Sedentary time in a nationally representative sample of adults in Japan: Prevalence and sociodemographic correlates

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ABSTRACT

Sedentary behaviour is associated with risks of detrimental health outcomes. It is crucial to understand how much time people spend in sedentary behaviour and what factors affect too much sedentary time for effective intervention. However, few studies examined the prevalence and the correlates of sedentary behaviour in Japan. Therefore, we assessed total sedentary time and its sociodemographic correlates using a nationally representative sample of adults in Japan. Cross-sectional data from Sports-Life Survey in 2016 and 2018 conducted by Sasagawa Sports Foundation was used. Participants' sociodemographic factors and total sedentary time were collected by questionnaires. We classified those with <8 h/day of total sedentary time as "low-sedentary" and those with ≥8 h/day of total sedentary time as "high-sedentary". A multiple logistic regression model was applied to calculate adjusted odds ratios and 95% confidence intervals (95% CIs) for the association of each variable with the "high-sedentary" group (≥8 h/day). In total, 5,346 participants were included in the analyses. On average, time spent in sedentary behaviour was 5.3 h/day (SD = 3.7) among Japanese adults. The percentage of "high-sedentary" was 25.3% (95% CI: 24.1–26.4) and higher body mass index (≥25 kg/m^2), being unmarried, unemployment, and higher educational level (graduate school or university) were positively associated with being "high-sedentary". In conclusion, higher sedentary time was among people with higher body mass index, being unmarried, un-employed, and higher education. Intervention for reducing sedentary time should be developed, targeting people with these characteristics.

1. Introduction

Sedentary behaviour has emerged as an independent behavioural risk factor of cardiovascular diseases, type 2 diabetes, cancer, and all-cause mortality (Biswas et al., 2015; Owen et al., 2020; Patterson et al., 2018). Sedentary behaviour is defined as "any waking behaviour characterized by an energy expenditure ≤1.5 metabolic equivalents while in a sitting, reclining or lying posture" (Tremblay et al., 2017). Understanding the prevalence and correlates of sedentary behaviour is an essential step in developing behavioural interventions to reduce sedentary behaviour.

Several studies have assessed the prevalence of self-reported total sedentary time using nationally representative samples (Aguilar-Farias et al., 2019; Harrington et al., 2014; Wallmann-Sperlich et al., 2013).

For example, a study conducted in the US found that female and male adults reported an average daily sitting time of 4.7 h and 4.8 h, respectively (Harrington et al., 2014). Another study in Germany found that adults spent about 5.3 h/day in sedentary behaviour (Wallmann-Sperlich et al., 2013). A few previous studies estimated the prevalence of total sedentary time in Japan (Bauman et al., 2011; Ishii et al., 2013); however, they used limited samples, not representative of the general population. Additionally, it is crucial to understand the correlates of too much sedentary time for developing effective interventions. For instance, Bennie et al. (2016) found that being male, having higher educational status, lower self-rated health, and higher body mass index were associated with a higher amount of time spent in sedentary behaviour among Australian adults. Another study conducted in six low- and middle-income countries (China, Ghana, India, Mexico, Russia, and

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South Africa) found that living in urban areas, unemployment, smoking, higher body mass index, worse physical and mental health status, poorer self-rated health, and higher levels of disability were associated with higher sedentary behaviour (Koyanagi et al., 2018). Whether those sociodemographic correlates are the same for Japanese adults remains unclear. Country-specific investigations of the prevalence and correlates of sedentary behaviour using nationally representative samples are needed to produce evidence-based behavioural interventions.

Therefore, using a nationally representative sample of adults, this study aimed to examine the prevalence and sociodemographic correlates of total sedentary time in Japan.

2. Methods

2.1. Participants and data collection

The present study was a secondary analysis of the national Sports-Life Survey conducted by the Sasagawa Sports Foundation in June-July 2016 and July-August 2018. This survey was conducted every two years and well-designed to avoid any participants' overlap for each year. Survey participants were selected by the quota sampling method with a set sample size of 3,000 individuals each year. For stratification, all prefectures in Japan were classified into 11 regions. Based on the population size of those aged 18 years or older in each region, 300 areas were allocated. Finally, 3,000 samples (10 samples/area) were distributed, representing the population composition by city size. For selecting participants, they used towns and villages in each municipality on the Japanese Local Government Code Table as primary sampling units, within a range of which they visited households at three-household intervals and extracted participants corresponding to assigned age and sex based on population composition in respective areas. Questionnaires were hand-delivered and later collected by survey conductors with the drop-off and pick-up method. This method has been valid for a higher response rate in population-based surveys (Allred and Ross-Davis, 2011). In 6,000 participants (3,000 participants each year), there were 5,855 people aged 20–79. Ethics approval for the use of analyzed data was obtained from Sasagawa Sports Foundation.

2.2. Measures

2.2.1. Sedentary behaviour.

Participants responded to the question, "How long do you usually spend in sedentary behaviour on a weekday? In the answer, you should include the time spent sitting at a desk at school, work and home, and in sitting, reclining or lying to watch television, to chat with your friends and to read books." The participants reported the typical number of minutes per day. The question has been included in the national survey conducted in Japan, and in this survey, they asked for total sedentary time only on a weekday. The data on a weekend day was not collected in the survey. Since a wide range of total sedentary time (0–19 h), we excluded data below 1st (<0.4 h/day) and above 99th (>16.5 h/day) percentile for the subsequent analyses. Similar to the previous studies (Bennie et al., 2016; Stamatakis et al., 2019), we classified those with <8 h/day of total sedentary time as "low-sedentary" and those with ≥ 8 h/day of total sedentary time as "high-sedentary".

2.2.2. Sociodemographic variables.

Participants provided information on sociodemographic factors such as sex, age, marital status, living arrangements, employment status, education level, and city size by choosing the most suitable response from a set of predetermined options, as follows; marital status (married or unmarried), living arrangements (living with others or living alone), employment status (employed or unemployed), education level (junior college, professional school, high school, junior high school, and primary school, or graduate school and university), and city size (big, medium, or small). Body mass index was calculated from height and

weight and categorized into <25 kg/m^2 and ≥ 25 kg/m^2. Our selection of these sociodemographic factors was based on the previous studies examining the association between total sedentary time and sociodemographic variables (Bakker et al., 2020; 2016, Ding et al., 2019; Herman and Saunders, 2016; Koyanagi et al., 2018; Nicolson et al., 2019).

2.3. Statistical analysis

For the total sedentary time, the distribution was skewed (SK = 0.996). We conducted the data transformation using a natural logarithm, which could not improve the distribution. Therefore, similar to one previous study (Klitsie et al., 2013), we did not transform the data. We estimated the mean ($\pm$SD), median scores and interquartile range (IQR) by each category. Percentages and their 95% CIs were calculated for the "high-sedentary" category. Chi-squared tests were conducted to test the differences between each category by sociodemographic variables. Multiple logistic regression analysis adjusted for all sociodemographic variables was used to estimate the associations of sociodemographic variables with the "high-sedentary" category. Adjusted odds ratios and their 95% CIs were reported. Assessing total sedentary time was more critical because there have not been any studies examining total sedentary time using a nationally representative sample of adults in Japan. However, we also examined the sociodemographic correlates related to be in the "high-sedentary" group (8 or more hours of total sedentary time per day) similar to one previous research conducted in Australia (Bennie et al., 2016). All statistical analyses were conducted using IBM SPSS 26.0 statistical software (SPSS Inc., an IBM Japan, Ltd, Tokyo). For all statistical tests, a p-value of < 0.05 was applied to indicate statistical significance.

3. Results

3.1. Sociodemographic characteristics of participants

After excluding those with missing sedentary behaviour values (n = 93), below the 1st (<0.4 h/day) and above 99th (>16.5 h/day) percentile of sedentary behaviour (n = 107), and at least one sociodemographic value (n = 309), data from 5,346 adults was included in the analysis. Table 1 shows the sociodemographic characteristics of the sample. About 50% in the sample were female (n = 2,651), about 76% were married (n = 4,085), about 93% lived with others (n = 4,982), about 67% were employed (n = 3,583), about 26% completed graduate school or university (n = 1,361), and about 79% had a body mass index < 25kg/m^2 (n = 4,218).

3.2. Total sedentary time

Table 1 also shows the daily average ($\pm$SD), median and IQR of total sedentary time by each category. Of 5,346 participants, the average time spent in sedentary behaviour was 5.3 h/day (SD = 3.7). The median score and IQR were 4.3 and 2.5–7.6, respectively.

3.3. Associations between total sedentary time and sociodemographic variables

Table 2 shows the percentages and adjusted odds ratios of the "high-sedentary" category by sociodemographic variables. About 25% of participants (95% CI: 24.1–26.4) were classified as "high-sedentary". There were significant differences in age, body mass index, marital status, education level and city size for the "high-sedentary" group. However, no significant differences were observed within sex, living arrangements, and employment status.

Table 2 also presents the adjusted logistic regression analysis results for 5,346 participants who answered all of the required questions. Participants whose body mass index was ≥ 25 kg/m^2 (adjusted odds ratio

Table 1
Sociodemographic characteristics and mean, standard deviation, median and interquartile range of total sedentary time of participants.

Characteristics n = 5,346	n (%)	Total sedentary time Mean ± SD (Median)	Interquartile range
Overall	5346 (100)	5.3 ± 3.7 (4.3)	2.5–7.6
Age (year)			
20–29	692 (12.9)	5.6 ± 3.8 (4.5)	2.6–8.3
30–39	886 (16.6)	5.1 ± 3.7 (3.9)	2.2–7.5
40–49	1075 (20.1)	5.1 ± 3.8 (4.0)	2.3–7.4
50–59	879 (16.4)	5.1 ± 3.5 (4.2)	2.4–7.4
60–69	1031 (19.3)	5.4 ± 3.6 (4.6)	2.7–7.3
70–79	783 (14.6)	5.5 ± 3.5 (4.8)	2.9–7.4
Sex			
Male	2695 (50.4)	5.3 ± 3.7 (4.2)	2.5–7.7
Female	2651 (49.6)	5.2 ± 3.6 (4.4)	2.4–7.4
Body mass index (kg/m^2)			
<25	4218 (78.9)	5.2 ± 3.6 (4.2)	2.2–7.4
≥25	1128 (21.1)	5.7 ± 3.8 (4.6)	2.8–8.0
Marital status			
Married	4085 (76.4)	5.1 ± 3.6 (4.2)	2.2–7.2
Unmarried	1261 (23.6)	5.8 ± 3.8 (4.8)	2.7–8.3
Living arrangements			
Living with others	4982 (93.2)	5.3 ± 3.6 (4.2)	2.4–7.5
Living alone	364 (6.8)	5.7 ± 3.9 (4.8)	2.7–8.0
Employment status			
Employed	3583 (67.0)	5.1 ± 3.7 (4.0)	2.1–7.5
Unemployed	1763 (33.0)	5.6 ± 3.5 (4.9)	3.0–7.7
Education level			
<University	3985 (74.5)	5.0 ± 3.5 (4.1)	2.2–6.9
≥University	1361 (25.5)	6.0 ± 4.0 (5.0)	2.7–8.5
City size			
Big	1561 (29.2)	5.5 ± 3.8 (4.7)	2.6–7.9
Medium	2145 (40.1)	5.3 ± 3.6 (4.3)	2.6–7.5
Small	1640 (30.7)	5.1 ± 3.6 (4.1)	2.1–7.1

Table 2
Percentages and adjusted odds ratios (AORs) and their 95% confidence intervals (CIs) of "high-sedentary" by sociodemographic variables.

	High-sedentary (≥8 h/day)	
	% (95%CI)	AOR (95%CI)
Total	25.3 (24.1–26.4)	
Age (year)		
20–29	31.6 (28.3–35.2)	1.00
30–39	24.7 (22.0–27.6)	0.83 (0.65–1.06)
40–49	24.7 (22.2–27.4)	0.87 (0.68–1.11)
50–59	24.3 (21.6–27.3)	0.87 (0.68–1.12)
60–69	23.5 (21.0–26.1)	0.81 (0.63–1.04)
70–79	24.4 (21.5–27.5)	0.86 (0.66–1.12)
p-value	0.003 (<0.01) *	
Sex		
Male	26.0 (24.4–27.7)	1.00
Female	24.5 (22.9–26.1)	1.01 (0.89–1.16)
p-value	0.187	
Body mass index (kg/m^2)		
<25	24.6 (23.3–25.9)	1.00
≥25	27.7 (25.2–30.4)	1.23 (1.05–1.43) *
p-value	0.031 (<0.05) *	
Marital status		
Married	23.7 (22.4–25.0)	1.00
Unmarried	30.3 (27.8–32.9)	1.36 (1.13–1.64) *
p-value	<0.001 *	
Living arrangements		
Living with others	25.1 (23.9–26.3)	1.00
Living alone	28.0 (23.6–32.8)	0.92 (0.70–1.22)
p-value	0.211	
Employment status		
Employed	24.7 (23.3–26.1)	1.00
Unemployed	26.5 (24.5–28.6)	1.21 (1.04–1.41) *
p-value	0.151	
Education level		
<University	22.1 (20.8–23.4)	1.00
≥University	34.6 (32.1–37.2)	1.91 (1.66–2.20) *
p-value	<0.001 *	
City size		
Big	27.6 (25.4–29.9)	1.00
Medium	25.0 (23.2–26.9)	0.88 (0.76–1.02)
Small	23.4 (21.4–25.5)	0.86 (0.73–1.00)
p-value	0.022 (<0.05) *	

*p-value < 0.05.

[AOR], 1.23; 95%CI, 1.05–1.43), unmarried participants (AOR, 1.36; 95%CI, 1.13–1.64), unemployed participants (AOR, 1.21; 95%CI, 1.04–1.41) and those who graduated from the graduate school or university (AOR, 1.91; 95%CI, 1.66–2.20) were more likely to be "high-sedentary". Total sedentary time was not significantly associated with age, sex, living arrangements and city size.

4. Discussion

The present study aimed to examine the prevalence and sociodemographic correlates of total sedentary time, using a nationally representative sample of adults in Japan. We found that adults in Japan spent an average of 5.3 h/day in sedentary behaviour.

The percentage of the "high-sedentary" group (those with ≥8 h/day sedentary time) was 25.3% in this study. This percentage was higher than a previous study conducted in Australia which found 21.1% of their participants spent ≥8 h/day in sedentary time (Bennie et al., 2016). A multi-countries study found that the percentage of participants with ≥9

h/day of sitting time in Japan was highest among 20 countries. However, the participants were mostly aged <40–49 years old (Bauman et al., 2011). While it remains challenging to compare these studies due to different age groups and sedentary behaviour threshold, the percentage of the "high-sedentary" group in Japan tends to be one of the highest worldwide. The number of working people may play a role here: >60% of the populations work in Japan (Ministry of Internal Affairs and Communications, 2019). They spend approximately 70% of their working hours in sedentary behaviour (Ishii et al., 2018). In the US (United States Department of Labor, 2019) and Germany (Eurostat, 2017), working people spend 42.2% and 49.6% of their working hours in sitting, respectively. Another reason for the higher percentage of the "high-sedentary" group in Japan can be due to their long waking time. According to the OECD survey (Organisation for Economic Co-operation and Development, 2021), Japanese people spent the least sleep time among 33 countries. Future studies using 24-hour activity composition are needed to identify the reasons for high sedentary behaviour in Japan compared with other countries.

Our findings showed that several sociodemographic factors, including higher body mass index, being unmarried, being unemployed, and higher educational status, were associated with being "high-sedentary". These results were similar to several previous studies (Bakker et al., 2020; Bennie et al., 2016; Ding et al., 2019; Herman and Saunders, 2016; Koyanagi et al., 2018; Nicolson et al., 2019). For example, a study conducted in six low- and middle-income countries found that 8 h or more of total sedentary time per day was associated

with higher body mass index and unemployment (Koyanagi et al., 2018). Another study conducted in the Netherlands found that 8 h or more of total sedentary time per day was associated with higher body mass index, higher educational status, and being unmarried (Bakker et al., 2020). However, our finding on the employment status and sedentary behaviour is in contrast with several previous studies. For instance, Bakker et al. (2020) and Ding et al. (2019) found that employed adults spent a higher amount of time sitting than unemployed adults. This inconsistency can be because of the lack of consensus on the definition of employment in the previous studies.

This study has some limitations. Sedentary time was self-reported by the questionnaire, which may cause recall bias (Chastin et al., 2018). However, for large population-based study, assessing objective accelerometer-based sedentary behaviour measures in large population-based cohorts is time-consuming and usually resulted in a lower response rate (Colley et al., 2018). Also, while the survey is being used as a national survey in Japan, the sedentary behavior item has not been validated yet. This is a cross-sectional study; therefore, we cannot infer any causal relationships between total sedentary time and sociodemographic variables. To the best of our knowledge, this was the first study that examined the prevalence of total sedentary time and its socio-demographic correlates using a nationally representative sample in Japan. National data collected through quota sampling is the strength of our study.

5. Conclusions

Japanese adults spent, on average, 5.3 h/day in sedentary behaviour. A higher amount of time in sedentary behaviour was associated with higher body mass index, unmarried, unemployment, and higher educational status. Due to the use of a nationally representative sample, this study provided unique evidence on the prevalence and the correlations of adults' sedentary time in Japan. Further studies are required to examine the reasons for a higher sedentary time among adults with these sociodemographic characteristics in this context.

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CRediT authorship contribution statement

Aino Kitayama: Conceptualization, Methodology, Writing - original draft, Writing - review & editing. **Mohammad Javad Koohsari:** Methodology, Writing - review & editing. **Kaori Ishii:** Project administration, Writing - review & editing. **Ai Shibata:** Project administration, Writing - review & editing. **Koichiro Oka:** Conceptualization, Supervision, Writing - review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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