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Keywords

gait speed, assessment scale, menopause

Cover Page Footnote

The researcher would like to thank the women that participated in the study

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Article

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1. Introduction

Gait Speed (GS) is the most popular tool used in clinical practice to diagnose functional performance [1]. This is because the aforementioned test is a quick, inexpensive and reliable method with a well-documented predictive value towards identifying major health problems [1, 2].

Numerous studies have documented that gait speed decreasing with age is associated with a number of adverse physical and cognitive outcomes, including an increased risk of falls, fractures, lack of independence, hospitalization, disability, morbidity and mortality, reduced quality of life, as well as cognitive impairment [3–8]. Other studies have shown a significant association between GS test scores and lower extremity strength ($r = 0.23$; $p < 0.03$) [9]. Therefore, gait speed is considered the sixth vital sign in older patients [10].

The Mobility Working Group emphasizes the importance of measuring functional performance with the GS test when providing care to the older patients. Other studies also report that gait speed is an important measure in comprehensive geriatric assessment [1]. Given that women are more prone to motor deficits than men (including a greater risk of falling during adult life [11]), improving the assessment procedure of functional performance (involving GS) seems particularly important in this group of individuals.

Recognizing the medical, clinical, physiological, cognitive, and health importance of maintaining gait speed in the elderly, there are ongoing studies aimed at defining the cut-off thresholds for the GS test to identify functional limitations and diseases, e.g., recognizing physical independence in individuals over 65 years of age (< 1 m/s) [12], severe sarcopenia (< 0.8 m/s) [13], and dementia in women over 75 years of age (< 0.9 m/s) [14].

The adoption of these cut-off thresholds is important in clinical practice, but is insufficient when controlling the functional performance of the elderly in the health coaching process. Having considered that, there are ongoing studies focused on developing scales to assess specific motor abilities of physically active individuals, examples of which include scales for body balance [15] or physical performance [16] of middle-aged and older women. Our knowledge shows that there are no such solutions for the GS test, which needs to be supplemented. Continuation of these studies is important, because quick diagnostics using the aforementioned rating scales allows for accurate selection of training loads in relation to individual abilities and needs of exercising persons. Moreover, it facilitates the follow-up process, allowing for early detection of functional limitations, which is important in the prevention of human aging processes. The control also allows verifying one's training program, thus making it easier to program further work. The construction of rating scales for individual motor abilities should be conducted in well-defined populations taking into account the subjects' age, health status, and physical activity level.

Having considered the above, the main objective of this study was to develop quantitative and qualitative criteria to assess gait speed in women aged 60–75 years.

2. Materials and Methods

2.1. Subjects

A total of 60 women aged 60–75 years (67.22 years; ±3.34) participated in the study. Recruitment of participants was conducted at the Universities of the Third Age in Gdańsk and Sopot. In addition, recruitment information for the study was posted at selected medical clinics and neighborhood bulletin boards.

The main inclusion criterion was age (range of 60–75 years). Participants were excluded according to the following criteria: pain preventing performance of physical fitness tests, and lack of consent to participate in the research project from a primary care physician. Participants were asked to provide information about the medications they were taking and to complete a survey questionnaire. The study was approved by the proper Ethics Committee.

The characteristics of the women, including selected morphological components and fitness level, are shown in Table 1.

Table 1. Characteristics of morphological components and physical fitness in women aged 60–75 years

Variables	M	Me	SD
BM [kg]	69.93	66.7	12.14
BMI [kg/m^2]	27.85	26.9	4.33
SM [kg]	23.04	22.96	2.69
PBF [%]	38.03	38.74	6.76
TBWM [l]	31.38	31.4	3.35
GS [m/s]	1.72	1.71	0.23

Abbreviations: BM – body mass, BMI – body mass index, SM – skeletal muscle mass, PBF – percentage of body fat, TBWM – total body water mass, GS – gait speed; M – mean, Me – median, SD – standard deviation

BMI values (27.5%) suggest that the subjects were in the range indicating overweight. At the same time, the results of the study showed no limitations in the physical fitness level in women. Values for the GS test were above the cutoffs for physical independence.

Age-related decrease in fitness levels is caused by many factors, which include chronic diseases, medications, and lack of or low physical activity [17]. Accordingly, Tables 2 and 3 present the characteristics of the health and physical activity status of the studied women.

Table 2. General characteristics of women's health

Variables	n	%
Self-reported health		
Very good	5	8.47
Good	35	59.32
Fair-poor	18	30.51
Bad	1	1.69
Pain in the last 30 days	35	59.32
Diseases		
Diabetes	3	5.08
Cancer	1	1.69
Hypertension	28	47.46
Coronary heart disease	2	3.39
Osteoporosis	11	18.64
Atherosclerosis	3	5.08
Arthritis	4	6.78
Lung diseases	5	3.39
Number of medications taken during the day		
≥3	44	74.58
4≤	15	25.42

Table 3. Characteristics of physical activity in women aged 60–75 years

Variables	M	Me	SD
Time [s]	114.32	120	89.47

Abbreviations: M – mean, Me – median, SD – standard deviation

More than half of the respondents (59.32%) assessed their health as good, with 30.51% assessing it as satisfactory. The women most commonly suffered from hypertension and osteoporosis. Most subjects (74.58%) took less than 3 medications per day. Just over half of the respondents (59.32%) reported experiencing pain in the past 30 days. The analysis also showed that the subjects spent an average of 114 minutes per week on physical activity.

2.2. Assessment of Anthropometry and Physical Fitness

In order to characterize the studied women, body mass level (BM), body mass index (BMI), skeletal muscle mass (SM), percentage of body fat (PBF) and total body water mass (TBWM) were assessed using InBody 720 body composition analyzer (Biospace, Seoul, Korea).

Gait speed was determined using the gait speed test (GS). The participants were instructed to "walk as fast as they could, without running." The time taken to walk a distance of 6 meters was measured [18]. The measurement was performed using a hand-held digital stopwatch with an accuracy of 0.01 s. The test was performed from a static start (acceleration distance: 0 m). In order to avoid a reduction in gait speed due to deceleration before the end line, the participants were instructed to walk an additional 2 meters (deceleration). The best score from 3 trials was included in the analysis to increase the reliability of the measure. Walking speed is reported in meters/second [m/s]. The tests were conducted on an indoor athletic track.

2.3. Design of the scale for assessing Gait Speed in women aged 60–75 years

In order to develop a quantitative and qualitative scale to assess the level of gait speed (based on the results from the GS test), we first analyzed whether women's age had an effect on walking time over a distance of 6 meters. In order to do this, the results of the GS test

were compared, with the subjects divided into three age categories: 60–64 years (group A), 65–69 years (group B), and 70–75 years (group C). The results of the analyses are shown in Table 4 and Figure 1.

Table 4. Comparative characteristics of female gait speed by age group

Groups	n	Gait speed [m/s]		
		M	Me	SD
A	13	1.79	1.79	0.16
B	29	1.75	1.73	0.23
C	18	1.62	1.61	0.26

Abbreviations: A=60–64 years old, B=65–69 years old, C=70–75 years old, M – mean, Me – median, SD – standard deviation

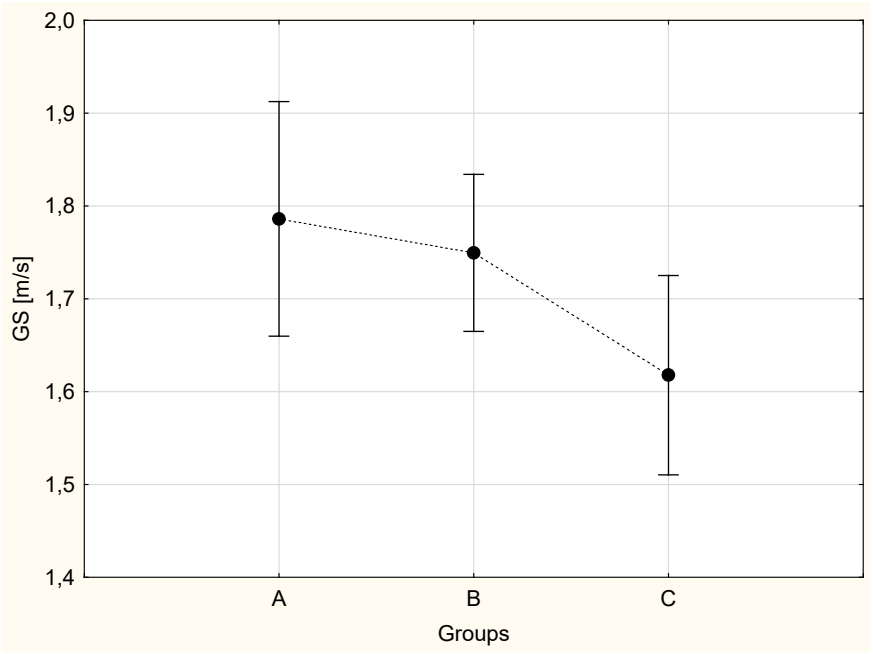

Fig. 1. Comparative characteristics of female gait speed by age group

The analysis showed that the scores for the GS test across age groups were not statistically significantly different. Having considered that, the decision was taken to develop a common quantitative and qualitative scale of gait speed assessment for women aged 60–75 years based on Zaciorski's model [19]. Consistent with the model adopted for the scale design, the distribution of the data was initially analyzed using the Shapiro-Wilk test. The test showed that the data had normal distribution (Table 1). The mean and median had similar values, which is an important condition for designing a reliable scale. A standard assumption was also made that results that differed from the mean by more than three SD were due to measurement error; therefore, they were discarded. A standardized score (T-score) was used in this study. The T-score is a standard scale in which 50 points are assigned to the arithmetic mean value, and 10 points are assigned to each interval equal to one standard deviation value. The formula describing this scale is shown below.

$$T = 50 + 10 \cdot \frac{x - M}{SD}$$

where:
x – result
M – mean
SD – standard deviation

Due to the large values of the standard deviation, a modification found in the literature was introduced in the scale design [16]. The scale intervals were reduced to half SD, making the scale more sensitive. From the middle value on the T-score to the left, there were values indicative of low gait speed (50 to 0 points), while to the right of the T-score from the middle value, there were values indicative of high gait speed (50 to 100 points).

2.4. Statistical analysis

The normal distribution of features was verified using the Shapiro-Wilk test. The significance of the differences between groups was determined using one-way ANOVA. The statistical significance level was set at $p < 0.05$. Statistical analyses were performed using StatSoft, Inc. STATISTICA software, version 13.1.

3. Results

The following is a comprehensive quantitative and qualitative scale for the data obtained in the GS test, which allows comparing the values of the results obtained by the tested person. A graphical version of the scale can also be helpful when monitoring the health coaching process for women aged 60–75 years.

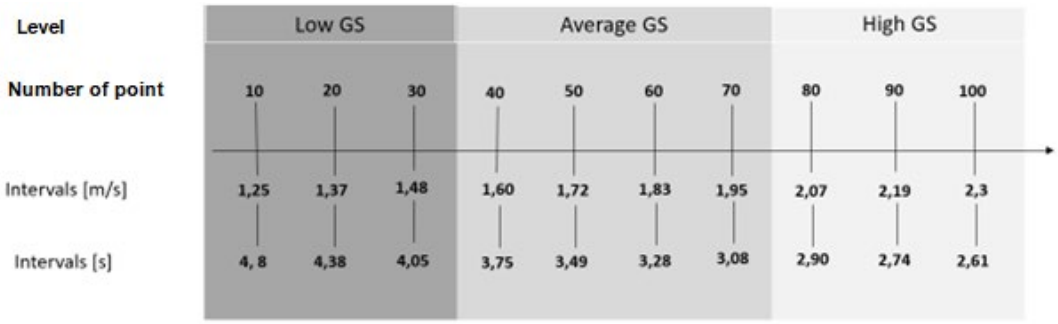

Fig. 2. Scale for quantitative and qualitative assessment of gait speed in women aged 60–75 years

The terms used by Kortas et al. [16], i.e. high level (80–100 points), medium level (40–70 points) and low level (10–30 points), were adopted when developing the qualitative evaluation criteria.

4. Discussion

The current trend in routine clinical practice is to use simple, inexpensive and effective tests to diagnose patients. This may be supported by recommendations to family physicians to include gait speed in clinical practice as a standard measurement of daily function and mobility in older adults [1, 20]. Similarly, the importance of controlling changes in functional fitness of exercising persons under the influence of exercise is emphasized in health coaching. The GS test, the wide applicability of which has been documented in many scientific studies, can be used both for diagnostic purposes and to monitor changes in the training process.

The study focused on the quantitative and qualitative assessment of gait speed based on the GS test. This involved manual time measurement over a distance of 6 meters. Recent studies suggest that the type of starting procedure, the length of the test distance, and the surface can have a clinically significant effect on the measured gait speed. One study showed that manual time measurement resulted in statistically significant differences in measured gait speed compared to automatic time measurement, but these differences were below the clinical significance level [13]. Nevertheless, other studies have not confirmed that differences in testing methods significantly affect the resulting gait speed [1,

21, 22]. The testing procedure adopted in this study was dictated by practical considerations. The use of manual timing does not require expensive, specialized equipment, is easy to perform, and is much more common in coaching practice.

Another study suggests that, from a clinical perspective, shorter distances (2.4 to 3 m) are more preferable by patients due to their mobility limitations [23]. However, the use of longer distances (6–10 m) seems more reasonable for the purposes of health coaching, which often involves people with higher fitness levels.

Still, the type of surface can demonstrate the biggest effect on gait speed. Rough or soft surfaces resulted in significantly slower gait speed compared to hard path surfaces [24]. Having considered the foregoing, in the process of checking training changes, we recommend conducting the test on an even and hard surface, thus increasing both the safety of tests and the repeatability of measurements.

It is also worth mentioning at this point that there is currently no general standardization of methods for gait speed testing protocol [21]. Because of that, we recommend using the GS test procedure described in this paper in the routine assessment of gait speed levels in women aged 60–75 years.

The construction of the scale presented in this paper is mainly based on the arithmetic mean and standard deviation of the GS test results, which were 1.72 m/s (±0.23) in the study group. The values obtained were found to be lower with respect to the speeds obtained by healthy and physically active elderly people at 70 years of age (2.0 ±0.3) [25], but comparable with the results of women (community-dwelling) in aged 60–74 years (1.7 ±0.2) [26], suggesting an appropriate sample for the study.

Other studies have shown that gait speed is subject to age- and dementia-related changes [27]. Before the age of 62, normal gait speed decreases by 1 to 2 percent per decade. After the age of 63, women showed a decrease of 12.4% per decade [28]. The study also showed a trend of GS scores decreasing with age in women. The regression in gait speed was especially true for the oldest female group and was 10.06% and 8% (relative to groups A and B, respectively). Nevertheless, the foregoing differences were not statistically significant. It is possible that the similarity of results across the analyzed age ranges was associated with undersampling (especially of women between 60 and 64 years of age), which constitutes a limitation of the present study. Because of that, we see a need to continue the study with a larger group, including men. Therefore, this study should be considered a pilot one.

5. Conclusions

The mean measurement on the GS test, in women aged 60–75 years, was 1.72 m/s. The results ranged from 1.25 m/s to 2.3 m/s. The gait speed scale presented in this paper is a tool that can be used by therapists, instructors or coaches in the process of diagnosing and programming physical activity in postmenopausal women between the age of 60 and 75.

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