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Analysis According to Gender and Body Mass Index of the Number of Steps Taken by Sedentary Workers as Measured by a Pedometer

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Abstract. [Purpose] The purpose of this study was to determine according to gender and body mass index the number of steps taken by the sedentary workers as measured by a pedometer. [Subjects] Thirty-six sedentary workers in their twenties in Ulsan city were enrolled in for this study and their step counts were investigated. [Methods] Step counts at the workplace between 9 am and 6 pm everyday for 2 weeks were measured by a pedometer. Data were analyzed using SPSS 20.0 to compare step count according to gender and BMI on different days of the week. [Results] Females showed a higher step count than males on every day of the week except Fridays and Sundays. The step count was higher among the low weight group than overweight group on every day of the week. [Conclusion] Future studies should examine ways of helping sedentary workers to increase their step count. Also, more effort should be made to find practical ways of improving the number of steps taken in the workplace to keep workers in good health, as additional benefit would accrue, such as improved work efficiency.
Key words: Pedometer, Step count, Sedentary worker

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INTRODUCTION

Physical inactivity is one of the major factors behind the increase in the death rate related to cardiovascular diseases since the introduction of modern work styles[1)]. In addition, due to sedentary lifestyles, physical inactivity has become a major risk factor of death regardless of sex[2)]. A well-modulated workout helps to relieve stress and keep muscles strong. Also, aerobic exercise helps cardiopulmonary functions to function smoothly and prevents aging, providing enough energy for everyday activities[3)]. Walking is the most fundamental exercise of all physical activities[4)]. Specifically, compared with some vigorous exercises, walking has been recommended as an optimal and practical type of exercise regardless of age, time, and location with less risk of hurt during exercise and high exercise effects[5, 6)]. In particular, one large-scaled study of 73,500 postmenopausal women showed that brisk walking for about 30 minutes prevented cardiovascular related diseases[6)]. The pedometer has recently been used to monitor walking. It has given people a direct motivation to continue as they can measure and see directly how many steps they have taken[7)]. The pedometer has been strongly recommended as a useful tool for everyone as its cost is low and it has high reliability and validity[8)]. Also, it can be of great use in regular exercise[9)] as it serves as a monitor and provides instant feedback[10)]. Sedentary workers are expected to have higher risk of diseases related to inactivity as they might neglect walking due to their working style.

Step count a day (step/day), which is measured and recorded by a pedometer, provides a basis for providing feedback and establishing walking goals in a walking program. Using step count a day, whether the goal has been achieved can verified and feedback is available. Thus, it is a minimal way of implementing a strategy to increase step count[11)]. Precise understanding and analysis of individuals' condition and walking patterns in everyday activity. In addition, in the analysis of walking pattern in which a pedometer is used, it is necessary to discriminate between different walking patterns, such as during the week and over the weekend, as the walking patterns are different, except for small groups of people and age ranges[12)]. A number of studies in which a pedometer was used have focused on every day activities within a day in all ranges of age groups, but there is a lack of research about sedentary workers. Therefore, the purpose of this study was to analyze the step counts of inactive sedentary workers in their twenties on different days of the week according to gender and degree of obesity by using a pedometer focusing on different days of the week and the weekend.

SUBJECTS AND METHODS

The participants of this study were enrolled from office workers in their twenties in U city. Thirty-six participants

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18 males and 18 females, voluntarily participated in this study. They were instructed to keep a journal of step count for 2 weeks and were given a pretest explanation of the method and direction of the experiment. All of the subjects participated in this study without dropouts till the end of the study.

BMI (body mass index) is used to determine obesity and is the body mass divided by the square of the subject's height[13] (Table 1).

A pedometer and a journal of step count were provided to each participant in the pretest session with instructions on how to keep the journal and how to use the pedometer. The subjects were instructed to record their step count during average work hours, or between 9 am to 6 pm, on different days of the week.

Participants' journal- keeping status and pedometer use were checked every day by phone and text message. The participants' journals were collected after 2 weeks and their average step counts were calculated.

The pedometer used to measure sedentary workers' step count objectively was a MP-500 (YAMASA Co, Tokyo, Japan) pedometer, and the step counts over 2 weeks were recorded daily. The pedometer was worn at the joint of the right thighbone and pelvis, or the anterior superior iliac spine (ASIS) point where belt line of the waist and the center-line of the legs meet vertically[14].

Individual participants' step counts at the workplace between 9 am to 6 am were recorded in daily journals which were collected for further analysis. The data of this study were analyzed using SPSS for Windows version 20.0. The average and standard deviation of the step count collected during the period of the experiment were calculated. Step counts on different days of the week were analyzed according to sex and obesity degree using the independent t-test and ANOVA.

Table 1. Characteristics of the subjects

	Low Weight	Standard Weight	Over weight	Total
Male	5	8	5	18
Female	5	8	5	18

Criteria of classification: low weight (BMI < 18.5 Kg/m^2), standard weight (18.5–24.9 Kg/m^2), overweight (25.0–29.9 Kg/m^2)

RESULTS

Table 2 showed the results of sedentary workers' step count during weekdays according to gender. Females had higher step counts than males on every day of the week except Fridays and Sundays. Both males and females had higher step counts over the weekends and males had the highest step count on Sundays, while female did on Saturdays. In addition, there was a statistically significant difference between the step counts of males and females on Thursdays using the independent t-test ($p<0.01$).

Table 3 provides the results of analysis of sedentary workers' step counts during days of the week for the different BMI groupings (Table 3). The step count of the low weight group was higher on every day of the week than that of the overweight group. Specifically, the step count of the standard weight group was lower than that of the overweight group on Tuesdays and Thursdays and the highest step counts of the standard weight group was reported on Sundays. There were statistically significant differences between the step counts of the different BMI groupings on both Mondays and Sundays using the ANOVA ($p<0.05$).

DISCUSSION

Pedometers have been used in a variety of physical programs, especially for low-active adolescent girls[15], sedentary workers[16], overweight adults[17]. They is because they

Table 2. Step counts on different days of the week of males and females (M±SD) (Unit: count)

	Male Group	Female Group
Monday	3966.83±1753.26	4649.50±1820.24
Tuesday	4103.08±1454.35	4952.33±1809.26
Wednesday	4084.16±1401.48	5151.50±2259.12
Thursday	3759.25±1270.14	5538.00±1523.45**
Friday	5416.50±2682.12	4590.91±1969.92
Saturday	6568.83±3603.25	8253.25±3164.63
Sunday	6988.41±4173.23	6149.58±3464.78

*: $p<0.05$, **: $p<0.01$, M±SD: Mean ± standard deviation

Table 3. Step counts on different days of the week of groups with different degrees of obesity (M±SD) (Unit: count)

	Low Weight Group	Standard Weight Group	Overweight Group
Monday	5161.62±1658.71	4478.72±1582.10	2567.40±1368.21*
Tuesday	5271.37±2098.42	3968.54±1367.93	4654.40±1298.64
Wednesday	5303.37±1874.35	4543.90±2101.67	3683.62±1381.25
Thursday	4924.50±1728.63	4485.09±1906.61	4567.00±1011.26
Friday	6162.50±2727.60	4724.09±2258.14	3764.80±1044.15
Saturday	8523.25±2759.53	8038.84±3841.26	4252.00±1122.51
Sunday	6263.50±2763.70	8274.63±4250.98	3305.40±1394.48*

*: $p<0.05$, M±SD: Mean ± standard deviation

can present concrete goals for physical activity during the day, and individuals are able to easily check their physical activities on their own. Also, it has been reported that a long-term pedometer-determined ambulatory activity helped to decrease risk factors[18]. Therefore, this study was conducted to see if there were any differences in the number of steps taken by sedentary workers in their twenties based on sex and their degrees of obesity.

Against the expectation that males' step counts would be higher than females' step counts on each day of the week according to sex showed that females' step counts were higher than males', except on Fridays and Sundays. This might be attributable to females' working habit of moving more frequently than males during work hours. Comparing step counts between weekdays and weekends, we found that both males and females showed higher step counts during weekends than weekdays. The target step count in walking programs for adults is generally 10,000 steps a day[10, 19]. This study counted daily steps of weekdays only during work hours, which led to lower step counts than the average adult's step count. Thus, the 10,000 step count may have been achieved if activities during rest hours at the workplace when participants didn't wear a pedometer were included.

As predicted, step counts on each day of the week differed among different degrees of obesity. It was highest for the low weight group, and lower for the standard weight, and overweight groups in rank-order. In particular, the difference in step counts between the low weight and overweight groups was approximately double during the weekend, compared with that of during weekdays. In addition, the step counts during the weekend of the low weight and standard weight groups were 2,000 to 4,000 step counts greater than those of weekdays. This indicates that the average physical activity during the weekend was higher in the low weight and standard weight groups than in the overweight group.

The sedentary workers' lower than average step count on each day of the week indicates low physical activity, which may lead to a variety of health problems such as obesity. Thus, future study should cover interventions to help sedentary workers' to increase their physical activity. Also, more effort should be made seeking practical ways to improve physical activity at the workplace to keep workers in good health. This would eventually bring additional benefits, such as improved work efficiency.

REFERENCES

1) Lengfelder W: Physical inactivity: a modifiable risk factor in primary prevention? Med Klin (Munich), 2001, 96: 661–669. [Medline] [CrossRef]
2) Haskell WL, Lee IM, Pate RR, et al.: Physical activity and public health: updated recommendation for adults from the American College of Sports Medicine and the American Heart Association. Med Sci Sports Exerc, 2007, 39: 1423–1434. [Medline] [CrossRef]
3) Nelson ME, Rejeski WJ, Blair SN, et al.: Physical activity and public health in older adults: recommendation from the American College of Sports Medicine and the American Heart Association. Med Sci Sports Exerc, 2007, 39: 1435–1445. [Medline] [CrossRef]
4) Bassett DR Jr, Ainsworth BE, Swartz AM, et al.: Validity of four motion sensors in measuring moderate intensity physical activity. Med Sci Sports Exerc, 2000, 32: S471–S480. [CrossRef]
5) Lee IM, Rexrode KM, Cook NR, et al.: Physical activity and coronary heart disease in women: is "no pain, no gain" passe? JAMA, 2001, 285: 1447–1454. [Medline] [CrossRef]
6) Manson JE, Greenland P, LaCroix AZ, et al.: Walking compared with vigorous exercise for the prevention of cardiovascular events in women. N Engl J Med, 2002, 347: 716–725. [Medline] [CrossRef]
7) Tudor-Locke C, Sisson SB, Collova T, et al.: Pedometer-determined step count guidelines for classifying walking intensity in a young ostensibly healthy population. Can J Appl Physiol, 2005, 30: 666–676. [Medline] [CrossRef]
8) Schneider PL, Crouter SE, Lukajic O, et al.: Accuracy and reliability of 10 pedometers for measuring steps over a 400-m walk. Med Sci Sports Exerc, 2003, 35: 1779–1784. [Medline] [CrossRef]
9) Bassett DR, Strath SJ: Use of pedometers to assess physical activity. Welk GJ, ed. Champaign: Human Kinetics, 2002.
10) Wilde BE, Sidman CL, Corbin CB: A 10,000-step count as a physical activity target for sedentary women. Res Q Exerc Sport. 2001, 72: 411–414.
11) Griffin-Blake CS, DeJoy DM: Evaluation of social-cognitive versus stage-matched, self-help physical activity interventions at the workplace. Am J Health Promot, 2006, 20: 200–209. [Medline] [CrossRef]
12) Tudor-Locke C: Taking steps toward increased physical activity: using pedometers to measure and motivate. President's Counc Phys Fit Sports Res Dig, 2002, 3: 1–8.
13) American College of Sports Medicine: ACSM's guidelines for exercise testing and prescription, 8th ed. Philadelphia: Lippincott Williams & Wilkins, 2010, p 65.
14) Tudor-Locke C, Lutes L: Why do pedometers work?: a reflection upon the factors related to successfully increasing physical activity. Sports Med, 2009, 39: 981–993. [Medline] [CrossRef]
15) Schofield L, Mummery WK, Schofield G: Effects of a controlled pedometer-intervention trial for low-active adolescent girls. Med Sci Sports Exerc, 2005, 37: 1414–1420. [Medline] [CrossRef]
16) Chan CB, Ryan DA, Tudor-Locke C: Health benefits of a pedometer-based physical activity intervention in sedentary workers. Prev Med, 2004, 39: 1215–1222. [Medline] [CrossRef]
17) Jensen GL, Roy MA, Buchanan AE, et al.: Weight loss intervention for obese older women: improvements in performance and function. Obes Res, 2004, 12: 1814–1820. [Medline] [CrossRef]
18) Hornbuckle LM, Bassett DR Jr, Thompson DL: Pedometer-determined walking and body composition variables in African-American women. Med Sci Sports Exerc, 2005, 37: 1069–1074. [Medline]
19) Hultquist CN, Albright C, Thompson DL: Comparison of walking recommendations in previously inactive women. Med Sci Sports Exerc, 2005, 37: 676–683. [Medline] [CrossRef]