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Self-monitored versus supervised walking programs for older adults

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Abstract

Walking is an effective, well accepted, inexpensive, and functional intervention. This study compared the outcomes and changes in walking behavior of self-monitored (SM) and supervised (SU) walking interventions for older adults.

Participants were assigned to SM ($n=21$) and SU ($n=21$) walking groups according to their place of residence. Both groups exercised and wore a pedometer for 3 months.

The outcome measures were step count, body mass index (BMI), and physical function. Two-way repeated-measure ANOVA and independent *t* tests were used to compare the intervention effects. We also plotted the trends and analyzed the walking steps weekly.

Only BMI exhibited a group × time interaction. The pre-posttest differences showed knee extension muscle strength (KEMS) and Timed Up and Go test were significantly improved in the SM group, whereas BMI, KEMS, 30-s sit-to-stand, functional reach were significantly improved, but 5-m gait speed significantly slower in the SU group. For participants attending ≥50% of the sessions, those in the SM and SU groups had similar results for all variables, except for 2-min step (2MS) and daily walking step counts.

Both self-monitored and supervised walking benefit older adults in most physical functions, especially lower-extremity performance, such as muscle strength, balance, and mobility. The effects of both programs do not differ significantly, except for BMI and 2MS (ie cardiopulmonary endurance). We recommend pedometer-assisted self-monitored walking for older adults because of its ability to cultivate exercise habits over the long term, whereas supervised walking to establish effective exercise intensity.

Keywords: older adults, fitness test, steps, walking training, supervised, self-monitored

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Highlights: Self-monitored and supervised walking programs benefit older adults. Self-monitored and supervised walking programs do not differ in their benefits except with respect to BMI.

Data availability: The datasets supporting the conclusions are included within the article.

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The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

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1. Introduction

Taiwan's population is aging at a rate second only to that of Japan, and medical expenditures have increased as a result. Specifically, in Taiwan's public health insurance program, the National Health Insurance (NHI), 29% of outpatient costs and 43% inpatient costs were for older adults.

Studies have often noted a low level of physical activity in older adults. This explains the rapid decline of physical function with age, even resulting in aging-related frailty and greater risks of falling, illness, and hospitalization. These declines constitute a health care burden on society and families with increased monetary and human resource costs. Therefore, increases to the physical activity level of older adults can reduce the health care burden and improve their health, reducing the likelihood of many diseases, such as diabetes, obesity, depression, cardiovascular disease, and joint function degeneration. Regular exercise also results in better mental health, higher quality of life, and greater independence of older adults.

Voluntary physical activity clearly declines with age; this decline increases fatigability because such physical activity is associated with maximal aerobic capacity and muscle strength.[1,2] Decline in the general status and mobility of an individual negatively affects their conduct of everyday activities. Thus, preventing decline in the health of older adults is a crucial issue. Several aging-induced physiological changes are modifiable by exercise. Exercise capacity and physical activity in late middle age are associated with lower rates of cardiovascular disease.[3] Another benefit of physical activity are the reduced risks of stroke, diabetes, cancer, and osteoporosis.[3]

Aging can cause a decline in physical functions, including exercise capacity and cardiovascular function. Aerobic capacity, gait speed, and muscle strength can decrease due to aging or disuse. Physical activity or exercise interventions can improve physiological parameters, resulting in increased muscle power or decreased blood pressure response.[4,5] In addition, aging also causes declines in nutritional status, metabolism, and hormonal regulation. However, consistent physical activity and exercise can mitigate the harmful effects of aging.[4,6]

Walking is an ideal mode of physical activity for older adults.[7,8] It benefits mental and physical health, resulting in decreased body weight and body fat percentage, healthy BMI, and improved resting diastolic blood pressure.[7] Habitual walking can increase physical activity in older adults, resulting in strong cardiovascular function and healthy metabolism. Physically active older adults have a better functional health, a lower risk of falling, and better cognitive health.[9]

A person's degree of engagement in walking can be measured using a pedometer, which counts the number of steps walked.[9] Because a pedometer is affordable and simple to use, it can be used in clinical and personal exercise programs. Although pedometers are not designed to directly detect physical activity intensity, they nonetheless provide a means of quantitatively measuring how physically intensive a person's everyday activities are. Such measurements aid monitoring of the benefits of daily exercise.

Previous research has reported that in free-speed walking, which is of moderate exercise intensity, the typical cadences for men and women are 81–125 and 96–136 steps per minute, respectively.[10–12] This finding suggests that moderate-intensity walking corresponds to 1000 steps taken in 10 min or 3000 steps taken in 30 min. These figures enable clear and easy establishment of walking goals for older adults.

Despite numerous evidence for walking's benefits, older adults tend not to engage in walking regularly. This may be due to a lack of interest in exercise, a reluctance to change their lifestyle, or a lack of support from their family or from society at large.[13] Thus, the present study aimed to develop a community-based walking program to inculcate walking as a habit, considering that walking is a simple, easily accepted, light-to-moderate aerobic exercise which is beneficial for different health status of older adults.

Among the types of exercise, walking is most acceptable to older adults. The goals and motivations are simple, and the physical activity of older adults can be enhanced. Therefore, the risks of disability and diseases can be reduced, and older adults can regain their confidence in exercising. In particular, self-monitored training is convenient, but its effectiveness depends on whether the exercise intensity, effect, continuity, and regularity match those of conventional supervised training. In the present study, a pedometer was used to make older adults more motivated to exercise by helping them track their achievement of exercise goals.

This study compared self-monitored and supervised walking programs with respect to effectiveness. Our comparison results can aid researchers in choosing intervention methods.

2. Methods

2.1. Participants

The participants were convenient sample of volunteers from two community residence centers for older adults in Northern Taiwan. Regarding the inclusion criteria, a prospective participant was recruited if only they were > 65 years old, able to understand commands, and able to walk independently with or without the use of aids. The pedometer device used in this study was the AGOSS FP2001. Initially, 56 individuals volunteered to participate, but 7 were excluded due to not meeting the inclusion criteria. Furthermore, during the intervention, five participants rescinded their consent, and two moved out the residence center ceasing attending the program. Therefore, 42 participants (21 in each group) remained, and their data were analyzed.

2.2. Trial design

The intervention program lasted 3 months; pre- and posttests as well as a follow-up at the 24th week were conducted (Fig. 1). The participants in the self-monitored group were asked to join the supervised walking program once a week to learn what a moderate-intensity walking pace was like. They were asked to practice on their own for at least 2 other days (or, even better, for the rest of the days of the week). The participants in the supervised group were asked to join the walking program thrice a week and to self-practice for the rest of the days of the week. Pedometer data for both groups were logged by the researcher once a week. The study and trial protocol were approved by the Chang Gung Medical Foundation Institutional Review Board in Taiwan in 2013.

2.3. Procedure

Participants were first briefed on the study procedure before giving their written informed consent. We then collected their baseline data through questionnaires and functional tests. Participants were then given a pedometer and were told to wear them while going about their daily activities for a week. After that week, we logged their pedometer data as baseline data. The walking exercise program then commenced, and their pedometers captured data for 26 weeks. The participants were carefully taught how to use the pedometer, and they were reminded to bring them back for logging once a week. Post tests were conducted in the third and sixth months.

2.4. Intervention

Older people reside in one of the elder center consisted the SM group and the other center as the SU group. For this 3-month walking program, the recommended walking intensity was a cadence of 100–115 steps per minute. This value was noted by a previous study[11] as being optimal for moderate-intensity walking. We used a metronome during supervised training sessions to set the walking tempo for the participants. Completing the step count of 3000 steps per day equated to approximately 30 min of moderate physical activity.

2.5. Measures

The number of steps is an important measure for walking outcomes. The pedometer data containing number of steps and estimated energy consumptions were obtained once a week. We measured the physical functional fitness of the older adult participants to determine their functional status before and after the intervention. Specifically, we measured muscle strength through tests of hand grip (HG), knee extension muscle strength (KEMS), arm curl (AC), and a 30-s chair sit-to-stand (30-s STS). We also measured aerobic endurance using a 6-min walk test (6-

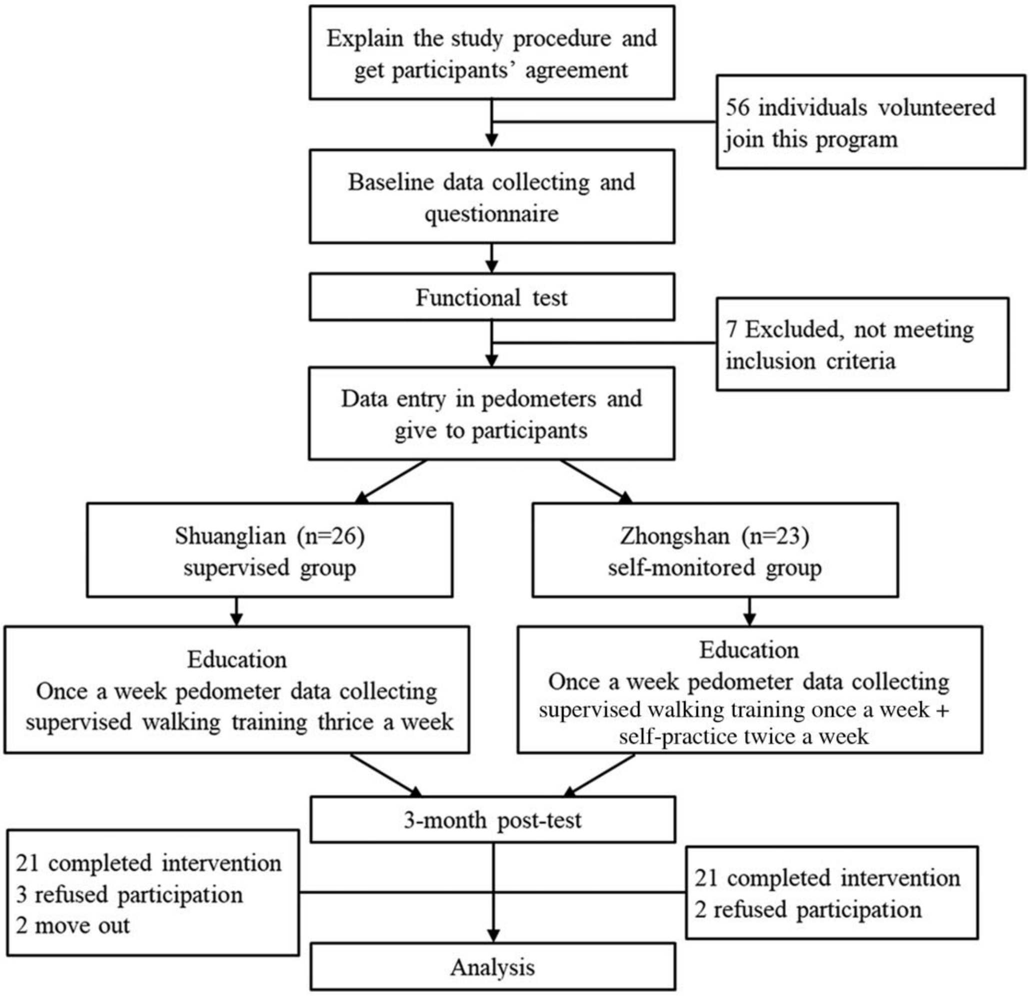

Figure 1. Flowchart of intervention and number of participants at each stage.

min WT) and 2-min step test (2-min ST). In addition, we measured flexibility using the sit-and-reach test (S & R) and functional mobility using the Timed Up and Go (TUG), functional reach (FR), and 5-m gait-speed tests (5-m GS). The fitness measurements were detailed in our previous study [15].

We also obtained demographic data, including those on height, weight, age, gender, and BMI. We helped the participants complete the questionnaire on ADL, IADL, and exercise habits.

2.6. Statistical analysis

IBM SPSS version 20 was used for statistical analysis, and significance was indicated if $P<.05$. An independent *t* test and χ^2 test were used to compare the two groups in the pretest with respect to baseline demographic data and functional test results. Two-way repeated-measures analysis of covariance (ANCOVA), adjusting for baseline differences, was used to analyze the group × time interaction. In addition, an independent *t* test was used for between-group and a paired *t* test was used for pre-post mean difference comparisons (baseline and 3-month data). Finally, we plotted the trends and analyzed the change in the weekly records of average daily number of steps walked.

3. Results

Regarding the descriptive statistics of demographic characteristics (Table 1), the groups significantly differed in age and body height. Thus, we subsequently adjusted for both as covariates. Regarding baseline physical function, the groups significantly differed only in FR. Thus, we subsequently adjusted for FR as a

Table 1

Older adult characteristics at baseline (n = 42).

	Self-monitored group (n = 21)	Supervised group (n = 21)	*P* value
Age	77.86 ± 4.52	81.00 ± 4.43	.028*
Sex	Male 5	Male 2	.214
	Female 16	Female 19	
Height	157.88 ± 9.60	152.12 ± 7.24	.034*
Weight	61.98 ± 14.28	58.26 ± 8.90	.317
BMI	24.80 ± 5.25	25.18 ± 3.45	.780
Fat mass	29.22 ± 8.16	31.37 ± 6.75	.359
Muscle mass	22.21 ± 3.79	20.67 ± 3.34	.171
Attendance	66.7%		

BMI = body mass index.

Table 2

Comparison of fitness functions between the self-monitored group and supervised group.

	All subjects (n = 42)			Participated 50%↑subjects (28)		
	P value ANCOVA for Repeated measures			*P* value ANCOVA for Repeated measures		
	Group	Time	Group × Time interaction	Group	Time	Group × Time interaction
BMI	0.979	0.254	0.004	0.311	0.146	0.001
6-min walk	0.010	0.990	0.098	0.032	0.935	0.456
Knee extension	0.578	0.757	0.123	0.883	0.365	0.127
Grip	0.300	0.818	0.873	0.480	0.792	0.940
30s sit-to-stand	0.800	0.477	0.116	0.441	0.338	0.144
TUG	0.612	0.997	0.610	0.812	0.959	0.656
OLS	0.363	0.512	0.086	0.406	0.598	0.173
Functional reach	0.903	0.075	0.903	0.129	0.040	0.625
Sit-to-reach	0.260	0.761	0.691	0.730	0.505	0.936
Drop role	0.202	0.784	0.174	0.515	0.539	0.309
5M	0.084	0.194	0.746	0.114	0.166	0.939
Arm curl	0.933	0.370	0.690	0.032	0.005	0.141
2-min step	0.684	0.180	0.956	0.911	0.308	0.049
Steps	0.566	0.709	0.393	0.337	0.111	0.862

ANOVA = analysis of variance, BMI = body mass index, TUG= timed up and go, OLS = one leg standing.

covariate. We analyzed physical function only for the 42 patients who remained until the end of the study.

As for the outcome, the repeated-measures ANCOVA results indicated a group × time interaction only for BMI (Table 2). Significant group main effects were found with respect to the 6-min WT score ($P < .05$). Further analysis of the mean differences between the pretest and post test results (Table 3) indicated significant improvements in KEMS and TUG performance in the self-monitored group; as well as significant improvements in BMI, KEMS, 30-s STS, and FR, but decrease in 5-m GS performance in the supervised group.

We also analyzed the fitness function of the participants who attended ≥50% of the training sessions (14 participants from each group). The two groups of such participants did not significantly differ in their baseline data. The fitness test scores of these participants showed more obvious changes after 3 months (data not shown). Repeated-measures ANCOVA indicated a group × time interactions in BMI and 2-min step tests (Table 2). Cardiopulmonary endurance function significantly improved with attendance rate in the supervised group. In addition, there were significant group main effects of such participants in the 6-min walk score and AC performance, significant time main effects in FR and AC performance.

The pretest versus post test comparisons (Table 4) showed similar while more obvious results. For the participants ≥50% of attendance, in the self-monitored group, except for KEMS and TUG, there were also significant improvements in the average daily step counts. In the supervised group, in addition to the significant improvements in aforementioned BMI, KEMS, and 30-s STS, 2-min step performance were also noted.

Figure 2 presents the 26-week trend in the average daily step counts of all participants. Both groups had increased step counts after the walking program intervention, indicating that the pedometer-assisted walking program changed how the participants walked and engaged in physical activity. The slope significantly differed between the two groups ($p = 0.035$) with the self-monitored group increasing more.

Figure 3 presents the 26-week trend for average daily step counts for participants who attended ≥50% of the training sessions. Both groups of such participants had increased step counts after the walking program intervention. However, the slope did not show significantly different between the groups after age and FR were adjusted for.

4. Discussion

Main findings of the present research indicated that only BMI showed significant interaction for either type of the walking program in the physical function measures, with supervised group significantly decreased in BMI after 3-month intervention. For the participants ≥50% of attendance, in addition to BMI, there was significant interaction in the 2-min step performance, that is, compared with self-monitored, supervised group revealed significant decreased in BMI and improved in cardiopulmonary endurance function. While, no significant differences in other measures between these interventions.

Further within group pre-posttest mean difference tests revealed both groups made significant progresses in lower-extremity muscle strength and mobility performances, reflected by KEMS, 30-s STS, TUG. Walking is an aerobic, whole-body exercise that emphasizes lower-limb and balance performance. Our results proved walking programs for older adults can improve their lower-extremity muscle strength and endurance and mobility function.

Previous research findings showed consistent results with ours. Breedland et al,[14] and Holmgren et al,[15] compared supervised and self-monitored exercise modes and noted that both benefited participants similarly well. In these studies, although participants in the supervised group initially performed better, the training effects became similar with time in both groups. Possible reasons for the findings: firstly, the number of the participants is small to come up with significant differences; secondly, large variances in the measurements, which affected statistical significance too; and thirdly, the exercise intensity of the supervised group was too low for a significant intergroup difference to be found. These reasons can also explain the results of the present study, in which the supervised and self-monitored walking programs yielded similar benefits in lower-extremity strength and performance and mobility function.

Table 3

Pretest versus posttest mean difference comparisons at 3 months for all participants.

		Self-monitored (n=21)	Supervised (n=21)	P*
BMI	Pre	24.8±5.3	25.2±3.4	.779
	Post	24.9±5.1	24.3±3.5	–
	Change	0.1±1.0	−0.9±1.2	.006
	P†	0.594	0.003	
6-min walk	Pre	413.7±72.4	369.1±87.0	.078
	Post	430.5±88.7	364.4±85.7	–
	Change	16.7±67.0	−22.6±71.9	.073
	P†	0.266	0.165	
Knee extension	Pre	19.6±5.4	20.1±6.7	.820
	Post	25.1±5.9	23.0±6.7	–
	Change	5.5±6.4	2.9±5.0	.124
	P†	0.001	0.015	
Grip	Pre	21.5±8.8	18.0±4.6	.111
	Post	20.5±9.3	17.1±4.4	–
	Change	−0.9±2.9	−0.9±3.2	.960
	P†	0.151	0.215	
30s sit-to stand	Pre	12.8±3.9	12.5±4.0	.816
	Post	13.7±3.6	14.6±4.2	–
	Change	0.9±2.5	2.1±2.7	.132
	P†	0.111	0.002	
TUG	Pre	10.4±1.7	10.9±3.5	.614
	Post	9.1±2.2	10.1±3.8	–
	Change	−1.2±2.2	−0.7±3.7	.642
	P†	0.017	0.351	
OLS	Pre	2.0±1.8	2.3±1.6	.596
	Post	3.2±3.4	2.1±1.1	–
	Change	1.2±3.8	−0.2±1.8	.183
	P†	0.149	0.542	
Functional reach	Pre	25.3±3.7	19.8±5.1	<.001
	Post	26.5±5.0	22.4±6.3	–
	Change	1.2±4.7	2.6±4.9	.299
	P†	0.238	0.023	
Sit-to-reach	Pre	2.7±10.8	−0.8±12.8	.341
	Post	4.9±11.7	−0.5±11.7	–
	Change	2.1±9.2	0.3±13.2	.610
	P†	0.298	0.922	
Drop rule	Pre	37.2±91	39.3±8.5	.455
	Post	35.1±7.2	41.6±11.1	–
	Change	−2.2±9.4	2.3±9.0	.119
	P†	0.298	0.250	
5M	Pre	3.7±0.7	4.1±1.2	.136
	Post	4.0±0.7	4.7±1.4	–
	Change	0.3±0.7	0.5±1.0	.744
	P†	0.083	0.030	
Arm curl	Pre	16.1±4.2	16.9±5.5	.637
	Post	17.7±7.1	17.3±4.9	–
	Change	1.6±7.0	0.5±1.9	.480
	P†	0.319	0.274	
2-minute step	Pre	79.0±32.4	82.2±14.2	.681
	Post	81.0±25.9	82.3±15.1	–
	Change	2.0±11.7	0.1±10.4	.595
	P†	0.443	0.967	
Steps	Pre	4670.1±2111.4	4443.0±2318.8	.742
	Post	4840.9±2160.1	5131.9±2655.6	–
	Change	170.7±2175.3	688.9±1925.7	.418
	P†	0.723	0.117	

BMI = body mass index, OLS = one-leg standing, TUG = Timed Up and Go.
* Independent *t* test.
† Paired *t* test.

Table 4

Pretest versus posttest mean difference comparisons at 3 months for participants who attended ≥50% of sessions.

		Self-monitored (n=14)	Supervised (n=14)	P*
BMI	Pre	23.2±3.8	25.3±2.9	.134
	Post	23.3±3.9	24.0±2.9	–
	Change	−0.1±0.9	−1.3±1.0	.002
	P†	0.712	<0.001	
6-min walk	Pre	429.9±77.8	374.6±75.7	.068
	Post	445.1±89.3	371.0±84.0	–
	Change	15.1±73.3	−3.7±55.7	.445
	P†	0.454	0.807	
Knee extension	Pre	20.4±6.1	21.6±7.2	.654
	Post	26.4±6.1	24.5±7.3	–
	Change	6.0±7.0	2.9±4.8	.162
	P†	0.007	0.039	
Grip	Pre	22.0±10.0	19.2±3.9	.340
	Post	20.7±10.8	17.9±4.9	–
	Change	−1.3±3.4	−1.3±3.5	1.000
	P†	0.184	0.187	
30s sit-to stand	Pre	13.1±4.0	13.4±4.0	.789
	Post	14.1±4.0	15.9±2.4	–
	Change	1.0±2.4	2.5±3.3	.178
	P†	0.141	0.014	
TUG	Pre	10.6±1.7	10.2±3.3	.721
	Post	8.6±21.	8.7±1.5	–
	Change	−1.9±2.2	−1.5±3.1	.766
	P†	0.006	0.096	
OLS	Pre	2.7±2.1	2.6±1.9	.709
	Post	3.8±4.0	2.3±1.1	–
	Change	1.4±4.6	−0.4±2.1	.279
	P†	0.263	0.535	
Functional reach	Pre	24.8±3.9	21.3±4.1	.029
	Post	27.0±5.0	23.6±7.2	–
	Change	2.2±4.6	2.4±4.6	.771
	P†	0.096	0.072	
Sit-to-reach	Pre	1.6±11.4	0.1±12.5	.743
	Post	3.4±12.8	1.7±13.0	–
	Change	1.9±88	1.6±13.7	.974
	P†	0.446	0.660	
Drop rule	Pre	36.7±9.3	37.6±7.6	.791
	Post	34.1±6.5	38.2±9.5	–
	Change	−2.6±9.4	0.6±8.8	.359
	P†	0.323	0.790	
5M	Pre	3.5±0.7	4.0±1.2	0.193
	Post	3.6±0.6	4.2±1.1	–
	Change	0.1±0.8	0.2±0.9	.481
	P†	0.500	0.385	
Arm curl	Pre	15.9±4.1	19.0±4.0	.050
	Post	15.6±3.7	19.4±3.	–
	Change	−0.2±2.2	0.4±2.1	.450
	P†	0.716	0.459	
2-min step	Pre	87.9±24.5	85.4±13.4	.733
	Post	84.6±22.4	88.0±9.1	–
	Change	−3.3±4.4	2.6±10.9	.072
	P†	0.015	0.380	
Steps	Pre	4399.7±2050.6	5131.1±2421.4	.394
	Post	5451.1±2277.4	6090.6±2709.6	–
	Change	1051.4±1661.0	955.4±2230.7	.899
	P†	0.034	0133	

BMI = body mass index, OLS = one-leg standing, TUG = Timed Up and Go.
* Independent *t* test.
† Paired *t* test.

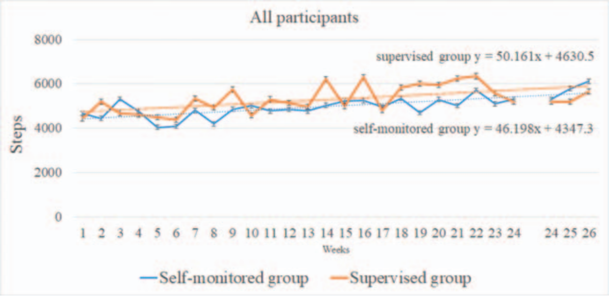

Figure 2. Trend for the average daily steps of all participants.

Intuitively, supervised exercise appears to be more beneficial, especially among older adults, considering that a professional can monitor the exercise intensity and ensure the participants meeting their goals. By contrast, self-monitored can easily result in insufficient exercise intensity. This may be the reason better explain why significant differences in BMI decreasing and 2-min step performance (an indicator of cardiopulmonary endurance and aerobic capacity) improving in the supervised group. However, the present study noted no significant differences between the exercise methods with respect to benefits in most physical functions, such as lower-limb muscle strength, balance ability, and overall mobility. The results may be related to the particular mode of exercise (ie, walking) in this study. Walking is an aerobic exercise that is suitable for older adults; it works out all parts of the body without being excessively intense. Walking, even at low intensity or for a short duration, can achieve many benefits. These benefits of walking are consistent with our findings.

How the walking activity influences cardiopulmonary endurance is closely related to its intensity. In the present study, we use a metronome to help maintain a walking cadence of 100–115 steps per minute to approximate moderate exercise intensity in the supervised group. As a result, this study discovered that better participated supervised walking can help older adults maintain their cardiopulmonary function at an improved level, while not the other group. This could be due to supervised group actually spent more time walking at moderate or higher intensity relative to those in the self-monitored group. The two interventions differed with respect to exercise intensity.

Nevertheless, the self-monitored walking program resulted in greater benefits to walking continuity than its supervised counterpart did. We attribute this to older adults having to actively and self-directedly change their walking habits in self-monitored training. By contrast, older adults undergoing supervised training are less likely to autonomously maintain their exercise habits once the program is complete because of idleness. Reminders or education programs are required to help such older adults maintain their exercise habits should supervision be absent. To change older adults' walking habits, we recommend self-monitored walking programs; they help older adults autonomously form good walking habits as a long-term intervention and are labor efficient.

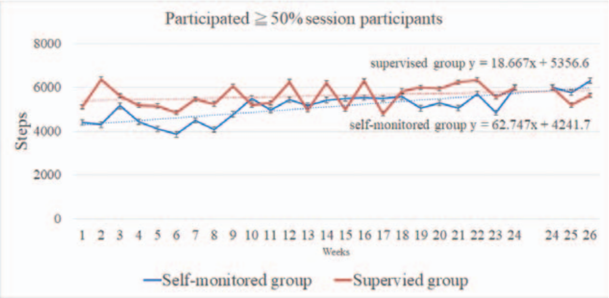

Figure 3. Trend for the average daily steps of participants who attended ≥50% of sessions.

Nonetheless, if the aim is more effectively enhancing physical functions, especially aerobic capacity, and better body composition in older adults, supervised walking training is more suitable. Although supervised training is more labor intensive, its duration and intensity can be more flexibly adjusted. In addition, we also found the posttest 5-meter gait speed became significantly slower in the supervised group. This may imply that older participants in the group walking more cautiously after intervention.

Walking encourages greater everyday physical activity, steering older adults away from a sedentary lifestyle. This is indicated by the participants having more steps walked daily in the posttest than the pretest. The step count for both groups increased after the start of the walking program, indicating that pedometer-assisted walking interventions change how older adults walk and engage in physical activity. For all participants in the self-monitored walking group, their average steps taken daily were increased after 3 months from 4670 ± 2111 to 4841 ± 2160 steps per day. For the supervised walking group, this increase was from 4443 ± 2318 to 5132 ± 2655 steps per day. There was no group difference. However, for the participants with attendance ≥ 50%, those in the self-monitored group had an increase from 4400 ± 2051 to 5451 ± 2211 steps per day, with significantly higher than those in the supervised group had an increase from 5135 ± 2421 to 6091 ± 2710 steps per day; these increases were approximately 1000 steps per day for both groups.

Compared with those who attended < 50% of the sessions, the participants who attended ≥50% of sessions had greater improvement in BMI and physical function, including KEMS, 30-s STS, TUG, FR, one leg stand, reaction time (responding to a dropping ruler), walking speed for a 5-m distance, and 2-min step test. The results indicated that attendance rate exerted a strong effect on performance. Participants with a higher attendance rate, compared with those with < 50% attendance, received more regular training with adequate intensity and duration. Accordingly, the effects were more obviously.

The limitations of our study are the small sample size, noncompulsory nature of the intervention, baseline age differences between the older adult participants, and the effect of weather. First, regarding the small sample, we analyzed data from 42 participants despite aiming to recruit 60 participants, which may have resulted in a lower power. Second, regarding the noncompulsory nature of the intervention, the participants lived independently, and they were sometimes unable to participate in walking sessions due to being engaged in other activities. Thus, some participants had a low attendance rate. Therefore, we further provided analyses of participants who attended ≥50% of the sessions. Third, regarding differences between the older adult participants, the participants varied in their physical conditions (such as experiencing pain, comorbidity, etc.), which may have caused some variances in the data. Fourth, older participants were less willing to exercise if the weather was raining, too hot or too cold. Nonetheless, the exercise regimen in this study was a solo walking exercise. It could be carried out indoor and was less likely being influenced by weather compared with other exercise mode. Furthermore, due to the exercise specificity, the lower-extremity performance of the participants had evidently improved after the intervention. Future studies can consider combining walking exercises with other training activities to better improve other physical functions.

5. Conclusion

A 3-month walking program resulted in significant improvements in body composition (BMI), lower-extremity strength and performance, balance and mobility function. Among them, BMI change showed interaction effect with group and time differences. Furthermore, for participants ≥50% of session attendance, compared with self-monitored, supervised group revealed significant improvements in BMI and cardiopulmonary endurance, reflected by 2-min step performance. However, self-monitored group showed significant better maintaining daily walking habit, reflected by significant pedometer step counts.

In conclusion, this study recommends self-monitored walking with a pedometer because of its benefits, low costs and professional labor requirement, and the ability to cultivate a habit of long-term walking as exercise in older adults., whereas we recommend supervised walking if the aim is to help older adults exercise at a stable and effective intensity level.

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