Received: 8 November 2022 | Revised: 26 January 2024 | Accepted: 15 February 2024

DOI: 10.1111/ijn.13252

ORIGINAL RESEARCH

INTERNATIONAL JOURNAL of NURSING PRACTICE WILEY

The effect of nurse-led motivational interviewing based on the trans-theoretical model on promoting physical activity in healthy older adults: A randomized controlled trial

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Funding information
None.

Abstract

Aim: The aim of this study was to evaluate the effect of motivational interviewing based on the trans-theoretical model promoting physical activity in older adults.

Methods: A randomized controlled trial study was conducted with 117 older adults (intervention group: 58, and control group: 59) between April and November 2019. The data were collected via a questionnaire, trans-theoretical model scales, the Physical Activity Scale for the Elderly, the Katz Activities of Daily Living scale and a pedometer. The 24-week intervention consisted of regular motivational interviewing. The control group received usual care at the family health centre.

Results: Following the intervention, the Intervention Group showed significant improvements Exercise Processes of Change Scale, Exercise Self-Efficacy Scale and Perceived Benefits of the Decisional Balance Scale for Exercise. There was a significant difference between the groups in terms of stages of change. In the Intervention Group, 81.5% were in the contemplation stage in the pre-test, while in the post-test, 70.4% had transitioned to the action stage. In contrast, in the control group, 62.5% were in the contemplation stage initially, but in the post-test, only 9.3% had reached the action stage. The mean number of step counts increased significantly in favour of the Intervention Group, as did the Physical Activity Scale for the Elderly total score.

Conclusion: The trial indicated that after the trans-theoretical model-based motivational interviewing, the stages of change among the older adults improved, as did their exercise behaviours. It is recommended that the trans-theoretical model and motivational interviewing be used by nurses to improve healthy lifestyle stage behaviours in older adults.

KEYWORDS
motivational interviewing, nurse, older adults, physical activity, trans-theoretical model

Summary statement

What is already known about this topic?

- Physical immobility ranks fourth among the leading risk factors for mortality globally.

- Older adults constitute the age group which leads the most sedentary life in society and is most affected by physical inactivity.
- In Turkey, one out of every two people undertakes insufficient physical activity, and this rate increases with advancing age.

What this paper adds?

- Nurse-led motivational interviewing based on the trans-theoretical model was effective in increasing the physical activity levels of the older adults.

The implications of this paper:

- It is recommended that the trans-theoretical model and motivational interviewing should be used by nurses to improve healthy lifestyle behaviours in older adults.
- It is recommended that studies be conducted to assess the effectiveness of interventions aimed at promoting physical activity in older adults via both qualitative and quantitative methods.

1 | INTRODUCTION

Physical inactivity ranks fourth among the leading risk factors for mortality globally, accounting for 6% of all deaths. The World Health Organization (WHO) reports that one in every four adults in the world leads a sedentary life (Katzmarzyk et al., 2022; Lee et al., 2012; WHO, 2010, 2018). Both the Turkey Nutrition and Health Survey (TNHS) and the Chronic Diseases Risk Factors Survey findings reveal that people's lifestyles become more sedentary as they get older (Ministry of Health, 2013, 2014). Increased physical activity is one of the best non-pharmacological means of promoting health and protecting functional independence, especially in older adults (Paterson et al., 2007). However, older adults have more barriers and perceived barriers concerning regular physical activity, such as age-related physiological changes, chronic diseases, lack of time, family responsibilities, fear of falling, pain, lack of social support, bad weather, negative perceptions and beliefs related to exercise, and lack of energy and motivation (Pender et al., 2015; Phillips et al., 2004). As every individual has different needs and barriers in relation to these matters, it is crucial for the nurse to guide and consult individually (Pender et al., 2015; Ross, 2019). Therefore, nurses who are active in primary healthcare services should monitor older adults closely, counsel them and determine their needs and barriers concerning exercise with a view to regular physical activity becoming a habit for them (Ross, 2019).

As one of the most frequently used models in health promotion, the trans-theoretical model (TTM) accepts the importance of motivation for behavioural change (such as improving exercise behaviour) and stresses the importance of strengthening the factors or processes that trigger behavioural change (Emmons & Rollnick, 2001; Velicer et al., 1998). Motivational interviewing (MI), which is a person-centred counselling method aimed at assisting individuals explore and overcome instability, can be useful for older adults to improve exercise behaviour. In the literature, MI has been identified as an effective means of promoting health behaviours—such as physical activity, smoking cessation and diabetes self-management (Perry & Butterworth, 2011; Purath et al., 2014)—and increasing levels of physical activity (Lin et al., 2016; Reid et al., 2012; Tse et al., 2013). No studies adopting the above approach have been carried out for the elderly in Turkey, where one out of every two people undertakes insufficient physical activity (Cankurtaran et al., 2021). Therefore, this study will act as a guide for nurses who work in protecting and promoting health.

This study is specifically aimed at examining the effect of nurse-led TTM-based MI on promoting physical activity levels among healthy older adults living in the Central Anatolia region of Turkey.

1.1 | Hypotheses

H1. Motivational interviewing based on the TTM to older adults is effective in progressing their stages of change.

H2. Motivational interviewing based on the TTM to older adults is effective in enhancing their exercise processes of change.

H3. Motivational interviewing based on the TTM to older adults is effective in increasing their perceived benefits.

H4. Motivational interviewing based on the TTM to older adults is effective in increasing their exercise self-efficacy.

H5. Motivational interviewing based on the TTM to older adults is effective in increasing their physical activity levels.

2 | METHODS

2.1 | Design, setting and sample

A randomized controlled, two-group pre-test and post-test experimental design was adopted for the study, conducted at a family health centre (FHC) in the Central Anatolia region of Turkey.

The study population consisted of older adults aged between 65 and 74 who were registered with the selected FHC ($N = 1630$). The researchers calculated, using power analysis for paired samples t test to compare pre-post Physical Activity Scale for the Elderly (PASE) scores, that the sample size should be at least 90 individuals ($dz = 0.30$; $1 - \beta = 0.80$; $\alpha = 0.05$) (Fernandes et al., 2010). Additionally drop-out ratio was considered as 30% (Binder et al., 2002; Peels et al., 2012). Therefore, 117 individuals who met the inclusion criteria and agreed to participate were randomly assigned to the groups (Figure 1).

2.1.1 | Inclusion criteria

- Older adults aged 65–74 who agree to participate in the study voluntarily

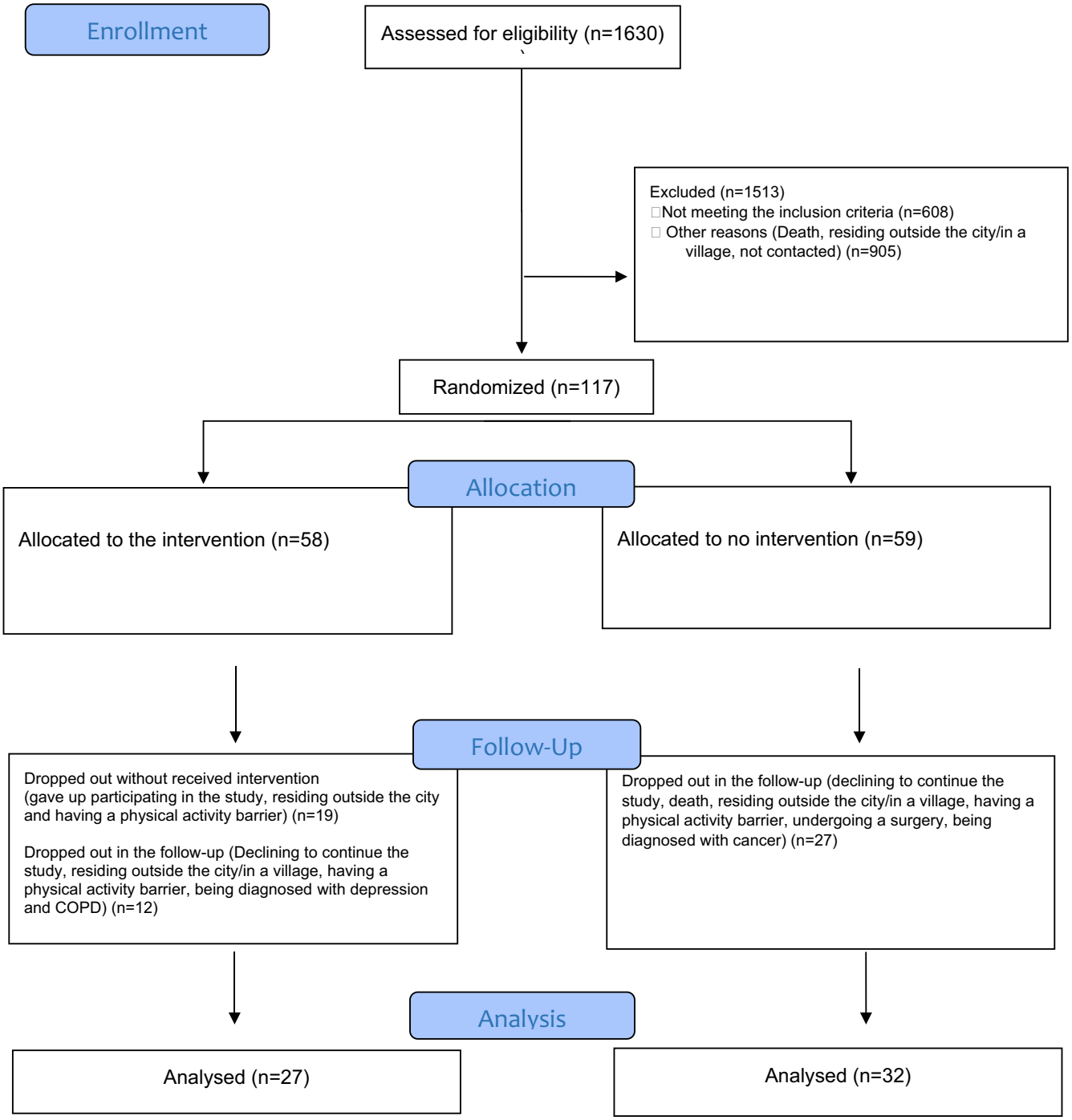

FIGURE 1 CONSORT 2010 flow diagram.

- Older adults who are at least literate or have an elementary school education
- Older adults who are at the pre-contemplation or contemplation stages of exercise behaviour change
- No cognitive impairment which affects interpersonal communication
- No muscle–joint problems which are a barrier to physical activity
- No neuropsychiatric disorders

2.1.2 | Exclusion criteria

- Older adults whose mini mental state examination (MMSE) scores are 24 points (mild cognitive impairment)
- Older adults whose Geriatric Depression Scale (GDS) scores are >5 points
- Older adults diagnosed with cancer, insulin-dependent type 2 diabetes mellitus, uncontrolled hypertension, heart failure, chronic obstructive pulmonary disease or asthma

2.1.3 | Termination criteria

- Change in the mental status of the senior during follow-up
- Any situation that requires the senior to be hospitalized
- A request to leave the study at any stage.

2.2 | Randomization and masking

After stratifying according to age (65–69, 70–74), gender and stage of change for exercise (contemplation and pre-contemplation stages), the stratified simple randomization procedure was used (Table 1). Random assignment was implemented by distributing individuals equally across cells corresponding to each group combination, ensuring an equitable allocation between intervention and control groups. The randomization procedure was conducted via version 3.5 of the programming language R (https://cran.r-project.org) by an independent statistician to achieve allocation concealment. No participant blinding was performed. In addition, the data were collected and recorded by an independent researcher from outside the research team, who was trained by the researcher (ESS) and did not know the groups. The statistical analyses also were performed by the statistician.

TABLE 1 Intervention and control groups according to stages of change, age and gender.

	IG ($n = 58$)	CG ($n = 59$)
Stages of change		
Pre-contemplation	20	20
Contemplation	38	39
Age groups		
65–69	35	35
70–74	23	24
Gender		
Female	30	29
Male	28	30

Abbreviations: CG, control group; IG, intervention group.

2.3 | Measures

2.3.1 | The trans-theoretical model scales

The TTM scales were developed by Prochaska and Diclemente (1982) based on smoking cessation studies and were adapted for exercise by Marcus et al. (Marcus, Banspach, et al., 1992; Marcus, Rakowski, & Rossi, 1992; Marcus, Rossi, et al., 1992). These scales include the following: the stages of change scale (SCS), the exercise processes of change scale (EPCS), the decisional balance scale for exercise (DBSE), and the exercise self-efficacy scale (ESES). These scales were translated and adapted into Turkish by Gümüş and Kitiş (2015). The SCS identified that the test reliabilities were 0.79 and the kappa index validity 0.81 (Ay & Temel, 2008; Gümüş & Kitiş, 2015). The EPCS, DBSE and ESES were found to have Cronbach's alpha coefficients 0.97, 0.89 and 0.85, respectively. The SCS has five stages and involves no scoring. These stages are pre-contemplation, contemplation, preparation, action and maintenance. The EPCS has 40 items and 10 subscales, five of which are cognitive processes and the other five behavioural processes. Each subscale has four items, scored from 1 to 5. The highest and lowest scores on the EPCS total score scale are 200 and 40, respectively. High scores indicate that the respondent has a better chance of being successful in terms of change. The DBSE compares the perceived advantages (pros) and disadvantages (cons) of new behaviour. The first 10 questions of this five-point Likert scale measure the perceived benefit, and the remaining six questions measure the perceived barriers. The lowest and highest scores are 10 and 50, respectively. While higher scores indicate a successful change, lower scores indicate perceived barriers. The ESES is a five-point Likert scale and has five items. The lowest and highest scores are 5 and 25, respectively. Higher self-efficacy scores signify that the individual exhibits a successful change.

2.3.2 | The physical activity scale for the elderly

The PASE is a short scale and was developed by Washburn et al. (1993) to assess the physical activities of individuals aged 65 and older. The PASE score is calculated according to the weight score for each of the different activities that were participated in during the past week. The total score can vary from 0 to 400 points. High scores indicate a higher level of exercise. Ayvat et al. (2017) adapted the scale to Turkish, and Cronbach's alpha coefficient was found to be 0.71.

2.3.3 | The Katz Activities of Daily Living scale

The Katz Activities of Daily Living (ADL) scale was developed by Katz et al. (1963) to examine the treatment and prognosis outcomes in older and chronically ill people. The scale has the following six items: taking a bath, getting dressed, toilet, transfer, continence and nutrition. Items are scored as zero-dependent and one-independent. Six points indicate being fully independent, while zero points indicate being fully dependent. Arik et al. (2015) adapted the scale to Turkish, and Cronbach's alpha coefficient was found to be 0.83.

2.3.4 | Pedometer

The researcher used a pedometer (Mesitaş JP-600) in the present study. A brief informative pedometer form was prepared, and older adults were orally informed about how to use the pedometer. The pedometer was provided to the participants prior to the collection of pre-test data in order to compare the weekly average step counts of the experimental and control groups.

2.4 | Data collection

An independent researcher, trained by the researcher (ESS) and who did not know the groups between April and November 2019, collected the data in the FHC via face-to-face interviews.

First, the individuals' health records were examined, and those who met the inclusion criteria of the current study were telephoned and invited to the FHC. The participants who arrived at the FHC were reassessed for the inclusion criteria (Figure 1). Community-dwelling older adults ($n = 117$), who met the inclusion criteria in the population and agreed to participate, were assigned for randomization (IG $n = 58$; CG $n = 59$). Figure 1 presents the CONSORT flow diagram of the study. The older adults who were initially considered for the intervention group (IG) and control group (CG) were first informed about the study. All participants completed the TTM scales, Katz-ADL and PASE as the pre-tests and post-tests. In addition, weekly average step counts were collected. The implementation process is presented in Table 2.

The IG was followed up for 6 months. First, the pre-test assessments were conducted. The researcher (ESS) held face-to-face MI sessions for the IG once every 2 weeks for 8 weeks (in weeks 2, 4, 6 and 8). After 4 weeks, the participants' change stage was assessed using the SCS. The researcher (ESS) held telephone-based MI sessions for the IG once a month for 2 months (in weeks 16 and 20). Then, post-test assessments were conducted. The CG was followed up twice, when the pre-test and post-test assessments were conducted. The study was completed with 27 older adults in the IG and 32 older adults in the CG.

2.5 | Intervention

MI sessions with the older adults were held by the researcher (ESS) who had been trained in MI techniques. The researcher conducted motivational interviews (face-to-face and via telephone) between April and November 2019. The implementation process is presented in Table 2. See also the flow chart of the study in the study protocol (Sönmez & Kitiş, 2021).

It is important to monitor the cognitive and behavioural processes of individuals, especially according to the stage of change they are in, and to motivate change according to the process through motivational interviews (Prochaska & DiClemente, 1986). In the present study, an effort was made to help the IG to realize the dilemmas with regard to exercising faced by individuals in the pre-contemplation stage, as well as to assist individuals in the contemplation stage to arrive at their own solutions. Consequently, techniques such as asking open-ended

TABLE 2 Measurement tools and follow-up intervals applied to the intervention and control groups.

	Intervention group									Control group	
	Pre-test								Post-test	Pre-test	Post-test
(weeks)	**0**	**2**	**4**	**6**	**8**	**12**	**16**	**20**	**24**	**0**	**24**
TTM scales											
-SCS	x	x	x	x	x	x[a]	x[a]	x[a]	x	x	x
-EPCS	x								x	x	x
-DBSE	x								x	x	x
-ESES	x								x	x	x
Katz-ADL	x								x	x	x
PASE	x								x	x	x
Mean weekly step counts	x								x	x	x
MI		x	x	x	x		x[a]	x[a]			

Abbreviations: DBSE, decisional balance scale for exercise; EPCS, Exercise Processes of Change Scale; ESES, Exercise Self-Efficacy Scale; Katz-ADL, Katz Activities of Daily Living; MI, motivational interviewing; PASE, Physical Activity Scale for Elderly; SCS, stages of change scale; TTM, trans-theoretical model.

[a]Phone-based.

questions, reflective listening, decision balance, importance and trust technique were applied, thus enabling participants to reveal their feelings, thoughts and reactions regarding the benefits/harm of doing/not doing exercise. They were supported to raise awareness about the consequences of and solutions to their individual situations.

Prior to the MI, it was determined which stage of change the older adult was at by the SCS. The researcher (ESS) held face-to-face MI sessions for the IG once every 2 weeks for 8 weeks (in weeks 2, 4, 6 and 8). Face-to-face motivational interviews lasted for an average of 30 minutes. After the MI, the exercise information guideline prepared by the researcher and the TTM-based MI guidelines according to the stages were given to the older adults. The TTM-based MI and Information Guidelines for Gaining Exercise Behaviour were prepared by the researcher within the scope of the relevant literature (Şekerci & Kitiş, 2016; Vries et al., 2017). The guideline was used after consulting five experts in the field of nursing who have published research on the TTM. During the MI, a form prepared by the researcher was used to record the content of the interview. At the end of MI, the next appointment was planned. In addition, the older adults were given a chart prepared by the researcher to record their walking. The researcher (ESS) held telephone-based MI sessions for the IG once a month for 2 months (in weeks 16 and 20). The telephone-based motivational interviews lasted an average of 5 to 7 min. Prior to the telephone interview, it was determined which stage of change the older adult was at by the SCS. Thereafter, a motivational interview was held according to the current stage of the individual. All participants in the IG received both face-to-face and telephone-based MI. MI sessions were terminated at the 20th week.

The CG was only followed up at the beginning and end of the study, and no intervention was made. The CG received the usual care at the family health centre. Although the FHC staff do not provide routine and standard training about the benefits of exercising to the elderly at the centre, they do furnish information when necessary.

2.6 | Statistical analyses

Version 23 of the IBM SPSS was used for analysis. The Shapiro–Wilk normality test was used to check variable distribution. According to parametric test assumptions, the independent samples *t* test, the paired samples t-test, the Mann–Whitney U test, and the Wilcoxon test were used. Pearson's Chi-square test and the Fisher–Freeman–Halton exact test were used to examine the correlation between the two qualitative variables. The marginal homogeneity test was used to compare the two dependent variable groups. In addition, the effect size was calculated using the G-Power 3.1 programme. Cohen's d defines the effect size as follows: $d \leq 0.20$ low, $0.20 < d < 0.80$ medium and $d \geq 0.80$ high. Cohen's *dz* defines the effect size as follows: $0.21 < dz < 0.35$ low, $0.35 < dz < 0.56$ medium and $dz \geq 0.56$ high (Lakens, 2013). The method by which data are analysed only from individuals who complete the study process (protocol) in randomized controlled studies is known as per-protocol (PP) analysis (Akın & Koçoğlu, 2017). In this study, only individuals who completed the study process (protocol) were included in the analysis. The most important advantage of this analysis is that it reflects real enterprise performance. When Little's missing completely at random (MCAR) test was applied, it was concluded that the missing data structure was completely random ($p > 0.05$). Therefore, no additional analysis was deemed necessary.

2.7 | Ethical considerations

This study was approved by the Gazi University Ethics Committee (Decision No: 838-Date: 13/11/2018) and registered with number NCT04128553. This study was conducted in accordance with the principles of the Declaration of Helsinki. The purpose of the study was explained to the participants, and their written informed consent was obtained. Participants were assured that the information they provided would be kept confidential. They were also informed that they have the right to end the interview at any time.

3 | RESULTS

This section presents the findings of the study conducted to examine the effect of nurse-led TTM-based MI on promoting physical activity in older adults.

3.1 | Participant characteristics

In the study, a total 117 older adults were recruited. The study was completed with 59 older adults, 27 in the IG and 32 in the CG (Figure 1). Table 3 presents a comparison of the older adults in the IG and CG in terms of descriptive characteristics. The intergroup difference was not found to be statistically significant ($p > 0.05$). Both groups had similar socio-demographic characteristics.

3.2 | Hypothesis tests

Table 4 presents a comparison of the stages of change the IG and CG in the pre-test and post-test assessments. Accordingly, MI based on the TTM to older adults in the IG was found to be effective in progressing their stages of change and the post-test was significant in favour of the IG ($p < 0.001$).

Figure 2 presents the distribution of stages of change in the IG in all follow-up assessments.

Table 5 presents the distribution of mean scores of the TTM scales of the IG and CG in the pre-test and post-test assessments. There was a significant increase in the cognitive and behavioural processes of the EPCS in the IG in the post-test ($p < 0.005$, $p < 0.004$; effect sizes of 0.651, 0.604, respectively). The intergroup difference was statistically significant in favour of the IG ($p < 0.001$; effect sizes of 1.073 and 1.105). The DBSE mean scores of the IG were significantly increased post-test compared to pre-test ($p < 0.004$; effect size

TABLE 3 Descriptive characteristics of the older adults in the intervention and control groups.

Characteristics	IG ($n = 27$)		CG ($n = 32$)		Test	p
	n	%	*n*	%		
Age[d]						
65–69 years	15	55.6	21	65.6	0.624[a]	0.429
70–74 years	12	44.4	11	34.4		
Gender[d]						
Female	14	51.9	16	50	0.020[a]	0.887
Male	13	48.1	16	50		
Stage[d]						
Pre-contemplation	5	18.5	12	37.5	2.572[a]	0.109
Contemplation	22	81.5	20	62.5		
Marital status						
Married	23	85.2	27	84.4	0.910[b]	1.00
Single, widowed or divorced	4	14.8	5	15.6		
Educational level						
No schooling or primary school	18	66.7	17	53.1	8.905[b]	0.055
Secondary school and higher	9	33.3	15	46.9		
Occupation/employment						
Housewife	13	48.1	14	43.8	3.268[b]	0.344
Retired	11	40.7	11	34.4		
Employee (shopkeeper, worker, lawyer)	3	11.2	7	21.9		
Income level						
Income less than expense	5	18.5	10	31.3	3.098[b]	0.225
Income equal to expense	18	66.7	21	65.6		
Income more than expense	4	14.8	1	3.1		
Whom they live with at home						
Alone	3	11.1	5	15.6	1.515[b]	0.836
With spouse and/or children	22	81.5	25	78.1		
Other	2	7.4	2	6.3		
State of doing exercise regularly before						
Yes	11	40.7	16	50	0.506[a]	0.477
No	16	59.3	16	50		
History of falling						
Available	11	40.7	15	46.9	0.224[a]	0.636
N/A	16	59.3	17	53.1		
Fear of falling						
Available	10	37	12	37.5	0.001[a]	0.971
N/A	17	63	20	62.5		
Presence of a chronic disease						
Available	5	18.5	12	37.5	2.572[a]	0.109
N/A	22	81.5	20	62.5		
Chronic diseases[c]						
Hypertension	16	59.3	12	37.5		
Diabetes	8	29.6	8	25		
Other	11	40.7	7	21.8		

Abbreviations: CG, control group; IG, intervention group.
[a]The Pearson's Chi-square.
[b]The Fisher–Freeman–Halton Exact Test.
[c]Multiple choices.
[d]Randomization features of the IG and CG.

TABLE 4 Stages of change intervention and control groups during the pre-test and post-test.

	IG ($n = 27$)				CG ($n = 32$)				
	Pre-test		Post-test		Pre-test		Post-test		p
Stages of change	n	%	n	%	n	%	n	%	(Post-test)
Precontemplation	5	18.5	2	7.4	12	37.5	10	31,3	**<0.001**[b]
Contemplation	22	81.5	-	-	20	62.5	18	56.3	
Preparation	-	-	6	22.2	-	-	1	3.1	
Action	-	-	19	70.4	-	-	3	9.3	
Maintenance	-	-	-	-	-	-	-	-	
Total	27	100	27	100	32	100	32	100	
p	**<0.001**[a]				0.083[a]				

Abbreviations: CG, control group; IG, intervention group.
[a]The Marginal Homogeneity Test.
[b]The Fisher–Freeman–Halton Exact Test.

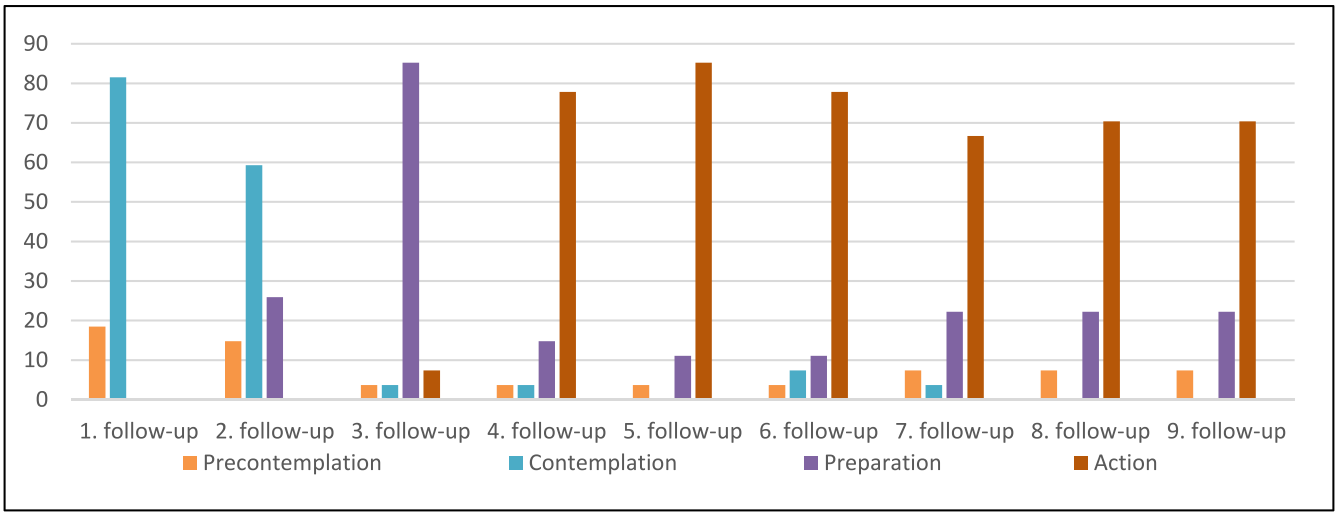

FIGURE 2 Stages of change in the intervention group in all follow-ups.

of 0.604). The IG's mean score on the perceived benefits subscale significantly increased post-test compared to pre-test ($p < 0.004$; effect size of 0.604). There was no significant difference in the perceived barriers subscale mean score post-test compared to the pre-test score ($p > 0.05$; effect size of 0.007). However, the mean scores of the perceived barriers and benefits subscale in the CG were found to be significantly decreased in the post-test assessments ($p < 0.007$ and $p < 0.003$, respectively). It was determined that the difference in the mean score of the DBSE perceived benefits subscale was significant in favour of the IG ($p < 0.001$; 1.182), while the difference in the mean score of the DBSE perceived barriers subscale was significant in favour of the CG ($p < 0.017$; effect size of 0.435). This is associated with the significant decrease in the DBSE perceived barriers subscale mean score in the CG.

Post-test, the mean score of the ESES significantly increased in the IG ($p < 0.001$; effect size of 0.952) and the CG ($p < 0.021$) compared to the pre-test scores. The difference between ESES mean scores of the groups was not statistically significant ($p > 0.05$; effect size of 0.409; Table 5).

In Figure 3, there is no significant difference in step counts in the IG ($p > 0.05$; effect size of 0.202), whereas there is a significant decrease in the mean step counts of the CG ($p < 0.017$). However, the difference between the groups was statistically significant in favour of the IG ($p < 0.041$; effect size of 0.641). In Table 6, the PASE mean total score exhibited a significant increase in the IG from the pre-test to the post-test ($p < 0.041$; effect size of 0.202); however, there was no statistically significant difference between the pre-test and post-test scores for the CG ($p > 0.05$). Accordingly, MI based on the TTM to older adults increased the physical activity level according to the PASE score. However, there was no statistical difference between the groups in terms of the score difference.

4 | DISCUSSION

Older adults constitute the age group which leads the most sedentary life in society and is most affected by physical inactivity. Despite the numerous health advantages of physical activity, the large majority of

TABLE 5 The distribution of mean scores of the TTM scales of the intervention and control groups in the pre-test and post-test.

The EPCS subscales	IG (*n*: 27)		CG (*n*: 32)		Test; *p*[a]
	Pre-test x̄ ± sd (min-max)	Post-test x̄ ± sd (min-max)	Pre-test x̄ ± sd (min-max)	Post-test x̄ ± sd (min-max)	
Cognitive processes	58.66 ± 16.60 (27–88)	66.33 ± 14.52 (32–91)	58.84 ± 14.87 (26–94)	53.18 ± 15.47 (28–97)	−4.089; **<0.001**[c]; $d = 1.073$
	$z = 2.805$; $\mathbf{p = 0.005}$[b]; $dz = 0.651$		$t = 2.457$; $\mathbf{p = 0.020}$[d]		
Awareness	10.88 ± 3.83 (4–19)	12.44 ± 3.91 (4–19)	9.53 ± 3.85 (4–20)	8.46 ± 3.58 (4–17)	2.621; **0.011**[c]
	$z = 2.137$; $\mathbf{p = 0.033}$[b]		$z = -1.459$; $p = 0.145$[b]		
Emotional stimulation	11.40 ± 4.30 (4–18)	13.37 ± 3.30 (6–19)	13.65 ± 3.84 (6–20)	11 ± 3.65 (4–20)	−3.584; **<0.001**[e]
	$z = 2.146$; $\mathbf{p = 0.032}$[b]		$t = 3.341$; $\mathbf{p = 0.002}$[d]		
Reassessment of environment	12.11 ± 3.90 (4–19)	13.66 ± 3.94 (6–20)	12.46 ± 4.54 (4–20)	11.87 ± 4 (5–20)	−2.153; **0.031**[e]
	$t = -2.826$; $\mathbf{p = 0.009}$[d]		$z = -0.447$; $p = 0.655$[b]		
Reassessment of self	12.88 ± 4.50 (4–20)	14.25 ± 3.69 (4–19)	12.84 ± 3.75 (4–20)	11.31 ± 3.91 (4–20)	3.102; **0.003**[d]
	$t = -1.882$; $p = 0.071$[d]		$t = 2.549$; $\mathbf{p = 0.016}$[d]		
Social liberty	11.37 ± 3.44 (5–16)	12.59 ± 3.59 (4–19)	10.34 ± 2.92 (6–16)	10.53 ± 3.61 (4–20)	−0.978; 0.328[e]
	$z = 1.439$; $p = 0.150$[b]		$t = -0.278$; $p = 0.783$[d]		
Behavioural processes	51.03 ± 13.29 (29–75)	57.18 ± 10.77 (32–71)	54.50 ± 13.92 (24–84)	48.84 ± 12.72 (28–84)	−4.212; **<0.001**[c] $d = 1.105$
	$t = -3.141$; $\mathbf{p = 0.004}$[d]; $dz = 0.604$		$z = -2.440$; $\mathbf{p = 0.015}$[b]		
Contradictory situation	9.88 ± 2.62 (4–15)	11.59 ± 2.56 (6–16)	11.37 ± 3.93 (4–20)	9.46 ± 2.53 (4–16)	3.870; **<0.001**[c]
	$t = -2.759$; $\mathbf{p = 0.010}$[d]		$t = 2.803$; $\mathbf{p = 0.009}$[d]		
Supportive relationships	9.55 ± 3.97 (4–16)	9.66 ± 3.29 (4–16)	10.21 ± 3.24 (4–16)	9.25 ± 3.82 (4–16)	1.149; 0.255[c]
	$t = -0.159$; $p = 0.875$[d]		$t = 1.535$; $p = 0.135$[d]		
Reinforcement	10.14 ± 2.72 (5–16)	12.22 ± 3.34 (5–17)	11.71 ± 3.40 (4–20)	10.68 ± 3.35 (6–20)	3.858; **<0.001**[c]
	$t = -3,345$; $\mathbf{p = 0.003}$[d]		$t = 1,973$; $p = 0.057$[d]		
Agreement with self	12.25 ± 3.53 (6–20)	14.25 ± 3.81 (6–20)	12.25 ± 4.58 (4–20)	11 ± 4.22 (4–20)	3.092; **0.003**[c]
	$t = -3.213$; $\mathbf{p = 0.003}$[d]		$t = 1.544$; $p = 0.133$[d]		
Contro of stimulus	9.18 ± 3.21 (4–17)	9.44 ± 2.29 (5–14)	8.93 ± 2.80 (4–16)	8.43 ± 2.61 (4–13)	0.898; 0.373[c]
	$t = -0.413$; $p = 0.683$[d]		$t = 0.880$; $p = 0.385$[d]		
The DBSE subscales					
Perceived benefits	29.40 ± 8.79 (13–47)	34.55 ± 6.78 (12–41)	33.03 ± 6.93 (14–43)	28.87 ± 8.44 (10–40)	4.558; **<0.001**[c] $d = 1.182$
	$t = -3.143$; $\mathbf{p = 0.004}$[d]; $dz = 0.604$		$t = 3.279$; $\mathbf{p = 0.003}$[d]		
Perceived barriers	11.77 ± 4.37 (6–24)	11.74 ± 3.53 (6–19)	13.93 ± 4.14 (6–22)	11.65 ± 4.38 (6–22)	−2.387; **0.017**[e] $d = 0.435$
	$t = 0.041$; $p = 0.968$[d]; $dz = 0.007$		$z = -2.689$; $\mathbf{p = 0.007}$[b]		
The ESES[f]					
	9.22 ± 2.92 (5–17)	11.81 ± 3.55 (6–18)	8.75 ± 3.02 (5–15)	10.12 ± 2.48 (5–15)	1.558; 0.125[c] $d = 0.409$
	$t = -4.951$; $\mathbf{p < 0.001}$[d]; $dz = 0.952$		$t = -2.430$; $\mathbf{p = 0.021}$[d]		

Abbreviations: CG, control group; DBSE, decisional balance scale for exercise; EPCS, exercise processes of change scale; ESES, exercise self-efficacy scale; IG, Intervention group.

[a]Post-test/pre-test score difference.

[b]The Wilcoxon Test.

[c]Independent samples *t* test.

[d]The paired samples *t* test.

[e]The Mann–Whitney U Test.

[f]No subscale.

older adults have inadequate levels of physical activity (Nied & Franklin, 2002). In addition to the different needs and barriers of each individual, lack of motivation is an important factor preventing the promotion of physical activity (Kitiş, 2017, 120; Pender et al., 2015). Individuals in the risk group need personal consulting to acquire healthy life behaviours. Due to the nature of their professional role, nurses are appropriate healthcare professionals to provide consulting to older adults (Pender et al., 2015). This study has assessed the

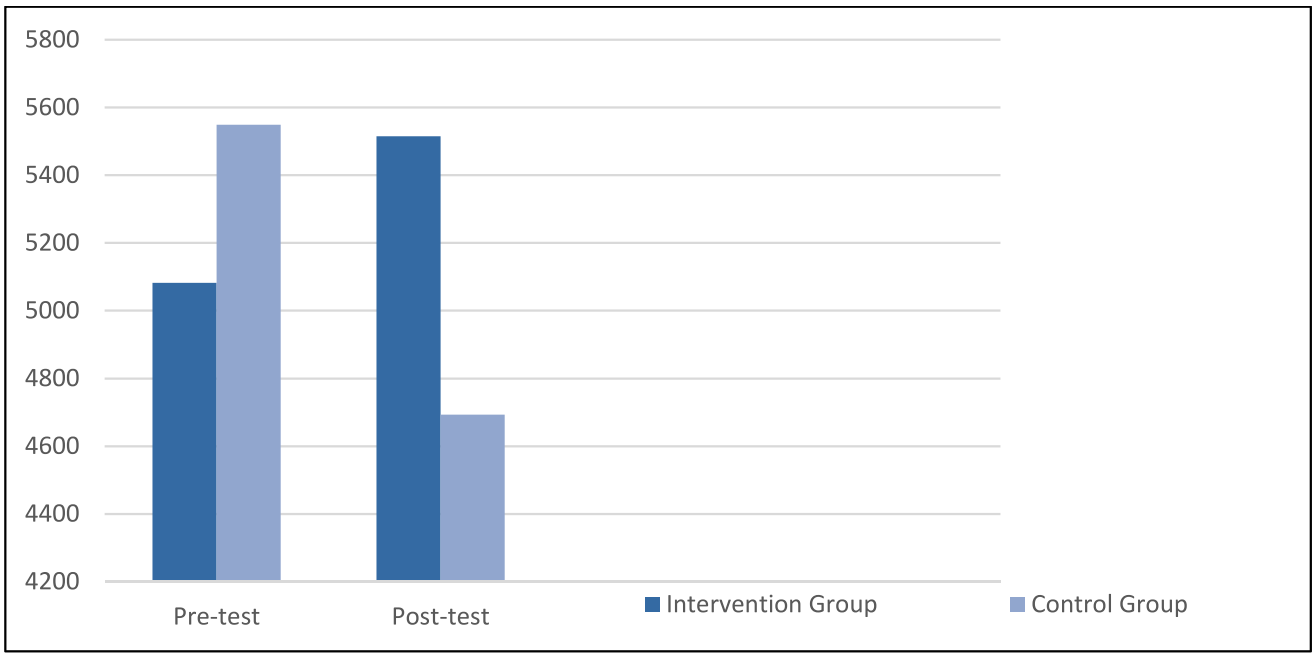

FIGURE 3 The comparison of the mean weekly step counts of the intervention and control groups in the pre-test and post-test.

effectiveness of the TTM-based MI conducted to promote physical activity in older adults.

The TTM states that individuals go through certain stages of behavioural change; they undergo behavioural change when they progress towards the next stages (Prochaska & Velicer, 1997). The literature reveals that TTM-based training and consulting result in significant progress among individuals with regard to their stages of change relating to exercise and increase their physical activity (Alciauskaite et al., 2015; Kim et al., 2004; Kirk et al., 2010; Perry & Butterworth, 2011). In addition, meta-analysis studies demonstrate that the TTM-based interventions make progress in stages and have a minor and moderate effect on promoting physical activity (Conn et al., 2011; Gourlan et al., 2016). The findings of the present study demonstrated that the TTM-based MI promoted the physical activity level of the participants (i.e., they made progress in the exercise stage). However, the CG did not make progress in the exercise stage.

The findings of the present study are compatible with those of similar studies (Cheung et al., 2006; Pinto et al., 2001) in terms of the effect of the intervention on the cognitive and behavioural processes mean score of the EPCS. The findings demonstrate that the TTM-based MI was effective in relation to the increase in the EPCS mean score (progress of the exercise behaviour processes). By contrast, it was observed that the average scores decreased in the CG.

The decision to realize any behaviour is based on the comparison between the advantages (pros) and disadvantages (cons) of exhibiting that behaviour (Marcus, Selby, et al., 1992; Velicer et al., 1998). The individual's perceived benefit of a behaviour triggers them to think about the change. After the perceived benefits increase, the individual may start the contemplation stage for that behaviour, followed by the preparation stage. Velicer et al. (1998) point out that as individuals progress in the exercise stages of change, they are expected to have higher perceived benefits and lower perceived barriers. Accordingly, the DBSE perceived benefits subscale score increased from the pre-contemplation stage to the contemplation stage, increased somewhat more in the preparation stage and remained constant in the action and maintenance stages. The DBSE perceived barriers subscale score remained virtually the same from the pre-contemplation stage to the preparation stage, but decreased after the preparation stage (Velicer et al., 1998). In other words, the individual considers both pros and cons of the behaviour, and when the perceived benefit outweighs the perceived barriers and progresses to the stage of action, the power of the perceived barriers decreases. In the literature, it was determined that in the TTM-based interventions, the DBSE perceived benefits subscale scores of the individuals increased significantly, and their physical activity levels increased (Kirk et al., 2010; Pinto et al., 2001). The findings of the present study are compatible with the findings of the studies in the relevant literature (Kirk et al., 2010; Pinto et al., 2001); they have demonstrated that the TTM-based MI increased the mean score of DBSE perceived benefits. In the present study, the perceived barriers decreased in the CG at the end of the application, whereas there was no significant decrease in the perceived barriers in the IG. The barriers perceived by the individuals in the IG significantly decreased as they progressed to the advanced stages of the exercise behaviour process. The reason why the perceived barriers remained important was probably because certain individuals in this group continued to have negative perceptions of exercise (various barriers such as a fear of falling) despite making progress in the exercise stage. Another factor might be that they had not gained sufficient internal control to do exercise and felt externally controlled, in that they continued to be interviewed by the researcher.

TABLE 6 The distribution of the PASE mean scores of the intervention and control groups in the pre-test and post-test.

	IG ($n = 27$)				CG ($n = 32$)				
	Pre-test		Post-test		Pre-test		Post-test		
	$\bar{x} \pm sd$	Median (min–max)	$\bar{x} \pm sd$	Median (min–max)	$\bar{x} \pm sd$	Median (min–max)	$\bar{x} \pm sd$	Median (min–max)	p[a]
PASE Leisure activities	32.80 ± 24.98	17.63 (10.25–104.44)	81.44 ± 67.99	58.64 (0–249.09)	32.94 ± 30.27	23.54 (0–138.30)	42.56 ± 39.37	29.13 (0–175.89)	0.107[d] $d = 0.433$
		$p = 0.002$[b]; $dz = 0.729$				$p = 0.277$[c]			
PASE Household activities	67 ± 32.62	60 (0–116)	59.44 ± 34.60	56 (0–136)	50.59 ± 31.72	50 (0–141)	43.59 ± 36.99	47.50 (0–136)	
		$p = 0.393$[b]; $dz = 0.224$				$p = 0.294$[c]			
PASE Occupational activities	16.60 ± 55.29	0 (0–252)	13.21 ± 42.16	0 (0–168)	10.50 ± 40.97	0 (0–210)	11.05 ± 44.31	0 (0–210)	
		$p = 0.180$[b]; $dz = 0.210$				$p = 0.655$[b]			
PASE total score	116.40 ± 67.27	118.12 (17.63–349.63)	154.10 ± 84.88	123.11 (12.99–385.09)	94.04 ± 51.94	89.34 (17.63–270.80)	97.21 ± 64.40	89.07 (17.63–31,189)	
		$p = 0.041$[c]; $dz = 0.202$				$p = 0.894$[b]			

Abbreviations: CG, control group; IG, intervention group; PASE, Physical Activity Scale for Elderly.
[a]Post-test/Pre-test score difference.
[b]The Wilcoxon Test.
[c]The Paired Samples t-Test.
[d]The Mann–Whitney U Test.

Indeed, the fact that certain individuals in the IG experienced a relapse in recent months supports this notion. In their randomized controlled trial, Cheung et al. (2006) stated that the presence of an increase or the lack of a decrease in the perceived barriers and the disadvantages of walking (such as a fear of falling) still played a key role among older adults, and they tended to worry about the negative aspects of walking even in different stages of change. In a meta-analysis study concerning physical activity and the TTM, Marshall and Biddle (2001) reported that the perceived barriers decreased when participants progressed to the next stages. The findings of the present study are compatible with the study by Cheung et al. and different from the study by Marshall and Biddle.

Self-efficacy is a determining factor that affects health behaviours both directly and indirectly. Individuals with low self-efficacy give up on attempting behavioural change, believing that their efforts will fail in the face of difficulties. On the other hand, those with high self-efficacy expect to achieve positive outcomes in behavioural change (Bandura, 2004). The exercise self-efficacy scale, based on Bandura's self-efficacy theory, was developed by Marcus, Rossi, et al. (1992). Higher mean scores signify that performance increases. As the stages of change progress, self-efficacy is expected to increase (Velicer et al., 1990). In their meta-analysis study on physical activity and the TTM, Marshall and Biddle (2001) indicated that when individuals progressed to the next stages, their self-efficacy increased; however, self-efficacy varied among those who were at the same stage. According to Marcus, Rossi, et al. (1992), self-efficacy perception is personal and may be lower in an individual at the advanced behavioural stages of change than the self-efficacy perception of an individual at the previous behavioural stages of change. This is because individuals in the contemplation and pre-contemplation stages are able to utilize informative and motivational experiences designed for increasing physical activity. An important point in supporting the self-efficacy of older adults is that exercise should be practicable, easy and repeatable and that there is no need to rush to increase the exercise. Otherwise, the individual will have an increased perception of failure and decreased self-confidence (Keskin & Başkurt, 2020).

In the present study, the exercises the individuals were asked to perform were walking and indoor activities that were appropriate for their physical condition. Other studies reported that in the TTM-based interventions, the ESES mean score of the individuals significantly increased, and their physical activity levels elevated (Kirk et al., 2010; McAuley et al., 2006; Pinto et al., 2001). The randomized controlled trials (Lilienthal et al., 2014; Tse et al., 2013) and the meta-analysis studies (Marshall & Biddle, 2001; McGrane et al., 2015) examining the effect of MI on the physical activity level of older adults reported that MI increased their self-efficacy and had positive impacts on their exercise behaviour. The findings of the present study revealed that the TTM-based MI increased the ESES score of the participants (increased self-confidence to do exercise). The CG's high ESES score was associated with the fact that they were motivated due to participating in the study and the fact that they were given a pedometer. Some studies demonstrated that the use of a pedometer increased the motivation and self-confidence of older adults (Ainsworth & Buchholz, 2017; Snyder et al., 2011).

In the present study, the parameters assessing the physical activity levels of the older adults were the PASE and the mean weekly step counts calculated by means of the pedometer. The PASE leisure activities subscale score of the IG increased (Table 6). As most older adults were unemployed, and they either received support or exhibited minimum effort in doing the housework, their leisure activities scores increased, indicating that their physical activity level also increased (Abbaspour et al., 2017; De Roos et al., 2018). There was no significant increase in the physical activity levels of the CG with similar characteristics. This demonstrates that the intervention was effective.

Although the step counts in the IG increased in the subsequent follow-ups compared to the beginning, this increase was not significant (Figure 3). This was thought to be associated with the presence of relapses towards the final follow-ups. In the CG, there was a significant decrease in the step counts in the subsequent follow-ups compared to the beginning. In the literature, it was determined that the interventions (such as model-based interviews and exercise training) increased the mean step counts and physical activity levels of the older adults. The findings of the present study are compatible with those of related studies in terms of the PASE score (Duru et al., 2010; Reid et al., 2012); they have demonstrated that the TTM-based MI elevated the physical activity level and promoted physical activity according to the PASE score.

4.1 | Strengths and limitations

One of the strengths of this study was its randomized design. Moreover, the fact that it consisted of experimental and control groups proved to be a further strength. However, this study also had certain limitations. Some older adults experienced difficulty in reading the guidelines and received support from family members. The prospective follow-up was short (24 weeks) due to time limitations. Although the Little's MCAR test showed that the losses were random, the fact that some of the participants left the study during the follow-up period can be regarded as a limitation.

5 | CONCLUSION

Older adults in the IG exhibited progress in the stages of change at the end of the 24-week process, and the intervention was effective in increasing the physical activity levels of the older adults. It is recommended that MI based on the TTM be used for developing healthy lifestyle behaviours in older adults and that studies aimed at increasing physical activity levels be conducted in larger sample groups for a longer period of time. Moreover, it is recommended that studies be conducted to assess the effectiveness of interventions aimed at promoting physical activity in older adults via both qualitative and quantitative methods.

AUTHORSHIP STATEMENT

(All authors meet the authorship criteria)

Conceptualization: ESS-YK.

Investigation: ESS.

Methodology: ESS-YK.

Resources: ESS.

Supervision: YK.

Writing–original draft: ESS.

Writing–review & editing: ESS-YK.

ACKNOWLEDGMENTS

This study was produced from a PhD thesis and was presented as an oral presentation at the 2nd International 3rd National Public Health Nursing Congress and received an oral presentation award (7-9 January 2021, Online, TURKIYE/Ankara).

CONFLICT OF INTEREST STATEMENT

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

ETHICS STATEMENT

Study was approved by University Ethics Committee (Document Date and Number: 13.11.2018/24074710-604.01.01-44, Decree no: 838). Permission was obtained from the Provincial Directorate of Health and also from the authors of the scales to use in the study. Also, consents were obtained from the participants.

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How to cite this article: Sönmez Sari, E., & Kitiş, Y. (2024). The effect of nurse-led motivational interviewing based on the trans-theoretical model on promoting physical activity in healthy older adults: A randomized controlled trial. *International Journal of Nursing Practice*, *30*(2), e13252. https://doi.org/10.1111/ijn.13252