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The Effect of a Pedometer-based Program Improvement of Physical Activity in Tabriz University Employees

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ABSTRACT

Background: Regular physical activity (PA) has been shown to reduce risk of morbidity and overall mortality. A study has displayed that achieving 10,000 steps/day is associated with important health outcomes and have been used to promote PA. Pedometers are a popular tool for PA interventions in different setting. This study investigated the effects on pedometer-based and self-reported PA among Tabriz University employees.

Methods: This experimental study assessed the effects of 16 weeks pedometer-based workplace intervention. Participants (*n* = 154) were employees of two worksites. Pedometer-based and self-reported PA from one intervention worksite was compared with the data of a comparison workplace. International Physical Activity Questionnaire (IPAQ) for self-reported measure of PA, and demographic (age, marital status, educational level, employment status, and stage of change) variables were obtained. To measure PA objectively pedometer was used.

Results: Participants reported to increase the step counts from baseline (end of summer) to posttest (winter). The intervention effect revealed significant increase in the intervention group (8279 ± 2759 steps/day than in the comparison work place (4118 ± 1136). Self-reported based on IPAQ concluded women in intervention worksite had a significant increase in the leisure time domain, but similar finding was not found in the comparison worksite.

Conclusions: Pedometer used might rather benefit those individuals who want feedback on their current PA, also walking should be considered to increase PA in employee women.

Keywords: Employees, pedometer-based program, physical activity

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INTRODUCTION

Regular physical activity (PA) has been shown to reduce risk of morbidity and overall mortality.[1] To maintain benefits of PA and good health, American College of Sports Medicine recommended 30+ min of moderate PA 5 or more days/week or 20 min of vigorous PA 3 or more days/week.[2] Moreover to these traditional guidelines, a study has displayed that achieving 10,000 steps/day is associated with important health outcomes and have been used to promote PA.[3] Together with step count guidelines, the pedometer has been used more frequently as a measurement tool imbedded in PA intervention programs.[4] Pedometers are simple electronic devices that measure ambulatory activity (walking)[4,5] and this is a "good thing" in terms of quantifying a mount of PA performed and to provide a clear and measurable goal for PA4. The pedometer-based program was originally designed for sedentary individuals.[5] Individuals holding relatively sedentary jobs may be at greater risk of becoming inactivity. Physical inactivity is an increasing problem at the worksite.[5] Self-reports displayed that the "at risk" individuals not reaching 10,000 steps/day at baseline, increased their PA mostly at work, which suggests that the worksite might be a suitable location to reach this inactive group.[1] The worksite has been recognized as a key setting to promote PA due in part to the fact that an intervention can coincide at a venue where individuals spend a significant amount of time on a consistent basis.[2,6] Although the worksite has been identified as a suitable setting to promote PA and the pedometer is found to be an effective tool for promoting PA, there are limited number documented studies on the effectiveness of using pedometer at the worksite.[5,7-11] Furthermore, these studies carried out in the Belgian,[1] Canada,[8] Australia,[9] Japan,[5] and the United States.[10,11,12-14] No study, if any, examined the effects of a pedometer-based program in Iran. However, no research could be found studying the effects of a supportive workplace intervention in Iran, continent with different socioeconomic, environmental and cultural characteristics compared with other parts of world. The present intervention study aimed to improve levels of PA in Iranian workplace. However, the increasingly inactivity nature of many jobs and work tasks is characteristic of the contemporary workplace. A need to counteract the changing nature of work and to support PA promotion at workplace is evident.[5] Previous study found that women are less active than men.[15] Hence in this study, women were selected as a target group of the research. The purpose of this study was to determine if the use of pedometer-based walking program could motivate sedentary employees to promote their PA at work as well as improve their lifestyle behavior at life.

METHODS

This study used an experimental pretest-posttest design, which evaluated the effects on pedometer-based (workday and nonworkday step counts) and self-reported PA. Following university ethics clearance, a convenience sample of 77 women from medical sciences employees as control worksite and 77 women from nonmedical sciences employees as intervention worksite from one Tabriz University located in Azerbaijan province at North-West of Iran, where most job were sedentary, volunteered for the study. The sample size in this study was taken from De Cocker *et al*.[1] study that the intervention's effect size was very strong (0.5–0.8) based on F index. Taking account of power and error according to software G-Power (SPSS Inc. IL Chicago, USA) the sample size was 51 also with 50% attrition rate, the sample size was estimated about 75 in each group. Participants were informed through mass E-mails and posters about the study purpose to evaluate PA through a questionnaire and a pedometer registration) those willing to participate were instructed to wear a pedometer to collect objective PA and a guide on how to use the pedometer and the activity log. Furthermore, participants were given information about International PA Questionnaire (IPAQ) to collect subjective PA. Participants submitted weekly logs that recorded number of the step taken per day using their pedometer through study. This study from one intervention worksite (60 participants at posttest) compared with the data of a comparison worksite (60 participants at posttest). Information on response rates is shown in Figure 1. Exclusion criteria for participation were any medical problems that would preclude them from participating in PA. All participants signed an informed consent form and the study protocols were approved by the Review Board of Shahid Sadoughi University.

Intervention

Pedometers were kept for the 16 weeks of the study. Participants in the intervention worksite were encouraged to develop teams and each team chose a team leader. The team leader was responsible for collecting step counts and delivering the logs to the researchers. Each team willing to participate "walking routes" to complete at least 30 min of continuous, brisk walking every workday, were given a map of walks around campus. Moreover, participants in the intervention worksite chose their own time walked and other activities based on the level of comfort. Participants were given instructions to increase PA throughout intervention phase. The instructions included: (1) Increase step counts (try to increase 500 steps a day this week); (2) providing solutions to overcome barriers; (3) recommending strategies to help perceived benefits of PA; (4) suggestions for increasing social support and encouragement to promote PA as teamwork and worksite step competition; (5) recommending to promote staircase instead of the elevator, using their break times to walk and parking their cars further away from building.

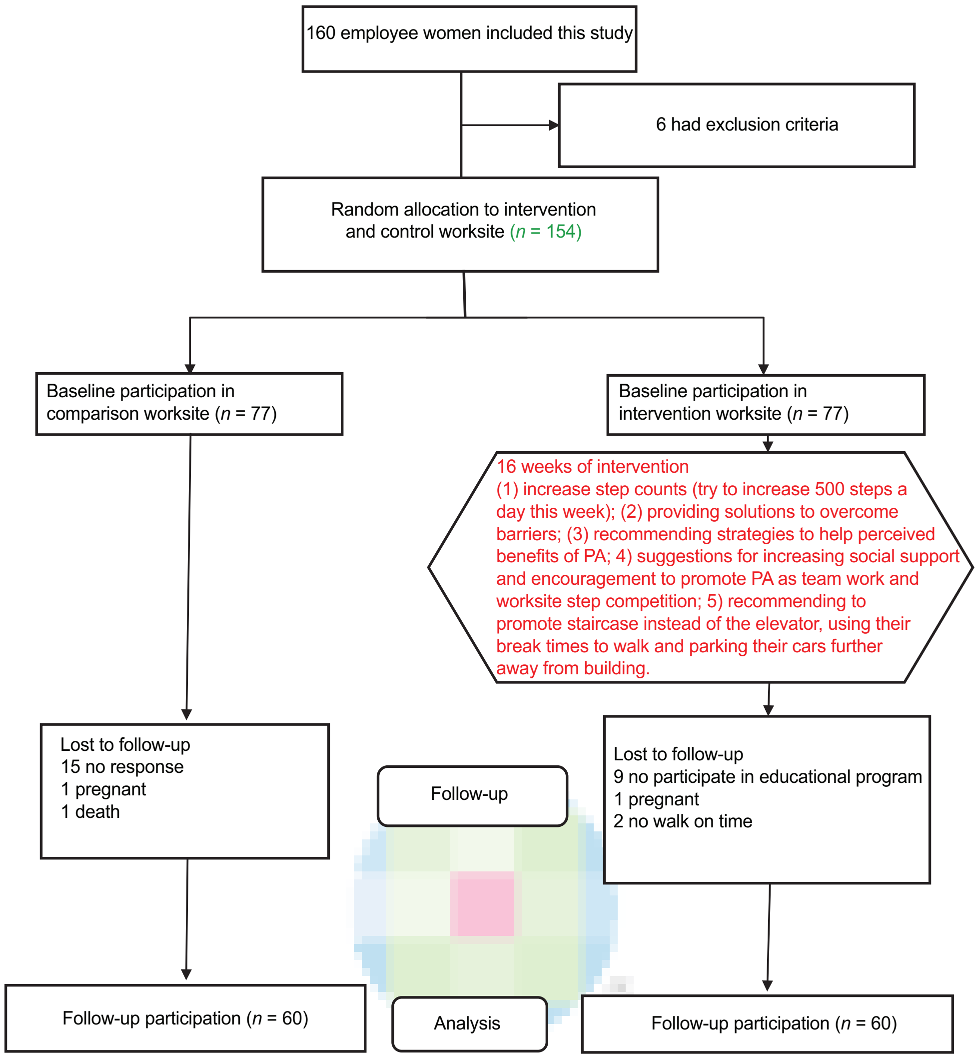

Figure 1: Flow of randomized clinic trial to promote physical activity

Research instrument

Demographic attributes

Age (year), number of children, employment status, marital status, and education level were evaluated in the self-administered questionnaire.

Participants reported the most suitable from the categories of employment status (formal employees of the government, worked on contract-based situation, semi-formal and private employment status), history of PA (yes, no), education level (no high school diploma, high school graduate, associate degree, BSc, MSc and doctorate degree), marital status (currently married, currently unmarried), self-reported PA based on participants opinion and stage of change (precontemplation, contemplation, preparation, action, and maintenance).

Physical activity

The level of PA was measured from the Iranian version of the long form of the IPAQ.

This self-administered questionnaire evaluated PA at work, during transport or traffic, during domestic and gardening activities and during leisure time (L-T). Based on the guidelines for data processing and analysis of the IPAQ total scores for PA extracted in metabolic equivalent (MET) - minutes per week, were computed. Furthermore, the total number of walking, moderate, and vigorous PA was calculated according to the IPAQ protocol.[16]

The MET scores were converted to MET in the IPAQ, for each type of activity by multiplying the number of minutes performed to each activity class by the specific MET score for that activity.[16] One MET = 3.5 ml/O_2 kg/min and is resting metabolic rate during quite sitting[17] Self-reported PA level was classified as "low" (MET ≥ 600), "moderate active" (600 < MET < 3000), and "vigorous activity" (MET > 3000).[18]

The IPAQ is known as a valid and reliable instrument to evaluate PA in the previous studies[19,20] also the Spearman–Brown coefficient (r = 0.941) and construct validity of this scale were confirmed in this population. The mean of content validity index and content validity ration was 0.85 and 0.77, respectively and indicated a good content validity for IPAQ. Cronbach's alpha coefficient (0.7) indicated good internal consistency for this instrument.

Pedometer

Pedometers were used to step count. Pedometer-based PA level was categorized according to baseline step counts into "sedentary – low active" (0–7499 steps/day), "moderately active" (7500–9900 steps/day) and "active" (>10,000 steps/day).[21]

Statistical analysis

All analyses were performed using the SPSS software (version 17.0) (SPSS Inc. IL Chicago, USA). Data were summarized using (*n* [%], median [max, min]), and mean standard deviation for qualitative and quantities variables.

Kolmogorov–Smirnov test was used to assess the normally distribution of the data. Square root transform was used for nonnormally distributed data. Independent samples *t*-test was used to compare step counts and Mann–Whitney test was used to compare METs between intervention and comparison group at baseline. Analysis of covariance (ANCOVA) was conducted to compare step counts and Wilcoxon test was used to compare METs between intervention and comparison group after intervention adjusting for baseline measurements. The percent changes were computed to analyze the effect of the intervention on pedometer-based and self-report. $P \leq 0.05$ considered as significant.

RESULTS

Participants' characteristics

Participants' characteristics are shown in Table 1.

Pedometer-based physical activity

At baseline, the comparison participants reported a workday average of 3806 ± 716 steps/day and a nonworkday of 3655 ± 4169 steps/day and the intervention group 4715 ± 1751 and 4339 ± 2414, respectively. There was a significant difference in step count between intervention and comparison participants at baseline. Results of the ANCOVA test indicated the average number of step counts adjusting for baseline showed significantly between intervention and comparison worksite at posttest. Percent change pedometer step counts at baseline and posttest are shown in Table 1. There was significant increase in mean step counts in workday and nonworkday in intervention worksite [Table 2].

Self-reported physical activity

IPAQ long form was used to evaluate self-reported PA. Results of Mann–Whitney suggest that participants in the intervention worksite did not differ significantly on any domains (at work, during transport, during domestic and gardening activities, or during leisure time) at baseline [Table 3]. Results indicated that all of intensity PA walking MET-minutes per week adjusting for baseline showed significantly between intervention and comparison worksite at posttest. No significant difference in moderate and vigorous intensities and total

Table 1: Participants' characteristics

	Intervention group	Comparison group	*P*
Age (mean±SD)	36.5±6.7	37.2±7.3	0.5
Education *n* (%)			
No diploma	3 (5)	2 (3.4)	0.6
Diploma	13 (21.7)	10 (16.7)	
Associated degree	2 (3.4)	6 (10)	
BSc	31 (15.6)	31 (15.6)	
MSc	10 (16.7)	10 (16.7)	
Doctoral degree	1 (1.6)	1 (1.6)	
Marital status *n* (%)			
Single	12 (21.8)	14 (23.4)	0.7
Married	48 (87.2)	46 (76.6)	
Number of children *n* (%)			
No child	19 (31.7)	22 (36.6)	0.6
1	21 (35)	21 (35)	
2 and above	20 (33.3)	17 (28.3)	
Employment status			
Formal	26 (43.3)	20 (33.3)	0.6
Contract based	21 (35)	29 (48.3)	
Semi-formal	11 (8.4)	6 (10)	
Others	2 (3.3)	5 (8.4)	

SD=Standard deviation

Table 2: Daily pedometer step counts (steps/day) at baseline (pre) and end line (post) for participants in the intervention and comparison worksite

	Pre	Post	*P*	Percentage change
Workday pedometer step counts (steps/day) (mean±SD)				
Intervention group	4715±1715	8279±2759	0.001*	70.16
Comparison group	3806±716	4118±1136	0.15	12.9
P	0.001*	0.001*		
Nonworkday pedometer step counts (steps/day) (mean±SD)				
Intervention group	4339±2414	6438±2755	0.001*	48.3
Comparison group	3655±4169	3529±1292	0.12	−3.44
P‡	0.30	0.001*		

*Probability is 0.001. Data reported as mean (SD). *P* value based on Wilcoxon test. ‡*P* value based on independent samples *t*-test was used to compare between the intervention and comparison group at base line and analysis of covariance adjusting for baseline measurements was used to compare between the intervention and comparison group at end line. SD=Standard deviation

Table 3: Domains of PA (MET - minutes per week) at baseline (pre) and end-line (post) for participants in the intervention and comparison worksite

Domain of PA MET - minutes per week (minimum, maximum)	Pre	Post	*P*
PA at work			
Intervention group	91.5 (0, 13,272)	178.5 (0, 5370)	0.41 (NS)
Comparison group	132.0 (0, 13,272)	5.0 (0, 13,272)	0.19 (NS)
*P**	0.41 (NS)		
P‡	0.41 (NS)		
PA during domestic and gardening activities			
Intervention group	500 (0, 6870)	487.5 (0, 1089)	0.75
Comparison group	422.5 (0, 10,260)	460.0 (0, 10,260)	0.87
*P**	0.78		
P‡	0.25		
PA during leisure time			
Intervention group	325.2 (0, 5859)	1086.0 (33, 6684)	0.001
Comparison group	320.5 (0, 11,542)	369.0 (0, 11,542)	0.36
*P**	0.99		
P‡	0.001		
PA during transport			
Intervention group	230.0 (0, 2970)	231.0 (0, 1980)	0.25
Comparison group	148.5 (0, 2970)	165.0 (0, 2970)	0.55
*P**	0.10		
P‡	0.30		

Data reported as median (maximum, minimum). *P* value based Mann–Whitney test was used to compare within each group. **P* value based on Wilcoxon test was used to compare between the intervention and comparison group at base line, ‡*P* value based on Wilcoxon test was used to compare between the intervention and comparison group at endline. PA=Physical activity, NS=Not significant, MET=Metabolic equivalent

PA MET - minutes per week could be found between intervention and comparison worksite at posttest. There was a significant increase in the leisure time domain, moderate intensity, and total MET- minutes per week in intervention worksite from baseline to posttest.

DISCUSSION

This study was designed to improve PA and increase the number of steps walked using a pedometer in a sample of Tabriz University employee women. Overall, an upward trend was found in average daily step counts from baseline to endline in intervention employees.

The findings showed significant group differences in a change to the workday and non-workday step counts. This indicates that a pedometer-based program may be effective at promoting PA in sedentary employees.[5] Similar to previous data[5,7,8] the findings suggest that employees who started with the lowest daily step counts achieved the highest increase. A systematic review[22] has also indicated that higher significant net increases in walking were seen in the most sedentary groups within the study population.

In this study, the number of steps was very low, even intervention group women did not reach to 10,000 steps/day.

This result shows that employee women with sedentary jobs are at a higher risk of chronic disease.

Despite previous pedometer walking program studies[1,21,23] indicated a decrease in the amount of PA during wintertime compared with the rest of the year, in this study the overall increase in average daily step counts from baseline (end of summer) to posttest (winter).

Our study indicated that was a significant increase in the leisure time domain in the intervention group from baseline to post-test. The increase of the leisure time PA in intervention worksite may be using at the lunch times to walk. Encouragement to promote PA and worksite step competition may be due to increasing PA at leisure time. In our study, the absence of group differences except walking activity on self-reported IPAQ was seen; also we found the increased number of steps based on the pedometer. The study showed walking is most encouraged of all types of PA[4] also Rzewnicki *et al*.[24] reported that more than two-thirds of the participants over reported walking on the IPAQ. Based on the guidelines pedometer – determined PA recommendations,[3] all employees in both worksites were categorized into sedentary – low active <7499 steps/day at baseline, the intervention group recorded on average of 8279 ± 2759 steps/day at post-test in workday and categorized into moderately active (7500–9900 steps/day). All employees in both groups were categorized into moderate active (600 < MET <3000) based on the guidelines for data processing and analysis of IPAQ. However, self-reported measurement of behavior, is identified to significant measurement error[15] and this difference findings from pedometer and IPAQ data may be explained by a bias self-reported. Rzewnicki *et al*.[24] concluded that 40% of the participants over reported vigorous and moderate intensity PA. Other studies[19,25-27] – revealed that women tend to report participating in low to moderate activities.

STRENGTHS AND LIMITATIONS

The substantial limitation of this study is the relatively small sample size. Furthermore, enrollment and attrition rates differed between the intervention and the comparison group, as also did some participants characteristics. All of the participants were women. As of the studies have shown that women have less mobility than men.[28,29] In addition, the short study duration and giving data collection in different seasons are other limitations of this study. The workday step count findings should be interpreted with caution because we do not know whether the workday step counts were actually taken at work or elsewhere. However, this study has strengths. First, this is the first study was evaluated PA with objective pedometer data in Iran. Pedometers identify a subtle change in PA, which may not be found through a questionnaire, in addition, this pedometer-based study had a control group. Other strength is the comparison objective data (step counter) and subjective data (IPAQ).

CONCLUSIONS

Data on the impact of pedometer-based workplace intervention on employees are scarce. The use of pedometer-based intervention improved PA among our study participants. This means that pedometer-based program is appropriate for this type of group. At the same time, pedometer used might rather benefit those individuals who want feedback on their current PA.

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Conflicts of interest

There are no conflicts of interest.

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REFERENCES

1. De Cocker KA, De Bourdeaudhuij IM, Cardon GM. The effect of a multi-strategy workplace physical activity intervention promoting pedometer use and step count increase. Health Educ Res 2010;25:608-19.
2. Services USDoH. Physical Activity Guidlines for Americans; 2008. Available from: http://www.hhs.gov. [Last accessed on 2015 Dec 01].
3. Tudor-Locke C, Bassett DR Jr. How many steps/day are enough? Preliminary pedometer indices for public health. Sports Med 2004;34:1-8.
4. Tudor-Locke C, Lutes L. Why do pedometers work? A reflection upon the factors related to successfully increasing physical activity. Sports Med 2009;39:981-93.
5. Faghri PD, Omokaro C, Parker C, Nichols E, Gustavesen S, Blozie E. E-technology and pedometer walking program to increase physical activity at work. J Prim Prev 2008;29:73-91.
6. Prodaniuk TR, Plotnikoff RC, Spence JC, Wilson PM. The influence of self-efficacy and outcome expectations on the relationship between perceived environment and physical activity in the workplace. Int J Behav Nutr Phys Act 2004;1:7.
7. Chan CB, Ryan DA, Tudor-Locke C. Health benefits of a pedometer-based physical activity intervention in sedentary workers. Prev Med 2004;39:1215-22.
8. Thomas L, Williams M. Promoting physical activity in the workplace: Using pedometers to increase daily activity levels. Health Promot J Austr 2006;17:97-102.
9. Behrens TK, Domina L, Fletcher GM. Evaluation of an employer-sponsored pedometer-based physical activity program. Percept Mot Skills 2007;105 (3 Pt 1):968-76.
10. Green BB, Cheadle A, Pellegrini AS, Harris JR. Active for life: A work-based physical activity program. Prev Chronic Dis 2007;4:A63.
11. Haines DJ, Davis L, Rancour P, Robinson M, Neel-Wilson T, Wagner S. A pilot intervention to promote walking and wellness and to improve the health of college faculty and staff. J Am Coll Health 2007;55:219-25.
12. Naito M, Nakayama T, Okamura T, Miura K, Yanagita M, Fujieda Y, *et al.* Effect of a 4-year workplace-based physical activity intervention program on the blood lipid profiles of participating employees: The high-risk and population strategy for occupational health promotion (HIPOP-OHP) study. Atherosclerosis 2008;197:784-90.
13. Gemson DH, Commisso R, Fuente J, Newman J, Benson S. Promoting weight loss and blood pressure control at work: Impact of an education and intervention program. J Occup Environ Med 2008;50:272-81.
14. Bandura A. Social cognitive theory: An agentic perspective. Annu Rev Psychol 2001;52:1-26.
15. Kahn EB, Ramsey LT, Brownson RC, Heath GW, Howze EH, Powell KE, *et al.* The effectiveness of interventions to increase physical activity. A systematic review. Am J Prev Med 2002;22 4 Suppl: 73-107.
16. Guidelines for Processing and Analysis of the International Physical Activity Questionnaire – Short and Long Forms [database on the Internet]; 2005. Available from: http://www.ipaq.ki.se. [Last cited on 2010 Jan 11].
17. Hagströmer M, Bergman P, De Bourdeaudhuij I, Ortega FB, Ruiz JR, Manios Y, *et al.* Concurrent validity of a modified version of the International Physical Activity Questionnaire (IPAQ-A) in European adolescents: The HELENA Study. Int J Obes (Lond) 2008;32 Suppl 5:S42-8.
18. Guidelines for Data Processing and Analysis of the International Physical Activity Questionnaire – Short and Long Forms; 2005. Available from: http://www.ipaq.ki.seAa. [Last accessed on 2010 Jan 11].
19. Vasheghani-Farahani A, Tahmasbi M, Asheri H, Ashraf H, Nedjat S, Kordi R. The Persian, last 7-day, long form of the International Physical Activity Questionnaire: Translation and validation study. Asian J Sports Med 2011;2:106-16.
20. Craig CL, Marshall AL, Sjöström M, Bauman AE, Booth ML, Ainsworth BE, *et al.* International physical activity questionnaire: 12-country reliability and validity. Med Sci Sports Exerc 2003;35:1381-95.
21. Puig-Ribera A, McKenna J, Gilson N, Brown WJ. Change in work day step counts, wellbeing and job performance in Catalan university employees: A randomised controlled trial. Promot Educ 2008;15:11-6.
22. Ogilvie D, Foster CE, Rothnie H, Cavill N, Hamilton V, Fitzsimons CF, *et al.* Interventions to promote walking: Systematic review. BMJ 2007;334:1204.
23. Tudor-Locke C, Bassett DR, Swartz AM, Strath SJ, Parr BB, Reis JP, *et al.* A preliminary study of one year of pedometer self-monitoring. Ann Behav Med 2004;28:158-62.
24. Rzewnicki R, Vanden Auweele Y, De Bourdeaudhuij I. Addressing overreporting on the International Physical Activity Questionnaire (IPAQ) telephone survey with a population sample. Public Health Nutr 2003;6:299-305.
25. Centers for Disease Control and Prevention (CDC). Prevalence of no leisure-time physical activity – 35 States and the District of Columbia, 1988-2002. MMWR Morb Mortal Wkly Rep 2004;53:82-6.
26. Forrest KY, Bunker CH, Kriska AM, Ukoli FA, Huston SL, Markovic N. Physical activity and cardiovascular risk factors in a developing population. Med Sci Sports Exerc 2001;33:1598-604.
27. Martin SB, Morrow JR Jr, Jackson AW, Dunn AL. Variables related to meeting the CDC/ACSM physical activity guidelines. Med Sci Sports Exerc 2000;32:2087-92.
28. Bolívar J, Daponte A, Rodríguez M, Sánchez JJ. The influence of individual, social and physical environment factors on physical activity in the adult population in Andalusia, Spain. Int J Environ Res Public Health 2010;7:60-77.
29. Cleland V, Ball K, Hume C, Timperio A, King AC, Crawford D. Individual, social and environmental correlates of physical activity among women living in socioeconomically disadvantaged neighbourhoods. Soc Sci Med 2010;70:2011-8.