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한국인 성인에서 주말전사 신체활동패턴과 심혈관대사 위험요인들과의 연관성

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The Association between Weekend Warrior Physical Activity Patterns and Cardiometabolic Risk Factors in Korean Adults

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Purpose: Few studies that have evaluated the relationships between physical activity (PA) patterns of weekend warriors (i.e., individuals who perform all their weekly exercises in one or two sessions) and health outcomes have reported inconsistent findings. The present study sought to examine the association between weekend warrior PA patterns and cardiometabolic risk factors in Korean adults.

Methods: This cross-sectional study included 29,543 men and women who participated in the Korean National Health and Nutrition Examination Survey between 2014 and 2019. The weekend warrior PA was defined as at least 150 minutes/week of moderate-intensity or at least 75 minutes/week of vigorous-intensity PA concentrated in one or two sessions/week.

Results: Compared with the inactive PA patterns, the multivariable-adjusted odds ratio (95% confidence interval) between the weekend warrior PA patterns and cardiometabolic risk factors were 0.89 (0.69−1.15) for hypertension, 0.81 (0.55−1.17) for diabetes, 0.92 (0.69−1.22) for dyslipidemia, 1.10 (0.91−1.34) for obesity, and 1.0 (0.83−1.27) for metabolic syndrome. Regularly active PA patterns, however, had lower odds of diabetes and metabolic syndrome.

Conclusion: Our results suggested that no evidence of significant associations between the weekend warrior PA patterns and cardiometabolic risk factors in a representative Korean population. Large-scale prospective cohort studies are warranted to confirm or refute these findings.

Keywords: Cardiometabolic risk factors, Health benefits, Physical activities

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Introduction

The prevalence of cardiometabolic diseases, such as hypertension[1], diabetes[2], obesity[3], metabolic syndrome[3], and cardiovascular disease (CVD)[4] has continued to increase due to aging and the rapid and increasing use of modern technology, changing patterns of commuting, and urbanization in the last several decades, which has contributed to increased levels of physical inactivity globally. The relationships of physical inactivity with hypertension[5], diabetes[6], dyslipidemia[7], obesity[8], metabolic syndrome[9], and CVD[10] are well established.

Higher levels of physical activity (PA) have a significant beneficial impact on health[11] and positively modulate several cardiometabolic risk factors[12]. The PA guidelines of World Health Organization (WHO) and U.S. Department of Health and Human Services recommend at least 150 minutes/week of moderate-intensity aerobic PA or 75 minutes/week of vigorous-intensity aerobic PA or an equivalent combination of moderate and vigorous-intensity PA[13-15]. However, a fourth of adults do not currently meet global PA recommendations[16]. There are many reasons people cannot comply with the guidelines for PA, and this includes lack of time[17]. The reasons for the lack of time include the variety of jobs due to changes in the social environment, the diversity of work patterns, urbanization, the increased distance and time between workplace and home, and the heavy burden of work.

In accordance with compliance with the PA guidelines, the leisure time PA (LTPA) profile can be categorized into four groups[18], which are inactive, insufficiently active, "weekend warrior," and regularly active. When the recommended amount of PA pertaining to the guidelines is met but achieved in one or two sessions a week, it is called a weekend warrior PA[18]. In 2004, Lee et al.[18] first reported the health benefits of the weekend warrior PA patterns.

Previous studies evaluating the relationships between weekend warrior PA patterns and health outcomes are sparse and the results have not been consistent. A number of studies have shown a beneficial effect of weekend warrior PA patterns on the risk of all-cause mortality, CVD mortality, cancer mortality, and cardiometabolic risk factors[19-22].

However, other studies have not confirmed these results[23,24]. Therefore, from a global perspective, further studies are needed to confirm or refute whether weekend warrior PA patterns have a beneficial effect on cardiovascular outcomes. In addition, there is no previous report on the association between weekend warrior PA patterns and cardiometabolic risk factors in a Korean population. We hypothesized that weekend warrior PA patterns will be associated with decreased adverse cardiometabolic risk factors in the Korean general population. The aim of this study was to determine the associations of weekend warrior PA patterns with several cardiometabolic risk factors in a Korean population.

Methods

1. Participants

This study was conducted using data collected through the Korean National Health and Nutrition Survey from 2014 to 2019. In the Korean National Health and Nutrition Survey, the Korea Disease Control and Prevention Agency of the Ministry of Health and Welfare conducted health, nutrition, and screening surveys by extracting representative samples of residents over 1 year of age residing in Korea every year (http://knhanes.kdca.go.kr). Data were collected using health questionnaires administered during interviews, physical measurements, and clinical tests. From 2014 to 2019, 47,309 people participated in this survey, of whom 37,916 were over 19 years of age. We analyzed data for 29,543 individuals (median age, 46 years; range, 19–80 years), with exception of those with missing data on PA or cardiometabolic risk factors.

Ethical approval for this study was provided by the Institutional Review Board of the University of Seoul (No. 2021-05-002).

2. Physical activity questionnaire

The global physical activity questionnaire (GPAQ), developed by the WHO in 2002[25], was used to assess PA in the Korean National Health and Nutrition Examination Survey since 2014[26]. It was translated into Korean, and its reliability and validity were verified[27]. In the GPAQ, the domains of PA were divided into LTPA, occupational PA (OPA), and transport PA. GPAQ is a standardized measurement tool that measures the amount of PA by domains and can compare the trends of PA within and between countries. In the present study, physical activity has been defined

as sport, exercise, and LTPAs, excluding PA at work or when moving from one location to another[28]. Participants were asked about the types of activities, the number of days of activity per week, and the number of hours and minutes of activity per day[26]. Vigorous exercise was defined as high-intensity sport, athletics, and recreational activities in which the heart beats very fast or when one is out of breath for at least 10 minutes[13,15] (e.g., running, jumping rope, mountain climbing, basketball, swimming, badminton singles, etc.). Moderate exercise was defined as a moderate-intensity sport or an exercise in which there is a slightly faster heartbeat or slight shortness of breath for at least 10 minutes[13,15] (e.g., brisk walking, jogging, weight training, golf, dance sports, Pilates, etc). PA was classified into four groups according to the frequency, duration, and intensity of PA[18]. The four groups are as follows: (i) inactive, defined as not reporting any moderate-intensity or vigorous-intensity PA; (ii) insufficiently active, defined as reporting less than 150 minutes/week in moderate-intensity PA and less than 75 minutes/week in vigorous-intensity PA; (iii) weekend warrior, defined as at least 150 minutes/week of moderate-intensity or at least 75 minutes/week of vigorous-intensity PA concentrated in one or two sessions/week; and (iv) regularly active, defined as reporting at least 150 minutes/week in moderate-intensity PA or at least 75 minutes/week in vigorous-intensity PA spread over 3 or more sessions during the week.

3. Cardiometabolic risk factors

Hypertension was defined as systolic blood pressure of ≥140 mm Hg, diastolic blood pressure of ≥90 mm Hg, or taking antihypertensive medications. Diabetes was defined as a fasting glucose level of ≥126 mg/dL, taking oral hypoglycemic agents, using insulins, or being diagnosed by a physician. Dyslipidemia was defined as total cholesterol of ≥240 mg/dL or taking lipid lowering agents. Body mass index (BMI) was calculated as body weight (kg)/height^2 (m^2) and obesity was defined as a BMI of ≥25 kg/m^2. Metabolic syndrome was defined based on the criteria of the modified National Cholesterol Education Program Adult Treatment Panel III (NCEP ATP III, 2007) which included the presence of more than three of the following metabolic abnormalities: (1) elevated blood pressure of ≥130/85 mm Hg or on medication; (2) elevated fasting glucose of ≥100 mg/dL or on medication; (3) abdominal obesity (waist circumference of >90 cm for men and >85 cm for women in Korean); (4) elevated triglyceride of ≥150 mg/dL or on medication; (5) reduced high-density lipoprotein cholesterol of <40 mg/dL for men and <50 mg/dL for women or on medication[29].

4. Covariates

Marital status was classified as people living with their spouses and those living without their spouses, including single, divorced, and separated persons. The level of education was divided into middle school graduates or lower, high school graduates, and college graduates or higher. Household income was divided into quartiles according to monthly average household equalization income, and the quartiles were lower, lower-middle, upper-middle, and upper classes. The monthly average household equalization income was calculated as monthly household income square root of household numbers. Occupation was divided into professional and managerial, skilled nonmanual, skilled manual, routine and manual, and no occupation. Alcohol consumption was divided into drinking and nondrinking groups. Those who drank more than once a month in the past year were included in the drinking group, and those who drank less than one time or did not drink at all were included in the nondrinking group. Smoking status was categorized as smoking and nonsmoking groups. The smoking group included those who smoked more than five packs (100 cigarettes) of cigarettes throughout their lives, as well as smoke currently, while the nonsmoking group included those who smoked less than five packs throughout their lives or never smoked.

5. Statistical analysis

To compare the general characteristics of participants by PA patterns, we used the complex sample chi-square test for categorical variables and the complex sample generalized linear model for continuous variables. We calculated odds ratios and 95% confidence intervals (CIs) from logistic regression analyses with adjustment for confounding factors (age, age group, gender, marital status, education level, household income, occupation, smoking status, and alcohol consumption) to determine the associations between PA patterns and cardiometabolic risk factors. Statistical significance was set at $p<0.05$ and analyses were conducted using SAS software version 9.4 (SAS Institute Inc., Cary, NC, USA).

Table 1. General characteristics of the study population by physical activity patterns

Characteristic	Physical activity pattern				
	Inactive	Insufficiently active	Weekend warrior	Regularly active	p-value
No. of patients	21,514 (68.9)	3,470 (13.0)	638 (2.8)	3,921 (15.3)	
Age (yr)	49.0±0.2	43.4±0.3	40.6±0.6	42.5±0.3	
Male sex, n=12,290 (41.6)	8,170 (44.7)	1,648 (55.6)	443 (76.9)	2,029 (60.2)	<0.001
Body mass index (kg/m^2)	23.8±0.0	23.8±0.1	24.2±0.2	24.0±0.1	
Marital status					0.003
Living with spouse	14,925 (66.6)	2,511 (67.3)	450 (64.7)	2,748 (63.1)	
Living without spouse	6,584 (33.4)	959 (32.7)	188 (35.3)	1,172 (36.9)	
Education level					<0.001
Middle school or less	8,418 (29.3)	505 (10.2)	73 (8.5)	562 (9.4)	
High school	6,656 (35.3)	1,105 (33.1)	235 (39.2)	1,440 (33.1)	
College or over	6,384 (35.4)	1,860 (56.7)	330 (52.3)	1,913 (51.5)	
Household income					<0.001
Lower	5,091 (18.5)	307 (6.9)	33 (4.4)	390 (8.3)	
Lower middle	5,727 (26.0)	693 (18.9)	116 (17.7)	771 (19.0)	
Upper middle	5,523 (28.4)	1,076 (31.5)	199 (33.2)	1,132 (29.6)	
High	5,112 (27.1)	1,384 (42.7)	289 (44.7)	1,621 (43.1)	
Smoking status					0.011
Current	3,540 (20.8)	542 (19.4)	136 (24.6)	601 (18.8)	
Never or ex-smoker	17,824 (79.2)	2,920 (80.6)	502 (75.4)	3,312 (81.2)	
Alcohol consumption					<0.001
Yes	10,378 (54.1)	2,099 (64.7)	460 (73.0)	2,454 (66.8)	
No	11,005 (45.9)	1,363 (35.3)	178 (27.0)	1,459 (33.2)	
Occupation					<0.001
Professional and managerial	4,248 (23.9)	1,262 (40.2)	238 (39.1)	1,173 (33.3)	
Skilled nonmanual	2,607 (13.3)	416 (12.6)	88 (14.6)	502 (13.8)	
Skilled manual	3,201 (15.2)	417 (12.4)	112 (15.9)	400 (10.2)	
Routine and manual	2,208 (9.4)	185 (4.7)	33 (4.3)	222 (4.9)	
Inoccupation	9,182 (38.2)	1,184 (30.1)	164 (26.1)	1,605 (37.8)	
Cardiometabolic risk factors					
Hypertension	7,699 (29.5)	835 (21.2)	129 (18.2)	936 (20.1)	<0.001
Diabetes	2,299 (11.2)	223 (6.8)	39 (5.8)	244 (6.5)	<0.001
Dyslipidemia	4,669 (20.3)	623 (16.4)	91 (13.4)	709 (16.2)	<0.001
Obesity	7,337 (34.0)	1,107 (31.9)	230 (37.7)	1,317 (35.6)	0.043
Metabolic syndrome	6,056 (29.5)	769 (22.5)	161 (24.8)	790 (19.5)	<0.001

Values are presented as frequency (%) or mean±standard error.

Results

Of 29,545 analyzed participants, 21,514 (68.9%) were classified as inactive; 3,470 (13.0%) as insufficiently active; 638 (2.8%) as weekend warriors; and 3,921 (15.3%) as regularly active. The weekend warriors were younger than the other PA pattern groups with a mean age of 40.6 years and had more men than women (76.9%). All four groups of PA patterns had mean BMIs in the overweight range. (Table 1). The prevalence of hypertension, diabetes, and dyslipidemia in the weekend warrior PA patterns was lower than in the other groups (Table 1, Supplementary Table 1). Compared with an inactive PA reference group, there were associations of weekend warrior PA with hypertension, diabetes, dyslipidemia, and metabolic syndrome in the crude model, but the associations were attenuated to null after adjustment for age and gender, and subsequent adjustment for sociodemographic and lifestyle variables (Table 2). Those who were regularly active had lower odds of diabetes and metabolic syndrome in multivariable analysis (Table 2). In the subgroup analysis by gender, there were no associations between weekend warrior PA patterns and

Table 2. Association between weekend warrior physical activity pattern and cardiometabolic risk factors

Physical activity pattern	Cardiometabolic risk factors, OR (95% CI)				
	Hypertension	Diabetes	Dyslipidemia	Obesity	Metabolic syndrome
Subjects, n (%)	9,599 (32.6)	2,805 (12.3)	6,092 (22.0)	9,991 (33.9)	7,776 (30.0)
Model 1					
Inactive	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)
Insufficiently active	0.64 (0.58−0.71)	0.58 (0.49−0.69)	0.77 (0.69−0.85)	0.91 (0.84−0.99)	0.47 (0.41−0.55)
Weekend warrior	0.53 (0.42−0.67)	0.49 (0.34−0.70)	0.61 (0.46−0.80)	1.18 (0.97−1.42)	0.51 (0.33−0.79)
Regularly active	0.60 (0.54−0.66)	0.55 (0.47−0.64)	0.76 (0.68−0.84)	1.03 (0.94−1.12)	0.43 (0.37−0.50)
Model 2					
Inactive	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)
Insufficiently active	0.91 (0.82−1.02)	0.80 (0.67−0.96)	1.03 (0.92−1.15)	0.89 (0.82−0.97)	0.81 (0.73−0.91)
Weekend warrior	0.83 (0.54−1.08)	0.73 (0.50−1.06)	0.94 (0.71−1.25)	1.04 (0.86−1.26)	0.96 (0.77−1.18)
Regularly active	0.85 (0.76−0.95)	0.75 (0.63−0.88)	1.04 (0.93−1.16)	0.99 (0.91−1.08)	0.68 (0.61−0.76)
Model 3					
Inactive	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)
Insufficiently active	0.97 (0.87−1.09)	0.88 (0.73−1.05)	1.01 (0.90−1.13)	0.95 (0.87−1.04)	0.87 (0.78−0.97)
Weekend warrior	0.89 (0.69−1.15)	0.81 (0.55−1.17)	0.92 (0.69−1.22)	1.10 (0.91−1.34)	1.05 (0.83−1.27)
Regularly active	0.90 (0.81−1.01)	0.83 (0.70−0.98)	1.03 (0.92−1.15)	1.06 (0.97−1.16)	0.74 (0.66−0.82)

OR: odds ratio, CI: confidence interval.
Model 1: non-adjusted, model 2: adjusted for age and gender, model 3: adjusted for age, gender, marital status, education level, household income, occupation, smoking status, and alcohol consumption.

cardiometabolic risk factors in men and women (Table 3). The association between regularly active PA pattern and metabolic syndrome persisted in subgroups of men and women (Table 3).

Discussion

In this general population-based sample of Korean men and women, regularly active PA patterns were associated with lower risk of diabetes and metabolic syndrome. However, we did not find any significant associations between weekend warrior PA patterns and cardiometabolic risk factors. Though several previous studies have demonstrated that PA was associated with beneficial health outcomes when the recommended amounts of PA are met, findings on the effects of weekend warrior PA have mostly been inconsistent.

A previous study showed that weekend warriors who were active only at a moderate intensity were more likely to have low levels of cardiorespiratory fitness than men who exercised more frequently but at the same intensity[23]. Another study showed that moderate-intensity activity only at weekends did not improve cardiovascular risk factors in elderly persons with a relatively normal cardiovascular risk profile. However, in elderly persons having hypertension, there might be some beneficial effects from such an activity[24]. In addition, Lee et al.[18] reported that the decrease in the mortality rate of weekend warriors was not significant compared to sedentary activity (relative risk [RR], 0.85; 95% CI, 0.65–1.11); in their subanalysis, weekend warriors showed a 59% decrease in the risk of mortality (RR, 0.41; 95% CI, 0.21–0.81) in the low-risk group, but not in the high-risk group with either smoking, obesity, hypertension, or hypercholesterolemia (RR, 1.02; 95% CI, 0.75–1.38). Our results are consistent with these previous studies that reported no evidence of significant associations between the weekend warrior PA patterns and health outcomes and add to the accumulating literature on these relationships in a Korean population.

In contrast to the results of studies demonstrating that weekend warrior PA patterns were not associated with reduced risk of mortality and adverse cardiometabolic risk factors, a few studies have demonstrated that a favorable effect of weekend warrior PA patterns on all-cause and CVD mortality and cardiometabolic risk factors. In a pooled analysis of 11 population-based cohorts, using a large sample of British adults, O'Donovan et al.[19] reported that weekend warriors had a reduced risk of all-cause mortality by 30%, cerebrovascular disease mortality by 40%, and cancer

Table 3. Association between weekend warrior physical activity pattern and cardiometabolic risk factors by gender

Physical activity pattern	Cardiometabolic risk factors, OR (95% CI)				
	Hypertension (n=9,599)	Diabetes (n=2,805)	Dyslipidemia (n=6,092)	Obesity (n=9,991)	Metabolic syndrome (n=7,776)
Men, n (%)	4,404 (45.9)	1,415 (50.4)	2,219 (36.4)	4,851 (38.6)	3,653 (47.0)
Model 1					
Inactive	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)
Insufficiently active	0.96 (0.83−1.10)	0.91 (0.72−1.15)	1.11 (0.95−1.30)	0.98 (0.87−1.10)	0.92 (0.80−1.06)
Weekend warrior	0.81 (0.61−1.08)	0.79 (0.52−1.20)	0.96 (0.69−1.33)	1.08 (0.86−1.35)	0.96 (0.75−1.21)
Regularly active	0.87 (0.76−0.99)	0.75 (0.61−0.93)	1.09 (0.93−1.27)	1.07 (0.95−1.20)	0.72 (0.63−0.83)
Model 2					
Inactive	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)
Insufficiently active	0.96 (0.82−1.11)	0.99 (0.77−1.26)	1.02 (0.87−1.20)	0.95 (0.84−1.07)	0.90 (0.78−1.03)
Weekend warrior	0.82 (0.61−1.09)	0.86 (0.57−1.31)	0.87 (0.62−1.21)	1.04 (0.83−1.34)	0.95 (0.75−1.20)
Regularly active	0.87 (0.76−0.99)	0.83 (0.67−1.03)	1.05 (0.89−1.22)	1.08 (0.96−1.21)	0.73 (0.64−0.84)
Women, n (%)	5,195 (54.1)	1,390 (49.6)	3,873 (63.6)	5,140 (51.4)	4,123 (53.0)
Model 1					
Inactive	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)
Insufficiently active	0.86 (0.73−1.01)	0.62 (0.47−0.81)	0.94 (0.81−1.10)	0.79 (0.70−0.90)	0.66 (0.56−0.77)
Weekend warrior	0.74 (0.44−1.25)	0.46 (0.17−1.24)	0.75 (0.45−1.25)	0.76 (0.51−1.13)	0.79 (0.48−1.30)
Regularly active	0.84 (0.71−0.98)	0.76 (0.57−1.00)	0.97 (0.84−1.25)	0.84 (0.73−0.96)	0.61 (0.52−0.72)
Model 2					
Inactive	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)
Insufficiently active	0.95 (0.81−1.13)	0.67 (0.50−0.89)	0.93 (0.79−1.09)	0.91 (0.79−1.04)	0.74 (0.63−0.87)
Weekend warrior	0.85 (0.51−1.43)	0.52 (0.20−1.39)	0.77 (0.46−1.29)	0.89 (0.60−1.34)	0.95 (0.58−1.57)
Regularly active	0.92 (0.78−1.08)	0.83 (0.62−1.11)	0.95 (0.81−1.10)	0.95 (0.83−1.09)	0.68 (0.58−0.80)

OR: odds ratio, CI: confidence interval.
Model 1: adjusted for age, model 2: adjusted for age, education, marital status, household income, occupation, smoking status, and alcohol use.

mortality by 18%. Furthermore, Shiroma et al.[21] objectively assessed accumulated patterns of PA recorded while wearing an accelerometer. They reported a 69% reduction in mortality rate in weekend warriors versus inactive participants after adjustment for socioeconomic covariates. In addition, another study based on Chinese rural adults showed that the decreased odds of hypertension, diabetes, and metabolic syndrome in male weekend warriors were 21%, 48%, and 42%, respectively, and in female weekend warriors were 29%, 48%, and 33% respectively[20], compared with inactive participants. In another study that evaluated associations between PA patterns and cardiovascular risk factors in Swiss middle-aged adults, Gubelmann et al.[22] reported associations of lower prevalence of hypertension and obesity in weekend warriors following adjustment for socioeconomic variables.

The reasons for these conflicting results are not fully understood, but differences in study design, or racial or outcomes differences between previous studies and the present study could, in part, explain these conflicting results. In the present study, we used a cross-sectional design and our population was based on Asian adults. Future studies are needed to confirm these results in participants with different racial or ethnic origins and to clarify the prospective associations of weekend warrior PA patterns and a variety of health outcomes.

In addition, the differences in PA questionnaires between previous studies and the present study could also explain these conflicting results. In the PA questionnaires used in the study by O'Donovan et al.[19], PA had three domains that were housework, walking, and sports. There was no distinction between PA domains by LTPA in the analysis of weekend warrior PA patterns. In the questionnaires used in the study by Xiao et al.[20], the questionnaire was IPAQ that PA had two domains which were OPA and LTPA. However, there was no distinction between PA domains by LTPA in the analysis of weekend warrior PA patterns. They reported less than 30% of weekend warriors were only

engaged in LTPA. PA questionnaires in these previous studies were not distinct by domains of LTPA and OPA. In the present study, we only used LTPA, with OPA excluded from the GPAG. It is of interest to note that the recent evidence of Holtermann et al.[30] suggests a contrast between the health effects of LTPA and OPA. According to Wanner et al.[31], LTPA was associated with a reduced risk of cardiovascular health, whereas OPA was associated with adverse cardiovascular health. Thus, such differences in the evaluation of PA may provide insight into these conflicting results. Future studies are needed to clarify the associations between weekend warrior LTPA patterns and a variety of health outcomes using the same PA questionnaires.

The present study has several methodological limitations which should be acknowledged. Because this study was based on a cross-sectional design, the temporal relationship between weekend warrior PA patterns and cardiometabolic risk factors cannot be determined. The relatively small sample size of participants with weekend warrior PA patterns is also a limitation. Since the information on PA was obtained from a self-reported questionnaire, there could be misclassification in terms of duration, frequency, and intensity of LTPA. Other confounding factors such as diet, living place, and the presence of musculoskeletal diseases were not considered. In spite of these limitations, this study has several strengths. This is the first study to evaluate the associations between weekend warrior PA patterns and cardiometabolic risk factors in a Korean population. The sample was large and utilized a nationwide cohort using an appropriate sampling process and is representative of the general population.

In conclusion, though regularly active PA patterns were associated with lower odds of diabetes and metabolic syndrome, there was no evidence of significant associations between weekend warrior PA patterns and cardiometabolic risk factors in a representative Korean population. Large-scale prospective cohort studies are warranted to confirm or refute these findings.

Conflict of Interest

Sae Young Jae is the editor-in-chief of *The Korean Journal of Sports Medicine.* He was not involved in the review process of this study. No other potential conflict of interest relevant to this article was reported.

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Conceptualization, Visualization: CG, SYJ. Data curation, Formal analysis: CG. Methodology: all authors. Writing–original draft: CG, SYJ. Writing–review & editing: all authors.

Supplementary Materials

Supplementary Materials can be found at https://doi.org/10.5763/kjsm.2022.40.4.234.

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