**Secular Trends and Related Factors in Leisure-Time Sedentary Behavior
among the South Korean Population: using the 2011–2017 Community Health Survey**

Running Title: Trends and Factors in Sedentary Behavior among Koreans

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None declared.

Authors' contributions

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Abstract

Objectives: This study identified trends in leisure-time sedentary behaviors on weekdays, as well as characteristic sociodemographic and lifestyle correlates in Korean adults. Sedentary behavior has gradually increased and has become a public health problem.

Methods: We analyzed data from 914,946 adults aged ≥ 19 years who participated in the Korea Community Health Survey (2011, 2013, 2015, and 2017). Leisure-time sedentary behavior was categorized using binary variables (< 4 and ≥ 4 h per day [h/d]). Multivariable regression analysis was used to model the prevalence of sedentary behaviors and estimate odds ratios.

Results: The prevalence of leisure-time sedentary behavior decreased from 15.18% to 14.40% in men and from 16.62% to 16.01% in women, respectively, between 2011 and 2017. However, a significant increase was observed in subjects with an education lower than high school in both sexes (β coefficient = 0.12 for men and 0.08 for women, and p for trend < 0.001 , respectively). Women with the lowest household income level (β coefficient = 0.08, p for trend = 0.001), and poor subjective health status (β coefficient = 0.05, p for trend = 0.013) showed an increasing trend. Additionally, the factors associated with sedentary behavior were age, educational level, BMI, household income, walking activity, perceived stress level, and subjective health status in both sexes.

Conclusions: Identifying the secular trends and correlates of sedentary behavior by gender and associated factors will provide empirical evidence for developing public health campaigns and promotion programs to reduce sedentary behavior in Koreans.

Keywords: Adults, Sedentary behavior, Socioeconomic factors, Health status, Public health

1. Introduction

Sedentary behavior is characterized by an energy expenditure of ≤ 1.5 , while awake, in a sitting, reclining, or lying posture. Sedentary time is defined as the time spent in any context engaged in sedentary behaviors. In the case of adults aged 18 years or older, the use of electronic devices, such as a television, computer, or phone while sitting, reclining or lying down, reading, writing, or talking while sitting, and sitting in a bus, car, or train are all defined as sedentary behaviors.^{1, 2} Sedentary behavior has been an increasing public health problem, with a significant number of people reporting long durations of sedentary time. Americans spend 55% of their waking time, or 7.7 h per day (h/d), in a sedentary state. Europeans were estimated to spend an average of 40% of their leisure time watching television, equal to 2.8 h/d in the UK, a rate that is stable or increasing.³

According to the Korean Health Statistics for 2018, adults in Korea aged ≥ 19 years reported an average of 8.3 h of sedentary time per day. Only 8.9% of the adult population engaged in <4 h of sedentary time, while 20.6% of adults spent >12 h engaged in sedentary behaviors.⁴

A sedentary lifestyle has been consistently reported to increase all-cause mortality and the risk of cardiovascular disease, diabetes, hypertension, and cancer.^{3, 5} Consistently, previous studies on longer leisure-time sedentary behaviors reported increased all-cause mortality,⁶ decreased survival time,⁷ and a higher risk of total cancer risk in women.⁸ Thus, sedentary behaviors, regardless of total sitting time or leisure time sitting time, have a substantial impact on mortality, comparable to those of tobacco use and obesity.⁹

Although sedentary time is regarded as a public health disease and the importance of primary prevention has been emphasized,¹⁰ the time spent on sedentary behavior in US adults significantly increased between 2001 and 2016.^{11, 12} Additionally, sedentary behavior

prevalence (> 4.5 hour of total sitting time/day) increased between 2002 and 2017 from 49.3% to 54.3% in EU adults.¹³ Previous studies on sedentary time and sedentary behavior conducted in South Korea used data obtained from a partial period to investigate factors related to sedentary behavior.^{14, 15} No studies have analyzed secular trends according to gender, age, and related factors using community health survey data. Therefore, this study aimed to examine the temporal trends of leisure time sedentary behavior on weekdays according to socioeconomic characteristics and to identify related factors affecting sedentary behavior.

2. Methods

2.1. Participants and data collection

This study used a cross-sectional data series from the Korea Community Health Survey (KCHS), an ongoing, cross-sectional, nationally representative survey of the non-institutionalized Korean population, using a stratified, multistage probability design. Since 2008, the KCHS has been a leading nationwide survey assessing the health and lifestyle behaviors of community-dwelling adults and the elderly. The survey collected data using questionnaires on demographics, socioeconomic status, health conditions, and health-related behaviors by trained interviewers through household interviews.¹⁶ The KCHS is administered by the Korean Center for Disease Control and Prevention (KCDC), and KCHS protocols have been approved by the institutional review board of the KCDC. Written informed consent was obtained from all the participants prior to their participation in the KCHS. The authors' university Institutional Review Board determined that the study was exempt from ethics approval as anonymous data were used.

We used KCHS data obtained continuously over 2-year cycles through 2011 to 2017. The same

questionnaire was used to assess time spent on leisure during this period. Information on sociodemographic characteristics, lifestyle, and sedentary behavior was combined into a single dataset for each cycle from 2011 to 2017. The study population consisted of adults aged 18 years or older. Individuals without complete data on sedentary behavior were excluded from the sample. There were 919,946 individuals included in the final sample.

2.2. Assessment of sedentary behaviors

The question related to sedentary behavior was “How many hours a day did you spend sitting, for example, watching the TV, playing games, or using the internet, in your leisure time during the last weekdays (from Monday to Friday)?” The response options were as follows: less than 1 h a day, less than 1–2 h, less than 2–3 h, and 4 h or more. The total sedentary time in hours per day (h/d) was used as a binary variable (<4 and ≥ 4 h/d) for the primary analyses. This cutoff value was used in a previous study, in which hazard ratios for mortality and cardiovascular disease death significantly increased for 4 h/d compared to less than 4 h/d.^{17, 18}

2.3. Assessment of sociodemographic and lifestyle characteristics

Sociodemographic factors (i.e., age, sex, education level, body mass index (BMI), and average monthly household income) and lifestyle characteristics (i.e., average daily sleep time and walking activity per week) were investigated as factors related to sedentary behavior in previous studies.^{11, 14, 15, 17} Additionally, psychological factors (i.e., subjective stress level and subjective health status level) were selected as independent variables.¹⁹ We categorized age into three groups as follows: 19–39 years old (young adults), 40–64 years old (middle-aged adults), and 65 years or older (elderly). Educational level was categorized into the following groups: less than high school, high school, and college or above.¹¹ BMIs were grouped according to the Asia-Pacific BMI classification.²⁰ There were four categories of average monthly household

income: < 846, 846–2,536, 2,537–4,227, and $\geq$ 4,227 USD.¹⁹ Average daily sleep time was divided into a dichotomous variable: obtained recommended sleep duration for adults (i.e., 7–9 h/d) and others,²¹ and walking activity was categorized into a binary variable: engaged in the recommended amount of walking activity (i.e., walking for 30 min a day for 5 days or over per week) and others.²² For subjective health status level, “very good, good, or moderate” were coded as good self-rated health status and ‘bad or very bad’ as poor responses.²³

2.4. Statistical analyses

Survey analysis procedures were used to account for sample weights, stratification, and clustering of the complex sampling design to ensure nationally representative estimates.¹⁶ Using cross-sectional weights proposed by the KCDC, data from a total of four cross-sectional surveys were collected every two years from 2011 to 2017, and a single data file was created to explore secular trends.

Estimates of crude weighted prevalence and 95% confidence intervals (CIs) of sitting time at leisure (≥ 4 h/day) were calculated by cycle, sex, and age group. Crude linear trends in sedentary behaviors were evaluated using linear regression models across survey cycles to estimate regression coefficients (β) and 95% CIs for every 2-year change. The p-value for the trends was estimated using the survey cycle as a continuous variable. Additionally, crude trends in the prevalence of sedentary behaviors (≥ 4 h/d) by sex and age are visually illustrated.

Logistic regression analysis was used to model the prevalence of sedentary behaviors and estimate odds ratios (ORs). Logistic regression analyses for secular trends during the entire period were conducted, using each year as an explanatory variable and sedentary behavior as a dependent variable (contrast vector value: 2011= -0.67082, 2013= -0.22361, 2015= 0.22361, 2017= 0.67082).²³ Sociodemographic and lifestyle correlates for sedentary behaviors over time

were identified using multivariable regression models adjusted for age, sex, educational level, marital status, BMI, monthly household income, average daily sleep time, walking activity, perceived stress, and subjective health status level for all participants.

All statistical tests were 2-sided and statistical significance was set at $p < .05$. P-values were not adjusted for multiple tests and should be interpreted as exploratory. All statistical analyses were conducted using the R statistical software version 3.6.1 (R Foundation for Statistical Computing, Vienna, Austria).

2.5. Ethics statement

The KCHS was approved by the institutional review board of the KCDC. The raw KCHS data were downloaded from the KCHS website after applying for and receiving permission from the administrator of the KCHS website (May 2021). This study was approved by the Institutional Review Board of Chungnam National University (Number 202105-SB-076-01).

3. Results

3.1. Subject characteristics

We included 914,946 participants aged ≥ 19 years (male: 411,052 [44.9%], female: 503,894 [55.1%]) from the KCHS from 2011 to 2017. The sample size per cycle ranged from 228,381 to 229,226. The unweighted and weighted sample sizes in the 2011–2017 cycle overall and for each age group according to sociodemographic and lifestyle characteristics are presented in Table 1. Of the male and female participants, 24.9% and 29.3% were 65 years or older, respectively; women were generally older than men. Compared with women, men were more likely to be obese and more commonly had educational levels of college or above (Table 1).

Participants with missing covariates (10.1%) were excluded from the multivariate analyses.

[Place Table 1 Here]

3.2. Trends in prevalence of sedentary behavior

The prevalence of sedentary behavior decreased from 15.18% to 14.40% in men and from 16.62% to 16.01% in women between 2011 and 2017, respectively. The secular trend in sedentary behavior showed a statistically significant decrease in both sexes (β coefficient = -0.06 for men, -0.04 for women, p for trend <0.05). In men, the estimated prevalence of sitting time (≥ 4 h/d) showed a statistically significant decline across all age groups (β coefficient= -0.09 for young adults; -0.11 for middle-aged adults; -0.05 for elderly, p for trend <0.05). However, the time spent engaged in sedentary behavior by elderly women increased over time, although this was not statistically significant (β coefficient= 0.01, p for trend >0.05). (Table 2).

The prevalence of sedentary behavior in both sexes significantly decreased over time among those with college or higher levels of education, those with a normal BMI, the highest household income level, the appropriate average daily sleep time group, the recommended walking activity group, the group with some level of perceived stress, and the good self-rated health status group. In contrast, a significant increase was observed in those with an education level less than high school in both sexes (β coefficient= 0.12, p for trend < 0.001 for men, 0.08 for women, p for trend < 0.001). In addition, women with the lowest household income level and poor self-rated health status showed an increasing trend of sedentary behavior over time (β coefficient= 0.08, p for trend=0.001 for household income level; β coefficient= 0.05 poor self-rated health status; p for trend=0.013) (Table 2).

[Place Table 2 Here]

3.3. Factors related to sedentary behavior

The factors associated with sedentary behavior were age, educational level, BMI, average monthly household income, walking activity, perceived stress level, and subjective health status in both sexes. Elderly individuals of both sexes, people with less than a high school educational level, people with higher BMI, participants from families with lower household income, people who did not engage in the recommended level of walking, and those who had a negative response to the subjective health status question reported a higher estimated prevalence of sedentary behavior (Table 3).

Additionally, men with the lowest household income level and poor self-rated health status were highly likely to exhibit sedentary behavior (adjusted OR: 2.02, 95% CI: 1.92–2.12 for those with a household income level of less than 846 USD per month; adjusted OR: 2.03, 95% CI: 1.96–2.09 for poor self-rated health status). For women, the adjusted OR in the obese group was 1.44 (95% CI, 1.4–1.48) compared with the normal-weight group; for those with the lowest household income, the adjusted OR was 1.47 (95% CI, 1.4–1.53) compared with the highest household income group; and for those with a poor self-rated health status, the adjusted OR was 1.59 (95% CI, 1.54–1.63) compared with the good self-rated health status group (Table 3).

[Place Table 3 Here]

4. Discussion

This study examined trends in leisure-time sedentary behavior using adult KCHS data. The estimated prevalence of leisure-time sedentary behavior for more than 4 h/day generally decreased from 2011 to 2017. This decrease in the prevalence rate was statistically significant in men, women aged between 19 and 64 years, and people with high sociodemographic status and healthy lifestyle characteristics. However, leisure-time sedentary behavior showed an

207 increasing tendency in women aged 65 years or older, those with less than a high school
208 education, women with the lowest incomes, and those with negative subjective health status.

209 The purpose of this study was also to identify gender specific trends in leisure-time sedentary
210 behavior in South Korean adults, from 2011 to 2017. Previous studies have presented
211 inconsistent trends because the different cutoff values of energy expenditure or time, and use
212 of various longitudinal periods and covariates. Leisure-time sedentary behavior trends in
213 Australian adults in 1992, 1997, and 2006 remained stable. This study reported that leisure-time
214 computer use showed a significant increase, while other behaviors, such as reading, hobbies,
215 and crafts, showed slight reductions.²⁴ In US adults, the time spent watching television or videos
216 for 2 h/d or more remained stable; however, computer use during leisure time of 1 h/d or more
217 significantly increased from 2003 through 2016.¹² In Dutch adults, leisure-time sedentary
218 behavior remained relatively constant at ~60%, while leisure screen time increased by 26%
219 between 1975 and 2005.²⁵ However, this study found that overall leisure-time sedentary
220 behavior did not increase due to an increase in occupational time by 4.7-h/week during the same
221 period. Although a decrease was seen in the leisure-time sedentary behavior of more than 4
222 hours in this study, this finding could only provide a limited understanding of sedentary
223 behavior as a whole, since important variables of occupational time and occupational intensity
224 ²⁶ are not presented in the KCHS. Therefore, additional standardized international research is
225 required to accurately reflect trends, including important variables, and to investigate cross-
226 sectional surveys for the prevalence of leisure-time sedentary behavior.

227 In this study, leisure-time sedentary behavior showed slightly increased in women aged over
228 65 years. This finding is consistent with a previously observed trend in US adults from to 2003-
229 2016,¹² which defined watching television for more than 2 h and using a computer over 1 h per
230 day as sedentary behavior. Older adults with high leisure-time sedentary behavior were

associated with low physical functionality after adjusting for confounding variables.²⁷ In a systematic review, nearly 60% of older adults reported sitting for more than 4 h/day, 15% of whom reported watching television for more than 4 h/day during that period.²⁸ These findings indicate that older adults have more leisure-time sedentary behavior than is recommended by public health policies. Therefore, reducing sedentary time is important for older adults. Considering that this study found no significant decreasing trend in leisure-time sedentary behavior in women aged 65 or over, a detailed health promotion campaign will be necessary to change the socio-cultural environment and reduce their overall sedentary time.

In agreement with previous studies, this study identified that trends of prolonged leisure-time sedentary behavior were associated with low socioeconomic factors.^{26, 29, 30} The trends of leisure-time sedentary behavior showed no significant change or any increase among individuals with lower than college education and those with low incomes. More leisure screen time, such as watching television, was correlated with lower formal education and lower incomes.^{12, 31, 32} In addition, income directly influenced leisure-time physical activity and sedentary behavior.³³ Considering the trends of overall leisure-time sedentary behavior among individuals with low socioeconomic conditions, prioritized and focused interventions designed to break up leisure-time sedentary behavior and to reduce these disparities are necessary from a public health perspective.

In this study, the trends of leisure-time sedentary behavior decreased in both men and women. However, the prevalence in women was consistently higher than that in men between 2011 and 2017. Systematic reviews on gender and sedentary behavior revealed a lack of consistency between the study results.^{31, 34, 35} A previous study using accelerometer-measured sedentary times reported that women had higher levels of sedentary time than men from 2007 to 2009, but there were no significant differences, from 2007 to 2017, by gender.³² Most typical causes

of leisure-time sedentary behavior were generally computers and television for men. In contrast, women spent more on reading and communication-based sedentary behaviors than men did.³⁵ ³⁶ There was an increasing trend of leisure-time sedentary behavior in women with low education levels and household incomes, and those with a negative subjective health status ($p < 0.05$). A previous study reported that an increase in sedentary time has a negative impact on subjective health status in women and stress recognition in both genders.³⁷ Increased opportunities for breaking leisure-time sedentary behavior in women contribute to ending gender discrimination, lower the gap in subjective health status differences and lead to economic participation.³⁸ The investigation of “gendered social and economic barriers,”³⁶ which influence leisure-time sedentary behavior, is necessary. It will also be essential to develop public health programs to reduce sedentary behavior and to promote further studies to identify additional causes of sedentary behavior, particularly in relation to sex.³²

This study had several limitations. Self-reported leisure-time sedentary behavior may not reflect the true amount of sedentary time compared to that measured with a device, such as a smartphone or accelerometer. Nevertheless, self-reported sitting time has been widely used in epidemiological studies,¹⁵ and measurement errors are unlikely to affect the secular trends over time. Second, it was not possible to evaluate contemporary trends in leisure-time sedentary behavior because leisure-time sedentary time has not been investigated in the KCHS since 2019. Thirdly, although the typical variables related to sedentary behavior were included, other potentially important factors such as intensity of work-related, depression, cognitive ability, and activity limitations were not. Therefore, future research should consider a wider range of variables, including activity levels at work, and psychological, physical, cognitive, and environmental factors. Fourth, this study focused on leisure time sitting time per day on weekdays because the KCHS does not collect data on total sitting time per day; therefore, the inability to analyze a particular type of sedentary behavior, including television viewing and

computer use, and the total sitting time per day restricted possible comparisons between the results of this study and those of other studies. Finally, this study used cross-sectional data, which limited the ability to identify causal relationships between the variables and sedentary behavior.

5. Conclusions

The secular trends of leisure-time sedentary behavior in adults for at least 4 h/d decreased in both sexes and in the 19–64 age group. The prevalence of sedentary behavior in women was consistently higher than that in men. No decreasing trend was found in women aged 65 years and older or in those with a high level of perceived stress. Additionally, these trends increased in people with low educational levels, household income, and negative subjective health status. This study could help identify secular trends in sedentary behavior depending on sex. Associated factors will provide empirical evidence for developing public health campaigns and health promotion programs to reduce leisure-time sedentary behavior in Koreans. Future research should systematically and deeply examine the physical, psychological, socioeconomic, and environmental causes of high levels of leisure-time sedentary behavior in the general population and implement programs that can effectively reduce leisure-time sedentary behavior.

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Table 1. Sample size for sedentary behavior in the Korean population by sociodemographic and lifestyle characteristics, KCHS 2011-2017.

	Men (n = 411,052)	Women (n = 503,894)	Weighted Men (n (%))	Weighted Women (n (%))
Year:				
2011	103,017(25.06)	126,209(25.05)	19,755,024(24.20)	20,149,808(24.24)
2013	102,722(24.99)	126,059(25.02)	20,204,229(24.75)	20,577,678(24.75)
2015	102,829(25.02)	125,729(24.95)	20,605,423(25.24)	20,949,235(25.20)
2017	102,484(24.93)	125,897(24.98)	21,083,080(25.82)	21,450,487(25.80)
Age, years:				
19–39 (young adults)	109,144(26.55)	125,599(24.93)	31,589,830(38.69)	29,477,017(35.46)
40–64 (middle aged adults)	199,436(48.52)	230,827(45.81)	38,843,755(47.57)	38,814,294(46.69)
≥ 65 (elderly)	102,472(24.93)	147,468(29.27)	11,214,171(13.73)	14,835,896(17.85)
Educational level:				
College or above	164,979(40.19)	147,816(29.38)	43,706,963(53.62)	34,861,951(42.01)
High school	130,087(31.69)	132,420(26.32)	25,215,200(30.93)	24,639,488(29.69)
Less than high school	115,396(28.11)	222,914(44.30)	12,596,990(15.45)	23,478,865(28.29)
Body mass index:				
18.5–22.9 (Normal)	149,730(38.10)	231,578(50.67)	29,483,080(37.40)	42,185,414(53.63)
<18.5 (Underweight)	115,60(2.94)	34,275(7.50)	1,895,963(2.40)	6,618,443(8.41)
23–24.9 (Overweight)	107,216(27.28)	95,129(20.81)	21,246,333(26.95)	15,167,370(19.28)
≥25 (Obese)	124,527(31.68)	96,077(21.02)	26,210,962(33.25)	14,693,924(18.68)
Household income level(USD/month):				
≥ 4,227	74,13(18.62)	84,212(17.29)	19,900,699(25.24)	19,383,599(24.23)
2,537–4,227	112,662(28.30)	124,625(25.59)	26,364,908(33.44)	24,874,452(31.09)
846–2,536	144,950(36.41)	165,350(33.95)	25,486,977(32.33)	25,478,305(31.85)
< 846	66,341(16.67)	112,911(23.18)	7,081,287(8.98)	10,264,918(12.83)
Average daily sleep time:				
7–9 hours	206,469(50.25)	249,047(49.47)	39,510,882(48.41)	40,920,890(49.26)
The others	204,387(49.75)	254,362(50.53)	42,109,571(51.59)	42,156,866(50.74)
Walking activity				
Walking for 30 min/day & ≥ 5 days a week	209,756(51.07)	242,058(48.07)	45,258,033(55.47)	43,629,544(52.51)
The others	201,004(48.93)	261,516(51.93)	36,333,646(44.53)	39,452,502(47.49)
Perceived stress:				
None	92,609(22.54)	104,998(20.86)	14,434,126(17.69)	14,360,396(17.29)
A little	217,226(52.88)	266,803(53.01)	44,739,252(54.82)	45,892,979(55.24)
Much	87,682(21.34)	114,364(22.72)	19,374,273(23.74)	19,797,270(23.83)
Very much	13,289(3.23)	17,181(3.41)	3,068,232(3.76)	3,025,094(3.64)
Subjective health status:				
Good	341,636(83.12)	377,413(74.90)	71,999,505(88.19)	68,337,331(82.21)
Poor	69,367(16.88)	126,445(25.10)	9,638,240(11.81)	14,784,706(17.79)

4 **Table 2.** Crude weighted trends of leisure-time sedentary behavior among Korean population, KCHS 2011-2017.

	Men, weighted % (95% CI)						Women, weighted % (95% CI)					
	2011	2013	2015	2017	β	<i>p</i> for Trend	2011	2013	2015	2017	β	<i>p</i> for Trend
Overall	15.18(14.86–15.51)	14.50(14.18–14.83)	13.68(13.38–13.98)	14.40(14.09–14.71)	-0.06	< 0.001	16.62(16.32–16.93)	15.87(15.57–16.18)	15.14(14.83–15.45)	16.01(15.71–16.30)	-0.04	< 0.001
Ages (years)												
19–39 (young adults)	15.31(14.77–15.85)	13.84(13.31–14.37)	12.83(12.33–13.33)	13.98(13.44–14.51)	-0.09	< 0.001	15.84(15.34–16.35)	14.08(13.60–14.56)	13.43(12.93–13.93)	14.71(14.20–15.22)	-0.08	0.001
40–64 (middle aged adults)	11.43(11.05–11.81)	10.75(10.38–11.12)	10.24(9.88–10.61)	10.10(9.74–10.46)	-0.11	< 0.001	13.29(12.90–13.68)	12.22(11.85–12.60)	11.40(11.04–11.77)	11.66(11.30–12.02)	-0.12	< 0.001
≥ 65 (elderly)	29.44(28.55–30.33)	30.05(29.18–30.93)	27.61(26.81–28.42)	28.69(27.87–29.50)	-0.05	0.020	27.88(27.09–28.66)	29.51(28.73–30.29)	27.97(27.21–28.73)	28.78(28.06–29.50)	0.01	0.541
Educational level:												
College or above	14.09(13.62–14.55)	12.32 (11.90–12.75)	11.33(10.94–11.72)	11.69(11.30–12.08)	-0.17	< 0.001	13.81(13.32–14.29)	11.77(11.35–12.19)	11.14(10.73–11.56)	11.79(11.40–12.19)	-0.13	< 0.001
High school	13.40(12.90–13.89)	13.86 (13.37–14.36)	13.41(12.91–13.91)	14.29(13.78–14.81)	0.04	0.056	14.59(14.10–15.09)	14.09(13.60–14.58)	13.79(13.28–14.29)	14.81(14.29–15.33)	0.01	0.777
Less than high school	21.85(21.16–22.54)	23.04 (22.31–23.77)	22.95(22.21–23.69)	25.07(24.28–25.86)	0.12	< 0.001	22.22(21.67–22.77)	23.47(22.90–24.04)	22.84(22.26–23.43)	24.54(23.95–25.13)	0.08	< 0.001
Body mass index:												
18.5–22.9 (Normal)	15.74(15.23–16.25)	14.75(14.26–15.24)	13.99(13.50–14.47)	14.57(14.06–15.09)	-0.08	0.001	14.26(13.87–14.65)	13.43(13.05–13.81)	12.66(12.27–13.05)	13.57(13.19–13.96)	-0.05	0.002
<18.5 (Underweight)	26.16(23.91–28.42)	24.48(22.34–26.61)	26.14(23.76–28.53)	28.01(25.60–30.43)	0.08	0.177	16.60(15.62–17.58)	14.84(13.83–15.84)	13.70(12.76–14.65)	14.86(13.81–15.91)	-0.12	0.005
23–24.9 (Overweight)	13.27(12.73–13.82)	12.59(12.07–13.12)	12.17(11.64–12.69)	13.24(12.70–13.78)	-0.01	0.723	16.93(16.27–17.59)	16.01(15.38–16.65)	15.57(14.93–16.22)	16.06(15.44–16.68)	-0.05	0.044
≥25 (Obese)	14.95(14.39–15.50)	14.63(14.07–15.19)	13.52(13.02–14.02)	13.95(13.46–14.44)	-0.07	0.001	21.45(20.70–22.21)	20.79(20.05–21.54)	20.44(19.73–21.16)	21.16(20.46–21.85)	-0.01	0.534
Household income level (USD/month):												
≥ 4,227	11.42(10.79–12.06)	10.41(9.88–10.94)	9.51(8.95–10.08)	9.85(9.32–10.37)	-0.13	0.001	12.50(11.88–13.13)	11.68(11.16–12.20)	11.01(10.41–11.60)	10.87(10.36–11.39)	-0.12	< 0.001
2,537–4,227	12.20(11.67–12.73)	11.34(10.84–11.83)	10.59(10.13–11.04)	11.29(10.81–11.76)	-0.07	0.003	13.55(13.03–14.07)	12.89(12.39–13.39)	11.85(11.38–12.32)	13.18(12.69–13.67)	-0.04	0.102
846–2,536	16.29(15.76–16.82)	16.68(16.12–17.23)	15.02(14.51–15.53)	17.05(16.48–17.62)	0.01	0.711	18.62(18.08–19.15)	18.05(17.53–18.58)	16.80(16.27–17.33)	18.08(17.55–18.61)	-0.05	0.014
< 846	28.90(27.80–30.00)	31.93(30.76–33.10)	29.01(28.01–30.02)	31.41(30.33–32.50)	0.05	0.067	25.68(24.84–26.53)	26.94(26.08–27.80)	25.01(24.22–25.81)	28.64(27.80–29.48)	0.08	0.001
Average daily sleep time:												
7–9 hours	15.23(14.78–15.67)	14.67(14.24–15.11)	13.82(13.39–14.25)	14.42(13.99–14.85)	-0.06	0.001	15.83(15.43–16.23)	15.04(14.65–15.44)	14.10(13.70–14.50)	14.95(14.54–15.35)	-0.06	0.001
The others	15.12(14.68–15.56)	14.34(13.91–14.77)	13.55(13.15–13.95)	14.35(13.94–14.77)	-0.05	0.002	17.42(16.99–17.85)	16.66(16.25–17.08)	16.11(15.70–16.51)	16.97(16.56–17.37)	-0.03	0.057
Walking:												
Walking for 30 min/day & ≥ 5 days a week	14.57(14.15–15.00)	13.30(12.90–13.70)	12.93(12.54–13.32)	13.05(12.66–13.45)	-0.09	< 0.001	14.68(14.28–15.08)	13.81(13.43–14.19)	13.42(13.04–13.81)	13.92(13.54–14.30)	-0.05	0.003
The others	15.95(15.48–16.41)	15.95(15.47–16.42)	14.62(14.18–15.05)	16.16(15.69–16.63)	-0.01	0.509	18.80(18.37–19.24)	18.09(17.66–18.53)	17.07(16.63–17.51)	18.29(17.87–18.72)	-0.04	0.013

Continued

Perceived stress:

None	20.07(19.31–20.83)	18.91(18.16–19.65)	18.52(17.81–19.23)	19.79(19.06–20.53)	-0.01	0.600	19.95(19.24–20.66)	20.11(19.40–20.82)	19.74(19.03–20.44)	20.56(19.88–21.25)	0.02	0.332
A little	13.13(12.73–13.54)	12.60(12.21–12.98)	11.69(11.31–12.07)	12.24(11.86–12.62)	-0.07	0.001	14.47(14.09–14.85)	13.68(13.32–14.05)	12.89(12.52–13.25)	13.90(13.54–14.26)	-0.05	0.004
Much	15.44(14.81–16.06)	14.72(14.09–15.35)	13.52(12.94–14.09)	14.35(13.72–14.97)	-0.08	0.001	18.19(17.59–18.80)	17.05(16.47–17.63)	15.95(15.35–16.54)	16.59(15.97–17.21)	-0.09	< 0.001
Very much	21.07(19.28–22.87)	20.56(18.74–22.38)	20.26(18.59–21.92)	19.68(17.93–21.42)	-0.06	0.267	22.91(21.14–24.68)	22.17(20.50–23.84)	21.30(19.70–22.90)	21.34(19.70–22.98)	-0.07	0.148

Subjective health status:

Good	13.36(13.03–13.69)	12.49(12.17–12.82)	11.74(11.44–12.04)	12.24(11.94–12.55)	-0.08	< 0.001	14.48(14.16–14.80)	13.48(13.18–13.78)	12.65(12.34–12.96)	13.50(13.20–13.81)	-0.07	< 0.001
Poor	28.69(27.70–29.69)	29.91(28.90–30.92)	28.22(27.25–29.19)	30.08(29.07–31.10)	0.03	0.260	26.32(25.57–27.07)	26.84(26.09–27.60)	26.77(26.00–27.55)	27.79(27.02–28.55)	0.05	0.013

5 CI: confidence interval

Table 3. Weighted Logistic Regression Models of leisure-time sedentary behavior, adjusted for sociodemographic and lifestyle characteristics, KCHS 2011-2017.

	Men	Women
	Adjusted OR (95% CI)	Adjusted OR (95% CI)
Year (continuous)	0.94(0.92–0.97)	0.96(0.93–0.98)
Age, years:		
19–39 (young adults)	Ref	Ref
40–64 (middle aged adults)	0.65(0.63–0.67)	0.62(0.60–0.64)
≥ 65 (elderly)	1.40(1.34–1.46)	1.15(1.10–1.21)
Educational level:		
College or above	Ref	Ref
High school	1.03(1.00–1.06)	1.24(1.20–1.28)
Less than high school	1.14(1.10–1.19)	1.37(1.31–1.42)
Body mass index:		
18.5–22.9 (Normal)	Ref	Ref
<18.5 (Underweight)	1.40(1.30–1.50)	1.05(1.00–1.10)
23–24.9 (Overweight)	0.92(0.89–0.95)	1.14(1.11–1.17)
≥25 (Obese)	1.07(1.04–1.10)	1.44(1.40–1.48)
Household income level (USD/month):		
≥ 4,227	Ref	Ref
2,537–4,227	1.07(1.03–1.11)	1.06(1.02–1.10)
846–2,536	1.36(1.31–1.41)	1.34(1.29–1.39)
< 846	2.02(1.92–2.12)	1.47(1.40–1.53)
Average daily sleep time:		
7–9 hours	Ref	Ref
The others	0.97(0.94–0.99)	1.03(1.00–1.05)
Walking activity		
Walking for 30 min/day & ≥ 5 days a week	Ref	Ref
The others	1.20(1.17–1.23)	1.31(1.28–1.34)
Perceived stress:		
None	Ref	Ref
A little	0.73(0.70–0.75)	0.75(0.73–0.78)
Much	0.83(0.80–0.86)	0.87(0.84–0.90)
Very much	1.10(1.03–1.17)	1.05(0.99–1.12)
Subjective health status:		
Good	Ref	Ref
Poor	2.03(1.96–2.09)	1.59(1.54–1.63)

Adjusted for survey year, age, educational level, body mass index, household income level, average daily sleep time, walking activity, perceived stress, subjective health status and interaction terms.

CI, confidence interval; OR, odds ratio; USD, United States dollar; Ref, reference.