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LEVELS OF PHYSICAL ACTIVITY IN PUERTO RICAN FEMALE ADOLESCENTS: A PILOT STUDY

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ABSTRACT

Álvarez, A.J., Ramírez Marrero, F.A., Ortiz, A. y Martínez L.R. (2013). Levels of Physical Activity in Puerto Rican Female Adolescents: a pilot study. **PENSAR EN MOVIMIENTO: Revista de Ciencias del Ejercicio y la Salud, 11 (1),** 1-12. Physical activity (PA) is known to decline and obesity to increase from childhood to adulthood. During adolescence, girls are particularly vulnerable to both physical inactivity and overweight leading to obesity. Childhood and adolescent obesity is a known health problem in Puerto Rico; however, PA has not been well described in this population. The purpose of this study was to evaluate PA levels and factors influencing PA in a group of Puerto Rican adolescent females. Forty participants wore an accelerometer during six consecutive days and completed a PA questionnaire. Participants were divided in two groups according to age (11-13 and 14-16 years). Parents completed a socio-demographic and PA questionnaire. ANOVA and independent t-tests were used to identify differences in moderate to vigorous PA (MVPA) by age group, and between adolescents and their parents. Multiple regression analysis was performed to identify factors related to PA. MVPA averaged 87 (54) min/week with no differences between age groups: 11-13y.o. =87 (58) and 14-16 y.o. = 86(50) min/week (p = .95).A significant association was observed between parents and adolescents' MVPA (r= 0.67, p< .01). The most powerful predictors of the adolescents' MVPA were parental MVPA and the days parents shared PA with their daughters. Puerto Rican female adolescent participants showed PA levels below the minimal recommendation for health. School-based health promotion interventions designed to help increase PA levels in this population must consider parental involvement.

Key Words: IPAQ, accelerometer, physical inactivity, sedentary lifestyle

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RESUMEN

Álvarez, A.J., Ramírez Marrero, F.A., Ortiz, A. y Martínez L.R. (2013). Niveles de actividad física en mujeres adolescentes en Puerto Rico: un estudio piloto. **PENSAR EN MOVIMIENTO: Revista de Ciencias del Ejercicio y la Salud, 11 (1),** 1-12. Durante la adolescencia, las mujeres son particularmente propensas a la inactividad física, el sobrepeso y eventualmente la obesidad. La obesidad entre niños y adolescentes es un problema de salud pública en Puerto Rico (PR); sin embargo, no existe suficiente información sobre la Actividad Física (AF) en esta población. El propósito de este estudio fue evaluar los niveles de AF y factores que influyen la AF entre mujeres adolescentes en PR. Cuarenta participantes divididas en dos grupos de acuerdo a la edad (11-12 y 14-16 años), utilizaron un acelerómetro durante seis días y completaron un cuestionario de AF. Los padres de familia completaron un cuestionario socio-demográfico y también de AF. Se utilizaron pruebas t para muestras independientes y ANOVA para identificar diferencias en la AF moderada a vigorosa (AFMV) por grupo de edad y entre las adolescentes y sus padres de familia. También se utilizó una regresión múltiple para identificar factores relacionados con la AF. La AFMV promedió 87(54) minutos/semana sin haber diferencias por grupo de edad: 11-13 años, 87(58) y 14-16 años, 86(50) minutos/semana (p=.95) y esta correlacionó significativamente con la AFMV reportada por los padres de familia (r=0.67, p<.01). La AFMV de los padres de familia y el número de días que los padres de familia compartieron AF con sus hijas fueron los factores con mayor capacidad de predicción de la AFMV de las adolescentes. El nivel de AF entre las adolescentes participantes estuvo por debajo del mínimo recomendado. En intervenciones para promover la AF entre mujeres adolescentes en PR se debe tomar en cuenta la participación de los padres de familia.

Palabras claves: IPAQ, acelerómetro, inactividad física, sedentarismo

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Physical activity (PA) is defined as body movement produced by skeletal muscle activation resulting in energy expenditure above resting levels (American College of Sports Medicine [ACSM], 2010). It is known that adolescents who keep high levels of PA have a better control of body weight, lower blood cholesterol levels, and lower risk of developing type 2 diabetes (Cairella et al., 2007; Raitakari et al., 1994).

Physical inactivity and sedentary time, on the other hand, are important factors that help explain the growing prevalence of overweight and obesity among adolescents (Berkey, Rockett, Gillman, & Colditz, 2003;Gordon-Larsen, Adair, Nelson, & Popkin, 2004).Obese adolescents are at a high risk of becoming obese adults, and also at a higher risk of experiencing obesity-related comorbidities such as hyperlipidemia, hypertension, and glucose intolerance(Trost, Kerr, Ward, & Pate, 2001).

The PA recommendation for youth suggests that school age children and adolescents (6-18 years of age) must engage in at least 60 minutes of daily moderate-to-vigorous physical activities (MVPA) that are fun, appropriate for their developmental stage, and that integrate a variety of activities (Strong et al., 2005;U.S. Department of Health and Human Services [USDHSS], 2008). However, research shows that children's MVPA is low (<60 minutes/day) and decreases during adolescence, particularly among women (Riddoch et al., 2004; Telama & Yang, 2000;Trost et al., 2002). Similar to the United States (US), the incidence and prevalence of obesity among children and adolescents have been growing in Puerto Rico (PR), and also growing are the health complications associated with overweight, obesity and lack of physical activity in this population (Venegas, Perez, Suarez, &

Guzman, 2003). It has been estimated that 47% of adolescents in PR are overweight or obese, and high blood pressures have been detected among obese compared with non-obese adolescents (Venegas, et al., 2003). A more recent study also showed that 80% of adolescents in PR do not comply with the PA recommendation (Vigo-Valentín, Hodge, & Kozub, 2011). In that study, PA was evaluated with self-reports.

There are no published data regarding objectively assessed PA levels among adolescent females in PR. Therefore, the purpose of this study was to evaluate PA levels in a group of adolescent females in PR using accelerometers, and to identify factors that influence their regular engagement in PA. The hypotheses of this study are: 1) PA levels in the group of adolescent females will be below the recommended level for youth, 2) older female adolescents will have a lower PA level compared with younger female adolescents, and 3) sociodemographic factors and parent's PA will be related to the PA level of female adolescents.

Methods

Study participants. A convenience sample of 40 female adolescents (24 between 11-13, and 16 between 14-16 years of age) and one of their parents (33 mothers and seven fathers) were recruited from the University of Puerto Rico Laboratory School in San Juan, PR. This sample size provided a statistical power of 95% (alpha < .01) to detect a 50% difference between the recommended MVPA and the MVPA of the female adolescent participants.

The Committee for the Protection of Human Subjects in Research of the University of Puerto Rico, Río Piedras Campus, approved the informed consent and assent forms that were signed by parents and female adolescents, respectively, prior to study initiation.

Instruments. The assessment of MVPA among female adolescents was obtained with an objective instrument (GT1M accelerometer, Actigraph™, Pensacola, FL) and a subjective one (short version of the International Physical Activity Questionnaire (IPAQ, 2005). The accelerometer was used to evaluate PA during six consecutive days including at least one weekend day. Although participants were asked to start wearing the accelerometer immediately, actual recordings started on the following day. Accelerometers were placed and collected back during school time between Monday and Friday. A minimum of 10 hoursof recording was considered a full day of measurements. Accelerometer activity counts were used to determine minutes/day of moderate (1500-2600 counts·30s^{-1}) and vigorous (> 2,600 counts·30s^{-1}) PA following recommendations for this age group (Treuth et al., 2004). The IPAQ was used to obtain the self-reported PA among the female adolescents and their parents by calculating the minutes/day of moderate PA, vigorous PA, the combination of both (MVPA), and the self-reported sitting time according to established guidelines for this instrument (IPAQ, 2005). A question about usual sleeping time was added to the instrument. The minutes/week of MVPA were then calculated with the IPAQ for the female adolescents and their parents, and with the accelerometer for the female adolescents.

Sociodemographic characteristics that have been previously associated with physical activity behavior (Bauer, Neumark-Sztainer, Fulkerson, Hannan, & Story, 2011; Trost, et al., 2001) were

evaluated with a questionnaire in which parents reported their annual income, years of education, marital status, occupation, smoking habits, access to recreational facilities, days per week in which they shared physical activities with their daughter, and perception of their current general health. Data was collected between January and March of 2008.

Study protocol. After obtaining authorization from School Officials, orientation about the research objectives and protocol was given to potential participants in their classrooms. Informative flyers were distributed to all interested female adolescents so that they could bring the information to their parents. An initial screening was conducted to identify those who met the inclusion criteria after parents signed the informed consent and each daughter participant signed the assent form. The inclusion criteria were: 1) ability to engage in ambulatory physical activities (e.g., walk), 2) no pregnancy or diagnosed cardiovascular, metabolic, or orthopedic disorder, and 3) post-menarche.

Parents completed the sociodemographic questionnaire and the IPAQ during an interview with the principal investigator. After measuring height with a stadiometer and weight with a digital scale, female adolescents were instructed about the proper use of the accelerometer (placementon the side above the hip bone, adhered to an elastic band worn around the waist) and were asked to wear it all the time except to shower or to sleep at night. Participants received a daily morning phone call in which the principal investigator reminded them of the proper use of the accelerometer. The following day after completing the evaluation period with accelerometers, participants met individually with the principal investigator to return the accelerometer and complete the IPAQ by interview. A question regarding hours of night sleep was also included.

Data analyses. Descriptive analyses (means (standard deviations), and proportions) were used to summarize all variables of interest. A two-way analysis of variance (ANOVA) was used to test for significant differences in MVPA of female adolescent participants by age group (11-13 vs. 14-16 years) and by instrument (IPAQ vs. accelerometer). An independent t-test and regression analysis were also used to identify differences and associations between: 1) recommended minutes/day of MVPA and accelerometer determined minutes/day of MVPA of female adolescent participants, 2) self-reported minutes/day of MVPA between female adolescents and their parents. Finally, a step-wise regression analysis was conducted to evaluate factors that might influence physical activity behavior among the female adolescent participants (family annual income, years of education among their parents, access to recreational facilities, PA of their parents, days/week that participants share PA with their parents). A .05 alpha was selected a priori to detect significant differences or associations. Data was analyzed with the STATA software (version 9.1, STATA Statistic/Data Analysis Package, 2006, STATA Corp., College Station, Texas).

Results

Descriptive characteristics of female adolescent participants and their parents are summarized in Table 1. Based on the age and sex specific percentile of body mass index (BMI) for children and adolescents (www.cdc.gov/healthyweight/assessing/bmi/, accessed on October 22, 2012), 15% (6/40) of the female adolescents were classified as obese, 20% (8/40) as overweight, and 65% (26/40) as

normal weight. Body weight, height and BMI were not different by age group. Age and BMI of parents were 44.5 (6.0)yearsand 26.5 (4.1) kg/m^2, respectively. Based on adult BMI analysis, 15% (6/40) of parents classified as obese, 25% (17/40) as overweight, 40% (16/40) as normal weight, and 3% (1/40) as underweight.

Sociodemographic characteristics are presented in Table 2. The majority of parents were mothers (83%). A high proportion of parents (85%) reported having at least a college degree, and 63% reported a relatively high annual income.Although 61% of parents reported having Access to recreational facilities, only 24% engaged in physical activities with their daughters.

Self-reported PA with the IPAQ among female adolescents and their parents, and accelerometer-determined PA among female adolescents are presented in Table 3. Minutes/week of MVPA among female adolescents (range: 20 to 238 minutes/week) were significantly lower than the recommended minimum of 300 minutes/week for this population (USDHHS, 2008). None of the female adolescents in this study reached the minimum PA recommendation, and only 10% reached at least 150 min/week of MVPA, the minimum PA recommendation for adults (USDHHS, 2008). Among these female adolescents, self-reported MVPA was significantly higher compared with the accelerometer (388.4 (202.7) vs. 86.9 (54.2) minutes/week, respectively; p = .001). The parent's self-reported MVPA and sitting time are also included in Table 3, with mean values of 696.5 (713.8) minutes/week of MVPA, and 6.7 (2.6) hours/day of sitting time

Table 1.

Descriptive characteristics of female adolescents by age group and their parents

Variables	*Mean (Standard Deviation)*			
	All (n=40)	11-13 years (n=24)	14-16 years (n=16)	t
Age (years)	13.2 (1.4)	12.2 (0.8)	14.7 (0.7)	-10.23*
Weight (kg)	53.6 (10.6)	52.1 (12.2)	55.8 (7.5)	-1.07
Height (cm)	155.1 (6.1)	153.8 (6.1)	157.0 (5.6)	-1.67
BMI (kg/m²)	22.2 (3.7)	21.9 (4.3)	22.6 (2.7)	-0.62
Parents	n=40			
Mothers (n)	33 (83%)			
Age (years)	44.5 (6.0)			
Weight (kg)	68.6 (13.5)			
Height (cm)	160.6 (7.9)			
BMI (kg/m²)	26.5 (4.1)			

Note: BMI = Body mass index, *p< .05

Table 2.

Sociodemographic characteristics as reported by parents (n = 40)

Variable	Proportion (%)
Education ≥ college degree	85
Annual Income> $40,000	63
Married	66
Work for salary (part time or full time)	83
Smokers	12
Access to recreational facilities	61
Engage in physical activities with daughter	24
Perception of general health as good or excellent	56

Table 3.

Mean (M) and standard deviation (SD) of physical activity variables among female adolescents as determined with the accelerometer and self-reported with the IPAQ, and self-reported physical activity with the IPAQ among parents.

	Mean (*Standard Deviation*)		
Variable	IPAQ	Accelerometer	*T(p)*
Vigorous PA (minutes/day)	27.9 (23.2)	1.7 (2.0)	-7.23(0.001)
Moderate PA (minutes/day)	31.4 (39.8)	10.7 (6.5)	-3.36(0.002)
MVPA (minutes/week)	388.4 (202.7)	86.9 (54.2)	-9.42(0.001)
Sitting time (hours/day)	9.7 (1.7)	-	-
Sleeping time (hours/day)	7.3 (1.0)	-	-
Parent **IPAQ**			
Vigorous PA (minutes/day)	38.3 (48.9)		
Moderate PA (minutes/day)	79.4 (112.1)		
MVPA (minutes/week)	696.5 (713.8)		
Sitting time (hours/day)	6.7 (2.6)		
Sleeping time (hours/day)	6.8 (0.9)		

Note: PA = Physical activity, MVPS = moderate to vigorous physical activity

The MVPA among female adolescents by age group and by instrument (IPAQ vs. ActiGraph accelerometer) is presented in Figure 1. Accelerometer-determined and self-reported PA were mostly of moderate intensity while very little time was spent in vigorous intensity PA (p = .001).

Among possible factors influencing the female adolescents PA behavior, sharing PA with their parents and parent's PA were the two most significant (t =2.64, p= .01; and t=2.21, p = .03; respectively) explaining 27% of the variance in the adolescent's MVPA ($F_{2,37}$ =6.82, p < .01).

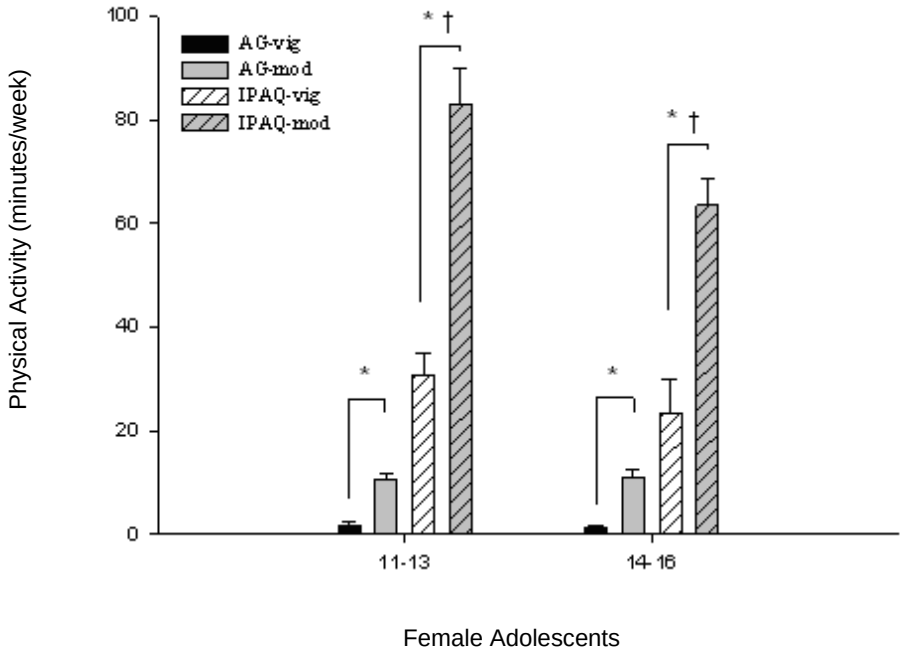

Figure 1. Moderate (mod) and vigorous (vig) physical activity as determined with the ActiGraph accelerometer (AG) and self-reported with the IPAQ among female adolescents by age group. †p<.05 comparing IPAQ and accelerometer (AG), * p< .05 comparing moderate (mod) and vigorous (vig) physical activity.

Discussion

This pilot study is the first to provide objective PA data of female adolescents in PR. The most important finding was that the group of female adolescents was below the minimum 60 minutes/day or 300 minutes/week of MVPA recommended for good health in this population (USDHHS, 2008). Female adolescents in intermediate grade school level (10th and 11th grade) in the US have also shown low levels of PA (Kelly et al., 2010; Trost, et al., 2002). However, the average MVPA reported in those studies(23-50 minutes/day) is higher than the average observed among female adolescents in the present study (approximately 12 minutes/day). In another study,(Santos, Guerra, Ribeiro, Duarte, & Mota, 2003)reported an average of 66 minutes/dayof MVPA in their sample of female and male adolescents (11-16 years of age) in the US; therefore, reaching the PA recommendation. A limitation of that study was that accelerometers were used for three consecutive days without including

a weekend day, which could have caused instrument reactivity and overestimation of the actual PA behavior. Research participants tend to modify their PA behavior when they are aware of the instruments and the purpose of the study (Treuth, et al., 2004).To prevent this potential error, investigators should include 5-9 consecutive days of measurements with accelerometers, including at least one weekend day (Treuth, et al., 2004). In the present study, accelerometer measurements were obtained for 6 consecutive days including one weekend day which make our results a close representation of the actual physical activity behavior in our study participants

Physical inactivity contributes to overweight and obesity among adolescents, and obese adolescents tend to have a higher risk of becoming obese adults with known obesity related morbidity and mortality risks (Berkey, et al., 2003; Gordon-Larsen, et al., 2004; Must, Jacques, Dallal, Bajema, & Dietz, 1992). Because of the extremely low level of PA in the present study, it is possible that these participants, particularly those who are overweight and obese, might develop a high risk of early age chronic diseases such as type 2 diabetes, hypertension or hyperlipidemia. Although the magnitude and severity of future cardiovascular and metabolic diseases in this population cannot be clearly determined, it is clear that developing chronic health diseases at an early age signify major and more serious social and economic problems for future generations.

Another important finding in this study was the significant association between the self-reported MVPA of female adolescents and that of their parents (R^2=0.45, $F_{1,38}$ =31.4, P< .001), and between the parent's self-reported MVPA and the accelerometer determined MVPA of the female adolescents (R^2=0.15, $F_{1,38}$ =5.72, p < .02);suggesting that physically active female adolescents probably have a parent that is also physically active. The association between the MVPA of female adolescents and the number of days that they shared physical activities with their parents was another interesting observation that suggests the consideration of parental involvement in the development of programs to promote physical activity among female adolescents in PR.Similar observations have been reported previously. For example, Moore and collaborators (Moore et al., 1991)observed that children who have physically active parents are 5.8 times more active than children with physically inactive parents. Bauer and collaborators(Bauer et al., 2011)also showed a strong association between the PA behavior of parents and that of their adolescent daughters. Other investigators have also reported that parental support is a strong predictor of their children's PA behavior (Van Der Horst, Paw, Twisk, & Van Mechelen, 2007). Most of these studies have assessed PA with self-reports. The few studies that have used objective assessment of PA report weak associations between the PA behavior of parents and their children (Kelly, et al., 2010). The present study is one of the first to show a significant association between the MVPA of parents and their adolescent daughters using self-reports as well as objective assessment with accelerometers.

Also noticeable was the big difference between self-reported and objectively assessed PA among the female adolescents in the present study. This is similar to other reports (Slootmaker, Schuit, Chinapaw, Seidell, & van Mechelen, 2009) and suggests the importance of including objective assessment of PA behavior in this population.

The present study has several limitations including first the relatively small convenience sample of adolescent females. Although the statistical power was adequate, the sample selection is probably biased and does not necessarily represent the population of adolescent females in PR. Therefore, observations and conclusions from the present study can be generalized only to adolescent females with similar sociodemographic characteristics. In addition, only seven fathers were recruited which

limits the capacity to identify which parent (mother or father) has more influence on their daughter's PA behavior. Another limitation is the need to remove the accelerometer for aquatic activities or bicycling. However, only one participant reported two hours of swimming during one study day. No participant reported engaging in bicycling activities.

In conclusion, this pilot study showed that none of the female adolescent participants complied with the minimal PA recommendation; their levels of PA, although extremely low, are positively associated with their parents'. These results highlight the need to continue studying PA, inactivity and sedentary behavior among adolescents in PR and other Hispanic countries, and to implement and evaluate PA interventions for this population that integrate parental participation and support. These recommendations are important to successfully reduce obesity-inducing behaviors and to promote healthier lifestyles among Hispanic adolescent females.

Implications for School Scenarios

Successful school based PA interventions are those that integrate activities which are:1) fun, 2) appropriate for the specific developmental stage, 3) diverse in the required physical movement skills, and 4) possible to implement in different scenarios (Stone, McKenzie, Welk, & Booth, 1998). School physical education programs, and after-school PA programs in which parents and the community could be involved are examples of scenarios to consider. It is important to highlight that female adolescent participants in the present study took two physical education classes per week, each of one hour duration. Nevertheless, their MVPA was extremely below the recommended level, thus suggesting the need to reevaluate the time and the intensity of physical activities allowed during school physical education classes. Each physical education period must contribute to the achievement of appropriate daily PA levels and better health of this population. It is also important to organize and integrate periods of PA during the school sessions which are not limited to the physical education class.

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