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【Brief Communication】

Domains of physical activity and self-reported health

Kenji Tsunoda,[1] Yuko Kai,[1] Naruki Kitano,[2,3] Ken Uchida,[4]
Tsutomu Kuchiki,[5] Tomohiro Okura,[6]
and Toshiya Nagamatsu[1]

Introduction

Physical activity（PA）can be achieved through various domains such as leisure-time, travel and occupational PA. Although PA provides numerous health benefits, the effects of individual PA domains may differ. For example, some studies[4,6] reported that spending an extended period of time engaged in occupational PA was linked with mental distress, whereas they confirmed the positive association between leisure-time PA and mental status. Additionally, Wanner et al.[10] confirmed a longevity effect with leisure-time PA but not with work-related PA. However, the health benefits associated with non-leisure time PA, such as travel, household activity and work PA, are still uncertain, and there may be a positive association between non-leisure-time PA and other beneficial health-related outcomes.

Self-reported health is a simple and powerful indicator of physical and psychological health,[8] and it can also predict mortality.[3] An Estonian study,[5] found a positive association between leisure-time PA and self-reported health, and a negative association between work PA and self-reported health. However, the study was limited only to women. Additionally, findings from western populations are not always applicable to Japanese people.

The purpose of this study is to investigate whether there are associations between individual PA domains and self-reported health in Japanese men and women.

Methods

A. Participants and data collection

Data were gathered at health check-ups conducted in Meiji Yasuda Shinjuku Medical Center in Shinjuku Ward, Tokyo, Japan. The majority of participants were employees and their spouses, with employers providing financial support for the annual health check-ups. We obtained 13498 examinees' data from May 2013 to March 2014. Of these people, 2630 individuals were excluded due to incomplete data, leaving 10868 men and women for the data analysis. All participants provided informed consent. The Ethical Committee of Meiji Yasuda Life Foundation of Health and Welfare approved this study（Approval number: 25005）.

B. Measurement variables

1． Physical activity

We assessed PA with the long version of the International Physical Activity Questionnaire（IPAQ）.[1] The IPAQ evaluates PA in a typical week in segments of at

1）Physical Fitness Research Institute, Meiji Yasuda Life Foundation of Health and Welfare, Tokyo, Japan.
2）Graduate School of Comprehensive Human Sciences, University of Tsukuba, Ibaraki, Japan.
3）Research Fellow of the Japan Society for the Promotion of Science, Tokyo, Japan.
4）Meiji Yasuda Shinjuku Medical Center, Meiji Yasuda Life Foundation of Health and Welfare, Tokyo, Japan.
5）Meiji Yasuda Wellness Development Office, Meiji Yasuda Life Foundation of Health and Welfare, Tokyo, Japan.
6）Institute of Health and Sport Sciences, University of Tsukuba, Ibaraki, Japan.

least 10 minutes and 3 metabolic equivalents (METs). The IPAQ considers the following 4 domains: leisure-time, household, travel and work PA. In each PA domain, we categorized participants as either not engaging, or engaging at less than 5.0 MET-h/wk, at 5.0 to 9.9 MET-h/wk or at 10.0 or more MET-h/wk. Additionally, as basic information, we made 4 categories for total PA: less than 10.0 MET-h/wk, 10.0 to 19.9 MET-h/wk, 20.0 to 29.9 MET-h/wk and 30.0 or more MET-h/wk.

2. Self-reported health

To assess self-reported health, participants responded to the question "Overall, how would you rate your health during the past month?" on a 6 point Likert scale (excellent, very good, good, fair, poor and very poor) by referencing the SF-8 health survey.[2] For analysis, we coded the responses of self-reported health into binary variables: excellent, very good and good were coded as good; and fair, poor and very poor were coded as poor.

3. Other variables

Demographic variables included age, gender, body mass index (BMI), education years, economic status (very good, good, poor and very poor), living arrangement (alone or living with someone), working status (engaging or not engaging), alcohol consumption (never, < 20.0 grams/day and ≥ 20.0 grams/day), smoking status (never, former and current), meat and green/yellow vegetable intake (never or seldom, once every two days and one or more times per day). We determined all demographic variables except BMI through a self-administered questionnaire.

C. Statistical analysis

Analyses were conducted by gender. We confirmed gender differences in characteristics using chi-squared tests for categorical variables and the Student's t-test for continuous variables. Logistic regression analysis was used to confirm the associations between PA domains and self-reported health. The odds ratios (ORs) and 95% confidence intervals (95% CIs) were adjusted by age, BMI, education years, economic status, living arrangement, working status, alcohol consumption, smoking status and meat and vegetable intake. Additionally, we entered the four domains of physical activity simultaneously into the model to adjust for their effects on each other as covariates. We used SPSS 21.0 for statistical analysis with the level of significance set at $P < 0.05$.

Results

Table 1 shows characteristics of participants. The rate of self-reported poor health was higher in women (32.2%) than in men (27.7%). Men were more likely to engage in leisure-time and work PA compared with women, whereas women engaged in household PA at a higher rate than men.

Table 2 presents the associations between PA domains and self-reported health. In both men and women, higher levels of leisure-time PA were associated with a lower rate of self-reported poor health. However, men who engaged in 10 or more MET-h/wk of work PA were more likely to report poor health compared with men who did not engage at this level of work PA. Similarly, in women there was a significant linear trend between higher levels of work PA and a higher rate of poor health. Women were also more likely to report poor health when they engaged in 1 to 9 MET-h/wk of travel PA. There was no association between household PA and self-reported health in either men or women. Higher levels of total PA were associated with a lower rate of self-reported poor health in both men and women.

Discussion

This study investigated the association between PA domains and self-reported health. Although increasing leisure-time PA corresponded with a decreasing rate of poor health in both men and women, higher levels of travel PA in women and work PA in both men and women were associated with a higher rate of perceived

Table 1. Characteristics of participants.

	Men (n = 5458)	Women (n = 5410)	*P* value
Mean (SD) age (years)	49.0 (11.8)	48.4 (11.5)	0.005
Mean (SD) BMI (kg/m^2)	23.8 (3.2)	21.6 (3.3)	< 0.001
Mean (SD) education (years)	15.6 (1.7)	14.4 (1.9)	< 0.001
Economic status			
Very good	343 (6.3)	351 (6.5)	
Good	3548 (65.0)	3788 (70.0)	
Poor	1425 (26.1)	1131 (20.9)	
Very poor	142 (2.6)	140 (2.6)	
Living alone	1046 (19.2)	951 (17.6)	0.033
Engaging in a work	5030 (92.2)	4130 (76.3)	< 0.001
Smoking status			< 0.001
Never	1885 (34.5)	4164 (77.0)	
Former	1982 (36.3)	690 (12.8)	
Current	1591 (29.1)	556 (10.3)	
Daily alcohol consumption			< 0.001
Never	435 (8.0)	1123 (20.8)	
Low-moderate (< 20.0 g)	3154 (57.8)	3700 (68.4)	
Heavy (≥ 20.0 g)	1869 (34.2)	587 (10.9)	
Meat intake			0.029
Never or seldom	1671 (30.6)	1746 (32.3)	
Once per 2 days	1704 (31.2)	1729 (32.0)	
Once a day or more	2083 (38.2)	1935 (35.8)	
Vegetable intake			< 0.001
Never or seldom	1539 (28.2)	919 (17.0)	
Once per 2 days	1354 (24.8)	999 (18.5)	
Once a day or more	2565 (47.0)	3492 (64.5)	
Self-reported poor heath	1510 (27.7)	1742 (32.2)	< 0.001
Leisure-time physical activity			< 0.001
0 MET-h/wk	2116 (38.8)	2456 (45.4)	
1-4 MET-h/wk	1046 (19.2)	1049 (19.4)	
5-9 MET-h/wk	839 (15.4)	772 (14.3)	
≥ 10 MET-h/wk	1457 (26.7)	1133 (20.9)	
Household physical activity			< 0.001
0 MET-h/wk	3418 (62.6)	2601 (48.1)	
1-4 MET-h/wk	921 (16.9)	1143 (21.1)	
5-9 MET-h/wk	546 (10.0)	677 (12.5)	
≥ 10 MET-h/wk	573 (10.5)	989 (18.3)	
Travel physical activity			< 0.001
0 MET-h/wk	1015 (18.6)	1080 (20.0)	
1-4 MET-h/wk	1078 (19.8)	1088 (20.1)	
5-9 MET-h/wk	1458 (26.7)	1240 (22.9)	
≥ 10 MET-h/wk	1907 (34.9)	2002 (37.0)	

(*continued on next page*)

Table 1. Characteristics of participants (*continued*).

	Men (n = 5458)	Women (n = 5410)	*P* value
Work physical activity			
0 MET-h/wk	3083 (56.5)	3886 (71.8)	
1-4 MET-h/wk	928 (17.0)	541 (10.0)	
5-9 MET-h/wk	525 (9.6)	239 (4.4)	
≥ 10 MET-h/wk	922 (16.9)	744 (13.8)	
Total physical activity			0.012
0-9 MET-h/wk	1518 (27.8)	1607 (29.7)	
10-19 MET-h/wk	1286 (23.6)	1202 (22.2)	
20-29 MET-h/wk	886 (16.2)	791 (14.6)	
≥ 30 MET-h/wk	1768 (32.4)	1810 (33.5)	

Values are percentages unless stated otherwise.

Table 2. Odds ratios of self-reported poor health by levels of physical activity.

Domains of physical activity	Men (n = 5458)		Women (n = 5410)	
	Poor health n (%)	Odds ratios 95% CI	Poor health n (%)	Odds ratios 95% CI
Leisure-time physical activity		**Trend *P* value < 0.001**		**Trend *P* value < 0.001**
0 MET-h/wk	739 / 2116 (34.9)	1.00	944 / 2456 (38.4)	1.00
1-4 MET-h/wk	291 / 1046 (27.8)	**0.78 (0.66 – 0.93)**	325 / 1049 (31.0)	**0.75 (0.64 – 0.87)**
5-9 MET-h/wk	214 / 839 (25.5)	**0.75 (0.62 – 0.90)**	216 / 772 (28.0)	**0.67 (0.56 – 0.80)**
≥ 10 MET-h/wk	266 / 1457 (18.3)	**0.51 (0.43 – 0.61)**	257 / 1133 (22.7)	**0.53 (0.45 – 0.63)**
Household physical activity		Trend *P* value = 0.773		Trend *P* value = 0.925
0 MET-h/wk	975 / 3418 (28.5)	1.00	859 / 2601 (33.0)	1.00
1-4 MET-h/wk	245 / 921 (26.6)	0.95 (0.80 – 1.13)	365 / 1143 (31.9)	0.98 (0.84 – 1.15)
5-9 MET-h/wk	141 / 546 (25.8)	0.95 (0.77 – 1.18)	215 / 677 (31.8)	1.03 (0.85 – 1.24)
≥10 MET-h/wk	149 / 573 (26.0)	1.07 (0.87 – 1.33)	303 / 989 (30.6)	1.05 (0.88 – 1.24)
Travel physical activity		Trend *P* value = 0.343		**Trend *P* value = 0.028**
0 MET-h/wk	289 / 1015 (28.5)	1.00	339 / 1080 (31.4)	1.00
1-4 MET-h/wk	321 / 1078 (29.8)	1.02 (0.83 – 1.24)	373 / 1088 (34.3)	**1.21 (1.00 – 1.46)**
5-9 MET-h/wk	421 / 1458 (28.9)	1.02 (0.85 – 1.23)	429 / 1240 (34.6)	**1.22 (1.02 – 1.47)**
≥ 10 MET-h/wk	479 / 1907 (25.1)	0.90 (0.74 – 1.08)	601 / 2002 (30.0)	1.02 (0.86 – 1.21)
Work physical activity		Trend *P* value = 0.155		**Trend *P* value = 0.039**
0 MET-h/wk	828 / 3083 (26.9)	1.00	1188 / 3886 (30.6)	1.00
1-4 MET-h/wk	265 / 928 (28.6)	1.10 (0.93 – 1.31)	206 / 541 (38.1)	**1.29 (1.06 – 1.57)**
5-9 MET-h/wk	136 / 525 (25.9)	0.96 (0.77 – 1.21)	85 / 239 (35.6)	1.17 (0.87 – 1.56)
≥ 10 MET-h/wk	281 / 922 (30.5)	**1.20 (1.00 – 1.43)**	263 / 744 (35.3)	1.19 (0.99 – 1.43)
Total physical activity		**Trend *P* value < 0.001**		**Trend *P* value = 0.034**
0-9 MET-h/wk	514 / 1518 (33.9)	1.00	569 / 1607 (35.4)	1.00
10-19 MET-h/wk	359 / 1286 (27.9)	**0.82 (0.69 – 0.97)**	405 / 1202 (33.7)	0.98 (0.84 – 1.15)
20-29 MET-h/wk	225 / 886 (25.4)	**0.74 (0.61 – 0.90)**	234 / 791 (29.6)	**0.82 (0.68 – 0.99)**
≥ 30 MET-h/wk	412 / 1768 (23.3)	**0.69 (0.59 – 0.81)**	534 / 1810 (29.5)	**0.83 (0.72 – 0.97)**

Bold numbers indicate $P < 0.05$. Odds ratios and 95% confidence intervals were adjusted by age, body mass index, education years, economic status, living arrangement, working status, alcohol consumption, smoking status, and meat and vegetable intake status. The four domains of physical activity were entered simultaneously in the model to adjust for their effects on each other as covariates.

poor health. The study with Estonian women[5] also reported a positive association between leisure-time PA and self-reported health, and a negative association between work PA and self-reported health. Our study demonstrated that excess work PA can be linked to poor health in both women and men.

Although travel PA is intended as a health promotion tool,[9] women who engaged in 1 to 9 MET-h/wk of travel PA were more likely to report poor health. If subjects walk as a means of travel 20 or 30 minutes per weekday, which corresponds to 5.5 or 8.3 MET-h/wk, respectively. This amount seems typical for metropolitan workers. For women, even these moderate levels of travel PA may be burdensome. Work and travel PA are frequently passive types of PA, that is, the individual may have little control over them, which can make these activities stressful. Spending an extended period of time engaged in occupational PA is a known factor for mental distress.[4,6] Therefore, to maintain an overall status of good health, voluntary PA, such as leisure-time PA, would be needed.

There was a significant linear association between increasing total PA and a decreasing rate of both men and women reporting poor health. Furthermore, when total PA is over 20 MET-h/wk, the rate of poor health was significantly decreased in both men and women. The Ministry of Health, Labour and Welfare, Government of Japan has recommended at least 23 MET-h/wk of total PA,[7] and our results support this recommendation. From the odds ratio, we found there was a more beneficial association between total PA and self-reported health in men than in women. This finding may reflect our results from each individual PA domain, that is, work and travel PA more often had a negative association with self-reported health in women than in men. By focusing only on total PA, it is easy to overlook the underlying reasons for the weaker association between women's total PA and self-reported health. There is still insufficient information on the health benefits derived from each type of PA, and further studies based on PA domains are still needed.

Although this study benefited from its large sample size, there were some limitations. First, this was a cross-sectional study, and to reveal causal relationships, we need prospective and interventional studies. Second, this study did not assess how participants felt about engaging in each PA, that is, did they like or dislike the activity. If people enjoy engaging in work and travel PA, there is less stress involved, and these types of PA may not be associated with poor health for those people. Further studies may reveal non-leisure time PA benefits that are more specific. Finally, it may be inappropriate to generalize the study's findings since we obtained the study data from health checkups in Shinjuku, Tokyo, Japan, which is a major business center. A future study should be conducted in a rural area.

Conclusion

This study investigated the association between PA domains and self-reported health. Although leisure-time PA was linked with better health as expected, people who engaged in higher levels of work PA were more likely to report themselves as having poor health. In women, higher levels of travel PA were also associated with self-reported poor health. It may be stressful for people to engage in passive PA such as during work and travel, whereas voluntary PA, including leisure-time PA, may improve health. Further research on this subject will increase our knowledge on how different types of PA affect health.

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