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Functional capacity and risk of frailty syndrome in 85-year-old and older women living in nursing homes in Poland

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ABSTRACT: Maintaining sufficient physical fitness to prevent any limitations in performing activities of daily living and to be functionally independent is of great importance for both longevity and quality of life in older adults. Aim of the study was to evaluate functional physical fitness of women aged 85 years and older, residents of nursing homes, in the Polish population and to assess the risk of frailty syndrome. The study involved 17 women aged 85 years or older, residents of nursing homes in the Lower Silesian voivodeship. The Senior Fitness Test was used to assess functional fitness. The results of functional fitness tests were related to the standards for the elderly population in Poland and to the reference standards for maintaining independence. In addition, hand grip strength level was measured using a hand dynamometer, height and weight were measured, and BMI was calculated. 15-item version of the Geriatric Depression Scale was used to assess the level of depression. We used 3 of the 5 proposed criteria from the Cardiovascular Health Study Frailty Index to assess the presence of frailty syndrome: gait speed, level of hand grip strength, and the presence of depression. The results of the Senior Fitness Test demonstrate the low level of functional fitness of female nursing home residents. A large percentage of the women surveyed are below the standard values developed for Polish seniors. The weakest results were in the timed up and go test, with more than 94% of the women tested falling outside the standard ranges. The mean results of all samples do not meet the developed reference standards for maintaining independence. No non-frail person was found among the study participants and the vast majority were at risk for frailty syndrome. Most of the studied women do not meet functional fitness standards developed for the Polish population, as well as reference standards for maintaining independence. Nursing home residents over the age of 85 are at risk for frailty syndrome.

KEY WORDS: frailty, physical fitness, older woman, healthy aging, institutional living

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Introduction

Maintaining sufficient physical fitness to prevent any limitations in performing activities of daily living and to be functionally independent is very important for both longevity and quality of life in older adults (CDC 2009; Motl and McAuley 2010). Unwanted changes occurring already in adulthood generate significant problems with movement, manipulations or changes in body composition, especially loss of muscle mass and strength (Cawthon et al. 2011). Loss in terms of balance, strength, and gait efficiency, thus, translate into increased limitations for these individuals (Patel et al. 2006). Consequently, this contributes to a more passive lifestyle and to an increased likelihood of morbidity, hospitalization and mortality (Pahor et al. 2014; Hicks et al. 2012).

It has been argued that in order to achieve successful aging, it should involve maintaining cognitive function (Rowe and Kahn 1997) and physical fitness at optimal levels (Ralston 2018), among other things. Spending time passively is detrimental to physical and mental health (Tkatch et al. 2017) at any age, but especially for the elderly. Adequate levels of physical fitness play a fundamental role in the case of older people, as they prevent numerous diseases or disabilities and are essential to maintaining daily functions at a satisfactory level. This is a condition that is not dependent on the place of residence of the elderly (own home or community dwelling). Forms of physical activity should be tailored to the abilities of individuals or groups . A prior assessment of functional fitness level is necessary in order to assess fitness levels. In cases of the elderly, the currently most widely used test to assess functional fitness (i.e., that related to activities of daily living) is the SFT by Rikli and Jones (2002). It is so widely used that standards for this test are already in place in many populations, which greatly facilitates interpretation of the score and inter-population comparisons (Rikli and Jones 2002; Langhammer and Kvalvik 2011; Marques et al. 2013; Ignasiak et al. 2020).

Frailty syndrome is associated with a high risk of adverse health outcomes, especially in older age (Fried et al. 2001). Frailty results from aging-related decline in physiological, as well as cognitive function, chronic stress, and impairments in the effective performance of daily living activities (Clegg and Young 2011; Xue 2011). The development of frailty syndrome definition was first coined by by Fried et al. (2001). Age-related changes, both physiological and psychological, are fundamental to the development of frailty syndrome. These can either be prevented or reversed by therapeutic interventions based on physical activity when detected in the early stage of development (Ignasiak et al. 2020). Although, other researchers (Martin and Ranhoff 2021) have presented their scales, there have been attempts to expand the frailty studying method itself, as well as its definition, which is still unclear. The prevalence of frailty syndrome in Europe varies widely across countries, and affects women more frequently, Furthermore, frailty syndrome appears to be related to social and cultural factors (Santos-Eggimann et al. 2009; Bandeen-Roche et al. 2006; Puts et al. 2005).

Elderly, single people with chronic conditions often reside in nursing homes (Garner et al. 2018; Kauppi et al. 2018). Individuals in residential care who experience significant functional decline, loss of independence, and feelings of loneli-

ness, are particularly at risk of developing frailty syndrome and also disability (Furtado et al. 2017). Nursing homes should provide an optimal quality of life for residents and ensure what is called active aging (Van Malderen et al. 2016). Properly managed physical exercises are essential for active aging, conditioning the individual to an appropriate level of physical fitness. Awareness of the need for physical activity classes is extremely important, both among personnel, as well as nursing home residents.

The aim of this study was to evaluate functional physical fitness of women aged 85 and older, residents of nursing homes, in a Polish population and to assess the risk of frailty syndrome.

Material and methods

The study was conducted in 2018–2019 in nursing homes of the Lower Silesian voivodeship. The research was carried out in accordance with the Declaration of Helsinki, and followed good clinical practice guidelines. The Commission of Research of the University School of Physical Education, Wrocław, Poland granted approval for the research (approval date: 2017). All study participants gave written informed consent to participate in the study. The study is a part of larger research that was retrospectively registered on the ISRCTN platform under the number 18225729.

The study included 17 women aged 85 years and older, residents of nursing homes in Lower Silesia. Inclusion criteria were (1) age of 85 years and older, (2) no medical contraindications, (3) ability to move independently and complete a functional fitness test, (4) normal verbal contact, and (5) written consent to participate in the study, as well as approval from the nursing home director. Exclusion criteria included (1) acute infections and diseases, (2) neoplastic diseases, (3) fresh post-infarction status, (4) other medical contraindications to the study, and (5) lack of written consent to participate in the study. Due to the exclusion criteria and lack of ability to move independently and complete a functional fitness test, 48 women over the age of 85 years were excluded from the study.

The Senior Fitness Test (Rikli and Jones 2012) was used to assess functional fitness. This test is designed for older adults and consists of six fitness tests to assess upper and lower body strength and flexibility, aerobic endurance, motor coordination and dynamic balance:

1. *Arm curl* – the number of forearm curls at the elbow joint with a 2.27 kg weight was measured within 30 seconds. This is a test that assesses upper body muscle strength.
2. *30-second chair stand* – the number of times a person stood up from a chair was measured in the given time. The test assesses lower body strength.
3. *Back scratch* – reaching with hands behind the back until touching fingers – was measured with a ruler to the nearest 0.5 cm. The test evaluates upper body flexibility.
4. *Chair sit and reach* – was measured with a ruler to the nearest 0.5 cm. The test evaluates the flexibility of the lower body.
5. *8-foot up and go* – the time to complete the test was measured to the nearest hundredth of a second. The test is used to assess motor coordination and dynamic balance.
6. *2-minute walk* – the number of single leg lifts while walking in place was measured for 2 minutes. The test evaluates aerobic endurance.

The study took place in the afternoon since the participants mentally and physically functioned best at this time of the day. Before starting the test, the participants were asked to perform each test part as well as possible. Performance of the test tasks was preceded by a demonstration.

The results of functional fitness tests were related to the standards for the elderly population in Poland developed by Ignasiak et al. (2020). The following score categories were adopted for all tests: „Below normal" – for scores below the 25th percentile for all tests except the 8-foot up-and-go test measured in seconds, for scores above the 75th percentile on the 8-foot up-and-go test. All other values were taken as normal functional performance scores. The cutoff points used for reduced functional fitness are shown in Table 1.

The scores of the studied female nursing home residents were also compared to the reference standards for maintaining independence developed for the four test samples by the test authors (Rikli and Jones 2012). The level of hand grip strength (HGS) was then measured using a hand dynamometer (JAMAR, Hand Dynamometer USA). Measurements of somatic characteristics such as body height (to the nearest 0.5 cm) using an anthropometer SECA 799 and body weight (to the nearest 0.5 kg) using a medical scale SECA 799 were also performed. For the body height test, the participants tried to adopt an upright posture. Body Mass Index (BMI) was calculated based on these measurements. Some researchers have noted that calculating BMI for older adults using body height may be incorrect. Body height is often underestimated due to degenerative changes in the spine and joints, and BMI is overestimated (Yilmaz et al. 2016). To avoid overestimation of BMI, the participants tried to adopt the most upright posture with hip and knee joints and spine as straight as possible. However, this was often not possible due to contractures in the hip and knee joints, as well as increased thoracic kyphosis.

Table 1. Cut-off points for reduced functional fitness assessed using the Senior Fitness Test set (according to Ignasiak et al. 2020) for women

Age (years)	85+
30-Second Chair Stand Test (no. of reps)	< 10
Arm Curl Test (no. of reps)	< 10
Chair Sit and-Reach Test (cm)	< −6
Back Scratch Test (cm)	< −19
8-Foot Up-and-Go Test (s)	> 7.3

15-item version of the Geriatric Depression Scale (GDS) was used to assess the level of depression (Lesher and Berryhill 1994). Result interpretation:
- 0–5 points – no depression,
- 6–10 points – moderate depression,
- 11–15 – severe depression.

Three out of five proposed criteria from the Cardiovascular Health Study Frailty Index were used to assess the presence of frailty syndrome (Fried et al. 2001). Individuals not meeting any criterion did not have frailty syndrome. Individuals meeting 1–2 criteria were judged as pre-frail, while those meeting 3–5 criteria were considered to be frail. We used gait speed from the 8-foot up and go test, level of hand grip strength measured with a hand dynamometer, and the presence of depression as assessed by the Geriatric Depression Scale. Criteria for gait speed frailty syndrome are sex- and height-dependent, and are ≥ 7 s (height ≤ 159 cm) and ≥ 6 s (height > 159 cm) for women. Hand grip criteria for frailty syndrome include the lowest 20% of scores, adjusted for sex and BMI:

– ≤ 17 kg for BMI ≥ 23,
– ≤ 17.3 kg for BMI 23.1–26,
– ≤ 18 kg for BMI 26.1–29,
– ≤ 21 kg for BMI > 29.

Collected results were then subjected to statistical analysis. The distribution of the variables was checked for normality using the Shapiro-Wilk test. The mean ($\bar{x}$), standard deviation (SD), minimum value (Min) and maximum value (Max) were calculated. Calculations were performed using Excel and Statistica 13.3.

Results

The mean age of the studied women was 90.75 ± 3.83 years. The mean BMI of the participants was 26.50, exceeding the overweight threshold. Age and somatic characteristics are presented in Table 2.

The results of the five test parts were compared to Polish criteria for the 85+ group (Ignasiak et al. 2020). Since Polish criteria include 6-minute gait test to assess aerobic capacity, and the women performed a 2-minute walk in place test, it did not meet the mentioned criteria. The results demonstrated low functional fitness level of female nursing home residents. A large percentage of the participants surveyed were below the standard values developed for Polish seniors. The worst results were obtained in the timed up and go test, with more than 94% of the participants tested falling outside the standard ranges (Table 3).

Next, the scores of the studied female nursing home residents were compared to the reference standards for maintaining independence developed for the four test samples by the test authors (Rikli and Jones 2012). The mean results of all samples did not meet the developed reference standards. The 8 ft up-and-go test part showed the worst results, with a mean score of more than double the developed standard, with more than 94% of individuals failing to meet the standard (Table 4).

The tests for assessing the risk of frailty syndrome included hand grip strength, gait speed, and presence of depression. The results were compared to frailty syndrome criteria. As many as 16

Table 2. Descriptive statistics of morphological trials of the surveyed women N=17

Variable	$\bar{X}$ ± SD	Min	Max
Age [years]	90.75 ± 3.83	85.00	98.08
Height [cm]	152.24 ± 6.31	140.50	163.00
Weight [kg]	61.50 ± 10.86	46.00	88.00
BMI [kg/m^2]	26.50 ± 4.16	20.24	35.25

Table 3. Comparison of Senior Fitness Test results to Polish criteria (according Ignasiak et al. 2020) N=17

Test	$\bar{X}$ ± SD	Below Polish norm n (%)
Chair stand [reps]	8.24 ± 2.80	12 (70.5)
Arm curl [reps]	10.76 ± 3.53	6 (35.3)
Chair sit and reach [cm]	−23.76 ± 12.44	13 (76.4)
Back scratch [cm]	−13.85 ± 10.11	10 (58.8)
8 ft up-and-go [s]	17.61 ± 8.82	16 (94.1)

Table 4. Comparison of mean Senior Fitness Test scores to criterion-reference fitness standard for maintaining physical independence (according Rikli and Jones 2012)

Test	$\overline{X}$ ± SD	Standard 85–89 years	Standard 90–94 years	Below the standard n (%)
Chair stand [reps]	8.24 ± 2.80	11	9	12 (70.5)
Arm curl [reps]	10.76 ± 3.53	13	11	11 (64.7)
2-min walk [steps]	53.76 ± 20.69	70	60	11 (64.7)
8 ft up-and-go [s]	17.61 ± 8.82	7.1	8.0	16 (94.1)

Table 5. Participants meeting the individual criteria for frailty syndrome

Criterion	Participants meeting criteria, n (%)
Gait speed [s]	16 (94.1)
Hand grip strenght [kg]	6 (35.3)
GDS	6 (35.3)

Table 6. Number and percentage of pre-frail and frail participants

		n (%)
Pre-frail	1 criterion	7 (41.1)
	2 criteria	9 (52.9)
	In all	16 (94.1)
Frail		1 (5.9)

participants met the criteria for frailty syndrome in the gait speed test, 6 women met the criteria for frailty syndrome in hand grip strength, and similarly 6 women had depression (Table 5).

Among the participants, 16 women met one or two criteria for frailty syndrome, indicating that the participants had pre-frail syndrome. One woman was found to meet three criteria, meaning the presence of frailty syndrome. None of the studied women were non-frail. The results are presented in Table 6.

Discussion

The primary objective of this study was to assess the functional physical fitness of 85+ female nursing home residents. The results indicate a low level of functional physical fitness among female nursing home residents aged 85+. Most of the participants did not meet criteria developed for the Polish population (Ignasiak et al. 2020) and the reference measures for maintaining independence (Rikili and Jones 2012).

Women who are 90-years-old, single, have at least two chronic conditions, and require assistance often become residents of nursing facilities (Kauppi et al. 2018). In case of such individuals, it is challenging to complete all the parts of a functional fitness test. Most studies on functional fitness in people over 85 years are based on completing questionnaires (Simonsson et al. 2020, Escourrou et al. 2020, Ćwirlej-Sozańska et al. 2020), in which the subjective assessment may not match the actual condition. The ages of the female nursing home residents we studied ranged from 85 to 98 years old, and their ability to complete the Senior Fitness Test parts alone was a positive element.

The low scores obtained on the Senior Fitness Test by female nursing home residents may be due to significant limitations in activities of daily living, such as shopping, meal preparation, etc. The study by Barber et al. (2015) found that physical activity levels of nursing home residents were very low, while time spent sitting was very long. According to Fisher, low physical activity levels were associated with living in nursing homes,

and activity levels decreased as seniors aged (Fisher et al 2018). A large study of the European elderly population has confirmed that sedentary lifestyles are a significant risk factor for disease and may contribute to increased mortality. Television viewing time has been shown to be a risk factor for frailty syndrome and major functional limitations in elderly people (Garcia-Esquinas et al. 2017). Thus, it is assumed that low levels of physical activity and sedentary lifestyles pose a serious risk for disability.

We used three criteria to assess the risk of frailty syndrome in female nursing home residents aged 85+, as proposed by Fried et al. (2001). Our findings are disturbing, as we found no non-frail among the female participants in the study, and the vast majority were at risk for frailty syndrome.

Institutionalized women who experience significant functional decline and loss of independence are at increased risk of developing frailty syndrome and disability (Furtado et al. 2017). Increased vulnerability to adverse events such as falls, hospitalizations, disability, institutionalization, or death are consequences of frailty syndrome (Skalska 2016, Fried et al. 2001). Potential reversibility through multidirectional prevention, in which regular physical activity and proper diet are most important, is a significant characteristic of the frailty syndrome (Skalska 2016). This is why it is so important to identify the frailty syndrome threat in order to take preventive action early.

In the study by Furtado et al. (2017) who analyzed the prevalence of frailty syndrome among institutionalized women, the largest number of participants negatively rated three components of frailty syndrome – weakness (muscle strength), slowdown (gait speed), and low activity level. In this study, gait speed was found to be at the lowest level, with over 94% of participants meeting the criterion for frailty syndrome. Muscle strength was at a higher level, with over 35% of the women surveyed lacking muscle strength.

The low fitness level of the studied females may be related to the generally lower level of physical activity among seniors in Poland. The current generation of Polish seniors acquired their lifestyle habits and normal behaviors, including physical activity, in communist Poland. During the communist era, Polish seniors lived in a different cultural context than seniors in Western Europe and North America, where the idea of active aging was well established. In Poland, old age is traditionally considered a period of well-deserved rest, during which people should cease their previous activities. Hence, only a small percentage of Polish seniors participate in physical activity classes. The results of the „Bridging the East – West Health Gap" research project, aimed at assessing health status, attitudes, and health behaviors among the adult population of selected Central, Eastern, and Western European countries, indicate a marked variation in physical activity levels across individual countries. The highest percentage of respondents declaring high activity was reported in Western European countries (30.2% in Finland and 23.7% Spain), and the lowest in post-communist countries – Poland (6.4%) and Hungary (12.3%) (Drygas et al. 2001). Similarly, a small percentage (12%) of Czech seniors participate in sports or physical exercises (Mudrak et al. 2016). The rationale for the low levels of physical activity among older adults from Central and Eastern European countries may be that seniors

from post-communist countries generally live in poorer socioeconomic conditions than seniors in Western European and North American countries.Additionally, Central and Eastern European seniors tend to engage in behaviors that are less beneficial to health.

This study also had some limitations. A small number of women were studied. This was due to the fact that a very small number of female nursing home residents aged 85+ were able to perform the functional fitness test independently. In addition, only women participated in the study. Women are living longer than men and there are significantly fewer men aged 85 and older in nursing homes.

Only a small number of female nursing home residents over the age of 85 are capable of performing a functional fitness test. Most of the studied women did not meet functional fitness standards developed for the Polish population, as well as reference criteria for maintaining independence. Nursing home residents over the age of 85 are at risk for frailty syndrome. Due to the low level of functional fitness and the threat of frailty syndrome, measures need to be taken to improve the functional status of nursing home residents.

Clinical trial registration: on the ISRCTN platform at 18225729.

Authors' contribution

AK – designed the study, collected the data and digitalised, analysed the data, prepare the first draft; AS – collected the data, analysed the data, prepare the first draft; MK – analysed the data, interpreted results; SK – analysed the data, interpreted results, edited final draft; MT – collected the data, interpreted results; ZI – designed the study, prepare the final draft.

Conflict of interest

The authors declare no conflict of interests.

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