

ORIGINAL ARTICLE

Daily sedentary time of less than six hours is beneficial for the prevention of obesity in US adults

EXERCISE IS MEDICINE



Kim Heontae¹, Ryu Seungho², Kang Minsoo³

¹ School of Applied Sciences, The University of Mississippi

² Department of Sport Science, Pusan National University

³ Department of Health, Exercise Science, and Recreation Management, The University of Mississippi

Abstract

With suggestions that limiting sedentary time can prevent obesity, the need to identify a cut-off point for daily sedentary time is being recognized. Therefore, this study aims to examine the dose-response relationship between daily sedentary time and obesity and to suggest a cutoff of daily sedentary time for the prevention of obesity. Data from the 2003 to 2006 National Health and Nutrition Examination Survey (NHANES) were analyzed. A total of 5,127 adults (>19 years old) were included in the present study. Accelerometers were used to measure the daily sedentary time. Five sub-groups were created according to daily sedentary hours (e. g., <6 hours, 6 hours [i. e., 6 hours–6 hours and 59 minutes], 7 hours, 8 hours, or ≥9 hours). Obesity status was classified by body fat percentage measured by Dual-energy X-ray absorptiometry (DEXA). Logistic regression was used to examine the association between sedentary time and obesity after controlling for covariates. Participants who spent <6 hours of sedentary time were less likely to be obese (OR=0.61; 95% CI: 0.43, 0.86) compared to those who spent sedentary time of ≥9 hours.

We found that 6 hours can be suggested as a viable threshold for the prevention of obesity in US adults.

Résumé

L'idée selon laquelle la limitation du temps de sédentarité peut prévenir l'obésité a fait naître le besoin d'identifier un seuil pour le temps de sédentarité quotidien. Notre étude vise à examiner la relation dose-réponse entre le temps de sédentarité quotidienne et l'obésité et à proposer un seuil de temps de sédentarité quotidienne pour la prévention de l'obésité. Les données de la National Health and Nutrition Examination Survey (NHANES) de 2003 à 2006 ont été analysées. Au total, 5127 adultes (âgés de plus de 19 ans) ont été inclus dans l'étude. Le temps de sédentarité quotidien a été mesuré par des accéléromètres. Cinq sous-groupes ont été créés en fonction du nombre d'heures de sédentarité quotidienne (<6 heures, 6 heures [c'est-à-dire 6 heures-6 heures et 59 minutes], 7 heures, 8 heures ou ≥9 heures). L'obésité a été définie en fonction du pourcentage de graisse corporelle mesuré par absorptiométrie biphotonique à rayons X (DXA). La régression logistique a été utilisée pour examiner l'association entre le temps de sédentarité et l'obésité après prise en compte des covariables. Les participants passant moins de 6 heures de temps sédentaire étaient moins susceptibles d'être obèses (OR=0,61; 95% CI: 0,43 à 0,86) que ceux ayant passé ≥9 heures de temps sédentaire.

Nous concluons que 6 heures peuvent être considérées comme un seuil viable pour la prévention de l'obésité chez les adultes américains.

Mots clés: position assise, grand ensemble de données, lignes directrices, seuil, promotion de la santé

Introduction

Sedentary behavior has become a significant public health concern in recent years, with numerous studies documenting its adverse effects on health [1,2]. Furthermore, given that reducing sedentary time is recommended to prevent obesity [3], there is increasing recognition of the importance of investigating the dose-response relationship between daily sedentary time and obesity and establishing a threshold for daily sedentary time.

While previous quantitative guidelines for sedentary time recommended reducing sitting time at work by up to 4 hours per day [4], this recommendation was not based on solid evidence. Ku and colleagues have suggested limiting sedentary time to less than 9 hours per day [5]. However, the current evidence on the effects of specific amounts of sedentary time is inconsistent, and there has been limited research to determine a cutoff time that influences obesity in adults.

Therefore, the purpose of this study was to investigate the cross-sectional dose-response relationship between daily sedentary time and obesity and to propose a cutoff for daily sedentary time based on data from the National Health and Nutrition Examination Survey (NHANES) 2003–2006.

Methods

Design and participants

Data from the 2003 to 2006 National Health and Nutrition Examination Survey (NHANES) were analyzed for this study. The NHANES has surveyed a national representative, complex, multi-stage, stratified probability sample of the U.S. civilian, non-institutionalized population. The NHANES protocol was approved by the National Center for Health Statistics Ethics Review Board. A total of 5,127 adults (>19 years) were included in the analysis. Participants who did not have valid data on main outcome variables (e.g., DEXA and physical activity monitor) and covariates were removed from the analysis. Further, participants were categorized as either young (20–35 years), middle-aged (36–55 years), or older (>55 years) adults [6].

Measuring sedentary time

Actigraph accelerometers (model 7164; Actigraph, LLC, Fort Walton Beach, FL) were used to measure the average duration of minutes spent in sedentary time. Non-wear time was defined as a period with ≥ 60 consecutive minutes of 0 count per minute (cpm), with allowance for 1 or 2 minutes with < 100 cpm. Valid days were defined as those when participants wore the device for 10 or more hours. Participants were included in the analysis if they had a minimum of four valid days per week (e.g., three weekdays and one weekend day). Time spent in sedentary behavior during wear time was determined across valid days using the threshold of < 100 cpm [7,8]. Sedentary time was defined operationally as a period of time with at least 5 consecutive minutes with < 100 cpm during wear time [9]. To determine the threshold of sedentary time, five sub-groups were created according to daily sedentary hours (e.g., < 6 hours, 6 hours [i. e., 6

hours–6 hours and 59 minutes], 7 hours, 8 hours, or ≥ 9 hours).

	Total (n = 5,127)
Age (years)	44.98 (0.46)
Sex (%)	
Male	49.65 (0.80)
Female	50.35 (0.80)
Race (%)	
Mexican American	7.51 (1.18)
Other Hispanic	3.06 (0.50)
Non-Hispanic White	74.09 (2.22)
Non-Hispanic Black	10.42 (1.31)
Other	4.92 (0.57)
Education level (%)	
Some high school or less	13.39 (1.08)
High school graduate	24.37 (1.03)
Some college	33.47 (1.08)
College graduate or above	28.77 (1.80)
Household income (%)	
< \$45,000	41.28 (1.72)
\$45,000 - \$75,000	26.77 (0.84)
> \$75,000	31.95 (1.90)
Smoking status (%)	
Never smoker	53.46 (1.01)
Former smoker	25.57 (0.87)
Current smoker	20.97 (0.91)
Alcohol consumption (%)	
Life-long abstainers	11.42 (1.11)
Ex-drinkers	15.66 (0.91)
Current drinkers	72.92 (1.76)
Obesity status (%)	
Non-obese	26.27 (1.20)
Obese	73.73 (1.20)
Sedentary time (%)	
Less than 6 hours	13.49 (0.59)
6 hours to <7 hours	14.98 (0.55)
7 hours to <8 hours	20.81 (0.62)
8 hours to <9 hours	20.34 (0.78)
9 hours or more	30.37 (1.14)
Time spent in moderate-to-vigorous physical activity (min/day)	29.08 (0.71)
Total energy intake (kcal/day)	2215.49 (18.56)

Values are means or percentage (standard error).

Table 1: Demographic characteristics of participants

Measuring obesity

Obesity status was classified by body fat percentage, as measured by DEXA, which is recognized as a criterion method for body composition measurement [10]. Participants in this study were classified as obese (BF%>25 male; BF%>35 female) or non-obese (BF%≤25 male; BF%≤35 female) [11].

Covariate variables

We used age, sex, race/ethnicity, education level, household income, smoking status, alcohol consumption, physical activity, accelerometer wear time, and total energy intake as covariates in this study.

Data analysis

Logistic regression was used to examine the association between sedentary time and obesity, after controlling for covariates. In the logistic regression analysis, we used ≥9 hours of sedentary time as a reference group, according to a suggested cutoff of daily sedentary time [5]. The SAS v9.4 SURVEYLOGISTIC procedure was used to account for the complex nature of the NHANES sampling scheme.

Results

Detailed demographic characteristics of participants are presented in *Table 1*. An estimated 73.73% reported obesity among US adults in this study.

Results of the logistic regression analysis are reported in *Table 2*. For the whole sample, participants who spent <6 hours sedentary time were less likely to be obese (OR=0.61; 95% CI: 0.43, 0.86), compared to those who spent sedentary time of ≥9 hours. No significant association of sedentary time with obesity was found in young adults. However, middle-aged participants who spent sedentary time of <6 hours were less likely to report obesity (OR=0.51; 95% CI: 0.33, 0.77), compared to those who spent sedentary time of ≥9 hours. Also, among older adults, participants who spent sedentary time of <6 hours (OR=0.27; 95% CI: 0.13, 0.55), 6 hours (OR=0.47; 95% CI: 0.24, 0.91), 7 hours (OR=0.36; 95% CI: 0.20, 0.64), or 8 hours (OR=0.51; 95% CI: 0.33, 0.78) were less likely to report obesity, compared to those who spent sedentary time of ≥9 hours.

Sedentary time	Total	Young (20-35 years)	Middle-aged (36-55 years)	Older (>55 years)
9 hours or more	Reference			
8 hours to <9 hours	0.91 (0.71, 1.16)	0.85 (0.47, 1.54)	1.13 (0.72, 1.79)	0.51 (0.33, 0.78)
7 hours to <8 hours	0.74 (0.54, 1.02)	0.76 (0.45, 1.30)	0.84 (0.53, 1.33)	0.36 (0.20, 0.64)
6 hours to <7 hours	0.72 (0.47, 1.10)	0.75 (0.43, 1.31)	0.69 (0.38, 1.28)	0.47 (0.24, 0.91)
Less than 6 hours	0.61 (0.43, 0.86)	0.68 (0.36, 1.28)	0.51 (0.33, 0.77)	0.27 (0.13, 0.55)

Values are odds ratio (95% confidence interval); model was adjusted for age, gender, race/ethnicity, education level, household income, smoking status, alcohol consumption, moderate-to-vigorous physical activity, and daily total energy intake.

Table 2: Association of sedentary time with obesity according to age groups

Discussion

The present study demonstrates that limiting sedentary time to less than 6 hours per day could lower the risk of obesity, compared to a reference group of ≥ 9 hours spent in sedentary conditions [5]. However, sedentary time of 7 or 8 hours was not beneficial for preventing obesity, compared to ≥ 9 hours. In other words, 6 hours can be suggested as a viable threshold for the prevention of obesity in U.S. adults.

When divided by age group, we found that, for middle-aged adults, daily sedentary time of less than 6 hours was beneficial for preventing obesity, compared to a reference group of ≥ 9 hours. Further, sedentary time of 7 or 8 hours was not beneficial in preventing obesity, compared to ≥ 9 hours, which suggests that sitting for up to 6 hours in middle-aged adults is the maximum allowable time before obesity becomes a concern. For older adults, sitting for up to 6, 7, or 8 hours was beneficial in preventing obesity, compared to ≥ 9 hours, which suggests that 9 hours can be a cutoff of daily sedentary time for this group to prevent obesity.

However, young adult participants who spent 6, 7, or 8 hours of sedentary time were not less likely to be obese, compared to those who spent ≥ 9 hours in a sedentary state. The physical activity level of young adults is relatively high compared to other ages; thus, the relationship between sedentary behavior and obesity may have been offset by their generally high level of physical activity.

The strength of this study is that it objectively measured sedentary time and obesity status. It was also conducted using a nationally representative sample of U.S. adults, and several covariates were included. However, there was a limitation to this study. We could not determine a cause-and-effect relationship between sedentary time and obesity because of the cross-sectional study design. In summary, daily sedentary time is positively related to obesity among U.S. adults. Daily sedentary time of less than 6 hours is beneficial for the prevention of obesity. Particularly, 6 hours and 9 hours can be suggested as a viable threshold for the prevention of obesity for middle-aged and older adults, respectively. In the future, an additional validation study for establishing the sedentary time threshold is warranted.

Practical implications

- Increased sedentary time was related to obesity.
- Daily sedentary time of less than six hours is beneficial for the prevention of obesity for adults.
- 6 hours and 9 hours can be suggested as a viable threshold for the prevention of obesity for middle-aged and older adults, respectively.

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Corresponding author

Heontae Kim
97 Jeanette Phillips Drive, University, MS 38677
Phone: 662-915-1096
Email: hkim35@olemiss.edu



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GUIDELINES HEALTH PROMOTION LARGE DATASET SITTING THRESHOLD