ASSESSMENT OF MORPHOFUNCTIONAL CHANGES IN ELDERLY WOMEN PERFORMING NORDIC WALKING EXERCISE

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Key words: elderly, women, physical activity, health training, biological condition

Abstract

Aim. The purpose of research was assessment of the influence of increased physical activity on selected elements of biological condition in elderly women.

Basic procedures. The research material comprised measurement data of 80 elderly women that were divided into two groups: active (n=31) which participated in health training, and control (n=49). We measured: basic somatic features, BMI, WHR, BMD and functional physical fitness.

Results. The analysed parameters of bone mineral density were slightly better in the physically active women compared to the inactive ones. During analysis of the physical fitness tests, the active group achieved decidedly higher results, which indicates a positive influence of the Nordic walking health training on functional physical fitness among elderly women.

Conclusions. Utilised health training was an optimal stimulus for the examined women – their functional physical fitness and BMD improved considerably. No similar changes were noted in the control group.

Introduction

Demographic transformations occurring in the last few years around nearly the whole of Europe have significant influence on each aspect of functioning of its societies. Due to these changes, numerous social, economic, political, spiritual, psychological and cultural transformations can be observed in Poland [1,2]. Analysing demographic data available in the literature regarding the increasing number of people above the age of 65 in the majority of countries of the world makes the considerable increase of interest in involutional processes of the human body and in health advertising directed at multiplying health of the last few years understandable [3,4]. Influence of various areas of social and economic life on health depends considerably on civilization and national economy progress, which lead to the improvement of the social status. Knowledge and awareness of citizens regarding factors influencing health and quality of life of the society are of greatest significance among these aspects [5-9].

The number of initiatives supporting self-fulfilment of the elderly, as well as giving them an opportunity to actively participate in social and family life, is steadily in-
Increasing. Among them, the following may be named: the "Healthy Ageing, A challenge for Europe" project of the Swedish National Institute of Public Health [10], containing important information on factors and conditions of healthy ageing; the Polish “Polsenior” project, the purpose of which was to establish a holistic approach towards the ageing processes of an individual and society [2]; and the "Healthy People" programme developed by the American Department of Health and Human Services, directed at needs and skills of individuals in the aspect of their ability to choose and maintain a healthy lifestyle. The last one had two main purposes: to improve quality of life and health, and equalize health disproportions within the society [11].

Researchers note that next to the value of life and dignified ageing, the need to take care of health and maintain a rather high level of biological wellbeing of the elderly surfaces [6,12-14].

Actions advertising health strive to interest individuals in a healthy lifestyle, as well as in gaining benefits and satisfaction from maintaining good health. According to the theory of activity, emotional and physical wellbeing of the elderly is connected to maintaining a high level of physical, mental and social activity. This ensures adapting to the old age and makes it a time for facing new challenges and self-fulfilment [8,15].

In numerous papers, researchers point out the beneficial influence of physical activity on human health. Simultaneously, they note that physical activity should be adjusted to the individual capabilities of every person and that their safety during the activity should be ensured [6,16,17].

Li et al. [18] describe several factors which influence taking up physical activity: environment planning (footpaths and bike lanes, parks), demography (socioeconomic conditions, population density), social engagement (support systems), neighbourhood community (active and engaged in shared recreation), individual psychosocial features (community spirit and motivations), individual characteristics (gender, age, race).

Epidemiological research shows that regular physical activity decreases the total risk of fatality by 25-47%, and risk of fatality due to cardiovascular disease by 30-50% [19].

Campbell and McTiernan [20] prove that regular physical activity significantly reduces the occurrence of cancer of the large intestines, nipples, prostate, lungs and endometrium.

Therefore, the main factor slowing the ageing process is a healthy lifestyle, in particular nutrition and physical activity, which clearly improve biological condition of the adults and the elderly. These factors increase immunity and ensure emotional as well as physical wellbeing, while offering the opportunity to socially interact, reducing loneliness. However, first and foremost, they counteract helplessness and clumsiness of the old age. It should be noted that health is not only an individual value, but also a social one, which allows to fulfill one’s aspirations and provides satisfaction in life [7,13].

Extensive research shows that Nordic Walking is an optimal, year-round physical activity. It is an effective and safe form of health training [21,22]. Using poles equipped with handles and sharp spikes during the march allows to lighten pressure on the joints (via springy rebound from the ground), engage a larger number of muscles, and improves coordination and ensures stability during marching.

The actual socio-economic status (SES) in Poland differs from that in other European countries (cited). The purpose of the research was assessment of the influence of increased physical activity on selected elements of biological condition among elderly women.

**Material and methods**

The research was conducted twice in 2014-2015. The research material comprised measurement data of 80 women between the age of 60 and 75 living in the region of Lower Silesia (mean age 66.09 years).

The examined women were divided into two groups with regard to their level of physical activity: the first group (n=31) participated in health training (hereinafter, called the active group), and the second group (n=49) which did not participate in any regular physical activity (hereinafter, called the control group).

Women from the active group included participants of three-week-long rehabilitation stays at general and neurological rehabilitation clinics in the Jelenia Góra district. In all cases, the reason to attend the clinic was doctor’s recommendation connected to a locomotor system disease.

The women underwent congruent rehabilitation procedures and additionally participated in Nordic Walking training, learning the technique of the activity.

All women underwent five basic rehabilitation procedures, which took place between 8 a.m. and 3 p.m. (whirl massage, interferential therapy, magnotherapy, exercising on rehabilitation devices and gymnastics class).

After the end of the rehabilitation stay, the examined women continued to engage in Nordic Walking health training for another 10 months.

The research is a continuation of the project by the NCN Ministry of Science and Higher Education. The project was approved by the Senate Scientific Research Ethics Committee of Wroclaw University of Physical Education in 2009 [23].

The research was conducted at the Biokinetics Research Laboratory, Biostucture Department, Wroclaw.
The distance walked during one day amounted to about 6,000 – 7,000 m.
Training intensity was at moderate level (55 – 65% of maximum heart rate). The heart rate was monitored using a sport-tester (device registering heart rate).

Each of the participants underwent the research in the afternoon while wearing athletic shoes and appropriate clothing. The examined women were informed of the purpose of research, type and method of examination, as well as participation conditions. They also gave written, voluntary consent for participation.

Using the SECA brand (model 764) multifunctional measuring device, basic somatic features were measured: body height (with accuracy of 0.1 cm), and body mass (with accuracy of 0.1 kg). Using a tape measure (with accuracy of 0.5 cm), the following measurements were taken: waist measurement and hip measurement. On the basis of the measurements, two indicators were calculated: body mass index (BMI) and waist-hip ratio (WHR).

Bone mineral density (BMD) was examined using the EXA-3000 device (which is a peripheral densitometer). BMD examination was conducted in the area of the radial bone of the non-dominant limb. The measurements were taken using peripheral absorptiometry of X-rays of two different energy volumes. The examination concerned the following parameters:
- BMD absolute value [g · cm⁻²]
- BMD value in the form of percentage of peak value, reached at age 30–35 (%), and in the form of standard deviation (s), marked as the T-Score
- BMD value in the form of percentage of value typical for age (%), and in the form of standard deviation (s), marked as the Z-Score

Functional physical fitness was assessed on the basis of the test by Rikli and Jones [8].

Utilised form of health training

The training programme was carried out by physical therapists who were Nordic Walking instructors, and included basic components of health training (frequency, duration, intensity, forms of exercises). The training consisted of Nordic Walking preceded by a warm-up and was finalised with breathing and stretching exercises.

- Training took place twice a week in the afternoon (between 4 p.m. and 7 p.m.) in a mountainous area.
- The duration of each training session was about 80 minutes (accounting fatigue and other symptoms of temporarily worse effort tolerance).
- Training intensity was at moderate level (55 – 65% of maximum heart rate). The heart rate was monitored using a sport-tester (device registering heart rate).
- The distance walked during one day amounted to about 6,000 – 7,000 m.

Statistical analysis was performed on the gathered measurement data. Basic descriptive statistics were calculated, including arithmetic average (X) of the parameter in question and its standard deviation (s). Differences between average values of specific parameters from the first and the second examination were assessed using the Student’s t-test.

Statistical significance assessment of differences between average values of the groups was performed using variation analysis (ANOVA), along with comparisons of detailed NIR (Smallest Significant Differences) tests. Significant differences at the level of p≤0.05 are in bold in the tables.

Statistical analysis of the data was performed using the Statistica 10 software.

Results

Somatic feature analysis

On the basis of values of somatic features, body mass index (BMI) was calculated. The same direction of changes and in each group, a small, proportional decrease of the analysed parameters (which caused the weight to height ratio to remain at a similar level) were noted. Weight to height ratio result range classifies the examined women as belonging to the overweight category (Tab. 1, 2).

Maintaining good biological condition depends not only on the amount of adipose tissue, but also on its distribution. WHR informs of adipose tissue distribution and determines figure and obesity type: apple shape (android obesity), or pear shape (gynecoid obesity). Android obesity increases the risk of cardiovascular diseases.

Among the two analysed indicators (BMI and WHR), it was the adipose tissue distribution (WHR) indicator that underwent significant changes in the active group (Tab. 1, 2).

The change regarded the results of of waist measurement which decreased by 4.3 cm on average, while hip measurement remained basically unchanged. The result indicates changes in adipose tissue distribution type of the active women from android to gynecoid.

In the control group, values regarding the range of waist and hip measurements decreased, and the change was statistically significant. Despite the decrease, the control group remained on the border between android and gynecoid types.

Bone mineral density

No differences in the level of bone mineral density were noted between the physically active and inactive groups. In the first examination, BMD value was 0.34 g · cm⁻² in the active group and 0.32 g · cm⁻² in the control group, while in the second examination, it was 0.32 g · cm⁻² and 0.31 g · cm⁻², respectively (Tab. 3, 4).
Table 1. Statistical characteristics and significance assessment of differences in average somatic features of the examined groups (p<0.05)

<table>
<thead>
<tr>
<th>Feature</th>
<th>Examination I</th>
<th>Examination II</th>
<th>Student’s t-test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>x</td>
<td>s</td>
<td>x</td>
</tr>
<tr>
<td>BMI</td>
<td>28.91</td>
<td>5.09</td>
<td>28.67</td>
</tr>
<tr>
<td>Waist measurement [cm]</td>
<td>90.58</td>
<td>13.81</td>
<td>86.32</td>
</tr>
<tr>
<td>Hips measurement [cm]</td>
<td>104.90</td>
<td>9.53</td>
<td>103.99</td>
</tr>
<tr>
<td>WHR</td>
<td>0.86</td>
<td>0.08</td>
<td>0.83</td>
</tr>
</tbody>
</table>

| Control group          |               |               |              |              |       |      |
| BMI                    | 27.14        | 4.18         | 26.87       | 4.04         | 1.72  | 0.0923 |
| Waist measurement [cm] | 87.04        | 11.05        | 85.29       | 11.33        | 2.09  | 0.0423 |
| Hip measurement [cm]   | 101.64       | 8.21         | 100.45      | 8.09         | 2.44  | 0.0183 |
| WHR                    | 0.86         | 0.08         | 0.85        | 0.08         | 1.23  | 0.2242 |

Table 2. Analysis of variance of somatic features among active (Nordic Walking) and inactive women (control group) in examinations I and II (significance level of p<0.05)

<table>
<thead>
<tr>
<th>Features</th>
<th>Examination I and II</th>
<th>Examination I and II</th>
<th>Active – control</th>
<th>Active – control</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI</td>
<td>0.1832</td>
<td>0.0596</td>
<td>0.0939</td>
<td>0.0883</td>
</tr>
<tr>
<td>Waist measurement [cm]</td>
<td>0.0001</td>
<td>0.0377</td>
<td>0.2094</td>
<td>0.7128</td>
</tr>
<tr>
<td>Hip measurement [cm]</td>
<td>0.2335</td>
<td>0.0527</td>
<td>0.1044</td>
<td>0.0784</td>
</tr>
<tr>
<td>WHR</td>
<td>0.0002</td>
<td>0.2652</td>
<td>0.7915</td>
<td>0.2422</td>
</tr>
</tbody>
</table>

Table 3. Statistical characteristics and significance assessment of differences between average bone mineral density (BMD) values among examined women

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Examination I</th>
<th>Examination II</th>
<th>Student’s t-test</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMD [g · cm⁻²]</td>
<td>0.34</td>
<td>0.09</td>
<td>0.32</td>
</tr>
<tr>
<td>T-score [g · cm⁻²]</td>
<td>-2.51</td>
<td>1.45</td>
<td>-2.75</td>
</tr>
<tr>
<td>T-ratio [%]</td>
<td>69.17</td>
<td>17.76</td>
<td>66.22</td>
</tr>
<tr>
<td>Z-score [g · cm⁻²]</td>
<td>-0.72</td>
<td>1.38</td>
<td>-0.84</td>
</tr>
<tr>
<td>Z-ratio [%]</td>
<td>89.13</td>
<td>22.75</td>
<td>85.60</td>
</tr>
</tbody>
</table>

| Control group     |               |               |              |              |       |      |
| BMD [g · cm⁻²]   | 0.32          | 0.09          | 0.31          | 0.09          | 1.73  | 0.0902 |
| T-score [g · cm⁻²] | -2.79        | 1.50          | -2.96         | 1.53          | 1.91  | 0.0616 |
| T-ratio [%]       | 65.76         | 18.47          | 63.93         | 18.71          | 1.69  | 0.0973 |
| Z-score [g · cm⁻²] | -0.86        | 1.35          | -0.98         | 1.36          | 1.50  | 0.1404 |
| Z-ratio [%]       | 84.85         | 23.65          | 82.77         | 24.18          | 1.60  | 0.1158 |

In the physically active group, the absolute value of bone mineral density in the second examination (after 10 months of health training) significantly decreased. Nonetheless, the analysed parameters of bone mineral density were slightly better among the physically active women in comparison to the inactive females (Tab. 3, 4)

The percentage of women at risk of osteoporosis was also calculated. In the first examination, 22.58%
of women from the active group were within the norm, 25.81% of them were in the osteopenia group, and 51.61% were in the osteoporosis group. In the second examination, 10% of participants who were within the norm during the first examination were classified into the group at risk and were transferred to the osteopenia group, while the osteoporosis group only increased by 3%.

During the first examination, 16.33% of women in the control group were within the norm, 28.57% of them were in the osteopenia group, and 55.10% were in the osteoporosis group. During the second examination, the number of participants within the norm decreased. The number of women from the osteopenia group decreased by 4.08%, while the osteoporosis group increased by 8.17%.

There was a downward trend among both women from the active and control group, showing a decrease of bone mineral density with age, however, the process progressed quicker in the control group.

Therefore, the change is more beneficial in the examined group than the control group.

It is noteworthy that despite the passage of time and influence of unstoppable, involutional changes, the utilised health training limits the progression of bone mass loss, keeping women in the osteopenia group.

### Assessment of functional physical fitness level

During analysis of the physical fitness tests, a disproportion of physical fitness between women from the training group and the inactive women was noted (Tab. 5, 6).

**Table 4. Variation analysis of bone mineral density (BMD) parameters in examinations I and II of active women (Nordic Walking) and inactive women (control group)**

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Examination I and II</th>
<th>Examination I and II</th>
<th>Active – control</th>
<th>Active – control</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NIR test. Probability for post-hoc tests. Repeated measurements. Significance level p≤0.05.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Active</td>
<td>Control</td>
<td>Examination I</td>
<td>Examination II</td>
</tr>
<tr>
<td>BMD [g · cm⁻²]</td>
<td>0.0400</td>
<td>0.0913</td>
<td>0.4039</td>
<td>0.5530</td>
</tr>
<tr>
<td>T-score [g · cm⁻²]</td>
<td>0.0588</td>
<td>0.0658</td>
<td>0.4245</td>
<td>0.5512</td>
</tr>
<tr>
<td>T-ratio [%]</td>
<td>0.0583</td>
<td>0.1021</td>
<td>0.4199</td>
<td>0.5857</td>
</tr>
<tr>
<td>Z-score [g · cm⁻²]</td>
<td>0.2514</td>
<td>0.1479</td>
<td>0.6479</td>
<td>0.6462</td>
</tr>
<tr>
<td>Z-ratio [%]</td>
<td>0.0617</td>
<td>0.1296</td>
<td>0.4305</td>
<td>0.6023</td>
</tr>
</tbody>
</table>

**Table 5. Statistical characteristics and significance assessment of differences between average functional physical fitness levels of the examined groups**

<table>
<thead>
<tr>
<th>Test</th>
<th>Examination I</th>
<th>Active group</th>
<th>Examination II</th>
<th>Student’s t-test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>x</td>
<td>S</td>
<td>x</td>
<td>S</td>
</tr>
<tr>
<td>30 – second Chair Stand Test [s]</td>
<td>19.48</td>
<td>4.45</td>
<td>23.77</td>
<td>5.40</td>
</tr>
<tr>
<td>30 – second Arm Curl Test [s]</td>
<td>22.77</td>
<td>5.21</td>
<td>25.32</td>
<td>4.63</td>
</tr>
<tr>
<td>6-Minute Walk Test [m]</td>
<td>626.87</td>
<td>82.25</td>
<td>712.66</td>
<td>111.81</td>
</tr>
<tr>
<td>Chair Sit – and – Reach Test [cm]</td>
<td>8.58</td>
<td>6.17</td>
<td>11.35</td>
<td>6.77</td>
</tr>
<tr>
<td>Back Scratch Test [cm]</td>
<td>2.26</td>
<td>6.79</td>
<td>5.05</td>
<td>7.16</td>
</tr>
<tr>
<td>8 – Foot Up - and – Go Test [s]</td>
<td>5.48</td>
<td>0.76</td>
<td>4.75</td>
<td>0.94</td>
</tr>
</tbody>
</table>

**Control group**

| 30 – second Chair stand Test [n]    | 16.80        | 3.76         | 16.88          | 3.89           | -0.19     | 0.8514  |
| 30 – second Arm Curl Test [n]      | 20.29        | 4.65         | 21.06          | 4.50           | -1.10     | 0.2787  |
| 6-Minute Walk Test [m]             | 550.13       | 65.43        | 538.02         | 83.25          | 1.33      | 0.1894  |
| Chair Sit – and – Reach Test [cm]  | 8.10         | 8.68         | 6.55           | 7.56           | 1.53      | 0.1329  |
| Back Scratch Test [cm]             | -0.87        | 6.55         | -1.46          | 6.87           | 1.62      | 0.1126  |
| 8 – Foot Up - and – Go Test [s]    | 5.83         | 1.09         | 5.82           | 1.23           | 0.02      | 0.9856  |
In the first examination, the women did not differ significantly only in terms of oxidative capacity and flexibility of the upper part of the body.

Group comparison results of the second examination showed statistically significant differences in all fitness tests. The health training group achieved decidedly higher results, which indicates the positive influence of Nordic Walking health training on the functional physical fitness of elderly women (Tab. 5, 6).

Analysis of the changes occurring in the active group between the first and the second examination shows unidirectional functional and structural changes, proceeding in accordance with the utilised health training. Result ranges of upper and lower halves of body muscle strength were significantly higher (Tab. 5, 6).

During the 6-Minute Walk Test, the Nordic Walking group increased the average walked distance by 86 m. The average time of the 8 – Foot Up and Go Test was shortened by 0.7 s, which results in significantly better results of agility and dynamic balance assessment. Very good results of the test are connected to significantly reduced risk of falls, and therefore, increased safety and independence of the examined women (Tab. 5, 6).

Average values of the remaining tests (forward bend and reaching behind back) allowing to assess flexibility of the upper and lower halves of the body also increased considerably.

Functional physical fitness in the control group during examinations I and II remained at a similar level or slightly decreased, the differences not being statistically significant (Tab. 5, 6).

Discussion

Demographic changes connected to the growing number of the elderly in society present a challenge for many areas of science, social policy and health protection. They result in a need to change retirement and social systems, as well as a necessity to improve the living standards of seniors. As a result of social structure changes, expenditures on social welfare, health care and realisation of physical and social activation of the elderly programmes increase [1,2].

Numerous research centres proposed changes regarding: development of social infrastructure directed at activation of the elderly and providing them with aid (e.g. day-support and round-the-clock support centres, seniors clubs, Third Age Universities). Non-governmental organisations devoted to helping the elderly, intergenerational integration and community welfare are continuously supported. Additionally, numerous programmes for the elderly were developed and implemented [11-13].

The health of each and every individual is considerably conditioned by his/her economic standard of living and lifestyle. Personal choices influence physical, social activity and rest activity levels, as well as nutrition, hygiene, attending prophylactic exams and using stimulants [1,4]. Frequent engagement in physical activity is a sign of care for one’s own health and striving for self-sufficiency in everyday life.

Numerous authors note the dangers of nutritional habits of the elderly, leading both to malnutrition as well as overweightness or obesity. Recently, it has become a problem of the society as a whole. Unhealthy eating habits, sedentary lifestyle, stress and limited physical activity lead to an upward trend of civilisation diseases, including obesity [24].

In the authors’ study, the women from both groups were obese, and the observations were the same as conclusions formulated by other authors [5,25]. The result is beneficial in regards to the skeletal system of elderly women. According to Skrzek et al. [26], a slightly higher BMI value (ca. 27.0 kg/m²) in this age group has protective influence on bone tissue. Optimal body mass...
is beneficial for slowing the process of osteopenia and allows safer engagement in physical activity, simultaneously supporting the treatment of metabolic diseases.

Adipose tissue distribution is significant for health as well. In the authors’ own research, WHR values similar to those given by other authors were noted [27]. However, a decrease in WHR value among the active group was noted after the period of the Nordic Walking health training. The examined women belonged to the group with gynecoid adipose tissue distribution, thus, decreasing the risk of cardiovascular diseases.

Over the course of life, the level of fitness and self-sufficiency unavoidably decreases. During the ageing period of the body, many degenerative changes occur within the locomotor organs. Most frequently, they include soft tissue deformation and significant changes within bone tissue. Primarily, these changes consist of osteoporosis, periosteal reactions, calcification and osteosclerosis. Depending on the cause of the disease, there are few forms of osteoporosis. Most frequently, it is connected with hormonal changes at the advanced age (andropause, menopause). Advanced osteoporosis changes may endanger human health or even life. BMD examination enables quantity assessment of calcification and thus, indirectly, of bone mass [28].

Quickly progressing degenerative changes in the locomotor system typical for advanced age cause strong pain, thus, limiting fitness and presenting a risk of falls and fractures, which may lead to disability [29]. Early diagnosis of osteoporosis and its proper treatment, implementing a diet rich in mineral salts and vitamin D3, as well as adjusted physical activity ensures slowing disease progression, which facilitates functioning in the everyday life [7,15,30].

Kubica [31] attempted to assess the relationship between fall risk and physical fitness among the elderly. The results of her research showed significant connection between the two, and thus, proved the necessity of implementing fall prevention via proper physical activity programmes for the elderly.

In the authors’ own research, during the first examination, ¼ of women were in the osteopenia group, and about ½ of them in the osteoporosis group. In the second examination, 10% of women from the control group, who were within the norm during the first examination, were classified into the risk group and entered the osteopenia group. The group with osteoporosis increased only by 3% of the active women and as much as 8.17% of inactive women. Despite the fact that osteoporosis-related change progression was not stopped, results achieved by the active group indicate positive influence of the utilised health training on an elderly organism, which suggests a need for further research on the course of bone turnover under influence of increased physical activity.

Physical activity is considered to be a basic factor decisive in health, which is why it significantly influences the general biological condition of the elderly [9].

In the authors’ own research, fitness level of the active women was significantly higher after the end of the experiment than that of women from the control group. The examined group possessed more muscle strength of the upper and the lower halves of the body, as well as larger movement range of joints, assessed through testing flexibility of the upper and lower halves of the body. The examined group also achieved very good results for crucial movement safety concerning the 8 – Foot Up and Go Test, allowing to assess dynamic balance and fall probability. The optimal level of oxidative capacity was also noted in this group.

In the opinion of many authors, regular physical activity provides numerous benefits for the locomotor system – and not only among the elderly. Researchers note the preventive aspect of increased physical activity regarding balance disorders and falls [3,9,15].

The recently popular form of activity that is Nordic Walking is beneficial for the cardiorespiratory system and allows to maintain high intensity of an effort with a low level of experienced fatigue. Nordic Walking improves muscle strength and increases movement range of all joints, while ensuring safety from falls. It also improves effort tolerance level. Simultaneously utilising the health training form – Nordic Walking – significantly increases the level of lower and upper limb joint mobility of the elderly, as proven by researchers [32,33].

A review of literature shows that Nordic Walking health training is a dynamically developing form of physical activity that combines preventive and therapeutic means. Nordic Walking is a contemporary, effective form of preventive care and rehabilitation for the elderly, which is why it should be added to medical treatment standards [22,34].

Numerous researchers also note that regular, properly selected physical activity increases stress resilience and supports treatment of various diseases by stimulating the body’s defense mechanisms [7].

**Conclusion**

1. The utilised health training was an optimal stimulus for the examined women – their functional physical fitness level improved considerably. No similar changes in physical fitness level were noted among the control group. It should be expected, then, that active individuals are more self-sufficient in everyday life and social interactions.

2. Somatic parameters of the examined women which benefited from the utilised health training included: body mass, waist measurement, hip measurement and WHR value.
3. In both of the examined groups, a similar direction of changes in bone mineral density was noted. In the physically active group, it was on the border between osteopenia and osteoporosis, which indicates slower rate of involutional processes as a result of utilising the proposed health training. Meanwhile, in the control group, osteoporosis is clearly present, showing faster ageing rate of the passive locomotor system.

Declaration of interest statement: The authors declare no existing conflicts of interest.

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