Printed 2023.0630 ISSN 2189-4957
Published by Asian Society of Human Services

Total Rehabilitation Research

June 2023
11

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[Transit Point]

Asian Society of Human Services

DOI: https://doi.org/10.20744/trr.11.0_37
Total Rehabilitation Research, VOL.11 37-45

Short Paper

Relationship Between Physical Activity and Health-related Quality of Life for Community-dwelling Older Adults

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ABSTRACT

In 2019, the average daily number of steps taken by Japanese older adults 65 years or older was 5,396 steps for men and 4,656 steps for women. This study uses the average number of steps taken by older Japanese residents as the reference value. The study examined differences in lifestyle and Health-Related Quality of Life (HRQOL) between those who walked more and those who walked less than the reference value. The study also examined the relationship between age, number of steps, and HRQOL by dividing them into two age groups: men and women in their 70s, as well as men and women over 80. Participants were 124 older adults (60 men and 64 women) aged 70 years or older, living physically independently in the community. The mean age of the participants was 77.9 ± 5.3 years. Participants were instructed to wear an accelerometer to measure their average number of steps over a 10-day period. To measure the relationship between exercise and HRQOL, participants were asked to go out, exercise frequently, and answer the Short-Form Health Survey (SF-8) questionnaire. Participants' average daily steps were 5845.0 ± 3089.0 steps for men and 5230.6 ± 2820.1 steps for women. We then divided participants by their average daily step counts into a high-step group and a low-step group. The high-step group consisted of men with at least 5,396 steps (n=31) and women with at least 4,656 steps (n=32). The low-step group consisted of men (n=29) with less than 5,396 steps and women (n=32) with less than 4,656 steps. Between step groups, statistically significant differences were found in bodily pain and a physical component score of SF-8 for men ($p<0.05$). For women above 80 years of age, Physical activity was significantly correlated ($p<0.05$) with physical function, role physical, bodily pain, general health, role emotional, mental health, and the physical component score of SF-8. The results of this study showed an association between consistent engagement in physical activity and the maintenance of HRQOL, especially in the later years of aging women.

＜Key-words＞

older adult, physical activity, health-related quality of life,

Received

March 29, 2023

Revised

June 3, 2023

Accepted

June 13, 2023

Published

June 30, 2023

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I. Introduction

Japan's aging rate of 28.8% in 2020 was the highest in the world[1]. In recent years, the average life expectancy in Japan has exceeded 80 years for both men and women, placing it among the highest in the world. Meanwhile, Japan's total population has been declining since 2008, and the country has entered a full-fledged aging society with a declining birthrate. With the increased rate of population aging, there has been a significant increase in social security costs such as medical care and welfare resulting from illness and disability. Negative associations have been reported between physical activity (PA) and risks of morbidity and mortality, including obesity, diabetes, stroke, cardiovascular disease, osteoporosis, and dementia[2-5]. PA in older adults must be at least 150 minutes a week of moderate-intensity activity or 75 minutes a week of vigorous-intensity activity. Recently, epidemiological studies on the impact of lifestyle on health care costs have been developing worldwide, and the impact of PA on health care costs has been attracting attention[6]. Being physically active has been suggested as one way to enhance the quality of life (QOL) and well-being[7] Maintaining PA is expected to prevent disease, improve quality of life, and maintain physical and mental health. It might thus be desirable for older adults and society that PA be maintained in old age. Many studies have reported on PA. However, for the sake of simplifying the process of measurement, self-reporting using questionnaires tended to be a more common methodology[8-12]. Therefore, this study aimed to examine the relationship between the amount of PA, as quantified objectively with accelerometers, and the lifestyle and quality of life of older adults.

II. Methods

1. Participants

The participants in this study were 124 older adults (60 men and 64 women) living in Matsuyama City, Ehime Prefecture. These individuals participated in all the surveys. The mean age of the participants was 77.9±5.3 years, ranging from 70 to 90 years old, with 31 men and 32 women in their 70s, as well as 29 men and 32 women over the age of 80. Inclusion criteria for participants were older adults who belonged to 17 Matsuyama Fureai-ikiiki salons and lived independently in the community. A salon is a place for residents to visit, as judged by Matsuyama City. It is composed of a group of about 10 or more older residents of the city, aged 65 years or over. The Matsuyama City government entrusts the Matsuyama City Council of Social Welfare with the support of salon activities. Matsuyama City opened salons for older residents to improve their physical and mental well-being, preventing the need for long-term care.

2. Data Collection

The study was conducted for approximately two weeks in June 2018, during which the participants' PA was measured through the number of steps they took, as detected by accelerometers. The participants were instructed to always wear a PA accelerometer, except when bathing, swimming, or sleeping. Questionnaires were collected at the time of accelerometer collection.

3. Data Contents

1) Accelerometer

The validity and reliability of the accelerometers (SUZUKEN, Lifecorder GS) used in this study were confirmed by Kumahara et al[13]. The Lifecorder can measure low-intensity activities such as housework, as well as moderate to high-intensity activities such as walking or jogging. Days with fewer than 200 steps were excluded from the analysis. It would be impossible otherwise to distinguish between a genuine measurement or the participants forgetting to wear the accelerometer. Of the two weeks of measurements, 10 days with complete data were included in the data analysis.

2) Questionnaire survey

(1)

Participants were asked two questions about their frequency of leaving home and exercising in their daily lives. They were asked to choose between the following options for both the "frequency of going out" and "frequency of exercise: 1) 5 or more days a week, 2)3 to 4 days a week, 3) 1 to 2 days a week, or 4) less than 1 day a week.

(2) QOL assessment

This study used Short Form-8 (SF-8), which has excellent validity and reliability and is widely used internationally to assess HRQOL. SF-8 is based on a universal concept for measuring. It can measure the QOL of patients with various diseases as well as that of healthy people. The SF-8 subscales are scored as follows: (1) physical functioning (PF) (2) role physical (RP), (3) bodily pain (BP), (4) general health (GH), (5) vitality (VT), (6) social functioning (SF), (7) role emotional (RE), and (8) mental health (MH). The scores of the SF-8 subscales and the deviation scores based on the national average were calculated according to the SF-8 Japanese manual HRQOL scale. The higher the score for all items, the higher the QOL.

4. Statistical Analysis

The difference in PA for the participants was based on the criteria of average daily steps for Japanese 65+ years old men (5,396 steps) and women (4,656 steps) (2019)[14]. Participants were divided into four groups according to their sex and the number of steps taken per day: the high-step men's group (≥5,396 steps), the high-step women's group

(≥4,656 steps), and the low-stepping men's group (<5,396 steps), and the low-step women's group (<4,656 steps). Two independent groups of comparison tests validated significant differences. The analysis was further divided into two age groups, participants in their 70s, and participants who were in their 80s or older. The results are presented as the average ± standard deviation. An independent sample t-test was used to compare the step volumes between the two groups. The Mann—Whitney U test was used to compare the two groups in the questionnaire survey. Pearson correlation coefficient was used to correlate the steps with the SF-8 items. The statistical software IBM SPSS Statistics 27.0 was used, and the significance level was set at less than 5%.

5. Ethical Considerations

The staff of the Matsuyama Social Welfare Council explained this study to the participants at each salon. All participants provided written informed consent before participating in the study, and the study protocol was designed according to the Declaration of Helsinki.

III. Results

1. Result of difference in steps

The average daily number of steps taken by participants was 5845.0 ± 3089.0 steps for men and 5230.6 ± 2820.1 steps for women. For men, the high-step group had 31 participants, and the low-step group had 29 participants. For women, on the other hand, the high-step group had 32 participants, and the low-step group had 32 participants. The mean age, height, and weight of men in the high-step group were 75.1±4.1 years, 166.3±5.0 cm, and 65.1±5.3 kg, respectively. The mean age, height, and weight of men in the low-step group were 81.1±5.2 years, 162.0±7.0 cm, and 60.8±9.7 kg, respectively. The mean age, height, and weight of women in the high-step group were 77.1±4.1 years, 150.0±5.2 cm, and 49.9±6.2 kg, respectively. Lastly, the mean age, height, and weight of women in the low-step group were 78.5±5.5 years, 151.8±6.1 cm, and 50.9±9.9 kg, respectively. The average number of steps per day was 8031.8±2693.3 in the high step group and 3507.4±1175.0 in the low step group for men, showing a significant difference ($p<0.001$). The high step group for women accumulated an average of 7328.8±2329.6 steps, and the low step group for women accumulated an average of 3132.5±1283.5 steps, yielding a significant difference ($p<0.001$). The results of the SF-8 by step groupings are subdivided by sex in table 1 and table 2. Questionnaire results, as compared by step number, showed significant differences in PF, BP, and PCS on the SF-8 among men. There were no significant differences in all SF-8 items for women.

<Table 1> Results of SF-8 Score by Steps Volume Group (Men)

	Total (n=60)	Step group, step/d High : ≧5,396 (n=31)	Low : <5,396 (n=29)	P-value
Physical Functioning : PF	46.8(7.9)	48.6(7.0)	44.8(8.4)	0.06
Role-Physical : RP	47.0(7.9)	48.3(7.4)	45.6(8.2)	0.19
Bodily Pain : BP	50.1(8.0)	52.1(6.3)	48.0(9.1)	0.05*
General Health Perception : GH	49.9(6.8)	50.8(6.5)	49.1(7.1)	0.34
Vitality : VT	51.1(4.8)	52.0(4.8)	50.2(4.6)	0.16
Social Functioning : SF	50.3(7.0)	51.0(6.8)	49.5(7.3)	0.40
Role-Emotional : RE	50.2(5.1)	50.7(4.6)	49.6(5.6)	0.43
Mental Health : MH	52.5(4.7)	52.2(4.3)	52.8(5.2)	0.60
Physical Component Summary : PCS	45.7(7.5)	47.9(6.3)	43.4(8.1)	0.05*
Mental Component Summary : MCS	52.2(4.5)	51.7(4.3)	52.8(4.7)	0.34

* P<0.05 An independent sample t-test High : ≧5,396 vs Low : <5,396

<Table 2> Results of SF-8 by Steps Volume Group (Women)

	Total (n=64)	Step group, step/d High : ≧4,656 (n=32)	Low : <4,656 (n=32)	P-value
Physical Functioning : PF	44.8(7.5)	46.4(6.4)	43.3(8.3)	0.11
Role-Physical : RP	46.4(7.2)	47.4(6.5)	45.4(7.8)	0.26
Bodily Pain : BP	47.8(7.2)	47.9(7.4)	47.7(7.2)	0.90
General Health Perception : GH	48.5(6.6)	49.9(6.3)	47.0(6.6)	0.07
Vitality : VT	49.9(6.0)	51.1(5.6)	48.8(6.3)	0.13
Social Functioning : SF	48.4(7.1)	48.3(7.1)	48.6(7.2)	0.84
Role-Emotional : RE	49.1(5.6)	49.7(5.8)	48.6(5.6)	0.42
Mental Health : MH	51.0(5.8)	52.0(5.9)	49.9(5.6)	0.15
Physical Component Summary : PCS	44.1(7.9)	45.2(7.1)	43.0(8.5)	0.28
Mental Component Summary : MCS	51.1(6.0)	51.5(5.9)	50.6(6.0)	0.54

* P<0.05 An independent sample t-test High : ≧4,656 vs Low : <4,656

2. Results by Age Group

Participants were grouped into two groups: a group of participants between 70-79 years old and a group of participants over 80 years old. These groups contained both men and women. For men, the mean age of the 70s group was 73.4 ± 2.6 years (n = 31), while the mean age of the 80+ group was 82.9 ± 3.0 years (n = 29). Men in the 70s group tended to have a higher mean number of steps (7445.6 ± 3160.6 steps) than men in the 80+ group (4133.9 ± 1880.1 steps). This difference was statistically significant ($p<0.001$). For women, the mean age of the 70s group was 73.7 ± 3.1 years (n = 34), while the mean age of the 80+ group was 82.5 ± 2.0 years (n = 30). The average number of steps for women in their 70s was 5932.8 ± 4434.8 steps, which was greater and more variable than for the group aged 80 years and older, at 4434.8 ± 2466.2 steps. In relation to the results of the questionnaire between the age groups, a statistically significant difference was found in the QOL, as assessed by PCS for men ($p<0.05$). In the women's group, the frequency of

exercise was also significantly higher in the 80s group ($p<0.05$).

3. Correlation of PA (steps) with the frequency of going out, exercising, and SF-8

For men in their 70s, only step and exercise frequency showed a significant correlation ($r = 0.38$, $p<0.05$). Correlations between step and Sf-8 are shown in table 3 by sex.

<Table 3> Correlation between PA (steps) and SF-8

	PF	RP	BP	GH	VT	SF	RE	MH	PCS	MCS
Male Total (n=60)	0.25*	0.23	0.28*	0.11	0.18	0.15	0.21	-0.03	0.32*	-0.06
Male 70-79 years old (n=31)	0.14	0.06	0.14	-0.01	0.09	0.12	0.13	-0.07	0.14	0.00
Male 80 years and older (n=29)	0.32	0.36	0.43*	0.19	0.20	0.25	0.29	0.20	0.40*	0.05
Female Total (n=64)	0.41**	0.31*	0.19	0.23	0.25*	0.18	0.19	0.30*	0.29*	0.14
Female 70-79 years old (n=34)	0.22	0.17	0.00	0.08	0.26	0.04	-0.02	0.28	0.11	0.12
Female 80 years and older (n=30)	0.59**	0.42*	0.37*	0.45*	0.27	0.36	0.45*	0.37*	0.45*	0.23

* P<0.05, ** P<0.01

Abbreviations: PF, Physical functioning; RP, Role-physical; BP, Bodily pain; GH, General health perception; VT, Vitality; SF, Social functioning; MH, Mental health; RE, Role emotional; PCS, Physical component summary; MCS, Mental component summary

IV. Discussion

The average number of steps taken by the study participants, both men and women, was higher than the average number of steps taken by Japanese people aged 65 and older. From this, it can be inferred that the participants led relatively active lives compared to the average Japanese person of the same age bracket. It has been reported that higher PA has many positive effects on physical and mental health[15-17]. The results suggest that the physical quality of life of older men is influenced by the amount of PA. The women's group in this study was found to have no differences in HRQOL for varying amounts of PA. The results for the older women in this study did not support previous studies. The women in the study did not differ in the number of steps and frequency of exercise. It was inferred that the lack of differences in exercise frequency influenced the lack of differences in HRQOL.

Of note for the women's group, no significant difference in the average number of steps was found between the 70-79 age group and the 80+ age group. Furthermore, the average number of daily steps for the women's 80+ age group was higher than that of the Japanese older women in the same age group[14]. In Japan, no data is found showing the average number of steps taken by older adults over 80 years old. The recommended number of steps for older adults, based on Health Japan 21 (second term) policies is lumped together with the number of steps for those aged 65 and over. The current figure for women in Health Japan 21 (second term) is 4,656 steps. This result is equivalent to the steps taken by the 80+ age group in this study. Furthermore, this study has shown

that, among participants, the frequency of exercise for women aged 80 and over is higher than that of women in their 70s, which parallels differences in the frequency of exercise, as implied by the number of steps taken by each group. PA was positively and consistently associated with some QOL domains among older individuals; thus, promoting PA among older adults may have an impact beyond physical health[18]. Of note in this study, the correlation between PA and SF-8 was not significant for men and women in the 70s age group. For PF, RP, BP, GH, RE, MH, and PCS, the responses among women in their 80s showed significant correlations($p<0.05$). It was suggested that maintaining PA was associated with the maintenance of HRQOL, especially in the later stages of old age for women. Exercise Practice Improves Quality of Life-Related Scores [19]. A regimen of 12 months of regular walking for Nordic older adults increased the quality of life estimated on the scales of role-physical. physical functioning, overall health, role emotional functioning, vitality, psychological health, social functioning; these factors correlated with both physical and psychological components of health[20-23]. The cross-sectional data from this study showed no association between steps and quality of life in the early years of old age. Those in their 70s who are active in the salon are physically and socially active. It was inferred that there is not much difference in HRQOL among those in their 70s, unlike those in their 80s, where there is a large difference in physical fitness.

However, this study does suggest that maintenance of PA through walking and other physical activities could contribute to health promotion in old age. There are some limitations to this study, such as the small number of participants. The participants in this study were older adults who belonged to salons, a group that is hardly representative of the general older population. A study with a large number of participants is essential to establish the results. For studies with a larger number of participants, a questionnaire-based method of measuring PA will also be considered due to the limited number of accelerometers used to measure PA.

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as of April 1, 2023

Total Rehabilitation Research

VOL.11 JUNE 2023

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Publisher | Asian Society of Human Services
#303, Kokusaiboueki Bld.3F, 3-3-1, Buzenda-cho, Shimonoseki, Yamaguchi, 750-0018, Japan
E-mail: ashs201091@gmail.com

Production | Asian Society of Human Services Press
#303, Kokusaiboueki Bld.3F, 3-3-1, Buzenda-cho, Shimonoseki, Yamaguchi, 750-0018, Japan
E-mail: ashs201091@gmail.com

Total Rehabilitation Research
VOL.11 June 2023

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Published by
Asian Society of Human Services
Yamaguchi, Japan