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Pilates for Balance Improvements in the Elderly

[*Método Pilates para mejorar el equilibrio en los adultos mayores*]

[*Método Pilates para melhorar o equilíbrio em idosos*]

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ABSTRACT

Introduction: In Ecuador, the practice of Pilates has helped the elderly reduce the rate of falls, improving balance. It has demonstrated its effectiveness and encouraged the older population to use it. This method is not well known, though it has recently gained importance thanks to the physical fitness levels provided by therapists.

Aim: To analyze the effectiveness of flexibility exercises based on Pilates for the eldery.

Methods: The BERG test, consisting of 14 items, was used to measure static balance and dynamics; it also helps prevent the risk of falling in older age adults. This study comprised 30 advanced age adults, 13 men and 17 women.

Results: Proper application of Pilates maintains or improves the balance of older adults, allowing them to have autonomy to perform everyday activities without the assistance of other people.

Conclusions: Although the effectiveness of Pilates has been demonstrated to improve balance, there is little knowledge and experience among therapists in the application of this method, considering that in addition to rehabilitation, it is a proper exercise alternative that contributes to mental, physical, and emotional balance.

Keywords: exercise, healthy aging, exercise techniques with movements.

RESUMEN

Introducción: en Ecuador, el método Pilates es muy utilizado en la población de adultos mayores ya que ha permitido reducir el índice de caídas mejorando el equilibrio, demostrando la efectividad y motivando la aplicación de dicho método, no es muy conocido, pero está empezando a tomar importancia debido a que profesionales terapéuticos y deportivos han optado como método de acondicionamiento físico.

Objetivo: analizar la efectividad de los ejercicios de flexibilidad basados en el método Pilates para adultos mayores.

Métodos: se utilizó el test de BERG que consta de 14 ítems; los mismos que miden el equilibrio de forma estática y dinámica, además ayuda a prevenir el riesgo de caídas en los adultos mayores, para la investigación se trabajó con una población de 30 adultos mayores distribuidos en 13 hombres y 17 mujeres.

Resultados: el método Pilates aplicado de forma adecuada mantiene o mejora el equilibrio de los adultos mayores, permitiendo tener autonomía en la ejecución de actividades cotidianas si depender de terceras personas.

Conclusiones: a pesar de que se ha demostrado la efectividad del método Pilates en la mejora del equilibrio, entre los profesionales de fisioterapia existe poco conocimiento y experiencia en la aplicación de este método, teniendo en cuenta que a más de rehabilitar es una buena alternativa para hacer ejercicio contribuyendo en el equilibrio mental, físico y emocional.

Palabras clave: ejercicio, envejecimiento saludable, técnicas de ejercicio con movimientos.

INTRODUCTION

Pilates has demonstrated to be an excellent tool to improve balance in the elderly. This discipline was created by Joseph Pilates, and it aims to strengthen posture and increase flexibility. Pilates uses a combination of exercises based on endurance, control, and concentration, helping strengthen the stabilizing methods and improve proprioception, which is essential to maintain balance in older adults (Johnson, 2018).

Pilates emphasizes motor control and stability exercises, benefiting older adults with balance issues. The exercises are controlled and conscious, allowing the participants to develop greater consciousness of their bodies and improve coordination and balance (Thompson, 2019).

Pilates aims to restore the physical capacities of older adults, particularly balance, reducing the index of accidents caused by falls, that create dependence on other people, resulting from the deterioration of physical capacities caused by aging. The purpose is for the population of older adults to improve their physical capacities and perform basic and everyday activities when they are at an advanced age (Almirón, 2020).

This method is used by older adults to improve physical fitness that focuses on proper movement execution rather than physical exhaustion or joint impact that other techniques may have on the participants. Besides, it does not require many materials, and the exercises can be modified depending on the needs and capacities of the elderly (Gamboa Delgado & Rodríguez Ramírez, 2014).

Most older adults have sedentary practices, many of them have health conditions or difficulty moving, which cause them a loss of physical capacities that lead to a reduction of the autonomy to perform everyday activities. Hence, checking the effectiveness of Pilates in improving flexibility is important since it may become an alternative to

enhance and maintain the physical condition of the elderly (Rial Rebullido & Villanueva Lameiro, 2012).

Population aging is a global phenomenon challenging the health and well-being of the elderly. One of the most relevant aspects of this stage is maintaining proper balance and functional capacity. The deterioration of balance may increase the risk of falls, fractures, and other injuries, which, in turn, may hurt the life quality in older adults. In that sense, Pilates has gained ground as an effective choice to improve balance in this population (Martínez Pérez, González Aragón, Castellón León, & González Aguiar, 2018).

In older adults, flexibility and balance work secondarily, playing a special role in the elderly. Physical exercise has demonstrated its effectiveness in stopping or delaying aging, but only if it is performed regularly, with the proper intensity, the functional abilities of the body will improve. The various recommendations of physical activity for the elderly published so far establish these minimum levels of physical activity and intensity. Therefore, they must be taken into account when developing physical activity prescriptions for older adults (Ballesteros Balceda, 2018).

Pilates focuses on the body's consciousness and breathing, creating consciousness of the movements done, with complete body control. Pilates can strengthen the CORE muscles and abdomen, and it helps maintain proper posture that does not affect the back when the exercises are performed consciously (Santana Pérez, Burgos Carmona, & Fernández Rodríguez, 2010).

In addition to being a recommended practice for maintaining proper physical condition, it increases flexibility, improves coordination, corrects inappropriate postures, and alleviates muscle pain. It can be done on the floor or using special equipment, the movements can be done freely on a mattress, then other elements could be added to complement the exercises, such as balls, elastic bands, and rings (Castro Blanco, 2007).

Pilates has demonstrated to be an excellent tool for improving balance in the elderly. It focuses on core strengthening, posture, and flexibility improvements, emphasizing motor control and stability, creating an effective tool to promote balance and prevent falls in the elderly. The benefits of Pilates associated with balance improvements in older adults are supported by scientific research, thus becoming a recommended choice to those who wish to enjoy a satisfactory lifestyle at an advanced age (Smith, Brown, & Wyon, 2020).

Pilates can also help prevent falls in the aged. A study done by (Jones *et al.,* 2021) found that older adults who practiced Pilates regularly showed a lower risk of falling than their peers who were not engaged in the practice of Pilates. The strengthening of core muscles and improvements in balance were the main factors that contributed to the reduction of such risk.

According to World Health Organization (WHO) statistics, the second cause of death worldwide is traumatism following a fall in senior patients. They are the age group that undergoes a high number of accidents resulting from falls, usually due to a progressive loss of balance. Hence, active and healthy lifestyles must be encouraged (Ruiz, 2022).

In Ecuador, Pilates for the elderly is effective in the process of improvement and maintenance of balance, which results in the reduction of a high percentage of recurring falls in the older population. However, professionals who have used several methods, have decided on Pilates thanks to its high effectiveness and results (Herrera Gutierrez, Olmos Soria, & Brocal Pérez, 2015).

In the province of Tungurahua, Ecuador, there are few certified therapists for the teaching and practice of Pilates, the main reason why it is not known very well. However, the benefits observed in the people who practice it regularly and correctly, have shown clear signs of improvements, such as higher flexibility, elasticity, and trunk, arm, and leg strength. The incidence of falls, and age-associated issues like lack of strength, agility, and balance, are the main factors leading to injuries in older adults that

cause them total or partial dependency, limiting their life quality, and even causing death (Bolx Villella, León Zarceño, & Serrano Rosa, 2017)

This is the first time this method will be used in the local residents of Corazón de María nursing home, to evaluate the effectiveness of flexibility exercises based on Pilates in the elderly.

MATERIALS AND METHODS

This is a descriptive study with a longitudinal quantitative approach. the information was screened depending on the year of publication and topic of interest related to the aim of this paper.

The research study took place at Corazon de Maria nursing home, in the city of Ambato, province of Tungurahua, with a population of 87 older adults, from which a sample of 30 subjects (17 women and 13 men) between 65 and 75 years of age, was selected. The subjects showed no signs of cognitive deterioration (moderate to severe), no neurological diseases, or wheelchair dependence.

The BERG scale was used to quantitatively measure the functional state of balance in the elderly, whose validity, reliability, and sensitivity were also demonstrated in hemiplegic patients. BERG permitted an assessment of balance during the functional activities of older adults, which comprises 14 items with a score of 0-4, while the total scores may range between 0 (severely affected balance) to 56 (excellent balance) (Table 1).

Table 1. *- Scale and observation*

Scale	Observation
0-20	High risk of falling
21-40	Moderate risk of falling
41-56	Slight risk of falling

A pre-test was performed on BERG to obtain the initial data, and then the intervention plan was performed, which lasted 12 weeks. The post-test was performed to obtain the final data for tabulation and comparison of the results.

The reliability of the BERG scale was excellent in the elderly who lived in a community (CCI=0.98); the aged population residing in homes (CCI= 0.76 - 0.88), and Parkinson's patients (CCI=0.95).

The intervention plan was divided into phases, and the phases into weeks (three times a week), in 45-minute sessions.

Phase 1: Breathing exercises and body awareness

- Week 1: Diaphragm breathing
- Week 2: Diaphragm breathing, plus body awareness.
- Week 3: Diaphragm breathing, plus body awareness, plus movements.
- Week 4: Breathing using everything practiced in previous weeks.

Phase 2: Starting, CORE muscle activation exercises

- Week 1: Activation of abdominal muscles.
- Week 2: Activation of abdominal and gluteal muscles.
- Week 3: Muscular activation with supine and prone lateral and two-legged movements.
- Week 4: Integration of specific movements.

Phase 3: specific movements, flexibility exercises, coordination and concentration, and body balance using therapeutic balls and elastic bands.

Statistical analysis

The statistical validation of data was performed through SPSS, 29.0, and the results were shown in tables, using Student-T comparison of means with independent samples. The Shapiro-Wilk test was performed to obtain normality since the population of the study

was small. The Wilcoxon test was used to compare the results of the means between the pre and post-test, with a significance lower than 0.05, thus embracing the alternate hypothesis while the null hypothesis was rejected.

Bioethical considerations

This research project has been passed by the Bioethics Committee for Human Research, the Faculty of Health Sciences, Technical University of Ambato, under code 027-CEISH-UTA 2023. **T**he methodology used was published and the signed written consent was described in the project.

Importantly, there were several conflicting subjects in the study group, the reason why two groups were formed working at different times to avoid disputes during the research.

RESULTS AND DISCUSSION

Publications refer to the benefits of Pilates, particularly for the elderly after a particular time of practice.

Concerning the population in the sample, several methodological characteristics of the programs and intervention tests were included, which were used to evaluate improvements in balance with simple regular activities performed by the subjects in the study.

As described in the research methodology, the population consisted of older adults who lived in Corazon de Maria nursing home, whose characterization by gender is shown below (Table 2, Table 3, Table 4, Table 5 and Table 6).

Table 2. *- Characterization by sex, age, height, and weight*

Indicator	N	Minimum	Maximum	Mean	Deviation
Age	30	65	75	69.23	3.048
Height (cm)	30	1.52	1.72	1.6057	.04666
Weight (kg)	30	58	77	69.37	4.367

Table 3. *- Normality tests*

Indicator	Sex	Kolmogorov – Smirnov*		
		Statistics	gl	Sig.
Age	Male	.282	13	.006
	Female	.148	17	.200
Height (cm)	Male	.206	13	.134
	Female	.178	17	.158
Weight (kg)	Male	.164	13	.200
	Female	.132	17	.200

Table 4- *Mann-Whitney test*

Indicator	Sex	N	Average rank	Rank sum
Age	Male	13	13.58	176.50
	Female	17	16.07	300.50

Table 5- *T-test*

Indicator	Sex	N	Mean	Deviation	Average deviation
Height (cm)	Male	13	1.4108	.54016	.01112
	Female	17	1.4058	.05198	.01261
Weight (kg)	Male	13	59.33	4.585	1.272
	Female	17	68.47	4.332	1.061

T test-Pre and post-test comparison

Table 6. *- Results from the identification of the initial and final state of balance in older adults at nursing home Corazon de Maria*

		Mean	N	Standard deviation	Standard deviation mean
1. From resting to standing	P1_PRE TEST	1.83	30	1.440	.263
	P1_POST TEST	2.70	30	1.601	.292
2 Standing without assistance	P2_PRE TEST	2.87	30	1.008	.184
	P2_POST TEST	3.30	30	1.022	.187
3. Standing without leaning back, feet on the floor, or a stool or flight of stair	P3_PRE TEST	2.80	30	1.031	.188
	P3_POST TEST	3.17	30	1.020	.186
4. From standing to resting	P4_PRE TEST	1.73	30	1.081	.197
	P4_POST TEST	3.10	30	1.185	.216
5. Transferences	P5_PRE TEST	2.33	30	.884	.161
	P5_POST TEST	2.97	30	1.066	.195
6. Standing without assistance or closed eyes	P6_PRE TEST	2.53	30	1.167	.213
	P6_POST TEST	3.20	30	1.095	.200
7. Standing on their feet without holding their feet together	P7_PRE TEST	2.17	30	1.392	.254
	P7_POST TEST	2.97	30	1.474	.269
8. Extending the arms forward standing on both feet	P8_PRE TEST	1.87	30	1.279	.234
	P8_POST TEST	3.23	30	1.251	.228
9 Standing on both feet, picking up an object from the floor	P9_PRE TEST	1.70	30	1.119	.204
	P9_POST TEST	2.77	30	1.357	.248
10. Standing on both feet, turning and looking back	P10_PRE TEST	2.70	30	1.208	.221
	P10_POST TEST	3.63	30	.669	.122
11. Turning around (360 degrees)	P11_PRE TEST	2.43	30	1.455	.266
	P11_POST TEST	3.40	30	1.248	.228
	P12_PRE TEST	1.73	30	1.112	.203

12. Raising the feet alternatively onto a higher step or stool, while standing on the feet, without assistance.	P12_POST TEST	3.20	30	1.215	.222
13. Standing on the feet in tandem	P13_PRE TEST	.90	30	.923	.168
	P13_POST TEST	2.60	30	1.453	.265
14. Standing on one foot	P14_PRE TEST	1.20	30	1.215	.222
	P14_POST TEST	2.13	30	1.525	.278

A descriptive difference was performed between the pre-test and post-test; the outcome of the latter was higher than that of the former, with a significant improvement (Table 7).

Table 7. - *Analysis of the initial and final balance states*

Crossed Table Risk Level PRE*Risk Level POST				
		Risk level POST		Total
		Moderate risk of falling-moderate balance	Slight risk of falling-excellent balance	
Risk level PRE	High risk of falling-affected balance	2	0	2
	Moderate risk of falling-moderate balance	7	21	28
Total		9	21	30

The initial balance state of the elderly was identified, with certain difficulty and dependence to perform basic everyday activities.

These Pilate exercises for flexibility improved the strength and balance of the aged significantly.

A comparison between the final state following the intervention evidenced the efficacy of flexibility exercises using the Pilates method in the elderly.

Pilates's flexibility exercises led to improvements in balance, strength, and flexibility in the elderly, reducing the risk of falling in the population studied. It was also reported by Reche Orenes & Carrasco (2016) who demonstrated that the efficacy of Pilates in strength and balance was lower than for strength, though improvements were observed in balance. Lower percentages were observed in the number of falls by the elderly, as cited

by several authors, in stages of advanced aging, the physical and motor capacities deteriorate as a result of not paying proper attention.

A study used a strength platform to measure balance, which showed that after 48 Pilates sessions, a significant improvement was observed in terms of strength and balance by the elderly. Meanwhile, several studies associated with strength and balance improvements failed to show favorable effects in the use of Pilates. (Melián, 2016), in the intervention plan, 36 sessions were performed in 1-2 weeks, which resulted in better flexibility, and greater strength and balance development, allowing the older adults to have safety and autonomy in everyday activities.

A recent meta-analysis made by García, 2022; Santos Oliveira & Quevedo dos Santo, (2023) examined various research studies about the impact of Pilates on balance. The outcome showed that Pilates was effective in improving balance in several populations, including the elderly and subjects with neuromuscular disorders. The authors concluded that Pilates is a promising strategy to tackle balance deficiencies.

Different studies have dealt with the effect of Pilates on the balance of the aged population. For instance, Santos Oliveira & Quevedo dos Santo (2023) evaluated the impact of Pilates on 50 older adults with balance conditions. The participants took Pilates sessions twice a week for 12 weeks.

CONCLUSIONS

There was a significant improvement in balance, stability, and life quality associated with health, compared to the control group.

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The authors declare having competing interests.

***Author contribution statement*:**

The authors have participated in the redaction of the manuscript and the documentary review.