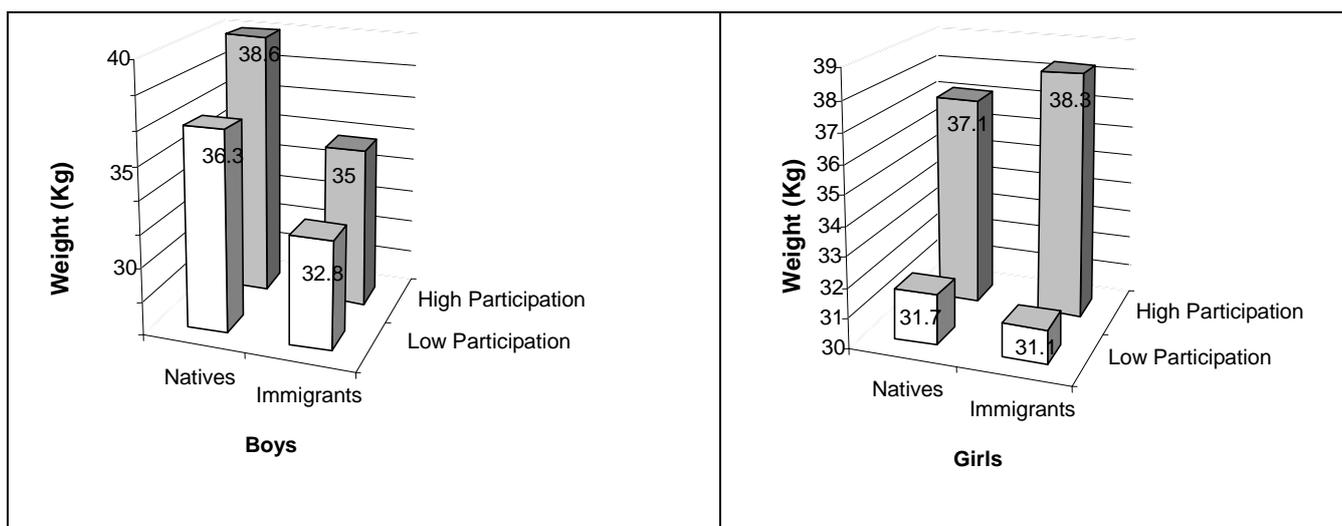
In bold letters, significantly higher values between boys and girls of the same nationality (Chi-Square).

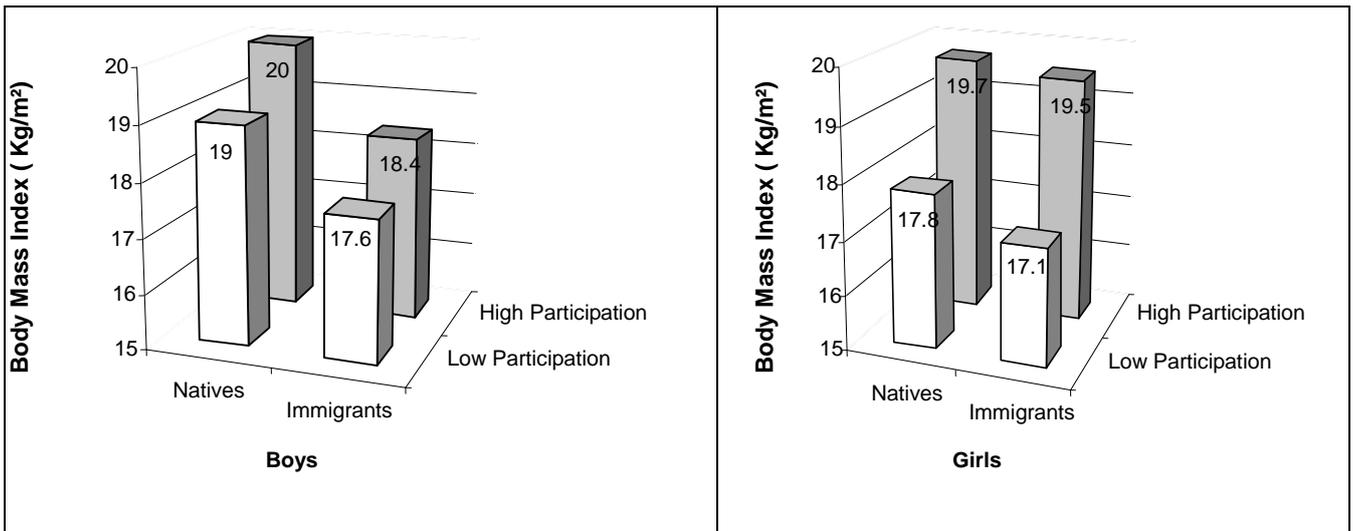
\*p<0.01 in compared to their classmate boys/girls of the same gender and different origin (Chi-Square)

Low, low Frequency of participation in one question; High, high frequency of participation in one question

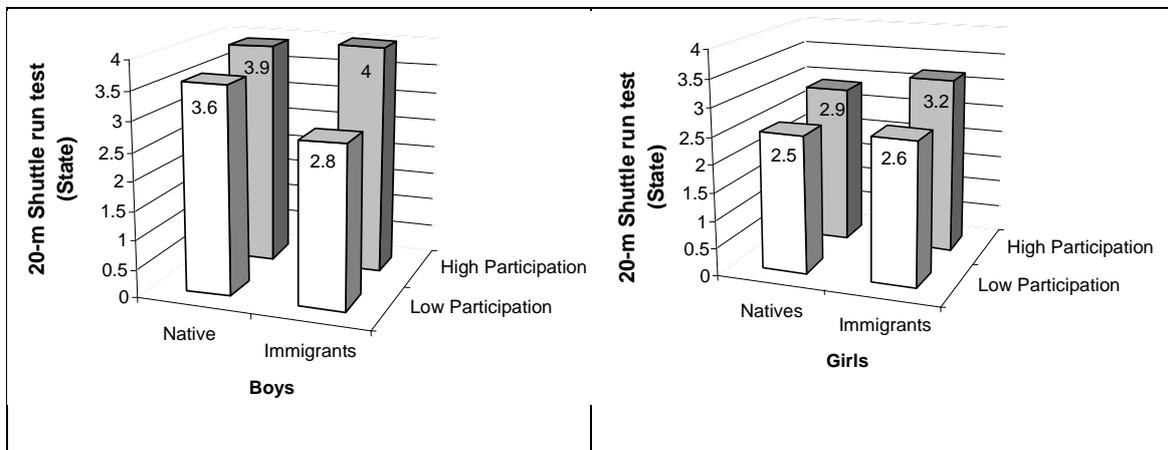
Passive, means that do not imply physical activity; Active, means that implies physical activity

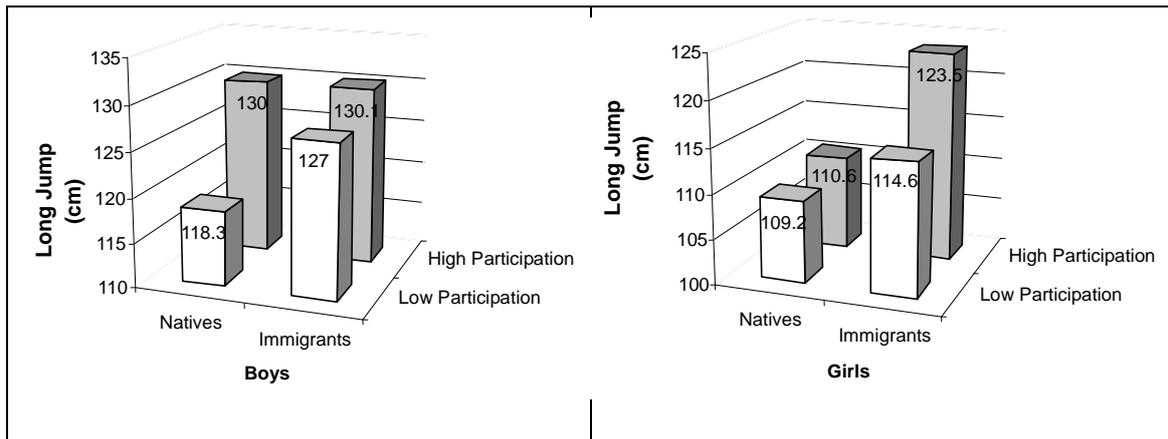
Figures 1 and 2 show the weight, body mass index, performance in standing long jump and 20 m shuttle run test of native and immigrant children, according to their high or low participation (question 5).





**Figure 1.** Weight and body mass index values according to the physical activity level (high or low participation; question 5) for native and immigrant teenagers. Graphics on the left side are referring to boys and on the right side referring to girls, top graphics show the weight and the bottom show the body mass index. Values at the front side represent the high participation and those at the back show the low participation, referring to natives on the left and to immigrants to the right. Body Mass Index ( $\text{kg/m}^2$ )





**Figure 2.** Fitness according to the physical activity level (high or low participation; question 5) for native and immigrant children. Graphics on the left side are referring to boys and on the right side referring to girls, top graphics show the standing long jump and the bottom show the 20 m shuttle run test. Values at the front side represent the high participation and those at the back show the low participation, referring to natives on the left and to immigrants to the right. Body Mass Index ( $\text{kg}/\text{m}^2$ )

In figure 1, both boys and girls of both nationalities, presented lower weight and body mass index levels when having a high participation in local sport activities. However, referring to boys we observed that average level of both variables is lower in immigrants than in their native classmate boys. Figure 2 shows that fitness levels were higher in those children who were more active (question 5). Starting from the marked differences found in physical activity patterns obtained by question 5, this one was used for the analysis.

## DISCUSSION

Immigrant scholars versus native studied in this sample presented lower levels of adiposity, bigger lower body strength (girls), and physical activity patterns showed a higher participation in both school and local sport activities (boys and girls, respectively). Those children, both immigrant and native, who presented a higher physical activity appeared to have lower body mass indexes and higher fitness levels.

The lowest levels of adiposity found in immigrant boys at this research clearly contrast with the highest overweight and obesity index in immigrants found in other researches (Renzaho et al., 2006 & 2008; Booth, 2004; Sundquist, 1999 & 2000; Fitzgerald, 2006; Markowitz, 2005; Will et al., 2005; Burgi et al., 2010). Among the main reasons described for these differences it is argued that such grade of adiposity might vary more according to the assimilating level of the local culture, grather than to the fact of being an immigrant (Renzaho et al., 2008; Sundquist, 1999 & 2000). Meanwhile other authors assert that it could be negatively affected in poor family children from different ethnic groups (Treviño et al., 2008). It would be therefore important to consider that immigrants' adiposity levels not only depend on the assimilating level of a culture, but also on the ethnic group they come from due to the differences between countries

found in other researches (Kirchengast et al., 2008; Akresh et al., 2008; Singh et al., 2009).

Physical fitness levels, generally, seemed not to vary between immigrant and native boys, except in case of the lower body strength of immigrant girls, that appears to be higher. Although there are few researches analysing the fitness of immigrants and natives, our results match up with some authors (Zahner et al., 2009), but differ from others (Treviño et al., 2008). Zahner et al. (2009) found significant differences in the coordination, resistance and speed tests in favour of children aged 6-7 and 11 years old having non-immigrant parents, whereas in strength tests, significant differences were in favour of children whose parents were both immigrants. However, Treviño et al. (2008) found in aged 9-10 children from poor families in different ethnic groups in USA, that only 11% presented an acceptable cardiorespiratory fitness after the Harvard test, being all the rest in an unacceptable situation or in a marginalized unacceptable situation. The existence of few related researches, the differences in the methodology and selection of the sample, and their own cultural differences between these researches, difficult the comparison between these researches and could explain the different results obtained.

Referring to the level of physical activity practice, native and immigrant boys present higher levels of practice, which matches up with other authors investigations (Chillon et al. 2010; De la Cruz et al. 2010; Ridgers et al. 2009; Day et al. 2009). When considering immigrants' and natives' fitness, we observed a pattern of higher participation by the immigrants. This not only happens in sport activities at school (school or extra school) for boys, but in local arranged activities for girls. These higher levels of participation in sport activities do not match up with most of the related studies (Singh et al., 2008; Singh et al., 2009; Zahner et al., 2009; Akresh et al., 2008; Burgi et al., 2010), although they are partially corroborated by a research made in the USA (Allen et al, 2007). Allen et al. (2007) observed higher levels of physical activity in first generation Asian teenagers and in residents in the USA compared to the native Americans. However, other authors showed lower levels of physical activity in USA immigrants' boys and girls aged from 6 to 17 years old compared to the natives (Singh, 2008 and 2009), and; moreover, a minor participation in sport activities (Singh, 2008). Zahner et al. (2009), in aged 6-7 and 11 Swiss boys and girls observed a quite significant difference between the immigrants who practice activities in sports clubs (45.1%) and those non-immigrant who do not (75.9%).

It has been suggested that the main point for this lower physical activity and participation focused on the influence of many factors such as sociocultural (C.D.C.P.P.B.C.C., 2000), the assimilation of cultural aspects (Singh, 2004, 2006 and 2008), place of origin (Ham et al., 2007), socioeconomic status, or the generation of immigrants studied in this sample (Singh et al., 2008). In this sense, according to Akresh (2008), Latin American immigrants in the USA end up by adopting the costumes, habits and conducts associated to the dominant society, sometimes acquiring negative health habits, such as poor diets or a sedentary lifestyle which increases the overweight or obesity risk. Moreover, the

families' lack of information about the benefits of these physical and sport activities may contribute their children to have lower levels of practice (C.D.C.P.P.B.C.C., 2000; Singh 2008; U.S.D.H.H.S., 1996; A.A.P., 2006). We hypothesized that the mechanism through which our results showed higher physical activity in immigrants can have the same sociocultural background displayed above. That means that a better adaptation to the social environment and to the sources at disposal, and that the necessity of spending more time playing in the street or under a family economic status, may lead to a better physical activity pattern in the immigrants. Under our concern, the present study provides a particular and new perspective allowing thus to improve the knowledge in this area.

This present research has several limitations. Its transversal design does not allow establishing a casual relationship between the analysed variables. The origin of this sample and its convenient selection make the results of this study be carefully taken into account in a mandatory basis, and make impossible the extrapolation of these results to a standard or representative population. Longitudinal studies to follow several groups of immigrant population as well as a bigger control of possible confusing variables are necessary. On the other hand, the lack of scientific literature in this realm makes these results interesting for their contribution to the scientific knowledge. What is more, the measuring of all the patterns by the same specialized evaluator provides rigor to the results.

## **CONCLUSIONS**

The present findings show that the immigrant children from our sample have a better profile of adiposity and better levels of physical activity and fitness than their colleagues native children. This suggests that sociocultural conditions of their environment might constitute a determinant factor at the time of providing a better adaptation for the immigrant population of this study. It is necessary to have future researches investigating the relationship of physical activity, fitness and adiposity with socioeconomic and cultural factors in populations of immigrant children in larger samples in order to confirm this results.

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