Effects of Chair-Based Exercises for Older People on Physical Fitness, Physical Activity, Sleep Problems and Quality of Life: A Randomized Controlled Trial

Yaşlı Bireylerde Sandalyeye Dayalı Egzersizlerin Fiziksel Aktivite, Fiziksel Uygunluk, Uyku Problemleri ve Yaşam Kalitesi Üzerine Etkileri: Randomize Kontrollü Bir Çalışma

Neslihan DURUTÜRK,[a]
Manolya ACAR,[a]
Metin KARATAŞ[a]

[a]Department of Physical Therapy and Rehabilitation,
Başkent University Faculty of Health Sciences, Ankara

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Yazışma Adresi/*Correspondence:*
Neslihan DURUTÜRK
Baskent University
Faculty of Health Sciences,
Department of Physical Therapy and Rehabilitation, Ankara,
TÜRKİYE/TURKEY
nalkan@baskent.edu.tr

ABSTRACT Objective: The aim of this study was to compare the effects of chair based exercises (CBE) with no exercise group on the physical fitness, physical activity, sleep problems and quality of life of older people. **Material and Methods:** Forty eight community-dwelling adults aged 65 years and older were randomly enrolled and divided into two groups: CBE or control group. CBE group participants performed 20 different exercises at sitting position, three times a week for 6 weeks. Physical fitness level was evaluated using Senior Fitness Test Protocol. Physical activity levels were evaluated by the short form of the International Physical Activity Questionnaire (IPAQ). Muscle strength was mesaured with digital dynamometer. Short Form-36 (SF-36) was used to evaluate health-related quality of life. Sleep Quality was determined by the Pittsburgh Sleep Quality Index. **Results:** The change in 6 minutes walk distance (p=0.01), two minutes step (p=0.00), arm curl (left) (p=0.00), chair sit-reach (p=0.04), and back scratch (right) (p=0.00) tests, muscle strength of iliopsoas (left) (p=0.00), deltoideus-anterior (right) (p=0.02), deltoideus-anterior (left) (p=0.04) muscles, IPAQ moderate intensity activity (p=0.00) and total scores (p=0.00), SF-36 pain (p=0.00) and physical role limitation (p=0.01) scores significantly differed between two groups. **Conclusion:** CBE may be appropriate for elderly population who has activity limitation and may be useful for those who cannot participate in other form of exercise.

Key Words: Geriatrics; exercise; quality of life; physical fitness

ÖZET Amaç: Çalışmanın amacı yaşlı bireylerde sandalyeye dayalı egzersizlerin (SDE) fiziksel aktivite, fiziksel uygunluk, uyku problemleri ve yaşam kalitesi üzerine etkisini egzersiz yapmayan grup ile karşılaştırmaktır. **Gereç ve Yöntemler:** Toplum içinde yaşayan 65 yaş ve üzeri 48 yetişkin randomize olarak alındı ve 2 gruba ayrıldı: SDE veya kontrol grup. SDE grup katılımcıları oturma pozisyonunda, 6 hafta, haftada 3 kez, 20 farklı egzersiz yaptılar. Fiziksel uygunluk düzeyi, Senior Fitness Test Protokolü kullanılarak değerlendirildi. Fiziksel aktivite düzeyi, Kısa Form Uluslararası Fiziksel Aktivite Anketi (UFAA) ile değerlendirildi. Kas kuvveti dijital dinamometre ile ölçüldü. Kısa form-36 (SF-36), sağlıkla ilişkili yaşam kalitesini değerlendirmek için kullanıldı. Uyku kalitesi, Pittsburgh uyku kalitesi anketi ile belirlendi. **Bulgular:** İki grup arasında 6 dakika yürüme testi mesafesi (p=0,01), 2 dakika adım (p=0,00), ön kol bükme (sol) (p=0,00), sandalyede otur uzan (p=0,04), ve sırt kaşıma (sağ) (p=0,00) testleri, iliopsoas (sol) (p=0,00), deltoideus-anterior (sağ) (p=0,02), deltoideus-anterior (sol) (p=0,04) kaslarının kuvvet, UFAA orta şiddetli aktivite (p=0,00) ve toplam skorları (p=0,00), SF-36 ağrı (p=0,00) ve fiziksel rol limitasyonu (p=0,01) skorlarındaki değişim anlamlı olarak farklıydı. **Sonuç:** SBE, aktivite limitasyonu olan yaşlı populasyon için uygun ve diğer egzersiz yöntemlerine katılamayanlar için yararlı olabilir.

Anahtar Kelimeler: Geriatrik; egzersiz; yaşam kalitesi; fiziksel uygunluk

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For older population there is clear evidence to support exercise training in developing health and well being. Exercise training has also a significant impact on diminishing risk of falls, costs to health and so-

cial care for community dwelling populations. Most of programmes involve exercises performed with standing and unassisted.[1,2] But these programmes may be difficult and crucial for people who are immobile or need assist. So, chair based exercise (CBE) programmes are usually provided for older people with limited mobility.

A recent research article developed the principles of CBE for older people and defined CBE as primarily a seated exercise programme and the aim of using a chair is to provide stability in sitting and also in standing.[2] Anthony et al., published a systemic literature review about CBE for frail older people and found the quality of the evidence base for CBE is low.[1] In this population, CBE effects on physical fitness and physical activity is investigated in few studies. Furthermore, there is a no study that determined the effects of CBE on sleep problems and quality of life.

The purpose of this study was to compare the effects of CBE with no exercise on the physical fitness, physical activity, sleep problems and quality of life of older people.

MATERIAL AND METHODS

SUBJECTS

Forty eight community-dwelling adults aged 65 years and older were enrolled randomly though advertisements or oral communications in this study between September 2014 and May 2015. Exclusion criteria were neuromuscular disease, unstable cardiovascular diseases, being non-cooperative and musculoskeletal disease that may interfere with the exercise. All parameters were assessed before and after the 6-weeks study period in all groups. This study was approved by the Medical Ethics Committee of Başkent University (Project no=KA14/221). Written informed consents were obtained from all of the participants.

STUDY DESIGN- INTERVENTION

A randomised controlled trial was performed to assign the effectiveness of CBE for older people. The subjects were randomised into either a CBE intervention group (n=24) or a non-exercise (control) group (n=24) before the baseline measurements. An independent therapist, not involved in the study, picked an envelope containing the letter A or B (indicating that the subject was assigned to the CBE or control group, respectively) for each participant. Thus, both the participants and the assessors were blinded to the group assignments.

Participants in the control group just been evaluated at the beginning of the study and after the 6-weeks period. All subjects in the CBE group trained three times a week for 6 weeks, in groups of 5 to 6, lasted 40 minutes each session under the supervision of a physical therapist. The older participants in CBE group performed 20 different exercises at sitting position that included strengthening and stretching of the lower and upper extremity muscles, 5 to 10 times per session (Appendix 1).[1,2] Weights of elastic bands that used in strengthening exercises were adjusted to participants' ability and progress. Warm-up and cool-down exercises involving lower and upper extremity joint movements were repeated at sitting position 5 times each. Heart rate and SpO_2 were obtained by a pulse oximeter and blood pressure was measured with a sphygmomanometer during the exercises for safety. The exercise intensity was adjusted based on the subjects' Modified Borg Scale rated dyspnea or fatigue.[3] We advised subjects resting if the perceived exertion rated was >7. All of the interventions and assessments in two groups were performed in the community-dwelling activity centre.

OUTCOME MEASUREMENTS

Baseline demographic and clinical characteristics were recorded at admission (Table 1).

Physical Fitness Level

Participants underwent Senior Fitness Test Protocol which assesses health-related physical fitness level for carrying out daily activities independently and safely.[4] The test consists of 7 measures as follows;

30-Second chair stand test; used to assess lower body strength. The number of full stands that could be completed in 30 seconds with the arms folded across the chest.

APPENDIX 1: Chair-based exercises for participants.

1. Diaphragmatic breathing exercises
2. Chest breathing exercises
3. Reciprocal ankle dorsi flexion and plantar flexion
4. Reciprocal hip flexion and extension
5. Shoulder posterior capsule stretching
6. Shoulder elevation
7. Shoulder circles
8. Shoulder anterior group muscle stretching
9. Shoulder / chest stretching (with fixing hands in waist)
10. Shoulder / chest stretching (with clenching hands in back)
11. Trunk flexion
12. Trunk and head rotation
13. Shoulder 90° abduction with elastic band
14. Elbow flexion with elastic band
15. Hip external rotation with elastic band
16. Knee extension and flexion with elastic band
17. Shoulder external rotation with elastic band
18. Shoulder 90° flexion with elastic band
19. Tighten a round object with wrist flexion
20. Sitting to standing

TABLE 1: Baseline characteristics of the subjects.

	CBE Group (Mean ± SD)	Control Group (Mean ± SD)	p
Female/male (number)	16/6	14/6	0.05
Age (years)	77.8±6.5	76.6±8.5	0.42
Body mass index (kg/m^2)	26.9±3.4	30.3±5.0	0.11
Mini Mental State Examination	21.2±6.3	22.6±6.4	0.48

CBE: Chair based exercises; SD: Standard deviation.

Arm curl test; used to assess upper body strength. The number of biceps curls that could be completed in 30 seconds while holding a hand weight of 5 lbs for women or 8 lbs for men.

2-Minute step test; used to determine aerobic endurance. The number of full steps completed in 2 minutes, with each knee rose to a point midway between the patella and the iliac crest. The score was the number of times the right knee reached the required height.

Chair sit-and-reach; used to assess lower body flexibility. The participants sat on the edge of a chair with the crease between the top of the leg and the buttocks even with the front edge of the chair seat. One leg was bent with the foot flat on the floor and the other leg was extended as straight as possible in front of the hip; the number of inches (or cm) (+ or –) between the extended fingers and the tip of toe were recorded.

Back scratch; used to assess upper body (shoulder) flexibility. One hand reached over the shoulder and one up the middle of the back; the number of inches (or cm) between the extended middle fingers (+ or –) were measured.

8-Foot up-and-go; used to assess agility/dynamic balance. The number of seconds required getting up from a seated position, walking 8 feet (2.44 m), turn, and return to a seated position was recorded.

6-minute walk test (6MWT)*;* used to determine cardiovascular endurance. The subjects were instructed and encouraged to walk the greatest distance possible in 6 minutes. During the tests, SpO_2, heart rate and heart pressure were measured and, dyspnea and fatigue were determined using the Modified Borg Scale.[3] The distance covered was measured in meters (Table 2).[5,6]

Muscle Strength

Muscle strength was also evaluated with an objective measurement which is digital dynamometer (JTECH, Medical Commander Powertrack II, ABD) for deltoideus-anterior, deltoideus-middle, biceps brachii, iliopsoas and quadriceps femoris muscles. Tests were repeated for each muscle three times to the right and left sides and were recorded in Newton (N). The best value was used for analysis.[7]

Physical Activity Assessment

Physical activity levels were evaluated by the Short Form of the International Physical Activity Questionnaire Turkish Version (SF-IPAQ).[8] SF-IPAQ is a scale to be recorded at different levels of physical activity time in the last week (7 days). The SF-IPAQ consists of 7 questions and provides information about the time spent on sitting, walking, moderate and vigorous activities. The data is reported as a continuous measure in median metabolic equivalent of task (MET)-minutes per week. The MET is a multiple of the resting metabolic rate that is assigned to a given activity and a MET-

TABLE 2: Comparison of physical fitness and muscle strength measurements between groups.

	CBE Group (n=22)			Control Group (n=20)			
	Baseline	6 weeks		Baseline	6 weeks		
Measurements	(X±SD)	(X±SD)	P^{α}	(X±SD)	(X±SD)	P^{α}	P^{β}
Senior Fitness Test Protocol							
6MWTD (meter)	125.77±96.62	169.22±118.06	0.00*	193.87±102.07	188.62±101.73	0.46	0.01*
Arm curl (right)	16.54±6.04	17.77±5.69	0.16	17.45±5.19	17.15±5.86	0.44	0.08
Arm curl (left)	16.31±6.22	18.18±4.90	0.03*	18.20±4.66	17.05±5.12	0.05	0.00*
2-minutes step	32.72±29.22	43.00±30.11	0.00*	50.05±30.80	47.20±22.07	0.51	0.00*
Chair sit-reach (right)	-7.81±11.00	-1.31±10.43	0.01*	-3.25±10.35	-3.05±9.93	0.97	0.04*
Chair sit-reach (left)	-7.36±10.38	-11.09±6.29	0.05	-4.25±10.21	-5.35±7.35	0.10	0.25
Back scratch (right)	-19.27±11.87	-14.59±7.74	0.01*	-15.35±8.81	-16.75±8.85	0.06	0.00*
Back scratch (left)	-20.50±12.80	-14.77±7.65	0.01*	-17.55±8.51	-16.40±8.85	0.16	0.05
8-foot up-go	18.13±9.48	17.56±6.98	0.82	17.52±8.63	18.52±8.50	0.07	0.26
Chair stand test (30 sc)	6.36±4.08	7.36±4.14	0.07	10.30±3.81	10.20±3.56	0.77	0.14
Muscle Strength (Newton/kg)							
Deltoid (anterior) (right)	60.17±32.12	66.55±39.80	0.01*	71.49±40.69	114.80±218.41	0.15	0.02*
Deltoid (anterior) (left)	59.51±33.83	69.15±39.83	0.05	67.13±37.75	62.34±27.82	0.73	0.04*
Deltoid (middle) (right)	54.29±33.87	57.73±35.73	0.41	67.76±39.31	63.12±30.32	0.88	0.30
Deltoid (middle) (left)	58.40±23.31	64.48±30.24	0.21	63.13±37.07	60.19±29.62	0.65	0.26
Biceps bracia(right)	76.71±28.04	83.85±45.88	0.21	75.67±34.81	72.68±26.45	0.88	0.27
Biceps bracia(left)	77.14±30.81	85.40±42.86	0.57	74.36±36.64	70.03±27.25	0.98	0.54
Iliopsias(right)	83.90±45.22	90.89±46.83	0.04*	75.01±39.06	67.08±29.16	0.40	0.05
Iliopsias (left)	78.42±35.73	87.35±47.62	0.01*	74.00±40.02	68.52±28.07	0.52	0.00*
Quadriceps femoris (right)	70.36±33.16	74.11±36.82	0.06	56.12±30.83	55.66±25.95	0.72	0.13
Quadriceps femoris (left)	67.25±28.71	69.45±30.85	0.25	58.12±29.18	55.94±22.75	0.42	0.43

*p<0.05 P^{α}: Baseline and after 6 week in each training and control groups difference p values. $^{\alpha}$: Wilcoxon signed rank tests, P^{β}: Two groups difference p-values , $^{\beta}$: Mann-Whitney U test. CBE: Chair Based Exercise. 6MWTD: 6 Minutes Walk Test Distance. SD: Standard deviation.

minute is calculated by multiplying the MET score of an activity by the minutes performed.[9]

Health-related Quality of Life

Short Form-36 (SF-36) was used to evaluate health-related quality of life. The SF-36 is a common used outcome measure which consist of 8 sub parameters; physical function, role-physical, pain, social functioning, general health, vitality, mental health, emotional role. The SF-36 is scored from 0 (extreme problem) to 100 (no problem).[10]

Sleep Quality

Sleep Quality was determined by the 19-item Pittsburgh Sleep Quality Index (PSQI). Scores are based on a four point likert scale that ranges from very good (0) to very bad (3). Global score of 0–21 is derived, with increasing score meaning worse sleep quality. A global score of 5 is accepted as changing well from poor sleepers.[11]

STATISTICAL ANALYSIS

Statistical analyses were performed using SPSS 20 (IBM Corp. Armonk, NY, USA). Quantitative analysis of data was reported as mean values and standard deviations (X±SD). Data from participants who completed the trial period were used, for all comparisons. The results of the homogeneity (Levene's test) and normality tests (Shapiro-Wilk) were used to decide which statistical methods to use to compare the study groups. According to those tests results parametric test assumptions were not avail-

able for these variables so the comparisons between baseline and post training were performed using the non-parametric Wilcoxon Test for each group. We performed comparisons between groups using the non-parametric Mann-Whitney-U test. Sample size calculations done by web based sample size calculators (http://www.stat.ubc.ca/~rollin/stats/ssize) indicated that 17 participants in each group were needed to show an improvement in quality of life using a power of 0.8 and α level of 0.05.

RESULTS

Sixty older people were screened, and 48 participants fulfilled the selection criteria and randomly assigned to one of the two groups and 22 (F/M: 16/6) older people in CBE group and 20 (F/M: 14/6) older people in control group participated in the last measurements (Figure 1). Compliance with the exercise intervention was very good; the CBE group attended an average of 17 of the 18 (94%) sessions. There were no baseline differences in the characteristics and clinical profiles between the groups (Table 1).

Senior Fitness Test parameter; 6MWT walking distance (p=0.00), two minutes step test (p=0.00), arm curl (left) (p=0.03), chair sit and reach test (p=0.01) and back scratch (right) (p=0.01) and left (p=0.01) scores were significantly improved in CBE group. In the control group there were no significant improvements in any physical fitness test parameters. While the differences between the baseline and 6-week values were compared, the magnitudes of the change over the study period were significantly differed between the two exercise groups. The change in walking distance (p=0.01), two minutes step test (p=0.00), arm curl (left) (p=0.00), chair sit and reach test (p=0.04), and back scratch (right) (p=0.00) scores between baseline and 6 weeks significantly differed between the CBE and control groups (Table 2).

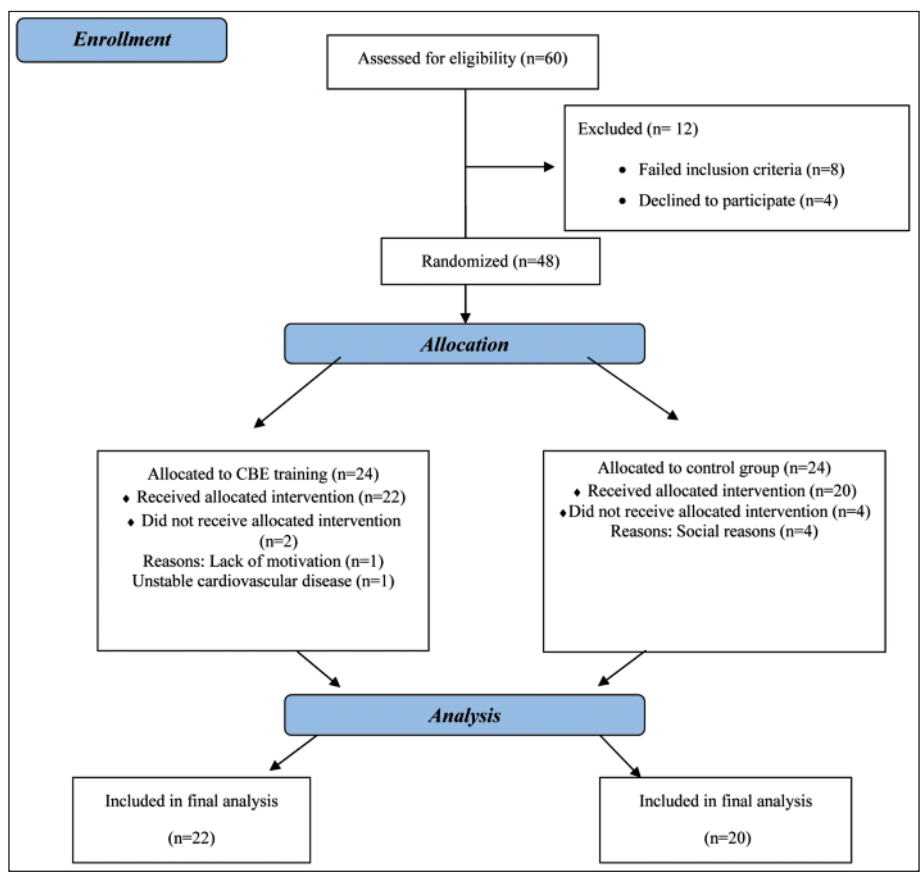

FIGURE 1: Study flow diagram.

Muscle strength of iliopsoas (p=0.04 for right, p=0.01 for left side) and deltoideus-anterior (right) (p=0.01) muscles increased significantly and tending to improve in deltoideus-anterior (left) (p=0.05) muscle over time in only CBE group. The change in muscle strength of iliopsoas (left) (p=0.00), deltoideus-anterior (right) (p=0.02) and deltoideus-anterior (left) (p=0.04) muscles values over the 6-week study period was significantly differed between the two groups and the improvement was higher in CBE group (Table 2).

IPAQ moderate intensity activity subgroup score was significantly improved in CBE group at the end of the training period (p=0.02). The between-group differences were statistically significant for the IPAQ moderate intensity activity (p=0.00) and total scores (p=0.00), and the values were higher in the CBE group (Table 3).

SF-36 pain sub group (p=0.01) score was significantly improved over time in CBE group with significant difference between two groups (p=0.00). The difference values of SF-36 physical role limitation sub parameter between two groups were significant (p=0.01) and the value was changed in favour of CBE group (Table 3).

Sleep quality (p=0.03) was significantly improved over time in CBE group with no significant difference between two groups (p=0.60) (Table 3).

DISCUSSION

In this study, we investigated whether CBE program in a community dwelling population would be effective in achieving gains in physical fitness, physical activity, sleep problems and quality of life. This is of great matter for older people because muscle strength and endurance decrease with aging. A previous study determined the health status of community dwelling orders and insisted on problems related with cardiopulmonary endurance, body flexibility, muscle power and endurance, balance and sleep quality.[12] Therefore, exercise programs aimed at improving these health related conditions could be beneficial for community dwelling seniors. Towards these expects our results showed that CBE program for older people have positive effects.

TABLE 3: Comparison of physical activity, quality of life and sleep quality scores between groups.

	CBE Group (n=22)			Control Group (n=20)			
	Baseline	6 weeks		Baseline	6 weeks		
Measurements	**(X±SD)**	**(X±SD)**	**P^{α}**	**(X±SD)**	**(X±SD)**	**P^{α}**	**P^{β}**
IPAQ Activity Scores (MET-min/week)							
Moderate	24.54±115.12	120.00±122.82	0.02*	73.62±155.95	63.62±153.82	0.31	0.00*
Vigorous	49.09±230.25	00.00±00.00	0.31	0.00±0.00	10.00±44.72	0.31	0.16
Walking	378.00±519.65	410.72±423.723	0.11	272.47±325.45	269.17±328.32	0.65	0.05
Total	451.63±575.33	530.72±462.11	0.06	450.02±556.52	342.80±348.10	0.46	0.00*
SF-36 Parameters							
Physical functioning	29.28±12.25	29.55±12.86	0.87	40.06±19.39	38.88±14.19	0.93	0.69
Physical role limitation	47.25±21.64	45.35±25.29	0.75	56.07±35.70	42.83±28.64	0.06	0.01*
Emotional role limitation	40.48±19.78	46.88±24.52	0.38	46.61±28.74	44.94±17.81	0.78	0.67
Energy	42.90±10.87	43.84±11.91	0.46	52.90±16.92	57.60±12.87	0.13	0.51
Emotional well-being	50.52±17.21	49.48±15.61	0.79	60.70±23.52	58.57±21.23	0.26	0.61
Social functioning	42.31±16.26	43.60±15.29	0.88	59.20±23.91	52.06±16.35	0.13	0.84
Pain	43.81±9.29	50.38±12.98	0.01*	67.16±25.77	57.24±16.62	0.11	0.00*
General health	46.70±13.50	43.33±15.22	0.29	48.97±16.22	46.32±16.98	0.47	0.71
PSQI Total Score	10.81±9.36	9.36±5.02	0.03*	7.60±4.09	6.70±3.14	0.08	0.60

*p<0.05 P^{α}: Baseline and after 6 week in each training and control groups difference p values. $^{\alpha}$: Wilcoxon signed rank tests, P^{β}: Two groups difference p-values , $^{\beta}$: Mann-Whitney U test.
CBE: Chair Based Exercise; IPAQ: International Physical Activity Questionnaire; SF-36: Short Form 36 Health Survery; PSQI: Pittsburgh Sleep Quality Index. SD: Standard deviation.

A well marked finding of this study was the high attendance of the supervised exercise program. The CBE was tolerated by the older people and had high participation rate. And most of the community dwelling seniors in the study were volunteers for continuing the exercises after 6-week study period. Furthermore, the exercise program appeared to be safe, there were no adverse effects reported after each exercise session from participants.

A recent published systematic review which examined the effects of CBE program for frail older people identified six studies for inclusion.[1,2] But all studies in the systematic review identified different applications with varied frequencies and settings. So it had concluded that the quality of evidence level is low for CBE in older people. Furthermore, all of these studies had determined different outcome measurements but none of them proved the effect of CBE programmes on quality of life and sleep disturbance.[13-18] To our knowledge this is the first trial that evaluates the effect of CBE program on these outcome measurements.

Analysis of the physical fitness responses to the exercise program compare with the control group indicated significant improvements in 6MWT, two minutes step test, chair sit-reach test and back scratch test. Most of previous studies had showed that walking speed and distance is associated with muscle strength and functionality.[19,20] Two study identified CBE on elderly population and examined the effects on cardiorespiratory fitness.[14,18] Witham et al., found no significant improvement in 6MWT while significant improvement in walk time was reported by Hruda et al. So our results support the literature with the improvement in 6MWT.[14,18] Significant improvements in flexibility (chair sit-reach and back scratch test) were seen in our intervention group. Roma et al, has also found improvement in flexibility after resistance training in elderly people and concluded that a decrease in flexibility is related with injury in joints, muscles and bones, and impairment in functional capacity.[20] Furthermore, none of the six studies that concluded in the systematic review had determined the effect of CBE on flexibility. On these bases this is the first study that clarifies the effects on flexibility in elderly population.

Balance measurement which is the other sub parameter of physical fitness had determined with the 8-Foot up-and-go test and unexpectedly the measurement was not significantly improved in exercise and control groups. Hruda et al., reported an improvement in 8-Foot up-and-go test.[14] Baum et al., has also found improvements in Timed up-go and Berg Balance Scale.[13] We thought that if the study continued for a longer period the effect of the exercise may have supported the others about balance measurements.

Our study showed muscle strength gains in CBE group. Muscle strength which measured with a digital dynamometer was significantly improved in iliopsoas and deltoideus-anterior muscles and tending to improve in deltoideus-anterior muscle. There is only three studies that clarify the effect of seated exercise programmes on muscle strength in elderly.[14,16,17] Nicholson et al. found improvement in grip strength in control and intervention group.[17] Hruda et al., reported gains in eccentric and concentric average power.[14] Thomas et al., reported improved grip strength but found impairments in dorsiflexion and iliopsoas muscle.[16] Therefore our exercise program which includes strengthening exercises with own weight and with elastic bands seems to be more effective in improving muscle strength especially in muscles related with balance and functionality.

Also a significant difference in moderate intensity physical activity was seen in intervention group and comparing with control group make difference in total physical activity and moderate intensity physical activity. Only one study determined the effect on physical activity and reported significant improvement in physical activity measurement.[18] So there is a need for determining exercise effects on physical activity with more objective measurements.

There was significant improvement in quality of life measurement related with pain and sleep quality in exercise group. Quality of life and sleep quality represents an essential component to well being and functional maintenance. Therefore, our study is the first study in these bases and highlights

the effects of CBE in these outcome measurements. These findings identify future researches about the effective of CBE on sleep problems.

Our study has some limitations. Our community dwelling elderly population were all healthy, so gains could probably have been greater if weaker or unhealthy elders were included in the study. Another limitation was that we could have used a more objective measurement to determine physical activity affect.

CONCLUSION

Our findings highlight the effectiveness of CBE on physical fitness, physical activity, sleep disturbance and quality of life in older people. CBE may be appropriate for elderly population who has activity limitation and may be useful for those who cannot participate in other form of exercise. Further long term studies are required to clarify the effect of CBE on mortality and morbidity in elderly population.

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