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Original Article

Correlation Between Physical Activity Measured by a Wearable Device and Quality of Life in Older Adults

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Key Words
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Background: Physical activity and quality of life (QOL) influence the health status of older adults. Recently, the use of wearable devices to monitor physical activity has increased.

Objects: This study examined the relationship between the amount of physical activity, measured using a wearable device, and QOL among older adults.

Methods: In total, 71 older adults (aged ≥ 65 years) were enrolled. The amount of physical activity was measured using a wearable device with a wrist strap, and daily physical activity was classified according to intensity (sedentary, light, moderate, or very active). Self-reported QOL was evaluated using the Short Form 36 (SF-36) questionnaire. Pearson and Spearman correlation analyses were conducted to analyze parametric and non-parametric variables, respectively. The relationship between amount of daily physical activity and SF-36 scores was assessed.

Results: The correlation analyses revealed positive correlations between the amount of moderate-intensity and very active physical activity (minutes/day) and SF-36 scores ($p < 0.05$).

Conclusion: Physical activity of at least moderate intensity is associated with better QOL in older adults. Further studies are required to verify the effects of increased physical activity on QOL in older adults.

INTRODUCTION

Physical activity is vital to maintain and promote physical, psychological, and cognitive health [1-4]. Decreased physical activity is related to an increased risk for chronic disease, disability, and mortality [1,5]. However, older adults often exhibit insufficient physical activity, i.e., failure to meet the amount of moderate-intensity activity recommended by the World Health Organization (150 min/week) [6,7].

Health-related quality of life (QOL) is an important predictor of overall health status; low QOL is related to impairment and functional limitations [8]. Older adults report decreased QOL in association with depression, low financial status, limited mobility, and longstanding illness [9]. The Short Form 36 (SF-36) questionnaire, used to evaluate health-related QOL, consists of eight dimensions: physical functioning, role limitations due to physical function, bodily pain, general health, mental health, role limitations due to emotional health, social functioning, and vitality [10,11]. It can be utilized to examine the effectiveness of interventions aimed at improving health status, both in the clinical setting and in experimental studies, in diverse population including those with diseases.

Wearable devices fitted to the wrist are useful for monitoring levels of physical activity. These devices can interface with mobile phones or computer software, and users can receive feedback regarding their physical activity behavior; this can facilitate positive changes in physical activity levels. In addition, physical activity data measured by wearable devices are more objective than self-reported physical activity data. This study assessed the relationship between the amount of physical activity, as measured via wearable devices, and QOL in older adults.

MATERIALS AND METHODS

1. Participants

Data were collected from 71 participants recruited from a local community in Wonju-si, South Korea. The inclusion criteria were as follows: aged ≥ 65 years, living in the community, and no cognitive problems (i.e., ability to understand the study procedure). This study excluded individuals with poor balance or ambulation due to musculoskeletal and/or neurological disease, and those with dizziness or breathing difficulties. All participants signed an informed consent form after confirming that they understood all of the study procedures. This study was approved by the Institutional Review Board of Sangji University.

2. Quality of Life

This study used the SF-36 questionnaire to measure self-reported QOL [11]. The SF-36 consists of 36 items and eight dimensions, with the dimensions further grouped into two components: physical and mental. The score range is 0–100, where higher scores reflect better perceived QOL. The scores for the physical and mental components, and the sum score for both components, were calculated in this study.

3. Physical Activity

All participants wore the Alta HR device (Fitbit, San Francisco, CA, USA) on their wrists to measure the amount of physical activity per day (Figure 1). On day 1, a researcher explained how to wear and charge the device. All participants were required to wear the Alta HR device at all times during a 7-day period, except when showering or charging the battery. The Alta HR device uses a triaxial accelerometer and collect raw acceleration signals. The collected data were imported into the Fitabase program (Small Steps Labs, LLC, San Diego, CA, USA) and the amount of physical activity per day was classified according to activity intensity [12]. Sedentary was defined as < 1.5 metabolic equivalent of tasks (METs), light as ≥ 1.5 and < 3 METs, moderate as ≥ 3 and < 6 METs, and very active as ≥ 6 METs. Outcomes included mean minutes per day in each activity intensity. Participants lacking data for at least 4 days were omitted from the analysis.

Figure 1. Wearing the Alta HR (Fitbit, San Francisco, CA, USA) device.

4. Statistical Analysis

SPSS for Windows software (ver. 26.0; IBM Co., Armonk, NY, USA) was used to analyze the data. All descriptive data are provided as mean ± standard deviation. The normality of the data was assessed using the Shapiro-Wilk test. Associations between daily activity intensity and SF-36 scores (total, and physical and mental components) were analyzed by Pearson's correlation for parametric variables and Spearman's correlation for nonparametric variables. A good–excellent correlation corresponded to a correlation coefficient (r) of > 0.75, moderate–good to an r value of 0.50–0.75, fair to an r value of 0.25–0.49, and little or none to an r value of 0.0–0.24 [13]. The significance level for all analyses was set to $p < 0.05$.

RESULTS

The characteristics of the participants are described in Table 1. Table 2 shows the SF-36 scores and amount of physical activity of the participants. Table 3 shows the correlations between the daily amount of physical activity and SF-36 scores. Moderate activity showed fair correlations with the total ($r = 0.462$, $p < 0.001$) and mental ($r = 0.331$, $p = 0.005$) SF-36 component scores, and a moderate–good correlation with the physical ($r = 0.514$, $p < 0.001$) SF-36 component score. The

Table 1. Participant characteristics (N = 71)

Variables	Values
Sex (male/female)	32/39
Age (y)	72.37 ± 4.95
Weight (kg)	62.63 ± 10.16
Height (cm)	160.07 ± 9.61
Body mass index (kg/m^2)	24.42 ± 3.31
Mini-mental state exam (scores)	28.18 ± 1.51

Values are presented as number only or mean ± standard deviation.

Table 2. Mean and standard deviation SF-36 of scores and amount of physical activity

Variables	Mean ± standard deviation
SF-36 (scores)	
Total	67.12 ± 13.22
Physical	66.69 ± 14.85
Mental	67.57 ± 13.76
Physical activity (minutes/day)	
Sedentary	721.62 ± 116.51
Lightly	221.76 ± 75.00
Moderate	22.11 ± 19.92
Very active	24.45 ± 22.57

SF-36, Short Form 36.

Table 3. Results of the linear correlation analysis

	Total SF-36	Physical component	Mental component
Sedentary	−0.041	−0.049	−0.016
Lightly	0.019	0.025	0.059
Moderate	0.462**	0.514**	0.331**
Very active	0.371**	0.444**	0.243*

SF-36, Short Form 36. *p < 0.05, **p < 0.01.

very active level of activity showed fair correlations with the total (r = 0.370, p = 0.001) and physical (r = 0.444, p < 0.001) and little or no correlation with mental (r = 0.243, p = 0.041) SF-36 scores. However, there were no significant correlations between the sedentary and light activity levels with any SF-36 scores.

DISCUSSION

This study examined the relationship between physical activity and QOL in older adults (aged ≥ 65 years). Fair and moderate–good correlations of moderate and very active physical activity levels with QOL were observed.

Self-reported health-related QOL is an important indicator of mortality in older adults. Similar to a previous study, this study found that older adults with higher levels of physical activity (moderate or very active) had higher life satisfaction, particularly in terms of the physical component of the SF-36 [14,15]. Inactivity in older adults is associated with depression and physical limitations, whereas sports and social activities promote overall well-being [16-18]. Older adults (aged ≥ 55 years) reported perceived environmental, motivational, and physical barriers (e.g., physical disabilities related to chronic disease) to physical activity; these barriers were associated with less physical activity [19]. Although this study showed fair and moderate–good correlations between physical activity and QOL, this study suggests that physical activity of at least moderate intensity such as a walking 3.0 miles per hour, water aerobics, or general gardening may be considered to improve perceived QOL in older adults [20].

Wearable device is useful and acceptable to monitor and assess physical activity pattern. In addition, real–time feedback of the wearable devices based on interface with mobile phone or computer could facilitate and promote physical activity [21]. Previous Wearable devices are useful for monitoring and assessing physical activity patterns. Real-time feedback from these devices, via a mobile phone or computer, may promote physical activity. Previous studies have demonstrated that individuals aged ≥ 60 years with impaired health status (e.g., with hypertension, cardiovascular disease, or diabetes) perceive smart wearable devices as useful and intend to use them (e.g., accelerometers, skin electrodes, piezoelectric sensors, and so forth) [22,23]. Thus, older adults appear to be willing to use wearable devices to monitor their physical health, with the expectation of improving their health status. This study recommends monitoring physical activity patterns of older adults can be monitored through wearable devices; future studies should assess the capacity of these devices for increasing physical activity and improving QOL in older adults.

This study had several limitations. First, it used a cross-sectional design, so this study could not infer causality in the relationship between physical activity and QOL. In addition, this study did not consider the effects of sociodemographic characteristics, such as loneliness, perceived social support, and chronic disease (e.g., osteoporosis and stroke), on health-related QOL [24,25]. Further study is needed to examine the relationship between physical activity and QOL while controlling for the sociodemographic characteristics of older adults. Despite these limitations, this study demonstrated an association between physical activity, as measured via wearable devices, and health-related QOL in older adults.

CONCLUSIONS

This study found an association between amount of moderate and very active physical activity and self-reported QOL in older adults. The amount of moderate or very active physical activity was positively associated with self-reported QOL ac-

cording to the physical and mental components of the SF-36, as well as with overall SF-36 scores. Further studies are warranted to verify the changes and improvements in QOL in older adults induced by at least moderate physical activity, as monitored by wearable devices.

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CONFLICTS OF INTEREST

No potential conflict of interest relevant to this article was reported.

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