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Functional fitness and quality of life among women over 60 years of age depending on their level of objectively physical activity

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Abstract: The aim of this study was to identify the differences in functional fitness and quality of life among women over 60 years of age depending on their level of objectively measured physical activity (PA) according to Global Recommendations on Physical Activity for health. The study used cross-sectional design with 213 volunteered women over 60 years of age. Physical activity was monitored for 7 days of the week using Actigraph Gt3X monitor. The Senior Fitness Test battery and Hand-grip strength tests were performed to assess functional fitness. Quality of life was self-reported using short version of WHOQOL-bref questionnaire. Women who met the PA recommendations achieved slightly better results in most functional tests and all domain of quality of life. The significant differences were found in upper body strength, dynamic balance and social relationships domain of quality of life. Physical activity programs developed on the basis of WHO recommendations have the potential to improve functional capacity and quality of life. However, further experimental studies in this area are required.

Keywords: WHOQOL; Senior Fitness Test; Exercises; Actigraph; Accelerometry; Elderly; Older adults, physical fitness

1. Introduction

Physical activity is one of the most important health behavior that can prevent ~~of~~ many age-related problems and is associated with successful aging [1-3]. There is a lot of research evidence that physical activity reduces the risk of many noncommunicable diseases (including cancer, coronary diseases, diabetes, pulmonary diseases etc.) [4-6]. Regular physical activity could also improve mental health, cognitive functions and overall well-being [7-10]. A lot of studies confirmed that people that are more physically active have a lower rate of overall mortality [11,12].

Therefore, the minimal level of physical activity is promoted by many international and national organizations for maintaining health and functional capacity of societies. The best known and documented are Global Recommendations on Physical Activity for Health developed by World Health Organization (WHO)[13]. In these guidelines, an accumulation of at least 150 minutes of moderate physical activity (MPA) or at least 75 vigorous physical activity (VPA) during the week is considered as a bare minimum for adults and older adults. It is recommended to increase physical activity up to 300 minutes of MPA or 150 minutes of VPA per week for achieving more health benefits .

Considering the fact that the world's population is aging, a special attention should be paid on health behaviors of older people. Participation of seniors in physical activity has a beneficial effect on functional ability and reduces the risk of functional limitations [14,15]. It allows them to maintain independence and keep self-reliance, which is very important for a good quality of life. Therefore,

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the monitoring of percentages of adults and older adults who meet recommendation on physical activity for health is an important and current research problem [16-18].

The relationship between various parameters of physical activity and functional fitness among older adults was confirmed in the previous studies [19,20]. Some researchers also emphasized the association between physical activity and quality of life among middle-aged and older adults [21-23]. However, the physical activity was measured using subjective self-reported assessment methods (questionnaires). It was confirmed that self-reported physical activity is often overestimated [24,25].

Therefore the aim of this study was to identify the differences in functional fitness and quality of life among women over 60 years of age depending on their level of objectively measured physical activity according to Global Recommendations on Physical Activity for health.

2. Materials and Methods

2.1. Participants

This study was approved by the ethical committee of Jerzy Kukuczka Academy of Physical Education in Katowice (No. 2/2012). The study used cross-sectional design with 213 women over 60 years of age. All participants were volunteers from Senior Clubs and Universities of the Third Age from regions near Katowice, Poland. The inclusion criteria were as follows: age, gender (women), agreement to participate in full study protocol (functional fitness assessment, weekly monitoring of physical activity using Actigraph monitor, quality of life assessment using questionnaire). The total number of participants was 213, included only women who met the inclusion critieria, implemented the full research program, and their whole data from all measurements were complete according to adopted criteria described in methodology sections. Women with missing data were excluded from analysis. More detailed participants characteristic is presented in table 1.

Table 1. Participants characteristic

	N	%
Age [years]		
60-64	70	32,9
65-69	74	34,7
70-74	43	20,2
75-79	17	8,0
80-85	9	4,2
Total	213	100,0
BMI		
18-24,9	53	24,9
25-29,9	73	34,3
30-34,9	56	26,3
35-39,9	23	10,8
40-45	8	3,8
Total	213	100,0
Physical activity [min/week]		
MPA>150	104	49,1
MPA>300	72	33,8
VPA>75	3	1,4
PA Recommendations		
Meet	104	49,1

Not meet	108	50,9

PA – physical activity, MPA – moderate physical activity, VPA – vigorous physical activity

2.2. Physical activity assessment

Physical activity was recorded for seven consecutive days using tri-axial accelerometer actigraph Gt3X worn at the waistband. Data from Actigraph were processed using the following settings:

- Acceleration were accumulated from three axes (vertical, medio-lateral, anterio-posterior) and combined into a vector magnitude score (VM),
- Valid day was defined as minimum 10 hours of wear time,
- Data were integrated into 60-second epochs and expressed as counts per minutes (cpm),
- Non-wear time was defined as 60 consecutive minutes of 0 cpm, with allowance for 1-2 minutes of counts 0-200 cpm (Troiano algorithm modified for VM data) [26,27],

The raw data from Actigraph were analyzed using Actilife v. 5 software and three levels of physical activity were identified according to following threshold counts values: 200-2689 cpm for light physical activity (LPA), 2690-6166 cpm for moderate intensity of physical activity (MPA) and more than 6167 cpm for vigorous intensity of physical activity (VPA) [28]. Physical activity was assessed according to Global Recommendations on Physical Activity for Health developed by World Health Organization (WHO)[13]. Therefore, women who accumulated at least 150 minutes of moderate physical activity or at least 75 minutes of vigorous physical activity or combination of moderate and vigorous activity during the week were considered to be sufficiently physically active.

2.3. Functional fitness assessment

To measure physical parameters associated with functional ability the Senior Fitness Test was used [1]. This test is designed for people over 60 years of age, and consist of 6 item test:

- 8-Foot Up and Go – to asses agility / dynamic balance. Number of seconds required to get up from the chair, walk 8 feet distance (2.44 m), turn and return to the seated position.
- 30-Second Chair Stand – to assess lower body strength. Number of full stands in 30 seconds with arms folded across the chest.
- Arm Curl – to assess upper body strength. Number of full curls in 30 seconds holding a hand weight of 2 kg.
- Back Scratch – to assess upper body flexibility. With one hand reaching over the shoulder and the other hand in the middle of the back. The result was the number of centimeters between extended middle fingers (+ or -).
- Chair Sit and Reach – to assess lower body flexibility. Test was performed in a sitting position in front of a chair, with one leg extended and hands reaching as far as possible toward toes. The result of this trial was the distance calculated in centimeters (+ or -) between extended fingers and tip of the toes.
- 2-minute Step Test – This test was used as alternate aerobic endurance test because of space limitation

Additionally, the hand grip strength was measured using hand-held hydraulic dynamometer JAMAR. The measurement was made in the standing position with the full extended elbow. For analysis the best result (in kg) obtained from 3 reps was selected.

2.4. Quality of life assessment

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The quality of life was assessed using short form of the standardized questionnaire WHOQOL-bref in polish version. This questionnaire contains 26 questions and allows to recognize individual's perception of quality of life in four domains [29]:

1. Physical health (activities of daily living, dependence on medicinal substances and medical aids, energy and fatigue, mobility pain and discomfort, sleep and rest, work capacity)
2. Psychological (bodily image and appearance, negative and feelings, self-esteem, thinking, learning, memory and concentration)
3. Social relationships (personal relationships, social support, sexual activity)
4. Environment (financial resources, freedom, physical safety and security, health and social care: accessibility and quality, home environment, opportunities for acquiring new information and skills, participation in and opportunities for leisure activities, physical environment, transport).

The questionnaire was self-administrated by participants. Domain scores were scaled in a positive direction (higher scores denote higher quality of life). The scores from questionnaire were calculated according to WHOQOL manual and the raw scores were converted to 1-100 scale.

2.5. Statistical analysis

Basic features of the data in this study were described using: statistical means (M) and standard deviations (SD) for quantitative data, and frequencies or percentages for qualitative data. The differences in the scores obtained in senior fitness test battery, hand-grip strength and quality of life between women who met and did not meet the physical activity recommendations were identified using non-parametric U-Mann Whitney test. The association between meeting PA recommendations and the percentage of women with functional fitness assessed in the range of normal values for the age were assessed using Fisher's exact test.

All analyses were performed using IBM SPSS 20 software. The level of significance of p-value was set at 0,05.

3. Results

The women who met physical activity (PA) recommendations achieved better results in all functional tests except 2 minutes step trial (tab 2). The most significant differences were found in dynamic balance assessed by 8-foot Up & Go test. The physically active women needed less time to perform this trial (p<0,001). Also the upper body strength was significantly higher among women who met PA recommendations in comparison to women who were insufficiently active. The significant differences were found in both, Arm Curl (p<004) and Hand-grip (0,010) strength test.

Table 2. Functional fitness of women who met and did not meet the physical activity (PA) recommendations

	Physical activity recommendations				**p**
	Not meet (n=108)		**Meet (N=104)**		
	Mean	SD	Mean	SD	
8-Ft Up-&-Go (seconds)	7,01	2,19	6,20	1,25	**0,001**
Chair stand (no. of stands)	14,36	3,27	14,92	3,59	0,162
Arm Curl (no. of reps)	16,04	4,03	17,87	3,76	**0,004**
Chair Sit-&-Reach (cm +/-)	5,49	9,99	4,52	8,43	0,418
Back Scratch (cm +/-)	-8,94	12,53	-6,77	10,53	0,332
2-Min Step (no. of steps)	87,31	25,06	82,61	25,89	0,164
Hand-grip strength (kg)	22,87	5,05	24,99	5,60	**0,010**

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According to SFT manual, the results of senior fitness test were compared to the normal range of scores for women in various age groups. It should be noticed that regardless of physical activity level functional fitness of examined women was good. In the majority of trials more than 50% of women achieved scores that can be considered as average or above average for their age (table 3). The most limitations in functional capacity were found in the flexibility of the upper body (back scratch test). Less than 50 % of women presented at least an average level of flexibility (42,6% of women who did not meet PA recommendations and 47,1% of women who met PA recommendations).

Table 3. Results of Senior fitness test (SFT) according to norm for the age among women who meet and did not meet the physical activity recommendations

Senior Fitness Test	Normal ranges	Physical activity recommendations		p
		Not meet (n=108)	**Meet (n=104)**	
8-Ft Up&Go (seconds)	Below	40,7%	38,5%	0,780
	Average/Above	59,3%	61,5%	
Chair stand (no. of stands)	Below	10,2%	13,5%	0,526
	Average/Above	89,8%	86,5%	
Arm Curl (no. of reps)	Below	13,9%	3,8%	**0,015**
	Average/Above	86,1%	96,2%	
Chair Sit&Reach (cm +/-)	Below	20,4%	15,4%	0,375
	Average/Above	79,6%	84,6%	
Back Scratch (cm +/-)	Below	57,4%	52,9%	0,581
	Average/Above	42,6%	47,1%	
2-Min Step (no. of steps)	Below	25,9%	33,7%	0,232
	Average/Above	74,1%	66,3%	

The analysis of quality of life in various domain depending on level of physical activiy showed that senior women who met the physical activity recommendations achieved better quality of life. The mean scores in all four domain were higher among women who were physically active in comparison to women who did not meet PA guidelines. However, significant differences were found only in social relationships domain (table 4). The mean score in this domain was 70,63±17,11 among women with sedentary lifestyle, and women with recommended level of physical activity achived 74,88±14,04 score. General quality of life was also higher among physically active women (69,14±8,75) in comparison to less active senior women (67,15±10,99). However this diefference was not statistically important.

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Table 4. Quality of life (QoL) in various domain depending on meeting physical activity recommendations

Domains of Quality of Life (QoL)	Physical activity recommendations				p
	Not meet		Meet		
	Mean	SD	Mean	SD	
Physical health	59,94	12,43	61,12	8,63	0,567
Psychological	64,23	12,58	65,81	11,41	0,476
Social relationships	70,63	17,11	74,88	14,04	**0,038**
Environment	73,81	12,62	74,76	11,77	0,714
QOL general	67,15	10,99	69,14	8,75	0,273

4. Discussion

The main purpose of this study was to identify the differences in functional capacity and quality of life among women over 60 years of age depending on the Global Recommendations on Physical Activity for Health. In our study 49% of women accumulated during the week recommended dose of moderate or vigorous physical activity. According to the previous study, this result should be considered very optimistic. In the study performed by Shiroma, *et al.* [30] the percentage of older women who accumulated at least 150 min/week of moderate or vigorous physical activity, on the basis of measurement with the same cut-points settings (2690 cpm), were only 19,3%. However, participants in this study were volunteers from Senior Centers and Universities of Third Age. Probably these types of institutions implement educational and promotional programs of health activities, which might resulted in better health behaviors of participants.

In our study women who met physical activity recommendations achieved better results in senior fitness tests, especially in dynamic balance and upper body strength. The relationship between physical activity and functional fitness among older adults was confirmed in other studies [20,31,32]. In our study also the hand-grip strength was higher (2,12 kg) among women who met the PA recommendations. The similar results were reported by Laddu, *et al.* [33]. In their research high PA groups (>/=1,200 metabolic equivalent (MET)-min/wk) had stronger grip strength, more chair stands, and faster gait speeds than sedentary women.

Our study demonstrated that level of physical activity is significantly associated with social relationships domain of quality of life (QoL). However, regardless of domain, slightly better scores of QoL were identified among physically active women in comparison to insufficiently physically active participants. The positive influence of physical activity on quality of life was presented in many other studies [34-39]. Vagetti, *et al.* [23] indicated that weekly volume of moderate and vigorous physical activity (MVPA) was associated with several domains of QOL, and higher frequency of MVPA was associated with better scores in 10 QOL domains.

Other studies also performed among the Polish population by Puciato, *et al.* [40] using the WHOQOL-bref questionnaire, the odds of high assessment of overall quality of life increased with respondents physical activity level. However, in comparison to our study, the physical activity was estimated using the international physical activity questionnaire (IPAQ), while we measured physical activity by tri-axial accelerometers.

Participants in our study were recruited from Senior Centres and Universities of the Third Age. The Relationship between levels of physical activity and quality of life among students of the University of the Third Age was recognized by Krzepota, *et al.* [41]. They showed that highly active seniors declared better QoL in the psychological and social domains more often than other respondents. However, also in this study the physical activity was estimated using IPAQ questionnaire.

The most significant relations between meeting of physical activity recommendations and quality of life were found in the social relationships domain. This domain was also significantly related to physical activity level in other studies [36,41].

Limitation of the study

The main strength of this study is using accelerometers for identification of physical activity levels. This guarantee more accuracy of the results in comparison to self-reported physical activity. The main limitation of this study is cross-sectional design with a convenience sample. Therefore, future studies should focus on the evaluation of the effects of implemented physical activity programs on functional fitness and quality of life among older adults.

5. Conclusions

There is an association between meeting physical activity recommendations and functional fitness and quality of life among women over 60 years of age. Physical activity programs developed on the basis of WHO recommendations have the potential to improve functional capacity and quality of life among aging women. However, further experimental studies in this area are needed.

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