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LONG-TERM EFFECTS OF REGULAR EXERCISING IN ELDERLY WOMEN

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ABSTRACT

The purpose of the research was to evaluate the long-term effects of regular physical activity for elderly women (over 65 years old) on their functional physical fitness. At the beginning, 32 women (69.68 ± 3.83 years) were included into an exercise (experimental) group and 32 women (70.75 ± 3.67 years) into a control group, who were not included into active exercise. The exercise took place at the Rudolf Maister School Centre in Kamnik and lasted for five years. It was performed intensively twice a week for 60 minutes from October 2006 to June 2007 and once a week for 60 minutes from October 2007 to June 2011. The Fullerton test battery was used to measure motor skills related to strength, power, flexibility, balance, endurance, speed and coordination. The first set of measurements for the members of the exercise group was taken in October 2006, the second after 6 months of exercise in July 2007 and the third in July 2011, including 20 women from the same exercise group who were still actively participating after four years. The measurements for the control group were only performed in October 2006 and July 2011, when 17 women from the same control group had their measurements taken again. The results of the Fullerton test battery showed a significant ($p < 0.05$) improvement in all tests after half a year of adapted exercise; additionally, significant ($p < 0.05$) progress was also noted in most tests following 4.5 years of exercising. Moreover, the exercise group, in comparison with the control group, also performed significantly ($p < 0.001$) better in most of the tests. Exercise can have a significant impact on the improvement of the motor skills of the elderly, which may result in the independent performance of all basic hygiene tasks as well as dressing, household and domestic work, shopping and other tasks related to freedom of movement, expansion of living space and an independent and autonomous life without the assistance of others.

Keywords: *elderly, women, adjusted physical activity, physical abilities, health.*

DOLGOROČNI UČINKI REDNE VADBE PRI STAREJŠIH ŽENSKAH

IZVLEČEK

Namen študije je bil ovrednotiti dolgoročne učinke redne telesne aktivnosti na funkcionalno telesno zmogljivost žensk po 65. letu starosti. V začetku raziskave je bilo 32 žensk (69.68 ± 3.83 let) vključenih v vadbeno (eksperimentalno) skupino in 32 žensk (70.75 ± 3.67 let) v kontrolno skupino, ki v vadbo niso bile vključene. Vadba je potekala pet let v Šolskem centru Rudolfa Maistra Kamnik. Intenzivno se je izvajala od oktobra 2006 do junija 2007, in sicer dvakrat tedensko po 60 minut, nato pa med oktobrom 2007 in junijem 2011 le enkrat tedensko po 60 minut. Za spremljanje gibalnih sposobnosti, vezanih na silovitost, moč, gibljivost, ravnotežje, vzdržljivost, hitrost in koordinacijo, je bila uporabljena Fullertonova baterija testov. Začetne meritve so bile za vadbeno skupino opravljene oktobra 2006, vmesne po polletni vadbi, julija 2007 in končne julija 2011, ko je po štirih letih še vedno aktivno sodelovalo 20 žensk iste vadbene skupine. Meritve za kontrolno skupino smo izvedli le v začetku, oktobra 2006, in na koncu, julija 2011, ko se je ponovnih meritev udeležilo 17 žensk iste kontrolne skupine. Rezultati Fullertonove testne baterije so bili značilno ($p < 0.05$) boljši po končani polletni prilagojeni vadbi pri vseh testih, prav tako pa se je pojavil značilen ($p < 0.05$) napredek pri večini testov tudi po 4,5 letih vadbe. Prav tako je vadbena skupina v primerjavi s kontrolno v večini testov dosegla tudi značilno ($p < 0.001$) boljše rezultate. Ugotavljamo, da lahko z redno vadbo pomembno vplivamo na izboljšanje gibalnih sposobnosti, kar se lahko odraža v samostojnem opravljanju vseh osnovnih higienskih opravil, oblačenju, opravljanju gospodinjskih in hišnih del, nakupovanju in drugih opravil, vezanih na svobodno gibanje, razširitev bivanjskega prostora in neodvisno ter samostojno življenje brez pomoči drugih.

Ključne besede: *starostniki, ženske, prilagojena telesna vadba, gibalne sposobnosti, zdravje*

INTRODUCTION

The world's population is aging. The aging of the European Union population will continue intensively as the number of people older than 65 is likely to have risen to 30 % while the number of people over 80 is likely to reach 12.1 % by 2060 (Vertot, 2008). In Slovenia, an increasing number of elderly people began to emerge when the generations born before and during World War II started to retire. These generations, compared to today's birth rates, are great in number and represent a significant portion of the population due to social, societal, biological and economic factors. It is assumed that in Slovenia in 2020, according to the data acquired in 1999, around 16 % of people will be over 65 years old (Jakoš, 1999) or, according to data collected in 2009, perhaps

even 19 % of the population will be over 65 (Sedej, 2009). It has also been calculated that by the year 2050, 39 % of the population will be over 60 years of age, with 12 % of these expected to be over 80 (Vertot, 2008). In the modern world, the definition of "old age" is also changing. One of the most popular expressions has become the newly coined "active aging", which represents the opposite of "old age" as a dependent and passive period of life. The World Health Organization (WHO) defines active aging as "the process of optimizing opportunities for health, participation and safety in order to improve the quality of life of elderly people". Active aging implies the ability of the elderly to live productive lives in both society and the economy. Active aging, in its broadest sense, can be understood as the continuous engagement of the elderly in social, economic, cultural and civil matters, namely, not only in the form of increased physical activity or brain fitness and extended employment (Kuhar, 2007). It is very important to distinguish healthy aging from the phenomena of diseases and pathological aging. The functional capabilities of a 70-year-old may be influenced by daily exercise in such a way that they do not differ from the functional capabilities of a 45-year-old (Tomek-Roksandić et al., 2003).

In old age, an individual's physical and mental health is of the utmost importance. Chronological age does not explain exactly what happens to a man as he grows older; it only explains that he is growing old, but not how. If we wanted to research the age of an individual, it would be necessary to assess his physiological functions. Erotological physiologists are of the opinion that physiological functions can be assessed by metabolic, structural and functional changes in the organism, preferably by checking homeostatic parameters such as blood pressure, blood sugar, breathing and the adaptation of the organism to stress (Chodzko-Zajko & Moore, 1996). In the old age period, in addition to the weakening of all organ systems, diseases such as type 2 diabetes, osteoporosis, hypertension, arthritis, hearing impairments, etc. (Timiras, 1988) occur more frequently. Infections of the lower respiratory tract, urinary tract, skin and soft tissues are frequent. Sepsis, infections of the abdominal cavity, infective endocarditis, bacterial meningitis, herpes zoster and tuberculosis also tend to break out more frequently (Videčnik Zorman & Maraspin Čarman, 2010). Through the growth of the elderly population, sarcopenia (Sumukadas & Burton, 2010), which plays an important role in the basic functional activities of an individual in his independent life later on in his old age, becomes more and more prominent as it causes a gradual reduction in muscle mass, strength and bodily functions. Due to a generally inactive lifestyle in old age, characterized particularly by too much sitting, diseases of the cardio-vascular system, strokes, colon cancers and breast cancers (Katzmarzyk et al., 2000) also appear more frequently; furthermore, the changes in the cardio-vascular system also affect the brain function. When one's memory starts to collapse, concentration is reduced and we are no longer able to perform certain tasks as effectively as we used to (Pustavrh, 2010). Such bodily changes generally appear as changes in the skin, bones and muscles, in the cardio-vascular system, respiratory system, nervous system and sense-organs as well as in the gastrointestinal tract, genitals, urinary tract and immune and hormonal systems (Rotovnik Kozjek, 2011). It has been proven that the impact of physical activity in old

age (Oražem Grm, 2008) is reflected positively in the cardio-vascular and muscular-skeletal systems as well as in psycho-social components of health. As aging changes one's physical appearance and physical abilities, it is important to establish the appropriate physical activity, for example walking, in order to enhance physical performance in old age. Regular training improves bone density, which consequently reduces the risk of osteoporosis (Strojnik, 2009). There is evidence that moderate physical activity in old age reduces the risk of cardio-vascular diseases, prevents an increase in the content of the C-reactive protein and, thus, atherosclerosis (Sasaki, 2011) while also preventing thrombosis by reducing blood coagulation and the activity of thrombocytes, activating the fibrinolysis system (Wang, 2006). Furthermore, physical activity reduces the concentration of the negative LDL-cholesterol and increases the concentration of the beneficial HDL cholesterol (Hardman, 1999). Physical activity in old age also protects the body against type 2 diabetes by increasing insulin sensitivity and preventing glucose intolerance, which improves the glucose metabolism and reduces the overall body fat content (Ryan, 2000).

Participation in regular physical exercise programs in old age also contributes to a longer life expectancy, improves functional abilities and enables a better well-being (Chodzko-Zajko et al., 2009). Daily activities, such as dressing, bathing, walking, eating, the maintenance of personal hygiene along with instrumental activities such as cooking, shopping, washing, handling money, using the phone, household tasks, cleaning, using a means of transport, taking medication and other activities related to independent life at home are very important for functional qualifications (Finkel, 2003).

Regular exercise is important for maintaining and improving one's level of health, preventing the development of non-infectious diseases in adults and the elderly, treating and rehabilitating numerous acute and chronic diseases, maintaining the ability for independent life in old age and increasing functional abilities or physical fitness (Mišigoj-Duraković et al., 2003). During the period of old age, exercising regularly can even prevent particular mental diseases such as depression, dementia and Alzheimer's disease as well as improving one's mental condition while also affecting their well-being (Fox et al., 2007; Mlinar, 2007). It is an effective method for overcoming stress, as it brings one both enjoyable entertainment and relaxation (Tušak, 2002).

Although aging is an inevitable bio-physiological process, the decline of physiological functions can be slowed down (Berčič, 2002), therefore each individual should, if it is within his power, attempt to slow the aging process as much as possible through daily physical and engaging in sports / recreational activities. When planning exercise programs for the elderly, the ability of an individual, his health status, diseases and physical fitness should be taken into account (Pendl Žalek, 2004). Consideration should be given to the type of activity, intensity, frequency, duration as well as to the gradual approach and regularity of exercise while also including a selection of joyful, simulative and pleasing exercises because only then we can persevere. Therefore, it was the aim of the presented study to assess the impact of longitudinal regular exercise programs on the bodily characteristics and functional physical fitness of elderly women.

METHODS

Subjects

The sample of the 2006/07 subjects included 32 women in the exercise (experimental) group and 32 women in the control group, aged 65 and over, from the cities of Kamnik and Domžale and its surroundings. In 2006, the average age of the exercise group participants was 69.68 ± 3.83 years and the average age of the control group participants was 70.75 ± 3.67 years. In 2011, only 20 (62.5 %) participants of the same exercise group were still included in the exercise group, 74.75 ± 4.17 years old on average; and only 17 (53.1 %) women of the control group, on average 75.12 ± 2.97 years old, had their measurements taken again. The reasons for lower participation in the measurements included the termination of participation in the research due to poor states of health or even deaths of the participants.

Procedures

The exercise program was intended to improve physical abilities of its participants, with the emphasis on strength, flexibility and balance. The training session was adapted to the abilities of participants and divided into the introductory period – learning exercises and intensifying the repetition and strain. We started every training session with warm-up exercises, followed by different exercises for the development and maintenance of physical abilities (with the stress on strength, balance and flexibility of the entire body) as well as exercises for muscle relaxation. Exercises were carried out gradually, comprising a part of the body from head to feet at a time (topological approach). The group performed an adapted exercise program in a small gym and fitness center at the Rudolf Maister School Centre in Kamnik from October 2006 to July 2007 twice a week for 60 minutes and once a week for 60 minutes from October 2007 to July 2011.

Measurements

The measurements of physical parameters, height and weight and motor-functional tests for the exercise group were carried out both before the beginning of the six-month exercise program in October 2006, and at the end of it, in June 2007, as well as after 5 years, in July 2011. The measurements for the control group were performed only at the beginning of the research, in 2006, and at the end of the research, in 2011.

The information about physical and functional abilities of participants was collected by using the Fullerton test battery (Rikli & Jones, 1999), since it includes the tests which determine the abilities that are necessary for independent life: getting up from a chair for 30 seconds (the number of repetitions), weightlifting in sitting position for 30 seconds (the number of repetitions), torso bending forward on the bench (in cen-

timetres), touching hands on the back (in centimetres), stand-up and go (in seconds), 9-minute walking (the number of meters), balance on one leg with eyes open (in seconds) and grip strength (in kilograms).

To perform the measurements, we used the devices intended to test pupils. Grip strength was measured by a dynamometer (Jamar Hydraulic Hand Dynamometer ─ 5030J1, Sammons Preston, Providence, ZDA) from the Department for Physiotherapy at the Health Centre in Kamnik. For weightlifting in sitting position a 2.27 kg handle was used.

Statistics

For statistical analysis the SPSS 16.0 program was used (SPSS Inc., IBM Corporation, Chicago Illinois, USA, 2008). The two-way RM ANOVA was used to assess the differences in physical parameters and motor-functional abilities for the exercise group, at the beginning (October 2006), after 6 months (June 2007) and at the end of the exercise program (July 2011). The Bonferroni correction was used for post hoc analysis. The variance analysis (the F-test) was used to assess the differences of physical parameters and motor-functional abilities among the members of the exercising group and the control group to compare the periods of 2006 and 2011. All statistically significant differences were verified at the p-level < 0.05.

RESULTS

Body weight did not differ significantly ($p > 0.05$) between the exercise and control group and it did not change significantly ($p > 0.05$) with time for the exercise group (Figure 1).

Weight (Figure 1) was on average slightly reduced at the members of the exercising group in the period before and after the exercising in 2006/07; after a four-year period the weight increased, but the differences, before and after the exercising in 2006 /07 as well as in the four-year period up to 2011, were not statistically significant ($p > 0.05$). Even at the members of the control group, in the four-year period, no statistically significant differences in weight were observed, also these differences were not observed between the groups at the initial measurement in 2006 /07 and the measurement in 2011, also no differences were observed in the change between the initial and the final state ($p = 0{,}723$).

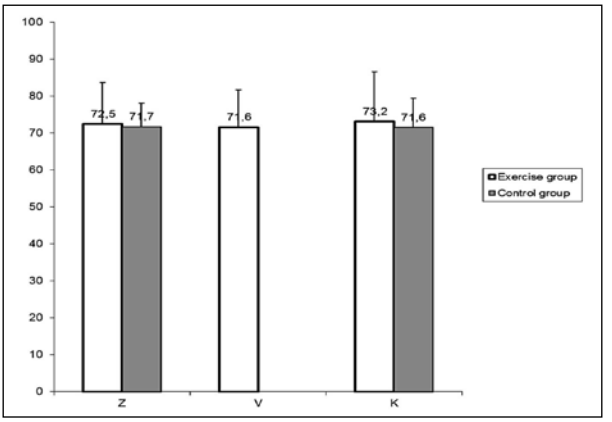

Figure 1: Body weight (kg).

*Legend: Z – initial measurement (October 2006), V – measurement after 6 months of exercise (June 2007), K – final measurement after 4.5 years (July 2011). Statistical significance: * P < 0.05 ** P < 0.01, *** P < 0.001.*

Figures 2 and 3 represent the results of motor-functional tests for assessing the power of the upper and lower muscles for both the members of the exercise group and control group.

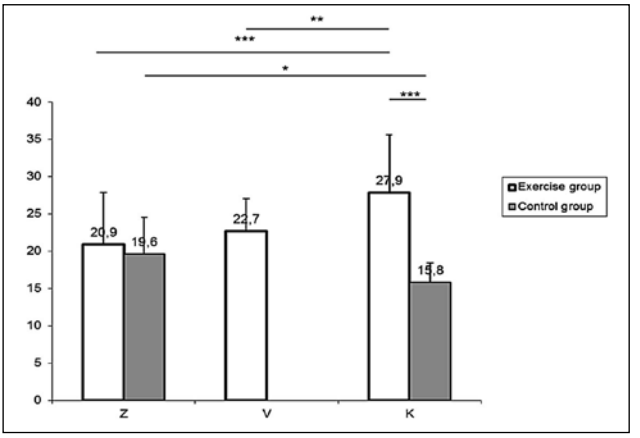

Figure 2: Getting up from the chair for 30 seconds (the number of repetitions).

*Legend: Z – initial measurement (October 2006), V – measurement after 6 months of exercise (June 2007), K – final measurement after 4.5 years (July 2011). Statistical significance: * P < 0.05 ** P < 0.01, *** P < 0.001.*

The test results of getting *up from the chair for 30 seconds* were not statistically significant for the members of the exercise group (Figure 2) neither before nor after the finished exercising in 2006/07, but they were statistically significant when we compared the results of the test before the start of exercise in 2006/07 and after a four-year period in 2011 ($p = 0.000$) as well as after the finished exercise in 2006/07 and four years later ($p = 0.004$). On average, the members of the exercise group reached better results in the test of *getting up from the chair for 30 seconds* when comparing the first measurement in 2006/07 to the final measurement in 2011, as the average number of lifting increased from 20.9 ± 6.9 to 27.9 ± 7.7. Statistically significant differences ($p = 0.013$) also appeared during a four-year period at the members of the control group, namely they reduced the number of lifting on average from 19.6 ± 4.9 to 15.8 ± 2.6. The comparison of the exercise group and control group before the start of exercise in 2006/07 showed no statistically significant differences ($p > 0.05$); statistically significant differences were observed between the groups present in the final measurement in 2011 ($p = 0.000$) since the members of the exercise group achieved in *getting up from the chair for 30 seconds* test an average number of 27.9 ± 7.7 of lifting, the members of the control group only 15.8 ± 2.6. Also, the comparison of both groups showed statistically significant differences in the change between the initial and final state ($p = 0.001$).

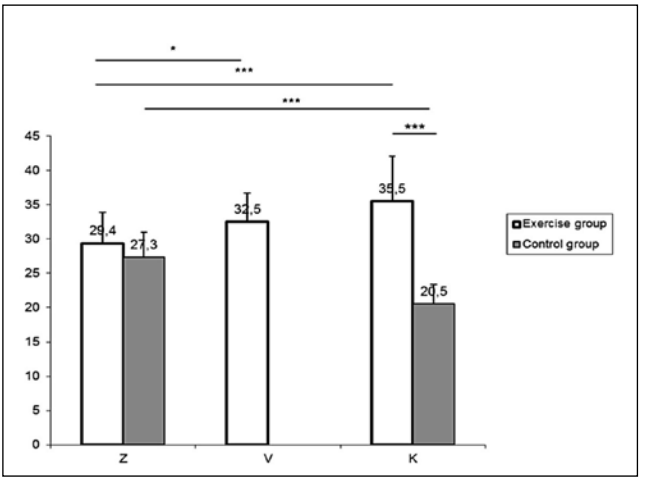

Figure 3: Weightlifting in sitting position for 30 seconds (the number of repetitions).

*Legend: Z – initial measurement (October 2006), V – measurement after 6 months of exercising (June 2007), K – final measurement after 4.5 years (July 2011). Statistical significance: * P < 0.05 ** P < 0.01, *** P < 0.001.*

The comparison of results (Figure 3) of the exercise group members in the *weight-lifting in sitting position for 30 seconds* test before and after the exercise in 2006/07 showed a statistically significant difference (p = 0.025), in favour of the test performed six months after exercise; a statistically significant difference (p = 0.000) was also observed when we compared the results of the tests performed before the start of exercise in 2006/07 and after a four-year period in 2011. Before the start of exercise the exercise group members attained an average result of 29.4 ± 4.5, at the end of exercise in 2006/07 32.5 ± 4.2 and 35.5 ± 6.5 lifts of weight in 30 seconds four years later. Statistically significant differences (p = 0.000) also appeared in the same test with the control group members; the control group members on average reached lower results after four years compared to the first measurement, since the average number of weight lifts in 30 seconds decreased from 27.3 ± 3.7 to 20.5 ± 2.8. The comparison between the exercise group members and the control group before the start of exercise in 2006/07 showed no statistically significant differences (p > 0.05); statistically significant differences (p = 0.000) between the two groups occurred during the final testing in 2011, in favour of the exercise group members and between the two groups, in the change between the initial and final state (p = 0.000).

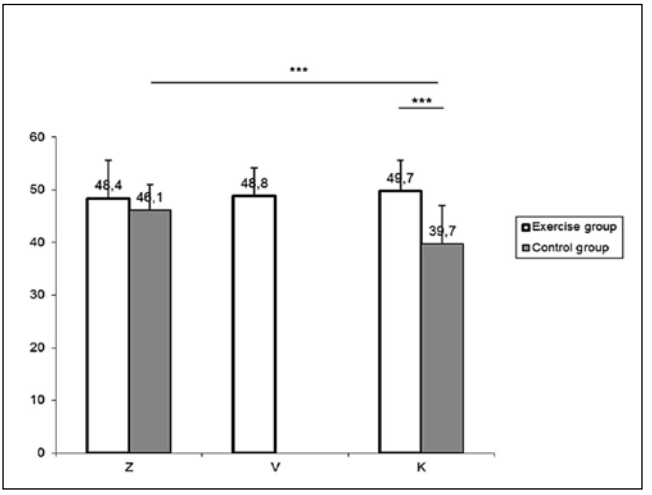

Figure 4: Bending forward on the bench (cm).

*Legend: Z – initial measurement (October 2006), V – measurement after 6 months of exercise (June 2007), K – final measurement after 4.5 years (July 2011). Statistical significance: * P < 0.05 ** P < 0.01, *** P < 0.001.*

The results of the flexibility test *bending forward on the bench* (Figure 4) were not statistically significant for the members of the exercise group, neither in the period before and after exercise in 2006 /07 nor four years later in 2011 ($p > 0.05$). a statistically significant difference ($p = 0.000$) appeared for the control group members, between the first and the final measurement, namely the average test results four years later were lower than the results of the initial measurements. The average measured value of *bending forward on the bench* was 46.1 ± 4.8 in 2006/07 and 39.7 ± 2011 7.3 cm in 2011. Also, the comparison of the exercise group and control group before the start of exercise in 2006/07 showed no statistically significant differences ($p > 0.05$); but statistically significant differences were observed between the groups at the final measurement in 2011 ($p = 0.000$), as the members of the exercise group in *bending forward on the bench* test achieved the average result 49.7 ± 5.8 cm and the members of the control group 39.7 ± 7.3 cm. Also, the comparison between the two groups showed statistically significant differences in change between the initial and final state ($p = 0.003$).

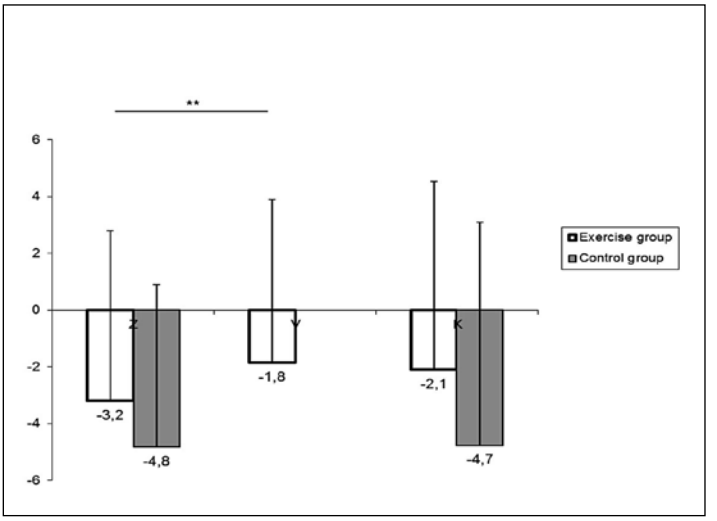

Figure 5: Touching hands on the back (cm).

*Legend: Z – initial measurement (October 2006), V – measurement after 6 months of exercise (June 2007), K – final measurement after 4.5 years (July 2011). Statistical significance: * P < 0.05 ** P < 0.01, *** P < 0.001.*

The results of the *touching hands on the back* test (Figure 5) were statistically significant ($p = 0.001$) for the exercise group members only six months after exercise in 2006/07, as the average distance between the tips of the middle fingers of both hands on the back was reduced from -3.2 ± 5.9 to -1.8 ± 5.7 cm from the time of the first measurement at the beginning to the end of exercise. Statistically significant differences

of *touching hands on the back* test were not noticed (p > 0.05) for the members of the control group after a four-year period; neither were these differences noticed between the groups at the initial measurement in 2006/07 and 2011, nor were the differences in change noticed between the initial and final state (p = 0,267).

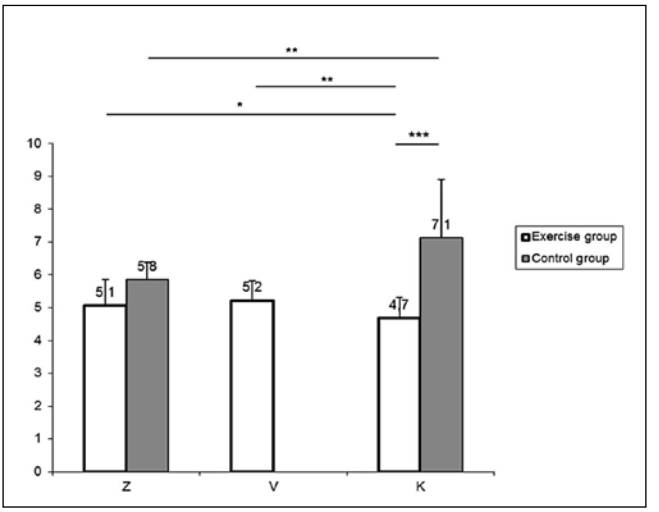

Figure 6: Stand-up and go (s).

*Legend: Z – initial measurement (October 2006), V – measurement after 6 months of exercise (June 2007), K – final measurement after 4.5 years (July 2011). Statistical significance: * P < 0.05 ** P < 0.01, *** P < 0.001.*

The test results of *stand-up and go* test (Figure 6) were not statistically significant for the members of the exercise group before and after exercise in 2006/07, but they were statistically significant when compared to the results before the beginning of exercise in 2006/07 as well as after a four-year period in 2011 (p = 0.012) and after the end of exercise in 2006/07 and after four years (p = 0.004). On average the members of the exercise group achieved better results from the time of the first measurement in 2006 /07 to the final measurement in 2011, as the average time of the finished task was shortened from 5.1 ± 0.8 seconds to 4.7 ± 0.6 seconds. Statistically significant differences (p = 0.007) also appeared at the control group members after a four-year period, namely the average duration of the test was extended from 5.8 ± 0.5 to 7.1 ± 1.8 seconds. The comparison of the two groups showed no statistically significant differences (p > 0.05) before the start of exercise in 2006/07; statistically significant differences were observed between both groups at the final measurement in 2011 (p = 0.000). The exercise group members achieved in *stand-up and go* test the average 4.7 ± 0.6 seconds performing time and the members of the control group 7.1 ± 1.8 seconds. The comparison between both groups showed a statistically significant difference in the change between the initial and final state (p = 0.000).

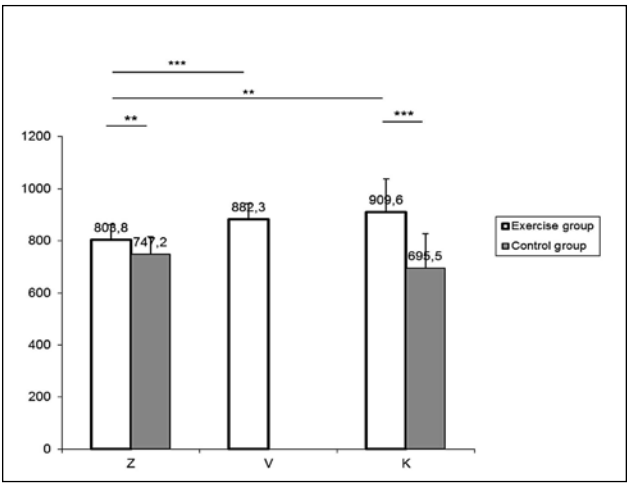

Figure 7: 9-minute walking (m).

*Legend: Z – initial measurement (October 2006), V – measurement after 6 months of exercise (June 2007), K – final measurement after 4.5 years (July 2011). Statistical significance: * P < 0.05 ** P < 0.01, *** P < 0.001.*

The comparison of results of a *9-minute walking* test of the exercise group (Figure 7) before and after the exercising in 2006 /07 showed a statistically significant difference ($p = 0.000$) in favour of the test six months after exercise; a statistically significant difference ($p = 0.001$) was also present when we compared the test results before the start of exercise in 2006/07 and after a four-year period in 2011. The exercise group members were able to walk on average 803.8 ± 56.8 meters in 9 minutes before the start of exercise, and 882.3 ± 60.7 meters at the end of exercise in 2006/07 and 909.6 ± 128.3 meters four years later. For the control group members, the statistically significant differences were not present ($p > 0.05$) in the same test, but they were able to walk on average 747.2 ± 66.9 meters in 9 minutes at the first measurement, and 695.5 ± 131.8 meters four years later. At the first measurement, before the start of exercise in 2006/07 the comparison of the exercise group results and control group showed a statistically significant difference in favour of the exercise group ($p = 0.009$); a statistically significant difference ($p = 0.000$) was also observed between the two groups at the final testing in 2011 and again in favour of the exercise group members. Statistically significant differences ($p = 0.000$) in the change between the initial and final state was shown also by the comparison of both groups.

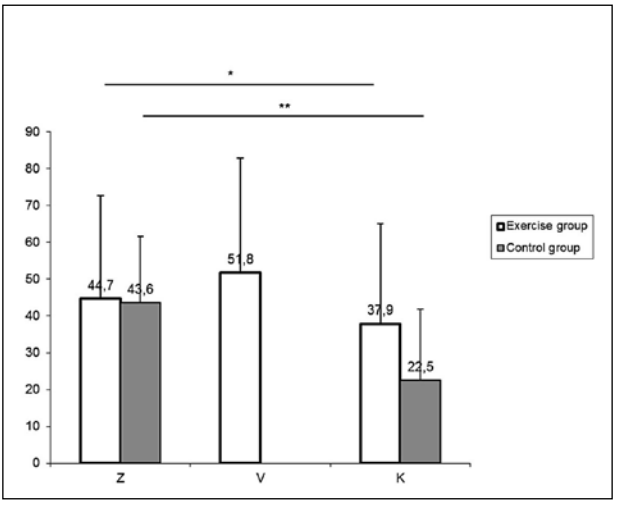

Figure 8: Balance on one leg with eyes open (s).

*Legend: Z – initial measurement (October 2006), V – measurement after 6 months of exercise (June 2007), K – final measurement after 4.5 years (July 2011). Statistical significance: * P < 0.05 ** P < 0.01, *** P < 0.001.*

The test result of *balance on one leg with eyes open* test (Figure 8) were for the members of the exercise group statistically significant compared to the beginning of exercising in 2006/07 and after four years in 2011 ($p = 0.013$), namely after four years the members of the exercise group achieved lower test results, as the average time of *balance on one leg with eyes open* test was shortened for 6.8 ± 0.7 seconds. The same test also showed a statistically significant difference ($p = 0.001$) for the members of the control group, thus, after four years the members of the control group reached significantly lower results compared to the first measurement, since the average time of *balance on one leg with eyes open* test was shortened from 43.6 ± 17.9 to 22.5 ± 19.4 seconds. The comparison of the two groups showed no statistically significant differences ($p > 0.05$) before the start of exercise in 2006/07 and after the exercise in 2011; statistically significant differences were also not present in the change between the initial and final state ($p = 0.121$).

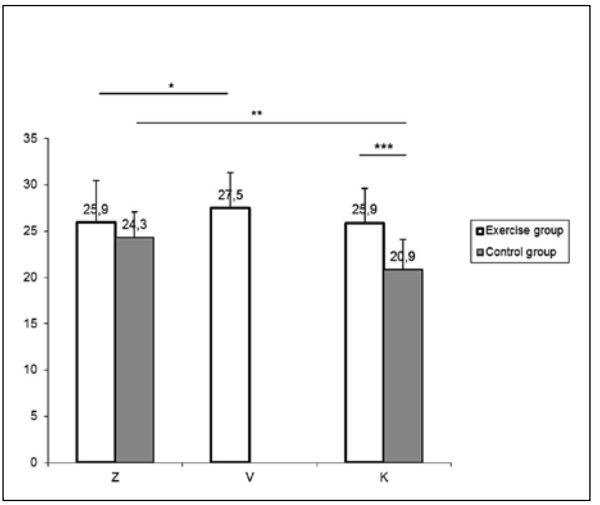

Figure 9: Grip strength (kg).

*Legend: Z – initial åmeasurement (October 2006), V – measurement after 6 months of exercise (June 2007), K – final measurement after 4.5 years (July 2011). Statistical significance: * P < 0.05 ** P < 0.01, *** P < 0.001.*

A statistically significant difference (p = 0.046) was noted with the exercise group members at the *grip strength by a dynamometer* test (Figure 9) regarding the measurements before and after the exercise in 2006/07, as the average power of the grip strength measured by the dynamometer increased from 25.9 ± 4.5 to 27.5 ± 3.8 kg after six months of exercise. The average measured grip strength decreased to 25.9 ± 3.7 kg four years later, but the difference was not statistically significant (p > 0.05). The average measured power of the *grip strength by a dynamometer* test was significantly reduced when observing the control group members, namely from 24.3 ± 2.8 to 20.9 ± 3.2 kg (p = 0.004) in the period from 2006/07 to 2011. The comparison made between the exercise and control group showed no statistically significant difference (p > 0.05) at the first measurement, before the start of exercise in 2006/07; a statistically significant difference (p = 0.000) was present at the final test in 2011 as the measured *grip strength by a dynamometer* test showed 25.9 ± 3.7 kg for the exercise group members and 20.9 ± 3.2 kg for the control group members. The comparison between the two groups also showed statistically significant differences between the initial and final state (p = 0.003).

DISCUSSION

Independent living plays an important role for the elderly, therefore the subjective factors such as age, accessibility and proximity of home, physical exercise and physical fitness, desire for doing certain sport, family situation and financial situation, have greater influence on sports activities than the objective ones. Fox (1992) states that self-confidence plays an important role as an indicator of psychological well-being and engagement in sport. For many people, being active in sport means active spending of free time and socializing, where the criterion is primarily the well-being. The positive correlations between physical activity and longer life expectancy (Seguin et al., 2010) were determined on the sample of older generation women from 23 American States. In the United States and Brazil they tested the 6-minute walk, stand-up and go, touching hands on the back and getting up from a chair on a sample of 1,033 participants by using the Fullerton test batteries, which both outlined the guidelines about normal fluctuations of functional abilities in older women and enabled the planning of better awareness of the positive effects in health policy for the elderly (Krause et al., 2009). In California, a research on the effects of 6-week fitness training on strength and flexibility was made on a small sample of 8 men and 14 women aged from 60 to 79. For each exercise, the participants performed 12 to 15 repetitions using the fitness equipment, preceded by a 20-minute warm-up and stretching exercises. 15 elderly people of the same age participated in the control group. Both groups were tested before and after the exercise by using the Fullerton test battery for measuring functional physical fitness: a 6-minute walk, getting up from a chair for 30 seconds, touching of hands on the back, stand-up and go and grip strength. The control group showed a substantially lower physical fitness; the testing group showed better results in grip strength, shoulder flexibility, the number of repetitions of getting up from a chair, walking speed and stand-up and go (Cavani et al., 2002). A similar research was also conducted in Oregon in cooperation with 22 men and women aged from 78 to 86. After a 10-week training program, which was based on everyday life activities, they also used the functional physical fitness test and they came to similar conclusions (Dobek et al., 2006). In Arizona (Klein et al., 2002) functional physical fitness, strength and flexibility was monitored in men and women from 73 to 94 years of age who were involved in a 5-week exercise program. The progress before and after the exercise was shown in the majority of tests which measure strength and flexibility except at the shoulder girdle; also there were no differences observed in the functional physical fitness tests (stand-up and go and getting up from a chair). The impact of walking on health was monitored in a longitudinal research at the University of California, San Francisco, in which 7,527 older women and men participated, aged 70 and more. The survey showed that 14.5 % of men and 8.9 % of women regularly walk every day, a negligible number of them walk 4 to 6 or 2 to 3 days a week, however, 46.2 % of men and 59.1 % of women never walked. The comparison of health status and walking was interesting, where the correlation between better health and walking appeared (Früs et al., 2003). Very similar results were found when we tested our group, as the members of the exercise group achieved better results

in the flexibility of the shoulder girdle, which was shown in touching hands on the back test; in the strength of the upper extremities, which was shown in weightlifting in sitting position for 30 seconds test and grip strength by the dynamometer test; in the power of the lower extremities, which was shown in the getting up from a chair for 30 seconds test and in general endurance, shown in a 9-minute walking test. We have also noticed that during the second testing after the end of exercise in 2006/07 and 2011 the motor abilities in the members of the exercise group were still improving which was shown by the tests of getting up from a chair for 30 seconds, weightlifting in sitting position for 30 seconds, torso bending forward on the bench, stand-up and go and a 9-minute walking. The decline of motor abilities four years later was observed only in the *balance on one leg with eyes open* test due to the links between the sensory-neuronal system and α-motor neurons, which die with age and weaken the stabilizing of the knee joint (Madhavan et al., 2005 & 2009); it was demonstrated by the comparative research between the young and the elderly over 65. They found out significant differences between the young and the elderly by *standing on one leg with squatting* exercise, at first with eyes open and then with eyes closed. Comparing the sample results of the control group members for the period from 2006/07 to 2011, and four years later we noticed the reduction of all motor abilities, because the measured results were lower in all tests, except at touching hands on the back. The comparison of the test results between the exercise group members and the control group and among the members of the control group in a four-year period additionally confirms the crucial importance of exercise for maintaining the motor abilities, flexibility and balance. It is well known (Pistotnik, 2003) that the movement of people at daily activities, professional work and sport, depends on their capabilities, characteristics and skills. Flexibility is an important factor of optimal physical fitness and well-being and it affects the quality of life of an individual, since the muscle relaxation linked to an adequate level of flexibility is closely associated with reduction of psychological tension and enables undisturbed autonomous and independent performance of daily and instrumental (Finkel, 2003) or functional and fun activities and self-sufficiency (Rogers & Keller, 2009). The mentioned research carried out in Slovenia and abroad shows a significant effect of exercise on the quality of life of the elderly. It can be concluded that the active life enables a better well-being; it has a positive influence on health, on greater autonomy and independence later in life.

CONCLUSION

The results of this research are part of the recognition that with adapted physical exercise, with an emphasis on strength, flexibility and balance, we can significantly influence the improvement in the function of the locomotors system, as well as that of balance and strength in the elderly. The exercise was, for all of the participants, a form of motivation and a challenge to do something for themselves; it allowed them to attend a pleasant gathering, to relax, and to enjoy both the pleasure and satisfaction of

socializing; it enhanced the affiliation to the group and the individual approval "to be important; I have a great time; I make a positive contribution to the common good" and also achieved the participants' regular attendance of the exercise classes, and for the time being, swapped their home environment for a gym or fitness centre. We hope that the results of the adapted physical exercise contributed to the decision-making process of the wider female and male population, aged 65 and over, to include physical activity into their way of their life. Further researches concerning the physical activity of the elderly (over the age of 65) would definitely be interesting as a follow-up on the national level in order to determine the functional capacity of older people, which would allow us to plan the development of programs for active lifestyles in the third period.

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