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Research article

Tri-Axial Accelerometer-Determined Daily Physical Activity and Sedentary Behavior of Suburban Community-Dwelling Older Japanese Adults

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Abstract

Knowledge regarding accelerometer-derived physical activity (PA) and sedentary behavior (SED) levels is scarce for Japanese older adults. The aims of this study were therefore to 1) describe levels of PA and SED in Japanese community-dwelling older adults, using tri-axial accelerometer; 2) examine the variation of PA and SED with respect to sex, age, and body mass index (BMI). Participants of this study were from the baseline survey of the Sasaguri Genkimon Study, who were 65 years or older and not certified as those requiring long-term care. PA was assessed objectively for seven consecutive days using tri-axial accelerometer. A total of 1,739 participants (median age: 72 years, men: 38.0%) with valid PA data were included. Overall, participants in the present study spent 54.5% of their waking time being sedentary and 45.5% being active, of which 5.4% was moderate-to-vigorous physical activity (MVPA). Women accumulated more minutes of light physical activity (LPA) and MVPA compared with men. In contrast, men spent more time being sedentary. Mean steps per day did not differ between sexes. Furthermore, participants with higher BMI (BMI ≥25) had lower PA levels, and longer SED compared with those with lower BMI (BMI <25). PA levels were lower and SED was longer with age. The present study is the first to demonstrate that the levels of PA and SED differed by sex, age, and BMI in Japanese community-dwelling older adults. In particular, women were more active compared with men, providing unique insight into the current level of PA in older adults. Data presented in the study will enable further investigation of additional determinants of PA and SED in order to develop effective population-based intervention strategies to promote PA and reduce prolonged SED in the Japanese population and possibly other rapidly aging societies.

Key words: Tri-axial accelerometer, physical activity, sedentary behavior, community-based study, older adults.

Introduction

A large body of evidence indicates that higher levels of physical activity (PA) in late life are associated with reduced risks of several chronic diseases and all-cause mortality (Nelson et al., 2007). On the other hand, sedentary behavior (SED), defined as any waking behavior characterized by an energy expenditure ≤1.5 metabolic equivalent units (METs) while in a sitting or reclining posture, is increasingly recognized as a life-style factor raising the risk of cardiovascular disease, type 2 diabetes and mortality, independent of PA levels (Biswas et al., 2015; Chomistek et al., 2013; Koster et al., 2012). Therefore, accurate measurement of the PA and SED levels in community-dwelling older population under free living conditions is needed to improve the understanding of daily PA and SED, and to inform public health strategies to increase PA and reduce SED in older adults.

Traditionally, epidemiological studies rely on subjective measures, such as questionnaires and behavioral records, in the assessment of PA in community-dwelling older people. However, such measures are often reported to either over- or underestimate PA levels due to recall bias, particularly in older adults (Kowalski et al., 2012). Moreover, many of the existing subjective tools fail to measure SED and light-intensity PA adequately (Shephard, 2003), while these two might be major determinants of daily PA level for older adults (Colbert et al., 2014; Meijer et al., 2001). Alternatively, accelerometers are capable of measuring PA objectively, and thus have been widely accepted as valid measures of PA in a number of populations including older adults (Copeland and Esliger, 2009; Lee and Shiroma, 2014). More recently, a tri-axial accelerometer with its prediction models accounting for the type of activity performed has been shown to yield more accurate estimation of PA intensity (Midorikawa et al., 2007; Ohkawara et al., 2011), which might potentially improve the understanding of daily PA and SED in older adults.

To date, there are only a few large-scale studies that objectively assessed PA and SED using accelerometers in older adults while most of accelerometer-based studies were carried out in the western population (Arnardottir et al., 2013; Davis et al., 2011; Evenson et al., 2012; Hansen et al., 2012; Jefferis et al., 2014; Lohne-Seiler et al., 2014). Little is known regarding accelerometer-derived PA and SED levels in older adults in countries of different cultures and environments, such as Japan. Moreover, although the Japanese society undergoing the world's fastest aging, Japan has the highest healthy life expectancy at birth (Tamiya et al., 2011). Thus, data from older adults in Japan may provide unique insight into the current levels of PA and SED in older adults. The main aims of this study were therefore to 1) describe levels of PA and SED in Japanese community-dwelling older people, using tri-axial accelerometers, 2) examine the variation of PA and SED with respect to sex, age, and body mass index (BMI).

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Methods

Participants

The present study was performed as part of the baseline survey of Sasaguri Genkimon Study (SGS) conducted from May to August 2011. The design of the SGS is described in detail elsewhere (Narazaki et al., 2013; 2014). Briefly, it is an ongoing community-based prospective study in the town of Sasaguri, a suburban town on Kyushu Island located in the southwest part of Japan, aiming to explore modifiable lifestyle factors causing older adults to require long-term care. Subjects of the baseline study (SGS-1) were all residents of the town, who were 65 years or older and not certified as individuals requiring long-term care by Japan's Long-term Care Insurance System (Tsutsui and Muramatsu, 2005) at the end of January 2011 (n = 4,979: 15.7% of residents of the town, men: 43.6%). Sixty-six subjects were excluded due to being dead or moving out by the onset of the study. A set of study information sheets and a questionnaire were mailed to all remaining subjects (n = 4,913), and 2,629 individuals, hereafter referred to as the participants of the SGS-1, agreed to take part in SGS-1 by 1) visiting the nearest community center or municipal office of the town, 2) agreeing to take an individual home-testing session if they were unable to come or not available on the testing day (recruitment rate: 53.5%). All participants of SGS-1 were invited to take part in the study of objectively measured PA during the SGS-1. Of these, we excluded 582 individuals who did not wear the accelerometer, 300 individuals providing less than 4 days of valid accelerometer data, and 8 participants missing BMI data (Figure 1). Given that individuals with long-term care needs were excluded from the SGS during the prescreening process and quality of the accelerometer data depends on participants' compliance (Wilcox et al., 2002), no additional exclusion criterion was decided to maximize the sample size. Thus, 1,739 participants were included in the present analysis (66.1% of the baseline sample) (Figure 1). All the participants provided written informed consent, and the study was conducted in accordance with the declaration of Helsinki and was approved by the Institutional Review Board of the Institute of Health Science, Kyushu University.

PA measures

PA was measured by a tri-axial accelerometer (Active style Pro HJA-350IT, Omron Healthcare, Kyoto, Japan). Participants were instructed to wear the accelerometer on either the right or left side of their waist for consecutive 7 days and to remove the accelerometer only before going to bed or water activities. A simple instruction and a log diary were also provided to encourage the compliance to accelerometer protocols.

Technical specification and data acquisition system for the Active style Pro have been previously reported (Ohkawara et al., 2011; Oshima et al., 2010). Briefly, data was collected in 1-minute epochs for the data analysis. An established model, in combination with PA classification algorithm for discrimination between locomotive and non-locomotive activities, was used to estimate the intensity of PA (Ohkawara et al., 2011). METs determined by the Active style Pro have been reported to be closely correlated with METs calculated by the indirect calorimetry, with an average percentage of differences less than 10% (Ohkawara et al., 2011). Accordingly, intensity of PA captured was expressed in METs (Ohkawara et al., 2011). Non-wearing time was defined as at least 60 consecutive minutes of zero counts, with allowance for 2 minutes with counts greater than zero. Data for participants with at least 4 valid wear days (at least 10 hours of wear time per day) were included in the analysis, which is in line with previous studies to estimate habitual PA in older adults(Arnardottir et al., 2013; Hansen et al., 2012; Lohne-Seiler et al., 2014).

METs-based cut-points were used to define SED, light PA (LPA), and moderate-to-vigorous PA (MVPA) as following: ≤1.5 METs for LPA, 1.6-2.9 METs for LPA, and ≥3 METs for MVPA (Ainsworth et al., 2000; Owen et al., 2010). Number of steps (steps per day) was also calculated using data from the accelerometer. Number of steps and numbers of minutes for the respective activities were summed over valid days, and mean values were then calculated.

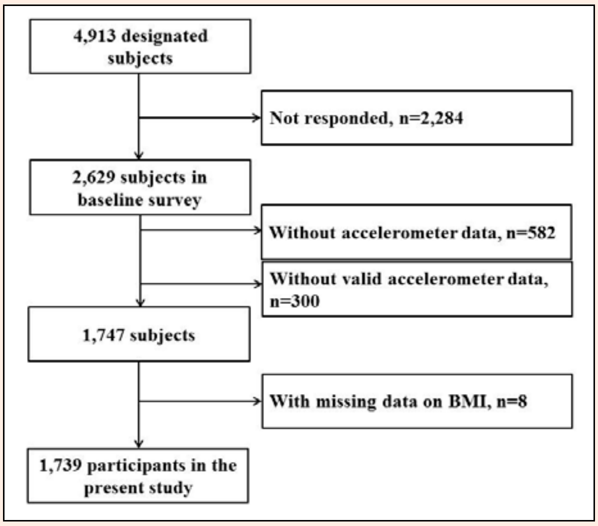

Figure 1. Flow chart of participation. BMI, body mass index.

Other measures

Demographic variables including age and sex were provided by the town. Body mass (kg) and height (m) were measured using standard protocols. BMI was calculated as weight mass divided by height squared (kg·m^{-2}) and then categorized into two groups: BMI <25 and BMI ≥25. Age was categorized into the following four groups: 65-69, 70-74, 75-79, and 80 years or older.

Statistical analysis

Descriptive data are presented as mean and standard deviation (SD) except where noted. The Mann–Whitney U-test and the chi-square test were conducted to compare age and sex, respectively, between participants of the present study and the rest of the subjects including subjects who did not respond to SGS and participants who

Table 1. Participants characteristics by sex, age, and body mass index (BMI).

	All (n = 1,739)	Men (n = 660)	Women (n = 1,079)
Age*, years	72 (68-78)	72 (68-77)	72 (68-78)
Age groups, n (%)			
65-69	576 (33.1)	221 (33.5)	355 (32.9)
70-74	486 (28.0)	192 (29.1)	294 (27.3)
75-79	371 (21.3)	139 (21.1)	232 (21.5)
≥80	306 (17.6)	108 (16.4)	198 (18.4)
BMI, kg·m^{-2}	23.1 (3.1)	23.2 (2.7)	23.1 (3.4)
BMI groups, n (%)			
BMI <25	1,308 (75.2)	504 (76.4)	804 (74.5)
BMI ≥25	431 (24.8)	156 (23.6)	275 5.5)

* Data are represented as median (interquartile range).

were excluded from the SGS-1 (n = 3,174). The Student's t-test was used to performed to assess the difference in BMI between the participants of the present study and participants excluded from the SGS-1 (n = 890).

Sex, age, and BMI differences in each of the PA variables were tested by three-way analysis of variance (ANOVA) including all possible interaction terms. Tukey-Kramer post-hoc tests were performed within significant age effects to identify differences across age groups. Because the distributions of time spent in MVPA and number of steps per day were positively skewed, we used a log transformation (log[x]) prior to the analyses. In the descriptive tables and figures, non-transformed data were presented for easy interpretation. A significance level was set at two-sided $\alpha = 0.05$. All statistical analyses were conducted using the SAS version 9.3 (SAS Institute Inc., Cary, N.C., USA).

Results

The participants of the present study differed from the rest of the subjects in terms of sex (higher percentage of women in the present study, $p < 0.001$), but not in terms of age ($p = 0.125$). Also, BMI was not different between the participants of the present study and those excluded from the SGS-1 ($p = 0.112$).The median age (interquartile range or IQR) was 72 (68-79) years and 38.0% of the participants were men. Table 1 presents the characteristics of the present participants and the frequency distribution of the sample by sex, age, and BMI groups.

Overall, mean (SD) accelerometer wear time was 13.8 (1.7) hours/day. The average steps/day among participants varied widely (49-20,872 per day). The mean (SD) or median (IQR) of the time spent in SED, LPA and MVPA were 7.5 (2.0) hours, 5.5 (1.6) hours, and 37.8 (19.0-60.7) minutes. Accordingly, the mean (SD) of the proportion of the wear time spent in SED, LPA and MVPA were 54.5% (12.9%), 40.2% (11.1%), and 5.4% (4.0%). Descriptive statistics of the PA by sex, age and BMI groups are presented in Table 2.

Results of ANOVA indicated significant age and BMI effects in steps/day, while there was no main effect for sex ($p = 0.3529$) (Table 2). Only one significant interactive effect was observed in steps/day: age × BMI ($F = 3.18$, $p < 0.05$) (Table 2). Post hoc comparisons showed significant difference between all age groups except between 70-74-yr and 75-79-yr age groups in higher BMI group. Within age groups, lower BMI group accumulated more steps/day than higher BMI group only in the oldest age groups (Figure 2).

There were significant gender, age, and BMI effects in SED and PA of different intensities (LPA and MVPA), and no significant interactive effects were observed (Table 2). Men had longer SED ($F=91.10$, $p < 0.0001$), and accumulated fewer minutes of LPA and MVPA ($F = 422.97$, $p < 0.0001$, and $F = 18.09$, $p < 0.0001$, respectively) than women. There was significantly shorter SED in lower BMI group compared with higher

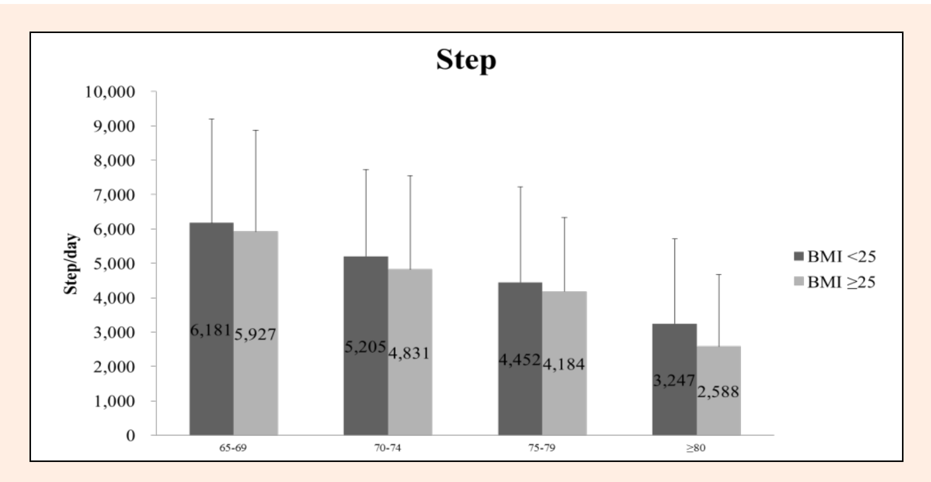

Figure 2. Mean steps/day by age and BMI groups (columns are means and standard deviation). BMI: body mass index.

Table 2. Tri-axial accelerometer-determined PA and SED by sex, age, and BMI.

	All (n=1,739)	Men (n=660)	Women (n=1,079)	P-value
Step (steps/day) †	4,473 (2,861-6,523)	4,615 (2,987-6,900)	4,402 (2,797-6,356)	0.3529
		Age groups		<.0001 [a]
65-69	5,670 (3,976-7,806)	5,767 (4,179-8,021)	5,583 (3,815-7,527)	
70-74	4,795 (3,301-6,600)	4,550 (3,229-6,538)	4,925 (3,374-6,713)	
75-79	3,986 (2,468-5,609)	4,174 (2,655-6,101)	3,778 (2,407-5,565)	
≥80	2,561 (1,396-4,089)	2,986 (1,694-4,716)	2,436 (1,351-3,729)	
		BMI groups		0.0011 [b]
BMI <25	4542 (2,922-6,672)	4,757 (3,014-7,084)	4,409 (2,818-6,426)	
BMI ≥25	4292 (2,730-6,042)	4,229 (2,779-6,191)	4,295 (2,720-6,042)	
SED (minutes/day)	451.6 (122.4)	485.4 (129.6)	431.0 (113.0)	<.0001 [c]
		Age groups		<.0001 [a]
65-69	430.8 (122.0)	458.5 (132.6)	413.6 (111.6)	
70-74	451.6 (124.1)	492.6 (137.0)	424.8 (106.9)	
75-79	456.1 (114.5)	493.8 (111.6)	433.5 (110.4)	
≥80	485.3 (122.4)	516.7 (122.4)	468.2 (119.2)	
		BMI groups		0.0009 [b]
BMI <25	446.6 (122.5)	482.2 (128.9)	424.3 (112.8)	
BMI ≥25	466.8 (120.9)	495.7 (131.5)	450.4 (111.5)	
LPA (minutes/day)	332.5 (98.1)	278.8 (89.3)	365.3 (88.3)	<.0001 [c]
		Age groups		<.0001 [a]
65-69	350.8 (96.3)	297.2 (88.9)	384.2 (85.1)	
70-74	334.8 (99.4)	272.6 (90.6)	375.4 (82.6)	
75-79	326.5 (90.5)	278.2 (77.3)	355.4 (85.6)	
≥80	301.5 (100.1)	253.2 (95.4)	327.8 (92.6)	
		BMI groups		<.0001 [b]
BMI <25	338.2 (98.0)	284.0 (87.9)	372.1 (88.3)	
BMI ≥25	315.1 (96.5)	262.0 (92.1)	345.3 (85.5)	
MVPA (minutes/day)	37.8 (19.0-60.7)	33.7 (16.8-57.9)	40.0(20.2-63.3)	<.0001 [c]
		Age groups		<.0001 [a]
65-69	54.2 (33.6-78.1)	53.3 (31.0-69.8)	54.9 (35.6-83.8)	
70-74	39.7 (23.3-58.8)	34.7 (21.3-53.2)	40.8 (26.8-66.0)	
75-79	31.0 (14.6-50.6)	25.9 (13.0-44.0)	33.3 (15.9-55.1)	
≥80	16.8 (7.6-34.5)	14.2 (7.1-32.1)	18.5 (7.7-34.8)	
		BMI groups		0.0408 [b]
BMI <25	38.9 (19.4-62.8)	34.6 (17.1-59.3)	41.3 (20.5-66.1)	
BMI ≥25	35.8 (17.5-56.4)	32.1 (15.7-49.9)	37.1 (19.4-59.3)	

Note: Data are represented as median (interquartile range) or Mean (SD). [a] Significant difference among age groups. [b] Significant difference between BMI groups.[c] Significant difference between sexes. † Significant age×BMI interaction effect. PA, physical activity; SED, sedentary behavior; BMI, body mass index; LPA, light physical activity; MVPA, moderate-to-vigorous physical activity.

BMI group ($F = 11.12$, $p < 0.001$). In contrast, time spent in LPA and MVPA were higher in lower BMI group compared with the higher BMI group ($F=28.28$, $p < 0.0001$, and $F = 4.19$, $p < 0.05$, respectively). Post hoc comparisons showed that the oldest age group spent significantly longer time in sedentary time and shorter time in LPA than other 3 age groups (Figure 3A and B, respectively). There was a marked decline in time spent in MVPA across the age groups, with significant differences between all age groups (Figure 3C).

Discussion

The present study included a larger sample than previous Japanese older adults based studies of objectively measured PA (Osuka et al., 2015; Yasunaga et al., 2008), and to our knowledge, is the first one to objectively measure SED using tri-axial accelerometer in community-dwelling older adults in Japan. The present study shows that the older adults spent 54.5% of their waking time being sedentary and 40.2% as LPA, while only a small proportion of the active time was spent in MVPA. Overall, median MVPA (IQR) was 33.7 (16.8-57.9) and 40.0 (20.2-63.3) minutes per day in men and women, respectively. The PA levels were lower and SED was longer with age. Furthermore, participants with higher BMI had lower PA levels, and longer SED than participants with lower BMI. In contrast with previous observations in western populations (Arnardottir et al., 2013; Davis et al., 2011; Evenson et al., 2012; Jefferis et al., 2014), women spent less time in SED and more time in LPA and MVPA than men in the present study. In light of this, the commonly accepted assumption that men are more active than women might be not the case in Japanese older population.

On average, men took 5,201 steps/day and women took 4,771 steps/day in the present study which were slightly higher than accelerometer-determined data observed in UK (Davis et al., 2011) and U.S. older adults (Tudor-Locke et al., 2013). In the Nakanojo Study, among 95 Japanese older adults, both men and women took much higher yearlong-averaged steps/day than data reported in the present study, which may explained by their convenience sampling method (Yasunaga et al., 2008). With respect to intensity distribution, the participants in the

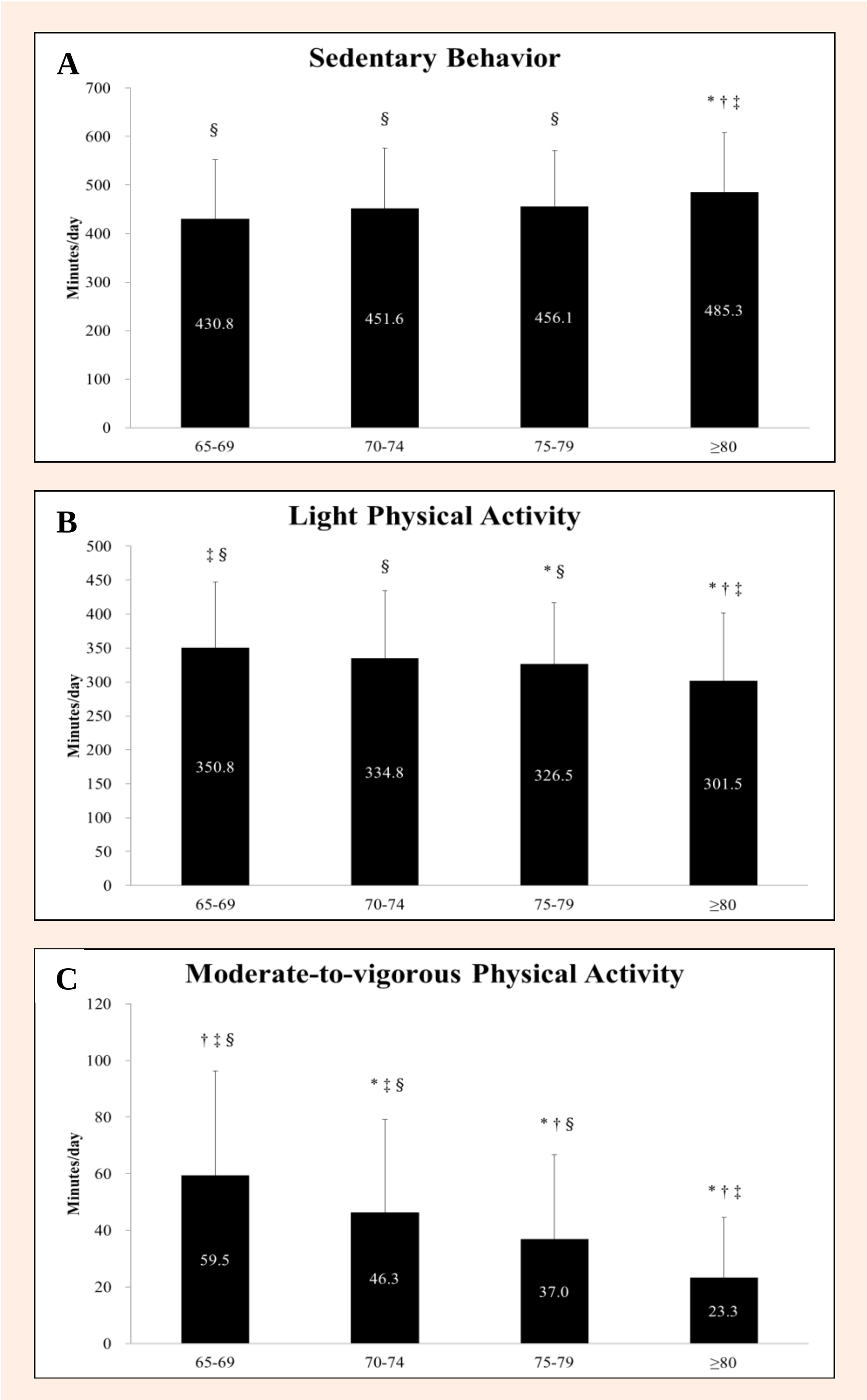

Figure 3. **Mean minutes spent in SED, LPA, and MVPA by age groups (columns are means and standard deviation).**
* Significantly ($p < 0.05$) different from the 65- 69-yr age group. † Significantly ($p < 0.05$) different from the 70- 74-yr age group. ‡ Significantly ($p < 0.05$) different from the 75- 79-yr age group. §Significantly ($p < 0.05$) different from the ≥80-yr age group. SED: sedentary behavior, LPA: light physical activity, MVPA: moderate-to-vigorous physical activity.

present study spent 7.5 hours (54.5%) in SED, 5.5 hours (40.2%) in LPA, and 44.6 minutes (5.4%) in MVPA. Based on the observed results, participants in the present study appeared to be somewhat more active than that have been reported in Iceland (Arnardottir et al., 2013) and Norway (Lohne-Seiler et al., 2014), in terms of smaller proportion of SED and greater proportion of LPA and MVPA. However, direct comparison between the present study and previous studies is somewhat problematic, because of existence of regional difference, the use of different methods, and more specifically different accelerometers and differences in data processing procedures. To date, most accelerometers in previous studies recorded acceleration data only from the vertical axis. A cut-point approach, which is developed from a single calibration equation, has been extensively used to distinguish intensity categories (e.g., LPA and MVPA) (Freedson et al., 1998; Hendelman et al., 2000). Unfortunately, much of the equation has derived only from locomotive activities, which was found to significantly underestimate the intensity of most lifestyle activities (e.g., laundry, cooking, vacuuming) (Bassett et al., 2000; Hendelman et al., 2000). On the other hand, the equations developed on moderate-intensity lifestyle activities tended to overestimate sedentary and light activities (Crouter et al., 2006). In contrast, the Active style Pro has been used in combination with its PA classification model developed from the synthetic acceleration of all three axes (anterior-posterior, mediolateral, and vertical direction), and thus provided a substantial improvement compared to non-classification model for estimating the intensity of various PA, accuracy improvements occurred for household activities in particular (Ohkawara et al., 2011). Given that the majority of activities in older adults is LPA and comes from daily life, the tri-axial accelerometer used in the present study would allow for more accurate estimation of daily activities in older adults.

Based on studies conducted in western populations (Arnardottir et al., 2013; Davis et al., 2011; Evenson et al., 2012; Jefferis et al., 2014), the bulk of the literature supports a higher level of PA among men. In contrast with previous observations, the present study showed that women were more active than men, in terms of time spent in MVPA. As indicated above, one explanation for the discrepancy in sex differences is the different methodologies used to quantify PA. In consideration of traditional gender roles, women are more involved in household activities, intensity of which would have formerly been underestimated (Bassett et al., 2000; Hendelman et al., 2000). Indeed, some of the household activities are applicable to activities above 3 METs, such as vacuuming, sweeping and mopping (Bassett et al., 2000). Thus, it is conceivable that the underestimated intensities of household activities might lead to underestimating MVPA in women in previous studies. Furthermore, Japanese older women may spend more time in household activities than western older women. According to the NHK (Nippon Hoso Kyokai, a Japan's national public broadcasting organization) National Time Use survey, over 88% of Japanese older women carried out housework on every day of the week, while that for older men were far lower than women, which were less than 59% on weekdays, less than 62% on Saturdays, and less than 58% on Sundays (Kobayashi et al., 2011). Accordingly, women spend substantially more time in housework than men, which may be a possible explanation for the observation in the present study that women spent more time in MVPA compared with men. Therefore, difference of lifestyle of older women between Japan and western population may also partly explain the discrepancy in sex differences in PA levels. The substantially higher LPA and lower SED in women than men observed in the present study, which are consistent with previous studies (Arnardottir et al., 2013; Davis et al., 2011; Hansen et al., 2012; Jefferis et al., 2014; Lohne-Seiler et al., 2014). Moreover, the non-significant difference in daily steps between the sexes observed in the present study suggests that, in addition to locomotive activities (e.g., walking, jogging), lifestyle activities may play a significant role to overall PA levels in women.

Consistent with previous studies (Arnardottir et al., 2013; Davis et al., 2011; Hansen et al., 2012; Lohne-Seiler et al., 2014), higher age is related to lower levels of PA and longer SED. A sharp decline in MVPA was observed across the age groups, which is not surprising, as the aging process along with functional limitations and health conditions may limit the ability to engage in or maintain MVPA (Brawley et al., 2003). In contrast, LPA remained relatively stable until age 80-yr, which seems to correspond with the observed age-related increase in SED. We could speculate that those spent less time in LPA may, therefore, spend more time in SED. Given recent findings by Buman et al. showing significant associations of objectively measured LPA with both physical and psychosocial well-being in older adults (Buman et al., 2010), replacing SED by LPA may be a practical and meaningful intervention strategy designed to increase PA levels for older adults.

In regard to BMI and PA, participants with higher BMI had fewer LPA and MVPA, and longer SED compared with those with lower BMI. These findings are consistent with existing cross-sectional data that showed lower PA levels and longer SED with increasing BMI (Arnardottir et al., 2013; Davis et al., 2011). In the present study, the difference in daily steps between BMI categories was observed only in the oldest age group. Given the different levels of PA and SED between BMI categories in the present study, BMI should be taken into account in the future PA interventions study in the Japanese old adults, especially for the oldest older group.

The major strength of the present study is the use of tri-axial accelerometer to assess PA and SED, which allowed for a more accurate estimate of PA intensity compared with a conventional uni-axial accelerometer (Midorikawa et al. 2007; Ohkawara et al., 2011). An additional strength is that the present report is based on a relatively large population-based cohort of older Japanese adults, which is a population of particular public health interest given the Japanese society undergoing the world's fastest aging with the highest health life expectancy (Tamiya et al., 2011). Limitations of the present study should also be considered in the interpretation of our findings. First, the sample of the present study was affected to some extent by the nonresponse, withdrawal and exclusion of originally designated subjects, which may reduce the potential for generalization. However, there was no age or BMI bias. Moreover, men included in the present study had better physical and cognitive function than those excluded from SGS-1 (data not shown). PA levels might be somewhat overestimated in men, thus it is reasonable to assume that higher response rate in women would not affect the sex-differences in PA levels. Second, it is known that limitations of accelerometers include their inability to detect some type of PA, such as water activities and cycling, thus these activities are likely to be missed or underestimated. However, such kinds of activities were not common according to the self-reported questionnaires in the present cohort (data not shown), which may diminishes the possibility that PA level was underestimated.

Conclusion

In summary, the present study first demonstrated PA levels and SED differed by sex, age, and BMI in Japanese community-dwelling older adults. In particular, findings that women were more active compared with men, provide unique insight into the current level of PA in older adults. Further research including a wider range of socio-demographic, psychological and environmental factors is recommended to provide a more comprehensive understanding of the determines of PA and SED in older adults, which will benefit the development of effective population-based intervention strategies to increase PA and reduce prolonged SED in the Japanese population and possibly other rapidly aging societies.

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Key points

- Accelerometer, that is capable to assess PA more precisely in large scale epidemiological studies, provides opportunity for improving understanding of daily PA in older adults.
- This study first demonstrated that the levels of PA and SED differed by sex, age, and BMI in Japanese community-dwelling older people.
- Women were more active compared with men, in terms of more minutes of MVPA.

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