Effect of resistance training with elements of stretching on body composition and quality of life in postmenopausal women

Małgorzata Socha, Paulina Frączak, Wiesława Jonak, Krzysztof A. Sobiech

University School of Physical Education in Wrocław, Poland

Abstract

Introduction: Physical activity in elderly persons contributes to prevention and treatment of chronic disease and, through its influence on the musculoskeletal system, increases physical capability and improves mental function.

Aim of the study was to assess the effect of resistance training with elements of stretching on body composition and quality of life in women of postmenopausal age.

Material and methods: Thirty-eight postmenopausal women aged 62.5 ±5.8 years were randomly divided into two groups. One group participated in an 8-week training program (60 minutes, twice weekly; 4 MET [metabolic equivalent] 2 hours/week). The second group performed no training. A comparison was made of body composition and quality of life (SF-36 Health Survey) prior to and after 8 weeks of training.

Results: In the training group, after 8 weeks there was a significant reduction in body fat (in %; \( p = 0.028 \)), and an increase in fat-free mass (in %; \( p = 0.025 \)) and total body water (in %; \( p = 0.021 \)), which indicates increased muscle mass. Furthermore, there were statistically significant differences in the assessment of quality of life in physical (role-physical [RP], bodily pain [BP], general health [GH] scales; \( p < 0.005 \)) and mental health (vitality [VT] scale; \( p = 0.05 \)). In the non-exercising group no changes were observed in features examined in the initial and final test.

Conclusions: Resistance training with elements of stretching in postmenopausal women improved body composition to achieve a reduction in risk factors associated with excess fatty tissue and muscle mass deficiency. It raises the quality of life in terms of both physical and mental function.

Key words: exercise training, body composition, physical health, mental health, elderly women.
ganism in older persons is not fully known. The results of some research indicate only a slight improvement in function following RT, despite the great positive results of such training on muscle strength [13, 14].

In light of these data, the aim of this study is to assess the effect of 8 weeks of RT, with elements of stretching, on body composition and quality of life in women of postmenopausal age.

Material and methods

Subjects

The study included 38 healthy women between the ages of 50 and 76 years, average age 62.5 ±5.8 years. There were no medical contraindications to participation in moderate PA. Based on careful medical history, we excluded patients with circulatory insufficiency and chronic diseases according to Kowalski and Mejer [15]. The women were divided randomly into two groups (G1 and G2) of 19 persons. Group G1 participated in an RT program with elements of stretching lasting 8 weeks (Table I). Group G2 was the control group, not participating in any form of PA. From the group of women who commenced training, 13 women systematically participated in classes, and for these women we have full comparative data. The subject women declared a lack of participation in regular RT for a period of six months prior to commencement of the study. Furthermore, they were committed to maintaining their current level of PA during the day, independently of the exercises completed within the program. The women in group G1 were familiarized with the principles of safe exercise in a gym. The women in groups G1 and G2 did not differ statistically significantly in terms of age, height or body mass, waist circumference or body mass index (BMI) or waist-hip ratio (WHR), or body composition parameters (Table II). The training program was conducted over 8 weeks, twice weekly for 60 minutes, and included exercise of moderate intensity, defined as 4 MET (metabolic equivalent) on the basis of “Compendium of physical activities” according to Ainsworth et al. [16]. 1 MET corresponds to oxygen consumption at rest, and in regard to body weight, is 3.5 ml · kg⁻¹ · min⁻¹.

The women in group G1 performed physical effort requiring energy expenditure of approximately 4 MET · 2 hours/week. The study was conducted in two stages – preliminary examinations, prior to training, and after eight weeks of training. These included anthropometric measurements, body composition measurements, and assessment of quality of life. Permission to conduct the study was received from the Polish local Commission for Ethics at the University School of Physical Education in Wroclaw 2014. All research participants had to provide written consent in order to participate in the project.

Exercise training program

Stationary form, endurance-strength training for muscle groups is shown in Table I. Work was performed in aerobic zones. The internal resistance training included 25 repetitions (very low load). The training was led by a qualified instructor. Training stages: 1) warm up to music (15 min), including various forms of aerobic exercise such as marching, basic fitness steps mixed with breathing exercises. The aim of this was to raise the body temperature and stimulate the organism in preparation for effort. The intensity of the warm up was at the level of 55-80% VO₂max; 2) endurance-strength exercises with the body’s own resistance, dumbbells (1 kg on each side) and large exercise ball (35 min), two series of maximum 25 repetitions for each exercise; this stage comprised 12 exercise types for selected muscle groups; 3) stretching of main muscle groups used in the exercises (10 min), two series of 20 seconds for each side; included 9 types of exercise for selected muscle groups (Table I).

Anthropometric measurements

Measurements were taken of body mass, body height, waist circumference (at the largest narrowing in the trunk at the waist) and hips (through the buttocks); BMI was calculated (body mass [kg]/body height [m²]) and WHR (waist circumference [cm]/hip circumference [cm]). Body composition assessment was performed with the bioimpedance method (BIA) – STA/BIA RJL – Akern 101/S tetrapolarna version (Italy); the following BC component percentages were analyzed: body fat (BF), fat-free mass (FFM), total body water (TBW) and body cell mass (BCM).

Quality of life

This was measured using the Short Form Health Survey (SF-36). Permission was obtained from QualiMetric Incorporated for using the Polish version questionnaire (IQOLA SF-36v2 Standard, Poland). The

| Tab. I. Characteristics of training |
|-----------------------------------|
| **Twice weekly, 60 minutes**      |
| **Resistance training:**          |
| Number of series                  | 2 series |
| Number of repetitions             | 25 repetitions |
| **Stretching:**                   |
| Number of series                  | 2 series |
| Duration of exercise              | 20 s     |
| Muscle groups:                    |
| m. quadriceps femoris             |
| m. adductores                     |
| m. gluteus maximus                |
| m. gluteus medius                 |
| m. dorsi                          |
| mm. femoris posteriori            |
| mm. flexoris genus                |
| m.m. membroi superioris           |
| m. pectoralis major               |
| mm. abdominis                     |
questionnaire contains 36 questions which allow comparison of subjects in 8 dimensions of quality of life: physical functioning (PF), role-physical (RP), bodily pain (BP), general health (GH), vitality (VT), social functioning (SF), emotional role functioning (RE) and mental health (MH). In each category, questions are marked on a scale of 0 to 100 points, where a greater points value corresponds to better quality of life. Furthermore, two indicators were compared: physical component summary (PCS) and mental component summary (MCS) [17].

Statistical analysis

Statistical analysis was performed using the Statistica 10.0. software. The data presented in the text and tables of the study are expressed as mean values ± standard deviation (SD). The difference between two samples of independent variables (groups G1 and G2) was examined with the Mann-Whitney U test. The significance of the differences between the mean values for dependent variables (prior to and following training) was analyzed with the Wilcoxon test. To assess the strength of the correlation between anthropometric features and body composition parameters and quality of life, the Spearman rank correlation coefficient (R) was calculated. A value of \( p < 0.05 \) was considered statistically significant.

Results

Prior to commencement of the program, in 38.5% of class participants G1 36.8% of subjects in G2 presented BMI within normal values (BMI < 25 kg/m²), 30.7% of subjects in G1 and 31.6% in G2 presented excess weight (BMI 25-29.9 kg/m²), 30.8% of subjects in G1 and 31.6% in G2 were found to be obese (BMI ≥ 30 kg/m²). In the total group of women (G1 and G2) a statistically significant correlation was found between BMI, waist and hip circumference and quality of life assessment (Table III). Lower point scores, and thus worse quality of life in the physical perception of health measured in categories of PF, BP and GH and PCS were observed in women with greater body mass, high BMI indicators and greater waist and hip circumference (R = from –0.43 to –0.61, \( p < 0.05 \)). Similar interdependencies occurred between examined BC features and subjective assessment of health (Table III). High physical fitness in terms of PF, BP and GH was observed in women with higher FFM and BCM (R = from 0.37 to 0.57, \( p < 0.05 \)). Physiological hydration was observed to be higher in women with lower fat measurements (R = –0.46, \( p < 0.05 \)) with greater FFM and BCM in body composition (R = from 0.41 to 0.47, \( p < 0.05 \)). Physical functioning and PCS were positively correlated with greater organism hydration (R = from 0.41 to 0.51, \( p < 0.05 \)). The subject group of women presented no significant correlation between BC parameters and mental function.

In G1 participation in RT caused statistically significant changes in BC parameters without an influence on body mass and mean BMI values (Table II). After 8 weeks of training there was a significant reduction in BF (\( p = 0.03 \)), and increase in FFM (\( p = 0.02 \)) and TBW (\( p = 0.02 \)), which indicated increased muscle mass. Among the examined anthropometric features, there

| Variables                                    | G1 (n = 13) | G2 (n = 19) |
|----------------------------------------------|-------------|-------------|
|                                             | Baseline    | Eight weeks | Baseline    | Eight weeks |
| Age (years)                                 | 62.7 (6.8)  | 62.4 ±5.2   |             |             |
| Height (cm)                                 | 159.3 (7.4) | 159.4 ±6.9  |             |             |
| Weight (kg)                                 | 69.5 (10.5) | 69.2 (11.6) | 68.5 (10.9) | 68.5 (11.4) |
| Waist (cm)                                  | 88.6 (11.2) | 88.0 (12.1) | 84.4 (9.5)  | 84.4 (9.8)  |
| Hips (cm)                                   | 104.1 (8.1) | 102.3 (8.1)*| 103.7 (7.8) | 102.7 (7.2) |
| BMI (kg/m²)                                 | 27.5 (4.4)  | 27.3 (4.7)  | 27.0 (4.4)  | 27.0 (4.7)  |
| WHR                                         | 0.85 (0.1)  | 0.86 (0.1)  | 0.81 (0.1)  | 0.82 (0.1)  |
| BF (%)                                      | 34.4 (4.6)  | 33.3 (5.0)* | 32.6 (4.5)  | 32.6 (4.4)  |
| FFM (%)                                     | 65.6 (4.6)  | 66.7 (5.0)* | 67.4 (4.5)  | 67.5 (4.4)  |
| TBW (%)                                     | 47.2 (4.8)  | 48.3 (5.2)* | 48.9 (4.6)  | 49.0 (4.5)  |
| BCM (%)                                     | 34.8 (5.9)  | 34.9 (5.7)  | 34.5 (2.5)  | 34.5 (2.5)  |

G1 – exercising group; G2 – non-exercising group; BMI – body mass index; WHR – waist-hip ratio; values are expressed as mean (±SD); * \( p < 0.05 \), Wilcoxon signed-rank test to compare two dependent variables, for comparison between baseline and after eight weeks of resistance training with elements of stretching.
was a reduction only in hip circumference ($p = 0.02$), which did not cause a change in distribution of fatty tissue expressed as WHR ($p$ insignificant). Furthermore, in G1 under the influence of RT, a statistically significant difference was observed in the assessment of quality of life in four of the eight scales (Table IV, Fig. 1). In the dimension of physical health there was a statistically significant improvement in quality of life in the categories RP ($p = 0.03$), BP ($p = 0.02$) and GH ($p = 0.01$), with no significant change in PF. In the dimension of mental health, there was an increase in point scores for VT ($p = 0.05$), but no significant difference was observed in the remaining emotional-social categories constituting this dimension i.e. SF, RE and MH. In the non-exercising group G2 no statistically significant changes were observed in body composition features or subjective assessment of quality of life between the initial and final examinations.

**Discussion**

Resistance training has a positive influence on biochemical and BC features in elderly persons [11, 18] and is recommended for persons in this age group to com-
Among the various forms of physical activity, RT is not widely used as therapeutic intervention in the treatment of menopause [28]. In light of the findings of the present study, RT may be a good strategy in modeling BC with the aim of preventing the occurrence of undesired changes and risk of chronic illness in the 50+ female population.

Conclusions

Eight-week participation in resistance training with elements of stretching leads to remodeling of the body
composition in the direction of reduced risk factors associated with excess body fat. Resistance training raises quality of life in women of advanced age, and above all in the dimension of physical function (SF-36 scales: RP, BP, GH and PCS), but also in the mental dimension (VT scale). Exercise at a gym can be recommended as a form of health training for women over the age of 50, which breaks the stereotype for participant age.

**Study limitations**

The work is limited by a small sample size, and at this stage the effects of the RT will be judged separately in groups of women with normal body weight and with overweight and obesity. However, the preliminary research results showed that even a relatively short period of RT training causes expected changes in body composition and quality of life in postmenopausal women.

**Disclosure**

Authors report no conflict of interest.

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