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# Effects of Therapeutic Home-Based Resistance Exercises on Functional Fitness Levels of Older Adults: Quasi-Experimental Study

## Terapötik Ev Tabanlı Direnç Egzersizlerinin Yaşlı Erişkinlerin Fonksiyonel Uygunluk Düzeyleri Üzerine Etkileri: Yarı Deneysel Çalışma

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**ABSTRACT Objective:** The elderly population in Türkiye is increasing rapidly; however, the participation rate of older adults in exercise remains very low due to various specific reasons. This situation indicates that there is a need for safe, low-cost, accessible, sustainable and therapeutic recreational exercise programmes to increase the well-being and life expectancy of older adults. This study aimed to examine the effects of an 8-week (2 days per week, resistance exercise) therapeutic recreational and online home-based resistance exercise programme on some functional fitness components of older adults. **Material and Methods:** The study was completed by 79 participants, 42 ($\bar{X}$ age: 72 years, standard deviation: 5.77) males and 37 ($\bar{X}$ age: 69.9 years, standard deviation: 4.30) females. Lower and upper extremity muscle strength, flexibility, quickness and aerobic endurance values the participants were collected using functional fitness test data tools. Exercise intensity were calculated through Rating of Perceived Exertion Scale. Groups, pretest-posttest time differences and group*time interactions were analysed by mixed design analysis of variance. Results were analysed at the 0.05 significance level. **Results:** The results showed that group*time interaction had a significant effect on lower-upper extremity muscle strength, lower-upper body flexibility, agility-motor coordination and aerobic endurance, respectively (F=17.547, p<0.001; F=12.475, p<0.001; F=26.697, p<0.001; F=6.662, p<0.012; F=8.776, p>0.004; F=16.969, p<0.001). There was no statistically significant difference in the group*time interaction in terms of body mass index (p>0.005). **Conclusion:** Home-based resistance exercise programs incorporating therapeutic recreational elements offer a safe, cost-effective, accessible and sustainable means of enhancing older adults' welfare, promoting independence in self-care, and potentially extending life expectancy.

**Keywords:** Geriatrics; metabolic safety;
online exercise; therapeutic recreation

**ÖZET Amaç:** Türkiye'de yaşlı nüfus hızla artmakta; ancak yaşlı bireylerin egzersize katılım oranı çeşitli özgün nedenlerle oldukça düşük kalmaktadır. Bu durum, yaşlı erişkinlerin refahını ve yaşam süresini artırmaya yönelik, güvenli, düşük maliyetli, ulaşılabilir, sürdürülebilir ve terapötik rekreasyonel içerikli egzersiz programlarına ihtiyaç olduğunu göstermektedir. Bu araştırma, 8 haftalık (haftada 2 gün, direnç egzersizi) terapötik rekreasyonel içerikli ve çevrim içi ev tabanlı direnç egzersiz uygulamasının, yaşlı erişkinlerin bazı fonksiyonel uygunluk bileşenleri üzerine etkilerini incelemeyi amaçlamıştır. **Gereç ve Yöntemler:** Çalışmayı, 42 ($\bar{X}$ yaş: 72 yıl, standart deviasyon: 5,77) erkek, 37'si ($\bar{X}$ yaş: 69,9 yıl, standart deviasyon: 4,30) kadın olmak üzere 79 kişi tamamladı. Katılımcıların alt ve üst ekstremite kas kuvveti, esneklik, çabukluk ve aerobik dayanıklılık değerleri fonksiyonel uygunluk test veri araçları kullanılarak toplandı. Egzersiz zorluk derecesi s-RPE aracılığıyla hesaplandı. Gruplar, ön test-son test zaman farklılıkları ve grup*zaman etkileşimleri karma tasarım varyans analizi ile analiz edildi. Sonuçlar, 0,05 anlamlılık düzeyinde incelendi. **Bulgular:** Sonuçlar, grup*zaman etkileşiminin sırasıyla alt-üst ekstremite kas kuvveti, alt-üst vücut esnekliği, çeviklik-motor koordinasyon ve aerobik dayanıklılık üzerinde anlamlı bir etkiye sahip olduğunu göstermiştir (F=17,547, p<0,001; F=12,475, p<0,001; F=26,697, p<0,001; F=6,662, p<0,012; F=8,776, p>0,004; F=16,969, p<0,001). Beden kitle indeksi bakımından grup*zaman etkileşiminde istatistiksel olarak anlamlı bir fark görülmemiştir (p>0,005). **Sonuç:** Sonuç olarak terapötik rekreasyonel içerikli ev tabanlı direnç egzersiz programlarının yaşlı erişkinlerin kendini iyi hissetme hâli, refahı, öz bakım ihtiyaçlarını bağımsız bir biçimde yerine getirme ve yaşam süresini artırmaya yönelik, güvenli, düşük maliyetli, ulaşılabilir ve sürdürülebilir potansiyel faydalar sağlayacağını göstermektedir.

**Anahtar Kelimeler:** Geriatri; metabolik güvenlik;
çevrim içi egzersiz; terapötik rekreasyon

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Advancements in science and technology have shifted production models from human labor-based systems to technology-driven production and consumption relationships. This transformation has led to increased average life expectancy, a decline in rural populations, and a significant rise in urbanization rates. However, this change has not only adversely affected ecosystem balance but also limited individuals' opportunities for physical activity. A sedentary lifestyle now poses a multifaceted threat to the health of individuals, particularly those in high-risk groups.

Research indicates that regular physical activity is effective in preventing and managing non-communicable diseases such as cardiovascular diseases, diabetes, and cancer. Additionally, it helps reduce symptoms of depression and anxiety, supports cognitive functions (thinking, learning, judgment), and enhances overall quality of life.[1-3] Studies have reported an inverse dose-response relationship between aerobic exercise and the risk of functional limitations.[4] Resistance exercises, on the other hand, are noted to slow age-related physical decline, support lower extremity muscle strength and blood pressure control, and provide positive effects in areas such as mobility, muscle strength, sarcopenia, fall risk, and functional independence.[5-7] However, most of these beneficial effects are based on structured protocols and exercise programs conducted under expert supervision.

Physical activity guidelines recommend progressive resistance training for adults 2-3 times per week, beginning with moderate intensity (e.g., one set of 8-12 reps) and gradually increasing load, sets, and frequency. Such programs, often gym-based and lasting up to 12 weeks, may be inaccessible to older adults due to economic, health, cultural, and gender-related barriers. Globally, participation rates are higher in developed countries (40-60% in Europe) compared to developing ones (20-30%), with walking and running being the most common forms of exercise.[8] In Türkiye, only 21.5% of individuals aged 50+ and 18.3% of those 65+ engage in regular activity with participation at 25.5% among men and 12.5% among women.[8,9] These low rates, dominated by walking, highlight home-based resistance exercises as a valuable alternative to improve functionality, preserve muscle strength, and reduce fall risk in older adults.

Systematic reviews show that home-based resistance exercises enhance strength and balance in older adults.[10] As age-related fitness decline threatens independence, monitoring motor skills and supporting biological health are essential. This study examines the effects of an 8-week home-based resistance program on functional mobility in healthy older adults and provides pilot data to inform future research among Turkish seniors.

## MATERIAL AND METHODS

### STUDY DESIGN

In this study, the participants were assigned to 2 groups (male-female) as a natural result of the gender factor, and the changes over time were followed by taking pre-test and post-test measurements. Although the design of the study was similar to randomized controlled trials, it was designed as quasi-experimental because it was not randomized. In addition, the Consolidated Standards of Reporting Trials (CONSORT) transparency rule was taken into account and only the quality of reporting was aimed to be improved.

Both groups followed the same exercise program. Time and group were treated as independent variables, while functional fitness components lower and upper extremity muscle strength, flexibility, balance and agility, and aerobic endurance served as the dependent variables. The study was completed over a period of 10 weeks. The pre-test and pilot assessments were conducted in the 1st week, and the post-test was carried out in the 10th week. The exercise intervention took place between the 2nd and 9th weeks. The same procedures used in the pre-test were applied again during the post-test phase. This study was ethically approved by the Eskişehir Technical University Scientific Research and Publication Ethics Committee for Science and Engineering Sciences (date: January 15, 2025; no: 62636) and conducted in accordance with the principles outlined in the Declaration of Helsinki. The study commenced in February 2025 and was completed in May 2025.

## PARTICIPANT RECRUITMENT AND STUDY PROCEDURE

The sample size for this study was determined based on methodologies employed in similar studies involving older adults.[11,12] Sample size was determined based on comparable studies in older adults and calculated a priori using G*Power (version 3.1.9.7; Heinrich-Heine University Düsseldorf, Germany), following Cohen's power analysis guidelines and the specifications provided in the G*Power manual.[13]

Inclusion criteria were as follows: (1) residence in; (2) age ≥65 years; (3) absence of medical conditions that may contraindicate physical activity [e.g., cardiovascular, orthopedic, visual, neurological, or cognitive impairments, or a body mass index (BMI) >40]; (4) ability to independently perform activities of daily living; and (5) no regular engagement in physical activity within the past year. Participants were recruited through flyers posted at randomly selected public transportation stops across, which clearly stated the inclusion and exclusion criteria. At the end of the 14-day announcement period, 98 (52 men, 46 women) individuals volunteered. Prior to the intervention, an informational session was held to explain the study protocol in detail. Participants were informed of their right to withdraw at any stage and were asked to read and sign a written informed consent form. It was emphasized that participant comfort would be prioritized throughout the process. Following the session, 11 individuals were excluded due to potential participation barriers such as part-time employment or anticipated travel. Consequently, 87 (45 men, 42 women) individuals were deemed eligible for the intervention. Baseline comparisons using independent samples t-tests revealed no statistically significant differences between groups across key variables. Eight (3 men, 5 women) participants did not complete the intervention and were excluded from post-test analyses. Statistical analyses were conducted with 79 [42 men, mean age=72.0 years, standard deviation (SD)=5.77; 37 women, mean age=69.9 years, SD=0.30] participants. Although this study did not employ a randomized controlled trial design, all procedures adhered to CONSORT guidelines, given the older adult population involved (Figure 1).

## DATA COLLECTION INSTRUMENTS

Functional fitness data for older adults were collected using the 6-item Senior Fitness Test, developed and validated by Rikli and Jones.[14] These instruments are safe, simple to administer, and have demonstrated reliability and validity coefficients ranging from 0.79-0.97, with test-retest reliability between 0.80-0.97.[14]

### 30-Second Chair Stand Test

Participants were instructed to sit on a 43 cm high chair with arms crossed over their chest. Upon a signal, they performed as many full stands as possible within 30 seconds. The total number of repetitions completed in 30 seconds was recorded (average of 2 trials).[14]

### Arm Curl Test

Participants held a dumbbell in their dominant hand. They performed as many bicep curls as possible in 30 seconds. Female participants used a 2.27 kg dumbbell, while male participants used a 3.63 kg dumbbell. The total number of repetitions completed in 30 seconds was recorded (average of 2 trials).[14]

### Chair Sit-and-Reach Test

Participants sat on the edge of a chair with their left knee bent at 90 degrees and left foot flat on the floor. They extended their right leg straight with the heel on the floor and attempted to touch their toes with both hands. The distance between the fingertips and toes was measured in centimeters. A negative value was recorded if the fingertips did not reach the toes, and a positive value if they extended beyond the toes (measurements were taken with 0.5 cm precision, and the average of 2 trials was recorded).[14]

### Back Scratch Test

Participants reached behind their back with one hand over the shoulder and the other up from the lower back, attempting to touch or overlap their fingers. The distance between the fingertips was measured in centimeters. Positive values indicated overlap, and negative values indicated a gap (measurements were taken with 0.5 cm precision, and the average of 2 trials was recorded).[14]

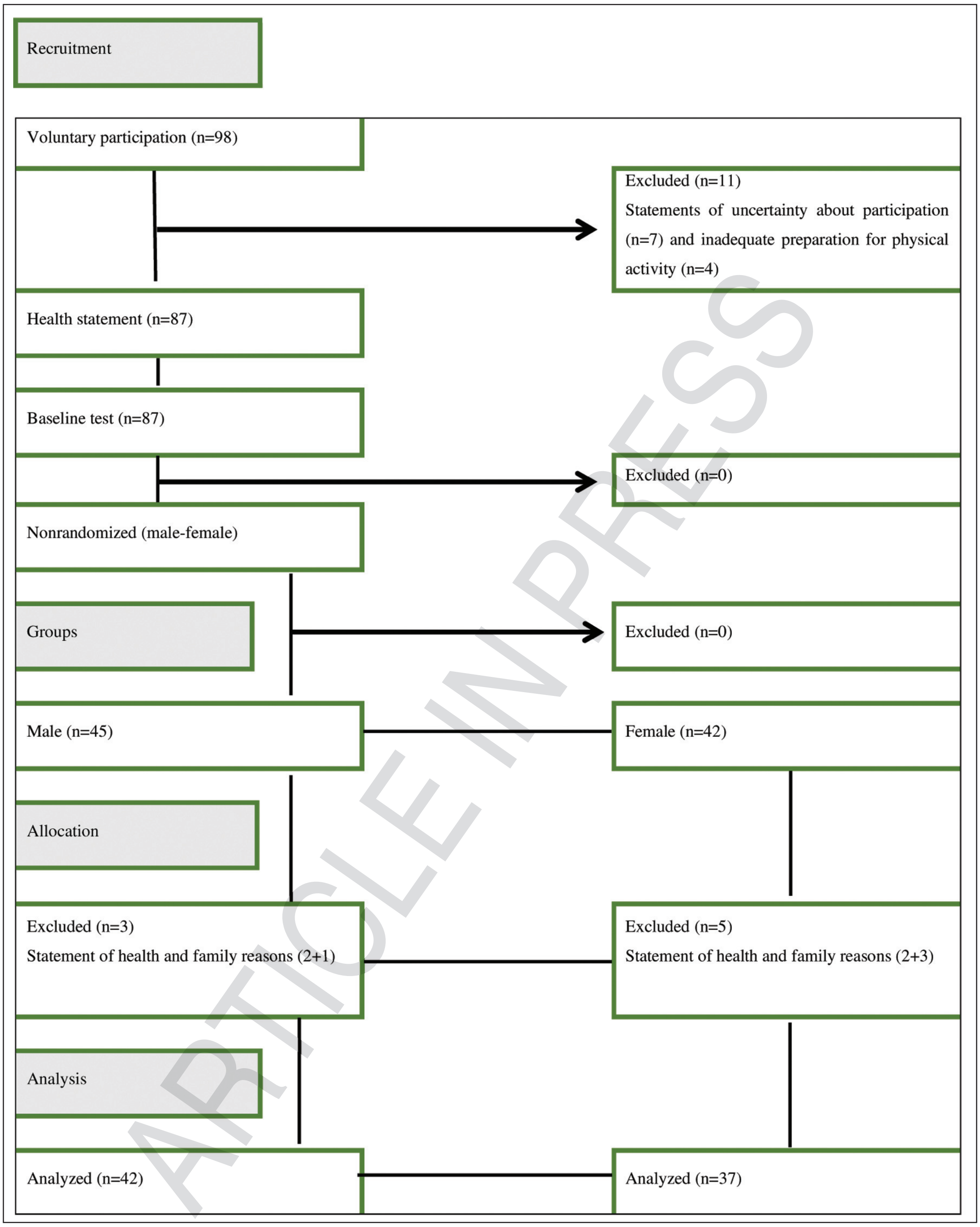



**FIGURE 1:** Flowchart of the study

### 8-Foot Up-and-Go Test

Participants sat in a standard chair with a cone placed 2.44 meters away. On the "Start" command, they stood up, walked to the cone, turned, returned to the chair, and sat down. The time taken to complete the task was measured in seconds. Each participant performed the test twice, and the average of the 2 times was recorded for analysis.[14]

### 6-Minute Walk Test

Participants walked as far as possible in 6 minutes along a 45.72-meter rectangular course. The total distance covered in 6 minutes was recorded.[14]

### Body Mass Index

Participants' height and weight were measured using a SECA brand (model 764, Hamburg/Germany) measurement device. BMI was calculated as weight (kg) divided by height (m) squared. BMI categories were defined as follows: underweight: <18.5 kg/m$^2$; normal weight: 18.5-24.9 kg/m$^2$; overweight: 25-29.9 kg/m$^2$; obese: >30 kg/m$^2$.

### Rating of Perceived Exertion Scale

The Borg Rating of Perceived Exertion (s-RPE) Scale was used to assess participants' perceived exertion during exercise sessions.[15] Thirty minutes after each session, participants were asked, "How was your exercise?" and provided a numerical rating. Two trial sessions were conducted before the study commenced. Responses were recorded numerically using the same scale.[16]

## EXERCISE PROTOCOL

This 8-week home-based resistance program, structured according to American College of Sports Medicine (ACSM) guidelines, was implemented twice weekly in \~50 (±5) minute sessions, including 20 minutes of warm-up and cool-down flexibility exercises.[17,18] The main component consisted of 5 stations (lower extremity, core, back, chest, shoulders), performed for 8-10 repetitions at moderate intensity (≈60-70% 1 RM), aligning with ACSM's FITT-VP framework. Warm-up and flexibility activities were conducted at light-to-moderate intensity.

Prior to the intervention, two pilot sessions familiarized participants with loading principles and the RPE scale. Weekly exercise visuals were shared via WhatsApp (separately for men and women), while sessions were performed every Tuesday and Thursday. Participants reported their RPE ratings 30 minutes post-exercise, and regular feedback and motivational support were provided through digital communication (Appendix 1, Appendix 2).[16]

The program was further designed with a therapeutic recreation perspective, supporting physical, mental, and social well-being. Strategies included encouraging family participation, exercising with preferred music, and maintaining an exercise diary to enhance engagement and emotional awareness.[19,20]

## DATA ANALYSIS

The normality of the data was assessed using the Kolmogorov-Smirnov test, while homogeneity of variances was evaluated through skewness-kurtosis values and the Levene test. Upon confirmation that the data followed a normal distribution, parametric tests were conducted. The assumption of sphericity was tested using Mauchly's W test, and conformity to normal distribution was also assessed with the

**APPENDIX 1:** Exercise plan with progressive workload building approach

| Weeks | 1. session | 2. session |
|---|---|---|
| Weeks 1-4 (8 sessions) | Total duration: 50 minutes<br>Warm-up: 10 minutes<br>Main phase: 30 minutes<br>Lower extremity,<br>core area, back, chest area,<br>shoulder area, stretching and cooling phase: 10 minutes | Total duration: 50 minutes<br>Warm-up: 10 minutes<br>Main phase: 30 minutes<br>Lower extremity,<br>core area, back, chest area,<br>shoulder area, stretching and cooling phase: 10 minutes |
| Weeks 5-8 (8 sessions) | Total duration: 55 minutes<br>Warm-up: 10 minutes<br>Main phase: 35 minutes<br>Lower extremity,<br>core area, back, chest area,<br>shoulder area, stretching and cooling phase: 10 minutes | Total duration: 55 minutes<br>Warm-up: 10 minutes<br>Main phase: 35 minutes<br>Lower extremity,<br>core area, back; chest area,<br>shoulder area, stretching and cooling phase: 10 minutes |

**APPENDIX 2:** 8 weeks of online practice exercises

| Warm-up | Lower extremities | Core area | Back | Chest | Shulder | Active cool down |
|---|---|---|---|---|---|---|
| Jumping jack | Stand up and sit down | Mountain climbers | Double damp row with bottle | Damb chest press with bottle | Seated damb. shoulder press with bottle | Cat cow opposite arm and leg raise |
| Torso rotation | Standing leg raise and hold | Heel touch | Lying back extension | Damb chest fly with bottle | Standing damb. lateral raise with bottle | Downward facing dog and baby cobra |
| Side bend | Lying side leg raise | Half crunch | Renegade row with bottle | | Knee push up | Butterfly |
| Arm circle | | | | | | Pike |
| Side arms raises | | | | | | Cat pose |

Shapiro-Wilk test. For variables violating the sphericity assumption, degrees of freedom were adjusted based on the epsilon (ε) value, and the Greenhouse-Geisser correction was applied (when $\varepsilon<0.75$). The statistical analysis of the functional fitness test data and s-RPE scores was performed using a mixed-design analysis of variance (ANOVA) to evaluate the main effects of group (male/female), time (pre-test/post-test), and group×time interactions. A p value of <0.05 was considered statistically significant. Bonferroni "post hoc" tests were used for group and time comparisons. Partial eta squared ($\eta^2_p$) values were calculated to determine the effect sizes for repeated measures.[13] To assess the magnitude of within- and between-group comparisons over time, Cohen's d effect sizes were also computed. The magnitude of effect sizes was interpreted as follows: trivial (<0.2), small (≥0.2), medium (≥0.5), and large (≥0.8).[13] All statistical analyses were conducted using R Studio (version 4.2.1; Posit PBC, Boston, MA, USA) and SPSS statistics (version 29.0; IBM Corp., Armonk, NY, USA).

## RESULTS

Table 1 demonstrates that, following the 8-week therapeutic home-based resistance exercise program, there were significant reductions in participants' body weight and BMI regardless of gender. Improvements were observed in upper and lower extremity muscle strength across both sexes, while flexibility levels showed particularly notable enhancements among female participants. In addition, there were positive developments in balance and functional mobility parameters, and aerobic capacity increased in both male and female participants.

Table 2 presents the results of the mixed-design ANOVA. For the body weight BW variable, there were no statistically significant differences between groups or in the group*time interaction ($F=3.20$, $p>0.077$; $F=0.01$, $p>0.075$, respectively). However, there was a statistically significant effect of time ($F=68.69$, $p<0.001$, $\eta^2_p=0.472$). In the BMI variable, statistically significant differences were found both between groups and over time ($F=7.32$, $p<0.008$, $\eta^2_p=0.087$; $F=72.19$, $p<0.001$, $\eta^2_p=0.484$), but no significant group*time interaction was observed ($p>0.097$) (Table 2).

For the CS variable, statistically significant differences were found for group, time, and group*time interaction ($F=24.92$, $p<0.001$, $\eta^2_p=0.245$; $F=94.64$, $p<0.001$, $\eta^2_p=0.551$; $F=17.54$, $p<0.001$, $\eta^2_p=0.186$, respectively). In the AC variable, no significant difference was observed between groups ($F=3.28$, $p>0.074$), while there were significant differences for time ($F=120.17$, $p<0.001$, $\eta^2_p=0.609$) and for the group*time interaction ($F=12.47$, $p<0.001$, $\eta^2_p=0.139$) (Table 2).

For the CSR variable, significant differences were found for group, time, and group*time interaction ($F=37.68$, $p<0.001$, $\eta^2_p=0.329$; $F=87.77$, $p<0.001$, $\eta^2_p=0.533$; $F=26.69$, $p<0.001$, $\eta^2_p=0.257$, respectively). Regarding the BS variable, there were also statistically significant differences for group, time, and group*time interaction ($F=10.28$, $p<0.002$, $\eta^2_p=0.118$; $F=43.70$, $p<0.001$, $\eta^2_p=0.362$; $F=6.66$, $p<0.012$, $\eta^2_p=0.080$, respectively) (Table 2).

| TABLE 1: Pre-test and post-test averages of the participants | | | | | |
|---|---|---|---|---|---|
| Variables | Groups | Tests | $\overline{X}$ | SD | Confidence interval (95%) lower-upper |
| BW (kg) | Male | Pre-test | 79.56 | 1.64 | 76.29-82.83 |
| | | Pos t-test | 77.83 | 1.47 | 74.90-80.76 |
| | Female | Pre-test | 75.48 | 1.75 | 71.99-78.96 |
| | | Post-test | 73.79 | 1.56 | 70.67-76.91 |
| BMI (kg/cm$^2$) | Male | Pre-test | 26.72 | 0.47 | 25.77-27.66 |
| | Female | Pre-test | 28.51 | 0.50 | 27.51-29.52 |
| | | Post-test | 27.94 | 0.46 | 27.01-28.87 |
| CS (reps) | Male | Pre-test | 13.64 | 0.29 | 13.05-14.32 |
| | | Post-test | 15.47 | 0.29 | 14.89-16.05 |
| | Female | Pre-test | 12.16 | 0.31 | 11.53-12.78 |
| | | Post-test | 12.89 | 0.30 | 12.27-13.50 |
| AC (reps) | Male | Pre-test | 15.07 | 0.26 | 14.53-15.60 |
| | | Post-test | 17.28 | 0.29 | 16.69-17.87 |
| | Female | Pre-test | 14.91 | 0.28 | 14.35-15.48 |
| | | Post-test | 16.05 | 0.31 | 15.42-16.67 |
| CSR (in) | Male | Pre-test | -1.23 | 0.42 | -2.08-(-0.39) |
| | | Post-test | -0.73 | 0.41 | -1.56-0.08 |
| | Female | Pre-test | 1.83 | 0.45 | 0.93-2.73 |
| | | Post-test | 3.56 | 0.44 | 2.68-4.44 |
| BS (in) | Male | Pre-test | -8.33 | 0.85 | -10.03-(-6.63) |
| | | Post-test | -7.31 | 0.76 | -8.83-(-5.78) |
| | Female | Pre-test | -5.28 | 0.90 | -7.09-(-3.47) |
| | | Post-test | -2.94 | 0.81 | -4.56-(-1.32) |
| 8-ft up (sec) | Male | Pre-test | 6.72 | 0.24 | 6.24-7.20 |
| | | Post-test | 6.38 | 0.22 | 5.93-6.83 |
| | Female | Pre-test | 7.34 | 0.257 | 6.83-7.85 |
| | | Post-test | 7.257 | 0.24 | 6.77-7.73 |
| 6-min (m) | Male | Pre-test | 449.64 | 7.04 | 435.62-463.66 |
| | | Post-test | 480.88 | 7.11 | 466.72-495.04 |
| | Female | Pre-test | 406.94 | 7.5 | 392.01-421.88 |
| | | Post-test | 421.78 | 7.578 | 406.69-436.87 |

BW: Body weight; BMI: Body mass index; CS: 30-sec chair stand (reps); AC: Arm curl (reps); CSR: Chair sit and reach (in); BS: Back scratch (in); 8-ft up (sec): 8-foot up and go (sec); 6-min: 6-min walk (m)



| TABLE 2: Mixed analysis of variance results of the functional-fitness tests of the older adults | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Groups | | | | Time | | | | G*T | | | |
| Variables | F | p value | $\eta^2_p$ | OP[a] | F | p value | $\eta^2_p$ | OP[a] | F | p value | $\eta^2_p$ | OP[a] |
| BW (kg) | 3.20 | 0.077 | 0.04 | 0.42 | 68.69 | 0.001*** | 0.472 | 1 | 0.01 | 0.914 | 0.075 | 0.51 |
| BMI | 7.32 | 0.008* | 0.087 | 0.76 | 72.19 | 0.001*** | 0.484 | 1 | 0.00 | 0.097 | 0.001 | 0.05 |
| CS (reps) | 24.92 | 0.001*** | 0.245 | 0.99 | 94.64 | 0.001*** | 0.551 | 1 | 17.54 | 0.001*** | 0.186 | 0.98 |
| AC (reps) | 3.28 | 0.074 | 0.041 | 0.43 | 120.17 | 0.001*** | 0.609 | 1 | 12.47 | 0.001*** | 0.139 | 0.93 |
| CSR (in) | 37.68 | 0.001*** | 0.329 | 1 | 87.77 | 0.001*** | 0.533 | 1 | 26.69 | 0.001*** | 0.257 | 0.99 |
| BS (in) | 10.28 | 0.012* | 0.118 | 0.88 | 43.70 | 0.001*** | 0.362 | 1 | 6.66 | 0.012* | 0.08 | 0.72 |
| 8-ft up | 4.90 | 0.03* | 0.06 | 0.59 | 25.52 | 0.001*** | 0.249 | 1 | 8.77 | 0.004* | 0.102 | 0.83 |
| 6-min | 25.16 | 0.001*** | 0.246 | 0.99 | 133.87 | 0.001*** | 0.635 | 1 | 16.96 | 0.001*** | 0.181 | 0.92 |

*p<0.05; ***p<0.001; OP[a]: Observations powera; G*T: Group*time; BW: Body weight; BMI: Body mass index (kg/cm$^2$); CS: 30-sec chair stand (reps); AC: Arm curl (reps); CSR: Chair sit and reach (in); BS: Back scratch (in); 8-ft up (sec): 8-foot up and go (sec); 6-min: 6-min walk (m)

For the 8-foot up-and-go variable, significant differences were found between groups, over time, and for the group*time interaction ($F=4.90$, $p<0.030$, $\eta^2_p=0.060$; $F=25.52$, $p<0.001$, $\eta^2_p=0.249$; $F=8.77$, $p<0.004$, $\eta^2_p=0.102$, respectively). Regarding the 6-minute walk (6-min) test, there were significant differences in all comparisons: group, time, and group*time interaction ($F=25.16$, $p<0.001$, $\eta^2_p=0.246$; $F=133.87$, $p<0.001$, $\eta^2_p=0.635$; $F=16.96$, $p<0.001$, $\eta^2_p=0.181$, respectively).

The perceived difficulty level of the exercise program was reported as 4.8 au for male participants and 4.1 au for female participants. The attendance rate for exercise sessions was 100% among males and 87.5% among females. No serious adverse events were reported during the study, and no exercise-related complications were observed.

## DISCUSSION

This study demonstrated that an 8-week online, home-based resistance exercise program with therapeutic recreation content significantly improved physical health parameters in older adults. Both genders showed reductions in body weight (males: -1.73 kg; females: -1.69 kg) and BMI (males: -0.569 kg/m$^2$; females: -0.573 kg/m$^2$), with no group*time interaction, indicating comparable effectiveness across genders.

These findings align with Vikberg et al., who reported increases in lean body mass and functional improvements after 10 weeks of home-based RT, and with evidence showing RT reduces fat mass while preserving lean mass more effectively than aerobic protocols.[21,22] Systematic reviews further support beneficial effects of RT on body composition and functional capacity in older women with sarcopenic obesity, despite methodological variations.[23] Mechanistically, RT enhances fat loss through elevated post-exercise oxygen consumption, lipid oxidation, and pathways involving mitochondrial enzyme activity and α-ketoglutarate-mediated lipolysis.[22,24] Preserving muscle mass remains critical in aging, as the “obesity paradox” highlights protective effects of modest fat yet increased morbidity and mortality with loss of fat-free mass.[25]

This study confirms that ≥8 weeks of resistance training positively affects body composition and functional health in older adults, consistent with prior meta-analyses in sarcopenic and obese populations. Both lower- and upper-body strength improved, with males showing greater absolute gains (lower body: +1.83 vs. +0.73 reps; upper body: +2.215 vs. +1.135 reps), as indicated by significant group*time interactions.

Sex-specific responses align with previous findings: older men generally achieve greater absolute strength gains, while women often display superior relative improvements, particularly in upper-body strength.[26,27] Neuromuscular efficiency and adaptation appear to underlie these outcomes.[28] Differences are linked to baseline muscle mass, hormonal profiles, and fiber composition, with early gains driven by neural adaptation and hypertrophy favoring men over time.[27] Practically, RT programs may be tailored by sex, with women benefiting from progressive overload and extended interventions (>20 weeks) to achieve comparable long-term outcomes.

Findings align with systematic reviews indicating greater absolute strength gains in men and moderate gains in women, driven by differences in muscle mass, hormones, and neuromuscular adaptation. Nonetheless, resistance training supports healthy ageing in both sexes by improving gait speed, balance, and muscle quality, thereby reducing fall risk. Future research should refine sex-specific exercise prescriptions to optimize outcomes and inform evidence-based guidelines.

A 24-week home-based resistance program targeting 10 muscle groups in older adults (\~70 years) significantly improved muscle mass, strength, walking speed, and balance, with high adherence and mild side effects.[29] Similarly, a systematic review of 21 randomized controlled trials on unsupervised home-based RT reported it as safe and feasible (mean compliance 67%), producing small-to-moderate gains in lower extremity strength, muscle strength, and balance, but limited effects on hand strength, overall performance, quality of life, or fall risk.[30] Flexibility outcomes also showed sex-specific differences: in the chair sit-and-reach, females improved more than males (+1.73 vs. +0.50 inches), and in the back scratch test, females gained +2.335 vs. +1.023 inches, suggesting greater responsiveness linked to physiological and hormonal factors.[31,32]

Interaction effects indicated gender-specific responses: females improved more in flexibility, while males showed greater gains in strength, balance, and aerobic capacity. These differences likely reflect physiological, hormonal, and baseline fitness factors, as well as training load and individual adaptability.

Balance, agility, and aerobic capacity improved significantly, with males showing greater gains (balance: -0.34 vs. -0.088 s; walking distance: +31.24 vs. +14.84 m), likely due to baseline strength and physiological differences.[29,33-35] Adherence was high (100% males, 87.5% females), with no adverse events, suggesting that therapeutic recreation elements enhanced motivation and engagement.

In conclusion, online home-based resistance training effectively enhanced physical fitness in older adults. Men showed greater strength and aerobic gains, women greater flexibility, yet overall efficacy was not gender-dependent. These results support RT in healthy ageing and underscore the need for gender-specific training prescriptions.

### STRENGTHS OF THE STUDY

This study uniquely examines home-based resistance training in older adults with attention to gender differences, linking fitness to functional mobility. Mixed-design analysis enabled assessment of temporal and gender effects, while therapeutic-recreational elements support sustainable activity habits at home.

### LIMITATIONS

Home-based delivery limited standardization and adherence, and the 8-week duration precluded long-term assessment. Socioeconomic and educational factors were uncontrolled, and findings from Türkiye may not generalize to other populations.

### RECOMMENDATIONS

Future studies should include larger, more representative samples across various age groups and socioeconomic backgrounds. Future studies should be designed to include long-term follow-up, holistic assessment of body composition variables and evaluation of clinical outcomes such as fall risk or metabolic markers. Extending intervention duration and incorporating long-term follow-ups would help evaluate sustained effects. Including psychosocial variables (e.g., self-efficacy, life satisfaction, depression) alongside physical fitness measures would offer a more holistic view of exercise benefits.

#### For Program Developers

Exercise interventions should be designed with a multidimensional therapeutic approach tailored to older adults' physical capabilities. Special attention should be paid to the balance between exercise load, fatigue, recovery, and reloading to ensure sustainable participation and safety.

#### For Policymakers

Therapeutic recreation strategies should be integrated into national geriatric health frameworks. These programs can reduce long-term care dependency and healthcare expenditures, while promoting autonomy and psychosocial well-being.

#### For Practitioners

Professionals working with older adults -such as exercise specialists, occupational therapists, and social workers- should adopt therapeutic exercise models that address both physical and emotional needs, fostering holistic care.

#### For Researchers

Future studies should investigate how program variables (e.g., duration, intensity, structure, participant demographics) affect the outcomes of therapeutic home-based exercise programs. Randomized controlled trials with larger samples and long-term follow-up are recommended.

## CONCLUSION

This study examined the effects of an 8-week online home-based resistance exercise program on the functional fitness levels of older adults. The intervention led to statistically significant improvements in multiple components of physical fitness, including body composition, muscular strength, flexibility, balance-agility, and aerobic capacity. Notably, significant gains were observed in upper and lower extremity strength, flexibility, balance, agility, aerobic endurance and BMI.

This study demonstrated that home-based, therapeutically enriched light resistance exercises significantly improve physical fitness levels in older adults. Such exercises, which include activities like music, journaling, and using household items, were found to be safe and well-tolerated, with no observed metabolic risks. Importantly, the therapeutic nature of the intervention was associated with higher adherence rates, likely due to increased engagement and psychological comfort. These findings highlight the potential of home-based therapeutic exercise programs to support functional independence, mobility, and self-care abilities among older adults. By strengthening both physical capacity and emotional well-being, such interventions may play a key role in promoting active and healthy aging. Furthermore, therapeutic recreation-based approaches may contribute to the integration of older adults into social life, enhancing both individual satisfaction and interpersonal connectivity. In conclusion, home-based therapeutic resistance training offers a practical, scalable, and low-risk intervention that can be integrated into geriatric health and rehabilitation strategies, particularly for aging populations with limited access to institutional services.


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*During this study, no financial or spiritual support was received neither from any pharmaceutical company that has a direct connection with the research subject, nor from a company that provides or produces medical instruments and materials which may negatively affect the evaluation process of this study.*

### *Conflict of Interest*

*No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.*

### *Authorship Contributions*

*This study is entirely author's own work and no other author contribution.*




## REFERENCES


1. Brasure M, Desai P, Davila H, Nelson VA, Calvert C, Jutkowitz E, et al. Physical activity interventions in preventing cognitive decline and Alzheimer-type dementia: a systematic review. Ann Intern Med. 2018;168(1):30-8. PMID: 29255839
2. García-Hermoso A, Ramirez-Vélez R, Sáez de Asteasu ML, Martínez-Velilla N, Zambom-Ferraresi F, Valenzuela PL, et al. Safety and effectiveness of long-term exercise interventions in older adults: a systematic review and meta-analysis of randomized controlled trials. Sports Med. 2020;50(6):1095-106. PMID: 32020543.
3. World Health Organization [Internet]. © 2025 WHO [Cited: ]. Physical activity. 2020. Available from: https://www.who.int/news-room/fact-sheets/detail/physical-activity
4. Bull FC, Al-Ansari SS, Biddle S, Borodulin K, Buman MP, Cardon G, et al. World Health Organization 2020 guidelines on physical activity and sedentary behaviour. Br J Sports Med. 2020;54(24):1451-62. PMID: 33239350; PMCID: PMC7719906
5. Fragala MS, Cadore EL, Dorgo S, Izquierdo M, Kraemer WJ, Peterson MD, et al. Resistance training for older adults: position statement from the national strength and conditioning association. J Strength Cond Res. 2019;33(8):2019-52. PMID: 31343601
6. Grgic J, Garofolini A, Orazem J, Sabol F, Schoenfeld BJ, Pedisic Z. Effects of resistance training on muscle size and strength in very elderly adults: a systematic review and meta-analysis of randomized controlled trials. Sports Med. 2020;50(11):1983-99. PMID: 32740889
7. Polat C. Effects of recreational swimming on blood pressure and lower extremity muscle strength of older adults with elevated blood pressure: a sample of Altınova beachgoers. Pamukkale J Sport Sci. 2024;15(3):512-30. https://dergipark.org.tr/en/download/article-file/3846942
8. Global oral health status report: towards universal health coverage for oral health by 2030. Geneva: World Health Organization; 2022. https://www.who.int/publications/i/item/9789240061484
9. Türkiye İstatistik Kurumu [İnternet]. Türkiye İstatistik Kurumu © 2025 [Erişim tarihi: ]. Erişim linki: https://data.tuik.gov.tr/Bulten/Index?p=Turkiye-Yasli-Profili-Arastirmasi
10. Fanning J, Awick EA, Wójcicki TR, Gothe N, Roberts S, Ehlers DK, et al. Effects of a DVD-delivered exercise intervention on maintenance of physical activity in older adults. J Phys Act Health. 2016;13(6):594-8. PMID: 26595937; PMCID: PMC5516906
11. Dekker-van Weering M, Jansen-Kosterink S, Frazer S, Vollenbroek-Hutten M. User experience, actual use, and effectiveness of an information communication technology-supported home exercise program for pre-frail older adults. Front Med (Lausanne). 2017;4:208. PMID: 29250523; PMCID: PMC5715376
12. Tsekoura M, Billis E, Tsepis E, Dimitriadis Z, Matzaroglou C, Tyllianakis M, et al. The effects of group and home-based exercise programs in elderly with sarcopenia: a randomized controlled trial. J Clin Med. 2018;7(12):480. PMID: 30486262; PMCID: PMC6306785
13. Cohen J. Statistical Power Analysis for the Behavioral Sciences. 2nd ed. New York: Routledge; 1988.

14. Rikli RE, Jones CJ. Senior Fitness Test Manual. 2nd ed. Champaign, IL; Human Kinetics; 2013.
15. Borg G. Borg's Perceived Exertion and Pain Scales. 1st ed. New York: Human Kinetics; 1998.
16. Foster C, Florhaug JA, Franklin J, Gottschall L, Hrovatin LA, Parker S, et al. A new approach to monitoring exercise training. J Strength Cond Res. 2001;15(1):109-15. PMID: 11708692
17. Westcott WL. Strength training for those who need it most. ACSM's Health & Fitness Journal. 2016;20(5):23-8. https://journals.lww.com/acsm-healthfitness/abstract/2016/09000/strength_training_for_those_who_need_it_most.8.aspx
18. Fien S, Henwood T, Climstein M, Keogh JWL. Feasibility and benefits of home-based strength training for older adults: a systematic review. Aging Clin Exp Res. 2016;28(6):927-51. PMCID: PMC4878364.
19. Lund H, Kekäläinen T, Kokko K, Tammelin T, Sipilä S, Walker S. Motivational characteristics and resistance training in older adults: A randomized controlled trial and 1-year follow-up. J Aging Phys Act. 2018; 26(3):457-65.
20. Huang WY, Huang H, Wu CE. The impact of exercise diaries on adherence and emotional well-being in older adults. J Gerontol Nurs. 2022;48(4):45-52.
21. Vikberg S, Björk S, Nordström A, Nordström P, Hult A. Feasibility of an online delivered, home-based resistance training program for older adults - a mixed methods approach. Front Psychol. 2022;13:869573. PMID: 35726270; PMCID: PMC9206532
22. Morze J, Rücker G, Danielewicz A, Przybyłowicz K, Neuenschwander M, Schlesinger S, et al. Impact of different training modalities on anthropometric outcomes in patients with obesity: A systematic review and network meta-analysis. Obes Rev. 2021;22(7):e13218. PMID: 33624411; PMCID: PMC8244024
23. Debes WA, Sadaqa M, Németh Z, Aldardour A, Prémusz V, Hock M. Effect of resistance exercise on body composition and functional capacity in older women with sarcopenic obesity-a systematic review with narrative synthesis. J Clin Med. 2024;13(2):441. PMID: 38256574; PMCID: PMC10817090
24. Chen M, Chen Q, Liu W, Tong H, Wu Y. The effectiveness of diet intervention in improving the metabolism of overweight and obese women: a systematic review and meta-analysis. Am J Transl Res. 2022;14(5):2926-38. PMID: 35702099; PMCID: PMC9185074
25. Lavie CJ, Lopez Jimenez F. The obesity paradox: protective role of maintaining fat free mass in older adults. Barron's. 2024.
26. Jones MD, Wewege MA, Hackett DA, Keogh JWL, Hagstrom AD. Sex differences in adaptations in muscle strength and size following resistance training in older adults: a systematic review and meta-analysis. Sports Med. 2021;51(3):503-17. PMID: 33332016
27. Da Boit M, Sibson R, Meakin JR, Aspden RM, Thies F, Mangoni AA, et al. Sex differences in the response to resistance exercise training in older people. Physiol Rep. 2016;4(12):e12834. PMID: 27354538; PMCID: PMC4923234
28. Roberts BM, Nuckols G, Krieger JW. Sex differences in resistance training: a systematic review and meta-analysis. J Strength Cond Res. 2020;34(5):1448-60. PMID: 32218059
29. Kuptniratsaikul V, Thanakiatpinyo T, Pongratanakul R, Chinsawangwattanakul P, Srisomnuek A, Inthibal S. Efficacy and safety of a simple home-based resistance exercise program for older adults with low muscle mass: a prospective longitudinal clinical trial. Int J Rehabil Res. 2021;44(3):241-7. PMID: 34034287
30. Mañas A, Gómez-Redondo P, Valenzuela PL, Morales JS, Lucía A, Ara I. Unsupervised home-based resistance training for community-dwelling older adults: a systematic review and meta-analysis of randomized controlled trials. Ageing Res Rev. 2021;69:101368. PMID: 34022464
31. Carvalho MJ, Marques E, Mota J. Training and detraining effects on functional fitness after a multicomponent training in older women. Gerontology. 2009;55(1):41-8. PMID: 18562788
32. Nelson ME, Rejeski WJ, Blair SN, Duncan PW, Judge JO, King AC, et al. Physical activity and public health in older adults: recommendation from the American College of Sports Medicine and the American Heart Association. Circulation. 2007;116:1094-105. https://www.ahajournals.org/doi/10.1161/circulationaha.107.185650
33. Holviala J, Kraemer WJ, Sillanpää E, Karppinen H, Avela J, Kauhanen A, et al. Effects of strength, endurance and combined training on muscle strength, walking speed and dynamic balance in aging men. Eur J Appl Physiol. 2012;112(4):1335-47. PMID: 21796409
34. Lacroix A, Hortobágyi T, Beurskens R, Granacher U. Effects of supervised vs. unsupervised training programs on balance and muscle strength in older adults: a systematic review and meta-analysis. Sports Med. 2017;47(11):2341-61. PMID: 28573401
35. Enright PL, Sherrill DL. Reference equations for the six-minute walk in healthy adults. Am J Respir Crit Care Med. 1998;158(5 Pt 1):1384-7. Erratum in: Am J Respir Crit Care Med. 2020;201(3):393. PMID: 9817683