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ORIGINAL ARTICLE

EPIDEMIOLOGY, CLINICAL PRACTICE AND HEALTH

Controlled randomized trial of walking exercise with positive education on cardiovascular fitness and happiness in retired older adults

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Aim: Regular walking exercise (RWE) is associated with increased cardiovascular fitness and might elevate subjective psychological well-being. Positive education links positive psychology concepts with self-efficacy through the curriculum, which helps foster well-being. This study examines if regular walking exercise with positive education has better effects on cardiovascular fitness and happiness than RWE alone in retired older adults.

Methods: Three arms of experimental design were used: pedometer walking exercise training (PWET); positive education and pedometer walking exercise training (PEPWET); and pedometer walking exercise (PWE). Trained walking exercise was provided to the PWET and PEPWET groups by a walking exercise coach three times per week, for 45 min per session for 12 weeks. Positive education was designed and led by a licensed PhD psychologist every other week. Of 150 participants, 60, 60 and 30 were randomly assigned to PWET, PEPWET and PWE, respectively. Demographic information, Chinese Happiness Inventory, RWE, and 6-min walking distance were assessed before and after the intervention.

Results: The percentage of participants who practiced RWE after 12 weeks was significantly higher in the PEPWET group (96.7%), followed by the PWET (75%) and PWE groups (40%). Cardiovascular fitness in the PWET and PEPWET groups was significantly better than in the PWE group. Chinese Happiness Inventory scores in the PWET and PEPWET groups were significantly higher than in the PWE group, and the PEPWET group also showed significantly higher Chinese Happiness Inventory scores than the PWET group.

Conclusions: In addition to RWE, the study findings show that positive education can be beneficial to promote older adults' RWE, cardiovascular fitness and happiness. **Geriatr Gerontol Int 2019; 19: 879–884**.

Keywords: cardiovascular fitness, pedometer, positive education, walking exercise, well-being.

Introduction

The global burden of mental and behavioral disorders is currently estimated to account for 22.9% of years lived with disability, which is higher than any other disease category.[1] Furthermore, aged people have higher levels of depression, dementia, cognitive dysfunctions, metabolic disease, diabetes and cardiovascular disease.[2] Health and well-being interventions typically involve three strategies: disease and illness treatment, disease and illness prevention, and health and well-being promotion. Previous research has predominantly focused on preventive and curative approaches to negative mental health disorders that are endemic in modern society. However, more and more interventions adopt a balanced view of illness prevention with the promotion of health and well-being.[3,4]

It has been consistently found that engaging in physical activity promotes mental and physical health.[5,6] Physical exercise is defined as a subset of physical activities that are planned and purposeful attempts to improve health and well-being. Previous studies documented that physical exercise leads to changes in the levels of neurotransmitters and hormones in the brain, including beta-endorphin, noradrenaline, serotonin (5-HT) and cortisol.[7,8] These hormones and neurotransmitters play an important role in promoting well-being and elevating mood, coping with stress, and changing pain perception.[7–9] Studies have also shown that various types of exercises lead to an improvement in mood in patients with major depressive disorder.[10] Studies have found correlations between exercise and lower levels of depression in untrained healthy participants.[11] Even 20-min sessions of regular aerobic exercise can lead to improved psychological health.[12]

Walking exercise was used in the present study, because it has been identified as having the "greatest potential for reach and population level impact" to maintain mobility among older adults.[13] Heesch *et al.*, in their 6-year follow-up study of older women in the Australian Longitudinal Study of Women's Health, reported better physical functioning among older women who practiced walking exercise compared with those who did not walk.[14] Furthermore, more walking exercise, up to the recommended amount of 150 min per week, was associated with better physical functioning.

The American College of Sports Medicine recommends that, to gain maximum benefits from physical exercise, individuals should be motivated, engage in at least moderate-intensity movement and exercise regularly.[15] Additionally, Centers for Disease Control and Prevention suggests that exercise companionship, family support and self-efficacy are important factors in sustained regular walking exercise among older adults.[16] Positive education is an approach that enhances personal positive emotions, strength, a positive self-concept, self-efficacy and personal motivation to

promote well-being.[17] Studies have also shown that positive education consisting of positive emotion, engagement, achievement and positive relationships leads to improvement in subjective well-being.[18] Positive education links positive psychology concepts with self-efficacy through the curriculum, which helps foster self-efficacy, a positive self-concept, positive emotion, motivation and well-being.

The use of regular walking exercise as a medium for health promotion is based on evidence from the literature on the mental and physical health benefits of physical activity, exercise and fitness interventions. Positive education might be beneficial for the promotion of well-being by enhancing motivation, a positive self-concept, positive emotions and self-efficacy mediated by regular walking exercise. However, limited attention has been paid to the relative effects of regular walking exercise plus positive education on older adults' physical and mental health. Thus, two hypotheses are proposed in the present study. First, older adults who exercise regularly through moderate-intensity walking have better cardiovascular fitness. Second, older adults who participate in positive education targeting improvement of motivation, emotion, self-efficacy and companionship have better psychological well-being responses and adherence to regular exercise compared with those who do just walking exercise.

Methods

Design and data collection

A randomized controlled trial design was carried out in the present study. A flow diagram of the randomized controlled trial is shown in Figure 1. To document the consent process, the study purposes and procedure were explained to aged residents in community gatherings in Taipei City and New Taipei City. Willing participants who had further questions called the research team for detailed explanations of the study. Inclusion criteria included being retired from work and being aged ≥55 years. Older adults who had cardiovascular disease, who were unable to walk, who had dementia or psychiatric disease, or who were unwilling to sign the consent form were excluded from the study. To identify the effects of the interventions on adherence to walking exercise training, participants who already exercised five times a week or more were excluded. A total of 150 retired older adults voluntarily signed consent forms to participate in this study. The research protocol was reviewed and approved before the commencement of this study by the Human Subjects Protection Committee of Taipei Medical University (no. 201003002). This study was registered as a clinical trial (identifier: NCT03607877).

The allocation ratio of 2:2:1 was used in the present study. Using G power version 3.1,[18] a power analysis, with the criteria being a small effect size, power of 0.8 and an a priori ANCOVA design for three groups, resulting in a minimum required sample size of 88, or 30 in each group. Because the main hypothesis of the present study focused on the comparison of positive education and pedometer walking exercise training (PEPWET) and pedometer walking exercise with training (PWET), specification of a small effect size and power equal to 0.90 required that the sample size be increased to 119, or >59 in each group, to maximize statistical power to detect the intervention effect.

Treatment regimens and randomization

Regular walking exercise (RWE) was defined as walking >30 min at least five times a week. Randomization (allocation ratio 1:2:2) was then stratified to three arms, two experimental groups and one control group, respectively: pedometer walking exercise (PWE), PWET and PEPWET. Randomization was carried out using opaque envelopes and a randomly generated number sequence by an independent research assistant who had no prior knowledge of the recruited older adults. Researchers allocated participants to their treatment condition based on the randomization code in the sealed envelope (opened in order of sequence). Researchers were not blind to the patients' treatment allocation.

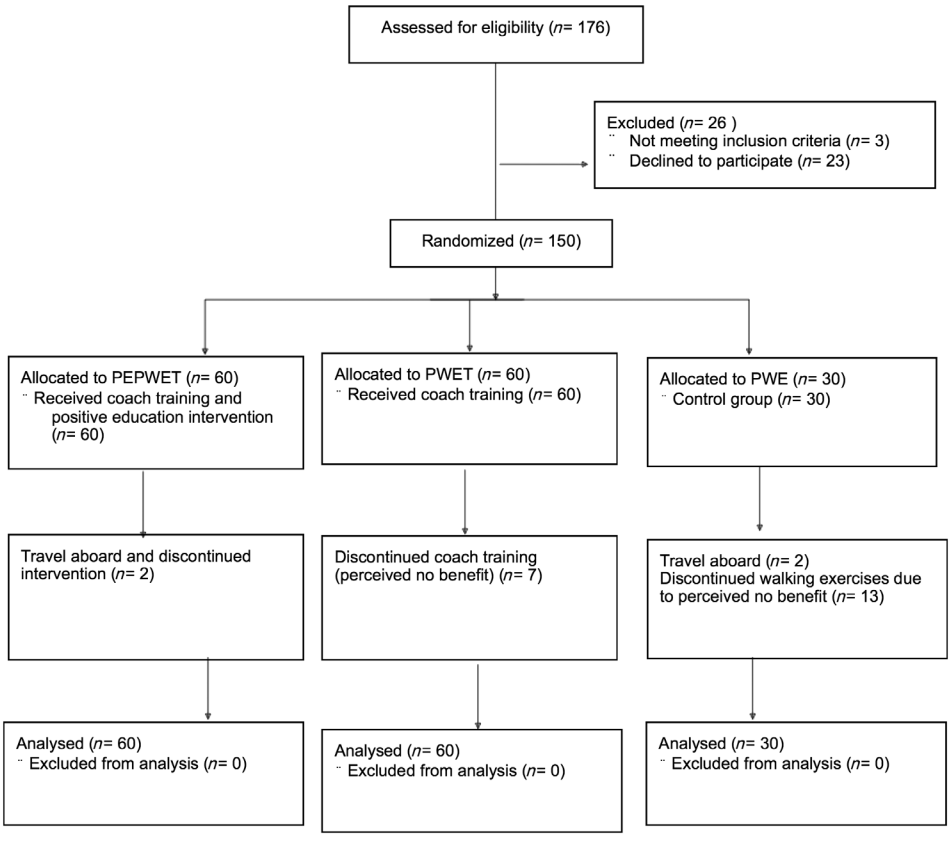

Figure 1 Flow diagram of the randomized controlled trial.

PEPWET

During the 12-week intervention, each participant was encouraged to do a walking exercise every day for at least 30 min, at least five times per week. A booklet was given to participants to write down the distance walked per day based on their pedometer. Participants in PWET received a pedometer plus 30-min walking exercise training from a walking exercise coach three times per week. The PEPWET group received a pedometer, 30-min walking exercise training three times per week and six 50-min sessions of positive education led by a PhD psychologist. The walking exercise training sessions and the positive education sessions were held in local public parks and community centers, respectively.

PWE

The pedometer walking exercise used for the control condition is a self-regulated walking exercise. Each participant was encouraged to walk for at least 30 min at least five times per week. A booklet was given to all participants to record the distance walked each day based on their pedometer readings. Participants in the PWE group exercised by themselves without receiving the extra 30 min of walking exercise training and positive education.

PWET

The pedometer walking exercises training consisted of 15 min of warm-up activities, 30 min of walking exercise and 10 min to cool down. Walking exercise training intensity for the first 4 weeks was 50–55% heart rate reserve (HRR). From the fifth to the eighth weeks, it increased to 60–65% HRR and it increased to 70–75% HRR from the ninth to 12th weeks. Each participant was required to wear a Polar FT1 Heart Rate Monitor (Polar OY, Finland) while carrying out walking exercise to make sure that they achieved the target heart rate and thereby ensured the walking exercise intensity. The walking exercise intensity was measured in terms of HRR (Karvonen method) with the formula: HRR% = ([HRmax – HRrest] × training %) + HRrest, where HRmax is maximum heart rate predicted based on the formula: 220 – age, and HRrest is resting heart rate. Warm-up activities included walking exercises targeting joint flexibility and balance, and aerobic walking exercise. Regulation of breathing, stretching and meditation were used in cooling down.

Positive education

Six positive education sessions were designed based on self-determination theory[18] and broaden-and-build theory[20] to enhance older adults' positive self, emotion, motivation and self-efficacy to walk at least 30 min per day at least five times per week with family support and walking exercise companions. These sessions focused on instilling competency and self-efficacy of walking exercise, networking and becoming acquainted with other participants; gaining familiarity with communication skills required for positive support, sharing positive emotions associated with successful walking exercise to enhance partnership, increasing autonomy in walking exercise every day and building a healthy lifestyle. Each session lasted approximately 45 min, and consisted of 25 min of motivation interviewing and storytelling followed by 20 min of activities for practicing skills.

Measurement

Measures were assessed twice at baseline and 12 weeks after the completion of intervention. Data were collected using a structured questionnaire and physical examinations. Self-reported variables included sex, age, education and Chinese Happiness Inventory (CHI). Physical examinations included height, weight, waist and hip circumferences, HRrest, distance walked per day and 6-min walk test (6MWT).

CHI

The CHI 20-item version has been widely used to measure individual well-being in Chinese culture.[21] Each statement represents a different level of happiness, ranging from 0 (very dissatisfied) to 3 (very satisfied). The CHI score is the sum of 20 items. The higher the score is, the higher the psychological well-being is. CHI has high validity and reliability.[22]

Physiological Index and Cardiovascular Fitness

Physiological indices examined body mass index, waist-to-hip ratio, HRrest and cardiovascular fitness. HRrest was used to calculate the intensity of walking exercise during the study period.

Cardiovascular fitness was calculated by using the 6MWT, which measures the distance an individual is able to walk over a total of 6 min on a hard, flat surface, and has been suggested as a useful outcome tool.[23] The goal is for the individual to walk as far as possible in 6 min. The individual is allowed to self-pace and rest as required as they traverse back and forth along a marked walkway. The 6MWT has been used to detect changes after interventions to improve walking exercise tolerance for healthy older adults.[24] With respect to concurrent validity, Hamilton and Haennel found that a positive correlation ($r = 0.624$, $n = 94$) exists between the 6MWT distance and the 36-item Short Form heath Survey physical function scale, indicating that as walk distance increased, physical function increased.[25] Additionally, test–retest reliability of 6MWT has been reported as high, ranging from 0.73 to 0.91 in previous studies.[26]

Statistical analysis

The data and calculations were carried out with the SPSS package (version 23.0; IBM SPSS Statistics, Chicago, IL, USA). Comparison of background variables between groups was carried out by analysis of variance, and the χ^2-test (Yates correction when required) for continuous and categorical variables, respectively. The intention-to-treat analysis included all 150 participants (with missing values) not in the PWE group. Analysis of covariance (ANCOVA) and Bonferroni-adjusted post-hoc tests were carried out to detect the between-groups intervention effect after controlling for the corresponding pretests.

Results

Table 1 presents the background information of participants. Their mean age was 61 years, 78.7% were women, 69.1% completed high school and 88.7% were married at the time of recruitment. Their mean body mass index, waist-to-hip ratio, heart rate at resting state and 6-min walking distance were 23.88, 0.83, 73.76 and 46 899.54 cm, respectively. No significant difference among the groups was found in these background variables, as shown in Table 1.

As shown in Figure 2, the proportions of participants who engaged in walking exercise at least five times per week during the 12-week study period were 96.70%, 75.00% and 40.00% in groups PEPWET, PWET and PWE, respectively. Results from the χ^2 analysis showed that the differences in these three proportions are statistically significant, $\chi^2 = 36.06$, $P < 0.01$. The χ^2 analysis also showed that people in the PEPWET group were significantly more likely to exercise regularly than those in the PWE group ($\chi^2 = 37.16$, $P < 0.01$; $\chi^2 = 10.55$, $P < 0.01$ by Fisher's exact test).

Table 2 presents the effects of walking exercise training and positive education on cardiovascular fitness, happiness, body mass index and waist-to-hip ratio for participants. Results from the ANCOVA shows that there were significant differences in 6-min walking distance and CHI scores among the three groups. Specifically, post-hoc comparisons using the Bonferroni correction showed that the 6-min walking distances for older adults in the PEPWET and PWET groups were significantly longer than for individuals in the PWE group, $F(2,144) = 24.00$, $P < 0.01$. Regarding happiness, post-hoc comparisons using the Bonferroni

Table 1 Demographic characteristics and physical status among participants at baseline

	PEPWET (n = 60) Mean (SD) or n (%)	PWET (n = 60) Mean (SD) or n (%)	PWE (n = 30) Mean (SD) or n (%)	F or χ^2
Age (years)	60.53 (6.56)	61.23 (6.46)	61.47 (6.14)	0.28
Sex				1.43
Males	10 (16.7%)	14 (23.3%)	8 (26.7%)	
Females	50 (83.3%)	46 (76.7%)	22 (73.3%)	
Education				0.99
<9 years	16 (26.7%)	19 (31.7%)	11 (36.7%)	
>9 years	44 (73.3%)	41 (68.3)	19 (63.3)	
Marital status				3.08
Married	51 (85.0%)	53 (88.3%)	29 (96.7%)	
Single/widowed/ separated	9 (15%)	7 (11.7%)	1 (3.3%)	
Height (cm)	157.28 (6.48)	158.07 (7.84)	157.65 (7.94)	0.17
Weight (kg)	58.95 (8.53)	60.11 (13.20)	60.20 (9.49)	0.20
Heart rate at resting state	75.69 (8.04)	73.05 (11.51)	70.67 (6.01)	1.59
6 min walking distance at baseline (cm)	48 103.72 (7911.01)	45 440.42 (9329.26)	47 376.69 (7807.34)	2.74
Waist-to-hip ratio	0.83 (0.07)	0.84 (0.69)	0.85 (0.72)	1.29

Total n = 150. PEPWET, positive education and pedometer walking exercise training; PWE, pedometer walking exercise; PWET, pedometer walking exercise training.

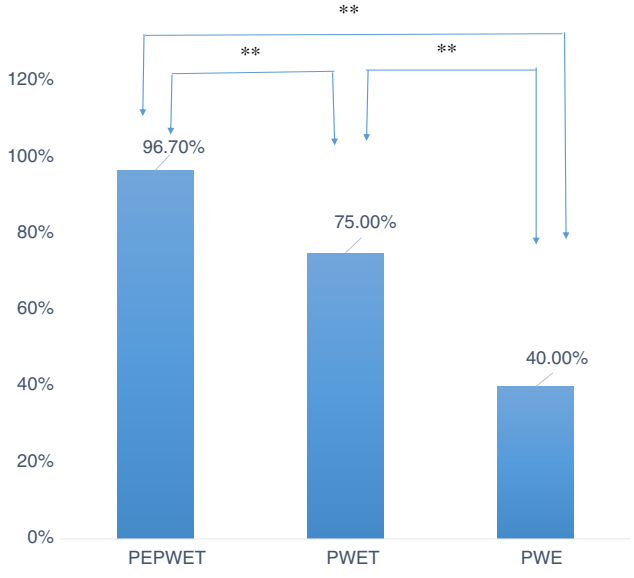

Figure 2 Percentage of participants by groups who exercised at least five times every week for the 12-week study period. **P < 0.01. Positive education and pedometer walking exercise training (PEPWET) versus pedometer walking exercise training (PWET): χ^2 = 11.58, **P < 0.01 for Fisher's exact test. PEPWET versus pedometer walking exercise (PWE): χ^2 = 37.16, **P < 0.01. PWET versus PWE: χ^2 = 10.55, **P < 0.01 for Fisher's exact test. PEPWET versus PWET versus PWE: χ^2 = 36.06, **P < 0.01.

method show that the CHI scores for the PEPWET and PWET groups were significantly higher than those for the PWE group, and the PEPWET group had significantly higher CHI scores than the PWET group, $F(2,138)$ = 43.02, P < 0.01.

Discussion

The results of the present study show that both walking exercise training and positive education effectively improve regular walking exercise, happiness and cardiovascular fitness. To our knowledge, this is the first study that combines walking exercise training and positive education. The results of the present study thus confirm that older adults in the PEPWET group, who exercised at least five times a week with "moderate intensity," had better physical outcomes than those in the control group (PWE). The second hypothesis, that older adults who participated in the PEPWET group (positive education and walking exercise training) would have better psychological well-being responses and adherence compared with those in the walking exercise only (PWET and PWE) groups, was also confirmed.

The finding that participants in the PEPWET and PWET groups had better cardiovascular fitness than those in the PWE group is consistent with previous studies. Research has proliferated showing that exercise training contributes to improvement in physiological and functional parameters.[27] In addition, the positive education incorporated in the present study was designed to enhance older adults' positive self-evaluation, positive emotions, motivation and self-efficacy by encouraging them to walk at least 30 min per day at least five times per week with family support and walking companions. The finding that positive education leads to improvement in self-efficacy and self-esteem through regular exercise, which in turn enhances the effects of that exercise, is consistent with previous studies.[20]

Participation in the PEPWET group (positive education and walking exercise training) led to better psychological well-being responses and adherence compared with those in the walking exercise only groups (PWET and PWE). The literature shows that engagement in regular exercise increases the release of neurotransmitters, such as serotonin and dopamine, in the brain, which helps to promote well-being and a positive mood.[7,8] The positive education applied in the present study focused not only on enhancing competency and self-efficacy, but also social networking and communication skills for positive support and positive emotion sharing, through walking exercise. Therefore, autonomy and self-efficacy through walking exercise and adherence to a regular exercise regimen were promoted by social support and family support. The results of the present study are consistent with previous studies in showing that positive education is beneficial for promoting positive mental health and positive social relationships.[28]

Better mood status and cognitive function, which could be gained from regular aerobic walking exercise, improve well-being and happiness in older adults. In the present study, all three groups received higher scores on the CHI after the 3-month walking exercise intervention. Although regular aerobic walking exercise obviously benefits all age groups, including older adults, not all people are able to engage in walking exercise regularly, even if

Table 2 Effects of walking exercise training and positive education for elders using analysis of covariance

Variables	Group Mean (SD)						Covariate (pretest)	Between groups comparisons
	PEPWET		PWET		PWE			
	Pretest	Post-test	Pretest	Post-test	Pretest	Post-test	*F*	*F*
Cardiovascular fitness (6-min test)	48 215.91 (7993.94)	55 926.90 (10 372.24)	45 717.64 (9675.97)	52 000.00 (10 749.68)	47 566.57 (8196.75)	46 197.69 (8016.31)	319.88**	24.00**†
CHI	30.30 (12.89)	50.65 (11.82)	30.56 (10.88)	40.90 (11.26)	31.67 (10.52)	34.44 (9.69)	85.44**	43.02**‡
BMI	23.86(3.00)	23.69(3.16)	23.87(3.59)	23.71(3.59)	23.49(2.26)	23.45(2.59)	35.59**	1.11
Waist-to-height ratio	0.82 (0.06)	0.82 (0.06)	0.84 (0.07)	0.84 (0.09)	0.83 (0.07)	0.83 (0.07)	323.57**	0.19

*$P < 0.05$, **$P < 0.01$. Post-hoc analyses were carried out using the Bonferroni method. Body mass index (BMI) was computed by bodyweight in kilograms divided by height in meters squared. †Post-hoc comparisons: positive education and pedometer walking exercise training (PEPWET) > pedometer walking exercise (PWE) and pedometer walking exercise training (PWET) > PWE. ‡Post-hoc comparisons: PEPWET > PWET > PWE. CHI, Chinese Happiness Inventory; SD, standard deviation.

they recognize this fact. Social cognitive theories identify several constructs that correlate with the regular walking exercise behavior of older adults, such as walking exercise attitude, perceived behavioral control/self-efficacy, perceived social support and perceived benefits of/barriers to continued activity.

In addition to emphasizing consistent findings on the effects of regular walking exercise, the present study provides the benefits of combining positive education with walking exercise training for older adults. Furthermore, social support and companionship are also pivotal factors for maintaining good walking exercise habits. Participants in PEPWET were encouraged to incorporate walking exercise into their daily lives, and special attention was paid to their self-efficacy, relationships with others and positive emotions in relation to walking exercise. Central to maintaining good walking exercise habits are the strong social and emotional skills provided by positive education that help establish and promote strong relationships of the self with others. Supportive relationships and positive emotions have been linked with good social engagement and achievement persistence.[28,29] The positive education designed for the PEPWET group provided older adults with a successful walking exercise experience, knowledge, and skills for forming and functioning in a social support network, and a workshop for enhancing positive emotions.

Participants in the PEPWET group might thereby successfully integrate intrinsic and extrinsic motivation, and thus enhance their performance in walking exercise and their wellness. PEPWET group members showed not only increased autonomy, competence and relatedness, but also joy and contentment while carrying out walking exercises.[20,30] Overall, the present study results support that regular walking exercise and positive education together enhance older adults' physical, mental and social well-being.

There were several limitations to the present study. First, participation in this study was limited to healthy older adults recruited in metropolitan areas. Second, the number of participants was moderate, and we hope that future studies will recruit more participants. In addition, the percentage of men was quite low in this study. Third, a small proportion of participants did not follow up at the end of study. We used the intention-to-treat analysis to interpret the data, but the ultimate goal would be to retain all participants in the study.

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Conflict of interest

The authors declare no conflict of interest.

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