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Physical Activity, Overweight, and Perceptions of Neighborhood Environments Among Portuguese Girls

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Background: The purpose of this study was 1) to compare physical activity levels according to body-mass index; 2) to determine which, if any, neighborhood perceived attributes were related to overweight. *Methods*: The sample comprised 610 girls age 14.7 ± 1.6 y. Girls were grouped into normal weight and overweight. Environmental variables and physical activity were assessed by questionnaire. *Results*: No significant differences were found in physical activity levels between normal weight and overweight girls. Logistic regression analysis revealed that girls who agreed that "there is so much traffic on the streets that it makes it unpleasant to walk in the neighborhood" were more likely to be overweight (OR = 1.78; 95% CI 1.10 to 2.89). *Conclusion*: The study found no relationship between perceptions of the environment and overweight among Portuguese girls, except for perceptions of security for walking in the neighborhood.

Key Words: girls, behavior, physical activity, obesity

Obesity is one of the most common health problems with increasing prevalence worldwide among people of all ages.[1] Obesity during childhood and adolescence is thought to be an important determinant of whether an individual will become obese as an adult.[2] Furthermore, obesity has been associated with increased risk for hypertension, coronary heart disease, insulin resistance,[3, 4] and several social and psychological problems.[3, 5]

Because of the increased prevalence of overweight and obesity among youth and the risk of subsequent chronic disease in adulthood, it is important to determine the correlates of risk for overweight in youth. The problem of obesity is multifactorial and thought to be a convergence of factors favoring an imbalance between energy consumed and expanded.[6] Complex social and environmental factors contribute to this imbalance, including changing food habits, declining physical activity (PA), and increasingly sedentary lifestyles.[7, 8]

Longitudinal studies have documented an age-related decline of 26% to 37% in total PA during adolescence and that girls have lower levels of PA.[9, 10] A review of

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correlates of PA in youth showed that one of most important variables consistently associated with PA was gender.[11] Therefore, there is a substantial public health value to identify modifiable factors that mediate patterns of physical activity which might differ by gender. One important research field involves how to increase and reinforce values of PA, so that more people choose to be active.[12] Built environments that facilitate more active lifestyles and reduce barriers to PA are desirable. Indeed, one aspect of the environment's role in obesity that has received recent attention is the way in which neighborhoods and communities are designed to promote or discourage different kinds of PA.[13] Thus, different environmental factors within neighborhood promote use and PA. The availability of outdoors play spaces, such as parks and playgrounds, may be especially important because time spent outdoors is strongly correlated to physical activity.[14]

However, little is known about the perceived environmental characteristics among obese girls. Thus, the purpose of this study was 1) to compare physical activity levels according to body-mass index (BMI); and 2) to determine which, if any, neighborhood perceived attributes were related to overweight.

Methods

Subjects and Setting

Eight public secondary schools from four urban middle schools in the north of Portugal participated in this study. The potential sample included all students of each school (n = 649) from the 7th through 12th grades. The questionnaires were distributed and filled out during physical education classes. A response rate of 94% was obtained. Questionnaires were deleted from the analysis if they contained a majority of missing information. After deletions, 610 adolescent girls entered the analysis. The average age was 14.7 y (SD = 1.6). Informed written consent was obtained from the participants and their parents or guardians before the subjects entered into the study.

Measures

Anthropometry

Body height and body weight was determined by standard anthropometrics methods. Height was measured to the nearest millimeter in bare or stocking feet with girls standing upright against a Holtain portable stadiometer. Weight was measured to the nearest kilogram, with subjects lightly dressed (underwear and tee-shirt) using a portable digital beam scale (Tanita Inner Scan, model BC 532).In this study, the BMI data was estimated from the ratio weight/height^2 (kg/m^2) and organized using linear interpolation between the cut-off points according age and sex as described by Cole et al.[15] In that study the centile curves were drawn so that age 18 y passed through the widely cut-off points of 25 and 30 for adult overweight and obesity. The resulting curves were averaged to provide age- and sex-specific cut-off points from 2 to 18 y. Thus, in our study girls were categorized as normal weight group and overweight group (defined as a BMI over 25), according to the age-adapted values mentioned above.[15]

Assessment of Physical Activity. PA was assessed by a questionnaire previously used with good reliability (ICC: 0.92 to 0.96).[16] A significant and negative correlation was found between the index of physical activity and heart rate at rest, serum insulin, and skinfold measurements, and were assumed as indicators of validation of the activity measure.[17] The questionnaire had five questions with four choices: 1) Outside school, do you take part in organized sport?; 2) Outside school, do you take part in non-organized sport?; 3) Outside school, how many times a week do you take part in sport or physical activity for at least 20 min?; 4) Outside school hours, how many hours a week do you usually take part in physical activity so much that you get out of breath or sweat?; and 5) Do you take part in competitive sport?

Overall, a maximum score of 20 points could be achieved. A PA index was obtained, which divided the sample into four different activity categories, according to the total sum of the points: the sedentary group (0 to 5); low active group (6 to 10); moderately active group (11 to 15); and vigorously active group (16 to 20).

Environmental Assessment. A questionnaire using the Environmental Module (Perceived Neighborhood Environments) of the International Physical Activity Prevalence Study was administered. The questionnaire was designed to be a brief assessment of variables believed to be related to the activity-friendliness of neighborhoods. Neighborhood environmental variables assessed included 1) access to destination (two questions); 2) connectivity of the street network (one question); 3) infrastructure for walking and cycling (one question); 4) neighborhood safety (two questions); 5) social environment (one question); 6) aesthetics (one question); and 7) recreation facilities (one question). These questions were previously used in Portuguese adolescents and showed good reliability.[18] A four-point scale assessed each question: strongly disagree, somewhat disagree, somewhat agree, and strongly agree. However, for statistical analysis, a dichotomous variable was constructed. Responses to items were collapsed in two categories: 1) "somewhat agree" and "strongly agree," and 2) "strongly disagree" and "somewhat disagree."

Statistical Procedures

The analysis was carried out using SPSS version 12 (SPSS, Inc., Chicago, IL). The chi-square^2 test was used to determine the differences in perceived environmental variables between normal weight and overweight groups. Bivariate associations between variables were done using Spearman's correlation. The independent association of perceived environmental variables with obesity as dependent variable was examined using logistic regression analysis. The variables entered in the final model were selected for variables associating at $P \leq 0.05$ in the correlation.

Results

No statistically significant differences were found for age and height among the normal weight and overweight groups, while significant differences were found for body mass and BMI ($P < 0.05$). Although more than half (53%) of obese girls belonged to the less active group, no significant differences were found in physical activity levels between normal weight and overweight girls (Table 1).

Table 1 Physical Characteristics and Physical Activity Level According to BMI

	Normal weight	Overweight	
	(*n* = 481)	(*n* = 129)	*P*
Age (y)	14.7 ± 1.6	14.5 ± 1.5	0.15
Height (cm)	161.0 ± 0.1	159.7 ± 0.1	0.22
Body mass (kg)	52.0 ± 6.8	66.7 ± 9.0	0.000
BMI (kg/m^2)	20.0 ± 1.9	26.3 ± 4.3	0.000
Physical activity	(%)	(%)	
Active	53.6	48.4	0.09
Low-active	46.4	51.6	

Differences in perceived neighborhood environments between normal weight and overweight girls are shown in Table 2. A significantly greater ($P < 0.05$) proportion of overweight girls agree with their normal weight counterparts that there is so much traffic on the streets that it makes it difficult or unpleasant to walk in their neighborhood. No other significant differences were found. In Table 3, logistic regression analysis showed that girls who agreed that "there is so much traffic on the streets that it makes it unpleasant to walk in the neighborhood" were more likely to be overweight (OR = 1.78; 95% CI 1.10 to 2.89).

Discussion

This cross-sectional study aimed 1) to compare physical activity levels according to BMI; and 2) to determine which, if any, neighborhood perceived attributes were related to overweight in girls. Given the link between some environmental features and PA as well the key role played by PA on weight management/control[12] the development of such knowledge could help to overcome barriers and increase girls' participation in regular physical activity.

In adults, the outcomes that observed the influence of the built environment on obesity have been inconclusive. One study found that increasing low population density and low connectivity/street accessibility was related to increasing obesity and BMI,[19] while Reddy et al.[20] reported that individuals living in areas with high population density were more likely to be overweight or obese. Moreover, the differences in the samples could be the cause of the divergent findings. Indeed, Ewing et al.[19] examined several US cities while Reddy et al.[20] examined individuals living in rural and urban India.

In youth, data are scarce but previous findings support the assertion that environmental characteristics related to both design and recreational facilities can explain part of the variance in physical activity in youth.[21] However, little is known about this relationship with obesity. Our data showed that traffic safety plays an important role in obesity. Findings from this study showed that overweight girls

Table 2 Differences in Perceived Neighborhood Environments Domains According to BMI

Scale composition	Item	Overweight (*n* = 129)	Normal weight (*n* = 481)	
		Agree (%)	Agree (%)	*P*
Access to destinations	Many stores are within easy walking distance of my home.	58.0	51.1	0.09
	It is easy to walk to a transit stop (bus, trolley) from my home.	62.9	60.3	0.52
Connectivity of the street network	There are many four-way intersections in my neighborhood.	51.1	53.7	0.32
Infrastructure for walking and cycling	There are sidewalks on most of the streets in my neighborhood.	51.7	58.7	0.07
Neighborhood safety	There is so much traffic on the streets that it makes it difficult or unpleasant to walk in my neighborhood.	30.4	24.1	0.04
	The crime rate in my neighborhood makes it unsafe or unpleasant to walk in my neighborhood.	27.0	25.6	0.71
Social environment	I see many people being physically active in my neighborhood.	70.7	72.4	0.66
Aesthetics	There are many interesting things to look at while walking in my neighborhood.	45.1	45.3	0.51
Recreation facilities	My neighborhood has several public recreation facilities, such as parks, walking trails, bike paths, recreation centers, playgrounds, public swimming pools, etc.	43.8	46.0	0.58

compared to normal weight girls significantly ($P < 0.05$) agree that "there is so much traffic on the streets that it makes it difficult or unpleasant to walk in my neighborhood." Furthermore, logistic regression analysis showed that girls who agreed that "there is so much traffic on the streets that it makes it unpleasant to walk in the neighborhood" were more likely to be overweight (OR = 1.78; 95% CI 1.10 to 2.89). This is an important finding because time spent outdoors is strongly associated with physical activity participation in structured and vigorous activities,

Table 3 Logistic Regression Analysis Showing Estimated Results with Obesity (BMI) As Dependent Variable

Scale composition	Item	OR	95% CI	Significance
Access to destinations	Many stores are within easy walking distance of my home.	1.56	0.90-2.6	0.11
	It is easy to walk to a transit stop (bus, trolley) from my home.	0.74	0.44-1.22	0.24
Connectivity of the street network	There are many four-way intersections in my neighborhood.	1.14	0.68-1.90	0.62
Infrastructure for walking and cycling	There are sidewalks on most of the streets in my neighborhood.	0.61	0.33-1.11	0.10
Neighborhood safety	There is so much traffic on the streets that it makes it difficult or unpleasant to walk in my neighborhood.	1.78	1.10-2.89	0.03
	The crime rate in my neighborhood makes it unsafe or unpleasant to walk in my neighborhood.	1.07	0.52-2.18	0.84
Social environment	I see many people being physically active in my neighborhood.	1.63	0.65-2.07	0.60
Aesthetics	There are many interesting things to look at while walking in my neighborhood.	0.66	0.37-1.18	0.16
Recreation facilities	My neighborhood has several public recreation facilities, such as parks, walking trails, bike paths, recreation centers, playgrounds, public swimming pools, etc.	1.04	0.55-1.80	0.98

including exercise, games, and sport.[14] Furthermore, this finding underscores the importance of walkable communities with destinations and recreation facilities. In adults, it was reported that a positive association between land-use mix and increased walking for transportation would be related to increased energy expenditure and theoretically to lower BMI.[22, 23]

Although more than half (53%) of obese girls belonged to the less active group, no significant differences were found in physical activity levels between normal

weight and overweight girls. This might explain that in this study we found no other association between BMI and measures of neighborhood perception. Nevertheless, the differences found in the perception of traffic safety may be worth noting. Some perceived measures of environment were positively associated with time spent participating in transport-related physical activity.[24] For instance, traffic safety and fear of crime were cited as reasons for not walking to school.[25] Further, access to facilities has been associated with participation in PA and high neighborhood crime rates have been associated with lower participation in PA.[11, 26]

Our data agree with other studies suggesting that improving road and pedestrian features in neighborhoods and/or perceptions of road safety may be important components of strategies for increasing the availability of walking and cycling.[27] In adults, transportation research shows that the choice to walk or cycle is influenced by the extent to which the environment supports these activities.[28, 29] Given that participation in non-organized sports is lower in older adolescents than in their younger counterparts[9, 16] strategies that enhance walking and cycling in the local neighborhood may be an important way for obese girls to accumulate PA that is sustainable and involves few parental resources.

Moreover, the relationship between PA and local neighborhood and PA, namely walking and cycling, is a complex issue. For example, living in an urban environment was associated with a greater number of sidewalks, which were a predictor of walking for exercise, but were also in a high crime area, which is a deterrent for walking.[30]

Strengths of this study include its focus on environmental factors among obese adolescent girls. In fact, programs targeting youth populations at risk for overweight should be developed based on substantive population obesity data. The study's limitations should also be noted. The results should be interpreted with the understanding that the data are cross-sectional and thus it may be difficult to assign causality, and preventing causal inferences from being drawn. Furthermore, there is a need to also include measures of social and individual factors in these studies to examine the relative importance of the environment in light of other determinants of PA. [21] Further, socio-demographic variables were not used in the analysis; it has been shown that higher socio-economic status was related to a more ''activity-friendly'' environment and may have an effect on how the built environment influences BMI.[30] Finally, the study lacks variation in these population-based environmental variables. More variation in these exposures might be required to detect a relationship between the exposures and obesity.[31] Therefore, it may be that different aspects of the urban environment other than those assessed in this study interact to influence whether an individual was overweight or obese.

Conclusions

This study found no relationship between perceptions of the environment and overweight among Portuguese girls, except for perceptions of security for walking in the neighborhood. Further research is needed using both objective measures of the neighborhood and physical activity to help clarify these relationships.

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