

# The Use of Pedometry to Assess the Physical Activity of Hong Kong Secondary School Students during School Lunch Period

## 利用步數記錄儀探討香港中學生在午膳間的身體活動量

Lobo LOUIE Pui-shan CHAN

Department of Physical Education,  
Hong Kong Baptist University, HONG KONG

雷雄德 陳佩珊  
香港浸會大學體育學系



### Abstract

The intent of the researchers was to determine the physical activity level of the secondary school students during their lunch period in regular school days in Hong Kong. The physical activity for the following two distinct groups were studied: Mandatory Group – students who are not permitted to have lunch meal outside the school, and Free Group – students who are free to go away the school for a meal. Subjects' age ranged from 13 to 18 with a mean of 14.6. Pedometers were utilized to assess the physical activity in terms of the step counts recorded. The step counts for the free group were significantly ( $p < .05$ ) larger than that of the mandatory group, indicating that more physical activity was achieved when the students were free to move outside the school during lunch time. In addition, boys were more active than girls in both groups. Recommendations for the promotion of students' habitual physical activity during lunch period were made.

### 摘要

本文作者旨在探討本港中學生於午膳間的身體活動量，利用輕便的步數記錄儀來比較兩組群之身體活動量分別：留在校內組及離開校園組。學童年齡由 13 至 18 歲不等，平均為 14.6 歲。結果顯示：留在校內組的身體活動量較離開校園組顯著少 ( $p < .05$ )，引證出學童留在校內午膳時，缺乏足夠的身體活動。而且女生的活動量也較男生顯著減少，校內學生活動量下降的問題，值得體育工作者的關注。

### Introduction

Physically inactive becomes a recent health concern issue in many developed countries. In Hong Kong, statistics from the Department of Health (1998) revealed that cardiovascular disease was the major factor leading to the cause of death. Physical activity is a key element and plays an important role in people's daily habitual lifestyle. There has been an increased awareness of the importance of physical activity in our society, especially the potential carryover effect of physical activity during childhood and adolescence into adulthood (e.g. Armstrong & Simon-Morton,

1994; Lauer, Lee & Clarke, 1988). Many cardiovascular disease risk factors can be tracked from children into adulthood as well (Baranowski et al, 1992).

Sallis (1993) denoted that over the school age years, a consistent decline in physical activity was seen, with boys decreasing about 2.7% per year and girls decreasing about 7.4% per year. These figures suggested that older youth and females were at increased risk of obesity because of a sedentary lifestyle. In order to further understand the factors influencing physical activity, Sallis, Prochaska and Taylor (2000) conducted a comprehensive

review of correlates of physical activity utilizing 108 studies to evaluate 40 variables for children and 48 variables for adolescents. Variables that associated with adolescents' physical activity were gender, ethnicity, age, perceived activity competence, sensation seeking, sedentary after school and on weekends, opportunities to exercise, etc.

Recent educational reform in Hong Kong has revised the whole curriculum for primary and secondary schools. Physical Education has been placed into one of the eight key learning elements. Its goal is to provide more opportunity for the school children to take part in physical activity. The promotion of physical activity in school children and adolescence becomes a recognized goal of public health authorities elsewhere. Blair (1992) pointed out that children are generally fitter and more active than adult, and most of them are active enough to receive important health benefit from physical activity. Thus, physical activity during childhood and adolescence was of interest to public health not only because of its concurrent relationships with risk factors, but also because of its possible influence on future adult participation in physical activity and sport. Sallis and Patrick (1994) recommended that adolescent youth accumulated at least 30 minutes of moderate-intensity physical activity daily and completed three bouts of continuous, moderate to vigorous exercise on a weekly basis.

Physical activity data collection methods such as heart rate monitors, accelerometry, pedometry, and activity recall are commonly utilized. However, researchers often find difficulties to choose one instrument in assessing children's physical activity accurately. Measuring physical activity in school children must involve with relative large number of subjects and inexpensive equipment. Louie et al (1999), and Eston, Rowlands, and Ingledew (1998) revealed that pedometry possessed excellent reliability and validity and it satisfied such cases. Pedometry provided the advantages of convenient to use, compatibility with most daily activities, objectivity and repeated use.

In Hong Kong, all secondary school students attend class on full-day basis. Students may bring along with their packed-lunch, have a meal at the school canteen or outside the school. Recently, some schools do not permit students to go away the school campus during the lunch period. The major reasons are to prevent students from hanging up on the nearby shopping malls, parks, or computer centers and to keep away the students from youth gangsters' contact. On the other hand, most secondary schools in Hong Kong only have limited area for physical activity: one to two basketball courts, one covered-playground, and one air-conditioned indoor school hall. There are no outdoor soccer and athletic field owing to the undersized school space. How

can a thousand students congregate in such small school throughout the whole lunch period? Are the schools providing sufficient area for physical activities? All these questions are being investigated in this study.

The intent of the researchers was to determine the physical activity level of the secondary school students during their lunch period in regular school days in Hong Kong. Meanwhile, the students' activity patterns were also being examined in order to better understand the habitual behaviors and recommendations on the promotion of physical activity during such period would be provided.

## Procedures

### Subjects

Subjects for this study were 168 secondary school students, including 81 boys and 78 girls. The subjects were recruited from a public secondary school located in a newly developed town in New Territories region. Informed consent was obtained from the school principal prior to the data collection. Their ages ranged from 13 to 18 with a mean of 14.6. The body heights and weights were  $164 \pm 7.9$ cm and  $50.5 \pm 9.5$ kg. The Body Mass Index ranged from 13.5 to 29.6 with a mean of  $18.7 \pm 2.8$ .

### Data Collection

**Pedometry.** Yamax Digi-walker SW-200 was utilized to collect data for this investigation. A pedometer is able to collect uniaxial motion data by measuring the vertical oscillations, step counts. It was worn securely to a waistband on the right side of the student's body. Each subject was encouraged to carry out his/her daily activity habitually.

**Physical Activity.** According to Bouchard and Shephard (1994), physical activity comprised any bodily movement produced by the skeletal muscles that resulted in a substantial increase over the resting energy expenditures. In the present study, physical activity was operationally defined as the number of step counts recorded by a pedometer. The physical activity phase was delimited at the school lunch period of 65 minutes (12.55 p.m. to 2.00 p.m.). Data were collected in two regular school lunch periods (day 1 and 2). The mean step counts of day 1 and 2 were utilized for further comparison.

**Physical Activity Questionnaire.** A simple questionnaire was designed for the purpose of obtaining information related to the subject's activity patterns and the determinants of the

habitual physical activity. Part I of the questionnaire involved the items concerning the variety of different activities to be taken by the subject. The subject was asked to tally the number of activities he/she participated during the lunch period. For each chosen activity, it had to be maintained for at least three minutes.

Part II of the questionnaire was concerned with perceived reasons of taking part in the activities during the lunch period. The items were scored on a five-point Likert scale, ranging from strongly agree (5 point) to strongly disagree (1 point).

### Internal Consistency

In order to determine the internal consistency of the pedometry in assessing the physical activity level of the Hong Kong secondary school students, 38 subjects were randomly selected and worn extra pedometers on the left waistband. Correlation coefficient between the right and left step counts was computed to establish the internal consistency of the pedometry.

To compute the day-to-day reliability, each subject was asked to wear a pedometer on two regular school days. Step counts on two different day's lunch periods would then be compared.

### Data Analysis

All statistical data analyses were carried out utilizing the Statistical Package for Social Science for Window 9.0 version. Descriptive statistics would be presented for easier interpretation. Pearson Product-Moment Correlation Coefficients were computed for the internal consistency as well as the day-to-day reliability. A 2 x 2 ANOVA was utilized to determine whether there was any interaction effects between the gender and the two groups: those were mandatory to stay at school during lunch period and those spent their lunch period outside the school campus with respect to the step counts recorded by the pedometers. The activity patterns as well as the perceived reasons were presented in rank orders for easy interpretation.

### Results

The purpose of this study was to identify the physical activity level of the secondary school students during regular school lunch period. The step counts recorded by the pedometry for the students who were mandatory to stay in school were compared with those were allowed to stay outside the school campus. Additionally, the researchers attempted to identify the habitual activity patterns between these two subject groups during such period.

The physical characteristics of the subjects were presented in Table 1. A total number of 159 students were volunteered in this study.

**Table 1. Physical Characteristics of the Subjects (N = 159).**

	Minimum	Maximum	Mean	SD
Age in years	13	18	14.6	0.5
Height in cm	147	196	164.1	7.9
Weight in kg	33	96	50.5	9.5
Body Mass Index	13.5	29.6	18.7	2.8

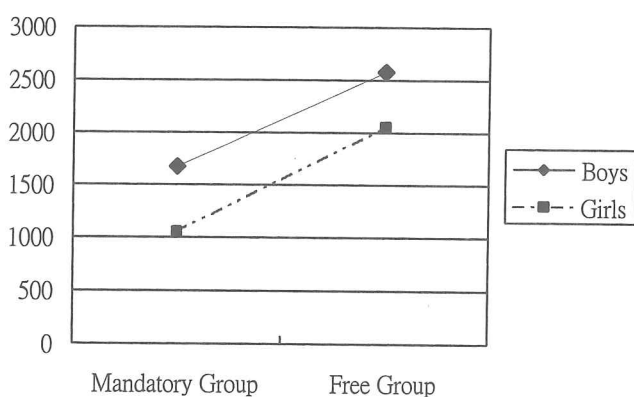
Of the 159 subjects, 78 (49%) students were randomly selected from the mandatory stay in school group (mandatory group) whereas 81 (51%) students were obtained from the group who was allowed to stay outside the school campus for lunch (free group). For the mandatory group, there were 42 boys and 36 girls whereas 39 boys and 42 girls were from the free group.

Internal consistency was established by means of correlating the pedometer data collected from the subjects worn on both (right and left) sides of the waistbands. A significant ( $r = .98, p < .05$ ) correlation between these two data set was obtained, indicating that the pedometry became a reliable tool to measure the step counts of the students during such period. The mean step counts recorded by the pedometers worn on the right and left waistbands were  $2037 \pm 915$  and  $2058 \pm 898$ , respectively. Moreover, the day-to-day reliability was computed by correlating two data set taken in two separate regular school lunch periods. The Pearson correlation between these two days' step counts was found to be significant ( $r = .54, p < .05$ ). It revealed that the subjects' habitual physical activities (step counts) between two different days were similar, allowing for further comparison. Apparently speaking, body mass index seemed to be a factor affecting children's physical activity level, however, no correlation was found between these two variables in this investigation.

The means and standard deviations of the step counts picked up by the pedometers were shown in Table 2. The mean step counts of the boys were significantly ( $p < .05$ ) higher than that of the girls. The mean step counts for the free group were also significantly ( $p < .05$ ) larger than that of the mandatory group. However, no interaction effect was found between the gender of the students and the two subject groups with respect to the total step counts (see Figure 1).

**Table 2. The Step Counts between the Free Group and Mandatory Group.**

	Gender	N	Mean	SD
Mandatory Group	Boys	42	1672.3	610.4
	Girls	36	1052.5	409.9
Free Group	Boys	39	2577.7	646.8
	Girls	42	2054.4	770.3

**Figure 1. Step Counts between the Gender and the Two Subject Groups.**

The activity patterns of the students during school lunch periods were presented in Table 3 and 4.

**Table 3. Top Ten Ranks of the Activities Taken by the Mandatory Group (n = 78).**

Activity	Rank Order	Percent Selected by Students
Walking	1	97.4
Standing	2	88.5
Watching TV	3	52.6
Listening to Music	4	38.5
Reading	5	35.9
Basketball	6	32.1
Running	7	32.1
Volleyball	8	9.0
Table-tennis	9	3.8
Badminton	10	2.6

**Table 4. Top Ten Ranks of the Activities Taken by the Free Group (n = 81).**

Activity	Rank Order	Percent Selected by Students
Walking	1	100.0
Standing	2	76.5
Shopping	3	48.1
Listening to Music	4	30.9
Running	5	28.4
Reading	6	25.9
Watching TV	7	11.1
Basketball	8	8.6
Computer Game	9	4.9
Playing Chess	10	3.7

The perceived reasons for taking part in the activities during lunch period were summarized as follows, in terms of the rank order: (a) to kill time, (b) enjoyment, (c) relaxation, (d) learn team work, (e) to make friends, (f) to improve personal health, and (g) to improve skills. All of these above items received mean ranks of over 3.0 in the Likert scale responded by the subject.

## Discussions

The reliability and validity of the pedometry to assess school children's physical activity were previously reported by many researchers in the field, e.g. Bassett et al (1996). The present finding further supported the recommendation by Louie et al (1999) that pedometry was a valid tool to measure children's habitual physical activity. Pedometers were relatively inexpensive, compact and user-friendly. An excellent advantage used in school setting was able to collect data for large number of subjects in the meantime.

Significant gender difference in habitual physical activity between boys and girls was also found in this study. This was in line with Armstrong et al (1990), Caspersen, Nixon, and DuRant (1998), and Sallis, Prochaska, and Taylor (2000). Hong Kong school boys were more physically active than girls. Although physiological and biological factors may possibly explain such occurrence, however, cultural aspect also plays a significant role. In oriental cultural, girls tend to be less physically active than boys. Traditionally, Hong Kong parents prefer their daughters to learn art crafts and play musical instruments that are sedentary in nature, rather than playing sport with heavy-sweating. Conversely, boys are encouraged to take part in mainstream sports such as swimming, soccer, and basketball. Such gender unfairness

should be distorted and more encouragement for regular physical activity should be given to both boys and girls.

This gender difference appeared to echo the comments from Burrows, Eves and Cooper (1999). In their study, they identified the motivators and barriers for boys and girls taking part in physical activity. Girls were more likely to perceive exercise as helping them 'look good' whereas boys recognized sport as 'fun'. Girls' reluctance to be involved in physical activity was observed in this study. Comparative small amount of step counts (see Table 2) recorded for the girls in the mandatory group revealed that significant sedentary lifestyle has been adopted. Apart from walking and standing, watching TV was their popular sedentary activity for mandatory groups during school lunch. School authorities should pay special attention on this issue in order to provide sufficient physical activity for the children to achieve proper physical health from school environment. TV watching was significantly associated with children's performance on the cardiovascular function, amount of body fat and body mass index. High TV viewing children tended to perform more poorly on the mile run than those children who watched less TV (Armstrong, Sallis, Alcaraz, Kolody, McKenzie, & Hovell, 1998).

International Physical Activity Guidelines for Adolescents suggested that all adolescents should be physically active daily, or nearly every day, as part of play, games, sports, work, transportation, recreation, physical education, or planned exercise, in the context of family, school, and community (Sallis & Patrick, 1994). Enhanced physical activity is a cornerstone in a multidisciplinary approach to preventing and treating juvenile obesity, as mentioned by Bar-Or (2000). Thus, more organized physical activity should be provided to those students who are required to stay at school during lunch period. The schools should aim at helping children and adolescents adopt active lifestyles that will be sustained throughout life.

The present finding serves as a preliminary report to be aware of the physical activity level of the Hong Kong secondary school students during school lunch period. With the recent local educational reform, the status of physical education in school is considered necessary to be upgraded so as to provide sufficient physical activity for Hong Kong school children to achieve better physical health.

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### Correspondence:

Dr. Lobo Louie  
Department of Physical Education,  
Hong Kong Baptist University,  
Kowloon Tong,  
HONG KONG.  
Email: [s62591@hkbu.edu.hk](mailto:s62591@hkbu.edu.hk)

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