Coll. Antropol. **34** (2010) 3: 995–999
Original scientific paper

The Benefits of Regular Kinesiotherapy Once a Week for Postmenopausal Women: an Aged-Matched Study

Zmago Turk, Dragan Lonzarić and Dragan Aleksić

Institute for Physical and Rehabilitation Medicine, Maribor University Clinical Centre, Maribor, Slovenia

A B S T R A C T

Regular exercise training improves overall physical fitness and quality of life in postmenopausal women. The exigent training frequency depends on a user-specified training aim. The aim of this study was to confirm the benefits of regular once a week exercise training for the maintenance of fitness in postmenopausal women. The test group included 20 postmenopausal women (65±3.1 years) who have been attending the exercise training program conducted by the physiotherapist once a week for three years. The age-matched control group included 20 healthy women (65.5±2.4 years) who did not regularly attend the training program. The outcomes were: right and left lateral trunk flexion, right and left shoulder flexion, right and left grip strength, endurance capacity of the trunk extensors, lower limb muscle strength (1' chair stand test), and balance (one-leg standing duration time with eyes open and closed). Women from the test group achieved statistically significant better results in the following outcomes: right lateral trunk flexion (15.4 cm: 12.6 cm, $p<0.001$), left lateral trunk flexion (15.4 cm: 12.6 cm, $p=0.001$), trunk extension muscle endurance (53.4 s: 40.5 s, $p<0.001$), lower limb muscle strength (28.4 x: 25 x, $p<0.001$), and one-leg standing duration time with open eyes (33.5 s: 19.7 s, $p<0.001$). The results suggest that a regular once a week exercise training program designed and conducted by the physiotherapist, may be helpful in the improvement or maintenance of flexibility, muscle strength and capacity, and balance in postmenopausal women. The better fitness proved by our study could be a result of other causes and not solely that of the designed training program.

Key words: *menopause, exercise training, fitness, disability, muscular strength, balance*

Introduction

Menopause represents the permanent cessation of menses resulting from the loss of ovarian follicular function. Postmenopause begins with menopause but cannot be diagnosed sooner than 12 months after the last spontaneous menstrual period[1]. At menopause, the risk of diabetes, atherosclerosis, ischemic heart disease, and cerebrovascular insults is significantly increased[2–6]. Physical inactivity causes atrophy of the musculoskeletal system and is an essential factor related to gaining weight in older age[6]. Several disabilities may be followed by reduced physical activity. Osteoporosis, which is the most frequent metabolic bone disease during this period, presents an increased risk of fractures[7]. Musculoskeletal pain, physical disabilities and a related decline in participation negatively affect the quality of life of menopausal women and present an important health care issue[4,8–11].

In general, the term fitness is used to define the level of physical state defined by weight, flexibility, muscle strength, and physical as well as cardiopulmonary capacity[12,13]. Physical fitness can be achieved by means of different forms of exercise and sports such as fast walking, running, cycling, swimming, and similar physical activities. Regular exercise has been proven to have a lot of beneficial physiological effects: it decreases the level of catecholamines and glucose, and increases cardiovascular endurance, muscle strength, flexibility, balance, and speed[11–18]. Exercise decreases the occurrence of negative somatic and vasomotor symptoms of menopause[19]. A regular one hour walk three to five times a week significantly improves lung capacity, increases oxygen uptake, and decreases the level of body fat[20]. Regular aerobic training significantly improves and preserves the bone

Received for publication February 20, 2009

mineral density of the lumbar spine in menopausal women. Usually the recommended training frequency is three times a week with a total duration of at least three hours[2–4,12,13]. The question of the optimal and minimal training frequency for achieving the desired effect remains open.

There are many preventive physiotherapeutic programs carried out regularly at the Institute for Physical and Rehabilitation Medicine (IPRM) of the Maribor University Clinical Centre (UCCM). One of them is designed for healthy postmenopausal women. We were interested in the effectiveness of this program and whether its frequency suffices for the maintenance of physical fitness.

Participants and Methods

The study was performed in October and November 2007 at the IPRM UCCM. We included 40 women with an average age of 65 years (range 58–69 years). They were divided into two groups. The test (intervention) group included 20 healthy postmenopausal women who have regularly attended an exercise program once a week at our Institute for the last three years. The control group included 20 healthy postmenopausal women of the same average age who were invited to participate by women in the test group. Women from the aged-matched group did not practice any kind of regular physical exercise training. Postmenopausal women did not have osteoporosis, they did not experience any fractures, and they did not have any severe acute or chronic health problems in the last three years. The groups were comparable regarding age, body weight and height.

The training program (intervention) consisted of exercises focused on spine flexibility, upper and lower limb flexibility, large muscle group strengthening, and balance training. The initial six-minute stretching program was usually carried out lying on the back. A 20-minute exercise program followed aimed at improving spine and main joint flexibility, and to strengthen large muscle groups such as abdominals, lumbar spine and pelvic area muscles, shoulder, elbow, hip, and knee muscles. The third part of training consisted of a 10-minute exercise program designed to improve balance, coordination and symmetry of movement (exercises on a ball, one and two-leg balance exercise, walking along a straight line etc.). The final part of the training program comprised six-minutes of stretching exercises and the relaxation of large muscle groups.

The evaluation of the fitness level of postmenopausal women has been done with simple tests of proven reliability[12,13,21,22].

Lateral trunk flexion (lateral bending) was measured with a tape measure in the following manner: a woman stood on marked lines which were 15 cm apart, with her back against the wall, arms loose at the sides of the body and the fingers moved down the lower extremity during maximal lateral bending. The movement was repeated three times. We calculated the average difference between distances between the tip of the third finger and the floor (in cm) measured in upright posture and in maximal lateral bending[20].

Shoulder joint flexibility was evaluated in the following manner: a woman stood on even ground with her back against the wall and arms straight at the sides of the body, then she simultaneously raised both arms (with elbows extended) above the head, and the distance between the thumbs and the wall was measured with a ruler (in cm). If the woman touched the wall with her thumb, she had a maximal possible range of motion (0 cm). A larger distance meant a smaller range of motion (flexibility)[20].

Grip strength was measured using a Martin vigorimeter. The woman stood during the measurement with her elbow flexed at 90° and she extensively grasped the tool with all her fingers. For each strength test the scores of three successive trials were recorded (in kPa) and the highest score was used for analysis[21].

Endurance capacity of the trunk extensor muscles was measured in the following manner: a woman had to lean with her lower abdominal part against a slightly elevated bank, fingers crossed behind the neck, and then raise her upper body off the bank to a straight back level while her legs were supported. The woman tried to remain in this position for up to 60 seconds. The results of three successive trials were recorded and the best score (the longest time) was used for analysis[20].

When measuring lower-extremity muscle endurance, the woman tried to get up from a chair as often as possible in one minute. The woman had to sit with both feet touching the floor and her arms folded across her chest and stand up with her knees extended. When she returned to the sitting position, she had to raise one foot (or at least the heel) from the floor as proof that she was really sitting. After three trials we used the highest number of repeated chair stands[21].

Balance was estimated with the time standing on one leg with closed and open eyes up to one minute (measured using a chronometer). The woman stood with her back against the wall for safety reasons, first with eyes open and then closed. While she was standing, she was not allowed to touch the floor with her other leg and the wall with her hand. After three trials, we took into consideration the best score[23].

The comparison of two groups and all the measurements were performed only once (in October and November 2007).

Statistical analysis was performed by means of the Statistical Package for Social Sciences for Windows 12 (SPSS Inc., USA, 2001). Normal variable distribution was reached only for the Body Mass Index (the Kolmogorov-Smirnov test for normality of distribution), therefore a t-test was used. For all other comparisons the non-parametric statistic (i.e. Mann-Whitney U-test) was used. The effect sizes were performed by means of an Effect Size Generator (Co GJ Devilly, 2004), and additional power statistics with Power and Precision 3.2 (Co M Borestein, 2007). The power value of ≥80% was de-

manded. Because of the multiple comparison between two groups (in total 10 outcomes), we used the Bonferroni correction for multiple testing, so the statistically significant results were defined with $p \leq 0.005$.

Results

The average age in the test group was 65±3.1 years (range, 58–69 years) and in the control group 65.5±2.4 years (range, 62–69 years). The difference between groups was not statistically significant.

The average height of women in the test group was 162±7 cm (range, 152–172 cm) and in the control group 159±6 cm (range, 151–178 cm). The average body weight in the test group was 67.3±8.5 kg (range, 52.7–87.3 kg) and in the control group 70.1±9.5 kg (range, 54.4–91 kg). The average BMI in the test group was 25.8±2.7 kg/cm^2 (range, 21–29.5 kg/cm^2) and in the control group 27.8±3.2 kg/cm^2 (range, 21–35.1 kg/cm^2). The first two variables had non-normal distribution; therefore the Mann-Whitney U-test was used. Despite the fact that there were no statistically significant differences between body weight and height, the difference between the groups in BMI (the Kolmogorov–Smirnov test for normality of distribution, $p=0.2$) was statistically significant ($p=0.035$).

The average right trunk flexion in the test group was 15.4±2.5 cm (range, 12–21 cm) and in the control group 12.6±1.9 cm (range, 9–17 cm). The average left trunk flexion in the test group was 15.4±2.4 cm (range, 11–21 cm) and in the control group 12.6±2.3 cm (range, 8–17 cm). Both differences were statistically significant (for right trunk flexion $p<0.001$, and for left trunk flexion $p=0.001$).

The average right shoulder joint flexibility in the test group was 1.6±2 cm (range, 0–6 cm) and the average left shoulder joint flexibility was 1.6±2 cm (range, 0–8 cm). The respective mean values in the control group were 3.1±2.5 cm (range, 0–8 cm) and 3.6±3.4 cm (range, 0–12 cm). The differences between groups were not statistically significant (suitable p-values were 0.06 and 0.04).

The average right hand grip strength in the test group was 51.9±9.5 kPa (range, 40–79 kPa) and the average left hand grip strength was 50.1±8.8 kPa (range, 38–70 kPa). Respective mean values in the control group were 48.3±10.5 kPa (range, 39–80 kPa) and 44.9±8.5 kPa (range, 38–65 kPa). The differences between the groups were not statistically significant (suitable p were 0.06 and 0.006).

The average endurance time of trunk extension in the test group was 53.4±5.6 s (range, 41–60 s) and in the control group 40.5±10.2s (range, 20–60 s). The difference was statistically significant ($p<0.001$).

The average number of repeated chair stands within 60 s in the test group was 28.4±2.1 (range, 26–33) and in the control group was 25±2.9 (range, 17–29). The difference between the groups was statistically significant ($p<0.001$).

The average duration of one-leg standing with open eyes in the test group was 33.5±8.4 s (range, 17–48 s) and with closed eyes was 11.2±3.8 s (range, 5–18 s). Respective values in the test group amounted to 19.7±5 s (range, 12–27 s) and 8.8±4.5 s (range, 4–19 s). The difference was statistically significant in one-leg standing with eyes open ($p<0.001$) and was not statistically significant in one-leg standing with eyes closed ($p=0.04$).

We were limited by the number of participants in the test (intervention) group (actually only 20 women regularly attended once a week exercise training for three years). The power analysis showed that satisfying statistical power was reached for right (97.9%) and left trunk flexion (96.5%), the endurance time of trunk extension (99.9%), the number of repeated chair stands (98.9%) and the duration of one leg standing with open eyes (100%). For all other outcomes the sample size was too low.

The effect size was evaluated by calculation of Cohen's d. Values of between 0.3 and 0.5 have medium effect size (right hand grip strength, 0.36) and values ≥0.5 have large effect size (valid for all other variables).

Discussion

The purpose of this study was to prove that better physical fitness exists in postmenopausal women who have been regularly attending a physical training program once a week for three years in comparison to women who do not exercise regularly. The control group was aged-matched, and comparable to a test group in terms of body weight and height, but the difference in BMI was statistically significant. None of the participants had osteoporosis, had been fractured or had contractures of large joints, and received no physiotherapy in the last year before inclusion in our trial. The program was designed and conducted by a physiotherapist.

We chose in total 10 outcomes that cover trunk and shoulder flexibility, hand grip strength, trunk and lower leg muscle endurance and one-leg standing balance. Although we use the term physical fitness, we were not interested in cardiopulmonary parameters. The women in the test group tend to have better results in all outcomes. Statistically significant better results considering the adequate values of effect sizes and power analysis were reached in right and left trunk flexion, trunk extension and lower leg muscle endurance time, and in one-leg standing balancing with open eyes.

We managed to reach group comparability in women in terms of mean height and weight but not in terms of BMI. Our goal was not to prove that the group which exercised regularly had less overweight issues, but this could possibly be the case. Morey and coll. have proven that a 20-minute workout three times a week for four months is sufficient for statistically significant weight loss and a decrease in BMI[23]. We do not presume that our once a week exercise program may have the same effect. We also do not claim that the effects of our exercise training exclude all other possible impacts on physical fitness.

Eventual differences in women's lifestyle and everyday physical burden were not analyzed. There is indeed a possibility of conscious or unconscious inclusion bias when choosing the participants for the control group by the participants of the test group.

Asymmetry in postmenopausal women or older adults is probably conditioned by the right dominance of the upper extremity. Germain and Blair also established similar asymmetry in older adults (men and women older than 50 years), but only in the case of trunk side-bending[24]. Amundsen also studied asymmetry caused by upper extremity dominance in older women where he measured greater right hand strength (22.2 kg *vs*. 18.6 kg)[25]. McMurdo and Rennie have proven that specific regular training carried out for 45 minutes twice a week for seven months improves grip strength[26].

The normative values of lower-extremity muscle endurance for women between 65 and 69 years old were provided by Rikli and Jones in 2001, namely 11 to 16 chair stands in 30 seconds[27]. The results in both groups in our study correspond with these normative values.

Skelton and McLaughlin determined a statistically significant improvement in balance while standing on one leg with eyes closed after eight weeks of training (one hour daily three days a week)[28]. Binder and coll. also report on an extended duration of one-leg standing after eight weeks of training in 62% of participants[29]. Zdešar confirmed the effectiveness of the exercise program carried out once a week where afterwards women were able to stand on one leg with eyes open for up to 30 seconds and with eyes closed for between 13 and 16 seconds[30]. The study results of the Slovenian authors prove a significant improvement of functional ability in active older people between 60 and 90 years of age who were included in six-month training programs at least three times a week for 40 minutes where they had to sweat and/or feel shortness of breath[31]. When performing the one-leg standing test, active older women reached an average time of 74.4 seconds standing with eyes open, which is much better than our results. Such a difference is probably the result of a more intensive and balance specific exercise program than it was in our case.

Conclusions

We proved that better physical fitness exists in postmenopausal women who have been regularly attending a physical training program once a week for three years in comparison to women who do not exercise regularly. Physiotherapists can design and conduct exercise training programs for healthy postmenopausal women intended to maintain their flexibility, muscle strength, and balance. Although many authors speak in favor of regular exercise training three times a week, our findings confirm the effectiveness of training only once a week. Such activity is beneficial and desirable, the more so because of the minimal organizational requirements and cost involved.

REFERENCES

1. WHO: Research on the menopause: Report of a WHO Scientific Group (1981, Geneva) — 2. HARDMAN AE, J Sport Sci, 14 (1996) 201. — 3. FRANK LL, SORENSEN BE, YASUI Y, TWOROGER SS, SCHWARTZ RS, ULRICH CM, IRWIN ML, RUDOLPH RE, RAJAN KB, STANCZYK F, BOWEN D, WEIGLE DS, POTTER JD, MCTIERNAN A, Obes Res, 13 (2005) 615. — 4. HUNG C, DAUB B, BLACK B, WELSH R, QUINNEY A, HAYKOWSKY M, Chest, 126 (2004) 1026. — 5. MATTHEWS KA, MEILAHN E, KULLER LH, New Engl J Med, 321 (1989) 641. — 6. MANOLIO TA, PEARSON TA, WENGER NK, Ann Epidemiol, 2 (1992) 161. — 7. Consensus Development Conference. Prophylaxis and treatment of osteoporosis, Am J Med, 90 (1999) 107. — 8. VILLAVERDE-GUTIÉRREZ C, ARAÚJO E, CRUZ F, ROA JM, BARBOSA W, RUÍZ-VILLAVERDE G, J Adv Nurs, 54 (2006) 11. — 9. ENGELKE K, KEMMLER W, LAUBER D, BEESKOW C, PINTAG R, KALENDER WA, Osteoporosis Int, 17 (2006) 133. — 10. GOLD DT, Bone, Suppl. 18 3 (1996) 185. — 11. WHO, J Aging Phys Activity, 5 (1997) 1. — 12. SUNI JH, MIILUPALO SI, ASIKAINEN TM, LAUKKANEN RT, OJA P, PASANEN ME, BÖS K, VUORI M, Phys Ther, 78 (1998) 134. — 13. MALMBERG JJ, MIILUNPALO SI, VUORI IM, PASANEN ME, OJA P, HAAPANEN-NIEMI NA, Arch Phys Med Rehabil, 83 (2002) 666. — 14. HOUCK JA, Bull Hist Med, 77 (2003) 103. — 15. GRIMBY G, GRIMBY A, FRANDIN K, WIKLUND I, Scand J Med Sci Sports, 2 (1992) 225. — 16. BOND MJ, CLARK MS, SMITH DS, HARRIS RD, Disab Rehab, 17 (1995) 63. — 17. HARDMAN AE, J Sports Sci, 14 (1996) 201. — 18. SLAVEN L, LEE C, Health Psychol, 16 (1997) 203. — 19. READY AE, NAIMARK B, DUCAS J, SAWATZKY JV, BORESKIE SL, DRINKWATER DT, OOSTERVEEN S, Med Sci Sport Exerc, 28 (1997) 1097. — 20. RIKLI R, JONES J, J Aging Phys Activity, 5 (1997) 244. — 21. MATHIOWETZ V, KASHMAN N, VOLLAND G, WEBER K, DOWE M, ROGERS S, Arch Phys Med Rehabil, 66 (1985) 69. — 22. CSUKA M, MCCARTHY DJ, Am J Med, 78 (1985) 77. — 23. MOREY MC, COWPER PA, FEUSSNER JR, DIPASQUALE RC, CROWLEY GM, KITZMAN DW, JR. SULLIVEN RJ, JAGS, 37 (1989) 348. — 24. GERMAIN N, BLAIR S, Am Correct Ther J, 37 (1983) 156. — 25. AMUNDSEN LR, DEVAHL JM, ELLINGHAM CE, Phys Ther, 69 (1989) 475. — 26. MCMURDO ME, RENNIE L, Age Aging, 22 (1993) 11. — 27. RIKLI ER, JONES CJ, Human kinetics, 1 (2001) 19. — 28. SKELTON DA, MCLAUGHLIN AW, Physiotherapy, 82 (1996) 159. — 29. BINDER EF, BROWN MB, BIRGE SJ, JAGS, (39) 1991 50. — 30. ZDEŠAR A, Graduate thesis, In Slovenian (Visoka zdravstvena šola za zdravstvo, Ljubljana, 2003). — 31. BURGER, H, MARINČEK Č, Zdrav Vest, 68 (1999) 731.

Z. Turk

Department of Physical and Rehabilitation Medicine, Maribor University Clinical Centre, Ljubljanska ulica 5, SI-2000 Maribor, Slovenia
e-mail: zmago.turk@ukc-mb.si

PREDNOSTI REDOVNE JEDNOTJEDNE KINEZITERAPIJE KOD ŽENA NAKON MENOPAUZE: ISTRAŽIVANJE POVEZANOSTI GODINA

S A Ž E T A K

Redovito vježbanje poboljšava sveukupnu tjelesnu spremu i kvalitetu života žena nakon menopauze. Učestalost prijeko potrebnog vježbanja ovisi o cilju individualiziranog treninga. Cilj ovog istraživanja bio je potvrditi prednosti redovite jednotjedne vježbe u održavanju tjelesne spreme žena nakon menopauze. Testirana grupa uključivala je 20 žena nakon menopauze (65±3,5 godina) koje su polazile program vježbanja vođenog od fizioterapeuta, jednom tjedno tijekom tri godine. Kontrolna grupa uključivala je 20 zdravih žena (65,5±2,4 godina) koje nisu polazile spomenuti program vježbanja. Istraživalo se: fleksibilnost lijeve i desne lateralne strane trupa, fleksibilnost lijevog i desnog ramena, snaga stiska lijeve i desne šake, kapacitet izdržljivosti mišića ekstenzora trupa, snaga mišića donjih udova (test sjedanja i ustajanja) i ravnoteža (stajanje na jednoj nozi u određenom trajanju s otvorenim i zatvorenim očima). Žene iz testirane grupe postigle su statistički značajno bolje rezultate u sljedećim ishodima: fleksibilnost desne lateralne strane trupa (15,4 cm: 12,6 cm, $p<0,001$), fleksibilnost lijeve lateralne strane trupa (15,4 cm: 12,6 cm, $p=0,001$), izdržljivost mišića ekstenzora trupa (53,4 s: 40,5 s, $p<0,001$), mišićna snaga donjih udova (28,4 x:25 x, $p<0,001$) i trajanje stajanja na jednoj nozi s otvorenim očima (33,5 s: 19,7 s, $p<0,001$). Ovi rezultati sugeriraju da program redovitog jednotjednog vježbanja, smišljenog i vođenog od strane fizioterapeuta, može biti koristan u poboljšanju ili održavanju fleksibilnosti, mišićne snage i kapaciteta te ravnoteže kod žena nakon menopauze. Bolja tjelesna sprema, dokazana ovim istraživanjem, može biti i rezultat nekih drugih uzroka, a ne isključivo zbog osmišljenog programa vježbanja.