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Characteristics of the Parameters of Somatic Construction and Fitness Level in Elderly People Based on Selected Fullerton Test Samples

Charakterystyka parametrów budowy somatycznej i poziomu sprawności fizycznej seniorów w oparciu o wybrane próby testu Fullertona

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Abstract

Introduction. Aging should be understood, however, as a progressive deterioration of the function of organs and systems caused by the passage of time, which leads to a reduction of adaptability in stressful situations. The moment when deterioration of organ function starts, is individually variable, just as the pace of its progress. Linking physical fitness with health is known as the H-R-F (Health-Related Fitness) concept. It corresponds to those components of fitness, which result from both the beneficial and adverse effects of regular physical activity, and which are related to the level of health condition.
Aim. The purpose of this study is to present the results of research on basic somatic construction parameters and of selected physical fitness tests of the students of Kujawsko-Dobrzyński Third Age University of the University of Humanities and Economics in Wloclawek, aged over 60.
Material and Methods. The research material consists of the data obtained from somatic measurements and fitness tests conducted among students of Kujawsko-Dobrzyński University of the Third Age at the University of Humanities and Economics in Wloclawek. Cross-sectional research was carried out under UHE team grant in November 2014 among 30 women. The age of the female students ranged from 60 to 75 years with the average age of 65 years. The group of women included in the tests were attending classes at the University of the Third Age at the University of Humanities and Economics, undertaking activities related to physical activity of elderly people in the area of a physical recreation (15 women) and the 'solo' dance (15 women). The classes of widely understood physical activity were supplemented by lectures and seminars in the field of philosophy, pedagogy, gerontology and life sciences.
Results. The study showed that the average age of the students was 65 years, the average value of the body weight was below 70.9 kg, and the average body height was 159.7 cm. Body mass index in more than 63% of women can be classified into the category of overweight and only in the case of 17% of the respondents the index can be regarded as standard. The analysis of physical fitness indicates that the average value of the strength of the upper limbs in an attempt to bend the forearm exceeds 22 repetitions, and the mean strength of the lower limbs in an attempt to stand up from a chair is 19.13 repetitions.
Conclusions. 1. The age of the study groups is different (a statistically significant difference) whereas the BMI index is the same. 2. In both fitness tests better results (statistically significant) were obtained by female listeners participating in fitness classes, which may result from the increased physical activity of higher intensity and frequency.
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Key Words: activity, successful aging, Fullerton test

Streszczenie

Wstęp. Starzenie się rozumieć należy jednak jako stopniowe pogorszenie funkcji narządów i układów wywołane upływem czasu, co prowadzi do zmniejszenia możliwości adaptacyjnych w sytuacjach stresowych. Moment, w którym rozpoczyna się pogorszenie funkcji narządów, jest indywidualnie zmienny, podobnie jak tempo ich przebiegu. Powiązanie sprawności fizycznej ze zdrowiem to tak zwana koncepcja H-RF (Health-Related Fitness). Odnosi się

ona do tych komponentów sprawności, które są efektem korzystnego i niekorzystnego wpływu zwykłej aktywności fizycznej, oraz które mają związek z poziomem stanu zdrowia.

Cel. Celem niniejszego doniesienia jest przedstawienie wyników badań podstawowych parametrów budowy somatycznej oraz wybranych prób sprawności fizycznej słuchaczek Kujawsko-Dobrzyńskiego Uniwersytetu Trzeciego Wieku Wyższej Szkoły Humanistyczno-Ekonomicznej we Włocławku po 60. roku życia.

Materiał i metody. Materiał badawczy stanowią dane uzyskane z pomiarów somatycznych i prób sprawnościowych przeprowadzonych wśród słuchaczek Kujawsko-Dobrzyńskiego Uniwersytetu Trzeciego wieku przy Wyższej Szkole Humanistyczno-Ekonomicznej we Włocławku. Badania o charakterze przekrojowym przeprowadzono w ramach grantu zespołowego WSHE w listopadzie 2014 r. wśród 30 kobiet. Wiek słuchaczek mieścił się w przedziale od 60 do 75 lat przy średniej wieku 65 lat. Poddana badaniom grupa kobiet uczęszczała na zajęcia Uniwersytetu Trzeciego Wieku przy Wyższej Szkole Humanistyczno-Ekonomicznej, podejmujące działania związane z aktywnością fizyczną seniorów w sferze rekreacji ruchowej o charakterze fitness (15 kobiet) oraz taniec „solo" (15 kobiet). Dopełnieniem zajęć z szeroko pojętej aktywności fizycznej są wykłady i seminaria z zakresu filozofii, pedagogiki, gerontologii oraz nauk przyrodniczych.

Wyniki. Badania wykazały, że średnia wieku badanych słuchaczek to 65 lat, średnia wartość masy ciała wynosi 70,9 kg, a średnia wysokość ciała 159,7 cm. Wskaźnik masy ciała u ponad 63% badanych kobiet mieści się w kategorii nadwagi, a tylko u 17% badanych wskaźnik ten wskazuje na normę. Analiza sprawności fizycznej wskazuje, że średnia wartość siły kończyn górnych w próbie zginania przedramienia wynosi ponad 22 powtórzenia, a średnia wartość siły kończyn dolnych w próbie wstawania z krzesła wynosi 19,13 powtórzeń.

Wnioski. 1. Badane grupy różnią się wiekiem (różnica istotna statystycznie) a nie różnią wskaźnikiem BMI. 2. W obu próbach motorycznych lepsze rezultaty (istotne statystycznie) uzyskały słuchaczki biorące udział w zajęciach fitness, co może wynikać ze zwiększonej aktywności fizycznej o większym natężeniu i intensywności. **(PNN 2015; 4(2):48–55)**

Słowa kluczowe: aktywność, pomyślne starzenie, test Fullertona

Introduction

For years, physical activity has been considered to be an essential element of a healthy lifestyle, a way to feel good and enjoy life, a chance for correct development in the period of childhood and the extension of active independent life at old age [1,2].

Old age is a specific period, the last of the seven stages of human life, often triggering fear of the inevitable and unknown. This period takes place in a differentiated manner, it is entirely personalized in relation to individual. It is also one of the concepts that have not been clearly defined both by the social and biological sciences [3].

There are different divisions of the aging periods, but the aging process is closely linked to calendar age. Taking into consideration the number of years lived, the stages of aging, according to Spirduso, can be divided into the following periods [4]:

— 'young–old' — 65–74 years,
— 'old' — 75–84 years,
— 'old–old' — 85–99 years,
— 'oldest–old' >100 years.

Aging should also be understood as a gradual deterioration of function of organs and systems caused by the passage of time, which leads to a reduction of adaptability in stressful situations. The moment at which the deterioration of organ functioning starts, is individually variable, just as the pace of its progress. This process, however is said to begin between the age of 30 and 40. It progresses very slowly, but still at the annual rate of approximately 0.75-1%, and one of the primary determinants of the rate of this growth is the physical activity [5].

According to Iwona Kiełbasiewicz-Drozdowska [6] 'physical activity is essential for man at every stage of one's life and in every age group. The significance of mobility changes and evolves with man's age, but always remains one of the main factors determining the 'health field', because the functional efficiency (functional) assumes the independence of the elderly from other people in their efforts to meet the basic needs regarding mobility, eating, controlling physiological activities, hygiene [7].

The experiences and experiments have proved that people who exercise may increase their physiological capacity, improve heart rate, increase the flexibility of vessel walls, improve the efficiency of senses (including visual and kinesthetic sense), improve blood supply to the brain etc. [8].

Physical activity undertaken in an appropriately determined and targeted manner (type, intensity, duration) reduces morbidity and contributes to the reduction of the rate of mortality resulting from cardiovascular diseases as well as to mortality in general. Meta-analyses carried out on the basis of good epidemiological studies published in the world have shown that regular physical activity reduces by 30% the risk of death due to any reason and approximately by 30–50% the risk of dying from cardiovascular system disease [9].

Until recently, there was no measurement tool enabling in a safe and comprehensive manner to assess the

physical fitness of elderly people. The available tools applied widely in physiotherapy (Katz, Lawton, Barthel and Tinetti scales) are useful mainly in the assessment of the ability to perform simple activities of daily living for the purpose of nursing care and not for improvement. In recent years, there has been published the Physical Fitness Test developed by Roberta Rikli and Jessie Jones at Lifespan Welles Clinic at California State University in Fullerton, known as the Fullerton Fitness Test or the Senior Fitness Test. With the use of 6 tests it allows to assess such parameters as: strength, flexibility, coordination, or endurance.

Nowadays, the progressive process of demographic aging of the society, results in the need to pay attention to the problems and needs of the elderly. The effect of that is the creation of Universities of the Third Age. These universities are meant to include older people in the education system, allow the elderly to update and expand their knowledge, as well as enable active participation in all processes occurring around them in order to preserve and increase their intellectual, mental as well as physical efficiency.

The purpose of this report is to present the results of basic research parameters of somatic structure as well as selected physical fitness tests of female students aged over 60, at Kujawsko-Dobrzyński University of the Third Age at the University of Humanities and Economics in Wloclawek.

Material and Methods

The material in question consists of the data obtained from somatic measurements and fitness tests carried out among students of Kujawsko-Dobrzyński University of the Third Age at the University of Humanities and Economics in Wloclawek.

A cross-section type of research was carried out under a UHE team grant in November 2014 including 30 women aged from 60 to 75 years with the average age of 65 years. The female students were divided into three age groups and two research groups of different forms of activity. Due to the age, the respondents were divided into three groups in the range: 60–64 years, 65–69 years, and 70 or more, and into two groups of 15 people according to the form of activity.

The first group of respondents took actions associated with the physical activity of the elderly in the area of recreation related to fitness. Members of this group were participating twice a week in circles of interest for over a year in regular aerobics classes. The second group of respondents (control group) commenced recreational classes of 'solo' dance type in October.

A wide range of physical activity classes are supplemented with lectures and seminars in the field of philosophy, pedagogy, gerontology as well as life sciences.

All tests were carried out at the gym in the mornings, maintaining the same order. Also, appropriate equipment necessary for the proper performance of individual tests was selected. Measurements of basic somatic features were made compliant with the Martin's technique [10,11].
— body height (B – v) — measured with antropometer with the accuracy of reading up to 0.1cm,
— body weight — measured on the medical weight scale with the accuracy of reading up to 0.1 kg.
On the basis of the performed measurements of individual somatic features, weight-height ratios were calculated [12]. Body Mass Index:

$$BMI \text{ (Queteleta II)} = \frac{body\ weight\ [kg]}{body\ height^2\ [m]}$$

In order to evaluate the physical fitness, two out of six specialist tests for the elderly were used — Fullerton Functional Fitness Test [13]. These tests were assumed to assess those physiological properties that are primarily supportive and are necessary to maintain independence and safe daily activity (strength, dynamic balance). The BMI (Body Mass Index) index, which determines the correct weight should also be taken into account here, because its value indicates a relationship with the danger of the emergence of diseases and dysfunctions [14].

All attempts of the test were based on the latest designs and verified in respect for their validity and reliability.

Statistical Methods of Data Processing

This study used a statistical analysis of test results. Elements of descriptive statistics were used in the analysis. Arithmetic mean (x), standard deviation (SD) were calculated. The correlation between two variables was calculated by means of Spearman's rank correlation coefficient. All calculations and drawings were prepared with Microsoft Excel and Statistica 10.0 spread shit.

Results

Analysis of somatic properties

It arises from the collected material that the average age of the women included in the test is over 65 years with a standard deviation of 6% from the mean value, which indicates a slight differentiation of age. In the fitness group the average value of age is 63 years, whereas in the control group it is slightly over 67 years, which

indicates a statistically significant age difference (p<0.05). The largest group of all respondents consisted of women aged 65–69 years — 15 people, representing 50% of the respondents, and the least numerous group was at the age of 70 years or more — 3 people (10%) (Table 1, Figure 1).

The average body height of the women tested is approximately 159.7 cm with standard deviation of 6.95, where the average body height of women participating in the 'fitness' classes is 158.5 cm, and with women participating in dance classes from the control group it was 160.1 cm.

Table 1. Analysis of somatic features

Group/age group	N	Mean	SD	Min	Max	Figure
Average age of the women tested						
Fitness	15	63.4	2.324	60.0	67.0	
Control group	15	67.5	4.502	60.0	75.0	Figure 1
Overall	30	65.4	4.083	60.0	75.0	
Average BMI of the groups tested						
Fitness	15	27.04	3.412	22.48	35.52	
Control group	15	28.60	3.319	23.39	36.29	Figure 2
Overall	30	27.82	3.401	22.48	36.29	

Table 2. BMI Index in the study groups

Group	Fitness		Control		Overall	
BMI	number	%	number	%	number	%
Standard	4	26.7	1	6.7	5	16.7
Overweight	9	60.0	10	66.7	19	63.3
Obesity of 1st degree	1	6.7	3	20.0	4	13.3
Obesity of 2nd degree	1	6.7	1	6.7	2	6.7
Overall	15	100.0	15	100.0	30	100.0

In the examined group of women the average value of body weight is 70.9 kilograms with a standard deviation of 7.55. Among the female students practicing 'fitness' it was close to 70.1 kg, whereas in the control group of female students it was 73.1 kg.

The average value of the BMI index in the women surveyed is 27.82 with a standard deviation exceeding 12% of the average value, which indicates a slight differentiation of the results. A higher mean of the BMI index was observed in the control group — 28.60, with the average value for the fitness group — 27.04. The minimum score of 22.48 was recorded in the fitness group, and the highest one — 36.29 in the control group (Table 1, Figure 2).

Body mass index in more than 63% of women did not exceed the category of overweight, and only less than 17% of respondents did not exceed the standard level, whereas 13.3% exceeded the level recognised as the first-degree of obesity, and 6.7% as obesity of the second degree. In the group practicing fitness only 26.7% of women had the standard BMI, and as many as 60% of respondents were overweight, where 6.7% of respondents in each group were obese at the level of the first and second degree. In the control group practicing 'solo' dance only 6.7% of women showed the standard BMI, more than 66% of respondents were overweight and 20% were obese at the level of the first degree, where 6.7% were obese at the level of the second degree (Table 2, Figure 9).
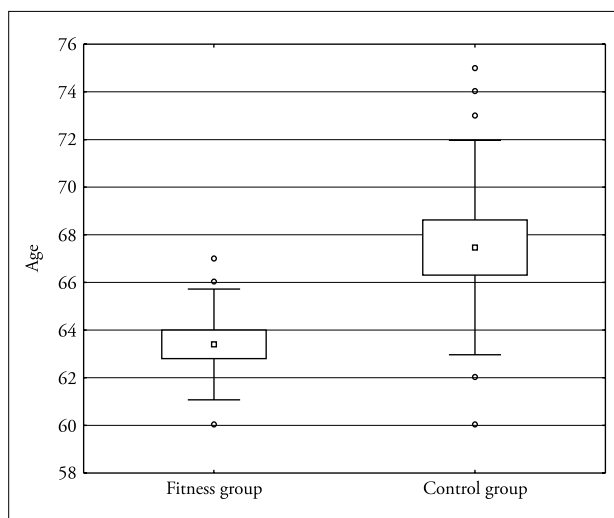

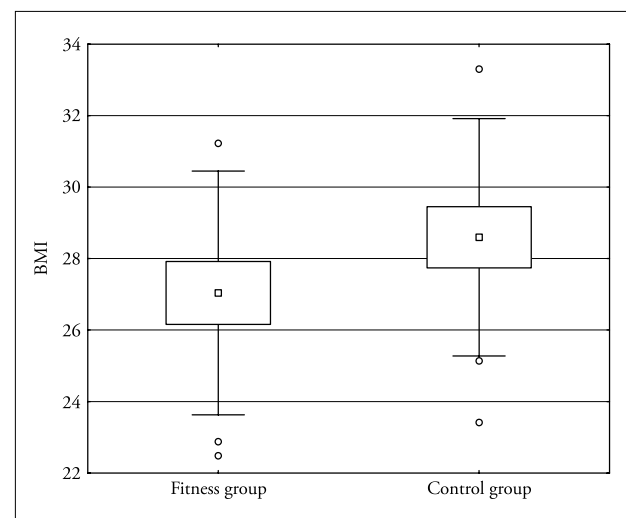Figure 1. Distribution of age average in the study groups

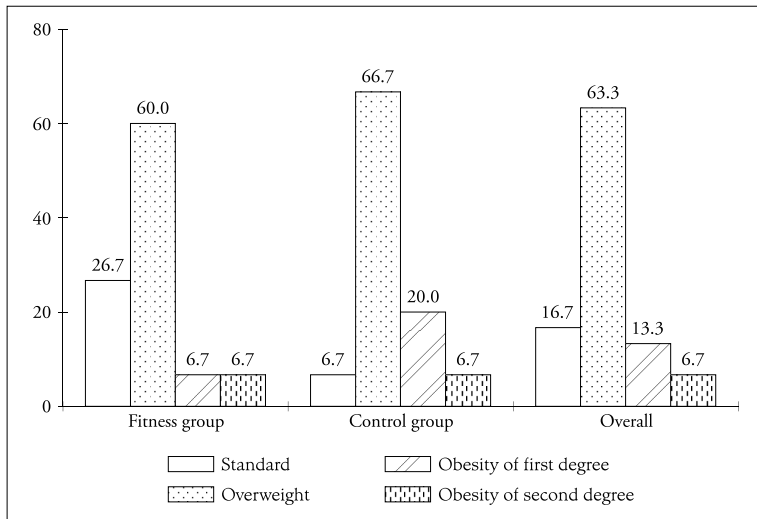Figure 2. Distribution of the BMI average in study groups

Figure 9. Distribution of the BMI index in the study groups

Analysis of physical fitness

The average result of the strength of the lower limbs in an attempt to stand up from a chair in the group of the women tested was 19.1 repetitions per 30 seconds, with a standard deviation higher than 20% of the average value, which indicates considerable variations of the results. It arises from the collected material that the higher mean was observed in the fitness group with the score of 22.4 repetitions whereas the average score in the case of the control group amounted for 15.9 repetitions. The lowest score of 10 repetitions was observed in the control group, and the highest — 27 repetitions in the fitness group (Table 3, Figure 3). In the test a statistically significant difference between the two groups was observed.

According to the age, the highest average number of 20 repetitions was performed by the women in the age group ranging 60–64 years, and the lowest in the number of 11.7 repetitions by the women in the age group of 70, whereas according to the BMI index value, the highest average rate was recorded in the standard index group with the number of 21 repetitions, and the lowest with the score of 17.8 repetitions in the obesity group (Table 3, Figure 4).

Table 3. Analysis of physical activity

| Group/age group	N	Average	SD	Min	Max	Figure
Average results of chair stand in the study groups						
Fitness	15	22.4	3.602	16.0	27.0	
Control	15	15.9	3.998	10.0	24.0	Figure 3
Overall	30	19.1	5.002	10.0	24.0	
Average results of chair stand in the age groups						
60–64 years	12	20.0	4.090	11.0	25.0	
65–69 years	15	19.9	4.978	12.0	27.0	Figure 4
70 years and more	3	11.7	2.082	10.0	14.0	
Average results of chair stand in the BMI index groups						
Standard	5	21.0	3.082	18.0	25.0	
Overweight	19	19.1	5.492	10.0	27.0	Figure 5
Obesity	6	17.8	4.834	12.0	24.0	
Average results of arm bending in the study groups						
Fitness	15	26.4	5.680	15.0	34.0	
Control	15	18.7	5.164	12.0	28.0	Figure 6
Overall	30	22.5	6.627	12.0	34.0	
Average results of arm bending in age groups						
60–64 years	12	24.4	5.900	12.0	34.0	
65–69 years	15	22.9	6.397	13.0	33.0	Figure 7
70 years and more	3	13.0	0.000	13.0	13.0	
Average results of arm bending in the BMI index groups						
Standard	5	26.2	4.147	20.0	30.0	
Overweight	19	22.8	6.362	12.0	33.0	Figure 8
Obesity	6	18.5	7.868	13.0	34.0	
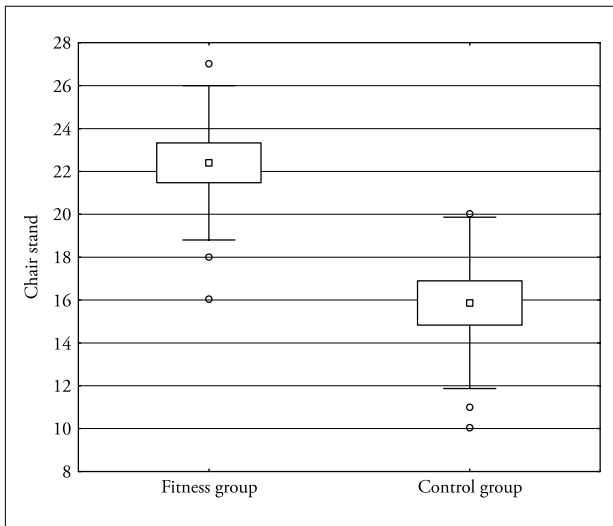
Figure 3. Distribution of chair stand average results in the study groups
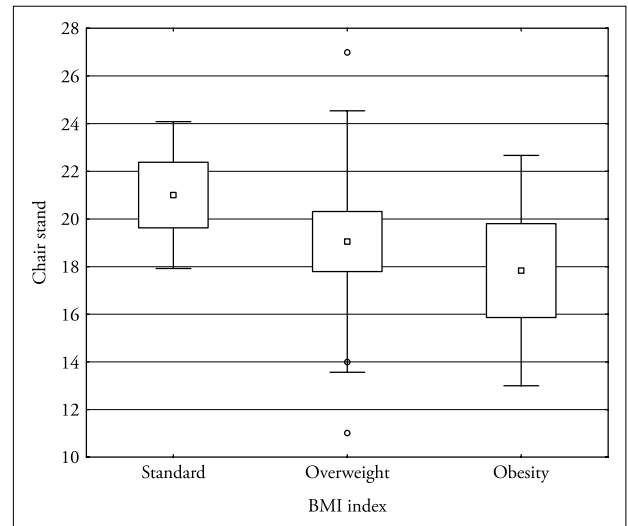

Figure 5. Distribution of chair stand average results in the BMI index groups
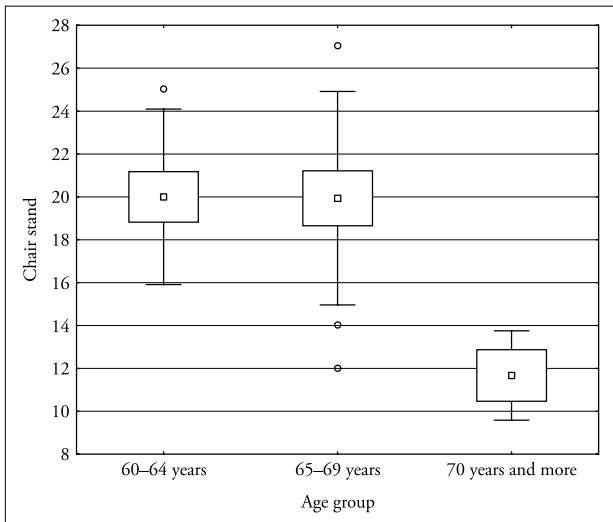

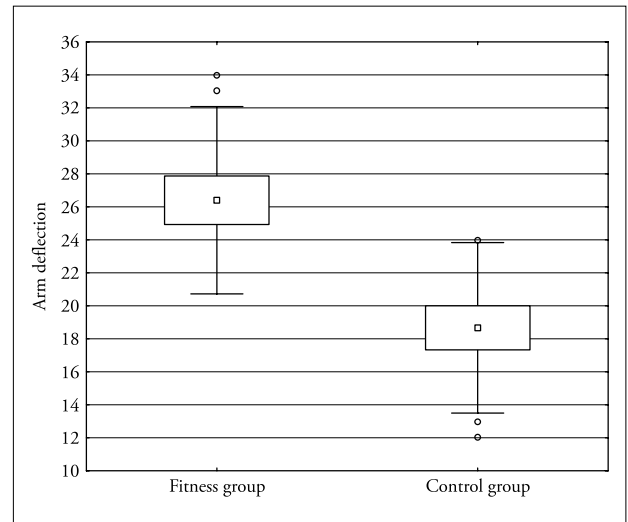Figure 4. Distribution of chair stand average results in age groups

Figure 6. Distribution of arm bending average results in the study groups

The highest average number of repetitions was performed in the group of standard BMI index — 21, and the lowest in the group of obesity BMI index — 17.8 (Table 3, Figure 5).

In the 30-second arm bending test the average score in the study group was 22.5 with a standard deviation exceeding 29% of the average value, which indicates a significant variation of the results. Higher average value was observed in the fitness group — 26.4 deflections, with an average in the control group — 18.7 deflections. The lowest score of 15 deflections was obtained in the control group, and the highest — 34 deflections in the fitness group. In the test there was reported a statistically significant difference between the test groups (Table 3, Figure 6).

According to the age, the highest average number of 24.4 deflections were done by women in the age group ranging 60–64 years, and the lowest in the number of 13 deflections by women in the age group of 70 years
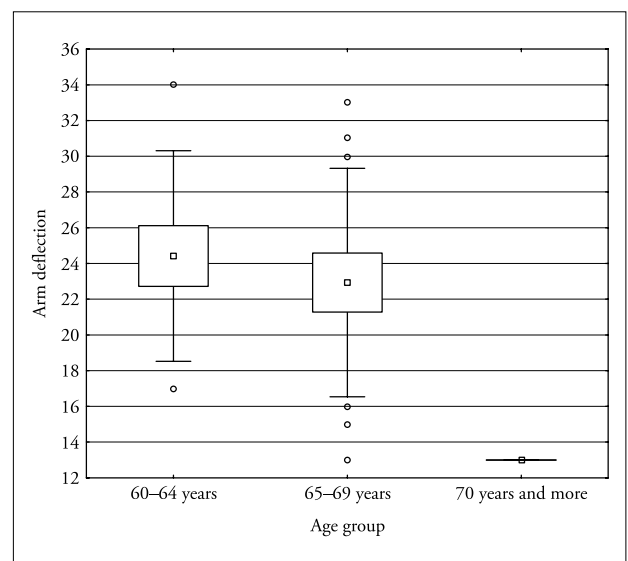

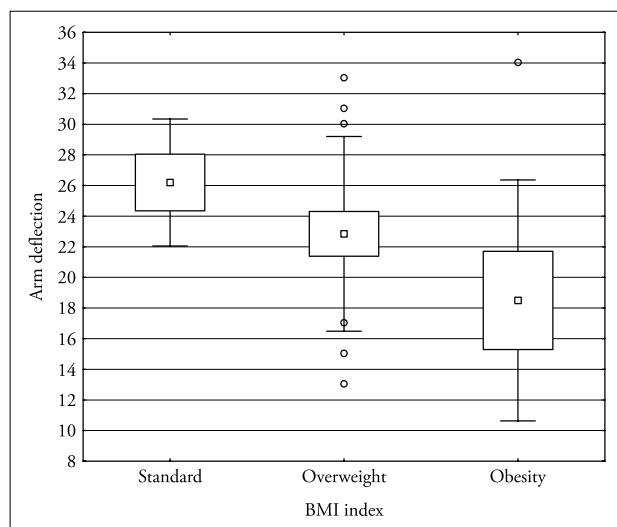Figure 7. Distribution of arm bending average results in the age groups

Figure 8. Distribution of arm bending average results in the BMI index groups

(Table 3, Figure 7), whereas according to the BMI index value the highest average was recorded in the standard index group with the number of 26.2 deflections, and the lowest with the score of 18.5 of repetitions in the obesity group (Table 3, Figure 8).

Discussion

The aging process occurs in humans differently. The sum of the years gone by, identified with the calendar age, does not coincide with biological age. Many people preserve a good level of physical and mental fitness until the old age. The factor which helps to maintain physical fitness is active lifestyle, and in the case of mental fitness it is systematic mental effort, neglected, unfortunately, after retirement [15].

Physical fitness is increasingly being recognized as one of the components of good health condition. Modern definitions of physical fitness emphasize the physiological and medical elements, with a particular emphasis on health aspects and energy efficiency of the system. An important role is also attributed the development of motor efficiency and morphological-structural predispositions, such as the correct physique and body composition [16,17].

There are many studies being carried out which aim at proving the beneficial effect of physical activity on both physical and mental health. The research carried out by Ignasiak et al. [18] evaluating physical fitness in older women by means of Fullerton test has proved that women staying at the sanatorium were characterized by a significantly higher level of fitness compared to the residents of social welfare homes (SWH). However, the standards determined for the American society in all cases turned out to be too high for all respondents from SWH, as well as for women from the sanatorium —

in the case of four tests. This proves that physical fitness in the elderly women in Poland should be improved [18]. In our study, physical fitness of women at Kujawsko--Dobrzyński University of the Third Age at the University of Humanities and Economics was compared. All female-respondents participated in aerobics and 'solo' dance classes organized by KDUTW under the section of interest.

The test results showed significant differences in the physical fitness of both groups in the case of bending the forearm as well as standing up from a chair.

In the test evaluating the strength of the lower limbs, the best results were obtained by elder women from the fitness group with the average score of 22.4 repetitions within 30 seconds compared to the research carried out by Ignasiak, where the average score was 21 repetitions as well as to the 'solo' dance group, where the average value was 15.9 repetitions. Other results were reported from the 'bending arm' Fullerton test, in which the women from the fitness group achieved better results (an average number of 26.4 repetitions) than the women from the 'solo' dance group (an average number of 18.7 repetitions) and than the women surveyed by Ignasiak (approximately 17–18 repetitions) [18]. Comparing the results to the standards of the authors of the test, one can notice that in both tests women in the age range of 60–64 years from the fitness group and from the 'solo' dance group achieved better results exceeding the upper limit of the standard.

The achievement of such good results in the forearm bending and standing up from a chair tests by women from the fitness group can be explained by the fact that they were very active individuals engaged in regular physical activity manifested in the participation in all sorts of activities connected with various forms of aerobics.

These studies indicate the problem related to aging, mainly in the case of passive or less physically active persons. Numerous authors prove the positive impact of physical activity on both physical and mental health and evaluate the level of mobility in older people. Very important is the fact that the elderly are fully accepted in the society and that an increasing number of people care about their successful aging.

Evaluation of physical fitness gives the opportunity to develop an appropriate programme of physical activity, which can slow down the aging processes and extend the period of independence and self-reliance of the elderly [19].

Conclusions

1. Study groups differ in age (a statistically significant difference) but do not differ in the BMI index.
2. In both fitness tests better results (statistically significant) were obtained by female listeners participating in fitness classes, which may be due to increased physical activity of greater intensity and frequency.

Implications for Nursing Practice

In the era of rapidly increasing percentage of elderly population worldwide, as well as to the feminisation of old age, it is necessary to undertake intensive activities in the field of gerontological prevention. Specific tasks in this regard relate to the nurse who performing professional functions, conducts activities in the field of health education among the recipients of benefits in various health condition and at different age. It is necessary here to put special emphasis on promoting active aging. The functional efficiency significantly forms the image of the quality of life of elder people. In such a case the risk of institutionalization, financial expenses and organizational activities in the field of nursing and care are reduced, and therefore the range of self-care as well as the sense of autonomy in the elderly is increased.

References

[1] Chrzanowski J. *Aktywność sportowa Polaków*. AWF, Warszawa 1997.
[2] Osiński W. *Zarys teorii wychowania fizycznego*. AWF, Poznań 2002.
[3] Szatur-Jaworska B., Błędowski P., Dzięgielska M. *Podstawy gerontologii społecznej*. Warszawa 2006.
[4] Osiński W. *Anthropomotorics*. AWF, Poznań 2003.
[5] Borowicz A.M., Wieczorkowska-Tobis K. *Fizjoterapia w geriatrii. Atlas ćwiczeń*. PZWL, Warszawa 2013.
[6] Kiełbasiewicz-Drozdowska I., Siwiński W. (Red.), *Teoria i metodyka rekreacji (zagadnienia podstawowe)*. AWF, Poznań 2001;53.
[7] Bień B., Wojszel Z.B., Wilmańska J., Sienkiewicz J. *Starość pod ochroną. Opiekunowie rodzinni niesprawnych osób starych w Polsce. Porównawcze studium środowiska miejskiego i wiejskiego*. Oficyna Wydawnicza TEXT, Kraków 2000;69–78.
[8] Penkala J., Wiencek R. Szlachetne zdrowie… *Zwiastun*. 2004;1(1).
[9] Jegier A. Trening zdrowotny. W: Górski J. (Red.), *Fizjologia wysiłku i treningu fizycznego*. Wydawnictwo Lekarskie PZWL, Warszawa 2011;236–237.
[10] Malinowski A., Wolański N. *Metody badań w biologii człowieka. Wybór metod antropologicznych*. PWN, Warszawa 1987.
[11] Martin R., Saller K. *Lehrbuch der Antropologie in systematicher Darstellung mit besonderer Berücksichtigung der anthropologischen Methoden*. G. Fischer Verlag, Stuttgart 1957.
[12] Drozdowski Z. *Antropologia dla nauczycieli wychowania fizycznego*. AWF, Poznań AWF, 2002.
[13] Rikli R., Jones J. Development and validation of a functional fitness test for community — Residing older adults. *Journal of Aging and Phisical Activity*.1999;7:129–161.
[14] Charzewska J. Metody stosowane w ocenie stanu odżywiania. W: Charzewski J. (Red.), *Antropologia*. AWF, Warszawa 1999.
[15] Rosławski A. *Wybrane zagadnienia z geriatrii*. AWF, Wrocław 2001.
[16] Ignasiak Z., Sławińska T. *Sprawność fizyczna jako pozytywny miernik zdrowia*, Materiały X Konferencji Naukowej: Uwarunkowania środowiskowe zdrowia dzieci, Legnica 2001;51.
[17] Osiński W. Tendencje w tworzeniu testów sprawności fizycznej w ramach koncepcji „Health-Related Fitness". *Antropomotoryka*. 1998;17:175–193.
[18] Ignasiak Z., Kaczorowska A., Katan A. i wsp. Sprawność fizyczna kobiet w starszym wieku oceniana testem Fullerton. *Fizjoterapia*. 2009;17(2):48–52.
[19] Sallis J.F., Simons-Morton B.G., Stone E.J. et al. Determinants of physicalactivity and interventions in youth. *Medical Science of Sports Exercise*. 1992;24 (6Suppl):248–257.

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