Physical Activity Level of Korean Adults with Chronic Diseases: The Korean National Health and Nutritional Examination Survey, 2010–2012

Ho-Seong Jin¹, Ah-Reum An¹, Ho-Chun Choi¹, Sang-Hyun Lee¹, Dong-Heon Shin¹, Seung-Min Oh¹, Young-Gyun Seo¹, Be-Long Cho¹,²,³,⁴,*

¹Department of Family Medicine, Seoul National University Hospital, Seoul, Korea
²Center for Health Promotion and Optimal Aging, Health Promotion Center for Cancer Survivor, Seoul National University Hospital, Seoul, Korea
³Advanced Institutes of Convergence Technology, Seoul National University, Suwon, Korea
⁴Institute on Aging, Seoul National University College of Medicine, Seoul, Korea

Background: Proper physical activities are known to be helpful in the prevention and management of chronic diseases. However, the physical activity level of patients with chronic diseases is low. Therefore, this study aimed to investigate the physical activity compliance of patients with hypertension, diabetes, and dyslipidemia in Korea.

Methods: This study analyzed the 2010–2012 Fifth Korean National Health and Nutrition Examination Survey data. We included 13,873 individuals in the analysis. The level of physical activity compliance was measured by performing multivariate logistic regression analyses.

Results: In the univariate analysis, the subjects with hypertension or diabetes tended to comply with the physical activity guidelines less faithfully than their healthy counterparts. The proportion of subjects with hypertension who were insufficiently physically active was 65.4% among the men and 75.8% among the women. For diabetes, the proportions were 66.7% and 76.8%, respectively. No significant difference was found between the subjects with dyslipidemia and their healthy counterparts. In the multivariate logistic regression analysis, no significant difference in physical activity compliance was observed between the subjects with hypertension, diabetes, or dyslipidemia and their healthy counterparts for both sexes.

Conclusion: The patients with hypertension or diabetes tended to have lower physical activity prevalence than their healthy counterparts. However, for dyslipidemia, no significant difference was found between the two groups. Given the significance of physical activities in the management of chronic diseases, the physical activities of these patients need to be improved.

Keywords: Physical Activity; Exercise; Chronic Disease; Hypertension; Diabetes; Dyslipidemia
INTRODUCTION

The incidence rates of chronic diseases in adults, such as hypertension, diabetes mellitus, and dyslipidemia, have been increasing. Consequently, issues regarding their treatment and prevention have received increased attention worldwide. The results of recent studies have shown that proper levels of physical activity reduce the risk of progression of these chronic diseases. Proper levels of physical activities also tend to lower cardiovascular risks and mortality rates.

Many organizations have encouraged and provided guidelines for appropriate physical activities (Table 1). For example, the 2014 American Heart Association guidelines recommend aerobic exercise of moderate intensity for at least 150 minutes per week (more than 5 days a week) or more than 75 minutes per week in vigorous intensity (more than 3 days a week). The guidelines also recommend more than 2 days per week of moderate to high intensity resistance exercise.

However, few people follow these guidelines. Research based on the National Health and Nutrition Examination Survey (NHANES) in 2005–2006 found that the 62.0% of people self-reported exercising according to guideline recommendations, which is far beyond the 9.6% rate measured by accelerometry. This finding suggests that their physical activity levels were not as sufficient as the respondents had reported them to be. In South Korea, research conducted in 2001 based on the Korean NHANES (KNHANES) showed that 71.8% of adults self-reported that they did not exercise at all. A 2012 study by the Korean National Health Insurance Service, found that only 7.95% of participants reported moderate physical activity (MPA) for more than 30 minutes, 5 days per week; 13.37% reported vigorous physical activity (VPA) for more than 20 minutes, 3 days per week.

Other studies have examined physical activity levels of patients with chronic disease. Examination of the amount of physical activity using accelerometry based on 2003–2006 NHANES data revealed that patients with cardiovascular disease exercised 8.6 to 11.4 minutes per day at moderate to vigorous intensity. In the United States, a study targeting stroke survivors found that 17.9% of stroke patients met the weekly physical activity guidelines, compared to 25.0% of unaffected participants. Another study compared physical activity levels between patients with diabetes and the general population. The results revealed that 31% to 34% of patients with diabetes did not meet the recommended level of physical activity, a rate 13% to 19% higher than that of the general population. The level of physical activity among patients with chronic disease was low, and even lower than that among the general population.

Several previous studies have analyzed the effects of aerobic physical activity in patients with chronic disease; however, these studies targeted only patients with single diseases. To our knowledge, no other studies have targeted patients with hypertension, diabetes, or dyslipidemia, which can result in cardiovascular and cerebrovascular diseases. Consequently, it is difficult to compare physical activity levels among patients with these three diseases based on data from previous studies.

In addition, most studies were performed in the United States; few have used representative data to evaluate the physical activity of Asian patients with chronic diseases. For this reason, the aim of this study was to investigate the association of physi-

Table 1. References on physical activity recommendation

| Country     | Organization                        | Publication year | Title                                                                 | Physical activity recommendation: aerobic exercise                                                                 |
|-------------|-------------------------------------|------------------|----------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|
| USA         | American Diabetes Association       | 2015             | American Diabetes Association 2014 guidelines                        | F: spread over ≥ 3 d/wk with no more than 2 consecutive days without exercise  
I: 50%–70% max heart rate  
T: ≥ 150 min/wk of MPA  
Type: NC                                                                 |
| USA         | American Heart Association          | 2014             | American Heart Association recommendations for physical activity in adults | F: ≥ 5/wk of MPA or ≥ 3/wk of VPA (or combination of MPA and VPA)  
I: moderate and/or vigorous intensity  
T: ≥ 150 min/wk of MPA or ≥ 75 min/wk of VPA  
Type: NC                                                                 |
| USA         | American College of Sports Medicine | 2011             | Quantity and quality of exercise for developing and maintaining cardiorespiratory, musculoskeletal, and neuromotor fitness in apparently healthy adults; guidance for prescribing exercise | F: ≥ 5/wk of MPA or ≥ 3/wk of VPA or ≥ 3–5 wk of combination of MPA and VPA  
I: moderate and/or vigorous intensity  
T: ≥ 150 min/wk of MPA or ≥ 75 min/wk of VPA  
Type: regular, purposeful exercise                                                                 |
| USA         | US Department of Health and Human Services | 2008         | Physical activity guidelines for Americans                           | F: ≥ 3/wk, preferably spread throughout the week  
I: moderate and/or vigorous intensity  
T: ≥ 150 min/wk of MPA or ≥ 75 min/wk of VPA  
Type: NC                                                                 |
| Korea       | Ministry of Health and Welfare of Korea | 2013         | The physical activity guide for Koreans                              | F: NC  
I: moderate and/or vigorous intensity  
T: ≥ 150 min/wk of MPA or ≥ 75 min/wk of VPA  
Type: NC                                                                 |
| F: frequency; I: intensity; T: time; MPA, moderate physical activity; VPA, vigorous physical activity; NC, no comment. |
cal activity levels with hypertension, diabetes, and dyslipidemia in South Korea using representative data.

METHODS

1. Study Population
Data were collected from the fifth KNHANES, a national project that examined the sociodemographic status, health status, and health behavior including physical activities and nutrition status, of all members of households living in South Korea between 2010 and 2012. The survey was based on the Population and Housing Census Report from the National Statistical Office and selected 13,800 households from 600 districts in which household members older than 1 year of age were interviewed. A three-step stratified cluster sampling method was used to extract the samples. The rolling sampling method was adopted so that each one-year rolling sample represented a probability sampling of the whole country. The rolling samples were designed to be homogeneous and independent. Health examinations and surveys were conducted by a mobile health examination center, while the nutrition surveys were conducted by visiting each household.

Among 25,534 people who participated in the survey and health examinations, 6,140 were excluded for age (less than 20 years); 4,349 for not answer questions regarding biological, demographic, psychosocial factors, physical activities, physician-diagnosed chronic disease; and 1,172, for medical history of angina, myocardial infarction, stroke, and cancer. The final number of participants included in this study was 13,873.

2. Variables Related to Chronic Disease
Individuals were classified as having chronic disease such as hypertension, diabetes, and dyslipidemia based on diagnosis by medical professionals.

3. Variables Related to Physical Activities
Self-reported physical activity levels were estimated based on responses gathered from interviews of household members, which involved asking participants to recall their physical activity behaviors in the previous week. A KNHANES questionnaire on physical activities was developed based on the short-form International Physical Activity Questionnaire. It contained the following questions: “How many days did you perform vigorous activities for more than 10 minutes last week? How long were these workouts?”; “How many days did you perform moderate activities for more than 10 minutes last week? For how long?”; “How many days did you walk for more than 10 minutes last week? For how long?”; and “How long did you remain sedentary last week?”

The weighting procedure was performed in accordance with recommendations in the appendix of the Physical Activity Guide.

4. Biological, Demographic, and Psychosocial Variables
A previous meta-analysis study described physical activities and their related variables. Based on this research, the final biological, demographic, and psychosocial variables measured in the current study were age, body mass index (BMI), monthly household income, education (12 years or less or 13 years or more), residential area (urban or rural), marital status (married, single, separated, divorced, or bereaved), exercise competence (workable or limited movement), stress level, self-evaluation of daily activity level (active: gentle or strenuous movement in the workplace; stable: no, little, or light movement in the workplace), and self-evaluation of health level.

5. Statistical Analysis
Stata ver. 13.1 for Windows (Stata Co., College Station, TX, USA) was used to process data and perform statistical analyses. To determine the baseline characteristics according to sex, numbers (%) or mean values were calculated. Multivariate logistic regression analysis was performed while controlling for pre-identified variables related to physical activities in order to clarify the correlation between chronic diseases and physical activities. Multivariate logistic analysis was also performed to identify factors highly related to physical activity levels.

RESULTS

1. Study Participant Baseline Characteristics and Physical Activity Levels
The basic characteristics of the study participants are shown in Table 2. Of 13,873 participants, 5,753 were male and 8,120 were female. Of these male and female participants, 2,412 (41.9%) and 668 (26.3%), respectively, met the physical activity level criterion (M2VPA ≥ 150 min/wk).

2. Association between Physical Activity and Chronic Disease
Univariate analysis of the association between physical activity and hypertension revealed that participants with hypertension tended to comply with the physical activity guidelines less faithfully than those without hypertension. Of male and female subjects without hypertension, 56.4% and 69.9% had insufficient physical activity levels, respectively. Meanwhile, of those with hypertension, 65.4% (odds ratio [OR], 1.46; 95% confidence in-
terval (CI), 1.27–1.68) and 75.8% (OR, 1.35; 95% CI, 1.18–1.53) had insufficient physical activity levels, respectively (Table 3).

Likewise, participants with diabetes tended to comply with the physical activity guidelines less faithfully than adults without diabetes. Of male and female subjects without diabetes, 57.4% and 70.7% had insufficient physical activity levels, respectively. Meanwhile, of those with diabetes, 66.7% (OR, 1.48; 95% CI, 1.21–1.82) and 76.8% (OR, 1.37; 95% CI, 1.10–1.72) had insufficient physical activity levels, respectively (Table 3).

However, no significant difference was found between the groups with and without dyslipidemia. Of male and female subjects without dyslipidemia, 57.9% and 71.1% had insufficient physical activity levels, respectively. Meanwhile, among those with dyslipidemia, 61.8% (OR, 1.17; 95% CI, 0.92–1.51) and 70.5% (OR, 0.97; 95% CI, 0.80–1.18) had insufficient physical activity levels, respectively (Table 3).

Multivariate logistic regression revealed no significant differences in physical activity levels for both sexes between groups with and without hypertension, diabetes, and dyslipidemia (men with hypertension: adjusted odds ratio [aOR], 1.04; 95% CI, 0.89–1.21; women with hypertension: aOR, 1.12; 95% CI, 0.97–1.30; men with diabetes: aOR, 1.06; 95% CI, 0.85–1.31; women with diabetes: aOR, 1.13; 95% CI, 0.89–1.42; men with dyslipidemia: aOR, 0.97; 95% CI, 0.75–1.25; women with dyslipidemia: aOR, 0.84; 95% CI, 0.69–1.03) (Table 3).

### Table 2. Baseline characteristics and physical activity level of the study participants

| Characteristic               | Male (n = 5,753) | Female (n = 8,120) |
|-----------------------------|------------------|--------------------|
| Age (y)                     | 50.5 ± 15.5      | 49.7 ± 15.8        |
| BMI* (kg/m²)                | 23.9 ± 3.1       | 23.3 ± 3.5         |
| Monthly household income (× 10^4 won) | 469.3 ± 1343.4 | 446.9 ± 1,160.9 |
| Education                   |                  |                    |
| ≥ College                   | 2,493 (43.3)     | 2,643 (32.5)       |
| ≤ High school               | 3,260 (56.6)     | 5,477 (67.4)       |
| Town                        |                  |                    |
| Rural                       | 1,247 (21.6)     | 1,654 (20.3)       |
| City                        | 4,506 (78.3)     | 6,466 (79.6)       |
| Marriage                    |                  |                    |
| Married                     | 4,807 (83.5)     | 6,012 (74.0)       |
| Single, separated, divorced, and bereaved | 946 (16.4) | 2,108 (25.9) |
| Exercise competence         |                  |                    |
| Walkable                    | 5,171 (89.8)     | 6,725 (82.8)       |
| Movement limited            | 582 (10.1)       | 1,395 (17.1)       |
| Stress                      |                  |                    |
| Moderate-severe             | 1,322 (22.9)     | 2,264 (27.8)       |
| None-mild                   | 4,431 (77.0)     | 5,856 (72.1)       |
| Self-evaluation of daily activity level* |                |                    |
| Active status               | 767 (13.3)       | 403 (4.9)          |
| Stable status               | 4,986 (86.6)     | 7,717 (95.0)       |
| Self-evaluation of health level |                |                    |
| Good                        | 2,249 (39.0)     | 2,593 (31.9)       |
| Medium-poor                 | 3,504 (60.9)     | 5,527 (68.0)       |
| Physical activity level     |                  |                    |
| M2VPA ≥ 150 min/wk          | 2,412 (41.9)     | 2,353 (28.9)       |
| M2VPA < 150 min/wk          | 3,341 (58.0)     | 5,767 (71.0)       |

Values are presented as mean ± standard deviation or number (%). The M2VPA score was calculated by doubling the vigorous physical activity time in a week and adding to it the moderate physical activity time in a week. BMI, body mass index; M2VPA, moderate to vigorous physical activity.

*Calculated as weight in kilograms divided by height in meters squared. †Active status: gentle or strenuous movement on their working place; stable status: no, little, or light movement on their working place.

### Table 3. Multivariate logistic regression models for variables, including HTN, DM, and DL associated with insufficient physical activity (M2VPA <150 min/wk).

| Disease | Male | Female |
|---------|------|--------|
|         | No. (%) | ORs (95% CI) | aORs* (95% CI) | P-value† | No. (%) | ORs (95% CI) | aORs* (95% CI) | P-value† |
| HTN     | No     | 2,631 (56.3) | 1.00 | 1.00 | 4,565 (69.8) | 1.00 | 1.00 |
|         | Yes    | 710 (65.3) | 1.46 (1.27–1.68) | 1.04 (0.89–1.21) | 0.636 | 1,202 (75.7) | 1.35 (1.18–1.53) | 1.12 (0.97–1.30) | 0.119 |
| DM      | No     | 3,045 (57.3) | 1.00 | 1.00 | 5,412 (70.6) | 1.00 | 1.00 |
|         | Yes    | 296 (66.6) | 1.48 (1.21–1.82) | 1.06 (0.85–1.31) | 0.622 | 355 (76.8) | 1.37 (1.10–1.72) | 1.13 (0.89–1.42) | 0.311 |
| DL      | No     | 3,168 (57.8) | 1.00 | 1.00 | 5,383 (71.0) | 1.00 | 1.00 |
|         | Yes    | 173 (61.7) | 1.17 (0.92–1.51) | 0.97 (0.75–1.25) | 0.794 | 384 (70.4) | 0.97 (0.80–1.18) | 0.84 (0.69–1.03) | 0.100 |

The M2VPA score was calculated by doubling the vigorous physical activity time in a week and adding to it the moderate physical activity time in a week. HTN, hypertension; DM, diabetes mellitus; DL, dyslipidemia; M2VPA, moderate to vigorous physical activity; OR, odds ratio; CI, confidence interval; aOR, adjusted odds ratio. *Adjusted for age, body mass index, income, education, town, marriage, exercise competence, stress, self-evaluation of daily activity level, and self-evaluation of health level in the men and women. †Calculated by multivariate logistic regression analysis.
health levels (aOR, 1.32; 95% CI, 1.22-1.43) showed insufficient physical activity levels (Table 4).

**DISCUSSION**

In the present study, data from the fifth KNHANES was used to investigate the association between physical activity levels and chronic diseases in adults older than 20 years. Univariate analysis revealed that people with hypertension or diabetes had insufficient physical activity levels compared to their healthy counterparts.

Comparison of physical activity between subjects with and without hypertension and diabetes revealed that insufficient physical activity level of patients was 9% greater in male and 6% greater in female than unaffected subjects. Hence, increased physical activity should be encouraged in this population.

Furthermore, because physical activities have been widely reported to affect not only chronic disease prevention and management but also reduce the risk of cardiovascular complications and mortality, it is necessary to recommend increased physical activities to patients with chronic diseases and low physical activity levels.2-4

Many studies have reported that physical activities prevent hypertension and lead to decreased blood pressure.2,18 Furthermore, Rossi et al.19 reported that physical activity could decrease the risk of cardiovascular complications and all-cause mortality rates.

In addition, physical activities prevent development of dia-
In conclusion, patients with chronic diseases such as hypertension and diabetes tended to have lower physical activity levels than their healthy counterparts, while patients with dyslipidemia showed no significant differences from their healthy counterparts. Given the significance of physical activities in chronic disease management, the physical activity levels of these patients need to be improved. Although many studies have confirmed the relationship between chronic disease and physical activity, few have investigated physical activity in patients with chronic diseases. This study uses representative data from Koreans to elucidate the current physical activity levels of patients with hypertension, diabetes, and dyslipidemia, which can lead to cardiovascular diseases.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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