

## Sex and Ethnic Differentials in Physical Activity Levels of Adolescents in Kuantan

Dan SP, Mohd. Nasir MT & Zalilah MS

*Department of Nutrition and Dietetics, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia, Selangor, Malaysia*

### ABSTRACT

A cross-sectional study was conducted to determine the physical activity levels of 400 adolescents (13 years old) in Kuantan, Pahang using the Physical Activity Questionnaire for Older Children (PAQ-C). The associations of physical activity levels with sex, ethnicity and body mass index were also determined. About one third (35.3%) of the adolescents were in the low physical activity level category, 61.5% in the moderate physical activity level and only 3.0% of the adolescents were in the high physical activity level category. More males (77.9%) were physically active than females (54.9%). Twice as many female adolescents (45.1%) were in the low physical activity level category compared to the male adolescents (22.1%). The associations between physical activity with ethnicity and body mass index were not significant. However, there was a significant interaction effect of sex and ethnicity in mean physical activity score ( $F = 2.36, p < 0.01$ ). Malay males had a significantly higher mean physical activity score as compared to Chinese males ( $t = 2.13; p < 0.05$ ). Although Chinese females had a higher mean physical activity score than Malay females, the difference was not statistically significant. Conversely, there was no interaction effect of sex and BMI status in mean physical activity score. This study suggests that physical activity intervention to promote regular physical activity is needed since a high proportion of the adolescents fall within the low physical activity level category.

### INTRODUCTION

Adolescence is a period that marks tremendous changes in physical, biological, hormonal, cognitive and psychosocial development of an individual (Neinstein & Kaufman, 1996; Neinstein *et al.*, 1996; Spear, 2002). These changes may produce conflicts and anxiety in adolescents that could influence the establishment of many undesirable lifestyle habits such as risk

taking behaviours related to alcohol, violence, sexual activity and drugs, poor eating habits and inactivity (Lytle *et al.*, 1995; Kennedy & Prothrow-Stith, 1997; Resnick *et al.*, 1997; Lytle, 2002).

During adolescence, adolescents gain up to 50% of their adult weight, more than 20% of adult height, and 50% of their adult skeletal mass (WHO, 2000). However there are sex differentials in the acceleration of growth and maturation during

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Correspondence author:

Dr Mohd. Nasir Mohd. Taib; Email address: nasir@medic.upm.edu.my

adolescence. These include earlier onset of puberty and higher fat mass in females but higher fat-free mass, peak height velocity and increase in shoulder span and leg-to-trunk ratio in males (Chumlea *et al.*, 1983; Vizmanos & Marti-Henneberg, 2000).

Physical activity during childhood and adolescence is crucial as it contributes to a normal skeletal development and is necessary for young adults to attain and maintain an appropriate bone mass (Lasheras *et al.*, 2001). Physical activity is defined as any bodily movement produced by skeletal muscles that results in energy expenditure beyond resting expenditure. Exercise is a subset of physical activity that is planned, structured, repetitive, and purposeful in the sense that improvement or maintenance of physical fitness is the primary objective (Thompson *et al.*, 2003). Physical activity is a modifiable risk factor that is protective against cardiovascular disease, type 2 diabetes, hypertension, obesity, osteoporosis, and certain cancers (Hambrecht *et al.*, 2000; Thompson *et al.*, 2003; Kohrt *et al.*, 2004; Breslow *et al.*, 2001), and promotes mental health (Peluso & Andrade, 2005). Although the health benefits of physical activity have been well documented, the lifestyle of modern society is increasingly sedentary and this inactivity is observed among children and adolescents as well (Lasheras *et al.*, 2001).

In the United States, a report of the Surgeon General of Health indicated that about 50.0% of the American children aged 12-21 years were not physically active on a regular basis (U.S. Department of Health and Human Services, 1996). In addition, data from the US National Youth Risk Behavior Survey indicated that there was a dramatic decline in the percentage of youths participating in daily physical education classes from 42.0% in 1991 to 27.0% in 1997 (CDC, 1997). A cross-country comparison study of Singaporean Chinese and Chinese American youths (Wang *et al.*, 1994) found that the

Singaporean Chinese youths ( $10.7 \pm 2.9$  hours/day) spent more time in sedentary activities as compared to their Chinese American counterparts ( $9.4 \pm 2.1$  hours/day). However, the mean time spent on daily vigorous activities was almost similar in both groups.

As Malaysia is undergoing rapid urbanization and industrialization that could lead to the population becoming more affluent and mechanized, a decline in physical activity is inevitable (MOH, 1999). The findings from the National Health and Morbidity Survey II indicated that the prevalence of adequate exercise among Malaysians was only 11.6% (MOH, 1997). This sedentary lifestyle among adult Malaysians is also extended into its pediatric population as shown in a study on school children aged 10 to 11 years old which reported that 46.7% of the children exercised 2-3 times per week and only 10% exercised daily. On the other hand, 18.3% of the children exercised once a week and 8.3% did not exercise at all (Bong, 2003). Another study found that among 13 year-old adolescents, 44% were in the sedentary category, while the remaining 33.3% and 22.7% were in the moderately active and very active categories, respectively (Lim, 2005).

In view of the lack of published information on physical activity of Malaysian children and adolescents, this paper aims to report on physical activity levels of 13-year-old adolescents in Kuantan, Pahang Darul Makmur. The associations between physical activity levels with sex, ethnicity and body mass index were also examined.

## METHODS

### Subjects

Subjects were Form 1 students from two national schools in Kuantan, Pahang. These schools were randomly selected based on the criteria of multi-ethnicity and

non-single sex schools. All Form 1 students in the two schools were invited to participate in the study with the final sample consisting of 400 adolescents.

Approval to conduct the study was obtained from the Medical Research Ethical Committee, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia and the Ministry of Education. Permission was also obtained from the respective school principals before commencement of the study. Written informed consent was elicited from the participating adolescents prior to their involvement in the study.

### Measurements

Physical activity information was collected using a self-administered questionnaire and the researchers gathered anthropometric measurements of height and weight. All measurements were carried out in the school setting.

#### *Assessment of physical activity*

The Physical Activity Questionnaire for Older Children (PAQ-C), which was modified and adapted from Kowalski *et al.* (2004), was used to assess general levels of physical activity of the adolescents. The instrument consisted of 10 items. Item 1 was on leisure time activity of the adolescents during the last 7 days. The adolescents were required to respond to an activity checklist and were scored on a 5-point scale ranging from "no" activity being scored as 1 and "7 times or more" being scored as 5. The mean of all activities on the activity checklist was calculated to form a composite score for item 1.

Items 2 to 8 were on activities of the adolescents during physical education (PE) class, recess, lunch, right after school, evenings, weekends, and leisure times. The answer options for each item begin from the lowest activity response (score 1) and progress to the highest activity

response (score 5). For item 9, the adolescents were asked on the frequency of participating in daily physical activity (e.g. playing sports, games, dancing) in the previous week. A score of 1 was assigned to "none" and a score of 5 was assigned to "very often". The mean score for all days of the week was calculated to form a composite score for item 9. Item 10 was used to identify adolescents with unusual activities (e.g. sickness or obstacles that prevent them from participating in normal physical activities) during the previous week.

Once the sum of scores from items 1 to 9 was calculated, the final PAQ-C activity summary score was obtained by taking the mean of these 9 items. A mean score of 1 indicates low physical activity, whereas a mean score of 5 indicates high physical activity. Adolescents were classified into three categories based on their mean total physical activity score. An adolescent with a mean total score ranging from 1 to 2.33 was categorized in the low physical activity level, 2.34 to 3.66 in the moderate physical activity level, and 3.67 to 5 in the high physical activity level category. In the present study, the internal consistency of this assessment calculated from an independent sample of 36 Form 1 students was 0.79.

#### *Anthropometric Measurements*

Weight and height of the adolescents were measured using a TANITA digital weighing scale and body meter, respectively. Each measurement was obtained twice with weight recorded to the nearest 0.1 kg and height to the nearest 0.1 cm. Body Mass Index (BMI) in kg/m<sup>2</sup> was calculated and compared to BMI-for-age reference (WHO, 1995).

### Statistical Analysis

Data were analyzed using the SPSS for Windows version 14.0. Descriptive statistics such as frequencies, means,

standard deviations and percentages were used to describe variables, such as physical activity, sex, ethnicity, and body mass index. Chi-squared test was used to determine associations between categorical variables. Independent t-test and one-way ANOVA were used to compare the differences between and among group means, respectively. Two-way ANOVA was used to test the interaction effects of independent variables on the dependent variable. Statistical probability level of  $p < 0.05$  was considered as significant.

## RESULTS

A total of 400 adolescents (165 males and 228 females) aged 13 years participated in the present study comprising 56.2% Malays, 42.0% Chinese, and 1.8% Indians. Mean weight, height and BMI were  $49.51 \pm 13.31$  kg,  $156.13 \pm 7.57$  cm and  $20.18 \pm 4.61$  kg/m<sup>2</sup>, respectively. As shown in Table 1, most (70.0%) of the respondents were normal weight, 22.7% were at risk of being overweight and 7.3% were underweight. More than half of the adolescents (61.5%) were in the moderate physical activity level category while only 3.0% of the

respondents were in the high physical activity level category. About one third of the adolescents (35.5%) were in low physical activity level category.

Male adolescents were significantly more physically active than females ( $t=6.94$ ,  $p<0.001$ ) with more male (77.9%) than female (54.9%) adolescents in the moderate/high physical level category (Table 2 & Table 3). There were twice as many female adolescents (45.1%) than male adolescents (22.1%) who had low physical activity level. In this study, further analyses indicated that male adolescents spent more time on activities such as walking for exercise, football, jogging or running and skipping. On the other hand, female adolescents reported more time participating in walking for exercise and skipping. In addition, male adolescents participated in physical education class more frequently than females ( $\chi^2=13.601$ ,  $p=0.009$ ) whereby about one third of the male adolescents always participated in physical education while only one fifth of the female adolescents were often involved in physical activity classes. Table 4 shows that males were also more physically active than

**Table 1.** Characteristics of study subjects

| Characteristics         | Male<br><i>n</i> (%) | Female<br><i>n</i> (%) | Total<br><i>n</i> (%) |
|-------------------------|----------------------|------------------------|-----------------------|
| Gender                  | 167 (41.8)           | 233 (58.2)             | 400 (100)             |
| Ethnicity               |                      |                        |                       |
| Malay                   | 82 (49.1)            | 143 (61.4)             | 225 (56.2)            |
| Chinese                 | 83 (49.7)            | 85 (36.5)              | 168 (42.0)            |
| Indian                  | 2 (1.2)              | 5 (2.1)                | 7 (1.8)               |
| Body Mass Index Status  |                      |                        |                       |
| Underweight             | 18 (10.8)            | 11 (4.7)               | 29 (7.3)              |
| Normal Weight           | 105 (62.8)           | 175 (75.1)             | 280 (70.0)            |
| At risk overweight      | 44 (26.4)            | 47 (20.2)              | 91 (22.7)             |
| Physical Activity Level |                      |                        |                       |
| Low                     | 37 (22.1)            | 105 (45.1)             | 142 (35.5)            |
| Moderate                | 122 (73.1)           | 124 (53.2)             | 246 (61.5)            |
| High                    | 8 (4.8)              | 4 (1.7)                | 12 (3.0)              |

**Table 2.** Mean value for body weight, height, body mass index and physical activity of adolescents by sex

| Characteristics                      | Mean $\pm$ SD     |                   |                   |
|--------------------------------------|-------------------|-------------------|-------------------|
|                                      | Male              | Female            | Total             |
| Body weight (kg)                     | 51.46 $\pm$ 15.11 | 48.10 $\pm$ 11.68 | 49.51 $\pm$ 13.31 |
| Height (cm)                          | 159.01 $\pm$ 8.91 | 154.06 $\pm$ 5.60 | 156.13 $\pm$ 7.57 |
| Body Mass Index (kg/m <sup>2</sup> ) | 20.16 $\pm$ 4.85  | 20.19 $\pm$ 4.43  | 20.18 $\pm$ 4.61  |
| Physical Activity Level              | 2.77 $\pm$ 0.56   | 2.40 $\pm$ 0.52   | 2.56 $\pm$ 0.57   |

**Table 3.** Mean score and distribution of physical activity level of adolescents by sex, ethnicity and BMI status

|                                      | Physical Activity    |                                  |                        |
|--------------------------------------|----------------------|----------------------------------|------------------------|
|                                      | Mean $\pm$ SD        | Low<br>n (%)                     | Moderate/High<br>n (%) |
| Sex                                  |                      |                                  |                        |
| Male                                 | 2.77 $\pm$ 0.56      | 37 (22.1)                        | 130 (77.9)             |
| Female                               | 2.40 $\pm$ 0.52      | 105 (45.1)                       | 128 (54.9)             |
|                                      | (t = 6.94, p=0.000)  | (χ <sup>2</sup> =22.30, p=0.000) |                        |
| Ethnicity                            |                      |                                  |                        |
| Malay                                | 2.53 $\pm$ 0.60      | 86 (38.2)                        | 139 (61.8)             |
| Chinese                              | 2.58 $\pm$ 0.52      | 54 (32.1)                        | 114 (67.9)             |
|                                      | (t = -0.78, p=0.436) | (χ <sup>2</sup> =1.55, p=0.213)  |                        |
| Body Mass Index (kg/m <sup>2</sup> ) |                      |                                  |                        |
| Underweight                          | 2.51 $\pm$ 0.58      | 10 (34.5)                        | 19 (65.5)              |
| Normal weight                        | 2.57 $\pm$ 0.58      | 100 (35.7)                       | 180 (64.3)             |
| At risk Overweight                   | 2.53 $\pm$ 0.53      | 32 (35.2)                        | 59 (64.8)              |
|                                      | (F=0.26, p=0.768)    | (χ <sup>2</sup> =0.02, p=0.988)  |                        |

**Table 4.** Distribution of the respondents according to the frequency of participation in physical activity after school and weekends

|              | Frequency (per week)  |          |           |           |                         |          |           |           | χ <sup>2</sup> | p      |
|--------------|-----------------------|----------|-----------|-----------|-------------------------|----------|-----------|-----------|----------------|--------|
|              | Male (n=167)<br>n (%) |          |           |           | Female (n=233)<br>n (%) |          |           |           |                |        |
|              | No                    | 1 time   | 2-3 times | ≥ 4 times | No                      | 1 time   | 2-3 times | ≥ 4 times |                |        |
| After school | 21(12.6)              | 22(13.2) | 61(36.5)  | 63(37.7)  | 32(13.7)                | 49(21.0) | 120(51.5) | 32(13.8)  | 33.34          | 0.0001 |
| Weekends     | 11(6.6)               | 30(18.0) | 75(44.9)  | 51(30.5)  | 34(14.6)                | 60(25.8) | 101(43.3) | 38(16.3)  | 18.26          | 0.001  |

**Table 5.** Interaction of sex with ethnicity and BMI status in mean score of physical activity

| <i>Interaction</i> | <i>F value</i> | <i>p</i> |
|--------------------|----------------|----------|
| Sex * Ethnicity    | 2.36           | 0.004    |
| Sex * BMI status   | 0.78           | 0.458    |

**Table 6.** Mean score and distribution of physical activity level of adolescents by sex and ethnicity

|         | <i>Physical Activity</i> |                                 |                                |
|---------|--------------------------|---------------------------------|--------------------------------|
|         | <i>Mean ± SD</i>         | <i>Low<br/>n (%)</i>            | <i>Moderate/High<br/>n (%)</i> |
| Male    |                          |                                 |                                |
| Malay   | 2.86 ± 0.61              | 16 (19.5)                       | 66 (80.5)                      |
| Chinese | 2.68 ± 0.50              | 21 (25.3)                       | 62 (74.7)                      |
|         | (t = 2.13, p=0.035)      | (χ <sup>2</sup> =0.80, p=0.373) |                                |
| Female  |                          |                                 |                                |
| Malay   | 2.35 ± 0.51              | 70 (49.0)                       | 73 (51.0)                      |
| Chinese | 2.48 ± 0.53              | 33 (38.8)                       | 52 (61.2)                      |
|         | (t = -1.91, p=0.057)     | (χ <sup>2</sup> =2.21, p=0.137) |                                |

females during weekends ( $\chi^2=18.26$ ,  $p=0.001$ ) and after school ( $\chi^2=33.34$ ,  $p=0.0001$ ). Male adolescents (30.5%) were twice as likely as female adolescents (16.3%) to be involved in physical activities such as sports, dance, or play games four times or more during weekends and 2.7 times more than female adolescents to engage in physical activities (sports, dance, or play games) four times or more after school.

In the analysis of physical activity level by ethnicity, Indians were excluded since they comprised only a small proportion of the respondents. The results showed that there was no significant association between physical activity and ethnicity. The distribution of the respondents in the physical activity level categories was almost similar for Malays and Chinese (Table 3). However, an analysis of interaction between sex and ethnicity in

physical activity (Table 5) revealed that there was a significant interaction effect of sex and ethnicity in mean physical activity score ( $F = 2.36$ ,  $p = 0.004$ ). As shown in Table 6, Malay males ( $2.86 \pm 0.61$ ) had significantly higher physical activity mean score ( $t = 2.13$ ,  $p < 0.05$ ) as compared to Chinese males ( $2.68 \pm 0.50$ ). Chinese females ( $2.48 \pm 0.53$ ) had higher physical activity mean score than Malay females ( $2.35 \pm 0.51$ ); however the difference is not statistically significant.

There was no significant association between physical activity level and BMI status (Table 3). The distribution of adolescents with high, moderate and low physical activity levels was almost similar whether they were underweight, normal weight, or at risk of overweight. Similarly, as shown in Table 6, there was no interaction effect of sex and BMI status in mean physical activity score.

## DISCUSSION

Studies in other countries have shown a marked decline in physical activity among adolescents (Kimm *et al.*, 2002; Jago *et al.*, 2005; Pahkala *et al.*, 2006). The present study showed that more than a third (35.3%) of the 13-year-old adolescents were physically inactive. This was consistent with a study by Pahkala *et al.* (2006) among 565 Finnish adolescents who reported that the amount of leisure-time physical activity of one-third of 13-year-old girls was extremely low.

Boys were more physically active than girls and this finding has been reported in several other studies (Vilhjalmsson & Thorlindsson, 1998; Lasheras *et al.*, 2001; Pahkala *et al.*, 2006). The present study revealed that twice as many female adolescents were grouped in the low physical activity level category compared to the male adolescents. A study conducted by Lasheras *et al.* (2001) among 1358 Spanish children and adolescents in Spain also reported that less than 30% of youths in their study were active in their leisure time and boys were 2.6 times more than girls to be physically active. Similar results were found in a study among 16 years old Finns in that the proportion of boys (33.5%) engaged in physical activity four times or more in a week was higher than girls (25.0%) (Aarnio *et al.*, 2002). This may be explained by the different roles in society assigned to boys and girls. Boys are more likely to participate in physical activity and are rewarded for their involvement by family and friends, while girls are less likely than boys to be rewarded for their physical activity (Lasheras *et al.*, 2001; Sallis *et al.*, 1996). Conversely, the results from a longitudinal study conducted by Paavola *et al.* (2004) in Finland reported that there was no difference in leisure-time physical activity between male and female respondents at any measurement point (13-, 15-, 21-, and 28- years olds).

This study also found that boys

reported more time spent on activities such as walking for exercise, football, skipping, jogging or running, and bicycling and girls spent most of their time on activities like walking for exercise, and skipping. Sallis *et al.* (1996) who conducted a study in California among 1871 students similarly reported that boys spent more time on activities like jogging, yard work, bicycling, weight lifting, basketball, football, surfing, and skateboarding, while girls reported more time participating in aerobic dancing, walking, calisthenics and other dances. Differences in sport participation among boys and girls may be due to different socialization patterns for boys and girls (Lasheras *et al.*, 2001; Sallis *et al.*, 1996). This may limit the opportunity and accessibility of certain types of sports. For example, very few girls were playing football and very few boys were joining gymnastics as reported in a study by Lasheras *et al.* (2001). Consistently, the present study found that more male adolescents participated regularly in physical education class and were more physically active than female adolescents after school and during weekends. Gordon-Larsen *et al.* (2000) and Sallis *et al.* (1996) also reported similar results in their studies.

Several studies have shown that physical activity patterns varied by ethnic or racial groups (Schmitz *et al.*, 2002; Gordon-Larson *et al.*, 2000). On the contrary, findings from the present study showed no significant association between physical activity levels and ethnicity. However, there was a significant interaction effect of sex and ethnicity in mean physical activity score in that Malay males were more physically active as compared to Chinese males whilst Chinese females were more physically active than Malay females. A study by Gordon-Larson *et al.* (1999) of 13,157 US adolescents (7205 non-Hispanic White, 2770 non-Hispanic blacks, 2260 Hispanics, and 922 Asians) aged 12-22 years found that ethnic differences were far greater for inactivity than for moderate

to vigorous physical activity. The prevalence of physical inactivity was highest for non-Hispanic black adolescents and was lowest for non-Hispanic white adolescents. Further, the likelihood of engaging in moderate to vigorous physical activity ranged from 37.9% for Asian males to 42.2% for non-Hispanic black males. While non-Hispanic white females (25.6%) were most likely to engage in moderate to vigorous physical activity, Asian females (12.5%) were least likely to have high physical activity level. Likewise, Gordon-Larson *et al.* (2000) also revealed that moderate to vigorous physical activity was lower and inactivity was higher for non-Hispanic black and Hispanic adolescents.

The present study found that there was no significant association between BMI status and physical activity level. Similar findings were also reported by other local studies in that there was no significant association between energy expenditure and body mass index among adolescents (Tan, 2003; Ho, 2001; Noor, 1998). However, in a Finnish study conducted by Lahti-Koski *et al.* (2002), it was reported that there was a negative relationship between body mass index and physical activity level. Likewise, Bellisle & Rolland-Cachera (2000) also reported that French children with higher body mass index were more likely to not participate in any sport activity. In contrast, several local studies reported that overweight adolescents tend to be more physically active than the normal weight adolescents (Pon, 1999; Dan, 2005; Chin, 2005). The discrepancy among these studies may be due to the selection of different segments of the study population, for example adolescents versus children.

There are several limitations to this study that could affect the interpretation of the findings. The cross-sectional design of this study is unable to determine causal relationship between variables and the direction of the relationship. The question-

naire used in this study was self-administered and the reliance on self-reported data depends on the honesty and the ability of the adolescents to understand the questions. Since the recruitment of the adolescents was from one geographic area, the results may not be representative of adolescents from different parts of the country. Nevertheless, despite these limitations, this study provides important information on physical activity levels among adolescents.

## CONCLUSION

Physical activity during childhood and adolescence is important as it exerts many health benefits. Sedentary behaviour often originates in childhood and adolescence and may persist into adulthood. Many studies have repeatedly reported that there are many children and adolescents who are physically inactive (Sallis *et al.*, 1996; Vilhjalmsjon & Thorlindsson, 1998; Frary & Johnson, 2000; Monge-Rojas *et al.*, 2002). Inadequate physical activity, often coupled with unhealthy dietary behaviors, may put adolescence at risk of many nutrition-related chronic diseases such as type 2 diabetes and cardiovascular disease (Rosenbloom & Joe, 1999; Strong *et al.*, 1999). The present study indicated that about one third (35.5%) of adolescents were physically inactive whereby female adolescents were more physically inactive than male adolescents. There were ethnic differentials in physical activity between Malay and Chinese males, but not in females. We also found that there was no significant association between BMI status and physical activity levels. However, further investigations are required to confirm these findings in the general Malaysian adolescent population. Nevertheless, it is recommended that both government and non-government agencies carry out concerted efforts to promote physical activity among children and adolescents so that regular physical activity patterns can be

established and maintained throughout life. This study also suggests that intervention programs should be carefully planned and implemented to motivate adolescents to be regularly involved in physical activity.

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