

PHYSICAL ACTIVITY AND GENDER: COMPARATIVE STUDY BETWEEN ADOLESCENTS FROM MONTERREY, MEXICO, AND ZARAGOZA, SPAIN

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ABSTRACT

The purpose of this study was to compare average energy expenditure and levels of physical activity between adolescents from Monterrey, Mexico, and Zaragoza, Spain, taking into consideration variables such as gender, type of school, and time of the week (week day or weekend). Methodology: adolescent students between 12 and 17 years of age from public and private schools in Monterrey (N= 396) and Zaragoza (N= 394). The Four-by-One-Day Physical Activity Questionnaire was used with a reliability of .89, along with a test-retest due to the format adaptation. Results: there is a significant number of students with low levels of physical activity both in Zaragoza and Monterrey. Almost half of the students have classified themselves as inactive or very inactive. The energy expenditure was very similar for both cities: Zaragoza 37.52 ± 2.12 kcal/kg/day and Monterrey 37.66 ± 2.95 kcal/kg/day. Conclusions: regarding gender, boys show greater levels of physical activity than girls, which coincides with the majority of the studies. Students perform a higher level of physical activity on school days than on weekends. The highest levels of energy expenditure were shown, on one hand, by males studying in Zaragoza private schools and, on the other hand, by females from Monterrey public schools.

KEY WORDS: adolescents, energy expenditure, levels of physical activity.

INTRODUCTION

Physical activity is defined by Caspersen, Powell, and Christenson (1985, p. 126) as “any bodily movement produced by skeletal muscles that results in energy expenditure... The total amount of caloric expenditure associated with physical activity is determined by the amount of muscle mass producing bodily movements and the intensity, duration, and frequency of muscular contractions.” This is one of the most accepted and quoted definitions in different studies on physical activity and health (Gutiérrez, 2000; Kriska & Caspersen, 1997) Consequently, talking about physical activity refers to the sports or recreational aspects, as well as a whole group of factors present in a person’s life, such as personal experience, sociocultural practice, and bodily movements (Devís, 2000).

Physical activity constitutes an important element in all stages of development. In the stage of youth development, physical activity offers great possibilities to improve skills, habits and types of attitude that will be present throughout a person's life. A significant number of studies (Álvarez, 2004; American College of Sports Medicine-ACSM, 2009; Serra, 2001) have shown how regular physical activity results in important health benefits. It has also been found that in the case of many adolescents the only physical activity in their daily lives is what they do in their Physical Education (PE) classes (Booth, Okely, Barman & Macaskill, 2002; Ceballos, Álvarez, Torres & Zaragoza, 2006; Cox, Smith, & Williams, 2008). This is far from the minimum standards (ACSM, 2009), which are essential to obtain health benefits.

Epidemiological studies have been mainly dedicated to research the relationship between physical activity and health, illness, or behaviors such as tobacco or alcohol consumption, obesity, etc. Knowledge resulting from these studies is used in the prevention and control of diseases and health promotion. Within those lines, some epidemiological studies have highlighted the benefits of following the healthy practice of regular physical activity at the physiological, biological, psychological and social levels (Álvarez, 2004; Pérez, 2000), as well as its effects on different pathologies, whether as prevention or as treatment. Practicing physical activities is almost always beneficial since it improves performance of most systems: cardiovascular, respiratory, skeletal muscles, digestive, endocrine, and neurological (Serra, 2001).

Physical activity offers great possibilities for enjoyment and psychological and social wellbeing. However, it is also accompanied by risks related to injuries, competitiveness and the social context that surrounds this activity (Devís, 2000). In general, risks are due to excessive exercising, both in terms of duration and intensity. Clear examples are high performance athletes, who are exposed to different physical, psychological and social risks (Álvarez & López, 2005).

Some basic recommendations for prescribing exercises for athletes, children, adolescents, and adults in general are not only to know their bodies and practice a specific physical activity, but to recognize the difficulties that the physical and social space can impose on the performance of the activity, taking into consideration type, intensity, duration, frequency, and progress of the physical exercise (Álvarez, 2004; Ceballos, 2002).

Methods used to measure physical activity and energy expenditure are calorimetry, job classification, physiological markers, behavior observation, mechanical and electrical recordings (pulsimeters, pedometers, and speedometers), dietary measures, and self-reported methods (surveys). The latter are the most widely used and practical instruments to measure physical activity in epidemiological investigations of large populations (Booth et al., 2002; Cantera, 1997; Ceballos, Pérez, Medina, Calatayud & Segura, 2005; Kriska & Caspersen, 1997; Kurpad, Raj, Maruthy & Vaz, 2006). Some examples of instruments are the short format of the International Physical Activity Questionnaires (IPAQ) (Rangul, Holmen, Kurtze, Cuyper, & Midthjell, 2008) and the 7-day physical activity diary (Rush, Valencia, & Plank, 2008).

Very few studies have been conducted on the physical activity practiced by the Mexican population, one of which is the research done by the National Sports Commission (*Comisión Nacional del Deporte*) (CONADE, 2009). The report includes some characteristics of the sports habits in adolescents, physical education, and infrastructure. This study mentions the poor quality of PE classes and the few hours (sometimes none) dedicated to these classes per

week, the lack of interest of adolescents (ages 14 to 18) who stop practicing sports since PE is not required in high school, and how UNESCO's recommendation regarding the hours to be dedicated to sports is not followed because the number of physical education teachers falls far short of the needs, in addition to the lack of adequate facilities and equipment.

In the case of Monterrey, Mexico, some studies have shown that women engage in less exercise than men. Women associate it more to slender bodies and social distinctiveness while men associate it to recognition from peers for their muscular bulkiness. As an alternative option instead of not eating and in order to "feel good", men practice more sports collectively (Álvarez, 2004; Ceballos et al., 2005).

Some studies on physical activity compare populations of different countries (Ceballos et al., 2006; Dugas et al., 2008) to show the differences and similarities resulting from cultural variations, which confirm the need to develop this type of research.

Based on the above, this study was aimed at comparing the average energy expenditure (AEE) and physical activity levels among adolescents in Monterrey, Mexico, and Zaragoza, Spain, taking into consideration variables such as gender, type of school, and time of the week (school day or weekend).

METHODOLOGY

Subjects: A random sample with a 5% error was selected from elementary and secondary schools, both public and private, in Monterrey and Zaragoza. After choosing the schools, participants were selected randomly and proportionally by gender and grade. The sample consisted of 396 Monterrey students of both sexes (193 boys and 203 girls) aged between 12 and 17 years, with a mean age of 14. In the case of Zaragoza, Spain, the sample was 394 students (199 boys and 195 girls) also with a mean age of 14 years.

Instruments: The questionnaire used to assess physical activity of adolescent students was Cale and Almond's Four by One-Day Physical Activity Recall Questionnaire (1997) with a cross-cultural adaptation by Cantera (1997). The questionnaire was considered appropriate because of the format modification, and reliability of the instrument was verified using a test-retest analysis. For this reason, the questionnaire was first applied to a sample of 20 adolescents (10 males and 10 females), and a modified version was applied two weeks later. Results were compared and the average energy expenditure was 34.66 ± 1.62 for the first questionnaire and 34.43 ± 1.70 expressed in kcal/kg/day for the second one.

In order to analyze reliability, data correlation was first calculated using Spearman's rho, which turned out to be high (.89). Secondly, means were contrasted using the Mann-Whitney U test, which were not significant ($p > .631$). The foregoing shows that there are no differences in the measurements obtained in both questionnaires. Due to the above, the modified questionnaire is considered to be a reliable instrument. The original structure of the questionnaire is maintained splitting activities by morning, afternoon, and evening. In addition, the instrument was validated by experts because of the cultural context adaptation (types of habits in both cities), for example, the differences in the names of some activities: using *piscina* or *alberca* for swimming pool, *hacer deberes* or *hacer la tarea* for doing homework, *fregar* or *trapear* for mopping, *andar* or *caminar* for walking, and *ordenador* or *computadora* for computer.

This questionnaire was used to identify the daily average energy expenditure in kcal/kg/day based on the distribution of activities performed, which were categorized by intensity. Each student recorded their AEE at different times during the school period, excluding vacation.

AEE is one of the most widely used ways to measure and classify physical activities in epidemiological studies and may be expressed in Metabolic Equivalents (MET). One MET is the energy consumed by a person during his/her basal or resting metabolic rate, which is approximately 1 kcal/kg/hr or 3.5 ml/kg/min (Ainsworth et al., 2000; McArdle, Katch, & Katch, 1994).

Procedure: after obtaining school principals and students consent to participate in the study, the questionnaire was applied in the classroom to groups of 10 students, with the assistance of an interviewer. The interviewer first read the instructions and some of the questions, while students answered simultaneously, until they understood the mechanics and were able to continue on their own.

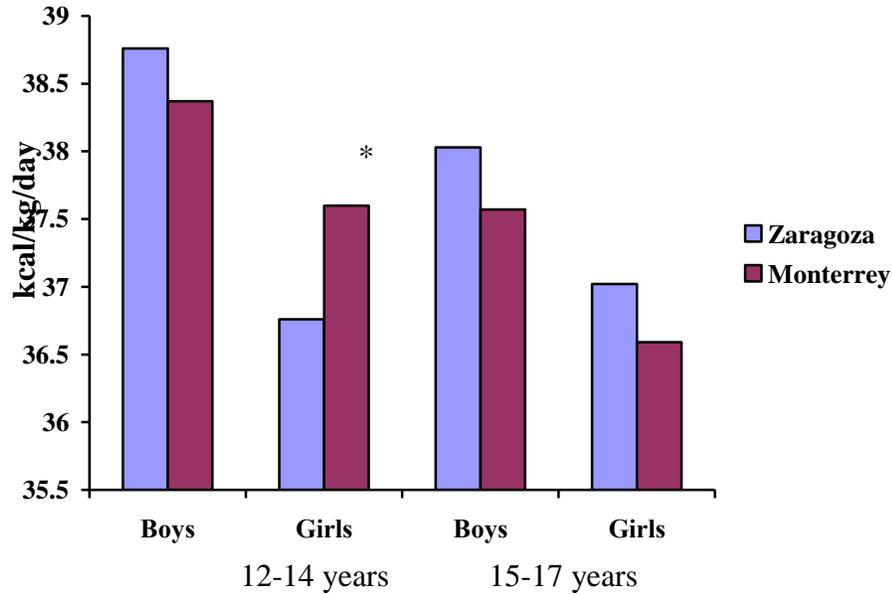
Statistical analysis: Data was collected in groups of 10 students, through a self-administered questionnaire applied at an appropriate place (classroom and/or library) with the support of an interviewer and the proper information and instructions.

The statistical analyses used were first a variable normality test (Kolmogorov-Smirnov) and then the contrast of means (t-student, $p < .05$ and CI 95%) to compare energy expenditure by city, age groups, gender, type of school, and school days versus weekends. Levels of physical activity were compared using contingency tables with the Chi-square. Data was processed with the SPSS software, version 15.0.

RESULTS

The results of this study are described as follows.

Figure 1. Results of t-test analysis with AEE variables (kcal/kg/day) by city, age, and gender

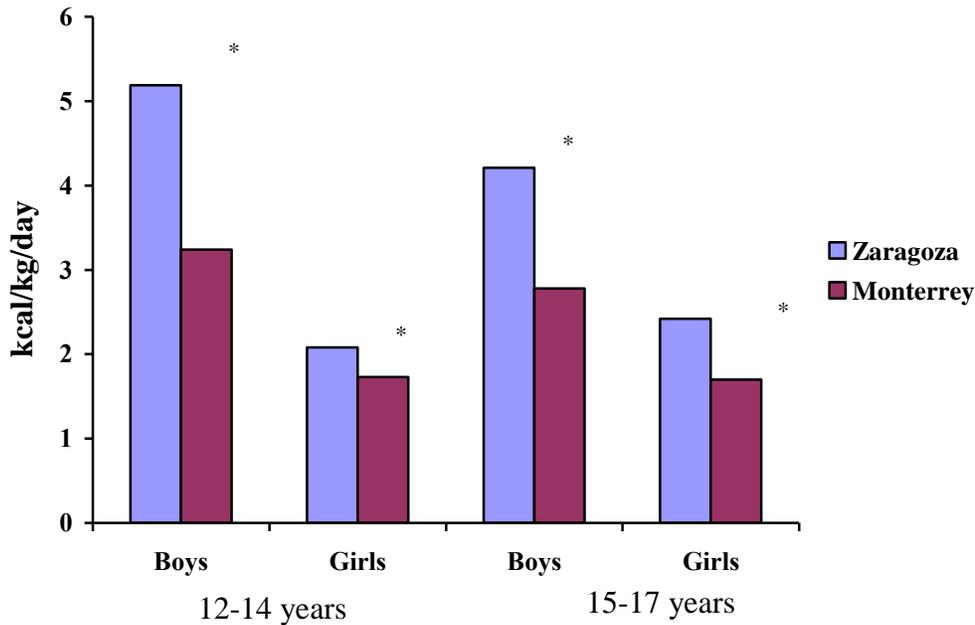


* $p < .05$

Age and gender

When comparing the two cities analyzed in this study (Figure 1), no significant differences were found between the AEE of 12-14 year old males in both cities. However, Monterrey girls of the same age group have a higher expenditure ($p = .000$), 37.60 ± 1.96 kcal/kg/day than Zaragoza girls, 36.76 ± 2.6 kcal/kg/day. On the other hand, when comparing both boys and girls aged 15-17 years, no significant differences were found between these two cities. It is important to note that at all times boys reported being more active than girls.

Figure 2. Results of t-test analysis with the strenuous activities variable (kcal/kg/day) by city, age, and gender

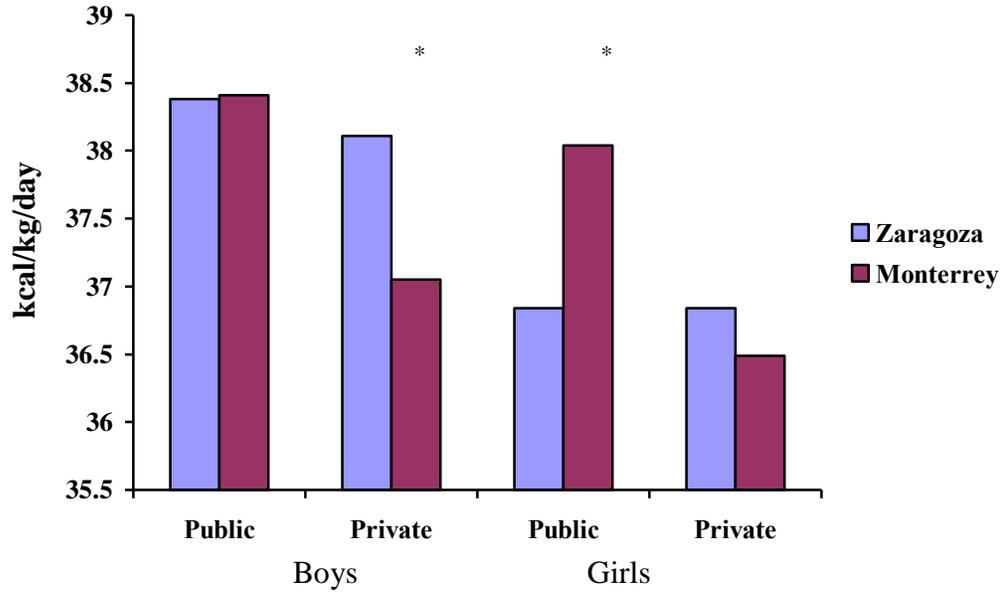


* $p < 0.05$

Strenuous activities

Average energy expenditure in strenuous activities (activities classified as strong and very strong causing a rapid rise in heart rate, body temperature and shortness of breath) was analyzed by age and gender as estimated by school adolescents in Zaragoza and Monterrey. It is observed (Figure 2) that boys do strenuous activities for longer periods of time ($p = .003$) than girls in both cities ($5.19 \text{ kcal/kg/day} \pm 3.71$ vs. $2.08 \text{ kcal/kg/day} \pm 2.01$ and $4.21 \text{ kcal/kg/day} \pm 3.66$ vs. $2.42 \text{ kcal/kg/day} \pm 2.65$ Zaragoza; $3.24 \text{ kcal/kg/day} \pm 2.53$ vs. $1.73 \text{ kcal/kg/day} \pm 1.36$ and $2.78 \text{ kcal/kg/day} \pm 2.01$ vs. $1.70 \text{ kcal/kg/day} \pm 1.11$ Monterrey). In addition, Zaragoza participants have higher average energy expenditure for this type of activities than Monterrey students in each comparison variable. In other words, Zaragoza participants practice more strenuous and/or sports activities than Monterrey students.

Figure 3. Results of t-test analysis with AEE variables (kcal/kg/day) by city, school type, and gender

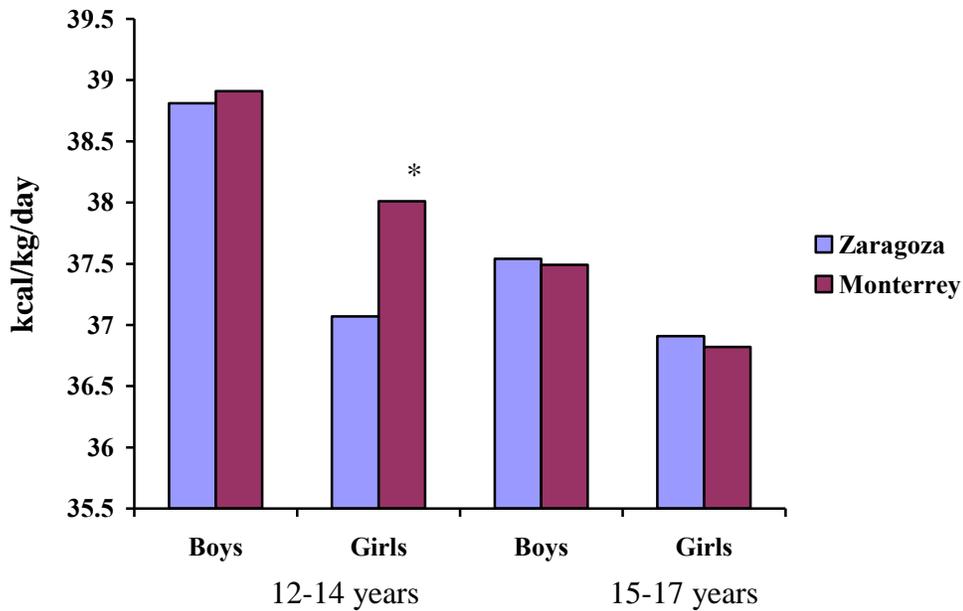


* $p < .05$

Type of school

When comparing AEE (kcal/kg/day) of school adolescents in Zaragoza and Monterrey, a more significant difference ($p = .015$) was found among boys who study in private schools in Zaragoza ($38.11 \text{ kcal/kg/day} \pm 3.01$ vs. $37.05 \text{ kcal/kg/day} \pm 1.66$). On the contrary, girls in Monterrey public schools show a higher value ($36.84 \text{ kcal/kg/day} \pm 2.18$ vs. $38.04 \text{ kcal/kg/day} \pm 2.02$; $p = .000$).

Figure 4. Results of t-test analysis with AEE variables (kcal/kg/day) during school days by city, age, and gender



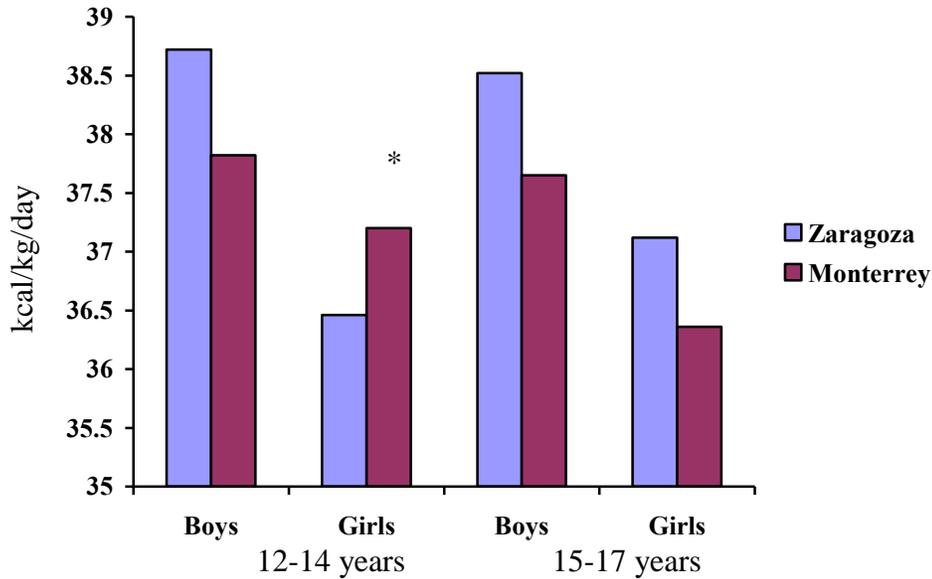
* $p < 0.05$

School days and weekends

Only girls 12 to 14 years of age in the city of Monterrey have higher AEE ($p = .026$) ($38.01 \text{ kcal/kg/day} \pm 2.45$) than girls in Zaragoza ($37.07 \text{ kcal/kg/day} \pm 2.48$) during school days. However, there are no differences for the rest of the comparisons made by age groups and sex (Figure 4).

The following figure (5) shows that girls in Monterrey ($37.20 \text{ kcal/kg/day} \pm 2.36$) performed more physical activity ($p = .033$) during the weekend than girls in Zaragoza ($36.46 \text{ kcal/kg/day} \pm 2.95$). There are no differences in the other variables compared.

Figure 5. Results of t-test analysis with AEE variables (kcal/kg/day) during the weekend by city, age, and gender



* $p < .05$

Overall levels of physical activity

Table 1 shows the comparison of overall levels of physical activity of the two cities studied. It should be stressed that Zaragoza has a higher percentage of active students (19.3%) with respect to Monterrey (10.9%). On the contrary, there are more moderately active students in Monterrey (46.7%) than in Zaragoza (33.5%).

Table 1. Results of Chi-square analysis with the variables levels of physical activity and city

	Levels of Physical Activity	Zaragoza		Monterrey		Chi-square
		n	%	n	%	
1	Active (40 kcal/kg/day or more)	76	19.3	43	10.9	p = .000
2	Moderately active (between 37 & 39.99 kcal/kg/day)	132	33.5	185	46.7	
3	Inactive (between 33 & 36.99 kcal/kg/day)	184	46.7	164	41.4	
4	Very inactive (less than 33 kcal/kg/day)	2	0.5	4	1.0	
	Total	394	100	396	100	

DISCUSSION

It was found that averages in the energy expenditure variable are similar in the two studied samples, which categorizes participants as moderately active, according to Cale and Almond's (1997) and Cantera's classification (1997). This suggests that there appears to be a cultural disposition to encourage physical activity as little as possible (Dugas et al., 2008) since both samples have a significant number of schoolchildren with low levels of physical activity and almost half of them have classified themselves as inactive and very inactive.

On the other hand, there are differences between samples in the strenuous activities variable. Mexican teenagers spend less time on these activities than those in Spain, which indicates that Mexican adolescents do not perform activities that involve physical effort as part of their daily routine, unlike the Spanish who report having slightly more physical activities. However, this is not an optimal amount for any of the groups since the minimum suggested by the ACSM (2009) is at least 30 minutes a day. This may be due to important factors that could influence the level of average energy expenditure of young adolescents such as: time spent watching television, the little time dedicated to physical activities in schools both public and private, as well as personal and family culture.

In addition, there is a tendency that boys perform physical activity for longer periods of time than girls and thus obtain more energy expenditure. This result seems to be a cross cultural gender trend because other investigations agree that boys are more active than girls, girls have lower energy expenditure, and in general individuals lower their physical activity with age (Barnett, Gauvin, Craig, & Katzmarzyk, 2007; Bratteby, Sandhage, & Samuelson, 2005; Cantera & Devís, 2000, 2002; Castillo & Balaguer, 1998; Domínguez-Berjón, Borrell, Nebot, & Plasencia, 1998; Dugas et al., 2008; Ekelund, Yngve, Brage, Westerterp, & Sjöström, 2004; Jago, Baranowski, Zakeri, & Harris, 2005; Piéron, Telama, Almond, & Carreiro, 1999; Telama & Yang, 2000; Tercedor, 2001; Trost et al., 2002).

Regarding the energy expenditure and type of school, it can be observed that students in Zaragoza private schools are more active than students in public schools; on the contrary, students in Monterrey public schools have greater energy expenditure than those studying in private schools and are also more active than students in Zaragoza public schools. On the contrary, private schools report less physical activity, with a lower level for Monterrey private schools. It seems that in Mexico there is more opportunity for young adolescents to develop physical activities in the public school setting. This data also suggests that perhaps private schools in both populations studied do not devote much time to physical activity, perhaps because it is not considered a priority in students' education. In addition, this data differs from other studies with Spanish samples. For instance, Cantera (1997) found no differences with regard to physical activity by type of school in the province of Teruel, nor did Tercedor (1998) in 10 year-old girls. However, Tercedor did find differences in boys the same age since they performed more physical activity in private institutions in Granada. This result highlights the need to know the basic cultural aspects of young adolescents regarding these types of activities in order to offer them, for example, varied activities that link interests and motivations of both boys and girls to increase the amount of physical activity.

Another finding indicates that students perform more physical activity during school days than during weekends, which suggests that physical activity is imposed by the school rather than by the family or personal environment. Practicing organized sports at school

(after-school activities and PE classes) and having better or more accessible sports facilities could justify this difference. Data from Gavarry, Giacomoni, Bernard, Seymat, & Falgairette (2003) indicating that French schoolchildren are more active during school days than during weekends coincides with this study.

A remarkable result of this study is to learn that there is a high number of school adolescents with low levels of physical activity, which may be explained by the following possible causes: time spent watching television, lack of sports facilities and programs for these ages, and beyond the school environment, inadequate habits such as smoking and physical inactivity, as well as cultural factors that tend to consider physical activity as irrelevant in education or daily life (Álvarez, 2004; Henry, Lightowler, & Al-Hourani, 2004).

CONCLUSIONS

Although no significant differences were found in the average energy expenditure of schoolchildren in Monterrey and Zaragoza, there is a considerable number of schoolchildren with low levels of physical activity in both samples, where almost half have classified themselves as inactive and very inactive.

It was also found that Monterrey 12-14 year-old girls are more active than female Zaragoza students. However, boys do more strenuous activities than girls, and adolescents from Zaragoza perform more strenuous activities than those in Monterrey.

Children in private schools are more active in Zaragoza than in Monterrey, but girls in public schools are more active in Monterrey than in Zaragoza. However, children have more AEE in Monterrey than in Zaragoza during both school days and weekends.

Consequently, a trend is established that boys present higher levels of physical activity than girls.

Lastly, the physical activity model used in this study to measure average energy expenditure of school students is considered to be appropriate due to its simplicity and easy application.

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