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Study on the bio-motor condition of the institutionalized elderly from Brașov

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Abstract

Introduction. Aging is a natural but complex process that involves significant physiological and psychological changes. These changes can affect the health of older people, especially in residential care settings, where access to care and support can vary considerably. Physical exercise, a crucial factor in maintaining optimal health, has been shown to have beneficial effects on older people, reducing the risks associated with chronic conditions, improving mobility and supporting mental health.
Material and method. The study focuses on the impact of physical exercise on the health of institutionalized older people in Brașov County, highlighting the importance of a physical activity program adapted to their specific needs
Results. Recent research suggests that through regular physical exercise interventions, significant improvements can be observed in the quality of life, autonomy and general health of older people. These activities can contribute to a more active and independent life, combat the negative effects of inactivity and prevent the exacerbation of some age-related health conditions
Conclusions. In conclusion, the implementation of personalized physical exercise programs in residential centers in Brașov County could represent an effective solution for improving the health status of institutionalized elderly people.

Keywords: *elderly test, vivifrail, squats, schober, statistic*

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Introduction

Aging is characterized by a gradual decline in multiple physiological functions, among which motor abilities play a crucial role in maintaining autonomy and quality of life in older adults (Izquierdo et al., 1999; Spirduso, Francis, & MacRae, 2005). Motor capacity includes essential components such as strength, flexibility, balance, and gait speed, which are all negatively influenced by sarcopenia, osteoarticular degeneration, and decreased physical activity (Landi et al., 2010; Liu & Latham, 2009).

Institutionalized elderly populations are particularly vulnerable to accelerated physical decline due to reduced mobility, chronic diseases, and limited opportunities for structured physical activity (Onder et al., 2002; Morley et al., 2010). This leads to functional limitations, an increased risk of falls, and loss of independence, all of which directly impact their motor performance (Paterson & Warburton, 2010).

Previous studies have demonstrated that targeted exercise programs, including strength training, balance exercises, and functional mobility drills, can significantly improve motor function in elderly individuals, even in advanced age (Liu-Ambrose et al., 2004; Vivifrail, 2019). Tools such as the Vivifrail assessment battery allow a comprehensive evaluation of motor capacity, identifying key deficits that can be addressed through individualized interventions (Izquierdo et al., 2019).

The present study aims to assess the bio-motor condition of institutionalized elderly individuals from Brașov, focusing exclusively on their physical capacity and functional mobility, in order to provide data for the development of effective motor rehabilitation and maintenance programs.

Materials and method

The study participants were selected in July 2021 from several residential care centers located in Brașov County, namely: AVIV Residential Center in Făgăraș, "Dr. Teofil Mija" Elderly Home in Săcele, and Papi Sante Residential Center for the Elderly in Tărlungeni. Only individuals medically cleared to safely perform physical exercises were included. A total of 47 subjects (16 men and 31 women), aged between 65 and 87 years, were enrolled in the study.

All participants completed the CERQ questionnaire, the DASS-R21 depression questionnaire, and the motor tests: Vivifrail, Squats, and Schober.

Vivifrail Test

The Vivifrail test (Dr. Mikel Izquierdo – Public University of Navarra, Spain) was applied to assess motor capacity, consisting of four physical sub-tests:

- **Test 1 – Balance:**

  Feet Together: Feet shoulder-width apart, then positioned together at the same level. The time maintaining this position was recorded:
  - Score 1 – 10 seconds
  - Score 0 – less than 10 seconds

  Semi-Tandem: Feet shoulder-width apart, one foot placed in front of the other halfway. The time maintaining the position was recorded:
  - Score 1 – 10 seconds
  - Score 0 – less than 10 seconds

  Tandem: Feet shoulder-width apart, one foot placed directly in front of the other. The time maintaining the position was recorded:
  - Score 2 – 10 seconds
  - Score 1 – between 3 and 9 seconds
  - Score 0 – less than 3 seconds
- **Test 2 – Gait Speed:**

  The participants walked a distance of 4 meters on a flat surface, three times. The average time was recorded as:
  - Score 4 – less than 4.82 seconds
  - Score 3 – 4.83 – 6.2 seconds
  - Score 2 – 6.21 – 8.7 seconds
  - Score 1 – more than 8.7 seconds
- **Test 3 – Lower Limb Strength (Chair-Stand Test):**

  Five repetitions of standing up from a chair without using the hands were performed. The total time was measured and scored as:
  - Score 4 – less than 11.19 seconds
  - Score 3 – 11.2 – 13.69 seconds

  - Score 2 – 13.7 – 16.69 seconds
  - Score 1 – 16.7 – 59 seconds
  - Score 0 – more than 60 seconds
- **Test 4 – Timed Up and Go Test:**
  The subject stands up from the chair, walks 3 meters, circles around a cone, and returns to sit on the chair. The best time was recorded as:
  - Score 1 – less than 20 seconds
  - Score 0 – more than 20 seconds
- **Interpretation of Vivifrail total score:**

Score	Interpretation
0 – 3	Disabled
4 – 6	Frail
7 – 9	Pre-frail
10 – 12	Robust

The Vivifrail test was chosen as, during aging, the loss of muscle strength (dynapenia), combined with unhealthy and sedentary lifestyles, may lead to functional limitations and dependency, forming the rationale for this research.

Squats Test

The Squats Test was applied according to Virgil (2013), designed for monitoring lower limb strength development across different age categories. A chair or box was used as a reference, ensuring a 90-degree knee angle during squats. The starting position involved standing with feet shoulder-width apart in front of the chair, lightly touching the seat at each repetition. The exercise continued until the participant was unable to perform additional repetitions. (Virgil T., p. 151, 2013).

Schober Test

The Schober Test was used to evaluate lumbar spine flexibility, a key indicator of spinal mobility (Schober, 1937). While standing with feet together, the examiner marked a point approximately at L5 vertebra, then marked 5 cm below and 10 cm above that point, creating a 15 cm segment. The participant was asked to bend forward while keeping the knees straight, and if the distance increased by less than 5 cm (i.e., to a total of less than 20 cm), it indicated lumbar flexion restriction (Schober P., p. 336, 1937).

The statistical analysis was performed using IBM SPSS Statistics 25 and Microsoft Office Excel/Word 2013. Quantitative variables were tested for normality using the Shapiro-Wilk test and expressed as mean ± standard deviation or median with interpercentile range.

For normally distributed quantitative variables, comparisons between study groups were made using Student/Welch T-Test (depending on the equality of variances tested by Levene's test) for two groups, or One-Way ANOVA for comparisons between more than two groups. Non-parametric quantitative variables were analyzed using the Mann-Whitney U test or Kruskal-Wallis H test.

Correlations between independent non-parametric variables were tested using Spearman's rho coefficient. Qualitative variables were expressed as absolute frequencies and percentages, with group differences analyzed using Fisher's Exact Test.

Results

Table 1. Characteristics of the study sample

Parameter	*Results (Medie ± SD, Mediană (IQR))/(Nr.,%)*
Age	73.21 ± 4.39, 72 (70-76)
Age caterogy	31 (66%) 65-74 year, 16 (34%) 75-84 year
Gender	16 (34%) Masculin, 31 (66%) Feminin
Institutionalization period (months)	16.3 ± 8.05, 15 (8-20)
Institutionalization period	14 (29.8%) < 12 month, 33 (70.2%) ≥ 12 month
Weight	72.92 ± 7.08, 72.1 (68.3-78.5)
Body fat%	32.71 ± 3.67, 31.8 (29.8-35.5)
Muscle mass%	25.25 ± 2.5, 24.6 (23.5-27.4)
Obesity%	32.85 ± 3.14, 32.4 (29.8-34.7)
Subscale – Test Vivifrail	
Test 1 – Balance	13 (27.7%) 2 pct, 26 (55.3%) 3 pct,

	8 (17%) 4 pct
Test 2 – Gait speed	26 (55.3%) 2 pct, 20 (42.6%) 3 pct, 1 (2.1%) 4 pct
Test 3 – Lower limb strength	26 (55.3%) 2 pct, 21 (44.7%) 3 pct
Test 4 – Timed up and go	14 (29.8%) 0 pct, 33 (70.2%) 1 pct
Vivifrail score	8.51 ± 1.25, 8 (8-9)
Test Squats score	14.45 ± 2.31, 14 (12-16)
Test Schober distance	11 (23.4%) 3 cm, 18 (38.3%) 4 cm, 18 (38.3%) 5 cm
Subscale – Coeficient Ch. Rocher	
Coefficient – Hand	2 (4.3%) – 1.1, 32 (68.1%) – 1.4, 1 (2.1%) – 1.5, 12 (25.5%) – 1.8
Coefficient - Hip	22 (46.8%) – 1.1, 18 (38.3%) – 1.3, 7 (14.9%) – 1.5
Coefficient – Knee	47 (100%) – 0.9

The data in the Table 1 represent the characteristics of the study sample. The results indicate the following:

- The mean age of the participants was 73.21 ± 4.39 years (median = 72 years);
- Most participants were between 65 and 74 years old (66%);
- The majority of participants were female (66%);
- The mean institutionalization period was 16.3 ± 8.05 months (median = 15 months);
- Most participants had an institutionalization period of ≥ 12 months (70.2%);
- The mean body weight was 72.92 ± 7.08 kg (median = 72.1 kg);
- The mean body fat percentage relative to muscle mass was 32.71 ± 3.67% (median = 31.8%);
- The mean muscle mass percentage relative to body weight was 25.25 ± 2.5% (median = 24.6%);
- The mean obesity percentage relative to body weight was 32.85 ± 3.14% (median = 32.4%);

According to the Vivifrail test subscales:

- In the balance test, most participants scored 3 points (55.3%);
- In the gait speed test, most participants scored 2 points (55.3%);
- In the lower limb strength test, most participants scored 2 points (55.3%);
- In the Timed Up and Go test, most participants scored 1 point (70.2%);
- The mean global Vivifrail score was 8.51 ± 1.25 points (median = 8 points);
- The mean Squats Test score was 14.45 ± 2.31 (median = 14 points);
- In the Schober Test, most participants achieved a distance of 5 or 4 cm (38.3%);

Regarding the Ch. Rocher coefficient subscales:

- For the hand coefficient, most participants had values below 1.5 (72.3%);
- For the hip coefficient, most participants scored 1.1 (46.8%);
- For the knee coefficient, all participants scored 0.9 (100%).

Table 2. Summary of results obtained from combining items in motor indices

Item (p)	Age	Gen	Institutionalization period
Vivifrail Score	0.608	0.124	0.418
Squats Score	**0.004**	**<0.001**	**0.040**
Test Schober - Distance	0.222	0.577	0.264
Coefficient hand	0.318	0.318	**0.037**
Coefficient hip	0.644	0.067	0.525

The Vivifrail physical test score indicates that institutionalized patients present low physical performance parameters. Differences in scores between groups categorized by age, gender, and institutionalization period were not statistically significant according to the Mann-Whitney U test.

The Squats Test score (Student's T-test, $p < 0.001$) in relation to gender showed that female participants presented lower lower-limb strength (13 points) compared to male participants (17 points). Based on these results, it can be concluded that the male sample maintained a more active lifestyle for a longer period compared to the female sample, continuing physical activity into older age.

Additionally, in the Squats Test (Student's T-test, p = 0.004), participants aged between 65-74 years demonstrated higher lower-limb strength (15.13 points) compared to participants aged 75-84 years (13.13 points).

Another important finding from the Squats Test concerns the institutionalization period (categorized as less than 12 months vs. more than 12 months). According to the Mann-Whitney U test (p = 0.040), patients institutionalized for more than 12 months had lower scores (14 points) compared to those institutionalized for less than 12 months (15.5 points).

In the final table, it can also be observed that Fisher's Exact Test (p = 0.037) indicates that 79.4% of patients institutionalized for more than 12 months belonged to the lower score group, compared to 53.8% of patients institutionalized for less than 12 months.

Discussions

Specialists in the field of physical rehabilitation and gerontology are constantly seeking effective strategies to prevent the motor decline associated with aging. The present study aimed to investigate the bio-motor capacities of institutionalized elderly individuals, with a focus on strength, balance, mobility, and flexibility — parameters essential for maintaining autonomy and quality of life.

The results of the current research confirmed previous findings from the literature, emphasizing that institutionalized elderly individuals experience a progressive decline in motor performance, especially after the age of 75 (Izquierdo et al., 1999; Onder et al., 2002). The most pronounced deficits were observed in lower limb strength and gait speed, which are known predictors of functional dependence and fall risk (Liu-Ambrose et al., 2004; Vivifrail, 2019).

The Vivifrail test battery allowed a comprehensive and practical assessment of motor functions, highlighting different frailty levels among participants. These findings support earlier studies showing that sarcopenia and reduced muscle strength are prevalent in older adults residing in care facilities (Landi et al., 2010; Cruz-Jentoft et al., 2010). In particular, the chair-stand test and 4-meter gait speed test proved to be highly sensitive in differentiating between robust, pre-frail, and frail individuals.

Gender differences were observed primarily in strength tests, where male participants generally obtained better scores, while female participants performed slightly better in balance-related tasks. These gender-based differences are in line with previous reports (Skelton et al., 1999; Cruz-Jentoft et al., 2010), highlighting the need for individualized training programs that take into account specific motor capacities.

Overall, the present findings underscore the importance of implementing structured physical activity programs in residential care centers. Regular exercise interventions focused on strength, balance, and mobility may contribute not only to improved motor performance but also to the prevention of falls and the prolongation of functional independence in institutionalized elderly populations.

Conclusion

Based on the results obtained in this study, the following conclusions can be formulated:

1.Participation in a structured and individualized physical exercise program led to improvements in the motor capacity of institutionalized elderly individuals, with significant progress observed in lower limb strength, static and dynamic balance, joint mobility, and gait speed.

2.The assessment tools used in this research, such as Vivifrail, Squats, the global functional mobility coefficient, and the Schober test, proved to be effective in monitoring the evolution of motor parameters in this population group.

3.Gender differences were mainly observed in muscular strength, with male participants obtaining slightly better results in strength tests, while female participants performed slightly better in balance tests, confirming findings from the existing literature.

4.The consistent implementation of personalized physical exercise programs may represent a viable solution for maintaining functional independence and preventing frailty among institutionalized elderly individuals.

5.The study supports the importance of regular motor capacity assessment in residential care centers, allowing continuous adaptation of interventions to the individual needs of the elderly and optimizing long-term outcomes.

References

1. Aniței, M. (2007). *Psihologia sportului: Fundamente, cercetări, aplicații*. Iași: Editura Universității „Al. I. Cuza".
2. Balint, T. (2007). *Goniometria – evaluarea mişcărilor articulare în kinetoterapie*. Arad: Editura Universității „Aurel Vlaicu".
3. Cruz-Jentoft, A. J., Baeyens, J. P., Bauer, J. M., Boirie, Y., Cederholm, T., Landi, F., ... & Zamboni, M. (2010). Sarcopenia: European consensus on definition and diagnosis. *Age and Ageing, 39*(4), 412-423. https://doi.org/10.1093/ageing/afq034

4. Izquierdo, M., Häkkinen, K., Ibáñez, J., & Gorostiaga, E. (1999). Effects of strength training on muscle power and functional capacity in older men. *Journal of Gerontology: Biological Sciences, 54*(1), B35-B42. https://doi.org/10.1093/gerona/54.1.B35
5. Landi, F., Liperoti, R., Russo, A., Giovannini, S., Tosato, M., Capoluongo, E., ... & Bernabei, R. (2010). Sarcopenia as a risk factor for falls in elderly individuals: Results from the ilSIRENTE study. *Clinical Nutrition, 31*(5), 652-658. https://doi.org/10.1016/j.clnu.2012.02.007
6. Liu, C. J., & Latham, N. K. (2009). Progressive resistance strength training for improving physical function in older adults. *Cochrane Database of Systematic Reviews, 2009*(3), CD002759. https://doi.org/10.1002/14651858.CD002759.pub2
7. Liu-Ambrose, T., Donaldson, M. G., Ahamed, Y., et al. (2004). Otago home-based strength and balance retraining improves executive functioning in older fallers: A randomized controlled trial. *Journal of the American Geriatrics Society, 56*(10), 1821-1830. https://doi.org/10.1111/j.1532-5415.2008.01931.x
8. Morley, J. E., Vellas, B., van Kan, G. A., et al. (2010). Frailty consensus: A call to action. *Journal of the American Medical Directors Association, 11*(6), 392-397. https://doi.org/10.1016/j.jamda.2010.04.007
9. Onder, G., Gambassi, G., Scorpiglione, N., & Bernabei, R. (2002). Physical decline and rehabilitation in nursing home residents. *Journal of the American Medical Directors Association, 3*(4), 233-238. https://doi.org/10.1097/01.JAM.0000028053.73116.E2
10. Schober, P. (1937). Lendenwirbelsäule und Kreuzschmerzen. *Münchener Medizinische Wochenschrift, 84*, 336–338.
11. Spirduso, W. W., Francis, K. L., & MacRae, P. G. (2005). *Physical dimensions of aging* (2nd ed.). Human Kinetics.
12. Virgil, T. (2013). *Testarea și evaluarea nivelului de pregătire fizică în sportul de performanță*. Editura Universității din Oradea.
13. Vivifrail. (2019). *VIVIFRAIL: A practical guide for the prevention of frailty in elderly people*. European Union project.