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RESEARCH PAPER

The effectiveness of synchronous tele-exercise to maintain the physical fitness, quality of life, and mood of older people - a randomized and controlled study

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Key summary points

Aim This study aims to investigate the effects of a synchronous tele-exercise program on physical fitness, quality of life, loneliness, and mood change when applied to older people under social isolation during the coronavirus pandemic.

Findings Synchronous tele-exercise seems to be an effective method to provide improvements in the physical fitness level of community-dwelling older people and maintain their quality of life. In addition, it can make positive contributions to coping with loneliness in the older people and improve their mood.

Message To maintain the physical fitness level and quality of life of community-dwelling older people, the exercises can be applied effectively via the synchronous tele-exercise method.

Abstract

Purpose The study investigates the effects of synchronized tele-exercise on physical fitness level, quality of life (QoL), loneliness and mood of older people individuals who experience social isolation during the coronavirus pandemic.

Methods A randomized controlled study was performed with 30 volunteers. A synchronized online exercise protocol was applied to the study group (SG) ($n=15$; 10 females, 5 males) (mean age 67.1 ± 3.7 years), while the control group (CG) ($n=15$; 7 females, 8 males) (mean age 69.3 ± 5.6 years) was placed on the waiting list. Physical fitness (Senior Fitness Test Battery-SFTB), health-related QoL (Nottingham Health Profile-NHP), loneliness (Loneliness Scale for the Elderly-LSE), and mood changes (Positive and Negative Affect Schedule-PANAS) were evaluated.

Results There was a significant difference in all the subscales of SFTB ($p<0.05$), physical activity and energy subscales, and total scores of NHP ($p<0.05$) and PANAS positive emotional status score ($p=0.002$) in the study group. While LSE scores worsened in the CG ($p=0.016$), there was no significant difference in the SG ($p=0.162$).

Conclusion Synchronous tele-exercise can provide improvements in the physical fitness level and can be used to maintain QoL and to improve the mood of community-dwelling older people.

Keywords Tele-exercise · Strength · Flexibility · Balance · Physical activity · Emotional status

Introduction

Regular physical activity (PA) maintains physical fitness and provides independence in daily life activities and a better QoL for older people [1]. PA is any bodily movement that requires energy expenditure produced by skeletal muscles and exercise is a subcategory of PA that is planned, repetitive, structured, and purposeful [2]. Muscle strength, flexibility, endurance, and cardiovascular fitness are the basic components of physical fitness. Exercise can prevent the decline in physical fitness of the older people, has positive

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effects on emotion, increases the QoL as well as social participation, and affects mood positively [3–5].

The PA opportunities of the older people, socially isolated in their homes due to the coronavirus pandemic, have decreased. Successive efforts to minimize transmission and conserve healthcare resources for patients and healthcare professionals have dramatically reduced outpatient clinical care. Decreased access to face-to-face rehabilitation care, PA counseling, and changes in health care financing and delivery have contributed to the exponential increase in tele-rehabilitation [6].

Tele-rehabilitation is rehabilitation services provided to patients from distant locations using information and communication technologies. Tele-rehabilitation consultations may include diagnosis, assessment, education, therapy, goal setting, and monitoring. Literature reviews on tele-rehabilitation practices in the older people have shown that tele-rehabilitation can produce results similar to face-to-face methods [7]. Generally, asynchronous methods have been used in studies of tele-rehabilitation in the literature [6]. Communication between patients and rehabilitation specialists takes place through a variety of synchronous approaches such as telephony, internet-based video conferencing, or asynchronous methods like video-based exercise [8]. However, further research is needed to better understand the features of effective tele-exercise methods. Exercise practices in which the physiotherapist synchronously accompanies the individuals via video conference allows the physiotherapist to readily supervise the exercises, intervene and provide appropriate feedback, so that the participant does exercises properly and safely. Based on this, we hypothesized that the synchronously applied tele-exercise method may be maintain the physical fitness, QoL, and mood of the older people when face-to-face exercise methods are not possible. For this reason, we aimed to investigate the effects of synchronized tele-exercise on the physical fitness level, QoL, loneliness, and mood of community-dwelling older people experiencing social isolation due to the COVID-19 outbreak.

Method

Participants

Participants in the study were older people who living in urban areas who have internet access and who responded to posted invitations through social media and e-mail during the coronavirus restrictions imposed in Turkey. Before proceeding to tele-assessment, the participants were given information about the research and inclusion criteria via online invitations. Participants were asked to confirm that they met the inclusion criteria and were voluntarily participating in the study. Ninety-two people were initially contacted; 58.7% of these refused to participate in the study and 38 individuals wanted to participate in the study and confirmed that they met inclusion criteria. A meeting over Skype was planned for each individual and one investigator evaluated each with a synchronous tele-assessment session. The study accepted individuals age 65 years and over who lived in the community, who declared they did not have a physical limitation/disability to perform PA, who were in social isolation due to the COVID-19 pandemic, and who had an internet connection and a device that could access a program offered online.

The study excluded participants with severe cognitive impairment (Mini-Mental Total Test score of 25 and above), hearing problems, visual or vestibular disorders that can cause balance loss, diabetes/hypertension, neurological disease or respiratory disease.

At the end of the synchronous tele-assessment session, eight individuals were excluded from the study due to inclusion–exclusion criteria. (Fig. 1).

Study design

This is a blind, randomized controlled study carried out between July 2020 and December 2020. Before enrollment in the study, informed consent was obtained from all participants. The study was granted by the Human Research Ethics Committee at Istinye University (IRB:67, Date: 25.06.2020). The research protocol was conducted according to the Declaration of Helsinki. The study was registered to a clinical trials database (NCT04334434).

G*Power 3.1.9.4 program was used to determine the sample size. There was no available clinically important minimal difference value from past literature for the Senior Fitness Test. To calculate a minimum sample size we relied on the "8 Step Up and Walk Test" value because the test related to both lower extremity muscle strength and balance (7.28 and 6.08 (δ), and 0.92 and 1.06 (σ); ($d = 1.21$) [9]. The estimated sample size was determined to be 26 (at 80% power (1–β) and α at 0.05). A total of 30 cases were included in the study in case of dropouts.

Thirty participants were randomly divided via the e-picos website (1:1 allocation) into 2 groups, a study group (SG) and a control group (CG).

Outcome measures

Before the assessment, participants were sent videos regarding the methods and materials to be used during the test protocol. Participants were evaluated via an online system (Skype) in the synchronous session by the same blind investigator at baseline and again at the end of the study. To collect the demographic data, a survey was administered with questions about several demographic variables (age,

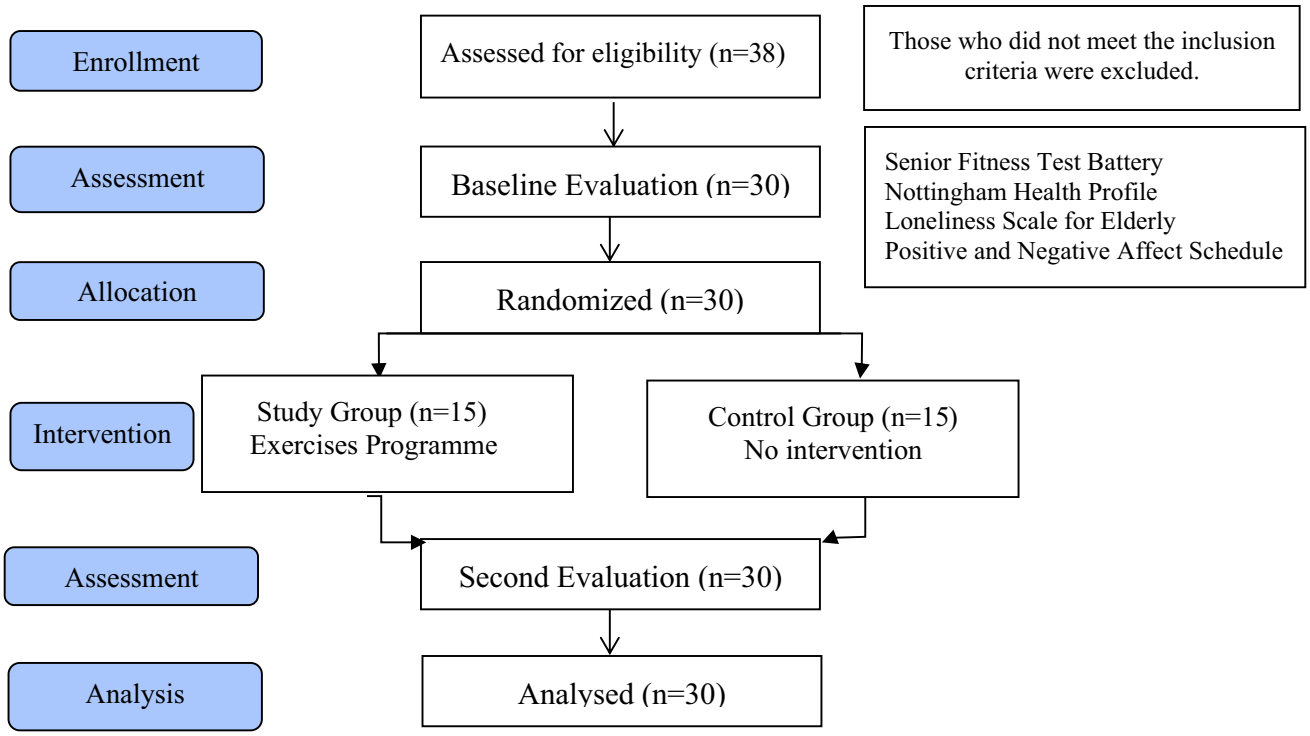

Fig. 1 CONSORT flow diagram of study

gender, height, weight). Physical fitness (Senior Fitness Test Battery-SFTB), health-related QoL (Nottingham Health Profile-NHP), feelings of loneliness (Loneliness Scale for the Elderly-LSE), and mood changes (Positive and Negative Affect Schedule-PANAS) were evaluated. To ensure that there was no change in the PA level in the CG, the Physical Activity Scale for the Elderly-PASE was applied to the CG. Participants accessed the self-administered questionnaires online under the supervision of the investigator. Performance was tested with the assistance of a companion and observed and recorded by the investigator from the online system (Skype). To observe participants during the tests, a camera was positioned in full view of the participant. Performance before and after the intervention was tested at the same time of day.

Senior fitness test battery (SFTB)

Physical fitness was assessed with SFTB validated for the evaluation of fitness in community-dwelling older adults (Cronbach's alpha = 0.708, test–retest reliability = 0.851–0.960) [10]. Before testing each participant sat in a chair and rested for at least five minutes and engaged in 5–8 min of warm-up and stretching exercises. Throughout the test, the participant was observed for adverse reactions such as shortness of breath, dizziness, chest pain, loss of balance or confusion, and the risk of injury. Each test was explained and demonstrated to the patient before assessment. The tests were performed in the order suggested by Rikli and Jones to guard against fatigue. Between tests, individuals were given a rest period [11].

The battery consisted of 6 parts:

The Chair Stand Test: The number of times standing up from and sitting on a chair for 30 s was recorded as a score to evaluate the lower limb muscle strength. A standard height (approximately 45 cm) chair without armrests was used for the test.

The Biceps Curl Test: The number of dominant arm completed movements from full extension to full flexion position for 30 s was recorded to evaluate the upper limb muscle strength. To ensure the standardization of weights, a water bottle was used (2.25 kg for women and 3.5 kg for men).

2-Minute Step Test: Participants walked as fast as possible for 2 min and the exact number of steps taken with their dominant foot was recorded to evaluate aerobic endurance.

8 Step Up and Walk Test: This test was used to measure agility and dynamic balance. The participant sat upright in a chair. A water bottle was placed 2.44 m forward from the front edge of the chair. The participant moved around the water bottle to arrive at the chair again as soon as possible and the time was recorded.

Sit and Reach Test: This test was used to determine the flexibility of the lower limb. Without bending the knee in extension, the participant extended the body forward,

reaching towards the toes with both hands. The distance was measured with a ruler and recorded as (−), zero (0), or (+) cm.

Back-Scratching Test: This test was used to determine upper limb flexibility. One arm makes an external and internal rotation relative to the opposite arm. The distance between the middle fingers is measured for both hands with a ruler and recorded as (−), zero (0), or (+) cm.

Nottingham health profile (NHP)

NHP is a general QoL questionnaire consisting of 38 questions and 6 subscales assessing individuals' health problems and how they perform their activities of daily life. The subscales are classified as energy (3 items), social isolation (5 items), pain (8 items), sleeping (5 items), PA (8 items), and emotional reactions (9 items). The answers to the questions are Yes / No. Each subscale is scored between 0 and 100. A high total score indicates bad health. The Turkish version of the questionnaire was used in the study (Cronbach Alpha = 0.56–0.83, test–retest reliability = 0.70–0.92) [12].

Loneliness scale for the elderly (LSE)

LSE has 6 (2, 3, 5, 6, 9, 10) negative items that evaluate emotional loneliness and 5 (1, 4, 7, 8, 11) positive items that evaluate social loneliness; the sum of these two subscales gives the overall loneliness score. Each item in the scale is defined by a 3-point Likert-type grading (0 = Yes, 1 = Possible, 2 = No). A high total score indicates that the loneliness of the individuals is high [13, 14]. The Turkish version of the questionnaire was used in the study (Cronbach Alpha = 0.85, test–retest reliability = 0.93) [14].

Positive and negative affect schedule (PANAS)

PANAS consists of 20 items, ten of which indicate positive mood and ten of which indicate negative mood. The scale is graded in a five-point Likert type from 1 = 'never felt' to 5 = 'felt very much'. A high score on the scale for positive items indicates positive emotions, and a higher score for negative items indicates negative emotions [15]. The Turkish version of the scale was used for the study (Internal consistency = 0.83 and 0.86 for positive and negative affect, test–retest reliability = 0.40 and 0.54 for positive and negative affect) [16].

Physical activity scale for the elderly (PASE)

PA was objectively assessed with the PASE validated for the older people. The PASE assesses the duration and frequency of leisure-time activity, work-related activity, and housework during the previous week; the frequency of participating in the activities is defined as often (5–7 days/week), sometimes (3–4 days/week) and never/rarely (1–2 days/week); the duration of activities is determined as more than 4 h, 2–4 h, 1–2 h, and less than 1 h. A higher score indicates a higher level of PA [17]. The Turkish version of the scale was used in the study (Cronbach Alpha = 0.714, test–retest reliability = 0.993–0.997) [18].

Interventions

The participants in the study group ($n = 15$) were given an online personalized exercise program. The exercises were performed in real time online via Skype under the supervision of a physiotherapist; each session was 40 to 45 min in duration for 3 days per week over 6 weeks, 18 sessions in total. The exercises were checked and corrected verbally when necessary by a physiotherapist and advanced from easy to difficult according to the individuals' progression. In each session, participants were verbally questioned about the exercise side effects with no side effects reported.

The participants in the CG ($n = 15$) were put on the waiting list during the study and were asked to continue their daily life at home as usual. To prevent dropouts from the study, participants were called by phone in the third week and reminded the exercise program would start soon. The participants in the CG received an exercise program with the same method immediately after the research schedule was completed.

Exercise program

The program was planned to start with a 5-min warm-up (mini-squat, shoulder circles, trunk twists, and ankle circles in a sitting position) and end with 5-min cool-down (shoulder circles, trunk twists, and ankle circles in chairs).

The main part exercise program consisted of strengthening, balance, and stretching exercises. Since we aimed to maintain general fitness in the older people, the exercise program consisted of muscle endurance, flexibility, and body balance exercises [19]. Exercises were selected and combined with the World Health Organization (WHO) PA recommendations for older adults [20].

Strengthening exercises consisted of isotonic (knee extension in the chair, hip, and calf raise) and resistance exercises (straight arm raise, straight arm pulls, and ankle dorsiflexion). Resistance exercises were mainly exercised with red-colored elastic exercise bands (indicating the corresponding resistance level, with a force production of 1.77 kg) [21]. All exercises were performed with 6–8 repetitions and 30 s of rest between each exercise.

Balance exercises consisted of standing on one leg by the chair (15–30 s, 5 times) and heel-to-toe walking by the wall (15–30 steps).

Stretching exercises were performed from the neck, shoulder-upper back, triceps, hip-hamstring, and calf stretch in a sitting position. These exercises were performed in 2–3 repetitions holding a stretch position for 15 s.

Progression in the exercise program took place by increasing the number of repetitions (or a number of steps for walking) in two or three increments every 2 weeks.

Statistical analysis

Analysis was done using the statistics program "Statistical Package for Social Sciences" (SPSS) Version 20.0 for Windows (Chicago, USA), ($p < 0.05$). The normality of data distribution was analyzed using the Shapiro–Wilk test for all group variables. Among the normality tests, non-parametric tests were preferred. During the 6-week intervention period, intragroup and intergroup comparisons were made to determine both the changes within the groups and the differences between the groups of the online exercise program. Changes within the groups were reported with a 95% confidence interval (CI). Effect size was calculated and impact was interpreted as 0.2–0.5 (small), 0.51–0.80 (medium), 0.81 and above (large) [22]. The differences in the scores before and after the treatment of each two groups were analyzed using the Wilcoxon Signed-Rank Test. Mann–Whitney *U* test was used for comparison between groups. The statistical significance value was accepted as $p < 0.05$.

Results

There were no significant differences between groups for age, body mass index, and gender ($p > 0.05$). The participants in the two groups were assessed for age (SG: 67.1 ± 3.7 years; CG: 69.3 ± 5.6 years; $p = 0.394$); Body Mass Index (BMI) (SG: 26.9 ± 2.8 kg/m^2; CG: 27.7 ± 5.1 kg/m^2; $p = 0.414$); and gender (SG: 10 females, 5 males; CG: 7 females, 8 males; $p = 0.269$).

There were no significant differences between groups for all baseline outcome measures ($p > 0.05$). The baseline comparison, differences before and after treatment (Δ), comparison of outcome measures between the groups are indicated in Tables 1 and 2.

There was a positive significant difference in the SG in all the subscale scores of SFTB after treatment ($p < 0.05$), but there was a negative significant difference in the CG in the 2-Minute Step Test and 8-Step Up-Walk Test ($p < 0.05$). Comparing of the two groups revealed a significant difference in all subscales of the SFTB ($p < 0.05$).

There was a positive significant difference in the PA subscale, energy subscale, and the total score of the first and second part of NHP in the SG after treatment ($p < 0.05$). There was a negative significant difference in sleeping, pain,

Table 1 Comparison of physical fitness scores within group and between groups

Outcome measures	Baseline comparison (SG-CG)	Study group ($n = 15$) Mean ± SD				Control group ($n = 15$) Mean ± SD				Between group differences
	p^{**1}	Δ	p^*	95% CI	r^2	Δ	p^*	95% CI	r^2	p^{**2}
SFTB										
Chair Stand Test (rep.)	0.083	3.3 ± 1.4	**0.001**	0.000–0.95	0.99	0.5 ± 1.3	0.190	0.033–0.300	0.13	**≤ 0.001**
Biceps Curl Test (rep.)	0.631	3.1 ± 2.7	**0.003**	0.000–0.095	0.90	0.3 ± 1.2	0.372	0.108–0.425	0.05	**0.001**
2 Minutes Step Test (rep.)	0.836	17.3 ± 9.9	**0.001**	0.000–0.095	0.99	− 2.3 ± 2.6	**0.009**	0.000–0.095	0.10	**≤ 0.001**
8 Step Up and Walk Test (min.)	0.885	− 1.2 ± 1.8	**0.017**	0.000–0.098	0.48	0.6 ± 1.0	**0.047**	0.000–0.095	0.13	**0.010**
Sit and Reach Test (cm)	0.173	− 1.7 ± 1.7	**0.007**	0.000–0.095	0.35	0.3 ± 0.6	0.102	0.000–0.156	0.08	**0.028**
Back-Scratching Test (cm)	0.477	1.6 ± 2.0	**0.005**	0.000–0.095	0.39	− 0.1 ± 0.7	0.394	0.057–0.343	0.02	**0.010**

PASE Physical Activity Scale for the Elderly, *SFTB* Senior Fitness Test Battery, *SD* Standard Deviation, *Δ* Within group difference, *95% CI* 95% Confidence Interval, r^2 Effect Size, *SG-CG* Study Group-Control Group

p^* Wilcoxon Signed-Rank Test, p^{**1}: Mann–Whitney *U* Test (baseline comparison), p^{**2}: Mann–Whitney *U* Test (group comparison)

Bold numbers represent the statistical significance ($p < 0.05$)

Table 2 Comparison of quality of life, loneliness and emotional status scores within group and between groups

Outcome measures	Baseline comparison (SG-CG)	Study group ($n=15$) Mean ± SD				Control group ($n=15$) Mean ± SD				Between group differences
	p^{**1}	Δ	p^*	95% CI	r^2	Δ	p^*	95% CI	r^2	p^{**2}
NHP (0–100)										
Physical activity	0.585	− 12.7 ± 11.5	**0.002**	0.000–0.095	0.84	1.6 ± 3.9	0.144	0.108–0.425	0.05	**≤ 0.001**
Sleeping	0.514	− 2.7 ± 13.3	0.441	0.082–0.385	0.13	6.5 ± 8.0	**0.017**	0.000–0.095	0.20	**0.010**
Pain	0.882	− 14.6 ± 25.3	0.074	0.000–0.095	0.39	8.6 ± 1.0	**0.007**	0.000–0.095	0.32	**0.002**
Emotional reactions	0.790	0.4 ± 10.2	0.753	0.165–0.502	0.06	3.7 ± 6.0	**0.042**	0.000–0.156	0.13	0.052
Social isolation	0.160	− 1.1 ± 4.1	0.317	0.225–0.575	0.15	4.3 ± 12.1	0.180	0.165–0.502	0.33	0.150
Energy	0.094	− 12.5 ± 20.2	**0.042**	0.000–0.098	0.39	− 0.9 ± 18.2	0.705	0.194–0.539	0.02	0.096
Total score of first part	0.309	− 41.3 ± 40.4	**0.017**	0.000–0.207	0.48	22.6 ± 33.6	**0.023**	0.000–0.156	0.16	**0.011**
Total score of second part	0.114	− 0.5 ± 0.7	**0.023**	0.000–0.095	0.41	0.2 ± 0.7	0.257	0.165–0.502	0.12	**0.010**
LSE	0.138	− 0.6 ± 1.6	0.162	0.000–0.156	0.16	1.0 ± 1.6	**0.016**	0.000–0.980	0.18	**0.010**
PANAS/Positive Emotional Status	0.100	3.3 ± 2.2	**0.002**	0.000–0.095	0.57	0.7 ± 3.8	0.893	0.355–0.712	0.09	**0.002**
PANAS/Negative Emotional Status	0.070	− 0.7 ± 4.0	0.195	0.000–0.207	0.15	1.0 ± 3.1	0.127	0.000–0.098	0.16	**0.035**

NHP Nottingham Health Profile, *LSE* Loneliness Scale for the Elderly, *PANAS* Positive and Negative Affect Schedule, *SD* Standard Deviation, *Δ* Within group difference, *95% CI* 95% Confidence Interval, r^2 Effect Size, *SG-CG* Study Group-Control Group

p^* Wilcoxon Signed-Rank Test, p^{**1} Mann–Whitney *U* Test (baseline comparison), p^{**2} Mann–Whitney *U* Test (group comparison)

Bold numbers represent the statistical significance ($p < 0.05$)

and emotional reaction subscales and the total score of the first part of NHP in the CG ($p < 0.05$). Comparing the two groups revealed significant differences in the total score of the first and second part, PA subscale, sleep subscale, and pain subscale of NHP ($p < 0.05$).

There was no significant difference in the LSE scores of the SG ($p > 0.05$) but a negative significant difference in LSE in the CG ($p < 0.05$). Also, differences in LSE were significantly different between the groups ($p < 0.05$).

There was a significant difference in the scores of PANAS positive emotional status in the SG ($p < 0.05$) but no significant difference in the PANAS positive score in the CG ($p > 0.05$). And in comparing the two groups, changes in the PANAS positive and negative scores were seen to be significantly higher in the SG compared with the CG ($p < 0.05$).

There was no significant difference in the PASE level in the CG (baseline: 45.7 ± 35.5; end: 50.2 ± 33.1; $p = 0.195$).

Discussion

This study shows that synchronous tele-exercise can be used to maintain physical fitness and can positively affect QoL, loneliness, and mood of community-dwelling older people. Advantages of home-based synchronous tele-exercise include ease of access (provided there is access to the necessary technology), one-to-one supervision during training and feedback based on the data obtained [23]. Home-based synchronous tele-exercise allowed community-dwelling older people to remain physically active during the COVID-19 pandemic without risk of exposure to the disease.

Our study used the SFTB to define the effect of the exercise program on physical fitness. The tests included in the SFTB are like many activities in daily life. At the end of our study, there were improvements in physical fitness level as a result of 6 weeks of exercise intervention in the SG; this result is similar to other studies [24]. Also, the Chair Stand Test, Biceps Curl Test, and 2 Minutes Step Test in particular had a large effect size. Meanwhile, the fitness level of community-dwelling older people who did not exercise tended to decrease even after just six weeks. A significant negative change was observed in the CG with respect to the "8-step up and walk test" and "2-min step test", which are related to aerobic endurance and balance. This finding is especially noteworthy in terms of preserving the aerobic capacity necessary for older people to maintain independence in their daily lives and prevent falls; this is important because the literature states that there may be losses in parameters such as strength, balance, and stability due to aging, and that these losses may be associated with repeated falls [25]. Regular exercise becomes important to maintain the general fitness of community-dwelling older people who do not have a specific diagnosis. Our findings indicate that the synchronous tele-exercise method can present exercise effectively. Due to the advantages of tele-exercise (freedom from the limitations of time and place), tele-exercise may enable more older people to exercise. However, whether the same efficiency can be achieved with asynchronous methods needs to be investigated. Several studies report that exercise improves the QoL of community-dwelling older people [26]. In this study, although the effect size was small, both total scores of NHP increased in SG. When the subscales were examined, there was an improvement with a large effect size for the PA subscale due to the exercise intervention. Also, there was a significant improvement in the energy subscale, which may have resulted from the improvement in the 2 Minutes Step Test, 8 Step Up and Walk Test, as a reflection of the aerobic capacity of the participants. Conversely, sleep, pain, emotional reaction subscale scores, and the first part total score of NHP significantly changed negatively in the CG.

The COVID-19 pandemic has particularly affected older people due to their sensitivity to the virus. Social isolation not only affected their PA but also their QoL and emotional status. Gezgin Yazici and Okten reported that older people experienced sleep disturbances and loneliness during the COVID-19 pandemic [27]. Fallon et al. stated that people perceived increases in their pain during the lockdown [28]. Llorente-Barroso and Kolotouchkina reported social isolation negatively impacted the well-being of older people [29]. Our study results indicate that synchronous tele-exercise can be effective in maintaining and preserving the QoL of the elderly. However, because the 6-week duration of our study may not have been sufficient to create effective changes in all subscales of NHP, studies of longer duration may be needed.

With aging, loneliness and social isolation become major risk factors for broad-based morbidity and significantly impact health and well-being [30]. Sayin Kasar and Karaman stated that loneliness is exacerbated by the restrictions brought on by the pandemic [31]. The COVID-19 pandemic has increased feelings of loneliness among community-dwelling older people [32]. The existing literature associates exercise with an improved sense of psychological well-being and decreased loneliness [33–35]. Our study found that while synchronous tele-exercise could not provide a significant improvement for a loneliness in the SG, LSE scores increased significantly with a small effect size in the CG. Thus, our findings can be interpreted as preventing the decline of feeling lonely during this social isolation period.

Nevertheless, considering our sample size and the duration of the exercise program, our results should be confirmed by further studies with larger-sized samples and longer durations. It is also important to note that our study could only include individuals who can implement technology. The way participants were selected (via e-mail and social media) may have created a selection bias by excluding the most isolated.

Exercise represents an evidence-based and promising approach to mental health in older people [36]. According to the literature, older adults who were more physically active scored higher on the PANAS positive emotional state scale [37]; we found that positive emotional status scores improved significantly only to a medium degree in the SG. A systematic review of the literature revealed optimism to be one of the factors mediating the relationship between PA and well-being in older people [38]. Therefore, a significant improvement in PANAS positive score could be interpreted as beneficial for the psychological well-being of older people. On the other hand, the lack of a significant change in the PANAS negative emotional status may be due to the isolation of people at home focusing on negative thoughts of the high risks associated with COVID-19.

In conclusion, synchronous tele-exercise seems to improve the physical fitness level of community-dwelling older people and maintain their QoL. In addition, it can alleviate loneliness in older people and improve their positive mood. These findings can be generalized to any situations of social isolation for older people. Synchronous tele-exercise can be used to maintain the physical fitness of community-dwelling older people during isolation and when outpatient rehabilitation services are not available. As this study was performed during the COVID-19 pandemic when the participants were in social isolation, it was appropriate to associate parameters such as QoL, mood, and emotional state with PA. An advantage of our study is that it was randomized, controlled and blind. We created a program that included safe and simple exercises to prevent negative situations that older people potentially encounter during exercise. Yet after the 6-week exercise program, we could not follow up. For this reason, we could not determine how long the effect of the results gained with exercise persists in the long term.

Declarations

Conflict of interest The authors declared no conficts of interest.

Ethical approval Human Research Ethics Committee at Istinye University (IRB:67, Date: 25.06.2020).

Informed consent Informed consent was obtained from all participants.

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