

# Levels of Physical Activity of Urban Adolescents According to Age and Gender

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**Abstract** The aim of this study is to examine the patterns of physical activity of adolescents, according to age and gender. The sample includes 877, twelve, fifteen and eighteen year's old adolescents (436 boys, 441 girls) from Metropolitan Lisbon Area. Physical activity was assessed by five items 4-point scale: frequency of physical activity participation per week, participation in organized physical activity, participation in unorganized physical activity, intensity, and participation in competitions. To express the activity levels of the adolescents an index of physical activity was computed by summing these five items range from 5 to 20 points. The mean index of the participants was  $15.15 \pm 5.15$ . The boys showed higher values than the girls. It was interesting to observe that the lowest value for the boys, at 18 years of age ( $14.65 \pm 5.70$ ), was higher than the highest value for the girls at 12 years of age ( $14.10 \pm 4.60$ ). With the increase of age, a decrease of the amount of physical activity is evident which indicates a reduction in the general levels of participation physical activity. Although the decrease was registered, for the girls from 12 to 15 years old it was very slight, being the largest break from 15 to 18 years old. The amount of teenagers classified as sedentary increases throughout their adolescence. The global consideration of these facts is worrying because from a scientific point of view, the value of physical activity for health is unquestionable.

**Keywords** Physical Activity, Adolescence, Gender, Age

## 1. Introduction

The changes in diet and lifestyle as a result of industrialization, urbanization, and economic development, have occurred rapidly in the last few decades. The combination of an unhealthy diet and a sedentary lifestyle is having a significant impact on the state of health of the population, to the point where a global problem already exists[1,2]. Several epidemiologic studies have shown that the relation between an active lifestyle and the risk of illness or death is inversely proportional[3-5].

The importance of the epidemiologic data, and the effects of physical activity on health, is unquestionable. However, this information alone does not lend itself to creating perspectives of change in health improvement. From the studies about young people's participation in physical activity, some factors that determine the level or intention of participating can be pointed out and called correlates or determinants[6,7]. Correlates are from research that assesses only statistical association, and determinants are identified in studies of aetiological design[8].

From research of physical activity, age and gender can be

identified as two correlates or determinant factors[6,9]. Male gender is a consistent positive determinant of physical activity in children[10], and a correlate factor for adolescents[11-13]. Although the correlation exists between physical activity and being male, studies that assessed other physical activities (non-sport) show no consistent sex differences across adolescence[14]. Regarding age, several studies have shown that it is negatively associated to physical activity among adolescents[13,15-17]. However, in a review of correlates and determinants age was inconsistently related to physical activity[7].

Although most studies pointed out that sex and age can be correlate factors of physical activity among adolescents, it cannot be ignored that studies show some inconsistency. This could be due to cultural and contextual differences. Thus, the aim of this study is to examine the patterns of physical activity of Portuguese adolescents living in an urban area, according to age and sex, and to establish a comparative analysis to identify the differences.

## 2. Material and Methods

### Participants

The participants were 877 (436 boys, 441 girls), twelve, fifteen, and eighteen year old adolescents (table 1), who attend 6 randomly selected public schools in the Metropolitan Lisbon Area. The criteria used for the choice

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of the participants were their participation in Physical Education classes, and not having any health problems that could limit their practice of sport. The study was conducted according to ethical standards in sport and exercise science research[18] and the protocol received approval from both the institutional review board of the Faculty of Human Kinetics, and the Portuguese Minister of Education.

**Table 1.** Characteristics of the sample, by gender

	Boys		Girls		Totals	
	N	%	N	%	N	%
<b>Ages</b>						
12 years	125	14.3	125	14.3	250	28.5
15 years	271	30.9	279	31.8	550	62.7
18 years	40	4.6	37	4.2	77	8.8
<b>BMI</b>						
Non-obese	385	88.4	404	91.7	790	90.1
Overweight	39	8.9	34	7.7	73	8.3
Obese	12	2.7	3	0.6	14	1.6
<b>ESE</b>						
High	284	32.4	245	27.9	264	30.1
Middle	427	48.7	420	47.9	424	48.3
Low	166	18.9	212	24.2	189	21.6
<b>Total</b>	<b>436</b>	<b>49.7</b>	<b>441</b>	<b>50.3</b>	<b>877</b>	<b>100.0</b>

### Data collection instruments

The data was collected by a questionnaire published by Ledent *et al.*[19]. The questionnaire had five questions and a 4-point scale to assess physical activity: 1) Outside school do you take part in organized sport? (1=never, 2=less than one time a week, 3= several times a week, 4=every day), 2) Outside school do you take part in non-organized sport? (1=never, 2=less than one time a week, 3= several times a week, 4=every day), 3) Outside school, how many times per week do you take part in sport or physical activity for at least 20 minutes? (1=never or less than once a month, 2=once a month or once a week, 3=2 to 3 times a week, 4=every day), 4) Outside school hours, how many hours per week do you usually take part in physical activity so much that you get out of breath or are sweating? (1=none, 2=approximately 1 hour, 3=2 to 6 hours, 4=7 or more hours), 5) Do you take part in competitive sport? (1=no, 2=yes, I do it in the school setting, 3=yes, I do it in a club, 4=yes, I do it at the national or international level). These items were used in Portuguese and other European populations previously to assess physical activity with good reliability[12,20]. To express the activity levels of the students, an index of physical activity was computed by summing these five items, range from 5 to 20 points[12,19,20].

Body mass index (BMI) was calculated from self-reported height and weight ( $\text{kg}/\text{m}^2$ ). Thus, adolescents were categorized into non-obese, overweight and obese according to age-adapted BMI values[21]. Socioeconomic status (SES) was calculated based on parental occupation and educational level. Parents' occupation titles were regrouped in order to classify the subjects as lower, middle, and upper class. The lower class included skilled and unskilled manual workers, farmers, and fishermen; the middle class included service

occupations such as nonprofessional health service workers, office clerks, and salespeople; the upper class consisted of business-owners, executives, university-educated specialists and professionals[22].

### Procedures

Prior to starting the questionnaire application, institutional consent was sought to carry out the research. In addition, informed written consent was obtained from the students and their legal guardians. The adolescents filled out the questionnaire in Physical Education class. Of the 3115 children and adolescents who attend the six schools, 2670 responded to the questionnaire for a response rate of 87.5%. From those 2670, we selected adolescents aged 12, 15 and 18 years ( $n=877$ ). The rationale for selecting these ages was based on developmental changes in adolescents[23].

### Statistical analysis

The mean and the standard deviation were calculated for each age group and for each gender. To evaluate whether gender and age significantly affected the index of physical activity, *two way* ANOVA, followed by the *post hoc* HSD of Turkey, *two way* were used. The significance of the difference between genders within each age group was evaluated using a t-Student test for independent samples. The normality of the index of physical activity in the different groups was evaluated by the Kolmogorov-Smirnov test with Lilliefors' correction. For students aged 12 and 15, of both genders, the distribution of the variable was not normal. However, as those groups had a dimension that was much larger than 30, we applied the central limit theorem. The homogeneity of the variances was validated with the Levene test. The statistical analyses were executed with the SPSS 15.0 and the significance level was 0.05.

## 3. Results

The indexes of physical activity of each group and of the general sample are presented in table 2. On a scale of 5 to 20 the mean index of the participants was  $15.15 \pm 5.15$ . The boys showed higher values than the girls in all age groups. It was interesting to observe that the lowest value for the boys at 18 years of age ( $14.65 \pm 5.70$ ) was higher than the highest value for the girls at 12 years of age ( $14.10 \pm 4.60$ ). With the increase of age, a decrease of the amount of physical activity is evident which indicates a reduction in the general levels of participation in physical and sports activities. Although the decrease was registered, for the girls from 12 to 15 years old it was very slight, with the largest break being from 15 to 18 years of age.

According to the data from ANOVA, the effect of interaction between the age and gender factors was not significant ( $F(2,871)=0.043$ ;  $p=0.958$ ). With respect to age, a significant effect on the amounts of physical activity was verified ( $F(2,871)=4.617$ ;  $p=0.01$ ;  $\eta^2=0.01$ ;  $\text{power}=0.780$ ). Through the analysis of the *post hoc* test HSD of Tukey, significant differences occurred between the ages of 12 and 18 ( $p=0.012$ ) and between 15 and 18 ( $p=0.016$ ). Similarly,

after considering the effect of age, gender significantly influenced the amount of physical activity ( $F(1,871)=28.074$ ;  $p<0.001$ ;  $\eta^2=0,031$ ;  $\text{power}=1$ ), being the power of the test maximum.

**Table 2.** Index of physical activity according to age and gender

Age	Gender		<i>p</i>	Total
	Male	Female		
12 years	16.70±5.65	14.10±4.60	<0.001	15.40±5.30
15 years	16.45±4.95	14.05±4.90	<0.001	15.20±5.05
18 years	14.65±5.70	12.35±4.75	0.062	13.55±5.35
Total	16.35±5.25	13.90±4.80	<0.001	15.15±5.15

The effect of interaction between age and gender, and the singular effects of gender and age were tested by ANOVA.

The comparison of gender at 12, 15 and 18 years were tested by t test.

At the age of 12, the amount of physical activity of boys and girls differed significantly ( $t(248)=3.990$ ;  $p<0.001$ ), verifying the same result between the 15 year old pupils ( $t(548)=5.769$ ;  $p<0.001$ ). For the age of 18, the significance of the differences was not statistically relevant ( $t(75)=1.895$ ;  $p=0.062$ ), showing that with the increase of age the differences between boys and girls tends to disappear. However, the direction is opposite to the desired one, given that the amount of physical activity decreased in both genders.

## 4. Discussions

From the results of this study we were able to verify that the general index of physical activity lies on the medium point of the scale, indicating that the group of students was not very active. The index of physical activity was inversely proportional to the increase of age, for both genders. However, among the girls the difference between 12 and 15 years was almost non-existent. The boys, with higher values, had higher levels of participation than the girls, for all ages.

The results of this study are on the same line as others where the decrease in physical activity with increase of age was verified[15-17].

In a longitudinal study in Finland, Telama and Yang[24] verified a decrease in physical activity, especially between 12 and 18 years for boys and 12 and 15 for girls. Our results are slightly different with respect to the girls, the turning point being from 15 to 18 years. For the boys, between 12 and 15 significant differences were not recorded although a tendency was already visible.

In the United States of America, similar results to ours were found, the age group 15 to 18 being the one with a higher risk of decrease[16]. As for the 15 year olds, these authors verified a 5% decrease in physical activity per year. Seabra et al.[25], in another study with similar characteristics, observed the biggest decline from 16 years onwards, which can be inserted into 15 to 18 groups. The variation in the results could be linked to the different methodologies of the

studies, or to the difficulty of the adolescents reporting the amount of physical activity[26].

One consistent piece of data is the existence of a decrease in physical activity with the increase of age. Having verified this decrease, it would be interesting to inquire as to what kind of activity offers most guarantee of stability given that, to calculate the index of physical activity, both formal and informal activities were taken into consideration. In this respect, Aarnio et al.[27], as observing a constant decline of 16, 17 and 18 year old adolescents, they noticed that the ones who showed most stability in participation were the ones who were involved in organized activities. Those results were reinforced by the discoveries of Telama et al.[28], where the ones who participated in organized physical and sports activities while young, were more active as adults than the ones who didn't participate. This finding seems to suggest that organized activities showed a higher probability of keeping adolescents loyal to physical activities and also to induce high levels of energy expenditure[29].

The tendency to decrease physical activity with the increase of age is a constant variable in Europe[15]. Riddoch et al.[17], in what is considered the first study to measure objectively physical activity with a representative sample of European children, verified that 9 year old children were considerably more active than 15 year old adolescents, presenting similar results in all countries. Virtually all 9 year old children practice the same amount of physical activity, or more than recommended, whilst only a small percentage of 15 year olds did.

The significant differences observed in our study were between 12/15 and 18 year olds. It is thought that the small differences between this study and others may be related to the different methods of evaluation of physical activity that didn't allow for an objective comparison of results. Nevertheless, despite the differences between the studies, the decline of physical activity with increase of age is a known and accepted phenomenon. However, it is not well understood, because the mechanisms that create this decline are unknown.

Looking to summarize the findings about the ages where the decline can be observed, Sallis[30], by analysing various studies, concluded that the ages between 13 and 18 are at risk. Having also observed the decline in animals, the author was lead to suppose that the decline had a biological origin. The consistency of the results of the study of Riddoch et al.[17] between different countries is in some way congruent with Sallis[30] assumptions, allowing one to state that children's and adolescents' physical activity is probably determined biologically. This being true, it is possible to state that this tendency to decline is something that has always existed.

This line of reasoning presents some problems because there are studies, although not very many, where the decline of physical activity was not verified[31]. Also, one can't ignore that in this study, despite the effect of age being significant on the index of physical activity, it only explained 1% of the variability, which means that it could be related to

other factors (e.g., academic issues for the older students, who experience the pressure of final exams to complete their secondary education and apply to higher education).

In order to find answers to explain the differences of levels of participation in physical activity within adolescents, more studies are needed.

As far as the difference between genders is concerned, the fact that the boys had higher values than the girls is a common statement; one that agrees with many other investigations[11,25]. In the overwhelming majority of studies, it can be clearly observed that boys are more physically active than girls. This is a phenomenon common to all countries and appears to be a common denominator in people with different ethnicities[11]. Our studies corroborate this fact and reinforce it for young people from urban areas.

From the analysis of the results of several studies, significant associations between physical activity and gender are observed[6,9]. The differences can be explained sociologically: boys are more encouraged to practice physical activity, they have more opportunities out of school, and reveal more positive experiences of physical activity. Girls, on the other hand, are guided toward other types of activities that are more related to the social role that is envisioned for them when they become adults. Although the role of women in society has undergone profound changes in the last few decades- resulting consequently in an increase of their participation in physical activity-the levels of participation are still far from matching up. For this reason, found significant differences were found.

Our study unearthed, as well as confirmation of results from other studies, a few curious elements. For 18 year old students, although the boys showed a higher amount of physical activity, the differences weren't statistically significant. This shows an approximation of the values as age increases and suggests a decrease in the levels of physical activity that is more pronounced in the boys. These results do not agree with those of Seabra *et al.*[25], whose sample was also made up of Portuguese adolescents and teenagers and also evaluated physical activity through a questionnaire.

It is believed that the similarities found between genders may be related to the time at which the investigation was carried out. The field work was done close to the end of the school year, meaning that the students were probably concentrating on exams that were shortly to come. The social pressure and the need for obtaining good grades may have altered their usual routine and made girls and boys match up with respect to the levels of practice of physical activity.

The current findings show that boys are more active than girls and physical activity decreases with age. This information is important for the development of interventions aimed at increasing physical activity among adolescents in general, and among girls and older young people in particular. Schools can play an important role in promoting physical activity across all adolescents at school-age, and minimizing the difference between boys and

girls (once they spend the same time at the school and the same opportunities are available for both).

Some limitations to this study should be acknowledged. Data was collected cross-sectionally, thereby making it impossible to determine cause and effect. Data was collected via self-report rather than objectively measured. Although the questions have previously demonstrated both reliability and validity, responses could be subject to bias. Participants were from 6 schools from an urban area, thus limiting the generalization of the results to other locations, particularly rural areas.

## 5. Conclusions

Although the effects of being active are commonly assumed as beneficial, younger students do not always choose to participate in physical and sports activities. The boys are clearly more active than the girls but the differences tend to minimize with the increase of age. The amount of young people classified as sedentary increases throughout their adolescence. The global consideration of these facts is disturbing because, from a scientific point of view, the value of physical activity for health is unquestionable.

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## REFERENCES

- [1] Lopez, A., Mathers, C., Ezzati, M., Jamison, D., Murray, C., 2006, Global and regional burden of disease and risk factors, 2001: systematic analysis of population health data, *Lancet*, 367, 1747-1757
- [2] Onis, M., Blossner, M., 2000, Prevalence and trends of overweight among preschool children in developing countries, *American Journal of Clinical Nutrition*, 72, 1032-1039
- [3] Haveman-Nies, A., de Groot, L., Burema, J., Cruz, J., Osler, M., van Staveren, W. A., 2002, Dietary quality and lifestyle factors in relation to 10-year mortality in older Europeans: the SENECA study, *American Journal of Epidemiology*, 156, 962-968
- [4] Lee, I., Sesso, H., Oguma, Y., &Paffenbarger, R., 2003, Relative intensity of physical activity and risk of coronary heart disease, *Circulation*, 107, 1110-1116
- [5] Schnohr, P., Scharling, H., Jensen, J., 2003, Changes in leisure-time physical activity and risk of death: an observational study of 7,000 men and women, *American Journal of Epidemiology*, 158, 639-644

- [6] Sallis, J., Prochaska, J., Taylor, W., 2000, A review of correlates of physical activity of children and adolescents, *Medicine and Science in Sports and Exercise*, 32, 963-975
- [7] Van Der Horst, K., Paw, M., Twisk, J., Van Mechelen, W., 2007, A brief review on correlates of physical activity and sedentariness in youth, *Medicine and Science in Sports and Exercise*, 39, 1241-1250
- [8] Bauman, A., Sallis, J., Dziewaltowski, D., Owen, N., 2002, Toward a better understanding of the influences on physical activity: the role of determinants, correlates, causal variables, mediators, moderators, and confounders, *American Journal of Preventive Medicine*, 23, 5-14
- [9] Biddle, S., Gorely, T., Stensel, D., 2004, Health-enhancing physical activity and sedentary behaviour in children and adolescents, *Journal of Sports Sciences*, 22, 679-701
- [10] Bauman, A., Reis, R., Sallis, J., Wells, J., Loos, R., Martin, B., 2012, Correlates of physical activity: why are some people physically active and others not?, *Lancet*, 380, 258-271
- [11] Marshall, S., Jones, D., Ainsworth, B., Reis, J., Levy, S., Macera, C., 2007, Race/ethnicity, social class, and leisure-time physical inactivity, *Medicine and Science in Sports and Exercise*, 39, 44-51
- [12] Mota, J., Santos, M., Ribeiro, J., 2008, Differences in leisure-time activities according to level of physical activity in adolescents, *Journal of Physical Activity and Health*, 5, 286-293
- [13] Seabra, A., Maia, J., Mendonca, D., Thomis, M., Caspersen, C., Fulton, J., 2008, Age and sex differences in physical activity of Portuguese adolescents, *Medicine and Science in Sports and Exercise*, 40, 65-70
- [14] van Mechelen, W., Twisk, J., Post, G., Snel, J., Kemper, H., 2000, Physical activity of young people: the Amsterdam Longitudinal Growth and Health Study, *Medicine and Science in Sports and Exercise*, 32, 1610-1616
- [15] Armstrong, N., Welsman, J., 2006, The physical activity patterns of European youth with reference to methods of assessment, *Sports Medicine*, 36, 1067-1086
- [16] Caspersen, C., Pereira, M., Curran, K., 2000, Changes in physical activity patterns in the United States, by sex and cross-sectional age, *Medicine and Science in Sports and Exercise*, 32, 1601-1609
- [17] Ridoch, C., Bo Andersen, L., Wedderkopp, N., Harro, M., Klasson-Heggebo, L., Sardinha, L., Cooper, A., Ekelund, U., 2004, Physical activity levels and patterns of 9- and 15-yr-old European children, *Medicine and Science in Sports and Exercise*, 36, 86-92
- [18] Harriss, D., Atkinson, G., 2009, *International Journal of Sports Medicine - ethical standards in sport and exercise science research*, *International Journal of Sports Medicine*, 30, 701-702
- [19] Ledent, M., Cloes, M., Telama, R., Almond, L., Diniz, J., 1997, Participation des jeunes Européens aux activités physiques et sportives, *Sport*, 159-160, 61-71
- [20] Telama, R., Nupponen, H., Piéron, M., 2005, Physical activity among young people in the context of lifestyle, *European Physical Education Review*, 11, 115-137
- [21] Cole, T., Bellizzi, M., Flegal, K., Dietz, W., 2000, Establishing a standard definition for child overweight and obesity worldwide: international survey, *British Medical Journal*, 320, 1240-1243
- [22] Raudsepp, L., Viira, R., 2000, Sociocultural correlates of physical activity in adolescents, *Pediatric Exercise Science*, 12, 51-60
- [23] Kail, R., 2006, *Children and their development*, London: Pearson Education
- [24] Telama, R., Yang, X., 2000, Decline of physical activity from youth to young adulthood in Finland, *Medicine and Science in Sports and Exercise*, 32, 1617-1622
- [25] Seabra, A., Mendonca, D., Thomis, M., Peters, T., Maia, J., 2008, Associations between sport participation, demographic and socio-cultural factors in Portuguese children and adolescents, *European Journal of Public Health*, 18, 25-30
- [26] Booth, M., Okely, A., Chey, T., Bauman, A., 2002, The reliability and validity of the Adolescent Physical Activity Recall Questionnaire, *Medicine and Science in Sports and Exercise*, 34, 1986-1995
- [27] Aarnio, M., Winter, T., Peltonen, J., Kujala, U., Kaprio, J., 2002, Stability of leisure-time physical activity during adolescence--a longitudinal study among 16-, 17- and 18-year-old Finnish youth, *Scandinavian Journal of Medicine & Science in Sports*, 12, 179-185
- [28] Telama, R., Yang, X., Hirvensalo, M., Raitakari, O., 2006, Participation in organized youth sport as a predictor of adult physical activity: a 21-year longitudinal study, *Pediatric Exercise Science*, 17, 76-88
- [29] Katzmarzyk, P., Malina, R., 1998, Contribution of organized sports participation to estimated daily energy expenditure in youth, *Pediatric Exercise Science*, 10, 378-386
- [30] Sallis, J., 2000, Age-related decline in physical activity: a synthesis of human and animal studies, *Medicine and Science in Sports and Exercise*, 32, 1598-1600
- [31] Cantera-Garde, M., Devis-Devis, J., 2000, Physical activity levels of secondary school Spanish adolescents, *European Journal of Physical Education*, 5, 28-44