FITNESS EDUCATION AND TRAINING FOR ELDERLY POPULATION

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Abstract: Adulthood, particularly the senior or elderly stages of life, brings about significant changes primarily in the social sphere, which in turn affect behaviors related to physical activity (PA). Upon retirement, the decline in activity levels is directly linked to previous work engagement, levels of socialization, family presence, and the social network available to an older adult.
With this in mind, we sought to assess physical activity behaviors among beneficiaries of a day center for the elderly and, further, to examine the effects of a physical training program specifically adapted and designed to meet identified needs. These needs reflect age-related changes and the prevalence of low activity levels, with evaluation and intervention crafted by experts in sports, kinesiology, and elderly care as part of the project "***Erasmus+ KA220-VET – Cooperation partnerships in vocational education and training***." The participants (n=24, age 69,79) engaged in a three-month exercise program, at the end of which notable improvements were observed in flexibility, grip strength, and certain components of coordinative capacity ($p<0.05$). The study highlighted the positive impact of physical exercise on the fitness levels of senior participants and demonstrated how this training model could be implemented across other centers serving the elderly.

Keyword*:* elderly, aging, fitness, assesment, training

Introduction

The benefits of maintaining a short or long-term level of physical activity (Olson et al., 2023) are well-known. The "Global Status Report on Physical Activity 2022" by the "World Health Organization" (2022) underscores "the need to promote physical activity among older adults", is highlighting the widespread reality that "*in most countries*," activity levels decline as individuals age. Also "World Health Organization" advocates for a "*Global Action Plan on Physical Activity 2018-2030*", recognizing interconnected factors, even at the environmental level, and noting influences from economic, political, and cultural domains (Abu-Omar et al., 2020). Worldwide guidelines are available in various languages, and both literature and media consistently discuss quantitative recommendations based on studies involving multiple subjects.
The intensity of physical activity is frequently cited as key to maintaining good health. For example, Tudor-Locke et al. (2021) in the "*Cadence-Adults Study*" used a cycle ergometer to identify an accessible algorithm for quantifying METs (metabolic equivalents) across different age groups. Their lab-based findings offer practical guidance, showing that for adults aged 61-85, 100 steps correspond to 3 METs, 110 steps to 4 METs, and 120 steps to 5 METs (Tudor-Locke et al., 2021). This type of walking, calculated in steps per minute, aligns with the general recommendations, which suggest minutes of physical activity based on age, to help maintain a satisfactory fitness level crucial for preserving health. Particularly in older adults, a lack of comprehensive movement increases functional decline and raises the risk of various health conditions.
Assessing levels of physical activity and fitness, along with implementing a *preventive-therapeutic approach* to counteract sedentary behavior and functional changes in the elderly, should be guided by established frameworks grounded in reliable statistical evidence.
The positive impact of physical activity on mental functions should also not be overlooked (McPhee et al., 2016), especially when exercise is coupled with social

interaction and motivation, which, in turn, help reduce the risks associated with inactivity and chronic health conditions.

Physiological Considerations for the Elderly in Physical Activity

Saxena et al. (1997) identified factors defining quality of life as: *physical health* (including the acceptance of disability or illness), *psychological well-being, independence, and the individual's relationships with their environment* (living area, family dynamics, or social interactions).

Aging, especially in later adulthood, brings significant changes, particularly in the social domain, which influence behaviors related to physical activity (PA).

It is important to emphasize that today's elderly population often lives much longer than previous generations, and for this demographic, maintaining a high quality of life is crucial.

The health and preservation of the nervous system and its functions, such as balance and movement coordination, should be more widely promoted among older adults, as these directly impact functionality and independence. Numerous health and fitness variables present challenges for trainers or therapists when designing fitness programs aimed at increasing PA levels among the elderly. Consequently, many professionals find this population segment challenging to approach, despite the broad benefits of PA, which should be one of the most advocated methods for "managing aging".

Methods

The study aimed to identify the outcomes following the application of a standardized assessment and training program, conducted over a period of three months, with 24 elderly participants aged between 63 and 80 years. These individuals volunteered to participate in this "challenge" and successfully adhered to the research requirements outlined in the study.

Objectives of the research

General Objectives

- To provide methodological data regarding the assessment and recommendations applicable to elderly individuals with varying fitness levels, aimed at improving parameters associated with quality of life and maintaining good health;
- To analyze the impact of a standardized physical activity program on fitness levels in the elderly.

The study involved 24 participants, inpatients at a day center in Romania, who voluntarily agreed to participate in this research between April and June 2024.

Inclusion Criteria for Study Participants:

• Retirees over the age of 60

• Subject without cardiovascular or other health conditions that would be a contraindication to participate in-PAproposed programs (such as arrhythmias, cancer, recent surgeries)

• Ability to perform at least 20 minutes of exercises from the center's program at home, three times a week.

Data collection through a questionnaire (administered at the beginning - T1, and end - T2 of the follow-up period) identified participants' PA levels. The sedentary behaviors impact in a negative way the quality of life especially of urban-residing elderly individuals.

The comparative results between T1 and T2 were recorded after 24 *supervised* sessions of fitness training and education on integrating exercise programs regularly to improve fitness levels.

1. The given questionnaire aimed to gather information on the following:

- Anthropometric characteristics of participants (age, weight), from which Body Mass Index (BMI) was calculated,

- Physical activity behaviors, specifically regarding the preferences and especially the previous attitudes of individuals towards PA.

2. The senior fitness assessment designed under the "Erasmus+ KA220-VET – Cooperation partnerships in vocational education and training project".

This series of tests, adapted for older adults to determine their fitness level and functional capacity, includes: 1) *Chair Stand Test or Sit-to-Stand Test*, 2) *Arm Curl Test or Bicep Curls*, 3) *2-Minute or 6-Minute Walk Test*, 4) *Chair Sit-and-Reach Test*, 5) *Back Scratch Test*, 6) *Foot Up-and-Go Test* (Innovative

Intersectoral Training Kit for Professionals Working with Elderly Individuals – Caregivers and Physical Trainers, 2024).

Physical activity behaviors, specifically regarding the movement preferences of the elderly individuals assessed, and their relationship with physical activity.

The subjects' living environment was urban, with a significant number residing in apartment buildings (18 out of 24). The living environment plays a crucial role; those residing in houses reported more daily activities, such as yard and garden maintenance or caring for pets like dogs and cats, which increased their daily activity level and had a positive impact on their fitness levels. Conversely, those living in apartments did not have the same opportunities for such activities. The subjects' ages were over 63 years, with an average of 69.79 years (see Figure 2); 10 participants (41.6%) were women, and 14 (58.3%) were men (Figure 1).

Regarding marital status, married participants were more active, while those who were single or widowed (5 subjects) lived either alone (2 subjects) or with extended family (children, grandchildren).

In terms of body weight, the average BMI was 28.26, which falls within the range of 25.00 to 29.99, defining overweight status. Four participants had a BMI under 25, indicating a normal weight (see Figure 2).

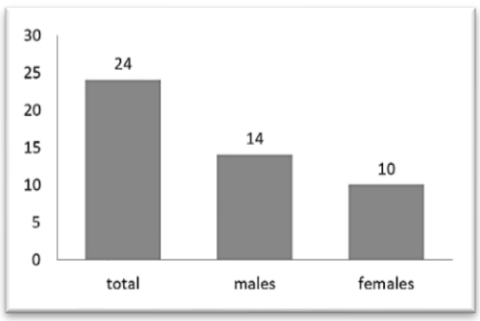

Figure 1. Gender Distribution of Participants

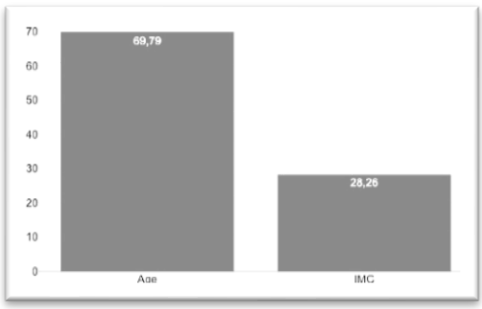

Figure 2. Age and Body Mass Index (BMI) of the Studied Participants

Research Design

The 24 participants followed an exercise program aimed primarily at achieving an improved state of fitness.

The exercise program implemented after the initial assessment (T1) focused on restoring and improving balance, coordination, and postural control.

The training phases were adhered to: warm-up (5-10 minutes), the main workout (20-30 minutes), and the cool-down period after exercise (5-10 minutes).

Participants performed exercises at low, moderate, and vigorous intensities depending on their functional level: beginner, intermediate, or advanced (see Innovative Cross-Sector Training Kit for Professionals Working with the Elderly (Caregivers and Physical Instructors), 2024).

Exercises targeting each major muscle group were applied, progressively increasing up to 10 repetitions.

Walking exercises in various forms (tandem walking, stepping over objects, loop walking, multi-component training, etc.) were also included.

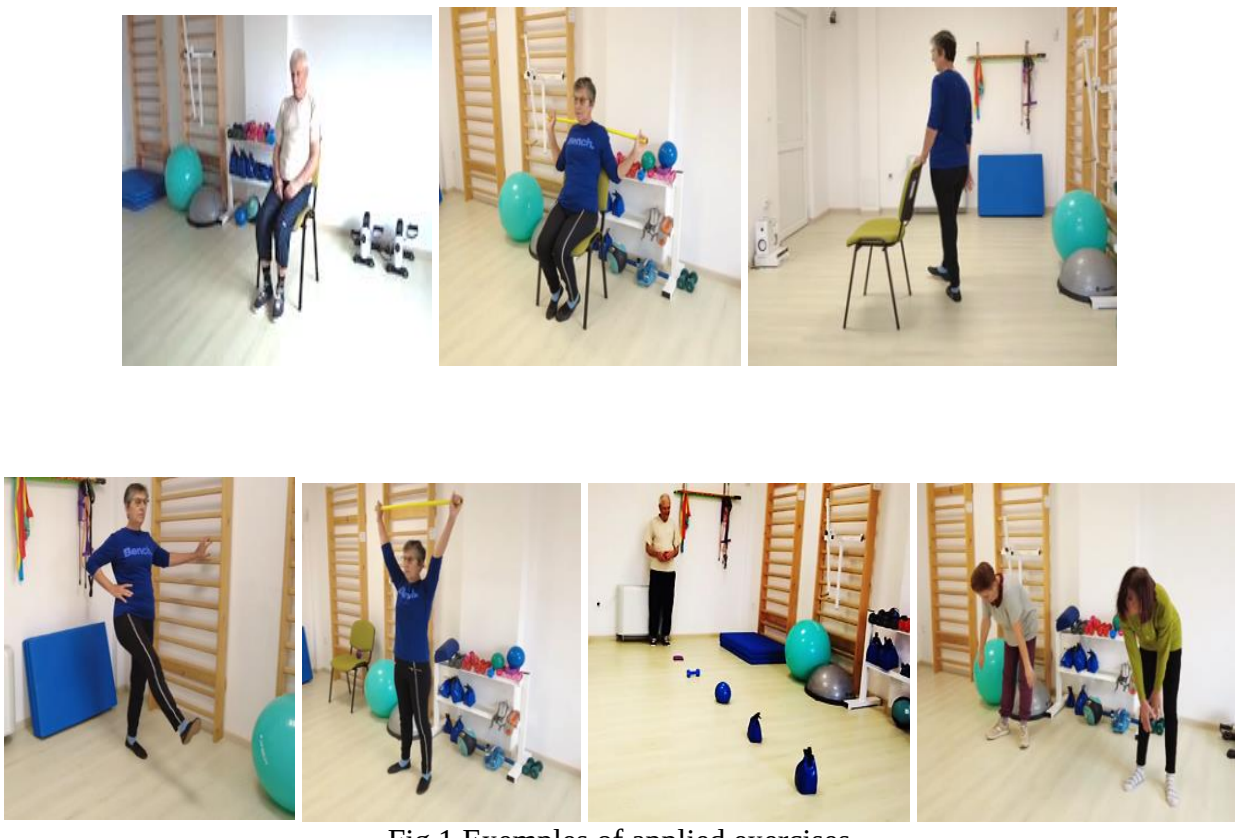

Fig.1 Exemples of applied exercises

The subjects participated in two supervised sessions per week, totaling 24 sessions over the 3-month monitoring period. The final assessment (T2) was conducted during the last session (session 24).

The subjects were advised to follow the program designed under the supervision of the trainer at the day center, as well as at home, at least three times per week. Only those who participated in all assessments were included in the statistical analysis.

Results

The research was a descriptive, longitudinal study. The data were analyzed using the program *DATAtab: DATAtab Team (2024).* Regarding the average age of the study participants and their body mass index, a negative skewness is observed (Table 1).

For the elderly, and possibly even more so than for other population groups, an intervention aimed at maintaining or reducing weight is essential, among other things, to mitigate the negative effects of age-related joint changes (joint structures become stiffer due to age-related dehydration), which are accompanied by pain. These pains trigger a vicious cycle, with physical inactivity at its core, leading to the restriction of activities that further amplify and exacerbate the age-related degenerative changes in the joints, muscles, and bones.

Ultimately, these changes result in a behavior characterized by reduced engagement in physical activities (which leads to muscle loss), a primary element in the emergence of risk factors for various conditions or the onset of frailty in the elderly, along with decreased autonomy and social independence, ultimately lowering quality of life. Partridge et al. (2018) discusses the “challenges of agin” for human subjects, highlighting the need for behavioral interventions, particularly to address nutrition and weight control. In a systematic analysis, Ryan et al. (2020) found a strong association between biological aging (quantified through DNA methylation as a marker of biological age) and BMI and frailty.

Table 1. Data related to age and body mass index

	Age	BMI
Mean	69,79	28,26
Std. Deviation	4,53	3,93
Minimum	63	22
Maximum	80	34
Skew	0,57	-0,01

*BMI= body mass index

Table 1 presents the descriptive statistics of study participants in term of age and body mass index (BMI). It is observed that the average BMI is 28.26. According to Kıskaç et al. (2022), subjects with BMI values <25 and >35 kg/m² face a higher risk of functional capacity decline, those subjects present especialy walking or balance deficiencies, with a higher risk of falls or with a decreased muscle strength. Based on their findings, BMI values of 31-32 for women and 27-28 for men are recommended as the minimum thresholds to define good functional or health status.

From *the series of tests in the Innovative Cross-Sectoral Training Kit for Professionals Working with Older People*, we have selected to present the *Chair-Sit and Reach test and the Foot Up-and-Go test*, which have shown significant value changes between the two evaluation moments.

Table 2. Descriptive statistics for the tests FOOT UP-AND-GO and CHAIR-SIT AND REACH

	T1_FOOT UP-AND-GO TEST	T2_FOOT UP-AND-GO TEST	T1_CHAIR-SIT AND REACH TEST	T2_CHAIR-SIT AND REACH TEST
Mean	4,35	2,97	-4,5	-3,37
Std. Deviation	2,03	1,58	3,62	3,4
Minimum	1,71	1	-12	-12
Maximum	9	7	0	0

The T1_*foot up-and-go test* group had higher values (*M* = 4,35, *SD* = 2,03) than the *T2_foot up-and-go test* group (*M* = 2,97, *SD* = 1,58). The T1_*chair-sit and reach test* group had lower values (*M* = -4,5, *SD* = 3,62) than the *T2_chair-sit and reach test* group (*M* = -3,37, *SD* = 3,4).
The data from the previous table (Table 2) shows a decrease in the recorded values (time taken to complete), which indicates an improvement in the speed of performing the test and an enhancement in the functionality of the 24 subjects.

Table 3. Inferential statistics for the Foot Up-and-Go test and the Chair-Sit and Reach test

	t	df	p	Cohen's d
T1_FOOT UP-AND-GO TEST - T2_FOOT UP-AND-GO TEST	10,86	23	<.001	2,22
T1_CHAIR-SIT AND REACH TEST - T2_CHAIR-SIT AND REACH TEST	-5,33	23	<.001	1,09

A t-test for paired samples showed that this difference was statistically significant, *t*(23) = 10,86, *p* = <.001, 95% Confidence interval [1,12, 1,64]. The t-test result was therefore significant for the present data and the null hypothesis was rejected. With *d* = 2,22 there was a large effect. For the chair-sit and reach test, the t-test for paired samples showed that this difference was statistically significant, *t*(23) = -5,33, *p* = <.001, 95% Confidence interval [-1,56, -0,69].

The t-test result was therefore significant for the present data and the null hypothesis was rejected. The effect size *d* was 1,09, indicated a large effect.

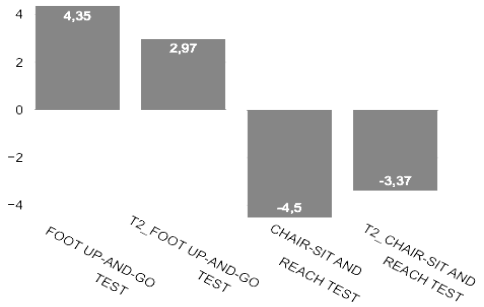

Fig. 3. Graphical representation of the average values at the two evaluation points for the studied subjects

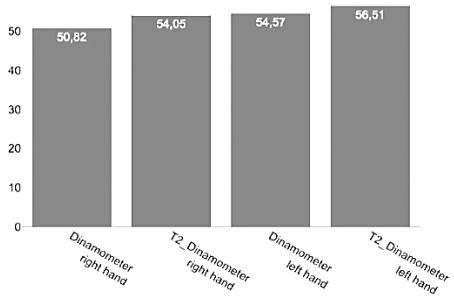

Fig. 4. Graphical representation of the average values in the dynamometric assessment

As an objective measure of the functional improvement of the proposed program, we chose to assess the grip strength of each subject using a medical digital dynamometer (CAMRY spring dynamometer) on both hands.
In geriatric practice, CAMRY-type dynamometers, according to Huang et al. (2022), are inexpensive, easy-to-use, and practical tools, with reliable grip strength values obtained from them.

Table 3. Average values obtained from dynamometry between the two arms and at the two measurement points.

	T1_Dinamometer right hand	T1_Dinamometer left hand	T2_Dinamometer right hand	T2_Dinamometer left hand
Mean	50,82	54,57	54,05	56,51
Std. Deviation	22,15	21,62	20,67	21,47
Minimum	23,5	18,9	25	20
Maximum	81,2	83,6	83	85

As shown in Table 3 and Figure 4, there is a noticeable difference between the two testing moments.

The decline in muscle strength, particularly handgrip strength, is a sign of frailty and decreased physical function in the elderly, and there is a lack of standardization regarding the normative values for this evaluation (Benton, 2022). Vaishya et al. (2024) refer to handgrip strength as "*a vital sign of health,"* especially in elderly subjects.
However, this type of assessment is easy to use in practice by coaches or therapists and can objectively quantify progress. The "biomarker" values (Vaishya et al., 2024) obtained from the 24 participants were progressively higher, demonstrating the beneficial effects of the program on functional capacity.
Wang et al. (2018) in the United States and Amaral et al. (2019) in Brazil attempted to define reference values of handgrip strength by age groups that can be used in practice. However, for our study, the values obtained served as a prognostic tool or a measure of progression and were used to verify results obtained from other tests proposed by the Senior Fitness Test designed within the "Erasmus+ KA220-VET – *Cooperation Partnerships in Vocational Education and Training project*."

Table 4. The inferential statistics in dynamometric testing

	t	df	p	Cohen's d
T1_Dynamometer right hand - T2_Dynamometer right hand	-2,55	23	,018	0,52
T1_Dynamometer left hand - T2_Dynamometer left hand	-6,13	23	<.001	1,25

According to the values presented in table 4, for the dinamometer right hand the calculated t-statistic for the test, which in this case is -2,55. A t-statistic is a measure of the difference between the two groups relative to the variation in the data. The negative sign indicates the direction of the difference, suggesting that the mean score for the T1_Dynamometer right hand group is lower than the T2_Dynamometer right hand group.
The p-value is .018, indicating the probability of observing the test results, or more extreme, given that the null hypothesis is true, so this result suggests that there is a statistically significant difference between the T1_Dynamometer right hand and T2_Dynamometer right hand means. A Cohen's d of 0,52 is considered a medium effect size.
The T1_*Dynamometer left hand* group had lower values (M = 54,57, SD = 21,62) than the *T2_Dynamometer left hand* group (M = 56,51, SD = 21,47). A t-test for paired samples showed that this difference was statistically significant, $t(23)$ = -6,13, p = <.001, 95% Confidence interval [-2,6, -1,29]. The t-test result was therefore significant for the present data and the null hypothesis was rejected.

Conclusions

Although aging is a natural process, the changes it brings to our bodies significantly impact the quality of life. As a result, many elderly individuals experience age-related conditions that may discourage them from being more physically active.
Langhammer et al. (2018) emphasized that older adults are unlikely to engage in long-term physical activities without support and supervision. Therefore, the dropout rate from such activities may be higher.
Encouraging regular physical activity can be a significant challenge for authorities, particularly in less affluent areas. McPhee et al. (2016) pointed out that vigorous sports and resistance exercises are not commonly practiced among the elderly.
Experts recommend simple guidelines: 30 minutes of physical activity daily to reduce many of the health issues associated with a sedentary lifestyle. Unfortunately, this recommendation lacks further details on how this process should be implemented, especially for the elderly.
The influence of specialists, family members, or acquaintances can play a decisive role in increasing motivation (McPhee et al., 2016) among the elderly, particularly when it comes to participation in or engagement with physical activities. It is crucial for exercise programs to be tailored to individual needs and conducted under the supervision of professionals in the field.
A key aspect highlighted in this *training kit* for specialists working with the elderly is that an informed, evidence-based intervention is critical to overcoming the barrier of recommending physical activities to older adults. Izquierdo et al. (2021) even argue that it is unethical not to prescribe physical exercise for individuals over the age of 75, especially since supervised interventions have proven to be safe and effective in preventing or alleviating functional and cognitive decline. According to their conclusions, physical exercise has not been fully integrated into primary or geriatric medical practice and is nearly absent from the basic training of most doctors and other healthcare providers (Izquierdo et al., 2021).
The studies mentioned consistently show that physical exercise can help prevent or manage conditions such as depression and anxiety, which are common among older adults. In Romania, the lack or limited availability of community facilities for the elderly, such as fitness centers with cardio equipment,

weights, and space for movement, can present barriers to elderly participation in physical activities.

Community centers are spaces where elderly Romanians have the opportunity to reconnect with therapists or specialists who can introduce them to simple, viable, science-based methods for resuming or starting a long-term physical activity program. Physical activity is essential for mitigating the effects of aging.

Aknowlegment

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