

## Adolescents' and young adults' physical activity related to built environment

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**Cita sugerida:** Cocca, A.; Viciano-Ramírez, J.; Mayorga-Vega, D.; Ceballos-Gurrola, O.; Liukkonen, J. & Cocca, M. (2015). Adolescents' and young adults' physical activity related to built environment. *Educación Física y Ciencia*, 17(1). Recuperado de <http://www.efyc.fahce.unlp.edu.ar/article/view/EFyCv17n01a04/>

### Abstract

**Objectives.** This study aims to analyse physical activity (PA) levels of high school and university students; to estimate their perception of built environment with regard to physical PA; and to assess the relation between PA and built environment. **Methods.** A sociological cross-sectional study with non-experimental design was applied. The International Physical Activity Questionnaire and the Built Environment Characteristics Questionnaire were filled in by a sample of 1.862 students from high schools and the university in Granada, Spain. **Results.** High school students were significantly more active than university students, the latter reaching insufficient levels of PA. Nevertheless, they consider Granada as a good context for carrying out outdoor exercise. No relations were found between PA levels and built environment. **Conclusion.** The discrepant outcomes for PA levels and perceived built environment suggest the need of interventions focused on making youth aware of the possibilities that an environment provides to them for exercising. Consequently, environment could have an impact on their health at the same time as youth learn to respect it.

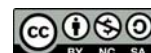
**Keywords:** Health; Youth; Young adults; Physical activity; Built environment.

### Actividad Física y entorno construido en adolescentes y adultos jóvenes

#### Resumen

**Objetivos:** este trabajo tiene como objetivo analizar los niveles de actividad físicas en estudiantes de escuelas secundarias y estudiantes universitarios; estimar su percepción del entorno construido en relación con la actividad física, y evaluar la relación entre la educación física y el entorno construido. **Metodología:** Se aplicó un estudio sociológico trasversal con diseño no experimental. Se completaron el cuestionario internacional de actividad física y el cuestionario de características de entorno construido con una muestra de 1.862 alumnos de escuelas secundarias y universidad en Granada, España. **Resultados:** los alumnos de la escuela secundaria fueron significativamente más activos que los estudiantes universitarios, quienes alcanzaron niveles insuficientes de actividad física. Sin embargo, consideraron Granada un buen contexto para hacer ejercicio al aire libre. No se encontraron relaciones entre los niveles de actividad física y el entorno construido. **Conclusión:** la discrepancia de resultados entre los niveles de actividad física y la percepción del entorno construido sugieren la necesidad de intervenciones focalizadas en hacer que los jóvenes se den cuenta de las posibilidades que el medio les ofrece para ejercitarse. En consecuencia, el medio puede tener un impacto en la salud al mismo tiempo que los jóvenes aprenden a respetarlo.

**Palabras Clave:** Salud; Juventud; Adultos jóvenes; Actividad física; Entorno construido.



## Introducción

Several recent reports on health conditions worldwide have awakened the attention of local and national governments by stressing a negative situation both in public and individual health state. The World Health Organization (WHO, 2015) has confirmed this circumstance in its last world sanitary statistics, which showed a subsequent aggravation of health in the last decade. These statistics demonstrate that more than one thousand million people currently suffer from being overweight or obese. WHO added that overweight and obesity are the most relevant public health matters in European youth nowadays, with more than 45 million children aged five or less being obese. Children's and adolescents' obesity represent a major problem since it entails a higher probability of keeping this condition during adulthood, as well as an increased risk of suffering from non-transmissible diseases (Ogden, Yanovsky, & Carroll, 2007). Likewise, authors found out that adolescents and young adults are being more and more engaged in harmful habits such as smoking or sedentary behaviour, to the detriment of positive behaviours (Hedman, Bjerg-Bäcklund, Perzanowski, Sundberg, & Rönmark, 2007).

WHO indicates that the main response to this negative trend is modifying life behaviours, which could be enough for enhancing the quality of life of the future generations (WHO, 2015). This relation is stronger when healthy behaviours are learnt during childhood and adolescence. The importance of promoting healthy behaviours in youth has been stated by many authors, who emphasized the positive effects of a healthy lifestyle on physical, mental, psychological and social areas (Stock et al., 2007). Modifying life behaviours in children and adolescents would mean to apply a primary prevention, i.e., remove the agents of future illness rather than reduce the effects of already existing diseases (Driskell, Dymont, Mauriello, Castle, & Sherman, 2007). Moreover, abolishing unhealthy conducts is easier in early ages since they have not already become structured behaviours (Heaven, 1996).

The governments, as well as public and private organizations in charge of health matters, have tried to contrast this trend by means of several strategies. Among them, improving Physical Activity (PA) is considered as one of the main approaches (Peel, Bartlett, & McClure, 2007). PA constitutes a primary health factor as it influences people's well-being in many aspects. Primarily, it makes individuals grow in a harmonious way, since it positively influences bodily development as well as psychological constructs and social integration (De la Cerda, Cervelló-Gimeno, Cocca, & Vicianá, 2011). Secondly, it plays an important role in reducing the risk of suffering from non-transmissible diseases such as cardiopathy, diabetes or even cancer (Andersen et al., 2006). Furthermore, PA directly acts on obesity by reducing the Body Mass Index (BMI), which is an indicator of obesity and overweight. Kimm et al. demonstrated that individuals who have been active during their growth, have higher probability to present good BMI and reduced risk of suffering from obesity even if they become inactive during their adult life (Kimm, Glynn, Obarzanek, Daniels, Barton, & Liu, 2005).

The importance of PA in the process of reverting the current negative trend about health is clear. Therefore, building targeted programs that permit improving PA levels and participation in exercise among youth should be a priority. Experts from the field of PA and health have identified many factors influencing active behaviours in several ways. Starting from this, they created explanatory models concerning the relation between PA and those factors, aiming to clarify the processes through which PA is affected by external variables and vice versa. As a result of these works, three main areas influencing PA were defined: psychological, social, and environmental, all being direct and indirect factors of PA levels and engagement in motor activities (Welk, 1999).

Among the above-mentioned factors, the relation between PA and environment has recently assumed great importance because of the impact that different contexts can have on people's active behaviours. Many variables are included in the environmental features, for instance climate, natural zones, and presence of sea, lakes or mountains (Kolle, Steene-Johannessen, Andersen, & Anderssen, 2009). However, built environment represents one of the most studied environmental components, being defined as the structure of neighbourhoods. Organizations such as International Physical Activity and Environment Network (IPEN), Assessing Levels of Physical Activity and fitness at population level (ALPHA), or Health Behaviour in School-aged Children (HBSC) have been created with the purpose of analysing the relation between PA and environment among youth and adults worldwide, focusing on the influence of built environment on active behaviours. Among the most

studied characteristics of built environment, authors mention neighbourhood safety, neighbours' use of the spaces for exercising, and availability or access to facilities, parks or green zones (Saelens, Sallis, Black, & Chen, 2003). Research on the relation between PA and built environments has given contradictory results. As a consequence, it is difficult to design a common, scientific method for assessing the effects of neighbourhood features on PA (McDonald et al., 2012). Timperio et al. demonstrated an existent but yet low correlation between neighbourhood insecurity, unavailability of facilities, and children's sedentary behaviours (Timperio, Salmon, Ball, De Velde, Brug, & Crawford, 2011). Other authors found a positive relation between the quantity of PA and neighbourhood characteristics, adding that this relation is strongly influenced by the overall contextual characteristics such as culture, geographical zone, and also social structure (De Meester, Van Dyck, De Bourdeaudhuij, Deforche, Sallis, & Cardon, 2012). Seliske et al. showed a high positive correlation between urban sprawl, active transportation and overall PA levels in children, while other studies demonstrated opposite results, showing a positive relation between reduced population density (e.g., living in towns and small cities) and engagement in more PA (Seliske, Pickett, & Janssen, 2012).

More research is required; though, it is evident that the relation between environment and PA could be drastically modified by the specific social context in which people live. Consequently, possible correlations between environment and active habits might not be generalized and should be studied in each specific social context. This could permit designing an intervention that takes advantage of the peculiarities of an environment in accordance with its cultural features, and thus improving PA levels among people in a more effective way.

Therefore, the aim of this study is to assess PA levels among adolescents and young adults living in Granada, Spain; to estimate their perception of the built environment; to assess the differences between high school and university students with regard to perceived built environment; and to verify possible correlations between the specific built environment of Granada and their PA levels, with a view to improving health conditions in this population.

## Methods

### Sample

1.862 students from high school and university educational stages, living in Granada (Spain), were selected for the study. Detailed information about the sample is given in [table 1](#).

[Table 1](#). Descriptive data of the sample, by stage and gender

Stage	Gender	n	Age	Weight (kg)	Height (m)
College	Males	243	16,95 ± 0,982	69,89 ± 10,03	1,77 ± 0,07
	Females	266	17,03 ± 1,203	57,58 ± 8,181	1,65 ± 0,062
	total	509	16,99 ± 1,103	63,46 ± 10,98	1,71 ± 0,088
University	Males	644	22,29 ± 2,288	75,97 ± 9,723	1,77 ± 0,075
	Females	707	22,36 ± 2,12	60,05 ± 8,632	1,66 ± 0,061
	total	1353	22,08 ± 2,647	67,58 ± 12,58	1,71 ± 0,089
Total	Males	887	19,62 ± 5,124	72,93 ± 17,79	1,77 ± 0,163
	Females	973	19,69 ± 5,138	58,81 ± 12,06	1,66 ± 0,119
	Total	1,860	19,65 ± 5,131	65,87 ± 15,89	1,71 ± 0,147

A technique based on stratified conglomerates and proportional affixation was used to define a representative sample of the population of high school and university students in Granada, taking into account gender and educational stages proportions. We set an error of 5% for the High school sample, while the error was set at 2.5% regarding the university sample. This difference depended on a greater availability and collaboration of the university institutions in providing census information and collecting data. After applying the correction for finite populations, the final sampling fraction was set at 2.79%.

## Design and variables

A sociological cross-sectional study with non-experimental design was applied. The variables considered for this research were total daily PA and built environment characteristics.

## Instruments

The Spanish short version of the International Physical Activity Questionnaire (IPAQ) was used to assess PA level of the participants. The questionnaire consists of asking people how long (specifying total number of hours and minutes) they are engaged in low, moderate and vigorous PA during a typical day. In addition, individuals are asked to report how long they are completely sedentary in a typical day. A brief description of the activities involved at each of the PA intensities studied (including typical daily tasks such as gardening or housework) is enclosed to the items, in order to make them easier to understand. Roman-Viñas, Serra-Majem, Hagströmer, Ribas-Barba, Sjöström, & Segura-Cardona (2010) carried out a comparison between IPAQ and accelerometer (MTI Actigraph by Computer Science and Application, Inc.) in a Spanish population. They reported high levels of Spearman's correlations ( $\rho = 0,82$ ,  $p < .05$ ) and a kappa coefficient of 0.61.

After deep literature review, a three-item scale (named "*built environment characteristics*") was created to assess perceived built environment features. Each item referred to a specific feature of the built environment, i.e. neighbours' outdoors exercise, safety of neighbourhood, and availability of facilities. A scale of values (Likert type) ranged from one to four was established, where 'one' indicated the poorest built environment conditions and 'four' the best conditions for PA. A validation analysis was carried out for the created scale. The analysis of consistence showed statistically significant values for both high school ( $\alpha = ,663$ ) and university samples ( $\alpha = ,722$ ). Pearson's correlations between items were significantly high, as well as correlations between each item and the new scale ( $\rho$  ranged from ,701 to ,822). Finally, confirmatory factorial analysis (Promax rotation) was carried out confirming the validity of the scale.

## Procedure

Questionnaires were applied during the first semester of 2010 academic year, at each of the educational institutions involved in the study. Previous to the data collection, the researchers made contact with the principals and teachers of the institutions, explaining the features of the project and the procedure to follow, and asking for their permission. A written consent was signed by each of the participants or their parents/tutors (when required). The researchers supervised the whole process of data collecting.

## Analysis

Descriptive statistics (means and standard deviations) for age, weight, height, total daily PA and built environment characteristics of the participants were calculated. In addition, student's t tests were carried out to compare daily PA and perceived built environment by gender and educational stage. The analysis of correlations (Pearson's correlation) was executed for PA and built environment characteristics variables. All statistical analyses were performed using SPSS 19.0 for Macintosh (SPSS® Inc., Chicago, IL). The statistical significance level was set at  $p < 0,05$ .

## Results and discussion

Total daily PA was calculated as a sum variable of daily low, moderate and vigorous PA assessed with IPAQ, representing the total time (min) per day dedicated to exercise. [Table 2](#) shows the results concerning descriptive analysis of total daily PA and built environment characteristics in both high school and university samples.

**Table 2.** Descriptive data of Physical Activity Levels and Built environment characteristics

		College	University	Total
Physical Activity (min/day)	Males	103,78 ± 56,41	64,62 ± 61,06	84,20 ± 57,12
	Females	81,31 ± 60,11	49,93 ± 54,55	65,62 ± 56,35
	Total	91,98 ± 59,35	57,06 ± 58,23	74,52 ± 58,74
Built environment characteristics	Males	2,97 ± 0,73	2,90 ± 0,76	2,93 ± 0,74
	Females	2,96 ± 0,82	2,88 ± 0,80	2,92 ± 0,85
	Total	2,96 ± 0,79	2,89 ± 0,77	2,92 ± 0,78

High school students were physically active for an average of 91.98 min per day, while in university students the average daily PA was set at 57.06 min. The comparative analysis showed significant differences between the two stages, high school students being more active than university ones ( $p < .001$ ).

Concerning the built environment characteristics scale, students from the high school stage obtained an average score of 2,96, while university students' average score was 2,89. No significant differences were found comparing high school and university samples. A summary of comparative results is shown in [table 3](#).

**Table 3.** Comparison of Physical Activity Levels and Built Environment Characteristics between college and university students. Students' t

	College		University		t	df	p
	Average	SD	Average	SD			
Physical Activity	91,98	59,35	57,06	58,23	9,057	1235	,001
Built Environment characteristics	2,96	0,79	2,89	0,77	1,732	1858	,083

The analysis of correlation showed no significant results in considering the whole sample or analysing separately by gender and educative stage.

This study aimed to assess PA levels of youths living in Granada, to estimate their perceived built environment, to analyse differences in the perception of context according to educational stage and gender, and to verify possible correlations between built environment and active habits.

The data analysis regarding PA levels underlined good active habits among high school students, but not among those at the university stage. According to the recommended PA levels established by the main international organizations in charge of health matters, the threshold for healthy PA is set at 60 min per day (WHO, 2011). In our sample, only participants from the high school stage were found to be above that threshold. On the other hand, PA was significantly lower at the university stage, university students being engaged in less than the minimum daily PA necessary for obtaining benefits on health. This result is even worse if we consider that many authors put into evidence the need for raising the threshold in order to assure real long-term effects on individuals' health (Oja, Bull, Fogelholm, & Martin, 2010).

The high PA levels found for high school students are in contradiction with the outcomes shown in other studies on European and non-European samples (Moliner, Martínez, Garatachea, & Márquez, 2010; Zimmermann-Sloutskis, Wanner, Zimmermann, & Martin, 2010). Many reasons could justify this incongruity. A main cause can be found in the higher motivational level of the adolescents living in

Granada, as stated in a study carried out by Macarro Moreno, Martínez Baena, & Torres Guerrero (2012). The authors assessed that adolescents in Granada had high intrinsic motivation towards PA (they declared that they exercise for the pleasure to be active, for feeling healthy and fit, and because it was fun to do PA in their leisure time), which is in contrast with the findings of the majority of the studies in this area. According to the Self-Determination Theory (SDT), intrinsic motivation is strongly associated with high participation rates in sports, free and organized physical activities (Deci, & Ryan, 1985). The favourable environmental characteristics emerging from the outcomes of this study could represent a factor for both higher intrinsic motivation towards PA and higher PA levels than usual. For instance, Biddle, Vrehm, Verheijden, & Hopman-Rock (2012) demonstrated that environmental characteristics could have an influence on youths' motivation to be active. Consequently, it could be possible that a favourable context for PA (like Granada seems to be, according to our results) determined higher levels of intrinsic motivation and consequently, indirectly increased PA behaviours of adolescents living in Granada (Macarro Moreno et al., 2012).

As mentioned above, PA levels of university students are not sufficient for achieving the recommended daily healthy PA. These findings are confirmed by literature, the majority of studies highlighting a negative tendency about the practice of PA in young adults, which determines the non-achievement of the minimum quantity of PA in adulthood (Jurakic, Pedisic, & Andrijasevic, 2009; Williams, Stamatakis, Chandola, & Hamer, 2011). Many authors affirm that negative environmental features could play a role in this circumstance (Ding et al., 2012; Skogan, & Maxfield, 1981). For instance, the fear of strangers, or not knowing the nearby environment, could determine a modification of normal behaviours (such as exercising outdoors) as a safety measure. Though, despite the fact that most of the university students in our sample moved to Granada for studying from different places of Spain and did not know that context at all, their perception of the environment was positive.

In fact, the high scores obtained in the built environment characteristics variable by both high school and university students showed that this population consider Granada a proper context to develop outdoors exercise. These results are not congruent with those obtained by the university students regarding daily PA levels. This incongruity is confirmed by the correlational analysis, which did not highlight any relation between PA levels and perceived environmental characteristics in this sample.

This can be justified in two ways. Firstly, it could be logical that the characteristics of certain specific contexts are perceived in the same way by the whole sample, regardless of the use that each person makes of them: participants were all living in Granada and were polled almost at the same time. The opportunities for PA that a certain environment provides, as well as its general conditions, could be the same or similar (with some dissimilarities depending on the neighbourhoods) for all individuals. Results could perhaps have been different if we had carried out a longitudinal study, which is characterized by a long-term analysis. In that case, the conditions for outdoors exercising could have changed through the study period. For instance, changes in the built environment such as the construction of new sports facilities or adding sports equipment to the existing one, could have occurred and significantly influenced PA levels (Stratton, Fairclough, & Ridgers, 2008). These eventualities cannot appear using cross-sectional designs, which entail only one session of measurements.

Secondarily, our results confirm that environment does not constitute a factor that directly influences PA behaviours, as stated by Welk (1999). The author demonstrated that positive conditions for the practice of PA do not directly determine an increase in the active behaviours of individuals, but can be considered an agent that encourages the carrying out of PA. For example, a positive built environment provides the opportunities to increase PA levels, but does not entail that people will really become more active (Welk, 1999). Biddle et al. (2012) found out that infrastructure and accessibility constitute a frame in which PA can be executed, not directly improving active habits. Other authors demonstrate that people living in a built environment facilitating the practice of PA will have greater opportunities to do sports daily, but being more active is not a direct consequence of that circumstance (Arnadóttir, Gunnarsdóttir, & Lundin-Olsson, 2009). Hence, it is possible that the participants in this study consider the environment of Granada suitable for performing physical activities, but still they do not take advantage of it due to other external or internal reasons.

As a conclusion, we can affirm that youths living in Granada are physically active at sufficient levels. Nevertheless, PA conducts are not positive at the university level, highlighting the necessity of an intervention in order to improve active behaviours among young adults. This could lead to a better quality of life in adulthood and elderly, since it could reduce the risk of suffering from non-transmissible diseases.

The built environment of Granada is perceived as appropriate for carrying out PA in the neighbourhoods, providing individuals with sufficient safety and facilities to enjoy outdoor exercise. However, the outcomes of this study highlight that even if the environmental characteristics are suitable, PA levels are still insufficient in the sample of university students. This confirms the theory that environment represents a promoting factor not directly influencing engagement in PA. Though, environment is still important when we attempt to design interventions for improving healthy habits by means of PA among youths. A context that permits people to be active is the basis which outdoor active behaviours must be built on (Biddle et al., 2012; Ogilvie, Egan, Hamilton, & Petticrew, 2004; Sallis, King, Sirard, & Albright, 2007; King, 2008; Rainham, Bates, Blanchard, Dummer, Kirk, & Shearer, 2012), whereas the absence of environmental features favouring PA reduces the opportunities for performing exercise and contributes to sedentarism (Rütten, & Abu-Omar, 2004; Sallis, Owen, Glanz, Rimer, & Lewis, 2003). Using the environment for exercising implies summing important bouts to the total daily PA levels, thus playing an important role in achieving the recommendations on healthy PA. The environment of Granada satisfies most of the requirements for a PA-favouring environment: recently, cycling and running paths have been added (or improved); many public facilities are present in each of the neighbourhood of Granada; they are administered by the Local Sports Administration, which provides citizens with a wide offer of low-cost sports activities. In addition, most of the neighbourhoods of Granada seem to be safe, as confirmed by the statistical reports of the Regional Government of Andalusia. According to this, we could affirm that Granada provides enough opportunities for encouraging an individual to be active.

Consequently, the discrepancy between PA levels and perceived built environment highlighted at the university stage could represent an indicator that young adults living in Granada are not able to take full advantage of their nearby environment for exercising. For this reason, targeted interventions should be planned, focusing on improving youth awareness on how to carry out PA in their living context in a safe and conscious way. This could improve the opportunities of being active, and consequently positively affect overall PA levels. Local governments, sports organizations, schools and public corporations in charge of environmental issues should be involved in these interventions, because they could be effective only by means of their integrated mediation.

More features regarding the context must be added in future studies focusing on the relation between PA and environment network, in order to have a wider view of the environmental factors that could affect the decision of being active or sedentary. In this study we did not consider aspects such as walkability and connectivity, and the related concept of city traffic. In addition, presence of natural zones as well as urban architecture could represent important aspects of the built environment in relation to PA. Moreover, factors such as psychological components or social environment should be included for a better understanding of the system of elements that have an influence over PA levels. Variables like self-concept and motivation in the psychological area, or parents and peer influence with regard to the social area, should be considered and studied in accordance with the particular environmental features, which are vital for understanding in depth the mechanisms that build active behaviours among youths.

### **Acknowledgements**

The third author is awarded a grant by the Spanish Ministry of Education (AP2010-5905).

This research was supported by the project: Support for Creating Excellent Research Teams and Intersectoral Mobility Teams and Intersectoral Mobility at Palacky University in Olomouc (Reg.no: CZ.1.07/2.3.00/30.0004).

## Notas

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**Recibido:** 20-05-2015

**Aceptado:** 31-05-2015

**Publicado:** 10-06-2015