



# GROWTH AND MATURATION IN HUMAN BIOLOGY AND SPORTS

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## USING PAQ-C AMONG BRAZILIAN YOUTH

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In the past decades, the prevalence of chronic diseases increased among all age groups in the population, in most countries, regardless of their socioeconomic levels. There is a clear trend indicating that changes in both dietary and physical activity (PA) behaviors are at least partially responsible for these diseases, especially obesity and metabolic syndrome (Katzmarzyk et al., 2008). The health concerns among youth rely on the long exposure to risk factors and disease itself, which in turn, increase the chances of greater disease burden. Therefore, research on PA levels became mandatory in health behavior surveillance, allowing for the description of regular PA and also the factors affecting youth participation. After mapping active and sedentary lifestyles, interventions may be better tailored and are more likely to succeed (Tremblay et al., 2010).

PA levels can be assessed by objective and self-report methods. In epidemiological research, self-report is the assessment of choice, although it offers limitations during younger ages, mainly due to lower capability of recalling time spent on a specific type of activity. Objective measures of PA using electronic devices, such as accelerometers, offer information on both intensity and duration of PA throughout the day for several days. As technology evolves and becomes more affordable, this method will be wide-spread. Furthermore, there will be a clear distinction between sedentary behavior and low level of PA (Pate et al., 2008; Tremblay et al., 2010). Nevertheless, self-report of type and context of physical activity is still necessary to define active behavior (Biddle et al., 2011).

The physical activity questionnaire for older children (PAQ-C) was developed to assess levels of moderate-to-vigorous physical activity (MVPA) in children older than grade 4 who were participating in the Saskatchewan Pediatric Bone Mineral Accrual Study, Canada (Kowalski et al., 1997). A second instrument, PAQ-A, was developed to investigate PA levels among adolescents (Crocker et al., 1997). Both questionnaires were developed to provide low subject burden during the assessment, with an estimated completion time of 20 minutes. Two recent reviews on instruments for assessing PA among youth referred to PAQ-C as a promising tool (Biddle et al., 2011; Chinapaw et al., 2010). Biddle et al. (2011) identified three questionnaires for population surveillance based on their psychometric properties as well as support from expert researchers in the area, and the PAQ-C/PAQ-A was one of them.

A modified version of the PAQ, PAQ-AD, was developed to assess PA among adults, as individuals engaged in the longitudinal study grew up. In this way, PA level in adulthood can be observed and compared to the scores of childhood and adolescence (Copeland et al., 2005).

The PAQ-C is a seven-day recall self-administrated questionnaire that uses 12 items assessing (1) common sports, leisure time activities and games, and (2) activity during segmented day (in physical education classes, recess, lunch, after school, and in the weekends). Each of the items have a 5-point scale, the total score is a composite mean of 9 items (items 1 through 8 and 12). For the activity checklist, item 1, it is necessary to transform the score into a 5-point scale, by dividing the total number of points on the item by the number of activities in the checklist, including activities under the *other* category. A similar procedure is addressed to item 12, the activity on each day of the week, where the total points are divided by 7. Items 9 and 10 are related to peer comparison of PA level while item 11 asks if the subject was sick during the week which is being reported. Those three items are not included in the computation of the score. In two studies (Crocker et al., 1997; Kowalski et al., 1997), the scores of the PAQ-C were normally distributed. PAQ-C score represents a spectrum from the very inactive (1) to the very active (5). Based on the score, the subject may be classified as inactive, when his/her score is  $< 3$  or active ( $\geq 3$ ). It is important to emphasize that those categories are related to MVPA.

PAQ-C was validated against an activity rating, other PA questionnaires, motion sensor (Caltrac accelerometer) and a fitness test. All correlations were significant and low to moderate (0.28 to 0.57), consistent with other validation efforts (Kowalski et al., 1997). Scale reliability analyses of PAQ-C showed acceptable item-scale properties ( $\alpha=0.80$  to 0.83) for either a combined sample of boys and girls or separately by sex (Crocker et al., 1997). PAQ-C also had acceptable test-retest reliability ( $r_{\text{intraclass}}=0.75$  and 0.82 for males and females, respectively) (Crocker et al., 1997).

The questionnaire version for adolescents, PAQ-A, generates the score based on a 5-point scale of 8 out of 9 items, by applying the same procedures of the PAQ-C score. The item not included in the computation is that of reported sickness during the week. Suppressed items are those comparing PA of same sex and age peers. Psychometric properties were also investigated by Kowalski et al. (1997). The findings were consistent with those of PAQ-C. Similar psychometric results were found to PAQ-AD, which has the same structure of PAQ-A, with modified activity checklist and day segments according to work context of adults (Copeland et al., 2005).

## THE BRAZILIAN PORTUGUESE VERSION OF PAQ-C

### The original study

PAQ-C was translated into Portuguese for use in a dissertation project held in the city of Niterói, Rio de Janeiro, Brazil in 1997 (Silva, 1998). This project investigated cardiovascular risk factors among adolescents, including physical activity patterns. The main reason of using PAQ-C instead of PAQ-A was that there is a recess from Elementary to High School in Brazil, which can be used for some level of physical activity. The recommended procedure of back-translation (World Health Organization) was not established at that time. However, the Portuguese version of PAQ-C was evaluated by a language professional for appropriateness of translation as well as of written Portuguese. PAQ-C had the activity checklist modified to exclude sports that are not played in Brazil.

The sample of this project included 329 students (126 males and 203 females) with a mean age of  $15.0 \pm 0.5$  years. PAQ-C scores were  $2.3 \pm 0.6$  for males and  $2.0 \pm 0.6$  for females. There were no differences in physical activity scores between age groups (14 and 15 yrs) in each sex; however, the values represented low levels of activity for the subjects. In both sexes, mean values for the PAQ-C score were lower than those reported by Kowalski et al. (1997) in youth from 8 to 14 years. As physical activity decreases with age, this may explain the lower scores observed in this Brazilian sample, since the subjects were older than the sample upon which the PAQ-C was validated (Silva and Malina, 2000).

The lower scores may also indicate that the questionnaire was not sensitive to cultural differences related to the perception of physical activity in Brazilian youth. In fact, the correlation between the self-reported activity rating and the PAQ-C score was 0.40 ( $p < 0.001$ ), which is slightly lower than the coefficient of 0.63 reported by Kowalski et al. (1997).

Most subjects were classified as inactive; the prevalence was 85% for boys and 84% for girls. There was a trend for longer periods of TV watching among subjects at risk, especially in girls. Although Niterói was a medium sized city at that time, it also had and still has safety problems, including high crime rate, which is known to decrease opportunities for physical activity (Ferreira et al., 2007).

The PAQ-C score did not explain the variance in body composition indicators (sum of 6 skinfolds, BMI, trunk-to-extremity and waist to hip ratios) or systolic blood pressure. However, the PAQ-C score was inversely related to diastolic blood pressure ( $R^2 = 0.03$ ) and cardiovascular fitness ( $R^2 = 0.04$ , measured by the 12-min run); however, it explained only a very small portion of the variance in those risk factors. The PAQ-C score in this sample seemed to protect subjects from risk of overweight (OR=0.42, CI=0.19-0.92) (Silva and Malina, 2003, 2004).

A PAQ-C validation study was held in the city of Florianópolis, Santa Catarina, with students of the Elementary and High School that is integrated to the Federal University. Participants wore pedometers and completed the Bouchard activity record for 7 days after the application of PAQ-C. Preliminary analyses of data showed low values of PAQ-C scores for the entire sample (175 subjects, 10 to 18 years of age). Correlation coefficients of PAQ-C score and MVPA and total activity from Bouchard record and weekdays and weekend pedometer counts ranged from 0.35 to 0.43 (unpublished data).

#### Other studies

Silva et al. (2005) studied CHD risk factors among adolescents from Maceió, Alagoas, Northeastern Brazil. They investigated elevated blood pressure, risk of overweight and overweight as well as physical inactivity and tobacco use in a representative sample of 1253 students (43.7% males). Prevalence of inactivity was reported as PAQ-C scores  $< 3$ , and most of that sample (93.5%) was under this threshold. The data were stratified by sex, type of school (private or public) and SES, but differences in PAQ-C

scores were only found between sexes. As the mean age was  $12.4 \pm 2.9$  years, Silva et al. expected a lower prevalence of inactivity in comparison to the findings of Silva and Malina (2000) due to their younger sample; nonetheless, they found a low negative association between PAQ-C score and age ( $r=-0.27$ ,  $p<0.05$ ). Rivera et al. (2010), using data of the same sample, showed no relationship of PAQ-C score and TV viewing ( $r= -0.04$ ,  $p>0.05$ ), although 65% of the students spent more than 3 hours of TV viewing per day (mean value =  $3.6 \pm 2.3$  hours per day).

PAQ-C was also used to ascertain the association between PA levels and obesity among 733 children from two slums in the Great Recife area, in Pernambuco, Northeastern Brazil (Alves et al., 2009). The children were engaged in the Programa de Saúde da Família (Family Health Program), which is coordinated by the Brazilian Ministry of Health and has the purpose of following up health conditions of individuals in their household by health practitioners. The results showed that 73.1% of children were at risk of overweight, while obesity was prevalent in 19.2%. Almost 60% of the sample was classified as inactive. There was a significant association between PAQ-C scores  $<3$  and overweight /obesity (71.6% vs 56.7% normal weight,  $p<0.05$ ). The authors indicated that living conditions and negative environment contributed to high prevalence of inactivity. Another contributor to low activity levels was TV viewing, since more than half of the sample spent more than 3 hours per day in such a behavior.

PAQ-C has been also used in research projects in our graduate program (Diniz, 2007; Dummel, 2007; Lima, 2011). Two theses investigated children and adolescents living in the state of Rio Grande do Sul, Southern Brazil (Diniz, 2007; Dummel, 2007). Dummel (2007) conducted a study in Três de Maio, a small size city in the state of Rio Grande do Sul. Cardiovascular risk factors (blood pressure, plasma HDL and total cholesterol, glycemia, eating pattern and physical activity level, family history, tobacco use and anthropometric measurements) were collected among adolescents in high school in both public and private settings. Physical activity assessment included PAQ-C and a check list for identifying time spent in MVPA. Sedentary individuals were classified if had PAQ-C scores  $< 3$  or less than 300 minutes of MVPA. The results showed that 86.1% of subjects had habitual atherogenic diet, 32.6% increased abdominal adiposity, 25.9% low levels of HDL-c and 20.3% high levels of total cholesterol. For inactivity, prevalence using PAQ-C was 97.6% while for the check list it was 61.2%. PAQ-C mean scores for males and females were  $2.09 \pm 0.5$  and  $1.86 \pm 0.4$ , respectively. Dummel did not observe any associations between inactivity and other risk factors in her sample.

Another project in the state of Rio Grande do Sul explored growth, physical activity level and food habits in youth aged 9 to 15 years, taking into consideration ethnic background, since this state had great immigration from European countries, mainly Germany, Italy and Poland, in the late 19<sup>th</sup> and beginning of 20<sup>th</sup> centuries (Diniz, 2007). Six cities were investigated in the Northwestern area of the state. The sample was composed by 1428 students (696 males). Polish-descendent students tended to show lower values for growth variables, although the differences were significant in only a few age groups. According to PAQ-C, 75.5% of the students were classified as inactive. Inactivity was positively associated with sex, ethnicity, parental education and hours of daily television watching. The German group presented a 43%

higher probability for being inactive than the Polish group. Socioeconomic status was associated with inactivity only for the Polish group. At least half of each ethnic group did not achieve the recommended daily consumption of fruits, vegetables and milk.

Lima (2011) used PAQ-C score as a control variable for the analyses of body composition components in HIV-infected children, who acquired infection through maternal transmission. The cross-sectional study investigated 51 children and adolescents (26 males) living in Florianópolis, Santa Catarina, with mean values of body mass, stature and age of  $39.9 \pm 12.6$  kg;  $147.2 \pm 15.4$  cm, and  $12.5 \pm 2.7$  years, respectively. Lymphocyte TCD4<sup>+</sup> count was obtained from medical records and revealed that most of subjects had no severe immunologic suppression (76% and 80.8% respectively for females and males). Dual-energy x-ray absorptiometry was used to measure body composition components. For Bone Mineral Density (BMD), Bone Mineral Content (BMC), percent of body fat (%BF) and lean body mass (LBM), z-scores were computed based on the National Health and Nutrition Examination Survey (NHANES) data. In all components, negative z-scores were found (z-BMD<sub>subtotal</sub> -1,22 sd, z-BF% -1,03 sd and z-LBM/stature<sup>2</sup> -0,81 sd). PAQ-C mean scores were  $2.36 \pm 0.7$  for males and  $2.48 \pm 0.6$  for females, indicating low levels of MVPA. It was expected that low levels would be associated with stage of disease; however, data showed no relationship between immunologic suppression category and PAQ-C score.

In summary, PAQ-C scores indicate low levels of MVPA among Brazilian youth. Efforts to identify individuals at risk of sedentary behavior are a priority in order to prevent health complications. Additional analyses of validation data will provide the psychometric properties needed to confirm the appropriate use of recognized research tool for assessing PA in children and adolescents.

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