GENDER DIFFERENCES IN LONGITUDINAL CHANGES OF MAXIMAL SHORT-TERM LEG PEAK POWER DURING GROWTH

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Keywords: multilevel regression analysis, qualitative muscular factors, cycling

Introduction
Although it provides the only method for the direct study of the natural course of human growth and development, longitudinal data on young people's short term power output (Pmax) are sparse. Recently, using an apropriate statistical method for multiple longitudinal data analysis (multilevel regression analysis; MlwiN) Armstrong et al. (2001) demonstrated that Pmax values are higher in boys than in girls and that gender differences increase with age. It may be attributable to quantitative (muscle volume) and qualitative (muscle fiber type, anaerobic energy production and neural adaptation) muscular factors. However, Pmax was not standardized to the effective muscle quantity and younger age groups are missing. Moreover, the authors don't use the optimal pedalling frequency (Vopt; rpm) and force (Fopt; N) as done by Martin et al. (2003) with the force-velocity test. The purpose of the present multiple longitudinal study is to examine the effect of lean leg volume (LLV), body mass and age on Pmax in both sexes from 7.5 to 17.5 years using multilevel regression analysis with multiplicative allometric equations. Additionally, the measurement of V_{opt} and F_{opt} with the force-velocity test will provide information to understand gender differences better.

Methods
Subjects consisted of 100 girls and 109 boys divided in eleven cohorts which cover the human growth pubertal period from 7.5 to 17.5 years old. Individual were measured twice and the time interval between the two measurements was 3.8±0.4 years. Each session period was used for anthropometric measurement including LLV, mass and leg length (LL) and for a short term cycling power test (Doré et al., 2000). Pmax was defined as the apex of the power-velocity relationship. F_{opt} and V_{opt} corresponded to the force and pedalling frequency at Pmax.

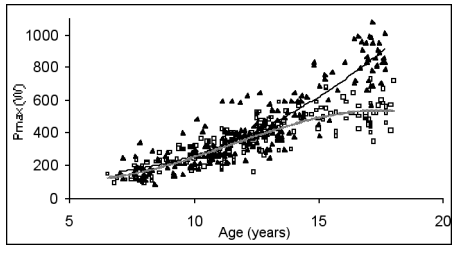
Results
Figure 1 showed that the increase of Pmax doesn't depend on sex until the age of 14. From that age, Pmax values are lower in girls than in boys. It also demonstrate that the increase of Pmax between 7.5 and 17.5 years old is higher in boys than in girls. Table 1 summarizes the results of the multilevel regression analysis in girls and in boys. It showed that mass, LLV and age are significant explanatory variable in both sexes and that in girls, LLV is the parameter which best explains the variance of Pmax (68%) whereas in boys it is age (57%). Significant exponential relationships were found between F_{opt} and LLV in girls (r^2=0.74, p<0.0001) and in boys (r^2=0.83, p<0.0001). ANCOVA indicated that the ordinate and slope of the linear regressions were not significantly different between girls and boys. Significant exponential relationships were also found between V_{opt} and LL in boys (r^2=0.55, p<0.0001) and in girls (r^2=0.41, p<0.0001). ANCOVA indicated that the ordinates were significantly different (p<0.0001).

Discussion
The results of figure 1 demonstrated that between 7.5 and 17.5 years old, Pmax increased 295% in girls whereas it increase 375% in boys. In girls, LLV was responsible for 68% of the total explained variance (Table 1). Accurately, it means that Pmax increase was greatly dependent on quantitative muscular factors improvement. In boys, age was responsible for 57% of the total explained variance of Pmax. In the present multilevel regression analysis, when quantitative muscular factors such as LLV and mass were significant explanatory variables, the significant main effect of age refers to muscular qualitative factors which are related to the percentage of type II fibers, glycolytic ability motor coordination and motor unit activation changes during the adolescent spurt. It was shown that for the same LLV, there are no significant differences between boys and girls. On the contrary, for the same LL, V_{opt} is higher in boys than in girls. It demonstrate that the observed gender differences in Pmax are related to contracting velocity determinants (type II fiber and motor coordination).

Parameters	Proportion of explained variance caused by explanatory variable (%) in girls	Proportion of explained variance caused by explanatory variable (%) in boys
Constant		
Ln mass	5	16
Ln LLV	68	27
Age	27	57

Table 1: Results of the multilevel regression analysis with log-transformed Pmax as dependent variable and age (years), lean leg volume (LLV, l) and mass (kg) as explanatory variables.

Figure 1: Relationship between Pmax (W) and age (years) in girls (°; dashed line) and in boys (▲; black line). Girls: R^2= 0.75; p<0.05;Boys: R^2=0.85; p<0.05.



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LONGITUDINAL STUDY IN PREPUBERTAL CHILDREN WITH REFERENCE THE LEVEL OF PHYSICAL ACTIVITY

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Keywords: somatic developement, aerobic power, physical performance

The aim of the present 5-years longitudinal study was to analyse the changes in somatic development and cardiorespiratory performance of 7-year-old children, living in higher socioeconomic conditions in one of the districts of Buda.
The children took part in the investigations on their voluntary base between the years of 1997 and 2002. The written consents of their parents were also collected. Altogether 42 children have been taken part in all the 6 data collections.
For the anthropometric characterisation the Conrad (1963), Drinkwater-Ross (1980) and Parízková (1961) techniques were used, all of them are accepted by the international literature.
The biological development of children was assessed according to the suggestions of Mészáros and Mohácsi (1983). The peak spiroergometric variable were recorded by Jaeger m-DATASPIR analyser, and the test exercise was performed on treadmill (Jaeger 6000 LE). All the children had preliminary practice in treadmill running.
The means of the anthropometric and peak exercise physiological variables were statistically the same at the time of first data collection, consequently the possible initial differences may not restrict the evaluation of the effects of regular physical actívity.
The anthropometric and exercise physiological characteristics can be divided into two groups by the differences between the respective means of the two samples and by the directions of their changes. No significant effects of the regular physical activity could be observed on the age dependency of mean height, body mass, plastic index, heart rate, absolute aerobic power, respiratory exchange ratio, oxygen utilisation, respiratory equivalent.
These observations are inconsistent in part with the publications of Frenkl and associates (1998) and also with our respective hypothesis.
The essential point of view in this relationship is, that the physical performance and also the efficiency of the physical work were greater in the active sample during the time of the final 5 data collections. The distorting effects of sampling error can clearly be excluded in this respect, since the initial performances were not used as consideration in grouping.
The development of aerobic power, however, cannot be end in itself. We have to stress for the extremely high aerobic performances relative to body mass do not refer good or excellent physical performance necessarily.
Our evaluation could be right only in such manner, if we can qualify and evaluate the exercise physiological fundamentals and the outcomes (the characteristic physical performances) together.

PHYSIQUE, BODY COMPOSITION AND MOTOR PERFORMANCE IN HUNGARIAN AND ROMA BOYS

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Introduction
Though no clear agreement exists with respect to the anthropologic origin of different Roma (Roma is the official terminus technicus for the indication of gypsy) ethnicity, the Roma population is characteristic in almost all of the European countries. The Roma ethnicity represents the greatest minority within the population in Hungary. The ratio of Roma ethnicity has doubled during the past 30 years, bringing it to about 9% of the population in 2003. As a comparison the summarised ratio of German, Slovakian, Serbian, Rumanian, and other nationalities combined is less than 9%. The marked increase has two important components. One of them is that more Roma families have declared their ethnicity during the past national census, and secondly the birth rate in the Roma families is more than 2.5 times greater than in the Europid groups.
Though the official former politics (between 1945 and 1990) declared that no differences exist among the nationalities and ethnic groups of Hungary, nevertheless, the Roma population lived separately in the settlements, and it has represented the lowest socio-economic class in Hungary. Anthropometric or socio-cultural studies were published neither about the nationalities nor the ethnic group of the Hungarian society.
In spite of that the 8th grade elementary school is obligatory for all Hungarian citizens, including Roma, about 50% of Roma children do not answer this requirement (though special schools with adapted curricula, including their Beas language were organised and adjusted to their special culture), and less than 10% of the Roma children take part in the secondary school education. Moreover, only 1-2% enter into the colleges and universities. The most marked barrier to their elementary education is that a majority of 6- and 7-year-old Roma children do not speak the Hungarian language at the necessary level. More and more Roma families have moved into the centre of greater settlements (that is, mainstream Hungarian life) during the past 20 years. However, because of their special life style basically they could not adapt themselves to the new surroundings. The ratio of unemployment (about 50%) and crime are the highest among them, consequently their life condition did not change remarkably. Both unemployment and crime rate are related to their very low educational level. Though their integration was aimed by all Hungarian governments of the past 50 years, the endogamy is almost solely characteristic among them, and neither their educational level, nor life standard and life style changed.
The aim of the present study was to compare the body dimensions, physique, body fat content, and motor performance scores of Europid and Roma origin boys. By the anthropologic differences and according to their long lasting social separation, and living standards, remarkable differences can be supposed between the compared two groups.

Methods
A total of 1225 volunteer urban, Europid and 435 Roma boys aged between 9.51 and 13.50 years were recruited for the study. The subject numbers are not proportionate to the representation within the population. They ranged between 269 and 342 in the

European group, and 106 and 113 in the Roma sample. It was extremely difficult to collect the written consents of the Roma parents. Many of them refused participation without reason, and the other explanation was, that this comparison gives a new basis for the additional separation. Height, body mass, shoulder width, chest depth and -width, lower arm girth, hand circumference and five skinfold thicknesses were measured according to the suggestions of the International Biological Program (Weiner and Lourie 1969). Physique was characterised between the extremes of leptomorphic and picnomorphic body build by the metric index, and the bone-muscle development by the plastic index following the suggestions of Conrad (1963). Relative body fat content was estimated by the modified Parízková (1961) technique (Szmodis et al. 1976) and the body mass index was also calculated. Running speed was estimated by the scores in 30 m dash. The best results of the 3 trials were analysed. Cardiorespiratory endurance was assessed by the results in 1200 m run. Differences between the means were tested by t-tests for independent samples at 5% level of random error.

Results

Means, standard deviations, and results of comparative statistics are summarised in Tables 1-4. The Europid children were significantly taller than their Roma age mates in all four compared age groups, however, the respective standard deviations around the means were the same (Table 1). The investigated 10 and 13-year-old Europid boys were slightly taller than those in the national representative sample (Eiben et al. 1991). As we stressed earlier no anthropometric data were published about the Hungarian-Roma ethnicity. In spite of the significant differences between the height means the average body masses were statistically the same consistently, nevertheless the intra-group variabilities were more marked in the groups of Roma boys (Table 1). The age dependent increases in height and body mass were significant in both anthropologically different groups, and no remarkable difference can be supposed between the speeds of age dependency.

The different height means and the similar body mass averages theoretically predict the differences among the BMI averages. The statistical analysis did not prove the theoretical expectation (Table 2). The only difference that can be pointed out in this respect is the consistently greater standard deviations in the Roma samples. The increasing BMI trends with age were significant in both samples. The mean relative body fat contents were between 18.5-19.0% in the Europid age groups; the body fat content of the Roma children and adolescents were significantly higher (Table 2). The lowest average in this sample was 21.77% and the highest 23.01%. Beyond the greater mean body fat content, the intra-group variabilities were consistently greater in the Roma samples. The age dependent fat increase was not significant in the group of Europid children, however, an increasing mean trend can be calculated in the group of Roma boys.

Table 1. Descriptive and comparative statistics for height and body mass

	Height (cm)					Body mass (kg)				
	Europid origin		Roma			Europid origin		Roma		
Age	Mean	SD	Mean	SD	P	Mean	SD	Mean	SD	P
10	143.23	6.20	140.15	7.08	<5%	37.06	7.51	36.68	8.94	NS
11	148.39	6.59	144.21	7.59	<5%	39.91	8.23	40.31	9.86	NS
12	153.76	7.72	150.49	8.03	<5%	45.18	8.29	45.13	9.27	NS
13	159.84	7.82	156.14	8.55	<5%	50.44	8.42	50.08	9.72	NS
P	<5%		<5%			<5%		<5%		

Abbreviations: SD = standard deviation, <5% = difference between the means is significant, NS = non significant.

Table 2. Descriptive and comparative statistics for body mass index and body fat content

	Body Mass Index (kg × m^{-2})					Relative body fat content (%)				
	Europid origin		Roma			Europid origin		Roma		
Age	Mean	SD	Mean	SD	P	Mean	SD	Mean	SD	P
10	18.07	3.66	18.57	4.55	NS	18.75	5.33	21.77	6.23	<5%
11	18.12	3.92	19.38	4.74	NS	18.99	5.25	22.89	6.33	<5%
12	19.11	3.63	19.93	4.09	NS	18.86	5.31	23.01	6.02	<5%
13	19.74	3.45	20.54	3.99	NS	18.56	5.43	22.81	6.01	<5%
P	<5%		<5%			NS		<5%		

Table 3. Descriptive and comparative statistics for metric and plastic indices

	Metric index (cm)					Plastic index (cm)				
	Europid origin		Roma			Europid origin		Roma		
Age	Mean	SD	Mean	SD	P	Mean	SD	Mean	SD	P
10	-1.42	0.30	-1.31	0.20	<5%	67.87	3.31	64.25	2.94	<5%
11	-1.52	0.30	-1.30	0.25	<5%	69.87	3.37	66.02	3.91	<5%
12	-1.59	0.34	-1.35	0.46	<5%	72.01	3.93	68.32	4.36	<5%
13	-1.62	0.31	-1.46	0.26	<5%	76.00	4.65	72.57	4.88	<5%
P	<5%		<5%			<5%		<5%		

Table 4. Descriptive and comparative statistics for 30 m dash and 1200 m run

	30 m dash (s)					1200 m run (s)				
	Europid origin		Roma			Europid origin		Roma		
Age	Mean	SD	Mean	SD	P	Mean	SD	Mean	SD	P
10	5.86	0.59	6.05	0.42	<5%	382.23	58.01	405.23	42.88	<5%
11	5.68	0.59	5.95	0.48	<5%	374.55	58.29	398.61	44.44	<5%
12	5.58	0.60	5.86	0.41	<5%	358.73	57.61	389.78	43.55	<5%
13	5.27	0.57	5.79	0.45	<5%	345.66	54.95	381.75	45.99	<5%
P	<5%		<5%			<5%		NS		

Table 3 contains the descriptive and comparative statistics for the growth type indices. The mean metric indices were significantly more negative in the sample of Europid children, consequently their physique was more linear, more leptomorphic, although the intra-group variablities were similar in both races. The average absolute bone-muscle development of the Roma children was significantly less than those of the Europid boys. The differences were greater, and were not just attributed to their shorter body height. No remarkable inter-race variability was found between the respective standard deviations.

The characteristic means for running speed and cardiorespiratory endurance can be seen in Table 4. The Europid children and adolescents performed significantly better than the Roma boys. Interestingly, the standard deviations around the means were greater in the age groups of the Europid subjects. The age dependency in 30 m dash was significant in both groups, nevertheless the age group means for 1200 m run in the Roma sample did not differ significantly.

Discussion

Among the eight variables studied only the stature and metric index can be attributed to the race differences. The height and physique variability among various races of same age range were significant in another investigation (Mészáros et al. 2002). The rate in height growth between 10 and 13 years of age is high in spite that the peak height velocity cannot be supposed within the observed age range, however, the respective averages are comparable if the biological maturation level of the subjects is the same. The observed taller stature of the Europid children can be attributed to race differences. The patterns of age dependent metric index trends of the two compared races were similar, but the trend lines of the means ran parallel. Consequently the race differences were marked, although the three dominant Roma subraces (Beas, Olah, and XXX) were not separated in this comparison.

The body mass, BMI, and body fat content are more sensitive to environmental effects than height and physique characteristics (Bouchard et al. 1997). Consequently the relatively greater body

mass and the high body fat content are the consequences of their characteristic life style, namely definite hypo-activity or sedentarism. Since the marked hypo-activity was also characteristic during the observation period among Europid children according to the findings of Laki and Nyerges (2000), we have to evaluate the differences between the quality of everyday nutrition also. As it was stressed in the introductory paragraph of this article, the majority of Roma families represent the lowest socio-economic class of present day Hungarian society. In such economical circumstances the price and quantity of everyday nutrients are determinative. It is a returning observation that the members of poor families are more often fat and obese than those belonging to middle and higher socio-economic classes (Mészáros et al. 1989, Frenkl and Mészáros 2002). The serious hypo-activity can be related to the urban status of our subjects. Higher, but not remarkably high habitual physical activity characterises the rural children in Hungary (Eiben et al. 1991).
The characteristic hypo-activity or definite sedentarism determines the quality of running performances too. The observed better scorings of the Europid sample were also lower than means for non athletic children published 26 years ago (Szabó 1977). The very low level of cardiorespiratory fitness and the high ratio of body fat content together imply greater risks than the mentioned anomalies separately (Bouchard 2000).
Although both ratios were high, the distribution of relative body fat content was about 25% for the Europid boys, and more than 35% (indicating great obesity) for the investigated Roma children.
The observed anthropometric and physical characteristics of Roma children are in close harmony with their low socio-economic status. The possible and necessary solution belongs to the Roma families just in part, since without effective governmental and social intervention the Roma population reproduces enlargedly the observed unfavourable living conditions.

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PHYSIQUE, BODY FAT CONTENT AND MOTOR PERFORMANCE IN TWINS

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Keywords: speed, endurance, physique

Introduction
The inheritance of various anthropometric characteristics is different, it depends for instance on the investigated sample size and age range, however, the available evidence indicate that a significant proportion of the within-pair variation in size and physique is genetically determined (Bouchard et al. 1997). The biologically related persons often have in common similar measurable phenotypic characteristics, however, by using the anthropometric somatotyping technique for the description of physique in male twins had greater heritability indices than in female twins (Carter and Heath 1990). Gender differences could be observed also in other morphological variables.
Since the absolute or relative body fat content is the linear function of energy intake and energy expenditure, no clear agreement exists among the investigators regarding the importance of genetic factors for body fat content (Garn et al. 1989). Body composition and skinfold thickness patterning vary with growth and development, moreover show significant gender differences from early childhood up to adulthood. The dramatic increase in the prevalence of overweight, fatness and obesity in the economically developed countries during the past 4-5 decades also reveals that the non-genetic influences are extremely important in the development of body fat content. Estimated heritabilities in various motor performance scores vary within a very wide range in the early study of Kovar (1981). A variety of running, jumping, and throwing tasks have been considered in non-athletic twins. The comparisons suggest a significant genetic effect during childhood and adolescence, but the magnitude of the effect varies among motor performances and among studies. Some investigations suggest that fine motor performances have a significant genetic component that reaches about 50% of the variation and perhaps more (Pérusse et al. 1987, Malina 1995, Chatterjee and Das 1995). Thus, the genetic influence was significantly reduced by habitual physical activity (Malina and Mueller 1981). Although a great variety of motor perfomance tests are available for estimation of motor qualities, limited data are available for the inheritance level of simple motor performance scores.
The aim of this investigation was to assess the heritability of morphological growth type and selected motor performances in pubertal and postpubertal twins. Comparison of the results of various assessment procedures can be determined as a secondary aim.

Methods
A total of 50 Hungarian, non-athletic volunteer twins were recruited into the comparison. Their calendar age ranged between 13 and 18 years. Among them 22 were identical (13 boys and 9 girls), and 28 (13 boys and 15 girls) dizygotic twins. Zygozity was determined by blood and/or placental analysis. All the pairs were living in the same family. No long

lasting disorders (asthma bronchiale, renal, metabolic, gastrointestinal or endocrine diseases, myocarditis etc.) that may influence on the physiological pattern of child development were reported by the parents. The investigated children and adolescents were the members of middle and high socio-economic class families, thus the possible modifying effects of chronic under nutrition can be excluded definitely.

Growth type indices, describing the physique between the picnomorphic and leptomorphic extremes were determined by the anthropometric characterisation of Conrad (1963). This technique is more often used in the Central European countries and Germany. The metric index is a ratio of chest width and chest depth corrected by the stature. The plastic index is the sum of the shoulder width, lower arm girth and hand circumference. This character is one of the absolute estimations of bone-muscle development, and it has significant correlation with bone-age and motor performance scores in children and adolescents. The successive means of growth type indices describe the age dependent changes in physique and body proportions that is followed by every healthy children.

Body fat content was estimated by the suggestions of Parízková (1961), and expressed as a percentage of body mass. This procedure requires 10 skinfold thicknesses. In taking the necessary body dimensions the guideline of the International Biological Program (Weiner and Lourie 1969) were observed.

Running speed was estimated by the scores in 30 m dash. Reading accuracy: 0.01s. Standing long jump (reading accuracy: 5 cm) and fist ball throw (reading accuracy: 10 cm) were used for the estimation of explosive strength and arm-trunk-leg coordination. Three trials were performed in these tests, and the best results were entered into the statistical analysis.

Cardiorespiratory endurance was estimated by the scores in 1200 m run (reading accuracy: 1s). The pairs were physically tested separately on the same day.

Within-pair linear correlation coefficients were calculated in the groups of monozygotic and dizygotic twins. Differences between the correlation coefficients were tested by Z-transformation at 5% level of random error. The level of inheritance was calculated by two different equations:

$$\text{equation 1: } h^2 = 2 \times (rMZ\text{-}rDZ),$$
$$\text{equation 2: } h^2 = (rMZ - rDZ) \times (1 - rDZ)^{-1}.$$

Results

The results of statistical analysis are summarised in Table 1 and the within-pair differences of motor performnaces scores are shown in Figure 1-4. The vertical axis is scaled by the differences between the first born and second born. The horizontal line in the position of zero value indicates that theoretical case, when no differences were found between the values of identical twins. Dots indicates the monozygotyc twins, and the squares refer to the fraternal twins. According to the published results in the international literature all the correlations were significantly stronger in the group of identical twins in spite of the limited number of subjects. The highest coefficient was found in body mass (r = 0.93) and the lowest one characterises the relationship between the scores in 30 m dash (r = 0.81) in the group of identical twins. The pattern of correlations was only partly similar in the group of dizygotic pairs. The highest correlation was also found in body mass (r = 0.68), however, the within-pair similarity of metric and plastic indices, the relative body fat contents and the scores in 30 m dash, standing long jump and fist ball throw could be characterised by similar correlation coefficients around 0.50 only. Statistical differences between the coefficients calculated in the group of mono- and dizygotic twins were consistently significant.

Table 1. Inheritance in studied variables

Variable	rMZ (n=22)	rDZ (n=28)	h^2 2 × (rMZ-rDZ)	h^2 (rMZ-rDZ) × (1-rDZ)$^{-1}$
Stature (cm)	0.92	0.61	**0.62 (6)**	**0.79 (1)**
Body mass (kg)	0.93	0.68	**0.50 (9)**	**0.78 (2)**
Metric index (cm)	0.88	0.49	**0.78 (1)**	**0.76 (3)**
Plastic index (cm)	0.90	0.53	**0.70 (4)**	**0.79 (1)**
Body fat content (%)	0.82	0.50	**0.64 (5)**	**0.64 (4)**
30 m dash (s)	0.81	0.51	**0.60 (7)**	**0.61 (5)**
Standing long jump (cm)	0.88	0.50	**0.76 (2)**	**0.76 (3)**
Fist ball throw (m)	0.90	0.53	**0.74 (3)**	**0.79 (1)**
1200 m run (s)	0.91	0.62	**0.58 (8)**	**0.76 (3)**

Figure 1. Congruence between 30 m dash scores.

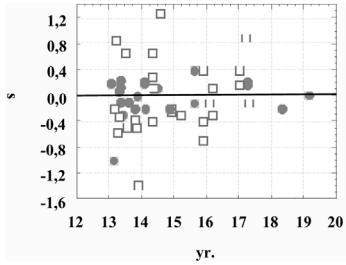


Figure 2. Congruence between standing long jump scores.

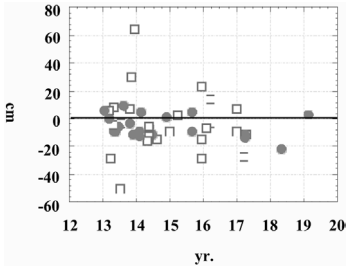
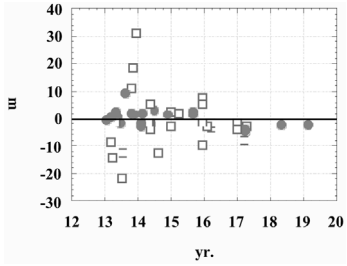


Figure 3. Congruence between fist ball throw scores.



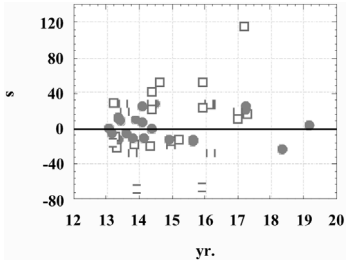


Figure 4. Congruence between 1200 m run scores.

The estimation of inheritance by the used two various techniques yielded different results. The rank order of estimated inheritance (4th and 5th columns of Table 1) can be seen in parenthesis. By using the equation 1 the observed range was wider (0.28 vs. 0.18), consequently this procedure can be evaluated as more sensitive. The first equation estimated the strongest genetic effect in metric index ($h^2 = 0.78$) which character is one of the anthropometric descriptor of physique linearity or roundness. Using the second equation the level of inheritance was similar in stature, plastic index (the indicator of bone-muscle development) and fist ball throw ($h^2 = 0.78$). The lowest genetic determination was found by the first equation in body mass ($h^2 = 0.50$). The second equation resulted the weakest inheritance in 30 m dash ($h^2 = 0.61$). Numerically similar effect was found in the inheritance of relative body fat content ($h^2 = 0.64$). The greatest difference between the two estimates of genetic influences can be observed in body mass ($h^2 = 0.50$ vs. 0.78).

Discussion

According to the international literature the close genetic influence in stature seems to be obvious, nevertheless the environmental effects are greater in body mass. The observed differences between the correlation coefficients found in mono- and dizygotic twins in respect of stature and body mass were similar to the cross sectional observations of Wilson (1986). The very slight differences between the results of the two investigations can be attributed to the various age ranges. The younger the twins are the smaller the absolute within-pair differences are in body dimensions. Our subjects were markedly older.
No observations were found in respect of metric index, the linearity character of physique introduced by Conrad (1963). Since the calculation of relative linearity of anthropometric somatotype needs the height and the body mass, the metric index requires the stature and the two chest diameters, these characteristics (III. somatotype component and metric index) are not directly comparable. The distorting effect of absolute or relative body fat content is lower in metric index than in the relative linearity component of the somatotype (Mohácsi et al. 2001). However, the correlation coefficients for the III. somatotype component of mono- and dizygotic twins published by Song and associates (1994) were very close to the relationships found in metric index. The different statistical relationships of identical and dizygotic twins indicates the significant genetic effect in the age related development of metric index. Nevertheless, the roles of genetic and non-genetic factors in the development of metric index need further investigation with larger samples, wider age range, and preferably with longitudinal data collection. The observed level of inheritance in relative body fat content was slightly higher than the findings of Bouchard and co-workers (1997). This result would be easily related to sampling error in one hand. On the other hand this finding can be evaluated rather as non-genetic influence. The familial effects (dietary habits, habitual physical activity etc.) seem to be stronger in this respect than those of zygozity. The continuously increasing and nowadays higher than 30% ratio of fat and obese children in Hungary cannot be attributed to the genetic background. These non-genetic effects may also have a role in the biologically similar qualification of the used two procedures for the determination of inheritance.
The genetic influence on the observed motor performances were significant irrespective of the technique of calculation. Interestingly the correlations between the scores of dizygotic twins were higher than 0.50 in all the four motor tests. They can be evaluated as being more or less higher than the characteristic correlations in the literature. These relationships do not inform naturally about the quality of performances. Since the investigated children and adolescents were not athletes (they were rather hypoactive or sedentary) the moderate and close relationships describe the similarity between the weak performances. In contrast to the general expectation (namely the genetic determination in speed performances is stronger) the inheritance in the two running tests (30 m dash and 1200 m run) were biologically similar and also statistically moderate. The genetic influence on standing long jump and fist ball throw was higher than that in running performances. The last two performances contain more technical elements than the runnings, consequently the better scoring requires more and regular practice. The more or less similar motor performances contain also the effects of non-genetic factors. Among these the most important ones are the sedentary lifestyle, and the hypoactivity.

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THE CONTRIBUTION OF CLUMSINESS TO RISK FACTORS OF CORONARY VASCULAR DISEASE IN CHILDREN

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Introduction

Pediatric epidemiology research has suggested that major adult coronary vascular disease begins in childhood (Berenson et al., 1997). The purpose of this study was to explore the contribution of clumsiness to risk factors of coronary vascular disease in children. In 1994, the terms "clumsy child syndrome" or "specific developmental disorder" was replaced by "developmental coordination disorder" (DCD) based on the recommendations from the International Consensus Meeting on Children and Clumsiness (Polatajko, Fox and Missiuna, 1995). Currently, the Bruininks-Oseretsky test is recognized as an acceptable North American standard for diagnosing DCD. Since children with DCD have difficulty performing coordinated movements, they are typically characterized as clumsy (Piek & Edwards, 1997). Initially described in the Diagnostic and Statistical Manual III (American Psychiatric Association, 1987, p53), the criteria for DCD was revised in the DSM-IV to include: "1) a marked impairment in the development of motor coordination; 2) the impairment interferes with academic achievement or activities of daily living; 3) the coordination difficulties are not due to a general medical condition or Pervasive Developmental Disorder; and 4) if mental retardation is present, the motor difficulties are in excess of those usually associated with it". These criteria further distinguish DCD as a separate disorder from similar conditions such as apraxia or developmental dyspraxia (Miyahara and Register, 2000). The prevalence of DCD in the North American school-age population ranges from 5-10% (Kadesjo and Gillberg, 1999) with a slightly lower prevalence reported in The Netherlands (Van Dellen, Vaessen and Schoemaker, 1990). This discrepancy is due in part to the use of different instruments with varying criteria being used to diagnose DCD in children. According to Hay and Missiuna (1998), 129,000 Canadian school-aged children may suffer from DCD, however only a fraction of these cases are identified and referred for functional interventions. Since motor difficulties initially present outside the classroom such as recess breaks, DCD children are often excluded from active play opportunities. This exclusion from other children has contributed to the label "playground disability" (Hay and Missiuna, 1998). Of substantial interest, and yet to this moment uninvestigated, is the attendant fact that DCD compromises physical activity levels. Reports by Hay (1996, 2003) and others have consistently shown a marked depression of activity levels among clumsy children. As the prevalence estimates of DCD range from 5 to 10 per cent, this represents a significant proportion of the pediatric population which has an impediment to physical activity. This motoric impairment is rarely considered among the typically ascribed barriers to activity. The motoric impairment of these children is not particularly well addressed by campaigns that promote activity as fun and or challenging, nor by attempts to make facilities more common or accessible. These children have learned to avoid activity since it a source of frutration and failure. Hay has consistently found that clumsy children have significantly lower generalized self-efficacy toward physical activity and that their teachers report them as significantly less interested in activity than their peers. This leaves these children with an impediment to physical activity which goes largely undiagnosed and almost universally unaddressed. These children are substantially less active than their peers and this would appear to have major implciations for heart health. The extent to which clumsiness contributes to an elevated risk of coronary vascular disease by mediating lower activity, increased body fat levels, and lowered aerobic fitness requires further attention.

Methods

A cross-sectional design was used with a convenience sample of 206 eligible participants (120 males, 86 females). Questionnaires were administered in each student's classroom during regular class times prior to all other testing. Participants completed the 61-item Participation Questionnaire which asks children's actual participation levels in the areas of free-time play, seasonal recreational pursuits, school sports, community sports teams and clubs, and sports and dance lessons. Participation in organized activities encompasses a one-year period, and free play is recalled from typical pastime choices (Hay, 1992). Motor proficiency was evaluated using the Bruininks-Oseretsky short form test (BOTMP-SF). The 14-item BOTMP-SF was individually administered to each consenting child in the school's gymnasium behind a curtained barrier to ensure confidentiality. Aerobic fitness level was evaluated using the Léger 20-metre shuttle run test, which has been validated in a school setting for children 6 to 17 years of age (Léger and Gadoury, 1989). Testing was conducted in the school gymnasium during regularly scheduled physical education classes. The speed of the last completed stage (maximal aerobic speed {MAS}) was used to predict the subject's maximal aerobic capacity (VO_{2MAX}). Maximum aerobic capacity expressed as the maximum volume of oxygen utilized during physical activity was predicted using the regression equation: {[6.592 * (MAS)] – 32.678}. A medical scale-stadiometer was employed for the initial body composition measures for height and weight. Body fat was measured using the Bodystat 1500 bioelectrical impedance analyzer (Heyward, 1991).
This study tested a theoretical model linking clumsiness to two risk factors for coronary vascular disease (percent body fat and aerobic fitness) through physical activity levels. The authors incorporated a staged regression approach whereby the outcome variables were regressed on the Bruininks-Oseretsky score for clumsiness, while controlling for age, gender, height and weight. In subsequent models, we introduced variables for physical activity levels including free play and organized activity. A reduction in the coefficient for clumsiness would support the hypothesis that clumsiness is related to body fat through the mediating effect of physical activity.

Results

Prevalence of DCD in this previously undiagnosed population was 0.09±0.03. Average age of male and female subjects was 11.5±1.5 and 11.6±1.4 yrs, respectively. In the first part of the analysis, we examine the effect of clumsiness on aerobic fitness and whether or not two measures of physical activity (free and organized activity) can account for the effect of clumsiness on fitness. It should be noted that a regressing measure on the BOTMP short form suggests progressively significant clumsiness. We suspected, *a priori*, that there would be a difference in the effect of clumsiness on fitness by gender. This was confirmed in a regression model containing an interaction term for gender by clumsiness. For clarity of presentation, we undertook independent analyses for both boys and girls. In both analyses, the effect of clumsiness on fitness was significant for both boys and girls after adjusting for age, weight and height. The effect was in the anticipated direction, whereby increased clumsiness was associated with decreased aerobic fitness level. In Table 1, models 2 and 3, two measures of physical activity were introduced in the analyses for boys. Together, free play and organized activity (model 3) reduce the measure for clumsiness by 11%. Only organized play was significantly related to fitness in the final model. For girls, the introduction of the activity measures in models 2 and 3 reduced the measure for clumsiness by 7% (Table 2). A parallel analyses was incorporated in the second part of the analysis by substituting percentage body fat for aerobic fitness level. No significant ($p>0.05$) interaction was identified between gender and clumsiness in the multivariate model. Therefore, we combined the genders together in the same model (Table 3). After adjusting for gender, age, height and weight, clumsiness was inversely associated with body fat, whereby children with significant clumsiness demonstrated higher body fat. The introduction of the physical activity measures in models 2 and 3 reduced the coefficient for clumsiness by 3%. Neither measure of activity (i.e., free play or organized activity) was significantly ($p>0.05$) related to body fat in the final model.

Table 1. OLS Regression of aerobic fitness level on clumsiness adjusting for age, weight, height and physical activity for boys

Variables	Model 1	Model 2	Model 3
Clumsiness	0.225 ***	0.217 ***	0.200 ***
	(0.045)	(0.044)	(0.043)
Age	1.610 ***	1.409 ***	1.441 ***
	(0.472)	(0.478)	(0.460)
Weight	-0.245 ***	-0.245 ***	-0.264 **
	(0.066)	(0.065)	(0.063)
Height	23.792 ***	25.131 **	26.739 **
	(8.323)	(8.255)	(7.956)
Physical Activity			
Free Play		0.111†	0.054
		(0.058)	(0.059)
Organized Activity			0.377 ***
			(0.121)
Intercept	-9.120	-10.180	-13.499
r-squared	0.447	0.464	0.509

**** p<0.001, **p<0.01, † p<.10*

Table 2. OLS Regression of aerobic fitness on clumsiness adjusting for age, weight, height and physical activity for girls

Variables	Model 1	Model 2	Model 3
Clumsiness	0.101 *	0.101 *	0.094 *
	(0.039)	(0.040)	(0.039)
Age	0.936 *	0.957 *	0.692
	(0.404)	(0.411)	(0.418)
Weight	-0.063	-0.066	-0.066
	(0.042)	(0.043)	(0.041)
Height	-1.398	-1.145	0.735
	(7.059)	(7.125)	(6.998)
Physical Activity			
Free Play		0.022	-0.037
		(0.054)	(0.059)
Organized Activity			0.227 *
			(0.104)
Intercept	24.803	23.984	23.708
r-squared	0.204	0.206	0.256

** p<0.05*

Table 3. OLS Regression of body fat on clumsiness adjusting for age, weight, height and physical activity for boys and girls

Variables	Model 1	Model 2	Model 3
Clumsiness	-0.088 *	-0.086 *	-0.085 *
	(0.036)	(0.036)	(0.037)
Males	-8.622 **	-8.681 **	-8.690 **
	(0.789)	(0.795)	(0.797)
Age	-0.901 *	-0.888 *	-0.872 *
	(0.380)	(0.381)	(0.384)
Weight	0.595 **	0.596 **	0.597 **
	(0.046)	(0.046)	(0.046)
Height	-34.790 **	-34.997 **	-35.288 **
	(6.377)	(6.394)	(6.449)
Physical Activity			
Free Play		-0.031	-0.025
		(0.048)	(0.051)
Organized Activity			-0.040
			(0.099)
Intercept	57.421	57.959	58.303
r-squared	0.654	0.655	0.655

*** p<0.001, *p<0.05*

Discussion/Conclusion

It is widely assumed that habitual physical activity patterns of children is effective in reducing coronary risk factors (Berenson et al., 1997; Raitakari et al., 1994). Regular participation in physical activity has demonstrated a positive correlation with cardiovascular health. Some of these beneficial effects of physical activity in young adults can be seen in coronary risk factors including increased HDL cholesterol, decreased serum triglycerides, and body fat (Donahue et al., 1988). Clumsy children have less self-confidence in physical activities and social skills (Kadesjo and Gillberg, 1999). Challenges with motor coordination are worsened when the perception of low physical competency or social exclusion results in avoidance or withdrawal from physical activity (Missiuna, 1994). Since children with DCD often choose to avoid physical active settings, they may remain unnoticed in the school system for many years (Missiuna, 1994). This avoidance of physical activity leads to long-term health difficulties as the association between

decreased physical activity and increased risk of chronic diseases is well established (Lee and Paffenbarger, 1994; Blair, 1993). Recent preliminary evidence suggests that children with DCD are significantly less physically active, demonstrate lower aerobic fitness and are higher in body fat compared to their non-DCD peers (Hay et al., 2003; Faught et al, 2002). Our results suggest that participation in physical activity is a significant mediator in the relationship between clumsiness and aerobic fitness. Children with significant clumsiness were less likely to be physically active, which in turn is associated with lower aerobic fitness levels. This effect was somewhat stronger for boys than girls. This difference could be attributed to greater variability in physical activity levels found in boys compared to girls. This study did not find a mediating effect for physical activity in the clumsiness-body fat relationship. Children who are clumsy demonstrate a preponderance for higher body fat. However, neither free play or organized activity account for this relationship. It could be suggested that physical activity is more influential on aerobic fitness than body fat, particularly in boys. Body fat may be better explained by other factors including diet and genetic predisposition. Nevertheless, the overall results demonstrate a stronger association between motoric competency and aerobic fitness than body fat. In conclusion, it is important for parents and educators of children with DCD to emphasize daily physical activity in order to improve the risk factor profiles for coronary vascular disease.

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CARDIORESPIRATORY AND MUSCULO-SKELETAL LOADING DURING HIGH SCHOOL PHYSICAL EDUCATION

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Introduction

It has been suggested that physical education should be the principal forum for promoting children's physical activity, because it is the only element of the school curriculum that can practically address their health-related physical activity needs (Strand and Reeder 1996). Support can be lent to this supposition when one considers that the majority of children attend physical education lessons, which in secondary schools at least, are commonly taught within dedicated facilities by specialist teachers. However, participation in optimal levels of physical activity during physical education is hindered by the diverse aims of the subject. The overarching goal should be for students to take part in appropriate amounts of physical activity during lessons, and become educated with the knowledge and skills to be physically active outside school and throughout life (Simons-Morton 1994). However, the emphasis of learning in any particular lesson may quite legitimately have a motor, cognitive, social, spiritual, cultural or moral focus, which may not necessarily be consistent with achieving optimal physical activity levels. For this reason, it is unrealistic to expect every physical education lesson to successfully meet health-related physical activity aims.

Heart rate telemetry and accelerometry are valid measures of children's physical activity, which are concerned with different aspects of this behaviour (Rowlands et al., 1999). Telemetry assesses the demand placed on the cardiorespiratory system during a given activity. The linear relationship between heart rate and energy expenditure then allows an indirect estimation of physical activity. Conversely, accelerometry measures bodily acceleration, which places stress on the musculo-skeletal system. Thus, accelerometer counts may serve as a useful indicator of musculo-skeletal loading during physical activity. Heart rate and accelerometry data can be used to complement each other when attempting to evaluate physical education's contribution to the cardiorespiratory and musculo-skeletal dimensions of physical activity. Moreover, both instruments relate well to current physical activity guidelines for young people, which recommend participation in activities to benefit cardiorespiratory health, and promote musculo-skeletal development (Biddle et al., 1998). Furthermore, activity levels achieved during physical education may make a meaningful contribution to help young people meet recommended physical activity goals (Fairclough, 2003). This investigation assessed high school students' physical activity during a selection of physical education lessons, using heart rate telemetry and accelerometry. The major aim was to establish the extent of cardiorespiratory and musculo-skeletal loading during different activities.

Methods

Fifty five high school students (33 boys, 22 girls, aged 13.0 ± 0.9 years) volunteered to participate in this study. Students' physical activity during physical education lessons was monitored using heart rate telemetry (Vantage XL; Polar Electro Oy, Kempele, Finland), and triaxial accelerometry (Tritrac-R3D; Hemokinetics Inc., Madison, WI). Students were fitted with the equipment while changing into their physical education uniforms. Telemeters were attached by fitting a lightweight chest strap

(transmitter) and wristwatch (receiver), which was covered by a wristband. Accelerometers were placed in sealed pouches that were attached to adjustable fabric belts. Each participant wore the belt with the pouch positioned on their right hip, secured inside the waistband of their shorts or tracksuit pants. Before lessons commenced the telemeters' and accelerometers' internal clocks were synchronised with that of the computer system to which they would be interfaced for data analysis. At the end of the lessons both instruments were removed from each child and returned to the laboratory, where they were interfaced with a PC and data were downloaded for analyses.

Heart rate reserve (HRR) was calculated for each participant using resting and maximum heart rate values. Heart rates ≥ 50% HRR represented health-enhancing moderate-to-vigorous physical activity ($MVPA_{HR}$) (Stratton 1997). Mean activity heart rate (ActHR, i.e., mean heart rate minus resting heart rate, (Welk and Corbin, 1995)) was also calculated to provide a raw measure of cardiorespiratory load. Accelerometer vector magnitude values ≥1000 counts • min^{-1} represented the threshold for $MVPA_{AC}$ (Rowlands et al., 1999). In addition, mean vector magnitude counts • min^{-1} were included as a raw measure of musculo-skeletal loading during lessons. Students were monitored during twenty seven physical education lessons. These were categorised as invasion team games (e.g., soccer, basketball, hockey, etc.), net games (e.g., badminton, short tennis, etc.), movement activities (e.g., gymnastics, dance, etc.) and running/fitness lessons. The latter category was made up of athletics lessons (all with a focus on running events) and lessons where circuit or station training and running activities were the main focus. As sample sizes in each activity category were unequal, and some of the data were not normally distributed, non-parametric Kruskal-Wallis ANOVA's calculated differences in the amount of cardiorespiratory or musculo-skeletal loading during the different activities. Post-hoc Mann-Whitney U tests determined where identified differences occurred. To control for familywise error the Bonferroni correction procedure was applied, which resulted in an acceptable α level of 0.008. Although differences in boys and girls physical activity levels have previously been reported, their data were not treated separately in this study because of the limited sample size within each physical education activity.

Results

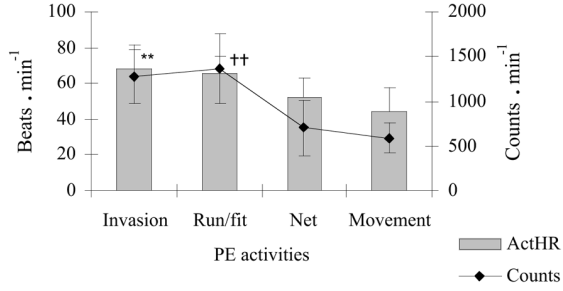
Participants' descriptive data are described in table 1. As expected, raw and adjusted physical activity values highlighted that boys were more active during physical education than girls.

	All (n = 55)	Boys (n = 33)	Girls (n = 22)
	Mean ± SD	Mean ± SD	Mean ± SD
Age (years)	13.0 ± 0.9	13.0 ± 0.7	13.0 ± 1.0
Stature (cm)	153.9 ± 8.7	154.7 ± 10.1	152.7 ± 6.0
Mass (kg)	47.2 ± 12.0	46.0 ± 11.5	48.9 ± 12.6
ActHR (beats • min^{-1})	57.7 ± 15.8	60.3 ± 12.8	53.8 ± 19.1
$MVPA_{HR}$ (% lesson)	39.9 ± 20.4	42.1 ± 17.8	36.7 ± 23.8
Counts • min^{-1}	987.0 ± 439.7	1109.5 ± 407.6	803.4 ± 430.1
$MVPA_{AC}$ (% lesson)	36.4 ± 19.1	42.0 ± 16.0	28.0 ± 20.6

Table 1. Descriptive data of participants.

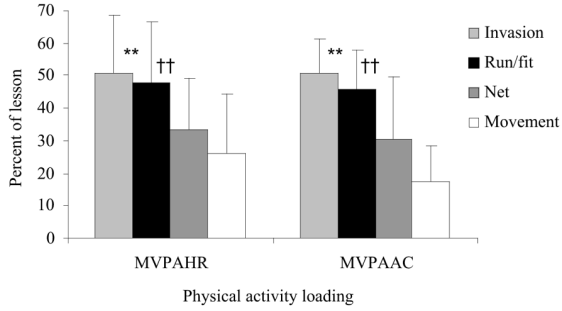
Differences in activity levels during PE activities were consistent, regardless of measurement variable. Students who took part in invasion game and running/fitness lessons engaged in significantly more activity than those who were taught movement activities and net games (significance values ranged from $p < 0.0001$ to 0.004). Figures 1 and 2 provide a composite representation of these data.

Figure 1. ActHR and counts • min^{-1} during different physical education activities.



*** Counts • min^{-1} during invasion games > net games (Z= -3.70, p < 0.0001) and movement activities (Z = -5.09, p< 0.0001). ActHR during invasion games > net games (Z= -3.40, p = 0.002) and movement activities (Z = -4.03, p < 0.0001).*
†† Counts • min^{-1} during running/fitness activities > net games (Z = -2.86, p = 0.004) and movement activities (Z = -4.08, p < 0.0001). ActHR during running/fitness activities > movement activities (Z = -3.23, p = 0.001).

Figure 2. Percentage of lesson time engaged in $MVPA_{HR}$ and $MVPA_{AC}$ during different physical education activities.



*** $MVPA_{HR}$ during invasion games > movement activities (Z = -3.50, p< 0.0001). $MVPA_{AC}$ during invasion games > movement activities (Z = -5.09, p < 0.0001).*
†† $MVPA_{HR}$ during running/fitness activities > movement activities (Z = -2.58, p = 0.01).). $MVPA_{AC}$ during running/fitness activities > movement activities (Z = -3.68, p < 0.0001).

Discussion

This investigation used heart rate telemetry and accelerometry to assess the extent to which a range of high school physical education lessons loaded the students' cardiorespiratory and musculo-skeletal systems. It is evident that the invasion game and running/fitness activities monitored were more able to engage the students in health-enhancing physical activity than net game and movement activities. These findings are supported by previous investigations that employed heart rate teleme-

try (Stratton 1997) and systematic observation (McKenzie et al. 1995). The nature of invasion games and running/fitness activities place a greater requirement on the students to be constantly moving, either as part of a team dynamic, or to accomplish a set task. Therefore, these activities emphasise full body movement, which places a large amount of stress on the major muscle groups. For these reasons, both activities engaged students in MVPA, regardless of measurement instrument, for approximately 50% of lesson time, which is the target recommended in the UK (Harris 2000) and US (USDHHS 2000). Conversely, net games and movement activities place a greater emphasis on motor skill and aesthetic performance, respectively, and as a result provided fewer opportunities for activity engagement.

Although there were significant differences in the amount of time that the activities promoted $MVPA_{HR}$ and $MVPA_{AC}$, the standard deviation values indicate the large variability in range of time spent in these thresholds. Although the most active students met the 50% of lesson time criteria in each of the activities (with the exception of movement activities), the least active students experienced MVPA for only ~30% (invasion games) to ~10% of lesson time (movement activities). This illustrates the differences in physical activity participation within and between different physical education activities, which are commonly attributed to inter-individual, pedagogical and environmental differences. Moreover, the accelerometer standard deviation values were generally smaller than for the heart rate data. Compared to the heart rate data, it is possible that the accelerometer data provided a more accurate representation of the students' activity. This may be because during inactive parts of the lessons, students' heart rates remained elevated for a period of time before decreasing to resting levels. As physical education lessons are characterised by intermittent periods of activity and inactivity, due to the pedagogical processes taking place (i.e., organising, instructing, demonstrating, etc.), it is likely that this lagged heart rate response occurred on a number of occasions. In contrast, accelerometers measured only the movement that took place, regardless of any physiological processes that were occurring.

These data have revealed that some physical education activities are more likely to stress the cardiorespiratory and musculo-skeletal systems more effectively than others. From a health perspective this information should be used to inform curriculum design. As students progress through their secondary school years, many students' interest in physical activity tends to wane. It may be appropriate for students to experience a greater proportion of health-enhancing activities during these years, to compensate for any decrease in activity levels outside of school. However, these lessons would have to be meaningful and enjoyable, in order for students to maintain a positive attitude towards physical activity participation once they have left compulsory education.

Conclusion

This investigation has revealed that during secondary school physical education lessons, activities that emphasise full body movement over consistent time periods are able to load the cardiorespiratory and musculo-skeletal systems to recommended levels. While all activities have the potential to achieve this, contextual factors that are difficult to control for in the fluid physical education environment preclude this from happening frequently. If health-enhancing physical activity is recognised as an important physical education goal, then findings such as these should inform future curriculum design, especially with students who are in the middle and upper years of secondary education.

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ENERGY INTAKE AND EXPENDITURE OF HIGH AND LOW ACTIVE CHILDREN

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Keywords: energy intake, energy expenditure, children

The effects of different levels of energy expenditure (EE) on energy intake (EI) are not fully understood, especially in young people. Therefore, the aim of this study was to compare the EI between a high and a low active group of children. Two hundred children participated in a physical activity survey (adapted from Cale, 1993). Boys and girls classified with the lowest and highest EE scores ($kcal.kg^{-1}.d^{-1}$) were then invited to participate further in the study. On three days (Sunday, a physical education day (PE) and a control-day, without PE) 34 boys and girls 12±1 years old again completed the same physical activity questionnaire and reported their food intake (24-hours recall). Body mass did not differ between the low active (47±5 kg) and the active (48±11 kg) groups ($p>0.05$). Average EE (3 days) was significantly greater in the active group compared to the low active group, 1922 ± 415 $kcal.d^{-1}$ and 1632±198 $kcal.d^{-1}$, respectively ($p<0.05$). The children expended on average more energy during the PE-day 1844 ± 401 $kcal.d^{-1}$ compared to Sunday 1729 ± 339 $kcal.d^{-1}$ ($p<0.05$) and the control day 1711 ± 354 $kcal.d^{-1}$ ($p<0.01$). EE was also greater between both activity groups during PE and the control-day ($p<0.05$). EI (3 days) tended to be lower in the low active group 2121 ± 361 $kcal.d^{-1}$ compared to the active group 2470 ± 542 $kcal.d^{-1}$ ($p<0.06$). However, only on the PE-day was EI higher in the high active group 2485±635 $kcal.d^{-1}$ compared to the low active group (2035±491 $kcal.d^{-1}$) ($p<0.05$). This difference was associated with a higher carbohydrate intake ($p<0.05$). In both

activity groups a positive energy balance (EB = EI - EE) of ~ 500 kcal.d^{-1} was observed. However, during the PE-day children had the lowest positive energy difference ($p>0.05$). Despite higher EE on the PE-day it was not enough to compensate for the higher EI. This lower positive energy balance on a PE-day suggests a weak but possible mechanism of body mass control.

PHYSICAL ACTIVITY: SOCIO-ECONOMICAL DIFFERENCES IN FLEMISH YOUTH

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Keywords: physical activity, computer-assisted questionnaire, adolescents

Introduction
It is well documented that a sedentary lifestyle is an important risk factor for obesity and other health-related fitness characteristics. Studies have also indicated that there is a positive association between the socio-economical and the physical activity status of adults. However, the concept of socio-economical status has been used in different ways. The most used measurements of socio-economical status are income, educational level, and profession (Pill et al., 1995; Chinn et al., 1999; Lindström et al., 2001). The differences between socio-economical and socio-professional status are rather small. Most of the studies focused on the relationship in adults. However, few studies investigated this relationship in youth. A Dutch study confirmed the positive association between socio-economical status of the father and the children's physical activity. Children's behaviour was less healthy (sedentary lifestyle) when the father had a job in the lower professional classes (Van de Mheen et al., 1998). The same relationships were found in other countries (Haglund 1984; Sallis et al., 1996; Scheerder et al., 2002). However, some other studies did not find an association between socio-economical status and physical activity (Aaron et al., 1993; Mota & Silva, 1999; West et al., 2002). The aim of this study was to investigate the relationship between the socio-economical status of the family and the physical activity level in Flemish adolescents.

Methods
In total 6.117 adolescents (2.379 boys and 3.738 girls between 12 and 18 years) participated in this study. Physical activity was measured by means of a computer-assisted questionnaire. Activity indices included moderate and heavy activities (frequency per week), sport participation during leisure time (h/week), passive and active transport (h/week, school and leisure time together) and total physical activity (h/week). Total physical activity included physical education and sport participation in school, active transport, sport participation during leisure time, and dancing during night life. Watching TV and computer business (h/week) were included as a measure of inactivity. Socio-economical status (3 levels: low, middle and high) was derived from the professions of the parents. Two-way ANOVA's with age (7 levels) and socio-economical status (3 levels) as independent factors were used in boys and girls separately. The 0.05 and 0.01 significance levels were used.

Results
In boys, physical activity indices showed no significant differences between the socio-economical levels, except for inactivity (table 1). Boys from the low socio-economical level spend 26.4 h/week on sedentary behavior, compared to 24.4 h/week for the boys from the high level ($p<0.05$). Passive transport showed a significant age effect with the highest values at older ages ($p<0.01$). In girls, the differences in physical activity indices according to socio-economical status were more pronounced (table 2). Differences were found for all physical (in)activity variables, except for active transport. Girls from the low socio-economical level had lower values for physical activity and higher values for physical inactivity, compared to their peers from the middle and high level. Clear age effects were found for moderate and heavy activities, and passive transport. Older girls had lower values for moderate and heavy activities, and higher values for passive transport. Moreover, interaction effects (group x age) indicate the biggest drop in the physical activity values (frequency of heavy and moderate activities, and sport participation) for the girls from the low socio-economical level. The oldest girls from the low, middle, and high socio-economical levels are participating on average respectively 1.1 (±1.0), 1.3 (±1.4), and 2.0 (±1.9) times per week in heavy activities (of at least 20 minutes). The same trend has been observed for the number of days participating in moderate activities (at least 60 minutes per day), respectively 0.9 (±1.0), 1.6 (±1.5), and 1.7 (±1.8) days per week.

Discussion
The present data clearly show higher values for physical activity in boys compared to girls, which is clearly documented in previous studies (Aaron et al., 1993; Lindquist et al., 1999; Sallis et al., 1999; Aarnio et al., 2002). Girls are still more prone to sedentary behavior, even in the beginning of the third millennium. Also the decline in physical activity with older age has been documented previously (Caspersen et al., 2000; Telama & Yang, 2000; Trost et al., 2002).
In this study, the socio-economical status of the children was derived from the professions of the parents. Although the socio-economical status can be defined in several ways, the present method also had been used in some other studies. However, studies focusing on the relationship between physical activity and socio-economical status in children and youth remain scarce.
The main results indicate that there still is a positive association between socio-economical status and physical activity in Flemish adolescent girls, which was not confirmed in boys. The impact of the socio-economical status of the family on the physical activity of the children should not be underestimated. First, the relationship between physical activity and socio-economical status in adults has been documented. Kawashi et al. (1997) found that families with low income less invest in social capital like education and health care. Second, some studies concluded that children from lower socio-economical status experience financial shortage which possibly obstructs sports club membership (Sallis et al., 1996; Van de Mheen et al., 1998).
In conclusion, children and adolescents from Flemish families

with lower socio-economical status are less physically active than their peers from a higher socio-economical level. Moreover, physical activity programs and promotion should pay special attention to girls.

Table 1: Differences in physical (in)activity in Flemish boys in relation to their socio-economical status (SES).

		SES			effect		
variable	age	low	middle	high	group	age	group x age
Total activity	12	13,4 ± 6,1	16,3 ± 7,9	16,6 ± 8,2	ns	ns	*
(h/week)	13	18,4 ± 9,4	15,7 ± 8,1	15,8 ± 9,0			
	14	15,0 ± 8,1	17,8 ± 8,9	16,8 ± 8,5			
	15	18,4 ± 9,2	15,4 ± 8,4	16,3 ± 9,1			
	16	16,4 ± 8,8	17,4 ± 8,9	17,6 ± 7,9			
	17	17,9 ± 7,1	16,2 ± 8,1	16,5 ± 7,8			
	18	18,0 ± 7,9	16,8 ± 9,8	15,1 ± 8,4			
Frequency	12	2,5 ± 1,9	3,1 ± 2,0	2,7 ± 2,1	ns	ns	ns
heavy activities	13	3,1 ± 2,0	3,0 ± 2,1	2,9 ± 2,2			
(n/week)	14	2,8 ± 2,3	3,0 ± 2,2	2,6 ± 1,9			
	15	3,4 ± 2,2	2,7 ± 2,4	2,9 ± 2,3			
	16	3,4 ± 2,4	3,0 ± 2,2	3,1 ± 2,2			
	17	3,2 ± 2,0	2,7 ± 2,0	3,0 ± 2,2			
	18	2,9 ± 2,3	3,0 ± 2,5	3,1 ± 2,6			
Frequency	12	2,2 ± 1,8	2,7 ± 1,8	2,5 ± 1,9	ns	*	ns
moderate activities	13	2,2 ± 1,5	2,4 ± 1,7	2,2 ± 1,6		13><16	
(days/week)	14	2,2 ± 1,6	2,6 ± 2,0	2,7 ± 1,9			
	15	2,8 ± 2,2	2,6 ± 2,0	2,9 ± 2,2			
	16	2,7 ± 2,2	2,5 ± 1,9	3,1 ± 2,2			
	17	2,5 ± 2,0	2,5 ± 2,1	2,4 ± 2,0			
	18	2,3 ± 2,2	2,2 ± 2,1	2,8 ± 2,2			
Sports	12	4,6 ± 3,7	6,2 ± 4,2	6,2 ± 4,9	ns	ns	ns
(h/week)	13	6,3 ± 5,0	5,7 ± 4,1	5,3 ± 4,2			
	14	4,7 ± 4,3	6,9 ± 4,7	6,2 ± 4,8			
	15	7,1 ± 5,1	5,6 ± 4,8	5,8 ± 5,0			
	16	6,3 ± 5,2	6,8 ± 5,5	6,6 ± 4,7			
	17	6,5 ± 4,5	6,0 ± 5,1	6,3 ± 4,8			
	18	6,5 ± 5,3	6,0 ± 5,8	6,0 ± 5,5			
Passive transport	12	2,2 ± 2,5	3,4 ± 2,8	2,9 ± 2,6	ns	**	ns
(h/week)	13	3,1 ± 2,9	2,6 ± 2,6	2,9 ± 2,6		12,13><15,16,17	
	14	3,3 ± 3,0	3,2 ± 3,0	3,5 ± 3,0		12,13,14><18	
	15	3,7 ± 3,2	3,7 ± 3,0	4,0 ± 2,9		15,16><18	
	16	3,7 ± 3,1	3,7 ± 3,0	3,9 ± 3,5			
	17	4,0 ± 3,2	4,0 ± 3,3	4,0 ± 3,1			
	18	4,0 ± 3,0	5,1 ± 3,2	5,2 ± 3,1			
Active transport	12	5,4 ±4,2	6,1 ± 4,6	6,8 ± 5,1	ns	ns	ns
(h/week)	13	6,9 ± 5,2	6,0 ± 4,9	6,9 ± 5,6			
	14	6,4 ± 4,3	6,6 ± 5,0	7,1 ± 5,1			
	15	6,4 ± 4,1	6,1 ± 4,8	6,9 ± 4,8			
	16	5,5 ± 3,9	6,1 ± 4,5	6,3 ± 4,6			
	17	5,8 ± 3,8	5,8 ± 4,4	5,7 ± 4,4			
	18	7,0 ± 4,7	5,7 ± 5,1	4,6 ± 4,2			
TV and computer	12	24,9 ± 11,2	24,5 ± 11,9	26,1 ± 11,5	*	ns	ns
(h/week)	13	27,3 ± 11,1	24,6 ± 11,6	22,8 ± 11,7	1><3		
	14	24,5 ± 11,1	25,3 ± 11,0	25,6 ± 12,1			
	15	28,4 ± 12,0	26,3 ± 11,4	25,5 ± 11,2			
	16	24,9 ± 10,6	26,3 ± 11,2	23,6 ± 11,7			
	17	28,5 ± 13,3	25,4 ± 11,4	22,9 ± 12,3			
	18	25,6 ± 13,1	27,0 ± 11,9	22,4 ± 12,8			

*Values are means ± SD; * p<0.05; ** p<0.01; >< indicates differences between groups*

Table 2: Differences in physical (in)activity in Flemish girls in relation to their socio-economical status (SES).

		SES			effect		
variable	age	low	middle	high	group	age	group x age
Total activity	12	11,2 ± 5,6	11,8 ± 7,0	12,9 ± 7,8	**	**	ns
(h/week)	13	10,2 ± 6,1	11,7 ± 6,7	12,1 ± 7,3	1><2><3	13><16,17	
	14	12,1 ± 7,3	12,3 ± 6,6	12,8 ± 7,5		16,17><18	
	15	11,1 ± 6,5	13,0 ± 6,4	12,8 ± 6,9			
	16	12,7 ± 6,5	12,8 ± 6,7	14,2 ± 7,4			
	17	11,5 ± 6,0	12,5 ± 6,6	15,0 ± 7,5			
	18	9,7 ± 6,2	11,2 ± 6,9	12,6 ± 6,5			
Frequency	12	1,6 ± 1,5	2,0 ± 1,8	2,2 ± 2,0	**	*	*
heavy activities	13	1,3 ± 1,4	2,0 ± 2,0	2,0 ± 1,6	1><2><3	12,13,14><18	
(n/week)	14	1,9 ± 1,7	1,9 ± 1,7	1,9 ± 1,6		15,16><18	
	15	1,5 ± 1,6	2,0 ± 1,7	2,2 ± 1,8			
	16	1,7 ± 1,8	1,9 ± 1,7	1,7 ± 1,9			
	17	1,5 ± 1,6	1,5 ± 1,5	2,2 ± 2,1			
	18	1,1 ± 1,0	1,3 ± 1,4	2,0 ± 1,9			
Frequency	12	1,8 ± 1,4	1,8 ± 1,4	2,1 ± 1,7	**	**	**
moderate activities	13	1,3 ± 1,5	2,0 ± 1,7	1,9 ± 1,4	1,2><3	12,13><18	
(days/week)	14	2,1 ± 1,7	1,9 ± 1,6	2,1 ± 1,6		14><17,18	
	15	1,4 ± 1,5	2,1 ± 1,9	2,0 ± 1,9		15,16><18	
	16	2,0 ± 1,8	2,0 ± 1,9	1,9 ± 1,8			
	17	1,5 ± 1,6	1,5 ± 1,6	2,0 ± 1,9			
	18	0,9 ± 1,0	1,6 ± 1,5	1,7 ± 1,8			
Sports	12	3,1 ± 3,1	3,8 ± 3,7	4,8 ± 4,3	**	ns	*
(h/week)	13	3,0 ± 3,4	3,8 ± 3,8	4,1 ± 4,1	1><2><3		
	14	4,1 ± 4,2	4,1 ± 3,9	4,3 ± 4,0			
	15	3,3 ± 3,9	4,3 ± 4,0	4,1 ± 3,9			
	16	3,7 ± 4,1	3,9 ± 3,9	4,6 ± 4,4			
	17	3,3 ± 3,8	3,2 ± 3,6	5,1 ± 5,1			
	18	2,4 ± 3,7	2,6 ± 3,4	4,4 ± 4,3			
Passive transport	12	3,3 ± 3,2	3,5 ± 2,9	4,0 ± 3,4	**	**	ns
(h/week)	13	3,5 ± 2,9	3,7 ± 3,1	3,7 ± 3,0	1><3	12,13,14><16	
	14	3,2 ± 2,8	3,8 ± 2,9	3,8 ± 3,1		12,13,14><17,18	
	15	3,5 ± 2,7	4,0 ± 3,1	3,8 ± 3,2		15><16,17	
	16	4,3 ± 3,2	4,7 ± 3,2	4,8 ± 3,4		15><18	
	17	4,3 ± 3,1	4,8 ± 3,0	4,8 ± 3,3		16><18	
	18	4,9 ± 3,4	5,1 ± 3,1	6,9 ± 3,7			
Active transport	12	4,9 ± 4,7	4,9 ± 4,3	4,8 ± 4,2	ns	ns	ns
(h/week)	13	4,7 ± 4,2	5,1 ± 4,1	5,0 ± 4,5			
	14	4,8 ± 4,0	5,1 ± 3,8	5,0 ± 4,2			
	15	4,4 ± 3,6	5,3 ± 3,9	5,1 ± 4,0			
	16	5,1 ± 3,9	4,6 ± 3,8	5,1 ± 3,9			
	17	4,4 ± 3,6	4,9 ± 3,5	5,0 ± 3,7			
	18	3,5 ± 3,5	4,5 ± 3,9	4,3 ± 3,5			
TV and computer	12	23,1 ± 10,4	23,2 ± 10,8	20,4 ± 10,8	**	**	ns
(h/week)	13	26,8 ± 10,7	25,9 ± 10,1	22,5 ± 10,4	1,2><3	12><13	
	14	24,4 ± 10,5	24,3 ± 10,9	23,4 ± 10,5		13,14,15,16><17	
	15	26,1 ± 10,9	23,9 ± 10,8	22,7 ± 10,9			
	16	24,3 ± 10,8	25,0 ± 11,2	22,8 ± 10,3			
	17	23,0 ± 11,6	21,6 ± 10,5	20,2 ± 10,6			
	18	24,0 ± 11,1	23,1 ± 10,4	20,8 ± 10,4			

*Values are means ± SD; * p<0.05; ** p<0.01; >< indicates differences between groups*

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PHYSICAL FITNESS AND SOCIO-ECONOMIC STATUS IN CHILDREN AND YOUTH. THE MADEIRA GROWTH STUDY

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Keywords: physical fitness, socioeconomic status, The Madeira Growth Study

The main purpose of this study was to investigate the associations between socioeconomic status (SES) and physical fitness levels in children and youth from the Autonomus Region of Madeira. A stratified sample of 507 students (251 girls, 256 boys), aged 8 to 18 old, including 5 cohorts (8, 10, 12, 14 and 16) was followed during three consecutive years (1996, 97 and 98) using a mixed longitudinal design.
Physical fitness was assessed with the Eurofit test battery. SES was evaluated with a questionnaire developed by the Portuguese Institute of Statistics. Stratification of socioeconomic groups was done with the Graffar method identifying three groups: low, average and high SES. ANOVA was used to test for differences among SES groups. For all calculations SAS was used.
Boys from the low SES group are more proficient than the high SES group in sit and reach, bent arm hang, standing long jump and 12 minutes walk/run for some age intervals. In contrast, the high SES group presents better results than the low SES group in sit ups, shuttle run and handgrip. For girls, differences are virtually non-existent. For standing long jump, sit ups, and shuttle run the results are better for the high SES group. In flamingo balance, the average and low SES groups show better performance than the high SES group at 7 to 9 years old.
Conclusions: (1) SES correlations are more pronounced in boys than in girls; (2) physical fitness levels are not always different between the SES groups, consequently there is no clear trend favouring high SES. These results call for a more detailed analysis looking at possible interactions of SES with biological maturation and motivation for sports participation that may induce relevant changes in physical fitness. It is also suggested that familial and genetic studies could provide more profound insight into the complexities of relating SES with physical fitness and physical activity.

VALIDITY OF THE PAQ-C SELF-REPORT PHYSICAL ACTIVITY QUESTIONNAIRE FOR CHILDREN LIVING TRADITIONAL VS CONTEMPORARY LIFESTYLES

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Keywords: physical activity, accelerometer, self-report

Introduction
Self-report surveys are widely used to assess physical activity behaviour in various populations because of their relatively low cost and participant burden. However, due to suspected memory errors in younger children (< 10 years-old), the validity of these instruments has been called into question (Montoye et al., 1996). The Physical Activity Questionnaire for Older Children (PAQ-C) was developed to assess physical activity in school-children (ages 8 to 14 years) during the school year (Kowalski et al., 1997). This is a 10-item questionnaire based on sport participation and activity anchored to a school day. The responses from the PAQ-C are averaged and a score from 1 (low activity) to 5 (high activity) is derived. The PAQ-C has become a widely used instrument to assess physical activity in children, however, the questionnaire has only been validated on contemporary living Canadian children. The validity of the PAQ-C to assess physical activity in children living in different cultures has not been explored. Communities of Old Order Mennonites (OOM) in Canada who live a traditional rural lifestyle without the modern conveniences of contemporary living (e.g. no motorized vehicles, TV, radio, computers, video games, organized sport) represent an ideal group to test how robust the PAQ-C is for assessing physical activity in children. Therefore, this study evaluated the concurrent validity of the PAQ-C, when compared to accelerometry, to assess physical activity in children living traditional (OOM) and contemporary lifestyles.

Methods
The physical activity behaviour of 9- to 12-year-old boys and girls was measured using the MTI accelerometer and the PAQ-C. One hundred and twenty-four Old Order Mennonites (OOM) were compared to both rural (n=165) and urban (n=110) dwelling children. The OOM live a traditional lifestyle whereas the rural and urban children live a contemporary Canadian lifestyle. Seven consecutive days of minute-by-minute objective physical activity measurements were obtained using accelerometry with the PAQ-C administered on the final day.

Results
There were no significant differences in mean PAQ-C scores between groups (OOM=3.05, rural=3.00, and urban=3.03). Correlation coefficients between PAQ-C scores, average accelerometer movement counts per minute (cnts/min), minutes of moderate (3-6 METS) physical activity per day (MPA), and minutes of moderate and vigorous (3+ METS) physical activity per day (MVPA) were determined for each group (Table 1).

Table 1: Correlation matrix showing the relationships among PAQ-C scores and direct accelerometry measures.

	OOM	RURAL	URBAN
CNTS/MIN	-.018	.403*	.278*
MPA	-.047	.373*	.001
MVPA	-.036	.394*	.095*

** significant correlations at $p < .05$*

Discussion/Conclusion
The results suggest that the PAQ-C instrument is not valid for

use with traditional societies like the OOM. Because the PAQ-C is designed to measure institutionalized forms of physical activity, it may fail to capture the activities of daily living relevant to the OOM population. Additionally, the PAQ-C may not be a valid measure of physical activity behaviour for urban dwelling children because of the tendency of some children to over-report their participation in physical activity. When the children with the top 10 PAQ-C scores from each group were analysed, the urban children had significantly higher PAQ-C scores compared to the OOM children, yet their objective physical activity measurements were no different. This study highlights the importance of ensuring the cultural appropriateness of measurement isnstruments when performing research.

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ENERGY EXPENDITURE OF SEDENTARY ACTIVITIES IN YOUTH

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Keywords: sedentary activities, leisure activities, energy expenditure

Introduction

Although investigation of moderate and vigorous activities is a primary focus of much research, increasing sedentariness among children and youth is reported and there is a documented need to understand more about the energy expenditure of sedentary activities (Marshall *et al.*, 2002). A highly sedentary lifestyle is considered a major contributing factor to non-communicable diseases (e.g., heart disease, type-2 diabetes, and some cancers) in many countries. With increasingly sedentary lifestyles comes a parallel growing burden in terms of personal, social, and overall economic burden, thus there is a global concern regarding the prevalence of a sedentary lifestyle (World Health Organization: 55th World Health Assembly, Mar 27, 2002).

Inactivity has been shown to start as early as 8 years of age and inactivity is more likely than a highly active lifestyle to track, or persist into adulthood (Kimm *et al.*, 2002). Further, when large amounts of time are spent in sedentary pursuits, there is less time for more vigorous activities (Marshall *et al*., 2002).

Increased sedentariness is documented in everyday leisure activities, as well as in school, where children spend a preponderance of their time: A large national study demonstrates an average of only about 25 minutes of moderate to vigorous PA per week in PE classes *per week*, well under the Healthy People 2010 goals for frequency and intensity of PA (The National Institute of Child Health and Human Development Study of Early Child Care and Youth Development Network, 2003). In the Cardiovascular Health in Children and Youth (CHIC) study, homework, reading, video games, and TV watching were among the most common activities reported in children and youth ages 8-17 (Bradley *et al.*, 2000). Of these common childhood activities, TV watching has been studied most often. Reports of time spent watching TV vary from as little as 1 or 2 hours a day (Hernandez *et al.*, 1999;Lindquist *et al.*, 1999), which is similar to the 5 to 15 hours per week reported by Robinson (1999), to a report of 23 hours/week (Faith *et al.*, 2001).

If we can understand more precisely the energy expenditure of activities considered sedentary and in which children participate regularly, we can gain a more complete understanding of sedentariness. An improved understanding of sedentary activities in children can aid in the development of interventions for reallocation of sedentary activities to a higher level of energy expenditure. Reallocation of even small numbers of activities to those that expend more energy can support increases in overall energy expenditure (Blair *et al.*, 1992;Marshall *et al*., 2002). In adults, TV viewing is estimated to be at the same energy expenditure as rest, with a MET of 1.0 (Ainsworth *et al.*, 2000). But is this true for children and adolescents? Energy expenditure (EE) for sedentary activities in children and youth is primarily based on estimates. More precise measurement of these activities is needed to understand the contribution of sedentary activities to total energy expenditure, as well as to provide a more informed base for intervention development.

The primary purpose of the Energy Expenditure of Physical Activity in Youth Study (EEPAY) was to determine energy expenditure in terms of oxygen uptake, caloric cost, and metabolic equivalent (MET) level of activities common to children and adolescents (ages 8-18), to evaluate the differences by age and gender, and to compare results with published METs of the Compendium (Ainsworth *et al*., 2000). This presentation gives data from a subset of the activities measured in the EEPAY study. The purpose is to evaluate energy expenditure of common sedentary activities and to determine if VO_2 differences of sedentary activity are (a) significantly different from energy expenditure at rest, or (b) if they differ by gender. The activities examined are TV viewing, video games (while seated and while standing), reading, planning a board game, and taking a computerized math test.

Methods

All procedures were approved by a multiple assurance Internal Review Board. Written informed parental consent and child assent were completed by all participants. Measurements were performed at the Applied Physiology Laboratory at the University of North Carolina. The study involved 317 children and youth, ages 8-18, with at least 10 subjects of each age and gender; that is, there were at least 10 boys and 10 girls who were aged, 8, aged 9, etc. Overall, 47% of the subjects were female and 53% male.

Self-administered questionnaires were used for age, sex, and racial affiliation and the Pubertal Development Scale (PDS) was used to determine self-reported pubertal status. The PDS is a scale that is widely used for determination of pubertal status and has been validated with physician-based ratings of pubertal development (Petersen *et al.*, 1988), by interview assessments of maturity (Brooks-Gunn *et al.*, 1987) and with self-reports using picture comparisons (Petersen *et al*., 1988). Internal consistency

reliability of the PDS ranges from a Cronbach alpha of 0.68 to 0.83 (Brooks-Gunn *et al.*, 1987;Petersen *et al.*, 1988).
We measured oxygen uptake (VO_2) with a portable metabolic system (COSMED K4b²), which is documented to accurately measure energy expenditure (McLaughlin *et al.*, 2001). Consistency for breath, CO_2 and O_2 were established. Measurements were taken at rest, and during 6 sedentary activities: board games, math test, self-selected homework or reading, a computer-adaptive math test, watching TV, and two types of non-violent video games (a seated Nintendo game and arcade style video games, completed while standing). Each of the activities was performed for 10 minutes, with a 5 minute break between the activities. The activities were done in the same manner by all subjects, following a carefully designed protocol. Subjects were familiarized with the portable metabolic system and instructed in all procedures and activities by trained research assistants. Data were collected breath-by-breath and later were averaged over the data collection period to provide the mean VO_2 for each activity. One of the investigators (RGM) reviewed the graphic print-outs of the data for all subjects to eliminate artefacts and assure that steady state was reached for all activities. To further assure steady state, the first two minutes and last minute of data for each activity were excluded. Thus data were analyzed for 7 minutes of each activity.
Analyses included descriptive statistics for demographic data, ANOVAs to determine age and gender differences, paired t-test, and two-sample t-tests for assessment of gender differences. Because of VO_2 similarities across ages, overall age groups were identified and results are provided for age-group rather than for each age. The age groups varied slightly for boys and girls, most likely because girls reach physical maturity at an earlier age and boys. For girls, group 1 = 8-11 years; group 2 = 12-14 years; group 3, 15-18 years. For boys, group 1 = 8-12 years; group 2 = 13-15 years; and group 3 = 16-18 years.

Results

The results are shown overall, with boys and girls combined, in Table 1. VO_2 differed significantly across age groups for all activities ($p<0.0001$ from one-way ANOVA). A post hoc test (Student-Newman-Kuels) showed that VO_2 decreased significantly ($p<.05$) with increasing age group (see Table 1).

Table 1: Mean VO_2 (ml/kg/min) for each Age Group

Activity	Age Group	N	VO_2	sd
Resting	1	129	5.92	1.41
Resting	2	83	4.58	1.22
Resting	3	83	4.00	0.79
TV Watching	1	117	6.00	1.40
TV Watching	2	75	4.79	1.17
TV Watching	3	83	4.21	1.07
Reading	1	134	6.56	1.70
Reading	2	88	5.23	1.32
Reading	3	93	4.51	0.94
Math	1	126	7.18	1.78
Math	2	78	5.72	1.44
Math	3	84	4.89	1.23
Video Game (sit)	1	134	7.05	1.78
Video Game (sit)	2	90	5.71	1.32
Video Game (sit)	3	93	4.96	0.99
Board Game	1	125	7.64	1.88
Board Game	2	77	5.85	1.37
Board Game	3	84	5.22	1.16
Video game (stand)	1	126	8.36	2.36
Video game (stand)	2	78	6.53	1.71
Video game (stand)	3	83	5.78	1.98

As shown in Table 2, there were some differences in EE by gender. VO_2 was slightly, but non- significantly greater in males for all but one activity. When using a Bonferroni correction for multiple analyses, the only significant difference by gender was for VO_2 during standing video games, which was higher for boys (7.5 ml/kg/min, sd ±2.3) than girls (6.6ml/kg/min sd ±2.4).

Table 2: Mean VO_2 (ml/kg/min) for each Gender

Activity	Sex	N	VO_2	sd
Resting	F	138	4.86	1.50
Resting	M	157	5.12	1.43
TV Watching	F	133	4.95	1.45
TV Watching	M	142	5.30	1.47
Reading	F	151	5.39	1.69
Reading	M	164	5.76	1.61
Video Game (sit)	F	151	5.94	1.84
Video Game (sit)	M	166	6.16	1.57
Math	F	135	5.88	1.79
Math	M	153	6.32	1.84
Board Game	F	134	6.17	1.93
Board Game	M	152	6.70	1.83
Video Game (stand)	F	134	6.63	2.36
Video Game (stand)	M	153	7.55	2.31

Because most values were very similar by gender, we looked at the difference between EE at rest and EE during each of the 6 sedentary activities. After Bonferroni correction, all sedentary activities except TV were slightly, but significantly greater than EE at rest (see Table 3). The EE during TV watching (ml/kg/min: girls 5.0 ±1.5; boys 5.3 ±1.5) was essentially the same as that during rest (ml/kg/min: girls 4.9 ±1.5; boys 5.1 ±1.4). On average, subjects expended the most energy while playing arcade video games and board games (see Table 3).

Table 3: Difference between energy expenditure during a sedentary activity and that of resting

Activity	N	Diff. in$VO_{2\ \text{from rest}}$	t value	PR > |t|	Bonferroni
Board Games	271	1.403	16.63	<0.0001	0.0006
Math Test	273	1.067	13.56	<0.0001	0.0006
Reading	289	0.600	10.04	<0.0001	0.0006
TV watching	266	0.130	2.10	0.0366	0.222
Video games (sit)	290	1.074	14.39	<0.0001	0.0006
Video games (stand)	272	2.078	17.49	<0.0001	0.0006

In addition we examined the METs for these sedentary activities by dividing the EE of each subject during these activities by his or her EE at rest, on a gender specific basis. For both genders there were no significant differences in METs for most activities: MET was 1.3 for board games, 1.2 for the math test, 1.1 for reading, 1.0 for TV watching, and 1.2 for sitting video games. There was a gender difference in METs during standing video games (MET was 1.4 for girls and 1.5 for boys).

Discussion

The results of this study indicate there are minor differences in EE across sedentary activities, with significant difference across age groups for arcade and video games for each activity. For both arcade and video games, a significant decrease in VO_2 with increasing age group is demonstrated. The EE during TV watching is very similar to the EE during rest, confirming relat-

ed findings regarding the low level of energy expenditure related to TV watching (Klesges *et al*., 1993). Thus, selective reduction of TV watching may be a promising intervention component to increase EE, even if replaced only with other sedentary activities of a slightly higher EE level.
On average, subjects expended more energy while playing arcade video games and board games than while resting (2.1 and 1.4 ml/kg/min more energy respectively), with males expending more energy while playing arcade games than females, although the gender difference is not statistically significant. Although small differences, this finding underscores the importance of conceptualizing TV viewing separately from videogames or computer activity. There is documentation of significantly different amounts of time spent in these activities among children and youth (Hernandez *et al*., 1999). The findings that board games use a little more energy than similar sedentary activities may be related to the fact that these were competitive games, played by the child with one of the research assistants.
Although it is recommended that all children and youth participate in moderate to vigorous activities on a regular basis to establish a healthy lifestyle, a documented rise in a sedentary lifestyle mandates better understanding of sedentary activities. These data further understanding of 6 sedentary activities of children and youth. If precise information regarding EE is needed, these measurements can be used. Understanding the energy expenditure of sedentary activities is essential to fully understand overall energy expenditure and to better inform timely, targeted, and pertinent behavioral interventions.
Further investigation is needed to understand the contribution of sedentary activities of children and youth to overall energy expenditure and to investigate the possibility of reallocation of sedentary activities to less sedentary.

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THE EFFECT OF PLAYGROUND MARKINGS ON CHILDREN'S PHYSICAL ACTIVITY LEVEL

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Keywords: physical activity, recess, multi-coloured markings

Few developmentally appropriate and sustainable interventions aimed at increasing children's physical activity have been investigated. School recess time represents a setting where children can engage in daily physical activity for the majority of the year. The aim of this study was to examine the effect of painting school playgrounds with multicoloured markings, designed by children and teachers, on children's involvement in moderate and vigorous physical activity (MVPA) during recess.
Four infant (years 4-7) and 4 junior schools (years 7-11) took part in the intervention. Half served as intervention and the other half as control schools. Physical activity was measured using heart rate telemetry with MVPA set at 50% heart rate reserve. This was repeated over 3 days and 3 recess periods per child. Of the initial 120 children who took part data from 53 boys (27 infant, 26 junior) and 49 girls (22 infant, 27 Junior) were available for further analysis.
After mean scores were adjusted for BMI and play duration the early primary experimental group increased MVPA from 39.6±2.4 to 51.4 ±2.3 compared to a control group decrease from 39.3±2.5 to 26.1±2.6 % recess time. The late primary experimental group increased MVPA from 33.2±2.8 to 43.0±3.2 compared to the control group increase from 33.8 ±3.5 to 35.5±4.% of recess time. The ANCOVA analysis (time x age x group) on MVPA revealed a significant 3 way interaction ($F\ 1,194=3.95$; $p<.01$).
Overall, results suggest that multicolor playground markings can be a low-cost method of significantly increasing children's daily physical activity levels in the short term. If these increases could be sustained then playgrounds designed in this way could make a valuable contribution to physical activity recommendations for young people.

INCREASE IN OBESITY IN CHILDREN FROM 1990 – 2000

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Keywords: obesity, race, tracking

Introduction
The recent increase of obesity in children in the US is well-doc-

umented. Straus and Pollack (2001), using data from the National Longitudinal Survey of Youth, showed that between 1986 and 1998, overweight increased significantly in African American, Hispanic and white children; by 1998, overweight (BMI $\geq$ 95th percentile) was 21.5% in AA, 21.8% in Hispanic and 12.3% in white children. Kimm and colleagues (2000) demonstrated increasing body mass index (BMI) in a biracial cohort of 2,379 girls from ages 9 or 10 to ages 18 or 19. BMI increased in Caucasian and African American girls, but the prevalence of obesity ($\geq$ 95th percentile) was twice as high in African American as in white girls. In the US in 1990, 11% were overweight and 11.3% were at risk for overweight (Troiano *et al.*, 1995) while in 2000, 15.3% were overweight and 15.0% were at risk for overweight (Ogden *et al.*, 2002). Data from other countries suggest similar increases in obesity since the 1980's. Wang, Monteiro and Popkin (2002) showed that the prevalence of overweight in children nearly tripled over 15 years in Brazil, doubled in the US from the 1970's to 1988-1994, and increased by one-fifth in China from 1991 – 1997; however, obesity decreased in Russian children between 1992 and 1998. Data from France, Germany and The Netherlands indicate that obesity is increasing there also, but at a slower rate than in the US (Fredriks *et al.*, 2000;Kalies *et al.*, 2002;Rolland-Cachera *et al.*, 2002).

Recent reviews provide increased evidence supporting the tracking of obesity (Must and Strauss, 1999;Power *et al.*, 1997a;Serdula *et al.*, 2001), as do primary studies (Guo and Chumlea, 1999;Power *et al.*, 1997b;Sugimori *et al.*, 1999;Valdez *et al.*, 1996;Whitaker *et al.*, 1997). Several studies have demonstrated that childhood obesity is a very significant risk for adult obesity. The Bogalusa study reported 77% of children with BMIs greater than or equal to the 95th percentile are still obese as adults (Freedman *et al.*, 2001). These correlations for Bogalusa between childhood BMI and adult BMI (r = 0.58) are also consistent by age, race, and gender (Freedman *et al.*, 2001). DiPietro and associates (1994) studied 504 obese children (aged 2 months to 16 years) with follow-up every 10 years for 40 years and reported the disturbing finding that all of these 504 obese children became obese adults. Because of this high level of tracking of obesity from childhood into adulthood, it is important to more fully understand the prevalence of obesity in childhood.

We hypothesized that obesity would be highly prevalent in North Carolina, a racially diverse, highly rural state in the Southeastern US. The purpose of this study was to compare the prevalence of obesity in racially mixed samples of 8 to 10 year old children in North Carolina in 1990 and 2000 and to see if the prevalence of obesity or the rate of increase in obesity differed by ethnicity.

Sample

Subjects were 3,240 children who were studied at two time points; 2,162 children aged 8 – 10 were studied in 1990 (77% white, 19% African American and 4% other races). In 2000 we examined 1,078 8 – 10 year olds (37% white, 53% African American, and 10% other races). Data were collected in 48 rural and urban elementary schools in North Carolina. Children were excluded from the study if they had a chronic illness such as diabetes, heart disease, or moderate to severe asthma.

Methods

Trained research assistants collected data in the schools. All study procedures were approved by a multiple assurance Internal Review Board and Single Project Assurance was obtained from all school superintendents. Before data collection, parents provided written consent and children signed assent forms. With participants shoeless, we measured height in cm with a stadiometer (Perspective Enterprises, Kalamazoo, MI) and weight in kg with a calibrated balance beam scale (Detecto Scales. Inc., Brooklyn, NY). Body mass index was calculated ($weight_{kg}/height_{m}^2$). Three body mass index (BMI) categories were developed using the age and gender tables published by CDC in 2002 (http://www.cdc.gov/nccdphp/dnpa/bmi/bmi-for-age.htm). Children with a BMI greater than or equal to the 85th percentile and less than the 95th percentile were considered at risk for overweight and those at or above the 95th percentile for age and gender were considered overweight. Race and age was determined by self-report of the subjects.

Results

In 1990, 34.6% of the 8 – 10 year old children were either at risk for overweight or overweight. By 2000, 47.2% were either overweight or at risk for overweight, that is, at or above the 85th percentile (see Table 1). The greatest increase was in the highest category, overweight ($\geq$ 95th percentile). Because the majority of the sample in 2000 was African American (AA), we tested the homogeneity of the race-risk association between 1990 and 2000. In 1990, 38.5% of the AA and 33.4% of the white children were at or above the 85th percentile, while in 2000, 49.6% of AA and 44.2% of white children were at that level. Even though we studied a greater proportion of AA in 2000, the odds ratios for race were the same for the two time points (1990, OR = 1.245; 2000, OR = 1.2410). Thus, the increase in obesity was similar in both races.

Table 1: Prevalence of obesity in 1990 and 2000 in North Carolina children aged 8-10

	%	%
Overweight (≥95% percentile)	17.6	30.7
Risk for overweight (≥85 th percentile and <95th percentile)	17.0	16.5
Either overweight or at risk for overweight (≥85 th percentile)	34.6	47.2

Discussion/Conclusion

The prevalence of obesity in this mainly rural state in the US increased markedly in the past 10 years. For the corresponding years, data for the US show that in 1990, 11% were overweight and 11.3% were at risk for overweight, for a total of 22.3% of youth at or above the 85th percentile. In the US in 2000, 15.3% were overweight and 15.0% were at risk for overweight, so 30.3% were at over above the 85th percentile. Thus, the prevalence of both overweight and risk for overweight in North Carolina children far exceeded that of American children as a whole. Comparisons with results from other countries are complicated by the use of a variety of sources for norms as well as different cut-off points. The study by Rolland-Cachera (2002) demonstrates how results can vary depending on the reference used. In 2000 in France, 20.6% percent of children (n = 1582) aged 7 – 9 were either overweight or obese when using the CDC standards; when the new international cut-off values of Cole and colleagues (2000) were used, the prevalence was 18.1%. When using the international cut off points for children in the Bavarian region of Germany, the prevalence of either

overweight or obesity was 10.3% in 1982 and 15.1% in 1997 (Kalies *et al.*, 2002). Thus, it is apparent that childhood obesity is much more prevalent in the United States than in Europe. One could speculate that a reason for the greater prevalence of obesity in North Carolina may be the fairly high number of African American youth, since obesity has been shown to be a greater problem in African Americans, especially African American girls and women. However, while our data indicate about 5% more African American than white children were obese at each time point, the rate of increase did not differ for white and non-white subjects. These results suggest that the increase in obesity is likely due to common unhealthy lifestyles of children rather than racial or genetic factors. Interventions to prevent and treat obesity in children are urgently needed in North Carolina and in the US to help combat the epidemic of obesity in children.

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GROWTH TYPE AND MOTOR PERFORMANCE IN OBESE CHILDREN

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Keywords: growth type, obesity, endurance

Introduction

A greater than biologically required (normal) ratio of fat gain in healthy individuals is the consequence of serious imbalance between energy consumption and utilisation, consequently it is the result of sedentary lifestyle. The increasing ratio of fatness and obesity presents a great challenge in all developed and many of developing countries (Bouchard 2000). The summarised ratio of fat and obese children increased from 22% up to 28% in Hungary during the past 25 years, as one of the consequences of very characteristic hypoactive lifestyle (Mészáros et al. 2001). However, no clear agreement exists among the investigators in the qualification of fatness and obesity. Many of the paediatricians suggest the BMI over 30 kg × m^{-2} as one of the most important criteria (Cole et al. 2000, Viner 2000) beyond the high ratio of body fat content and waist and hip circumference ratio. Since BMI increases significantly with age this technique of qualification often results only slight overweight instead of marked fatness or moderate obesity. Another difficulty with these criteria is that they not only are impossible to compare across populations, but when they are applied with advancing age, they do not correspond to the criteria for classification of overweight based on BMI for adults. Currently, a subgroup of the WHO International Obesity Task Force (IOTF) is attempting to develop international BMI-by-age standards. The opinion of Lohman (1992) in this respect is more simple and more useful. The boys and adolescents with relative body fat content between 25-30% must be evaluated as fat, and over 30% of relative body fat content the obesity starts irrespective of the method of estimation. Since the long lasting fatness or obesity is a risk factor of numerous diseases, the prevention of obesity should be among the high priorities in public health. This prevention should certainly include encouraging healthy lifestyle in all age groups including children and adolescents. This cannot be achieved by efforts aimed at the individual level. Communities, governments, the media, and the food industry need to work together to modify the environment so that is less conductive to weight gain (WHO 1998). The question arises more and more often: Is the obesity illness or it "just" the anteroom of various disorders.

The aim of the present study was to analyse the morphological properties and physical performance characteristics of definitely obese school-boys.

Methods

A total of 2152 volunteer Hungarian children aged between 10.51 and 13.50 years were investigated in the years of 2001 and 2002. Among them 455 were qualified as obese. Obesity was classified by the BMI (mean + 2SDs in all the four age groups) and a relative body fat content (greater than 30%). The body fat content relative to body mass was estimated by the suggestions of Parízková (1961). This technique requires 10

skinfold thickness measurements. The physique was described by the growth type indices introduced by Conrad (1963). The metric index is the ratio of chest depth and chest width corrected by the height. The index characterises the linearity (or roundness) of physique between the leptomorphic and picnomorphic extremes. The plastic index is the sum of shoulder width, lower arm girth and hand circumference, and it is the absolute estimation of bone-muscle development of the growth type. The plastic index has significant correlation with simple motor test scores and the bone age in non-fat and non-obese children and adolescents (Mészáros et al. 1986). Since the growth type technique uses neither skinfold thicknesses nor body mass for the description of physique, the comparison of growth type indices should be more informative in this respect than the anthropometric somatotyping as for instance.
The physical performance capacity was estimated by the results in 30 m dash, standing long jump, fist ball throw and 1200 m run. All the used motor test items are the part of 8-grade general school physical education program. The best results of the attempts in the speed and co-ordination tests were analysed. Differences between the age group means were analysed by F-test following one-way ANOVA.

Results

The results of descriptive and comparative statistics for anthropometric variables of non-fat (body fat content is below 25%) and obese boys are summarised in Table 1. The obese children and adolescents were significantly taller, than the non-fat boys, and their growth type was remarkably picnomorphic and hiperplastic in this comparison. Nevertheless, the mean heights in both groups of our investigations were slightly taller than their age mates in the representative Hungarian sample (Eiben et al. 1991). This results can be explained with the effects of secular growth trend (the representative data collection was carried out 12 years earlier), but does not inform about the possible reasons of the consistent height differences of the obese and non-obese children The taller height of fat and obese youngsters were also published following the investigation of smaller samples of Hungarian children adolescents in both sexes (Frenkl et al. 1988, Mészáros et al. 1989). The extremely high body mass and BMI means with significant age dependency are obviously the consequence of grouping. Nevertheless the obese children were heavier than their non obese counterparts by more than 17.4-22.6 kg. The relative body fat content means were greater by 12-13% than the respective Hungarian age group averages at the end of the century (Mészáros et al. 2001) and by 15% higher than the means 13 years ago (Szmodis et al 1990).
Mean differences between the motor performance scores can be seen in Figure 1-4. The full lines and the dots refer to the respective mean trends (linear regression lines) in the group of non-fat boys. The circles indicate the mean scores of the obese children. The vertical lines are the 0.5 standard deviations. The obese children and adolescents performed in very low level.
The differences between the group means (non-fat and obese) were significant in all four age groups and all four motor tests, in spite that the mean performances of non-obese children were also moderate, significantly lower, than those in the Budapest investigation of Szabó (1977). The relative standard deviations (SD × 0.01mean^{-1}) were the highest around the 1200 m run scores, and the lowest in 30 m dash. Although the age dependency was significant in all four performances in the groups of non-fat and non-obese children, no statistical differences were found between the group means of obese boys.

Table 1: Means and standard deviation of anthropometric variables

Age	9.51-10.50 yr.				10.51-11.50 yr.			
Group	F% > 30.0 (n = 90)		F% < 25.0 (n = 253)		F% > 30.0 (n = 120)		F% < 25.0 (n = 258)	
Variable	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Stature (cm)	144.74*	6.02	141.25	5.88	149.58*	6.91	146.35	6.50
Body mass (kg)	50.69*	7.08	33.28	4.66	57.95*	8.84	35.86	5.42
BMI (kg × m^{-2})	24.13*	2.53	16.68	2.34	25.82*	2.54	16.74	2.53
Metric index (cm)	-0.82*	0.40	-1.52	0.29	-0.78*	0.44	-1.63	0.30
Plastic index (cm)	72.70*	3.44	66.38	3.21	75.27*	4.11	68.20	3.70
Body fat content (%)	31.44*	1.49	16.60	4.33	31.85*	1.34	17.02	4.36
Age	11.51-12.50 yr.				12.51-13.50 yr.			
Group	F% > 30.0 (n = 147)		F% < 25.0 (n = 280)		F% > 30.0 (n = 108)		F% < 25.0 (n = 294)	
Variable	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Stature (cm)	154.12*	6.91	151.73	8.11	160.10*	7.62	156.46	-.12
Body mass (kg)	62.33*	8.84	39.93	7.19	70.17*	9.99	47.55	9.50
BMI (kg × m^{-2})	26.15*	2.54	17.34	3.12	27.25*	3.90	18.47	3.69
Metric index (cm)	-0.83*	0.44	-1.72	0.35	-0.68*	0.55	-1.69	0.36
Plastic index (cm)	76.60*	4.11	70.58	4.34	81.26*	5.14	75.39	5.30
Body fat content (%)	31.83*	1.34	16.80	4.01	31.94*	1.81	17.03	4.01

*Abbreviations: SD = standard deviation, F% = relative body fat content, * = difference between the means is significant at 5% level of random error.*

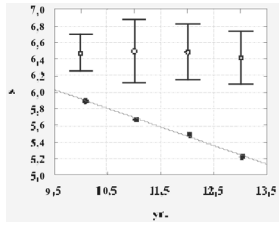

Figure 1. 30 m dash

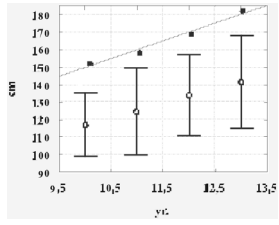

Figure 2. Standing long jump.

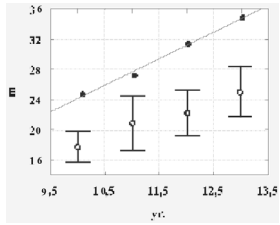

Figure 3. Fist ball throw.

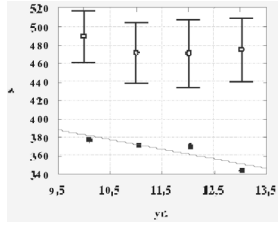

Figure 4. 1200 m run.

The mean performances of obese boys in 30 m dash were lower by "only" 10-13%, in standing long jump 22-23%, in fist ball throw 27-19% and in 1200 m run 29-38% than those of the children with normal body fat content.

Discussion

The very moderate motor performances of the obese children and adolescents should be evaluated as consequences of extremely high body fat content and the lifestyle which resulted in the observed unfavourable body composition through the past years. Laki and Nyerges (2000) has stressed that less than 10% of the respective population can be evaluated as athletic at the end of the past millennium, in contrast to the more than 35% in the middle of seventies. Moreover more than 50% of the Hungarian children evaluate a monthly excursion as regular physical activity.
Using Szabó's (1977) 0-15 scoring system (in which the maxi-

mum score is 60) the level of physical performance capabilities was more or less balanced in the group of non-fat children, they reached 28-32 points. The obese children have performed better in short burst activities and their scores were very close to zero in 1200 m run. Their summarised mean scores were consistently below 12 points!

Although the relationship between body fat content or BMI and the level of cardiorespiratory fitness is obviously strong, the physical performance capacity of an obese but athletic children can often reach the average or exceeds it remarkably. There is evidence from several studies that physical activity appears to protect against chronic disease morbidity and mortality in fat and obese children and adolescents (Bouchard 2000). The determination of the optimal exercise dose for body composition is of primary importance. Relatively little is known about how much, what modality, or what intensity of aerobic exercise is most efficacious in altering cardiorespiratory fitness. In concerning the relationship of regular exercise and cardiorespiratory fitness in youths, it is necessary to note that many of the exercises pose some risks in the form of sport injuries.

The physique of fat or especially obese children, adolescents, and adult individuals are described as balanced endomorph or meso-endomorph by using the anthropometric somatotyping method for the determination (Carter and Heath 1990). However, it cannot be forgotten, that in calculating somatotype components as well as in the simple indicators of fatness and obesity (for instance: BMI, ponderal index, relative body mass etc.) the skinfold thicknesses directly or the body fat content (as a part of body mass) inclusively are the variables for the estimation. One of our observations have the following stressed methodological importance too. The metric index as being directly independent of skinfold thicknesses and total body mass, sensitively points out the differences among the morphological physiques. The question of the relationship between the skinfold thicknesses around the chest and the measurable diameters may arise naturally. Using special chest calliper in taking the dimensions, the distorting effect of various skinfold thicknesses is negligible in our opinion. The metric indices in the groups of obese boys were greater by 53-60% than in the non-obese. Since the marked differences in the individual or mean metric indices are independent of skinfold thicknesses, it cannot be excluded that the observed metric index variability refers to the inherited characteristics of physique. Though Kretschmer has already stressed by theoretical considerations that the picnic constitution is more sensitive for fat gaining than the leptosom, and Bouchard (2000) described metabolic differences between the extremes of physique, these results do not give exemption for the fat and obese individuals. Nevertheless, the sensitivity alone does not mean necessity.

Some opened questions remained in the possible explanations of consistently taller stature of obese children and adolescents. Frenkl and associates (1988) pointed out the effects of earlier biological maturation. Since the height differences of obese and non-obese 17-18-year-old boys and young adult males are non significant generally, this effect cannot be excluded, but it is difficult to understand if the obesity is serious risk factor for various serious diseases, how this unfavourable biological state can facilitate the peed of growth and biological maturation.

In summary. The ratio of obese children among the 10-13-year-old Hungarian boys is very high. As a consequence of definite hypoacticity for the greater than 30% body fat content refers very low level of cardiorespiratory endurance. Since the normal child development and school physical education cannot compensate the strong effects of the environment the challenge is enormous. The various treatment modalities of the obesity are characterised by only modest success, and the measurable weight loss is followed by similar weight (fat) regain is often reported, consequently the only suggestion is to prevent the development of fatness and obesity among the growing children. It will require massive resources and an unprecendent level of concentration among all public health agencies and private organisations to begin reversing the trend that have emerged over the past decades.

Acknowledgement

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EUROFIT TEST RESULTS IN PRIMARY SCHOOL CHILDREN: A COMPARISON

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Keywords: Eurofit, primary school children, normative data

The aim of this study was to assess the health and skill related fitness of children from Liverpool (UK) and compare the findings to those reported in the literature. Currently there are no published studies on English children of primary school age. A total of 719 children (413 boys and 306 girls) performed a series of tests based on the Eurofit Tests of Physical Fitness (1988). The participants were all in year 5 (aged 9-10y). The following tests were performed after a short warm-up: 10 x 5 shuttle run, plate tapping, speed bounce, sit and reach, standing broad jump (SBJ), modified pull-ups, grip strength (GS), and the 20m shuttle run (20-MST). Stature, body mass, triceps skinfold and subscapular skinfold were also measured. The results of this study demonstrate that compared with children in Northern Ireland (Mahoney et al., 1991) Liverpool boys were 3% taller, 10% heavier, and 6% stronger (GS). A similar trend was evident in the girls who were 3% taller, 14% heavier and 9% stronger. However, the Eurofit tests showed that the children of Liverpool scored below average on many of the health and skill related tests. The only exceptions to this were the 20-MST and the SBJ, where both the groups of boys performed 46 laps and jumped a distance of 132 cm. Results from the 10 x 5 m shuttle run showed that the speed and agility of the children from Liverpool was ~9% slower than those recorded in Belfast. Furthermore, the endurance test showed a 9.5% difference between the girls' data, with 33 laps compare to 36 laps for the children from Liverpool and Belfast respectively. The sit and reach test highlighted the poor flexibility of the children from Liverpool. Further comparisons with other European countries are difficult to make due to the lack of reported studies using the Eurofit tests on primary school children. However comparisons with a study conducted in America shows that the upper body strength of the children from Liverpool was 44% (boys) and 63% (girls) of their American counterparts (Ross et al., 1987). In conclusion the results of the present study demonstrate that the children of Liverpool have a below average performance on some of Eurofit tests when compared to children of the same age in different countries. These fitness issues may have implications for the future health of the people of Liverpool. An intervention strategy is being implemented to encourage participation in sport and physical activity among school children.

FITNESS LEVEL OF CHILDREN LIVING TRADITIONAL VS CONTEMPORARY LIFESTYLES

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Keywords: fitness, lifestyle, contemporary living

Introduction
Reductions in lifestyle physical activity and increases in childhood obesity have caused speculation that the fitness level of Canadian children has declined over the past few generations. Unfortunately, accurate data to effectively assess this speculation are not available. Though it is not possible to go back in time, some cultures (Old Order Mennonites, Amish) have preserved the inherently active lifestyle of earlier generations, before technology seriously eroded leisure-time physical activity, and before the childhood obesity epidemic. As a means of assessing whether the physical fitness of Canadian children has deteriorated concomitant with changes in lifestyle behaviour observed over the past few generations this study compared the fitness level of children living a traditional lifestyle with those living a contemporary Canadian lifestyle.

Methods
The health-related physical fitness of 399 9-12 year-old children ("tweens") was assessed in this study. The fitness of 124 Old Order Mennonite children (OOM) was compared to both rural (n=165) and urban (n=110) dwelling children. The Mennonites live a traditional rural lifestyle without the modern conveniences of contemporary living (e.g. no motorized vehicles, TV, radio, computers, video games, organized sport). The rural and urban children live a contemporary Canadian lifestyle. Fitness was measured using the Canadian Physical Activity, Fitness, and Lifestyle Appraisal (CPAFLA). The CPAFLA is a battery of tests measuring anthropometry (height, weight, skinfolds, waist girth), aerobic fitness (step test), and musculoskeletal fitness (grip strength, push-ups, curl-ups, sit-and-reach flexibility). Sitting height was also obtained to allow a calculation of maturational age using the procedures of Mirwald et al. (2002). Using maturational age as a covariate ANCOVA was used to assess differences in fitness between the three groups (OOM, rural, urban).

Results
A summary of the group fitness data using adjusted means (standard error) is reported in Table 1. OOM showed significantly greater grip strength than both the urban and rural children ($p<0.0001$) and significantly better aerobic fitness than the rural group ($p<0.0001$). No differences in BMI were observed, but the triceps skinfolds were significantly smaller in the OOM children ($p<0.05$). No differences in curl-ups were observed between the groups. Push-ups and flexibility measures were significantly lower ($p<0.01$) in the OOM group.

Table 1: Summary fitness data comparing OOM children with rural and urban Canadian children.

VARIABLES	OOM	Rural	Urban
BODY MASS INDEX (BMI) (wt/ht^2)	19.6 (.24)	19.1 (.21)	19.3 (.26)
TRICEPS SKINFOLD (mm)	16.2 (.64)	17.9 (.56)	18.8 (.68)
MCAFT STEP TEST (aerobic fitness score)	520 (4.8)	497 (4.1)	512 (5.1)
HANDGRIP STRENGTH (right + left; kg)	60 (1.0)	48 (.8)	44 (1.0)
PUSH-UPS (reps)	9 (.8)	12 (.7)	13 (.8)
PARTIAL CURL-UPS (reps)	15 (.8)	16 (.7)	15 (.8)
SIT-AND-REACH (cm)	26.3 (.63)	29.9 (.54)	29.5 (.66)

Discussion/Conclusion
Collectively, the results suggest that children who live a lifestyle somewhat representative of previous generations (OOM) are leaner, stronger and more aerobically fit than children living a contemporary Canadian lifestyle. The superior fitness of the OOM may be caused by their lifestyle-related physical activity (e.g. farm chores, active commuting). It is possible that the lack of institutionalised physical education in the Mennonite school system contributed to their unfamiliarity with the push-up test. Therefore, the apparent contradiction between grip strength results and push up results may be

attributed to a learning effect. Additionally, the apparent poor flexibility scores of the OOM on the sit-and-reach test may be explained in part by their tight/restrictive clothing. This study provides insight into the speculation that the health-related physical fitness of contemporary Canadian children has declined over the last few decades and may offer an explanation to the rising obesity epidemic.

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PROMOTING INFORMAL PHYSICAL ACTIVITY AT SCHOOL RECESS. A PILOT STUDY WITH GIRLS AND BOYS FROM 2nd AND 4TH GRADES OF ELEMENTARY SCHOOL

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Keywords: physical activity, recess, girls, boys

Introduction

Urbanization, non-traditional family structures, proliferation of technological games, the increasing schooling of free time and the poorness of motor stimulation are clearly pointed out in the literature as being barriers to informal physical activities, free play and children socialization (Neto, 1999; 2001).
On the other hand is asked to school to promote physical activity, but results from several studies all over the world seem to find out that school can't surpass the situation, and that girls have always less amounts of physical activity than boys (Pomar&Neto, 1997). If physical activity at school is important for all, this importance is higher to girls.
It's unbelievable that children don't like anymore to play, run and jump. We think that school doesn't what it should be done; we propose simple changes to promote informal and free physical activity at school recess time.
The main goal of this study was to analyze children's physical activity at recess in an open space without materials (Moment 1 of the study) and their behavior when unfixed and unstereotyped materials were introduced (Moment 2).

Methods

Data for this study were collected from 16 girls and 16 boys from 2nd and 4th grades of elementary school.
Moment 1 (diagnosis) monitored 3 recess periods in order to find out favorite plays and motor skills, and the amount (in time) of physical activity. Categories *a posteriori* (activity/inactivity) were created based on these first results. According to their preferences and the literature (Botelho Gomes, 2000), we proposed a rearrangement of how space was occupied and introduced the materials for free play (ropes; hula-hoops; tennis balls; balls from different dimensions; sets for field hockey; junior and senior stilts; elastic bands; hoops; blocks for balance and constructions. Once again boys and girls were monitored on 3 recess periods.
Continuing duration record was applied to collect data.
Data analysis was done using the following statistical techniques: descriptive measures and Wilcoxon non parametric test in order to find out about physical activity changes between Moment 1 and 2, in each sex.
An alpha level of 0.05 was used to determine significance.

Results

According to results from Moment 1 physical activity was defined by motor skills such as walk, run, jump, balance, by activities such as play chase, play fight, skipping rope, hopscotch, and by simplified ball games (e.g. soccer). Inactivity was defined by behaviors such as to be seated, chatting, playing with electronic toys).

Results for girls

Table 1 and 2 show results concerning activity/inactivity for girls from 2nd grade in Moment 1 (M1) and 2 (M2).

Table 1: Girls, 2nd grade (n=8) – Total time Activity / Inactivity, mean and standard deviation in M1 and M2 (hours:minutes:seconds)

	M1		M2	
Variable	Total Time	M ± SD	Total Time	M ± SD
Activity	4:53:54	0:36:44±0:13:11	8:05:07	1:00:38± 0:07:51
Inactivity	4:31:38	0:33:57± 0:11:1‹	1:29:30	0:11:11± 0:02:50

The amounts of time for activity / inactivity in M1 are alike. But, in M2, when girls had the opportunity to explore new materials and conquest more space for play, the value for activity almost duplicated, and, of course, inactivity time suffered a decrease of about 34% (approximately 3 hours). In the present study, total time for activity in M1 is similar to that one found by Sleap and Warburton (1992). However, these authors were interested on intensity of physical activity, which wasn't our case.
Observing table 2 we can say that 7 girls were physically more actives in M2, and that fact means that occurred statistically significant differences intra-group.
In other hand, all the girls were less inactive in M2 than in M1 ($z=0.012; p \leq 0.05$).
This kind of results allow us to affirm that recesses can became an import moment for physical activity if the space and materials (simple and cheap) put some challenge and promote informal and free play.

Table 2: Girls 2nd grade (n=8) - results from M1 vs. M2 (Difference value, Mean Rank and Z value)

Variable		Difference Value	Mean Rank	Z
Activity M2	Negative diff.	1a	2.00	
Activity M1	Positive diff.	7b	4.86	0.025 *
	Draws	0c		
Inactivity M2	Negative diff.	8d	4.50	
Inactivity M1	Positive diff.	0e	0.00	0.012*
	Draws	0f		

Legend: a. activity M2<activity M1; b. activity M2>activity M1; c. inactivity M2=inactivity M1; d. inactivity M2<inactivity M1; e. inactivity M2>inactivity M1; f. inactivity M2=inactivity M1
** p ≤ 0.05*

Table 3 and 4 show the results for girls from the 4th grade.

Table 3: Girls, 4th grade (n=8) – Total time Activity / Inactivity, mean and standard deviation in M1 and M2 (hours:minutes:seconds)

	M1		M2	
Variable	Total Time	M ± SD	Total Time	M ± SD
Activity	3:28:30	0:26:03±0:07:52	7:40:39	0:57:34± 0:08:54
Inactivity	5:59:35	0:44:56± 0:08:42	2:04:28	0:15:33± 0:06:47

In M1, time spent in inactivity is higher than that one to activity (about 62% from total time for recess). Mota & Rodrigues (1999), studying Portuguese children, also refer that children have low participation in free activities.
Analyzing values for M2 we can see that total time in activity is more than the double than in M1, and the inactivity decreased almost 4 hours. In the first set of recess periods (3) the mean's value found for inactivity is almost 45 minutes, but in M2 decreased to 15 minutes and a half. For these girls, the materials and facilities in M2 promoted a revolution in recess!

Table 4: Girls 4th grade (n=8) - results from M1 vs. M2 (Difference value, Mean Rank and Z value)

Variable		Difference Value	Mean Rank	Z
Activity M2	Negative diff.	0a	0.00	
Activity M1	Positive diff.	8b	4.50	0.012 *
	Draws	0c		
Inactivity M2	Negative diff.	8d	4.50	
Inactivity M1	Positive diff.	0e	0.00	0.012*
	Draws	0f		

Legend: a. activity M2<activity M1; b. activity M2>activity M1; c. inactivity M2=inactivity M1; d. inactivity M2<inactivity M1; e. inactivity M2>inactivity M1; f. inactivity M2=inactivity M1
** p ≤ 0.05*

Comparing the values in both moments of the study, we can verify that for activity there are positive differences in all the girls from 4th grade; that means that they were significantly more actives in M2 (Mean Rank = 4.50; Z= 0.012, p ≤0.05).

Results for boys
Table 5 and 6 show the results for boys from the 2nd grade.

Table 5: Boys, 2nd grade (n=8) – Total time Activity / Inactivity, mean and standard deviation in M1 and M2 (hours:minutes:seconds)

	M1		M2	
Variable	Total Time	M ± SD	Total Time	M ± SD
Activity	5:08:57	0:38.52±0:09:43	8:22:05	1:07:08±0:02:55
Inactivity	4:26:48	0:33:21± 0:09:16	1:14:23	0:07:17± 0:02:32

In the first set of observations (M1, diagnosis), we can see that if boys were physically active a little bit more than 5 hours, and the time spent in inactivity is something terrifying: almost 4 hours and a half. Perhaps the routine and an empty space couldn't motivate them to play and actively enjoy the free time. The little transformation of the recess period allowed, in M2, to promote another attitude about physical activity: more than 8 hours in total time, with a mean of 1 hour and 7 minutes! The total time of inactivity decreased considerably (more than 3 hours).
The results from Wilcoxon test (table 6) prove that all boys changed behaviors in both variables: 8 positive differences in activity and 8 negative differences in inactivity, with a Z value that is statiscally significant.

Table 6: Boys 2nd grade (n=8) - results from M1 vs. M2 (Difference value, Mean Rank and Z value)

Variable		Difference Value	Mean Rank	Z
Activity M2	Negative diff.	0a	0.00	
Activity M1	Positive diff.	8b	4.50	0.012 *
	Draws	0c		
Inactivity M2	Negative diff.	8d	4.50	
Inactivity M1	Positive diff.	0e	0.00	0.012*
	Draws	0f		

Legend: a. activity M2<activity M1; b. activity M2>activity M1; c. inactivity M2=inactivity M1; d. inactivity M2<inactivity M1; e. inactivity M2>inactivity M1; f. inactivity M2=inactivity M1
** p ≤ 0.05*

Table 7 and 8 show the results for boys from the 4th grade.

Table 7: Boys, 4th grade (n=8) – Total time Activity / Inactivity, mean and standard deviation in M1 and M2 (hours:minutes: seconds)

	M1		M2	
Variable	Total Time	M ± SD	Total Time	M ± SD
Activity	6:14:20	0:46.47±0:05:53	9:41:30	1:12:41±0:01:05
Inactivity	3:33:02	0:26:37± 0:05:48	0:16:53	0:02:06± 0:01:05

Boys from 4th grade are the most actives in M1. Nevertheless they became even more actives in M2: 8 positive differences in activity and 8 negative differences in inactivity, with a Z value that is statiscally significant (table 8). Amazing is the value for inactivity in M2: 0:16:53, the lowest value of the present study. Once again, it seams that the improvements in facilities reached also this group.

Table 8: Boys, 4th grade (n=8) - results from M1 vs. M2 (Difference value, Mean Rank and Z value)

Variable		Difference Value	Mean Rank	Z
Activity M2	Negative diff.	0a	0.00	
Activity M1	Positive diff.	8b	4.50	0.012 *
	Draws	0c		
Inactivity M2	Negative diff.	8d	4.50	
Inactivity M1	Positive diff.	0e	0.00	0.012*
	Draws	0f		

Legend: a. activity M2<activity M1; b. activity M2>activity M1; c. inactivity M2=inactivity M1; d. inactivity M2<inactivity M1; e. inactivity M2>inactivity M1; f. inactivity M2=inactivity M1
** p ≤ 0.05*

Conclusions
The pedagogical intervention in order to improve physical activity in recess periods, through simple changes, surpassed everything what we could expect. 15 girls and all the boys (16), independently of the scholar grade, got a significant increased in time spent in physical activity.
Little things can make big differences.

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MOTOR COORDINATION LEVEL OF CHILDREN (6-10) OF THE AZORES ISLANDS

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Keywords: motor coordination, children, development

The purposes of this study were: (1) to characterize the level of motor coordination (MC) development in children (6 to 10 years), and (2) to analyse gender differences. Sample size comprises 3742 children (boys n=1829; girls n=1913) with 6 to 10 years of age. Motor coordination was evaluated according to the body coordination test battery (KörperkoordinationsTest für Kinder) developed by Kiphard e Schilling (1974). The battery comprises four tests: backward balance (BB), jumping sideways (JS), hopping on one leg (HL), and shifting platforms (SP). Factorial ANOVA (gender*age) was used to identify differences between boys and girls in each age. Discriminant function was used to test differences among multivariate profiles of motor coordination and was used to classify the children in each age group. All analysis were done in SPSS 10.0. It was found that performance increased with age in both gender, and in all coordination items. Boys out perform girls except in JS.
The first discriminant function explains 98.3% of generalized variance in boys (lambda = 0.617; Rc = 0.61), and 98% in girls (lambda = 0.635; Rc = 0.60). In both gender, the reclassification in each age group, was of low percentage (36.3% for boys and 34.5% for girls. We found a high number of children that had a lower multivariate profile of MC than the one expected for their age. It was also found that a high number of children had a higher multivariate profile of MC than the one expected for their age.
Conclusions: (1) the level of motor coordination was higher in older age groups, (2) boys had superior level of coordination than girls; (3) and there was low percentage of children with a coordination level correspondent with their own age; (4) and also a substantial number of children with a lower profile than the one expected for their age.

RELATIONSHIP BETWEEN TECHNICAL SKILLS AND GAME PERFORMANCE IN YOUTH BASKETBALL PLAYERS

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Keywords: basketball, performance, technical skills

Introduction
In spite of the multidimensionality of sports performance, Technical Abilities (TA) assumes an important role in the athletes' competitive capacity (Inglis, 1980; Riezebos et al., 1983; Beard, 1991; Maia, 1993; Janeira, 1994; Brandão, 1995; Sampaio, 2000).
The reasons of this importance root in two fundamental aspects: first, because represents a decisive factor in the youth athletes, allowing the best performers to present better incomes in game situation (Araújo, 1992; Thomas, 1994; Riera, 1995; Brandão et al., 1998; Adelino, 2000); second, because more endowed athletes from a technical point of view can reach in the future better sport results (Hopkins 1977, 1979; Brooks and col., 1987; Janeira, 1988; Brandão, 1995; Neta, 1999; Oliveira, 2000; Rocha, 2000; Silva, 2000; Trapani, 2000).
In this domain, analytical technical evaluation has been developed through Testing Batteries (TB) and the Technical Circuits (TC), although, this kind of technical evaluation goes away from the more actual perspectives, which refers that qualitative assessment is always a better way to look for game's reality (Griffin et al., 1997; Janeira, 1998; Oslin et al., 1998).
Commonly, athletes' game performance evaluation is made through game statistics. Starting from this game statistics it is possible to define player's effectiveness coefficients, which are good indicators of players' global performance in competition (Sampaio, 2000).
On the other hand, it is also available in the literature another instrument to evaluate qualitatively the players' technical performance in competition - The Game Performance Assessment Instrument (GPAI) - proposed by Oslin et al. (1998).
This idea was already studied in Basketball senior athletes (Rowe & Boutmans, 1997), but still unknown for young players. Therefore, the aim of this study was to identify the degree of relationship between technical skills and technical game performance in youth basketball players.

Method
The sample comprises 70 male basketball players aged from 12 to 14 years old, from 7 teams of Aveiro Basketball Association. Offensive technical skills (Passing, Dribbling and Shooting) were evaluated according to AAPHERD Basketball Battery (Kirkendall et al., 1987) and a Technical Circuit proposed by Brandão et al., (1998). Qualitative offensive technical game performance was evaluated according Game Performance Assessment Instrument – (GPAI - Game Performance), proposed by Oslin et al. (1998) and quantative offensive technical game performance was evaluated according Game Statistics – (MVP). Pearson Correlation and Simple and Multiple Regression were used as data analysis techniques.

Main results and discussion
Table 1 shows Simple Linear Correlation and Regression values between variables.

Table 1. Simple Regression between Technical Circuit and game performance (GPAI and MVP)

Variables	n	r	r^2	SEE	p
Technical Circuit vs. GPAI (performance)	70	0.69	48%	2.83	0.0001
Technical Circuit vs. MVP	70	0.65	42%	2.80	0.0001

These results evidence a moderate association between Technical Circuit and game performance (GPAI: r=0,69; MVP: r=0,65). Common variance was 48% and 42%, respectively. Figure 1 and Figure 2 expresses the regression lines for qualitative and quantitative association between game performance and Technical Circuit.

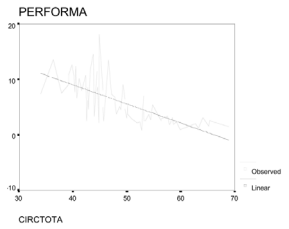

Figure 1. Relationship between GPAI (performance) and Technical Circuit.

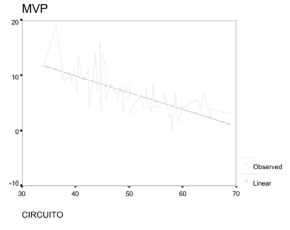

Figure 2. Relationship between MVP and Technical Circuit.

The associations presented in the previous graphs are positive and suggest that generally best game performances corresponds to the best results in technical analytical evaluation. For both regression lines the points' dispersion is very similar with values of SEE of 2,83 and 2,80, respectively.
Table 2 presents Multiple Regression analysis for the offensive tests of AAHPERD Basketball Battery and the game technical performance (GPAI and MVP).

Table 2. Multiple Regressions between AAPHERD Basketball Battery and game performance (GPAI and MVP)

	(*) r^2=61%	(**) r^2=57%				
Predictor	Coef ß (*)	Coef ß (**)	Stand.Coef. (*)	Stand.Coef. (**)	p (*)	p (**)
Passing	0.08	0.17	0.24	0.54	0.0206	0.0001
Dribling	-0.54	-0.15	-0.18	-0.05	0.0603	0.6061
Shooting	0.35	0.18	0.50	0.26	0.0001	0.0115
Constant	-0.56	-12.96				

(*) GPAI (performance); (**) MVP

These results show the contribution of Shooting in the explanation of game performance (GPAI: Coef ß=0,35; MVP: Coef ß=0,18), confirming the importance this skill in Basketball game, when appreciated in quantitative and qualitative perspectives. In fact, Shooting relevance in Basketball performance is largely described in the literature (i.e. Marques, 1990; Inglis, 1980; Lidor & Arnon, 1997; Neta, 1999; Sampaio & Janeira, 1998).
On the other hand, GPAI and MVP variation is explained in 61% and 57%, respectively, by technical indicators associated variation, analytically studied. Similar values were identified by Neta (1999) between technique and youth teams final standings. However, Rowe and Boutmans (1997) concluded that, at high level competition (senior players), technique is low correlated with players' performance (r=0,17).
Contrasting these results, it is clear that technique is quite important for youth players' performance, losing importance along players' sports career.
The explanation of this matter seems us extremely fascinating. The possibility of studying youth players longitudinally from a technical point of view, will help us to better understand this subject and find more solid justifications concerning technique importance in basketball players' performance.
In conclusion, AAHPERD Basketball Battery showed a better association with game performance, in qualitative (GPAI) and quantitative (MVP) analysis. This result presents the AAHPERD Basketball Battery as the best game performance predictor in this age group and well adjusted for pre-selection proposes of youth basketball players.

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RELATIONSHIPS BETWEEN PHYSICAL ACTIVITY, PERCEIVED MOTOR ABILITIES AND OPINIONS ABOUT SCHOOL PHYSICAL EDUCATION IN 16-18 YEAR-OLD ADOLESCENT

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Keywords: physical activity, perceived motor abilities, school physical education

The aim of this study was to investigate the relationships between physical activity level, perceived fitness and the level of school physical education lessons in 16-18 year-old adolescents. In total, 858 16-18 year old adolescents (335 males and 523 females) from Tartu, Estonia, were studied. All participants had two obligatory PE lessons every week. Physical activity index (PAI) was calculated according to Telama et al. (1996) questionnaire. Self-perceived fitness (SPF) was assessed using questions about perceived strength, speed and flexibility (Likert type scales). There were five questions about the changes during last year: changes in school PE lessons, about the total physical activity and about changes on flexibility, endurance and strength. Nine questions were connected with compulsory PE lessons: positive emotions, positive impressions, positive encouragements, etc. The mean PAI indices in males and females were 9.49 ± 1.94 and 8.96 ± 1.66 ($p<0.05$), respectively. Females had more positive emotions and impressions and they liked more PE lessons compared to males. By the females' opinion, the PE lessons were quite intensive and they liked more group work compared to males. During the last year by the females opinion they had more positive changes in school PE, their perceived flexibility, endurance and strength compared to males. Regression analysis indicated that the PAI characterized 12% (R^2x100) in males and 9% in females of the total variance of perceived motor abilities. The parameters that characterized the school PE lessons influenced PAI by 28% and 24 % in males and females, respectively. Perceived changes in last year characterized PAI by 17% and 6% in males and females, respectively. It was concluded that physical activity level in males compared with females is more related to the perceived fitness and opinions about the school PE lessons level.

PHYSICAL ACTIVITY LEVELS IN CHILDHOOD AND ADOLESCENCE. AGE AND GENDER DIFFERENCES.

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Keywords: physical activity, children, adolescent, accelerometry

Introduction

There is a strong agreement that physical activity (PA) positively influences individual health status. Regular PA is an important factor along the whole life cycle to promote a healthy life style. In childhood and youth, the main effects of physical activity are on the promotion of habits and attitudes that are thought to be carried out through the adult stage. In adulthood the benefits are of several levels, as documented in different epidemiological papers. PA is associated a) to longevity increase; b) to a lower risks of cardiovascular diseases and c) to the decreases of some of risk factors that are associated with cardiovascular diseases, such as obesity and hypertension (Blair, 1993; Mackelvie et al., 2001; Vuori, 2001; Williams, 2001; Riechamn et al., 2002; Westerterp, 1997).
Childhood and adolescence are golden ages to promote and acquire PA habits. Physical activity promotion in childhood and adolescence is based in part on the assumption that PA habits are developed during these periods of life and are maintained throughout adulthood. Physical activity is a complex behaviour that changes over the day, the week, the season, and over the year. In reality, no one has two equal days in PA. Nevertheless, to have a positive impact on health PA must have a regular basis over the days.
The importance of evaluating PA in any population is on the need of establishing (1) the current level of PA of that population and (2) to determine if its level is appropriate for health. Most of epidemiological studies in youth indicate that boys are more active than girls (Trost, 2002). Longitudinal studies report that PA decline with age mainly between childhood and adolescence and during adult age (Telama & Yang, 2000; Kimm, et al., 2000; Mechelen et al., 2000).
In Portugal most of the studies carried out with youth use self-report methods to assess PA. Although, these studies have important new knowledge about PA of Portuguese children and adolescents, it seems to us that is necessary a more precise and objective understanding about the PA characteristics of Portuguese children and adolescents population. Therefore, the purpose of this study was to evaluate age and gender differences in PA of children and adolescents, using accelerometry as an objective method of PA evaluation.

Methods

Sample

Sample size comprises 158 individuals (81 female, 77 male) grouped as follows: group 1 aged 6 to 10 years, n = 60 (26 boys and 34 girls); group 2 aged 11 to 13 years, n = 63 (33 boys and 30 girls); and group 3 aged 16 to 18 years, n = 35 (21 boys and 14 girls).

Physical Activity Measure

PA was evaluated for 7 consecutive days with the Computer Science and Applications Inc. (CSA) 7164 activity monitor. The CSA is a uniaxial accelerometer designed to detect vertical acceleration ranging in magnitude from 0.05 to 2.00 Gs with frequency of 0.25-2.50 Hz. These parameters values allow the detection of normal human motion and will reject motion from other sources such as riding in a car and machinery operation. The filtered acceleration signal is digitised and the magnitude is summed over a user-specified time interval (epoch). At the end of each interval, summed value or activity count is stored in memory, and the integrator is reset (Computer Science and Application, Inc., 1995). For this study, a 1-min epoch was used. Subjects were instructed to wear the CSA during waking hours. Monitors were attached to an elastic belt worn firmly over the waist. Subjects were instructed not to remove the device, except for bathing, swimming or sleeping. Each subject had to

register in a sheet the time that they worn the monitor. The stored activity counts were download to a computer for subsequent data reduction and analysis. The CSA data was reduced to bouts (20, 10, and 5 min.) of sustained moderate, and vigorous PA, as well to minutes spent in moderate-to-vigorous (3-5.9 METs) PA (MVPA), vigorous (6-8.9 METs) PA (VPA), and very vigorous (≥ 9 METs) PA (VVPA), with a QBASIC program (Trost et al, 2002). The age-specific count ranges corresponding to the above intensity levels were derived from the energy expenditure prediction equation developed by Freedson et al. (1997):

$METs = 2.757 + (0.0015 * counts*min^{-1}) - (0.08957 * Age[yrs]) - (0.000038 * counts*min^{-1} * Age[yrs])$

Statistical Analyses

Factorial ANOVA (gender*age group) was used to test gender and age group differences in PA variables. VVPA was excluded from the analysis because mean scores are zero or close to zero in all groups. All statistical analysis were done in SPSS 10.0. Statistical significance was set at $p \leq 0.05$.

Results

In Figures 1 and 2 are displayed the means and standard deviations for daily MVPA and VPA respectively. ANOVA results indicate no gender*age group interaction effects both in MVPA and VPA. Significant differences were found in daily MVPA and VPA both in boys and girls and among age groups, with daily MVPA and VPA exhibited a significant inverse relationship with age groups (MVPA – $F(2, 152)=105.068$, $p<0.001$; VPA - $F(2, 152)=28.333$, $p<0.001$).

For MVPA, the group difference relative to the previous age group was, in girls, about 50% in both cases. In boys the difference are of less magnitude: between group 1 and group 2 was 32%, and between group 2 and group 3 was 47.8%. For VPA in girls the difference between group 1 and group 2 was 43.5%, and between group 2 and group 3 was 68.3%. In boys the difference between group 1 and group 2 was 42.9%, and between group 2 and group 3 was 32.8%.

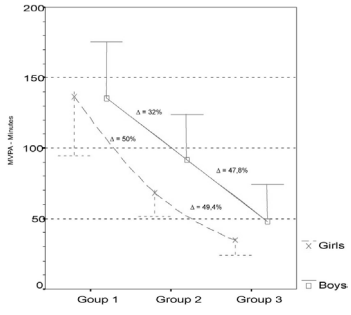

Figure 1 - Mean ± SD for daily MVPA by gender and age group.

Significant differences were found between boys and girls both in MVPA and VPA (MVPA: $F(1, 152)=5.119$, $p=0.025$; VPA: $F(1, 152)=15.093$, $p<0.001$). Except for MVPA in group 1 where the differences between boys and girls was only 1%, boys of all age groups were more active than girls. The magnitude of the difference was for MVPA in group 2 34.7% and in group 3 39%. For VPA the difference in group 1 was 44.3%, in group 2 was 45.8% and in group 3 was 200%.

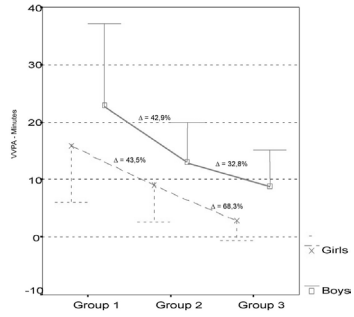

Figure 2 - Mean ± SD for daily VPA by gender and age group.

Means and standard deviations for the weekly number of 20-, 10-, and 5-min bouts of MVPA and VPA are shown in Table 1 and Table 2 respectively. There was a significant decrease in participation in bouts (20, 10, and 5-min.) of sustained MVPA with age (20-min bout: $F(2, 152)=24.365$, $p<0.001$; 10-min bout: $F(2, 152)=31.964$, $p<0.001$; 5-min bout: $F(2, 152)=71.988$, $p<0.001$). The decrease is in both boys and girls, there's no significant gender*age group interaction effect except in 5-min bouts but this is because girls who had higher mean value in age group 1 decreased (mean of 53% between adjacent groups) more than boys (mean of 41% between adjacent groups). Although there was significant gender differences (20-min: $F(1, 152)=17.33$, $p<0.001$; 10-min: $F(1, 152)=7.97$, $p=0.005$; 5-min: $F(1, 152)=3.973$, $p=0.048$), with boys of all age group showing significantly more bouts of sustained PA of any kind than girls, except in 5-min bouts in age group 1. In girls, only group 1 had a week mean of 3 bouts 20-min of sustained moderate PA, while in boys only group 3 did not have a week mean of 3 bouts 20-min of sustained moderate PA.

Table 1: Mean±sd of weekly 20-, 10-, and 5-min bouts of MVPA (≥3 METs) by gender and age groups

Group	20-min bouts		10-min bouts		5-min bouts	
	Girls	Boys	Girls	Boys	Girls	Boys
1	3.15±3.09	6.19±3.94	12.76±7.19	15.23±7.13	38.74±13.99	36.50±14.95
2	1.09±1.38	2.90±2.58	6.52±4.89	9.17±6.63	16.52±6.24	25.90±11.00
3	0.86±1.66	1.48±1.69	2.64±1.69	5.95±4.19	8.57±3.65	12.38±8.26

For bouts (20, 10, and 5-min.) of sustained VPA there was a significant decrease with age, except in 20-min bouts, but the mean in both boys and girls of the three age groups have a mean near zero (10-min: $F(2, 152)=3.279$, $p=0.04$; 5-min: $F(2, 152)=15.341$, $p<0.001$). The boys and girls from group 3 exhibited a mean of zero or approximately zero. In fact, boys and girls from all age group have very few bouts of VPA over the week. There was a significant gender differences, except in 20-min bouts (10-min: $F(1, 152)=5.925$, $p=0.016$; 5-min: $F(1, 152)=11,339$, $p=0,001$), boys participate more in bouts of sustained VPA than girls, except in 20-min bouts in group 3.

Table 2: Mean±sd of weekly 20-, 10-, and 5-min bouts of VPA (≥6 METs) by gender and age groups

Group	20-min bouts		10-min bouts		5-min bouts	
	Girls	Boys	Girls	Boys	Girls	Boys
1	0.03±0.17	0.04±0.20	0.44±0.96	1.19±1.86	3.18±2.92	6.38±6.24
2	6.06E-2±0.35	0.17±0.75	0.42±0.66	0.37±0.61	1.52±1.75	2.43±2.94
3	0.14±0.53	0.0±0.0	0.0±0.0	0.62±1.32	0.57±1.02	2.10±2.14

Discussion/Conclusion

The decrease of PA verified along the age is pronounced in both boys and girls, and is consistent with the preponderance of published empirical literature, and support the idea that PA declines with age (Sallis, 2000). Through childhood and adolescence PA decrease rapidly in the same magnitude, indicating that the decline begin early in childhood, contrary to previous studies that report that the declines begin in adolescence (Mechelen et al., 2000; Telama & Yang, 2000), this contradictory results is perhaps due to the fact that only few of these studies include young children in samples. In a sample of 2309 of both gender, Telama & Yang (2000) had find a marked decline after the 12 years of age. Also Kim et al. (2000) report a decline in the transition between the childhood and adolescence in a sample of 2379 children observed between 9 and 18 years of age. Yet, in a large study (n=3742) with children aged 6-10 years Lopes et al. (2003) evaluated PA with a questionnaire and found no PA decline. It is possible that the questionnaire don't have the ability to evaluate PA as accurate as accelerometry as. The degree of the decline in the present study is of the same magnitude reported by Trost et al. (2002). One limitation of the present study, and also some others about this issue, is that they are cross-sectional nature, because of that we couldn't have an unshaken confidence that decline is of the magnitude registered.

The literature report that boys are more active than girls, that is, engage more in vigorous and in competitive PA. (e. g. Janz et al., 1995). The results of present investigations confirm this general idea. Across the three age groups, boys are consistently more active than girls, and the difference is more marked in VPA. Van Mechelen et al. (2000) in a longitudinal study between 13 and 27 years of age, found that girls had more participation in moderate PA than boys, nevertheless, due to low involvement of girls in vigorous PA, the boys had a significant high values of total participation in PA. Also Mota & Esculcas (2002) found by means of a questionnaire that adolescent girls are significantly inactive than boy. Despite the fact that we don't find significant gender*age group interaction, indicating no significant difference between boys and girls in PA decline, the results show that the overall PA decline was grater in girls than in boys, and this decline was even grater when we consider VPA. The consistency of these results heightens the need of special attention, in eventual intervention programs for the promotion of PA, in girls of all ages.

During the 7 days of observation, the children and adolescents of the sample of this study, mostly the older, performed very few sustained bouts of PA. In fact, only group 1 performed 3 or more 20-min bouts of sustained MVPA. Participation in continuous 20-minutes bouts of VPA was near zero in both genders of all age groups. Hence, it seems that principally the adolescents of the sample of this study, don't accomplish PA recommendation of 30 minutes a day of MVPA (Cavill et al., 2001), or 20 minutes a day of VPA (Sallis & Patrick, 1994). Even son, there was a great participation in shorter bouts (10 and 5 minutes) of MVPA, and in younger boys there was also a remarkable participation in 5-min bouts of VPA. Perhaps these recommendations don't have in consideration the PA characteristics of children and youth. Children typical pattern of PA is characterize by short, intermittent bouts of VPA with frequent rest periods of longer duration. Bailey et al. (1995) reported that in children 95% of VPA lasted less than 15s and only 0.1% of bouts were longer than a minute, and no bouts longer of 10 minutes was recorded. The median duration of low and moderate PA was 6s while the duration for VPA was 3s. Maybe the criteria for define the duration and frequency of PA, that are based on more structured, adult-patterns of activity, are not appropriate for children. Welk et al. (2000) propose that a better criterion to define frequency would emphasize the accumulation of intermittent activity throughout the day. Depending on the approach used, an appropriate criterion for children might be the percentage that reports 2-3 bouts of short, intermittent activity totaling 30-60 minutes on at least 5 days a week. The mode of PA is also different between older and younger subjects, older subjects are described as involved in more formal PA, while younger mostly chose informal PA whatever their level of PA (Mota & Esculcas, 2002).

In summary, we found that boys of all ages are more active than boys, the adolescent, that is the older group (16-18 years of age) of both gender do not comply with physical activity guidelines which recommend 20-min a day of MVPA. We also found that the older groups of both gender had significantly lesser PA than the older ones, however, due the cross-sectional design of this study we can't make definitive conclusions concerning age-related trends in physical activity. Therefore, it is recommended longitudinal objective monitoring studies with long-term follow-up.

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GENDER DIFFERENCES IN PHYSICAL ACTIVITY DURING RECESS IN PORTUGUESE PRIMARY SCHOOLS

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Keywords: children, playground, activity

From a preventive point perspective, it makes sense to make sure that current low level of physical activity in young people and in particular gender differences are challenged. Because children spend a large portion of their day in school, it is important to examine physical activity levels of boys and girls in this environment (Sarkin et. al., 1997). Given that children spend up to 20% of their school week in play, primary school playgrounds provide an ideal setting for measuring children's PA (Stratton and Mota, 2000). Therefore, the purposes of this study were: (1) To measure the physical activity levels of children aged 8-9 years-old during a recess school period; (2) To investigate the gender differences in PA during unstructured recess period.
Thirty-nine Portuguese school children (16 boys; 23 girls) aged 8-9 years old took part in the study. Heart rate (HR) was assessed during morning recess, over 4 weeks during the spring term. (Polar Electro Oy, Kempele, Finland). Percentages of recess time spent in MVPA were calculated according Stratton (1996). The HR records were grouped into five time categories: (1) 15s–60s; (2) 60s–3 min; (3) 3min–5min; (4) 5min–10 min and (5) >10 min. The level of significance was set at $p \leq 0.05$.
Mean HR during recess of girls (138.3 beats·min^{-1}) was significantly ($p<0.001$) higher than boys (125.7 beats·min^{-1}). Thus the results indicated that girls experience higher cardiorespiratory load than males during school play. Boys spent 19% (approximately 4 min) and girls 34% (approximately 6.30 minutes) in MVPA indicating that low levels of PA are evident during school recess. The data showed that patterns of activity were sporadic and that children rarely engage in health promoting physical activity during recess. Girls were generally more active than boys, which may be a result of an equal opportunity to play in this setting. Thus, low levels of MVPA only provide a rationale for a greater play stimulus during recess. Thus strategies to enhance children physical activity at school recess playtime should be developed.

PHYSICAL ACTIVITY, BODY COMPOSITION AND OBESITY ACCORDING TO MATURACIONAL STAGE

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Keywords: physical activity, children, maturation

Obesity is one of the most serious health problems in industrialized countries and has been linked to low physical activity (PA) levels. Recently the importance of regular PA for youth has been positively connected to many health measures and because within a given chronological age group, some children may be advantaged or disadvantaged in the performance of some physical fitness tests due to their maturity status it's important to understand the associations between these factors. A positive, and strong relationship between the amount of PA or cardiovascular fitness and health status does exist in the adult population. This relationship is not clear for children and adolescents, and normal growth and maturation during adolescence may further obscure the association. The aim of the present study was to establish the associations between PA, obesity and biological maturation in children's and adolescents. A random sample of 1444 (8-15 years of age) children, 686 males (age, 10.8±2.3; weight, 40.4±12.5; height, 142.9±13.8; BMI, 19.4±3.4) and 758 females (age, 10.9±2.4; weight, 40.8±12.5; height, 142.6±13.2; BMI, 19.6±3.5) were evaluated from Porto region. Body Mass Index (BMI) was calculated from the children's height and weight [weight (Kg)/height^2 (m)].
Children's were classified as obese according to Cole et al. (2000). An adapted version of the "Weekly Activity Checklist Questionnaire" developed by Sallis et al. (1993), was applied to the sample for the diagnosis of their PA. Sexual maturity was determined according to Tanner's (1962). Our results reveal that BMI, weight and height increase with biological maturation. We also observed that PA decreases by biological maturation augment, both in boys and girls. Along biological maturation stages we found that the percentages of obese girls decreases ($p<0.01$), whilst in boys there is a decrease from pre-pubertal to pubertal stages and then an increase from pubertal to post-pubertal stages ($p<0.05$). PA levels decrease with biological maturation, both in boys and girls.

GENDER DIFFERENCES IN PHYSICAL ACTIVITY DURING RECESS TIME

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Keywords: physical activity, children, playground

The purposes of this study were: (1) To observe the participation into MVPA during recess at school period in children aged 8-10 years-old; (2) To determine the relative importance of physical activity levels during recess at school in overall daily physical activity; (3) To investigate the gender differences in PA during unstructured recess period. The participants of this study comprised 22 school children (boys n=10; girls n=12) aged 8-10 years old from 3rd and 4th school grade. Daily totals for the physical activity variables were calculated by summing the values from 13 hours of physical activity measurements (9:00 to 22:00), with 60-min time blocks comprising each day. The recess time (minutes) was drawn from the data collected as follows: morning period 10:30 to 11:00 and afternoon period 15:30 to 16:00.Our data did not showed differences among boys and girls in daily total counts and overall time spent in MVPA, while girls were more engaged in MVPA activities dur-

ing recess time than boys. However, girls were significantly ($p<0.05$) more involved (38.0%) in MVPA during recess time than boys (30.8%). Participation in MVPA during recess contributes significantly more ($p<0.05$) in girls (19.0%) than boys (15.4%) for the total amount required by international health-related PA guidelines, while the percent of time engaged in MVPA during recess time at school accounts in small amount for (6.5% boys and 8.3% for girls) daily MVPA. Results of this study suggest that unstructured time during the school day might be designed to provide encouragement and opportunities for all students to be physically active.

THE RELATIONSHIP BETWEEN 4-7 DAY ACCELEROMETRY MEASURES OF PHYSICAL ACTIVITY, CALCIUM INTAKE AND BONE DENSITY IN BOYS AND GIRLS, AGED 8-11 YEARS

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Keywords: exercise, bone, densitometry

Introduction
The accrual of bone mass during childhood and adolescence is a critical factor associated with the prevention of osteoporosis. There is no cure for osteoporosis once the disease is established, and a large amount of bone will have already been lost by the time of fracture (Lysen and Walker, 1997). At least 90% of total bone mass is accrued by the end of adolescence (Glastre et al., 1990). It is therefore important to maximise bone accrual during childhood in order to reduce subsequent loss.
Although there is evidence for a positive relationship between habitual physical activity and bone mineral density in children (Gunnes and Lehmann, 1996, McKay et al., 2000, Kemper et al., 2000, Lloyd et al., 2000, Bailey et al., 1999, Jones and Dwyer, 1998, Rowlands et al., 2002), the research appears to be confounded by the accuracy of measures of physical activity. Conceptually, the ideal solution for the assessment of physical activity is the use of monitors that actually measure or track movement. Accelerometers measure the accelerations of movement. The RT3 accelerometer is a small, lightweight triaxial accelerometer which stores activity data for up to 21 days. The three dimensional measure is potentially important when assessing activity.
Therefore, the aims of this study were i) to determine the relationship between habitual physical activity assessed by tri-axial accelerometry, calcium intake, and bone measures in pre-pubertal children and ii) to investigate the relationship between vigorous intensity activity and bone measures in pre-pubertal children.

Methods
Ninety-eight children, aged 8-11 years, wore accelerometers for up to seven days to assess activity. All children wore the accelerometer for a minimum of four days. The accelerometer was programmed to record minute-by-minute activity counts. The mean daily activity count on the X axis (total activity), and mean time spent in very hard, hard, vigorous, moderate, low intensity activities were used as the output measures for physical activity. Calcium intake was estimated by a four-day weighted food diary. Bone mineral content (BMC) and areal density (BMD) were measured at the total body (TB), proximal femur (PF) and femoral neck (FN) using dual energy X-ray absorptiometry. Multiple regression analyses were used to assess the contribution of total physical activity and above vigorous activity to BMC, residualised for bone area and body mass (BMC_R), after accounting for calcium intake.

Results
Boys were taller, had higher BMD at the TB, PF and FN, spent less time in low intensity activity and more time in moderate, vigorous and hard intensity activity than the girls ($p<.05$, Table 1).

Table 1. Descriptive statistics (mean ± SD)

	Boys (n = 41)	Girls (n = 57)	Total (n = 98)
Age (years)	9.2 ± 0.7	8.9 ± 0.9	9.0 ± 0.9
Mass (kg)	32.2 ± 6.3*	30.2 ± 7.5	31.1 ± 7.1
Height (cm)	133.9 ± 6.3	131.0 ± 6.7	132.2 ± 6.7
Ca^+ intake ($mg.d^{-1}$)	768.6 ± 303.0	684.7 ± 189.8	720.4 ± 246.5
Pubertal stage	1.1 ± 0.3	1.2 ± 0.5	1.2 ± 0.4
BMC-TB (g)	1024.5 ± 185.6†	901.7 ± 176.1	953.0 ± 189.2
BMD-TB ($g.cm^{-2}$)	0.867 ± 0.005†	0.816 ± 0.004	0.837 ± 0.005
BMC-PF (g)	13.8 ± 3.1*	11.9 ± 2.8	12.7 ± 3.0
BMD-PF ($g.cm^{-2}$)	0.741 ± 0.008†	0.653 ± 0.007	0.689 ± 0.009
BMC-FN (g)	3.4 ± 0.5†	2.8 ± 0.4	3.1 ± 0.5
BMD-FN ($g.cm^{-2}$)	0.701 ± 0.007†	0.614 ± 0.006	0.649 ± 0.008

*Significant gender difference = * $p<.05$, † $p<.01$.*

At the total body, total activity was a significant predictor of BMC_R in girls (R^2 = 17.6%, $p<.05$), but not boys. At the proximal femur and femoral neck, total activity was a significant predictor of BMC_R in boys (R^2 = 12.1% and 10.2%, respectively, $p<.05$) but not girls.

Conclusions
This study has provided evidence for an association between total activity and size-adjusted BMC at the total body in girls, and at the proximal femur and femoral neck in boys. These relationships persist after controlling for calcium intake. A strength of this study was the use of minute by minute accelerometry recordings of each child for at least four days to assess physical activity. This will have reduced the measurement error associated with the assessment of activity (Jones and Dwyer, 1998).

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THE INFLUENCE OF ANTHROPOMETRICAL PARAMETERS TO THE BODY COMPOSITION MEASURED BY DXA AND BIA IN 11–13 YEAR OLD CHILDREN

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Keywords: body composition, anthropometry, children

The aim of this study was to investigate the possible relationships between anthropometrical parameters and body fat% measured by DXA and BIA in 11-13 year old boys (n=27; 11.8±0.7 yrs; 152.8±8.5 cm; 39.4±6.3 kg; BMI: 16.8±1.5 kg/m^2) and girls (n=26; 12.2±0.7 yrs; 156.5±7.2 cm; 45.2±8.3 kg; BMI: 18.4±2.5 kg/m^2). Children were at Tanner stage 2 or 3. Children participated in 2-3 compulsory PE lessons per week. In total, 9 skinfolds, 13 girths, 8 length and 8 breadths/lengths were measured according to ISAK instructions (Norton & Olds, 1996). Body impedance was measured with a multiple-frequency impedance device (Multiscan 5000, UK) at 50 kHz. Both resistances at 50 kHz and resistance index height^2/resistance^2 were used. Body composition (body fat%) was assessed by DXA (Lunar Corp, Madisson, WI, USA). Stepwise multiple regression analysis indicated that supraspinale and iliac crest, and abdominal from the measured skinfolds characterized 92.2 and 61.8% (R^2x100) of the body fat% measured by DXA in boys and girls, respectively. Thigh girth from the measured girth parameters characterized 61.8 % in boys and 53.8 % in girls. The length parameters did not influenced body fat% measured by DXA. The influence of breadth/length parameters to the body fat% was relatively low but significant (in boys biacromial characterized 42.4% and in girls femur characterized 21.0% of the total variance). Body fat% measured by BIA was mostly influenced by the girth of small joints – wrist in boys (57.8%) and calf and neck (50.2%) in girls. We can conclude that body fat% measured by DXA or BIA highly depend on specific measured anthropometrical parameters.

THE EFFECT OF OVERWEIGHT AND BODY FAT ON PHYSICAL ACTIVITIES RELATED TO HEALTH IN MALE SCHOOLCHILDREN AGE 7 TO 10 YEARS OLD

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Keywords: body composition, physical activity, children

There is a growing concern in the world about the increasing prevalence of overweight and obesity in adults and children. In the case of children the data available is not uniform because the criteria for diagnosis of overweight and obesity is still under studies. The Body Mass Index (BMI) has been commonly used for nutritional assessment of adults but only in recent years it has been utilized for children. The aim of this study was to assess the impact of overweight on functional aspects of physical activities related to health in schoolchildren. The children were classified according to the BMI international standard per age (CDC, 2001) in normal children, between the 25th and 75th centile, and overweight children those between 85th and 95th centile (Dietz & Bellizzi, 1999). The research evaluated male children, age 7 to 10 years, of a private school in the city of Ipatinga, Minas Gerais (Brazil). Initially the height and weight were measured in 271 children to obtain the Body Mass Index and classify the children in groups of normal and overweight. From this group 50 normal children and 50 overweight children were selected randomly. Triceps and subscapular skin fold were measured from those children in order to calculated body fat (Slaughter, et al 1988). The two groups were submitted to tests to check the flexibility, measured by seating and reaching test, the muscle strength/muscle resistance, measured by the modified abdomen test, and the cardiorespiratory fitness, measured by the nine-minute running/walking test. The results show significantly better performance in a normal group for the cardiorespiratory fitness test compared with the overweight group ($p<0,05$). The other tests were similar comparing both groups. It was observed a significant correlation, using the Pearson correlation test, between body fat and BMI and cardiorespiratory fitness. The study showed that the body fat was inversely related to cardiorespiratory fitness in overweight children however it does not seem to influence the flexibility, muscle strength and muscle resistance.

SOMATIC CHARACTERISTICS AND PHYSICAL FITNESS IN YOUNG PLAYERS OF BASKETBALL FROM AMAZONAS, BRAZIL

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Keywords: somatic characteristics, physical fitness, basketball

Introduction

In the investigation of the players differentiated performance one of the concerns is to try to identify their individuals characteristics with the purpose to optimise the performance. In basketball, the evaluation of the players performance has been praised by different specialists and investigators (Maia, 1993; Janeira, 1994; Pinto, 1995; Brandão, 1995). The specialized literature emphasize the importance of the somatic characteristics and the physical fitness, using for its evaluation specific tests which allows to obtain specific information. The purpose of this study is to evaluate and compare by gender the somatic characteristics and physical fitness in young players of basketball from Amazonas, Brazil.

Methods

The sample comprises 79 players of basketball, 43 boys and 36 girls, 15 to 18 years of age was selected from Amazonas, Brazil. The evaluated indicators of the somatic characteristics had been: height, weight, arm span, hand length (stylion-dactylion) (HL) and transversal hand length (THL).
Physical Fitness was assessed according to the AAHPERD Youth Fitness Test, which is composed by the Sit-Ups, Shuttle-run, Standing Long Jump, 50-Yard dash, 12- Minute Run.

T-test of independent measures was used for the comparison of the averages in each one of the indicators of performance identifying the variables that best discriminates the groups (Male and Female). For testing means between groups by sex and specific positions in game (Guard, Forward and Post), Factorial ANOVA was used, followed by a post-hoc Shéffé F test. The p-value* 0.05 was chosen to accept statistical significance.

Results

The Table 1 presents the results of the comparisons among relative averages to the somatic characteristics in the male and female sex. In all the variables the male players present superior values, with evidence for the indicators to the hand lenghts (HL and THL) in that the male players' differences statistically significant are verified in relation to the female.

Table 1 - Comparison of the mean value (cm) of the somatic characteristics for the male and female sex

Indicators	Boys Mean ± SD	Girls Mean ± SD	F	p
Height	176.91± 0.081	164.17±0.075	0.036	0.851
Weight	71.87 ± 10.72	56.86±9.56	0.298	0.587
Arm span	181.05 ± 0.071	166.13±0.074	0.589	0.445
HL	23.10 ± 1.80	11.35±4.31	16.76	0.000*
THL	20.65 ± 1.43	20.08±3.28	24.42	0.000*

(*) Statistically significant (≤ 0.05)

Table 2 presents the average values obtained in the physical fitness tests among the male and female sex. Among the considered variables, we verified that Shuttle-run, 50 Yard and the 12-Minute run, present differences statistically significant male in relation to the female.

Table 2 - Comparison of the mean value of the physical fitness indicators for the male and female sex

Indicators	Boys Mean ± SD	Girls Mean ± SD	F	p
Sit-ups	43.27± 18.16	40.00±21.42	2.305	0.133
Shuttle-run	9.01± 1.86	19.45±15.51	102.89	0.000*
Long-jump	2.40± 0.36	1.97±0.33	0.872	0.353
50 Yard	9.48±2.84	11.18±2.58	5.104	0.027*
12-Minute Run	2091±7.78	1689±4.37	7.190	0.027*

(*) Statistically significant (p≤ 0.05)

Specific positions in game: female group

The Table 3 presents the comparison of the mean values of the somatic characteristics and physical fitness for the female group in agreement with the specific positions in game (Guard, Forward and Post). The existence of differences statistically significant is verified between Forward and the Post relatively to the indicator weight and among the Guard and Forward and Forward and the Post in relation to the indicator arm span. In the other indicators it is verified that the Post presents medium superiors results than the Guards and Forwards, with exception of the hand lengths.

Table 3 - Comparison of the mean values of the somatic characteristics and the physical fitness for the female group according the specific positions in game (Guard, Forward and Post).

Indicators	Guard mean±SD	Forward mean±SD	Post mean±SD	F	p
Height	163.00 ± 0.07	161.42 ± 0.06	168.40 ± 0.08	2.749	0.082
Weight	55.63± 9.07	52.90± 7.68	62.80 ± 9.82	3.562	0.042(1)
Arm span	163.25± 0.07	163.33 ± 0.07	171.80 ± 0.46	6.696	0.009(2)
HL	10.54 ± 3.86	12.63 ± 5.21	10.45 ± 3.40	0.883	0.425
THL	21.56± 4.01	20.42 ± 3.59	18.50 ± 1.22	2.209	0.129
Sit-ups	42.80± 25.32	39.07± 19.12	38.75 ±22.22	0.113	0.894
Shuttle-run	21.26± 18.63	16.74 ± 13.60	21.11 ± 15.72	0.337	0.716
Long-jump	1.95± 0.31	1.99 ±10.31	1.99 ± 0.40	0.110	0.896
50 Yard	11.15±2.10	11.16±3.18	11.22±2.27	0.002	0.998
12-Minute Run	1774.50 ± 4.88	1679.00 ± 5.39	1629.42 ± 2.42	0.294	0.747

Comparison a posteriore(Scheffé F-test)
(1) Forward vs. Post (0,047)
(2) Guard vs. Forward (0,034) and Forward vs. Post (0,019)

Specific positions in game: male group

The Table 4 presents the comparison of the mean values of the somatic and physical fitness indicators for the male group in according to the specific positions in game (Guard, Forward and Post). They were found differences statistically significant only in the somatic characteristics, just as in the female group. Of enhancing, the existence of some balance found in the medium values of the remaining indicators and in relation to the players' positions.

Table 4 - Comparison of the mean values of the somatic characteristics and the physical fitness for the male group in agreement with the specific positions in game (Guard, Forward and Post).

Indicators	Guard mean±SD	Forward mean±SD	Post mean±SD	F	p
Height	169.70 ± 0.052	175.67 ± 0.59	185.08 ± 0.06	19.209	0.000(1)
Weight	66.39± 6.79	70.61± 11.37	78.65 ± 9.27	4.490	0.017(2)
Arm span	174.10± 0.04	180.86 ± 0.06	187.75 ± 0.48	17.434	0.000(3)
HL	22.08 ± 1.27	23.08 ± 2.03	24.00 ± 1.29	3.462	0.041(4)
THL	19.80± 1.90	20.78 ± 1.21	20.91 ± 0.87	1.969	0.153
Sit-ups	44.80± 20.45	39.09± 12.10	49.41 ±23.95	1.296	0.285
Shuttle-run	8.94± 2.18	8.81 ± 1.70	9.42 ± 1.80	0.399	0.674
Long-jump	2.30± 0.33	2.39 ±10.36	2.53 ± 0.38	1.132	0.332
50 Yard	9.15±2.81	9.42±2.82	9.85±3.08	0.169	0.845
12-Minute Run	2110.90 ± 4.83	2089.71 ± 5.98	2060.75 ± 6.52	0.020	0.980

Comparison posteriori (Scheffé F-test)
Guard vs. Forward (=,042); Guard vs. Post (0,000); Forward vs. Post (0,000). Guard vs. Post (0,023). Guard vs. Forward (0,009); Forward vs. Post (0,000); Forward vs. Post (0,005). Guard vs. Post (0,041)

Conclusions
We can conclude that the male basketball players from Amazonas (Brazil), concerning the somatic characteristics, are taller, are heavier and their up-limbs are bigger, and they show differences statistically significant in the hand lengths than on the female players. They are also better in all physical fitness indicators, with special evidence in shuttle-run, 50-yard dash and 12 minute run, were we found differences statistically significant .
Concerning the players specific positions in the game (Guard, Forward and Post) we have found differences in the performance indicators studied in both groups (female and male) with special evidence to the somatic characteristics where we have verified differences statistically significant.

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TERM TIME AND HOLIDAY PHYSICAL ACTIVITY PATTERNS OF 7 TO 9 YEAR OLD GIRLS

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Keywords: accelerometer, season, moderate intensity physical activity

Aim: Objective measures are recommended when assessing children's physical activity (PA). However, most studies utilizing an objective measure of PA in children have used a one off measurement period, typically during term time. As PA is known to vary between school and non-school days, and across season, this may not be representative of overall PA. The aim of this study was to compare PA patterns of 7-9 year old girls during term time (TT) and summer holiday (SH) using accelerometry.
Method: Twenty eight girls [(mean±sd) age, 8.8±0.9 yrs: height, 129.5±5.4 cm; mass, 28.9±5.9 kg] were recruited from schools in the local area. Physical activity was assessed using triaxial accelerometry (RT3, Stayhealthy Inc., Monrovia, California) for up to seven days over both TT and SH periods [6.5 ± 0.6 days and 5.8 ± 1.1 days, respectively]. Minutes spent in moderate (3 to <6 METS) and > vigorous (> 6 METS) intensity PA were calculated using pre-defined cut-off points. A median split, using an aggregate value of total PA as the central tendency, was used to classify the girls as either high- or low- active.
Results: Two-way ANOVAs revealed group x time interactions for total PA counts (F1, 26 = 6.118, P<0.05) and minutes spent in >vigorous intensity (>vig) PA (F1, 26 = 5.829, P < 0.05), but not time spent in moderate activity. Post-hoc tests revealed high active girls had higher total PA counts than low active girls during both TT [463598.26 ± 73926.2 cf. 404936 ± 63839.8 counts, P 0.05] and SH [494333.30±10894.6 cf. 322479.72±60590.7, P<0.05]. However, while low active girls had lower PA counts during SH than TT (P<0.05), high active girls maintained the same activity levels during SH and TT. Low active girls spent less time in >vig PA than high active girls during SH (24.2±11.4 mins cf. 52.6±21.6 mins, P<0.05), but not during TT (34.0±14.2 cf. 44.9 ±13.2 mins, P>0.05).
Conclusion: Activity levels of low active girls appear to be lowered further in holiday time, relative to term time. This provides compelling evidence as to the potential benefits of school as an institution for promoting PA in girls, particularly those who exhibit low activity behaviours. It is recommended that studies using an objective measure of PA account for school days, non-school days and seasonal variation when assessing activity levels in children.

INFLUENCE OF SOCIOECONOMIC STATUS IN PHYSICAL FITNESS: A STUDY IN AFRICAN SCHOOL-AGED POPULATION

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Keywords: fitness, africa, socio economic status

The main purpose of this study was to analyze the influence of socioeconomic status (SES) in physical fitness in an African urban school aged population. Sample size comprises 1199 males and 1304 females aged 7 to 17 years from Maputo, Mozambique. Physical fitness was evaluated according to nine items: sit and reach, trunk lift, sit-ups, standing long jump, arm hang, curl up, handgrip, 10x5 meters run and one mile walk/run. Subjects were divided in three groups according to their socio-economic status: low, average, and high. Data analysis consisted of ANCOVA using SES as factor and age, maturity stage and body mass as covariates. All calculations were done in SPSS 10. Results showed significant difference among groups in almost all tests. Controling for age, maturity status and body mass index, subjects from the low SES group have significant higher performance in sit and reach (Fb(boys)=131.5; Fg(girls)=187.0), trunk lift (Fb=28.8; Fg=22.9), flexed arm hang (Fb=3.0; Fg=4.8), handgrip (Fb=23.9; Fg=123.4) and 1 mile run (Fb=157.0; Fg=258.1). High SES group performed better in sit-ups (Fb=44.5; Fg=35.8), curl-up (Fb=7.0; Fg=9.2) and 10x5 meters (Fb=24.9; Fg=4.0). In standing long jump differences were only significant in boys (Fb=17.1) favoring the high SES group. It was concluded that (1) the better performance of the low SES group may be linked to higher physical activity levels associated to survival activities and recreational outdoor games observed in this population, and (2) results in fitness tests favoring high SES group may be influenced by a socio cultural effect.

COMPARISON OF THE VALIDITY OF THE TRITRAC AND RT3 TRIAXIAL ACCELEROMETERS FOR ASSESSMENT OF CHILDREN'S PHYSICAL ACTIVITY

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Keywords: oxygen consumption, vector magnitude, heart rate

When assessing children's physical activity it is recommended that objective measures e.g. accelerometry, heart rate or pedometry are used. The Tritrac triaxial accelerometer (T303A, Reining International Professional Products, Wisconsin, USA) has been shown to be a valid measure of physical activity, but has recently been replaced with the RT3 (Stayhealthy Inc., Monrovia, CA); a smaller and more user-friendly accelerometer. The purpose of the present study was to compare the validity of the Tritrac and the RT3 for predicting oxygen consumption during a range of typical children's activities. Nineteen boys (mean age 9.5±0.8 years, height 137.8±6.9 cm, body mass 33.5±5.4 kg) took part in the study. Each child carried out seven different activities: four regulated activities (walking at 4 and 6 $km.h^{-1}$ and running at 8 and 10 $km.h^{-1}$) on a treadmill and three unregulated play activities (computer game, kicking a football to and fro, and playing hopscotch). Each activity was carried out for four minutes, with the exception of the computer game (ten minutes). Heart rate and oxygen consumption were measured in the last minute of each activity. The Tritrac and RT3 were securely fixed to a belt and worn above the left and right hip, respectively. Oxygen uptake was expressed as a ratio of body mass raised to the power of 0.75 (SVO_2). Mean activity counts, across all activities were 6811.5±2442.7 $counts.min^{-1}$ (Tritrac) and 7490.5±2987.2 $counts.min^{-1}$ (RT3). Activity measured by Tritrac vector magnitude (Vmag) and RT3 Vmag both correlated significantly with SVO_2 ($r = 0.867$ and $r = 0.873$, respectively; $p<0.01$) for all activities combined. RT3 Vmag and heart rate combined was the best overall predictor of SVO_2 ($R^2 = 0.818$, $p<0.01$). Bland and Altman plots showed RT3 counts were consistently higher than Tritrac counts (mean bias = 544.0 counts, 95% limits = ± 840.8 counts). However, the difference between RT3 and Tritrac counts increased as the mean of RT3 and Tritrac counts increased. This study supports previous research showing a strong linear relationship between the Tritrac counts and SVO_2. Prediction of SVO_2 by the RT3 was as good as the Tritrac and this, combined with the RT3s smaller size, makes it a suitable alternative to the Tritrac. However, there is a lack of agreement between the two accelerometers. As the Tritrac is no longer available, this limits comparison of RT3 data with previous research.

A MIXED-LONGITUDINAL STUDY OF SOMATIC GROWTH, PHYSICAL ACTIVITY, HEALTH-RELATED PHYSICAL FITNESS AND MOTOR CO-ORDINATION IN CHILDREN FROM VISEU, PORTUGAL

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Keywords: longitudinal, somatic growth, physical activity, coordination

The Portuguese educational system felts a strong need for longitudinal information, particularly in the Physical Education setting of children. The research program that we are going to briefly outline aims at the fulfillement of this gap, although it will be based primarily on a population from a city located in the center of Portugal – Viseu.
The main aims of this large study are: (1) to investigate change and stability in somatic growth (SG), physical activity (PA), health-related physical fitness (HRPF), and motor co-ordination over a 4 year period; (2) to study the tracking of the main items involved in the several domains of the study; (3) to model change and its predictors at the individual and school levels, and to (4) search for important clues regarding intraindividual changes in interindividual differences with the framework of structural equation modeling and hierarchical modeling.
Sample size comprises 900 subjects of both genders and was divided in two cohorts: cohort 1 (baseline age of 6 years, n = 450); cohort 2 (baseline age of 9 years, n = 450). This is a missing-by-design study with an overlapping age of 9 years. We shall cover a period of 7 years, i.e., from 6 to 12 years (main years related to the first years of official schooling where mandatory physical education classes will involve children in their first approaches to formal sports).
For most of the domains of the study a yearly evaluation will be scheduled. For the somatic domain, evaluation takes place two times a year.
Somatic measurements will be comprised of height, weight, sitting height and body mass index (BMI). Health-related

physical fitness will be assessed with the "Prudential Fitnessgram" test battery, which is composed of one-mile run-walk, trunk-lift, push-up, curl-up, and body composition. Some performance-related fitness tests are also conducted: shuttle-run of 10x5 meters, 50 meters dash, standing long jump, hand grip. Motor co-ordination will be evaluated with the Korper-Koordinationstest fur Kinder (KTK) test battery which includes 4 tests: walking backwards on beams of decreasing width, jumping with each leg separately over an increasing number of foam plates, jumping laterally to and from with both legs, and moving across the floor by stepping from one plate to second plate, then relocating the first plate, then taking the next step, etc. Physical activity will be assessed with different protocols: (1) the Godin & Shephard questionnaire will be used with the first cohort; (2) the Baecke et al. questionnaire will be used with the second cohort; (3) a seasonal evaluation of PA patterns will be assessed with the CSA accelerometer in 60 children for 7 days.
Data analysis will use most of the available models for change within the structural equation modeling approach, i.e. Markov and Wiener for the study of tracking, and latent growth and mixture models for the study of change over time, including, of course, fixed and non-fixed predictors. We shall use also a multilevel or hierarchical approach to study predictors of performance in different levels, i.e., students and schools.

PARENTAL INFLUENCES AND OTHER DETERMINANTS OVER THE LEVELS OF PHYSICAL ACTIVITY AND SPORTS PERFORMANCE BY CHILDREN AND TEENAGERS FROM 10 TO 19

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Keywords: physical activity, determinants, parental influence

Introduction
Physical activity and practising sports seem to be the most important behaviour to promote an active and healthier lifestyle and to prevent a substantial amount of risk responsible for some chronic diseases. This behaviour is due to an interaction between someone's genetic inheritance, family and schooling, teaching active lifestyles, as well as identify the influence of some factors upon such relationship.
Aim: To determine parental influence over the levels of their children physical activity and sports performances, as well as the influence of other important determinants of this relationship (the family social and economic status, the mother's age, the father's age, their schooling, sex, children's age, brothers, friends or even their Physical Education teacher).

Methods
The sample included 5850 children and teenagers, male and female, from 10 to 19, attending basic and secondary schools, and their parents. The assessment of physical activity and sports performances was based on the Baecke et al. (1982) questionnaire, which enables to estimate the rate of total physical activity, as well as the different types of physical activity (work/school, sports, leisure). The statistical procedures included the χ^2 test and the multiple regression, The data processing was done by the SPSS 10.0 statistical software.

Results and Conclusions
(1) The determinants (the father's, mother's age, and their brother) had no substantial influence over their sports performance; (2) there is a substantial parental influence over teenagers sports performances, being the father's influence ($\chi^2 = 97.39$; $p=0.000$) stronger than the mother's ($\chi^2 = 85.71$; $p=0.000$); (3) The male gender is more inclined to practice sports than the female; (4) Their family's social and economic status shows a positive influence over their sports performance.

STUDENTS' ATTITUDE TOWARDS PHYSICAL EDUCATION CLASSES: ANALYSIS OF TEACHING UNITS IN VOLLEYBALL AND TRAMPOLINE

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Keywords: physical education, student attitude, program

This study intended to analyse the students' general disposition towards physical education as a subject area, and the evolution of interest, attitude, perceived competence, and engagement through the teaching units in two regular contents of physical education programmes, volleyball and trampoline. Data were gathered from two 9th grade physical education classes taught by the same teacher (46 students: 28 girls, and 18 boys). A questionnaire adapted from Fonseca (1995) and Gonçalves (1998) applied for information about students attitudes towards physical education. Changes in students' interest and perceptions through specific teaching units were measured by a questionnaire adapted from Tjeerdsma et al. (1996). The assessment tool for students interest' and attitude in each class session was adapted from Mackenzie et al. (1994). Students' opportunity to respond (number of practice trials, and rate of successful trials) was observed using event recording procedures.
The analysis is built upon gender and skill level differences. Group differences, and repeated measures analysis were tested with nonparametric statistics.
In general, students have a positive attitude towards physical education. They like this subject area and they acknowledge its importance, namely for the health and fitness. Boys and girls valued different aspects for their liking. Boys put more emphasis on competition, and attribute relatively more importance to physical fitness. They have a higher perceived competence level, and they considered insufficient the time allocated to physical education (3X50mn a week). Girls, in contrast, gave precedence to social aspects and pleasure over competition. A considerable number of students, mainly girls and low skill level students, have low self-perceptions of competence at the beginning of teaching units, and they tend to remain stable over the units, excepting some increments in volleyball. The tracking of interest and liking of the activity through the class sessions portrayed contrasting tendencies, for increment in volleyball and decrement in trampoline. Differences in the opportunity to respond were influenced by gender in trampoline, and skill level in volleyball.

THE RECOGNITION OF AESTHETICS IN SPORT BY A POPULATION OF OVER TALENTED YOUNG BOYS

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Keywords: sport, aesthetics, over talented boys

Sport Aesthetics is a recognized domain of study by philosophers of Sport and by Sport Sciences community in general. However, it is a recent study area that is still in the need of understanding and knowledge to legitimate its territory. Most studies proceed from claims and statements of scholar; there is a lack of information grounded on empirical data. Data proceeding from youth are even scarcer.
The present study aimed to inquire the opinion of young boys about their image of Sport Aesthetics. It was selected a sample of 20 boys coming from a regular student population, another group deriving from an intellectual over talented population (n=8) and a third one of talented young male gymnasts (n=8). To collect information the respondents were asked to associate the classical aesthetic categories beautiful and ugly to a given list of twenty sports. The sports were representative of the three categories proposed by Kupfer (1988): quantitative, qualitative and competitive. Statistical handling included Fisher's Test.
The results enhanced that when intellectual over talented group is compared with regular students there are statistical significant differences on the opinion of both groups concerning some sports. In fact regular students considered ugly sports such as gymnastics, fence, artistic skating and trampolines, while intellectual over talented boys quoted it as beautiful. The comparison between talented young gymnasts and regular students made also in evidence differences in gymnastics and artistic skating: the gymnasts considered it beautiful, while students showed a contrary opinion. There were no significant differences on the confrontation between intellectual over talented group and talented young male gymnasts.
Regular students enhanced a sports aesthetic image that is against the traditional point of view.

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A CASE STUDY ABOUT THE PLANNING OF AN OUTSTANDING YOUTH BASKETBALL COACH

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Keywords: planning, basketball, coach

The present study intends to analyze two seasons of coaching planning from a first rank youth basketball coach. We analyzed 311 sessions of coaching plans referred to 93/94 and 94/95 seasons of a 16-17 years male league basketball coach. The coach is a well-known and estimated coach among sport community, a major reference among youth basketball coaches. The coding frame adopted for the analysis of plans was informed by Marques et al. (2000) category system of training means and methods, and training load.
Results showed that specific practice was the most used with 40,39% and 41,27% of the total training volume. The coach used more often specific preparation practice (58, 73% in 93/94, and 59,02%, in 94/95) than general preparation practice (41,27% and 40,98%, respectively). The game-based methods represented 37 ,8% and 40, 7% of the total training volume. The small games with ball are the most used of these methods. The coach assigned more time to strategy and tactics preparation (58, 75% and 59,02% of the total training volume) than to technique preparation (37,80% and 37,04%). Physical preparation by itself received little attention (3,48% and 3,94%). In the tactical preparation, the situation 5x5 is the game form most used by the coach, representing 18,36% and 18,03% of the total training volume.

REWRITTEN THE BODY AND SPORTS PRACTICES — NEW CHALLENGES

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Keywords: physical education, body values, new challenges

Introduction
This study is rooted in what is nowadays called the 'resurgence of the body'. The questions about the body have acquired increased visibility and are central topics in the agenda of several social sciences studies. Thus, the body is a prolific object for an epistemological, anthropological, sociological, and pedagogical analysis, and is a fundamental theme of the current research. Since physical education practitioners are inescapably confronted with the body while carrying out their activity, they have to be aware of the importance the body possesses as a central category of this same activity. So it is needed to understand the conceptions about the body that the physical education practitioners hold with them. It is our interest, and it is the purpose of this study to explore the position of the body in a post-modern time from an axiological perspective, by looking trough the lenses of discourses (teachers and students) in physical education, and to try to disclose possible avenues for physical education in our times.
But even if the body has suffered an increase of attention by the media and by the cultural analysts, schools, as places of body construction and constitution, tend to be forgotten. Physical Education and school sport are key elements of interest to this analysis, but there are subjects that keep on being laid aside by researchers interests. In an intellectual cultural context, which has accepted the body as an essentially biological phenomenon (part of an intellectualist tradition of western

societies), this omission won't be so hard to understand after all. As Kirk (1993) demonstrates, making a sport analysis and physical activities in literature, one verifies just some references to physical education, which is incredibly surprising, once we think physical education is an obvious place or ground to corporality issues to be studied.

As Bento (1999) refers, the fact of being the only subject that aims preferentially corporality, creating movement possibilities and avoiding that school became even more intellectualized and body enemy, it still is a central argument on behalf of Physical Education presence at school curriculum. Thus, Physical Education is the subject in which the body establishes itself as a Pedagogical treatment object. The first impression that desolates us when we think a little bit about Physical Education is the fact that we are currently attending a Physical Education based on a model and on a body understanding submitted to technical rationality, typical of the industrial society sport, where predominates an unilateral and merely instrumental understanding of the body.

The present times are times of changes, and those changes resultant of the most general transformations operated in western societies, are equally felt at physical and sportive activities field, creating some discouragement that begins to be evident, specially by the several intervening agents in this domain, and who start to question themselves if the physical and sportive activities really adjust themselves to the new sensibilities and expectatives of sport practioners.

Thus, the body must be a concern of Physical Education teachers because it's in their discipline that it viewed as an object of pedagogical treatment, and where is revealed the way that the Educational System understands it. But, which is the role of the body in Physical Education? What values does it express? What, in fact, do students and teachers valorise when we ask them: "what its really important when we talk about the body values at Physical Education?"

The main goal of this study was to analyse the body from an axiological perspective, by looking trough the lenses of discourses (teachers and students) in Physical Education.

Methods

Data for this study were collected from 6 schools in Grand Porto, Portugal. One 9th grade class per school was selected and the respective Physical Education teacher and students were interview. In order to inspect the material we have applied the content analyses technique (to the 12 interviews) introducing *a priori* defined categories.

The justification of the categorial system of our study is based on different body conceptions. Before a theoretical framing previously developed, it was possible to built three big categories about the body. The first category concerns to the Biological Body (Mechanical), the second to Expressive Body and the third category concerns to the social body. For Biological Body (Mechanical) category, we have considered different dimensions which we've referred as sub-categories: body/effectiveness, body /technical-instrumental, body/physical fitness and body/health. For Expressive Body category we have considered different dimensions which we've referred as sub-categories: body/aesthetic, body/pleasure and body/way of living experience. For Social Body category we've considered different dimensions which we've referred as sub-categories: body/ethic, body/ecology and body/social construction (Queirós, 2002).

Results

The analysis of the material reveals some discrepancy between teachers and students discourses. In general the biological/mechanical body category and the ethical category are paramount in teachers discourses.

The connection of the body to effectiveness appears to us connected with the idea of record, of effort, of overcoming, in conclusion, of achieving better results. In Tinnig's (1997) perspective this body/effectiveness is one of the vectors of a determined orientation of Physical Education, to which he refers as "Performance speech" and valorized by teachers who also justify the dominance of the technique by the valorization that the own programs made of it: "*In spite of having several goals, the programs aim the techniques improvement, usually there is techniques improvement, in spite of having there the goals and the partners respect, referee respect, teachers respect, … deep down the program is more techniques, learn the modalities techniques"*.

Another aspect to which teachers associate the technique importance is related to the fact that it constitutes itself as basis and starting point to the execution and to the possibility of a game or activities realization that have as basis the technical gesture and that through its domain can increase the motivation for practice. Relatively to technical questions and when questioned about their importance in Physical Education class, students expressed that this was one of the most worked aspects at School. Otherwise lets see: "*We spend the majority of classes time learning those things, it's technique*".

Relatively to health dimensions the teachers' opinions are placed on the physical activities influence, at Physical Education class in a future perspective, than its importance at the present.

The issues about the body connection to aesthetic are highly valued in contemporary society. The aesthetic model of the proposed (or imposed) body model by society is a young, thin and beautiful body model (Gervilla, 1997; Kirk, 1997 and Lipovetsky 1990). But is this category present at school, at least in the same patterns in which it is presented in society? Which representation do the teachers do about the body connection to aesthetic in Physical Education? What does their discourses say? In fact there are few references concerning the expressive body at all discourses (teachers and students).

A teacher says to us that at school these questions are not present: "*I think it is impossible to connect beauty to the body, it is impossible*". Relatively to the importance of the body/aesthetic category at Physical Education classes, students don't seem to give it a significant role. The great majority answered negatively when asked: "*I don't think it's the school duty*".

The elements of pleasure, so highly valued in the literature, are also values in the discourses of teachers and students, both sustaining in their particular views the importance of such elements. The hedonist values are a central category in contemporary societies, and are already legitimate values of these societies. The pleasure associated to body dominates certain life styles, being already an integrant part of today's societies individuals' projects. Bento (1999) and Meinberg (1990) also indicate the hedonist values of physical and corporal activities.

In teachers perspective there are several motifs to the pleasure (or the lack of it) at Physical Education class. Knowing the importance of this values nowadays ("*what they want is physical activity, they want movement, they want to use the body as they wish, as they like*"), there are teachers who try one way or the other to meet the students preferred activities, even if they have to

"escape" the established curriculum. When asked about this category, students showed its importance relatively to hedonist values, indicating, however, several factors which in their education "clients" perspective contribute to weak satisfaction rates in Physical Education activities. These students' opinions clearly show a difference between what students really want and what school proposes them or may actually offers. As Hargreaves (1998) refers, the lack of interest of many students in the curriculum and the teaching they have, it's not hard to understand. Teachers are competing more and more with this world and its involving culture. The issue of goals and aims seems to be also determining. At school, students say that there is no pleasure because there are no goals and aims, or at least they cannot feel them or identify them. Perhaps the school goals relatively to physical activities are not the same ones of the students.

Some teachers recognised some importance in their discourses to the experiential body category, but students say that those aspects are not valorised at Physical Education classes. In the interviews some discourses indicate a concern of the experience of that same body, and of given the student the possibility of knowing and exploring his/her own body: "*it is necessary to help this kids, so they can develop and know their own body*" and " *in my opinion what is more important in Physical Education, … is that they will be able to use the body, that they know how to run, that they know how to kick the ball, how to play with their hands, that they have the capacity to do all those things, that they want to do it and that they have pleasure doing it*".

Relatively to the body experiences, perhaps because of fear or shame, students don't venture themselves to verbalize.

Not only in the national scenery but also in the international one, there are authors (Bento 1999; Fernández-Balboa, 1997 and Tinning, 1997) who point out to the importance and relevance of the ethical dimension on the different sceneries of physical and sportive activities. The ethical category is paramount in teachers discourses: "*in my opinion the essential thing in physical Education is not properly related with the physical part, but with the ethical one, with the sportive one, because children are in such a way bombarded with the lack of sportive ethical, with the lack of sportive spirit… In my opinion, the great battle that teachers of Physical Education and Physical Education have to do, is to swim against the stream, and to made them to understand that sport is something, an activity that has to be healthy, that has to be played with fair play, with sportive spirit… in my opinion it is essential*."

The ethical values are not completely assumed through students' speeches. At school as it "*is not serious*" one do not invest in these aspects. At the club one already does. The values are not interiorized, one acts or has ethical behaviors because the fear of sanctions; as at school the sanctions are not very high (students say), or at least it does not affect them much, they put these issues to a secondary plan.

The body as social construction, so important in the current discourse outside school, does not seem to deserve any relevance within school settings. It is curious to verify that being an important aspect to be considered by literature, we have very few references about this subject, and the ones we have had are from the same persons. We think there isn't critical awareness by teachers that makes them feel as reproducers of social models and possibly hegemonicals. By students we do not verify any occurrence at verbalization level. It was not possible to us to extract any outlines of speeches that could have any relation with this matter.

Discussion/Conclusion

It seems to us that an effort to innovate the general education and, particularly, the physical education is at stake, which should lead to a redefinition of its essential goals, of its contents and object, as well as a raising of the quality of the organization ways, of the methods and teaching results, and we should not forget that the innovation opening is a concept strongly connected to the professionalism concept, which means that we are simultaneously in presence of a professionalism question in Physical Education field.

However in Kirk's (1997) opinion only a radical change of the School Institution will allow that Physical Education practices articulate themselves in a more coherent way with the corporal practices of the other social places. In alternative, Physical Education and school sport could continue its decline until being eventually substituted by programs or activities with no educational value. In the opinion of the same author we are attending to a true decline of Physical Education and its curriculum practices, which is someway surprising when the body and the different corporal practices as sport and Physical exercise are raising its meaning, and a prominent growing in post-modernity times. This actually obligates all the intervenient agents in these domains to reflect about the subject and to rethink their intervention ways.The justification for that radicates perhaps in a way of treating the body at schools that continues to construct massive practices of sportive skills and physical fitness without a liberal humanist philosophy of pleasure development, at a long-term choice and participation. In strictness way Kirk (1997, p.56) says: "*Physical Education and school sport are in decline because they represent a series of modern corporal practices, concerned in regulate and normalize the children's body, through methods and strategies which are perhaps culturally obsolete*".

But which strategies can we use that may contribute to reinvigorate the body at post—modernity? The same author suggests that if Physical Education programs are to maintain cultural relevance, they should start by reflecting and contributing more directly to popular physical culture. However, all this will be ineffective if at the same time and parallelly the best use of community resources for schools won't be done, as well as if the changes in teachers training and consequently in a strategy, methodology and contents group to be used by those teachers, won't be done.

In this way it is essential for us to understand which values of physical culture are transmitted by society, which are the one's transmitted by School and specifically by Physical Education, in which way do they adapt or not one from others, finally, to understand what's the relation between social corporal practices, outside School, and those who are made at School, specially in Physical Education class. So, it is imperative to rethink the School Institution in order to allow Physical Education practices to articulate themselves in a more coherent way with corporal practices of the other social places, because it is impossible to separate School activities from its social references and corporal practices planted in the culture of which it is a part of.

The practices of the teachers concern with the corporal educative possibilities has shown itself as a fructiferous way to develop their professional activity in a way that reverts into more rich and fair practices for students. The election of the contents should open doors and give skills and knowledge, that are not just to be consumed at School without any possibility of outside school application (Álvarez& Monge, 1997). It is needed that in Physical Education and sport it becomes visible

the emerging paradigm, already visible in other areas, which is predominantly holistic and systemic, seeing man in its entireness as a biological and cultural being.
Relating the social aspects with the cultural physical practices is an important aspect. The fast and dramatic changes in sport and the body prominence in society have a significative influence on physical activities field. Preparing the Physical Education teachers for the XXI century requires professional preparation programs, which are guided for students/clients diversity, and for a more advanced society. Physical Education teachers are working in an involving element that will require reflection capacities in a world of change, and their pedagogical practices will also have to reflect those complex involvements (Kirk & MacDonald, 2001).
We have to develop skills to "think beyond square" says Kirk (1997), reinforcing the need to prepare the new teachers for today and tomorrow's teaching at school and to take Physical Education out of the crisis it is in.
We must rethink the contemporary Physical Education in sense to becoming corporal richer in all dimensions, in way that boys and girls can find a more gratifying moments and humanly richer ones, through new practices and new ways to live their bodies.

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TEACHERS' KNOWLEDGE AND BELIEFS ABOUT GENDER AND SPORT ACTIVITIES

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Keywords: gender, teachers' knowledge

As a social reality, school is composed by "gendered" beings, meaning that children do not come into school as "tabula rasa" but already imprinted by experiences and acquirements, and this reality can not be neglected or disregarded when the teacher thinks, plans and organises the teaching. The teacher/educator works with very precise persons not with abstractions (Patrício, 1990), but on the other hand we must keep in mind that schools do not exist in a social vacuum - girls and boys start their education with definite ideas about what is appropriate for their respective gender, ideas which are reinforced by orthodox sexual divisions in the classroom, in the playground and on the games field (Hargreaves, 1994).
Either by action or by default, school tends to maintain, reproduce or even reinforce masculine and feminine stereotypes. Teacher's sexist attitudes and behaviours are characterised by their invisibility, and unconsciousness. They are difficult to change as they are neither lived nor perceived as a problem (Bonal, 1997).
It is important to know what the teacher does, its basis, how it is done, and its impact, since the events that occur on the games field, in the swimming pool or at the gymnasium are not isolated. The way social relations, namely those of gender, are structured and consolidated inside the class must be an issue submitted to the teacher's analysis, reflection and action. The teacher's decision-making and consequent actions or omissions influenced by personal beliefs and knowledge derived from his/her training as a professional become explicit or implicit messages which the students perceive within a specific context. The main goal of this study is to analyse teachers' knowledge and beliefs about gender and sport activities. Data for this study were collected from 10 structured interviews to secondary schools male and female teachers (schools in Grand Porto, Portugal). In order to inspect the material we have applied the content analyses technique.

THE CHILD AND THE PHYSICAL EXERCISE AT THE NINETEEN CENTURY IN PORTUGAL

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Keywords: child, physical exercise, nineteen century

The importance of the physical exercise as development of the children in the nineteen century wasn't new, at the time. In the previous century, some Portuguese writers had already noticed its importance and tried to convince educators to arrange activities so that children could practice according to their ages. However, it was only in the nineteen century that this type of speech make success to the efforts to acceptance of the physical exercise.
Along the nineteen century, Portugal developed some initiative to value physical exercise as being essential to the human as a whole. Despite the clear speech of medical doctors new initiatives began to appear coming from people who intend to promote physical education.
Our aim is to characterize the main ideas supported by the importance of the physical exercise in that century and the value of physical education in the same period.
For that, we intend to support our work with texts not only from the medical community but also from educators, politicians and all the others who make notice of the Gymnastics in Portugal.

INFLUENCES ON 14-15 YEAR OLD ADOLESCENTS PHYSICAL ACTIVITY LEVELS RELATED TO PUBLISHED GUIDELINES

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Keywords: children, physical activity guidelines, influences

The aims of this study were to assess the proportion of children who achieved the health-related criterion level of 30 preferably 60 minutes of accumulated moderate intensity physical activity per day (Biddle & Sallis, 1998 Young and Active? A policy symposium on young people and health enhancing physical activity. HEA: London) and to assess the influences upon it. A sample of 182 boys and 195 girls correctly filled in a physical activity diary for a week and an Environmental and significant others influences on physical activity questionnaire (Aznar 1998, PhD Thesis, Bristol University). Boys were more active than girls for the total week (Boys: mean: 987.77 min., SD: 477.47; Girls: mean: 832.57 min., SD: 452,98 t= 3.23, $p<0.01$), week days (Boys: mean= 631.54 min., SD= 310.6; Girls: mean= 485.3 min., SD= 296.03, t= 4.68, $t<0.01$) but not significantly different for the weekend. 42.9% of boys and 23.1% of girls achieved the guideline. For boys "friends influence" was the only factor that produced a significant function correctly classifying 67.24% of those boys who achieved the guideline. For girls "disliking physical activities" produced a significant function correctly classifying 62.03% of those girls who achieved the guideline. The fact that socio-environmental factors are significantly associated with the achievement of published guidelines may highlight the importance of a social aspect for boys, and for girls a wider range of physical activities choices, and perhaps different approaches (e.g. competitive, recreational and healthy approaches).

COMPARATIVE STUDY OF STUDENTS' SELF-PERCEPTION, SATISFACTION IN SPORTS AND ACADEMIC LEARNING BEHAVIOURS IN THE PHYSICAL EDUCATION LESSONS AND EXTRA-CURRICULAR SPORTS ACTIVITIES

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Keywords: self-perception, satisfaction on sport, academic learning behaviours

Introduction

The knowledge about students' perceptions concerning the Physical Education lessons and the extra-curricular sports activities can provide a better understanding of their behaviour patterns in relation to both settings. From the students' perceptions it is particularly important to know their self-perception and satisfaction in sports. It makes sense to know if the levels of self-perception and satisfaction in sports are similar in both settings as well as the kind of relationship there is between those variables and the students' learning behaviours. There are some studies that show a strong relationship between self-perception and satisfaction in sports and the learning behaviours in sports activities (Shigunov, 1991; Pieron, 1999). Self-perception is positively related with school achievement and very important related variables (Olszewska, 1982; Wittrock, 1986; Muller et al., 1990; Solmon, 1991). Pereira (1995) showed that the students with higher self-esteem had a significantly higher academic learning time in the physical education lessons. Moreover, the students with higher self-perception with regard to their competence in sports practiced sports activities outside the school and revealed concern with the development of their physical condition.
Concerning this matter, Piéron (1999) emphasises the influence of self-perception about sports competence on the students' physical education involvement and on the extra-curricular sports activities. Therefore, perception about sports competence has a significant role in maintaining a high interest rate both in the physical education lessons and in participating in competitive sports in and on outside the school.
On other hand, Pereira (1995) verified that the level of student satisfaction increased just after the physical education lessons. This study showed the relationship between the level of the satisfaction in sports and motivation to physical education activity.
The aim of the present study was to compare self-perception, satisfaction in sports and academic learning behaviours of the students in the physical education (PE) lessons and extra-curricular sports activities, namely in team sports. We wanted to analyse if self-perception, satisfaction in sports and academic learning behaviours were significantly different in both school settings.

Methods

The participants for this study were middle school students (n=300), of which one hundred and fifty (n=150) were involved only in PE lessons and the other one hundred and fifty (n=150) had complementary extra-curricular sports activities in school. We observed 20 PE lessons and 20 sessions of extra-curricular sports activities.
We considered one independent variable in two situations (students in Physical Education without extra-curricular sports activities, and students in Physical Education with extra-curricular sports activities) and different dependent variables: self-perception as a player, self-perception as a student in the physical education lessons, satisfaction in sports, and academic learning behaviours in physical education lessons and in extra-curricular sports activities.
We applied the sports competence scale to evaluate the students' self-perception, which includes 7 items, and two self-esteem scales (Pereira, 1995), which include 10 items. Each answer was put on the Likert Scale with 5 points. Concerning the Harter Sports Competence Scale (Harter, 1983) we only evaluated the physical competence component. To evaluate the students' satisfaction in sports we used the Chelladurai methodology (1984), composed of 7 items. We studied the consistency in these scales: the scale about students' satisfaction in sports showed one alpha of 0.818; the scale of self-perception one alpha of 0.85, and the scales of self-esteem as a player, as a physical education student and in extra-curricular sports activities showed values of 0.85, 0.80 and 0.63, respectively.
In all sessions the students practiced team sports games and were videotaped. We applied the OBEL-Ulg instrument (Piéron, 1988) for the systematic observation of academic

learning behaviours. This system includes 11 categories (motor engagement; attention to information; demonstrations; displacements; waiting; off-task behaviours; verbal interactions and others) which are used to measure the duration of the different behaviour patterns of the students. We observed all the sessions using an interval recording method (we considered intervals of three seconds). The reliability was estimated. The intra-rater percentage of agreement was between 93.2% and 100% and the inter-rater percentage of agreement was between 90.7 and 100%.
For the statistical analysis we used descriptive statistics (mean and standard deviations) and comparative statistics (Anova One-Way) after we verified the normality requirements (Kolmorov-Smirnov test) and the homogeneity of the variances (Levene test). We also used the Bravais-Pearson Correlation to analyse the relationship between the different variables. The reliability of the questionnaires was found with the alpha Cronbach test, considering the validity of the instruments applied in other previous studies (Pereira, 1995). For data analysis we used SPSS 11.0 program.

Results
The results showed that students participating in extra-curricular sports activities had significantly higher levels of self-perception ($p< 0.001$) in comparison to students who practice only curricular physical education, and higher self-perception of sports competence in the physical education lessons ($p<0.000$).
When we studied the levels of satisfaction in sports we verified that the students who practice extra-curricular sports activities showed significantly more positive satisfaction in the practice of sports ($p<0.000$) than the students that practice sports only in the physical education lessons. Nevertheless, in all students the levels of general satisfaction in sports were positive (3.9 and 4.2, respectively, on the Likert scale with 5 levels).
When we studied the correlations between self-perception as a player and general satisfaction in sports we verified positive and significant correlations between both constructs ($r=0.32$; $p<0.000$). The relationship between general satisfaction in sports and self-perception as a student in the physical education lessons showed the same direction ($r=0.45$; $p<0.000$).
On the other hand the students in extra-curricular sports activities had more favourable academic learning behaviours. Concerning this point, the students attending the extra-curricular sports activities showed higher levels of motor engagement ($p<0.00$) and paid more attention to the teacher's information ($p<0.04$). Contrarily, we observed that the students that practice only PE lessons, in the other categories like displacements ($p<0.04$), waiting ($p<0.009$), and off-task behaviours ($p<0.001$), revealed higher values than the students attending the extra-curricular sports activities. Only with regard to affectivity did they not stand out.

Discussion/Conclusion
In general, the students of extra-curricular sports activities showed better levels of self-perception, of satisfaction in sports and behaviour patterns, as players, more adjusted to learning. However, we cannot conclude that there is a direct relationship (cause and effect) between those variables because the present study is descriptive. It is possible that the option for extra-curricular sports practice is a consequence of higher self-perceptions and higher satisfaction in sports. We cannot exclude the possibility that extra-curricular sports activities can account for better levels of self-perception, satisfaction in sports (if the students choose the modality they prefer) and students' behaviour patterns are more favourable to the learning process. It is important to carry out research that can clearly define the nature of the causality in those relationships.

Conclusion
The major conclusion of this study showed a positive response of the students to extra-curricular sports activities. Indeed, extra-curricular sports activities in school proved to have strong value as a complementary activity to physical education lessons.

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RELATIONS BETWEEN PHYSICAL FITNESS AND HABITUAL PHYSICAL ACTIVITY LEVELS IN CHILDREN 8 TO 12 YEARS OLD

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Keywords: physical activity, physical fitness, children

Introduction
The aim of this study was to quantify the habitual physical activity level (HPA) of French prepubertal children during school and free days, and to analyze the possible relationships with physical fitness level (PF).

Methods
Thirty-nine children (15 boys et 24 girls), aged 8 to 12 years old, were involved in this study. They performed five field tests, some of which comprised in the European physical fitness test battery (EUROFIT)[1]. The selected tests were standing broad jump (SBJ in cm), 10*5 meter shuttle run (SHR in s), sit-and-reach (SAR in cm), the number of sit-ups in 30 seconds (SUP) and 20- meter shuttle run (20MST in km.h^{-1}). Children HPA was recorded during a 7-day period, with an uniaxial accelerometer (Computer Science Applications Inc (CSA), model 7164, Shalimar, FL). The epoch duration was set to 1 min between 7 am and 9 pm and the time spent above a HPA threshold, corresponding to moderate to vigorous intensity (> 3 Mets) (MVPA time), was calculated[2].

Results
There was no significant difference between boys and girls, in anthropometric measurements, performances in SBJ, SHR, and SUP, and in HPA and MVPA time, for school days, as for free days. Nevertheless, HPA (counts.min-1) and MVPA time (min.day-1) were significantly higher (respectively, $p<0.001$ et $p<0.01$) during school days than free days. Significant relationships ($p<0.001$) between HPA and MVPA time were observed, for school days ($r=0.82$) and free days ($r=0,89$). In addition, 56% of the children participated in MVPA activities for at least half an hour per day[3]. Only relationships between SBJ and MVPA time ($r=0.36$, $p<0.05$) during school days, and between body mass index and MVPA time ($r=0.34$, $p<0.05$), during free days, were found.

Conclusion
In children, the habitual physical activity level is significantly higher during school days, but was not related to the different components of physical fitness. It should be interesting to increase HPA during school days, notably in PE sessions, and observe the influence of such an improvement and its intensity on the habitual physical activity.

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TRAINING PERIODIZATION IN MIDDLE AND LONG DISTANCE RUNNING. EMPIRICAL AND COMPARATIVE STUDY BETWEEN PERIODIZATION MODELS OF BEST PORTUGUESE SENIOR ATHLETES WHEN YOUNGSTERS AND THE CURRENT YOUNG ATHLETES

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Keywords: middle and long distance running, periodization, young athletes

Introduction
In athletics and high competition, coaches and athletes are always searching for the best training system and the best periodization. However, the importance of training periodization has differentiated profiles, when it deals with children, young, or adult athletes. In adults, the training periodization is overwhelmed by competitive and economic reasons, a factor which may not occur in children and young athletes training. In these cases, it is claimed that periodization, when necessary, should be submitted to formative and educational values. Additionally, research on this subject is very scarce and we don't know what occurs in the practice of youngsters' training in Portugal. Therefore, we want to observe and compare the past [using a sample of success former athletes in middle and long distances running (MLD)] and the present (using a sample of MLD young athletes) training process, relating to periodization.

Method
The research was carried out with two independent samples of individuals: – sample A - 32 coaches who fit 84 young talented athletes (with ages between 10 and 19 years old) in MLD; and– sample B - circumscribed to 26 former elite athletes of both sexes that had participated in European and/or World Championships and/or Olympic Games (MLD events).
Two open reply interviews, specially made and validated for these samples were used. All the collected information (samples A and B) was examined using content analysis techniques. In sample B the collected information referred to the athletes past athletic lives, while young.

Results
The main obtained results were: (i) at stage of initial specialisation, the duration of the transition period was 32±16,5 days (7-63) for individuals of sample A and 79,5±26 days (31-122) for the athletes of sample B; (ii) at stage of deep specialisation, the duration of the transition period was 30,5±30,7 days (7-63) for actual youngsters and 50,4±30,7 days (0-122) for former success athletes; (iii) in sample A athletes, the duration of the transition period from one stage of preparation to another does not disclose statistically significant differences. The results show that the training periodization guided by formative principles is not part of the coaches concerns (for sample A), and that it follows (in all the preparation stages studied) the logic of income and importance of the competitive events and competition calendars.

MOTOR PERFORMANCE AND MATURATIONAL STATUS. STUDY IN CHILDREN OF TWO DIFFERENT SCHOOL ENVIRONMENTS (RURAL AND URBAN)

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Keywords: motor performance, rural and urban environments, children and adolescents

Introduction

The study of the physical fitness of the populations has congregated, in the last decades, a growing interest for recognizing it's association to physical activity routines, and the influence on the subject's adaptation to the continuous solicitation of daily tasks (Malina, 1991). Physical activity assumes more and more relevance in the well being and quality of life of individuals. For the child, it is also a way to acquire several knowledge and abilities, either motor or cognitive. Furthermore, physical activity is a good way of socializing and developing self-concept and self-esteem (Holopainen, 1986). Since childhood, it's fundamental to promote a regular physical activity instead of a sedentary lifestyle, which contributes to the appearing of several diseases of different ethiology since childhood, and the loss of quality of life (Astrand, 1992). According to Malina (1980), children's motor activities constitute the foundation of their motor proficiency. The more diversified the motor experiences in childhood, the more successful will the young and the adult be in their habitual physical activity and in their motor performance. There are several examples in the literature suggesting that children spend a lot of their free time in sedentary activities (Cale, 1991, in Gomes, 1996). This author also defends that the level of regular physical activity presents a tendency to decrease with age, mainly when the adult did not consolidate an active and healthy lifestyle, during childhood or in adolescence. In the last 20 years we assisted to the rising of studies which systematically investigate the relationships between biological, psychosocial and cultural events that mark adolescence. Despite that all of us recognize social life as a determinant factor in human development, there are few studies concerning the influence of different cultural contexts in the adolescent's lifestyle and regular physical activity. These studies (e.g. Malina, 1980) suggest, however, that the social, cultural and economic environment where the behaviour occurs is decisive in the individuals' lifestyle and regular physical activity. Social context concerns the interactions with the family, with others and with organizations. Cultural context comprises the cumulative weight of those interactions along generations, representing values and traditions associated to behaviour. The interactive effect of decisive factors as growth, maturation and the environment, turn physical fitness into a very "plastic" subject, of great variation among populations (Freitas, 2001).

The aim of this study is to evaluate the level of motor performance of children and adolescents living in different contexts (a rural area and an urban area), according to sex and maturational status.

Methodology

The sample comprises 204 subjects of both sexes, aged 11-15 years old, belonging to different contexts: one group (n=100) from an urban area (Matosinhos), and the other one (n=104) from a rural area (Trás-os-Montes). All subjects were drawn from the public school nearer to their home, and all of them belong to low or average socio-economic status. To assess motor performance the EUROFIT Battery (1988; 1993) was used. However, the test of endurance has been taken from the FACDEX Battery (1992). Two different inquiries were used in order to evaluate the maturational status: one of them, applied to the girls, was the menarcheal age (concerning the retrospective method) and the other, applied to the boys, was the genital development (using the Tanner Method, 1962). Statistical procedures involved descriptive statistics, the ANOVA Factorial, Pearson's product moment correlation coefficient (r) and the contingency tables. Concerning the nonparametric statistics, the Chi-squared test was used. The significance level was set on 5%.

Results

The results suggest a superiority of physical fitness levels in children and adolescents of both sexes of the rural environment, when compared to their counterparts of the urban environment. We observed significant statistical differences in the tests of hand grip (p=0.024) and shuttle run (p=0.000). (Table 1).

	Rural area	Urban area	t-test	p
Flamingo Balance	5,49	5,42	0,11	n.s.
Plate Tapping	12,71	12,34	1,34	n.s.
Sit and Reach	6,29	4,87	1,53	n.s.
Standing Broad Jump.	1,47	1,43	1,09	n.s.
Hand Grip	27,24	24,86	2,28	0,024
Sit up's 30"	19,19	19,98	-1,06	n.s.
Bent Arm Hang	9,56	11,35	-1,18	n.s.
Shuttle run 10x5	21,78	22,92	-4,17	0.000
Endurance 12'	1892,79	1959,25	-1,26	n.s.

Table 1: Physical fitness. Comparison between rural environment and urban environment. Mean, standard deviation, t and p values.

When we compared the results obtained with the boys, we verified that the boys' level of physical fitness is higher in the rural environment than in the urban areas. However, only the shuttle run test presented a significant statistical difference (p=0.000) (Table 2).

	Rural area	Urban area	t-test	p
Flamingo Balance	4,69	5,04	-0,44	n.s.
Plate Tapping	12,79	12,10	1,58	n.s.
Sit and Reach	3,06	2,39	0,5	n.s.
Standing Broad Jump.	1,61	1,55	1,14	n.s.
Hand Grip	29,53	26,47	1,69	n.s.
Sit up's 30"	20,98	21,43	-0,4	n.s.
Bent Arm Hang	13,32	16,01	-1,05	n.s.
Shuttle run 10x5	20,60	21,98	-3,96	0.000
Endurance 12'	2077,66	2151,86	-0,92	n.s.

Table 2: Boys. Physical fitness. Comparison between rural and urban environments. Mean, standard deviation, t and p values.

Concerning the girls, we also verified higher levels of physical fitness in the rural environment, with significant statistical differences in the shuttle run (p=0.035) and manual dynamometry (p=0.000) tests (Table 3).

	Rural area	Urban area	t-test	p
Flamingo Balance	4,89	4,13	1,04	n.s.
Plate Tapping	12,64	12,60	1,13	n.s.
Sit and Reach	8,95	7,45	1,4	n.s.
Standing Broad Jump	1,35	1,30	1,43	n.s.
Hand Grip	25,34	23,18	2,13	0,035
Sit up's 30"	17,72	18,47	-0,84	n.s.
Bent Arm Hang	6,46	6,51	-0,03	n.s.
Shuttle run 10x5	22,75	23,89	-3,6	0.000
Endurance 12'	1740,35	1758,78	-0,38	n.s.

Table 3: Girls. Physical fitness. Comparison between rural and urban environments. Mean, standard deviation, t and p values.

Concerning the physical fitness variation according to maturational status, results indicate that globally, boys evidence an improvement of the results along the maturational categories, namely in the following components: static strength (Hand Grip), explosive strength (Standing Broad Jump), flexibility (Sit and Reach), agility and running speed (Shuttle run 10x5) and cardio-vascular endurance (Endurance 12'). (Fig. 1)

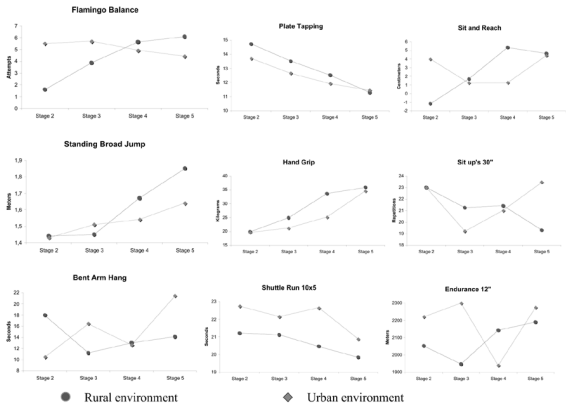

Fig. 1: Boys. Physical fitness according the maturational status (genital development).

Our results support the studies from other authors (e.g. Pineau et al., 1988; Jones et al., 2000) that found an important effect of sexual maturation in boys' physical fitness expression.
With respect to girls, our results suggest a physical fitness level improvement along the maturational development (age of menarche). Pos-menarcheal girls present superior physical fitness levels in almost tests when compared to their counterparts (Fig. 2).

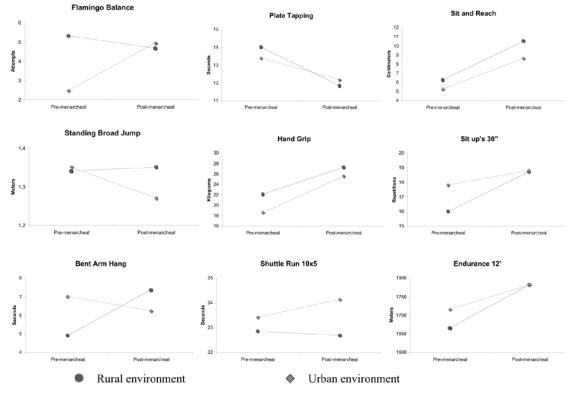

Fig. 2: Girls. Physical fitness according the maturational status (age of menarche).

Discussion

Comparing rural and urban environments, the results suggest that the differences observed between the groups can be related with the variety of incentives that children in the rural area have, as well as the variability of their practice. They play games and make movements evolving more strength and speed than their counterparts of the urban area. They have more mobility and more freedom to manipulate different objects, to climb obstacles, to catch, to pull, to run, to pursue, to jump, as well as wider spaces to accomplish all of these actions and movements.
Several authors (e.g. Bragada, 1995; Freitas, 2001) have been elaborating studies that suggest a physical fitness superiority of the infantile and juvenile populations of the rural environments.
Concerning the comparison between both environments in each sex, our results, support those observed in the study of Bragada (1995). This author, with a group of 9 and 10 years old girls from Trás-os-Montes, verified a statistically significant superiority of the rural environment in the test of manual dynamometry. However, in the shuttle-run test, Pissarra (1993) observed a statistically significant superiority in the 8 and 9 years old girls from the urban environment.
In general, we can say that there is a tendency to verify a superiority of physical fitness levels in girls and boys of the rural environments (e.g. Pissarra, 1993; Bragada, 1995).
Our results support the investigations undertaken from other authors (e.g. Pineau et al., 1988; Jones et al., 2000), that found an important effect of the sexual maturation in the boys' physical fitness expression.
Malina & Bouchard, (1991) emphasize that the physical fitness development is dependent to the rhythm of maturation. They suggest that we should take in account that this rhythm is not uniform and it can present important variations in each subject and across subjects.

Conclusions

The main conclusions are as follows: (i) The children and youth living in the rural area (taking both sexes into account) showed higher levels of motor performance than those living in the urban area; (ii) Significant differences have been observed in the tests of manual dynamometry (manual strength), as well as in the shuttle run (agility).

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MOTOR COORDINATION AND BODY IMAGE PERCEPTION. COMPARATIVE STUDY IN GIFTED AND NON-GIFTED BOYS

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Keywords: gifted children, body image, motor coordination

Introduction

"I don't have special gifts, but I am extremely curious" (Albert Einstein). Everybody recognize that understanding the extraordinary levels of the human mind is important for our society and for the scientific knowledge of human potential. The scientific investigation about the gifted people already remounts to the reports of Galton (1869). These reports concern the genetic and statistical researches on gifted children, being the first quantitative studies about human abilities. According to this investigator, subjects with the ability of outstanding accomplishment possess a larger amount of specific aptitudes. However, he verified that those qualities, although they are the same ones that others possess, they exist in a larger amount in gifted people.

Oliveira & Oliveira (1999) consider that the main impulse to enlarge the interest for studying gifted people came from the important study of Terman (1926). This investigator followed longitudinally 1500 gifted subjects since 1921, from primary and secondary school, and accompanied them up to 1955. The results of this investigation allowed to understand gifted subjects under several perspectives: physical and mental health, school success, personality, outside school interests, social origin, attitude towards life and professional success. The most important characteristic was a high IQ, and this aspect became the criterion used for identification of gifted children.

Cortizas (1999) suggests that gifted people possess the following characteristics: (i) IQ higher than 130 (understood as a group of abilities, talents or mental abilities); (ii) speed of learning; (iii) special abilities on processing information, using it and making decisions; (iv) great creativity; (v) great motivation and interests.

However, the social isolation reported in gifted children can have reflexes in their motor and perceptive development, including the areas of motor coordination and body image perception (Almeida et al., 1999).

Body image is a dynamic concept, which may be defined in terms of a picture or a mental representation of the body-self that gradually changes throughout life as the body develops and changes (Collins, 1981). Phenomenal body size is defined as the experienced or estimated size of body parts (Kreitler & Kreitler, 1988), and is one of the most characteristic aspects of the body image (Schilder, 1968), playing an important role in perception (Vasconcelos, 1995), in development (Cratty, 1986) and personality (Kreitler & Kreitler, 1988).

Regular engagement in physical activity appears to have both physical and mental benefits, including a better evaluation of one's body image accuracy and the development of a more positive body image satisfaction. These aspects of body image seem also to suffer alterations across the growth process, with emphasis during the pubertal period.

Perceptions of body parts and their functional abilities, the relationship of one's body in space, and the ability to regulate movement in space, all provide valuable feedback information about the image one has of one's body.

Several efforts have been done to study the relationship between ability in physical activities and sports and the development of positive feelings and beliefs about the self, including self-image and body image (e.g. Davis & Cowles, 1991).

Berger et al. (1997) accomplished studies with children aged 8 to 12, pretending to analyze the variation of motor coordination according to the levels of body image perception. The authors verified that children with higher body image perception accuracy levels presented higher levels of motor coordination.

The aim of this study is to investigate body image perception, motor coordination and the relationship between these two factors, in the gifted male and in the non-gifted male aged between 8 and 11 years old.

Methods

The sample comprises five gifted male and five non-gifted male aged between 8 and 11 years old. None of these children are athletes or present a special talent to physical activity or sports. Both groups have physical education classes twice a week (120 minutes).

The assessment instruments used in this study were the Body Size Estimation Method (BSEM), from Kreitler & Kreitler (1988) and the Körperkoordination Test für Kinder (KTK), from Schilling & Kiphard (1976). The first one consist of asking the subject to estimate, in a random order, the size of ten body parts: his height, width of the mouth, the shoulders, the waist and the hips, the length of the hand, the face, the ear and the nose, and the height of the forehead. The size estimations were preceded by the following instructions: with the aid of your hands or fingers you can show the size of various things. For instance, by bringing your hands nearer to each other you can show smaller sizes or distances and by spreading them further apart you can show bigger sizes. Your task will be to show the size of some of your body parts or aspects. All estimations were done in the standing position, with the eyes closed so as to enable a better representation of inner sensations and prevent distraction and comparison with external objects or even with the estimated body part. Because keeping the eyes closed for a longer period might create special effects that would influence the later estimations more than the initial ones, the subject was permitted to open his or her eyes between estimations (Kreitler & Kreitler, 1988).

To calculate the percentage difference scores, BPI (Body Perception Index) = (perceived body size/real body size) x 100 was applied. A value equal to 100 represents 100% accuracy. A value above 100 represents an overestimation, and a value bellow 100 represents an underestimation of body parts size (Ruff & Barrios, 1986). Test-retest reliability for the size estimations was checked over a two-week interval in 90 male and female subjects, ranging from 4 to 30 years old. The mean correlations across all estimations, in all groups, were in the range of .93 to .97 (Kreitler & Kreitler, 1988).
The second assessment is a body coordination test for children. It comprises the following tests: Backward Balance, Single Foot Jump, Sidestep Jump and Lateral Transposition.
The statistical procedures used were: mean, standard deviation, minimum and maximum values, Mann Whitney test and Pearson's correlation coefficient. Alpha level was set at p≤ .05.

Results

Results

	N	*Minimum*	*Maximum*	*Mean*	*Std. Dev.*
Height difference scores	10	1,00	13,00	4,3800	3,67357
Shoulders difference scores	10	,80	19,00	9,7900	6,17134
Waist difference scores	10	,70	11,80	5,8600	4,54806
Hips difference scores	10	,20	11,40	6,4300	3,74642
Hand difference scores	10	,10	5,50	1,7400	1,51599
Face difference scores	10	,50	10,70	4,6900	3,73733
Nose difference scores	10	,30	8,20	2,1100	2,30769
Ear difference scores	10	1,20	2,90	2,1300	,61833
Forehead difference scores	10	,90	4,50	2,1100	1,32619
Mouth difference scores	10	1,50	6,90	3,7300	1,80804
Mean difference scores	10	3,33	5,88	4,2970	,73315

Table 1: Means, Std. Dev., minimum and maximum values of raw difference scores of body size estimations for each body part.

The majority of phenomenal body size estimations presented deviations from the actual body size of the estimated body parts, the mean deviation in terms of raw difference scores being 4,30 cm ± 0,73 cm (range: 3,33 cm – 5,88 cm).

		BPI gifted	*BPI non-gifted*	*z*	*p*
Bodily parts	Height BPI	98,05± 1,65	100,73± 5,26	- 0,522	n.s.
	Hand BPI	93,72± 9,60	91,66±17,43	- 0,104	n.s.
	Waist BPI	126,74±18,80	113,71±21,30	- 1,149	n.s.
	Hips BPI	119,80±17,30	110,01±25,61	- 0,731	n.s.
	Shoulders BPI	135,24±21,05	116,32±15,89	- 1,567	n.s.
	Bodily BPI	127,25±10,56	113,35±15,12	- 1,149	n.s.
Facial parts	Face BPI	144,84±13,65	108,71±9,72	- 2,611	0,009
	Nose BPI	138,41±20,69	157,01±79,39	- 0,522	n.s.
	Ear BPI	142,64±11,80	113,34±32,66	- 1,776	n.s.
	Forehead BPI	116,48±17,31	143,96±40,45	- 1,358	n.s.
	Mouth BPI	98,05±1,65	100,73±5,26	- 0,522	n.s.
	Facial BPI	135,59±3,27	130,76±29,78	- 0,522	n.s.
Total mean BPI		123,9±2,69	117,27± 15,1	- 1,567	n.s.

Table 2: BPI (Body Perception Index) of bodily and facial parts in gifted and non-gifted children. Mean, standard deviation, z and p values.

There is a statistically significant difference between both groups, focused on Body Perception Index of the face.
The percentage difference scores varied significantly for the various assessed parts in each group. Percentage difference scores are larger for facial than for bodily parts.

	Gifted	*Non-gifted*	*z*	*p*
Backward Balance (3cm)	21,80± 2,17	18,00± 4,53	- 1,49	n.s.
Backward Balance (4,5cm)	19,40± 4,67	16,80± 5,36	- 0,75	n.s.
Backward Balance (6cm)	9,60± 2,70	12,40± 4,39	- 1,36	n.s.
Backward Balance (mean)	50,80± 7,29	47,20±12,68	- 0,21	n.s.
Single Foot Jump (right foot)	17,80± 6,38	23,00± 3,08	- 1,40	n.s.
Single Foot Jump (left foot)	17,00± 6,96	23,60± 2,19	- 1,70	n.s.
Single Foot Jump (mean)	34,80±12,48	46,60± 4,98	- 1,47	n.s.
Sidestep Jump (1st)	21,60± 8,59	20,00± 8,22	- 0,11	n.s.
Sidestep Jump (2nd)	22,20± 8,73	25,60±11,01	- 0,52	n.s.
Sidestep Jump (mean)	43,80±17,30	43,60±17,08	- 0,11	n.s.
Lateral Transposition (1st)	10,40± 1,34	11,60± 1,14	- 1,40	n.s.
Lateral Transposition (2nd)	10,60± 1,52	12,20± 0,84	- 1,97	0.04
Lateral Transposition (mean)	21,00±2,65	23,80±1,30	- 1,92	0.05

Table 3: Motor coordination (KTK tests) in gifted and non-gifted children. Mean, standard deviation, z and p values.

Table 3 shows a significant difference between gifted and non-gifted children in the Lateral Transposition test. Gifted children presented better performance in the Backward Balance (3cm; 4,5cm) and in the Sidestep Jump (1st attempt) tests. Non-gifted children presented better performance in the other tests.

		Motor Coordination			
		Backward Balance	Single Foot Jump	Sidestep Jump	Lateral Transposition
Body Image	Bodily parts BPI	- 0,496	- 0,584	- 0,237	- 0,823
	Facial parts BPI	0,010	- 0,738	0,238	- 0,627
	BIP (mean)	- 0,139	- 0,816	0,173	- 0,791
	Hand BPI	0,002	-0,63	0,183	0,050
	Height BPI	0,463	0,882*	0,506	0,675

** p ≤ 0.05 ** p ≤ 0.01*

Table 4: Gifted children. Correlations between Motor Coordination and Body Image Perception Index.

Table 4 shows a significant positive correlation between Height Body Perception Index and Single Foot Jump.

		Motor Coordination			
		Backward Balance	Single Foot Jump	Sidestep Jump	Lateral Transposition
Body Image	Bodily parts BPI	0,059	0,814	0,965**	0,447
	Facial parts BPI	- 0,636	- 0,549	- 0,690	0,100
	BIP (mean)	- 0,087	0,971**	0,958*	0,775
	Hand BPI	0,593	0,461	0,141	0,194
	Height BPI	- 0,826	0,292	0,162	0,851

** p ≤ 0.05 ** p ≤ 0.01*

Table 5: Non-gifted children. Correlations between Motor Coordination and Body Image Perception Index.

Table 5 presents significant positive correlations between Bodily parts Body Perception Index and Sidestep Jump, between Body Perception Index (mean values) and Single Foot Jump and between Body Perception Index (mean values) and Sidestep Jump.

Discussion

Body image perception. Results presented a significant statistical difference between gifted and non-gifted children on face length perception. Considering these results we can suggest, like Katchadourian (1977), that the behaviour alterations verified in the beginning of the pubertal period leads the subjects to spend many time in front of the mirror. Gifted children possess different interests and motivations, which brings them to spend fewer hours than the non-gifted children looking at the mirror.

Motor coordination. Results presented a significant statistical difference between gifted and non-gifted children on the lateral transposition test. We can suggest that non-gifted children spend more time playing games and having a larger variety of motor experiences than their counterparts. Malina (1984) and Krombholz (1997) did not observe significant differences in children of the same age. This observation led us to suppose that the differences we observed are resultant from the different characteristics of each group.

Body image perception and Motor coordination. Melo (1998) verified negative correlations (to higher values of body image perception correspond smaller values of motor coordination) and positive correlations (to higher values body image perception correspond higher values of motor coordination) in her comparative study of body image perception and motor coordination, on children between 7 to 10 years old. The existence of negative correlations between body image perception and motor coordination had been observed by several authors, such as Schoemaker - Kalverboer (1994, cit. Berger et al. 1997). The author compared groups of children with different levels of motor coordination, verifying that children with weak coordination presented more difficulties to percept their bodies. These children also manifested smaller levels of social competence.

Conclusions

The conclusions of our study were:
According body image perception: (i) Body image perception differs between gifted and non-gifted children; (ii) Non-gifted children presented higher levels of body image perception than their counterparts, (iii) Both groups overestimated their body image.
According to motor coordination: (i) Motor coordination differs between gifted and non-gifted children; (ii) Non-gifted children presented higher levels of motor coordination than gifted children.
According the relationship between body image perception and motor coordination: (i) There is an association between these two factors. However, this association is different in each group.

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ENERGY EXPENDITURE OF SEDENTARY ACTIVITIES IN YOUTH

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Introduction

Although investigation of moderate and vigorous activities is a primary focus of much research, increasing sedentariness among children and youth is reported and there is a documented need to understand more about the energy expenditure of sedentary activities (Marshall *et al.*, 2002). A highly sedentary lifestyle is considered a major contributing factor to non-communicable diseases (e.g., heart disease, type-2 diabetes, and some cancers) in many countries. With increasingly sedentary lifestyles comes a parallel growing burden in terms of personal, social, and overall economic burden, thus there is a global concern regarding the prevalence of a sedentary lifestyle (World Health Organization: 55th World Health Assembly, Mar 27, 2002).
Inactivity has been shown to start as early as 8 years of age and inactivity is more likely than a highly active lifestyle to track, or persist into adulthood (Kimm *et al.*, 2002). Further, when large amounts of time are spent in sedentary pursuits, there is less time for more vigorous activities (Marshall *et al.*, 2002). Increased sedentariness is documented in everyday leisure activities, as well as in school, where children spend a preponderance of their time: A large national study demonstrates an average of only about 25 minutes of moderate to vigorous PA per week in PE classes *per week*, well under the Healthy People 2010 goals for frequency and intensity of PA (The National Institute of Child Health and Human Development Study of Early Child Care and Youth Development Network, 2003). In the Cardiovascular Health in Children and Youth (CHIC) study, homework, reading, video games, and TV watching were among the most common activities reported in children and youth ages 8-17 (Bradley *et al.*, 2000). Of these common childhood activities, TV watching has been studied most often. Reports of time spent watching TV vary from as little as 1 or 2 hours a day (Hernandez *et al.*, 1999;Lindquist *et al.*, 1999), which is similar to the 5 to 15 hours per week reported by Robinson (1999), to a report of 23 hours/week (Faith *et al.*, 2001).
If we can understand more precisely the energy expenditure of activities considered sedentary and in which children participate regularly, we can gain a more complete understanding of sedentariness. An improved understanding of sedentary activities in

children can aid in the development of interventions for reallocation of sedentary activities to a higher level of energy expenditure. Reallocation of even small numbers of activities to those that expend more energy can support increases in overall energy expenditure (Blair *et al.*, 1992;Marshall *et al.*, 2002). In adults, TV viewing is estimated to be at the same energy expenditure as rest, with a MET of 1.0 (Ainsworth *et al.*, 2000). But is this true for children and adolescents? Energy expenditure (EE) for sedentary activities in children and youth is primarily based on estimates. More precise measurement of these activities is needed to understand the contribution of sedentary activities to total energy expenditure, as well as to provide a more informed base for intervention development.

The primary purpose of the Energy Expenditure of Physical Activity in Youth Study (EEPAY) was to determine energy expenditure in terms of oxygen uptake, caloric cost, and metabolic equivalent (MET) level of activities common to children and adolescents (ages 8-18), to evaluate the differences by age and gender, and to compare results with published METs of the Compendium (Ainsworth *et al.*, 2000). This presentation gives data from a subset of the activities measured in the EEPAY study. The purpose is to evaluate energy expenditure of common sedentary activities and to determine if VO_2 differences of sedentary activity are (a) significantly different from energy expenditure at rest, or (b) if they differ by gender. The activities examined are TV viewing, video games (while seated and while standing), reading, planning a board game, and taking a computerized math test.

Methods

All procedures were approved by a multiple assurance Internal Review Board. Written informed parental consent and child assent were completed by all participants. Measurements were performed at the Applied Physiology Laboratory at the University of North Carolina. The study involved 317 children and youth, ages 8-18, with at least 10 subjects of each age and gender; that is, there were at least 10 boys and 10 girls who were aged, 8, aged 9, etc. Overall, 47% of the subjects were female and 53% male.

Self-administered questionnaires were used for age, sex, and racial affiliation and the Pubertal Development Scale (PDS) was used to determine self-reported pubertal status. The PDS is a scale that is widely used for determination of pubertal status and has been validated with physician-based ratings of pubertal development (Petersen *et al.*, 1988), by interview assessments of maturity (Brooks-Gunn *et al.*, 1987) and with self-reports using picture comparisons (Petersen *et al.*, 1988). Internal consistency reliability of the PDS ranges from a Cronbach alpha of 0.68 to 0.83 (Brooks-Gunn *et al.*, 1987;Petersen *et al.*, 1988).

We measured oxygen uptake (VO_2) with a portable metabolic system (COSMED K4b^2), which is documented to accurately measure energy expenditure (McLaughlin *et al.*, 2001). Consistency for breath, CO_2 and O_2 were established. Measurements were taken at rest, and during 6 sedentary activities: board games, math test, self-selected homework or reading, a computer-adaptive math test, watching TV, and two types of non-violent video games (a seated Nintendo game and arcade style video games, completed while standing). Each of the activities was performed for 10 minutes, with a 5 minute break between the activities. The activities were done in the same manner by all subjects, following a carefully designed protocol. Subjects were familiarized with the portable metabolic system and instructed in all procedures and activities by trained research assistants. Data were collected breath-by-breath and later were averaged over the data collection period to provide the mean VO_2 for each activity. One of the investigators (RGM) reviewed the graphic print-outs of the data for all subjects to eliminate artefacts and assure that steady state was reached for all activities. To further assure steady state, the first two minutes and last minute of data for each activity were excluded. Thus data were analyzed for 7 minutes of each activity. Analyses included descriptive statistics for demographic data, ANOVAs to determine age and gender differences, paired t-test, and two-sample t-tests for assessment of gender differences. Because of VO_2 similarities across ages, overall age groups were identified and results are provided for age-group rather than for each age. The age groups varied slightly for boys and girls, most likely because girls reach physical maturity at an earlier age and boys. For girls, group 1 = 8-11 years; group 2 = 12-14 years; group 3, 15-18 years. For boys, group 1 = 8-12 years; group 2 = 13-15 years; and group 3 = 16-18 years.

Results

The results are shown overall, with boys and girls combined, in Table 1. VO_2 differed significantly across age groups for all activities ($p<0.0001$ from one-way ANOVA). A post hoc test (Student-Newman-Kuels) showed that VO_2 decreased significantly ($p<.05$) with increasing age group (see Table 1).

Table 1: Mean VO_2 (ml/kg/min) for each Age Group

Activity	Age Group	N	VO_2	sd
Resting	1	129	5.92	1.41
Resting	2	83	4.58	1.22
Resting	3	83	4.00	0.79
TV Watching	1	117	6.00	1.40
TV Watching	2	75	4.79	1.17
TV Watching	3	83	4.21	1.07
Reading	1	134	6.56	1.70
Reading	2	88	5.23	1.32
Reading	3	93	4.51	0.94
Math	1	126	7.18	1.78
Math	2	78	5.72	1.44
Math	3	84	4.89	1.23
Video Game (sit)	1	134	7.05	1.78
Video Game (sit)	2	90	5.71	1.32
Video Game (sit)	3	93	4.96	0.99
Board Game	1	125	7.64	1.88
Board Game	2	77	5.85	1.37
Board Game	3	84	5.22	1.16
Video game (stand)	1	126	8.36	2.36
Video game (stand)	2	78	6.53	1.71
Video game (stand)	3	83	5.78	1.98

As shown in Table 2, there were some differences in EE by gender. VO_2 was slightly, but non- significantly greater in males for all but one activity. When using a Bonferroni correction for multiple analyses, the only significant difference by gender was for VO_2 during standing video games, which was higher for boys (7.5 ml/kg/min, sd ±2.3) than girls (6.6ml/kg/min sd ±2.4).

Table 2: Mean VO_2 (ml/kg/min) for each Gender

Activity	Sex	N	VO_2	sd
Resting	F	138	4.86	1.50
Resting	M	157	5.12	1.43
TV Watching	F	133	4.95	1.45
TV Watching	M	142	5.30	1.47
Reading	F	151	5.39	1.69
Reading	M	164	5.76	1.61
Video Game (sit)	F	151	5.94	1.84
Video Game (sit)	M	166	6.16	1.57
Math	F	135	5.88	1.79
Math	M	153	6.32	1.84
Board Game	F	134	6.17	1.93
Board Game	M	152	6.70	1.83
Video Game (stand)	F	134	6.63	2.36
Video Game (stand)	M	153	7.55	2.31

Because most values were very similar by gender, we looked at the difference between EE at rest and EE during each of the 6 sedentary activities. After Bonferroni correction, all sedentary activities except TV were slightly, but significantly greater than EE at rest (see Table 3). The EE during TV watching (ml/kg/min: girls 5.0 ±1.5; boys 5.3 ±1.5) was essentially the same as that during rest (ml/kg/min: girls 4.9 ±1.5; boys 5.1 ±1.4). On average, subjects expended the most energy while playing arcade video games and board games (see Table 3).

Table 3: Difference between energy expenditure during a sedentary activity and that of resting

Activity	N	Diff. in$VO_{2\ \text{from rest}}$	t value	PR > |t|	Bonferroni
Board Games	271	1.403	16.63	<0.0001	0.0006
Math Test	273	1.067	13.56	<0.0001	0.0006
Reading	289	0.600	10.04	<0.0001	0.0006
TV watching	266	0.130	2.10	0.0366	0.222
Video games (sit)	290	1.074	14.39	<0.0001	0.0006
Video games (stand)	272	2.078	17.49	<0.0001	0.0006

In addition we examined the METs for these sedentary activities by dividing the EE of each subject during these activities by his or her EE at rest, on a gender specific basis. For both genders there were no significant differences in METs for most activities: MET was 1.3 for board games, 1.2 for the math test, 1.1 for reading, 1.0 for TV watching, and 1.2 for sitting video games. There was a gender difference in METs during standing video games (MET was 1.4 for girls and 1.5 for boys).

Discussion

The results of this study indicate there are minor differences in EE across sedentary activities, with significant difference across age groups for arcade and video games for each activity. For both arcade and video games, a significant decrease in VO_2 with increasing age group is demonstrated. The EE during TV watching is very similar to the EE during rest, confirming related findings regarding the low level of energy expenditure related to TV watching (Klesges *et al.*, 1993). Thus, selective reduction of TV watching may be a promising intervention component to increase EE, even if replaced only with other sedentary activities of a slightly higher EE level.

On average, subjects expended more energy while playing arcade video games and board games than while resting (2.1 and 1.4 ml/kg/min more energy respectively), with males expending more energy while playing arcade games than females, although the gender difference is not statistically significant. Although small differences, this finding underscores the importance of conceptualizing TV viewing separately from videogames or computer activity. There is documentation of significantly different amounts of time spent in these activities among children and youth (Hernandez *et al.*, 1999). The findings that board games use a little more energy than similar sedentary activities may be related to the fact that these were competitive games, played by the child with one of the research assistants.

Although it is recommended that all children and youth participate in moderate to vigorous activities on a regular basis to establish a healthy lifestyle, a documented rise in a sedentary lifestyle mandates better understanding of sedentary activities. These data further understanding of 6 sedentary activities of children and youth. If precise information regarding EE is needed, these measurements can be used. Understanding the energy expenditure of sedentary activities is essential to fully understand overall energy expenditure and to better inform timely, targeted, and pertinent behavioral interventions. Further investigation is needed to understand the contribution of sedentary activities of children and youth to overall energy expenditure and to investigate the possibility of reallocation of sedentary activities to less sedentary.

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RISK INDICATORS FOR RECURRENT NON-SPECIFIC LOW-BACK PAIN IN CHILDREN

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Recurrent non-specific low-back pain represents a significant health problem in children and as such, it is important to appreciate risk indicators related to its onset. The aims of this investigation were to a) evaluate biological risk indicators for recurrent non-specific low-back pain in children and b) present a conceptual model for the development of non-specific recurrent low-back pain in children. To fulfil the first aim a matched case-control design was utilised involving 28 children with recurrent low-back pain (RLBP, boys n=15, girls n=13, age=14.9(0.7) years) and 28 matched controls (CONT, boys n=15, girls n=13, age=14.9(0.7) years) with no history of low-back pain. Measures of stature, mass, sitting height, sexual maturity (Tanner self-assessment), lateral flexion of the spine, lumbar sagittal plane mobility (modified Schober), hip range of motion (Leighton flexometer), back and hamstring flexibility (sit-and-reach), and trunk muscle endurance (number of sit-ups) were performed using standardised procedures with established reliability. Backward stepwise logistic regression analysis was performed with the presence/absence of recurrent low-back pain as the dichotomous dependent variable and the biological measures as the independent variables. Significance was set at $p<0.05$. Hip range of motion ($p=0.045$), trunk muscle endurance ($p=0.001$), lumbar sagittal plane mobility ($p=0.032$) and lateral flexion of the spine ($p=0.008$) were identified as significant risk indicators of recurrent low-back pain. Follow-up analysis indicated symptomatic subjects had significantly reduced lateral flexion of the spine (RLBP=197(25) mm, CONT=221(22) mm, $p=0.000$), lumbar sagittal plane mobility (RLBP=70(9) mm, CONT=77(9) mm, $p=0.002$) and trunk muscle endurance (RLBP=37(6) sit-ups, CONT=42(8) sit-ups, $p=0.003$). These risk indicators identify the potential for exercise as a primary or secondary prevention method. To fulfil the second aim the findings of the current study were taken into account along with the findings of a systematic review of 21 previous research investigations. Overall it was identified that the risk of low-back pain is multifactoral and future research should evaluate complete models including biological, psychosocial and individual risk indicators. A conceptual model of the development of recurrent non-specific low-back pain in children will be presented.