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RESEARCH

Physical exercise as a nursing intervention for frailty in older adults

Ejercicio físico como intervención de enfermería para la fragilidad en adultos mayores

Exercício físico como intervenção de enfermagem para fragilidade em idosos

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Abstract

Introduction: Frailty is a physiological syndrome that is related to aging. Physical exercise is a key part of the functionality of the elderly. A physical exercise program may contribute to reducing the prevalence or severity of frailty syndrome. **Objective:** Determine the effect of physical exercise as a nursing intervention in older adults with frailty. **Methodology:** Quasi-experimental study, before and after type. In 25 older adults, non-probabilistic sample by quotas, nursing interventions were carried out that consisted of physical exercise where five routines corresponding to strength, flexibility, balance, gait and cardiovascular resistance were addressed. The FRAIL instrument and the timed get Up and Go test were used. Statistical analysis was by McNemar, Chi2, and Student's t tests for related samples and the effect was calculated using d de Cohen. **Results:** Eighty-eight percent were women and 12% men. The prevalence of frailty counted for 80% in older adults before the intervention. The most frequent frailty criteria were tiredness, inability to climb stairs and difficulty walking. After the intervention, the prevalence was 4% for frail patients and 64% for pre-frail patients. All the participants had gait disturbances; only 12% presented reduction in their muscle mass. The effect of the intervention turned out to be large and statistically significant. **Conclusions:** There are benefits according to the physical exercise program which are remarkable and recognizable in older adults with frailty.

Keywords: Elderly; Fragility; Physical exercise; Nursing DeCS.

Resumen

Introducción: La fragilidad es un síndrome fisiológico que está relacionado con el envejecimiento. El ejercicio físico es parte esencial en la funcionalidad del adulto mayor. Un programa de ejercicios físicos puede contribuir a reducir la prevalencia o severidad del síndrome de fragilidad. **Objetivo:** Determinar el efecto del ejercicio físico como intervención de enfermería en adultos mayores con fragilidad. **Metodología:** Estudio cuasi-experimental, de tipo antes y después. En 25 adultos mayores, muestra no probabilística por cuotas, se realizaron intervenciones de enfermería que consistieron en ejercicio físico donde se abordaron cinco rutinas correspondientes a fuerza, flexibilidad, equilibrio, marcha y resistencia cardiovascular. Se utilizó el instrumento FRAIL y la prueba timed get Up and Go. El análisis estadístico fue mediante pruebas de McNemar, Chi^2, t de student para muestras relacionadas y calculó del efecto mediante d de Cohen. **Resultados:** El 88% fueron mujeres y 12% hombres. La prevalencia de fragilidad fue 80% en adultos mayores antes de la intervención. Los criterios de fragilidad más frecuentes fueron: cansancio, incapacidad para subir escaleras y dificultad para caminar. Después de la intervención la prevalencia fue de 4% para pacientes frágiles y 64% para prefrágiles. Todos los participantes tuvieron alteraciones en la marcha; sólo 12% presentaron reducción en su masa muscular. El efecto de la intervención resultó ser grande y estadísticamente significativo. **Conclusiones:** Existen beneficios acordes al programa de ejercicio físico los cuales son destacables y reconocibles en los adultos mayores con fragilidad.

Palabras claves: Anciano; Fragilidad; Ejercicio Físico; Enfermería (DeCS).

Abstrato

Introdução: A fragilidade é uma síndrome fisiológica relacionada ao envelhecimento. O exercício físico é uma parte fundamental da funcionalidade dos idosos. Um programa de

exercícios físicos pode contribuir para reduzir a prevalência ou a gravidade da síndrome da fragilidade. **Objetivo:** Determinar o efeito do exercício físico como intervenção de enfermagem em idosos com fragilidade. **Metodologia:** Estudo quase-experimental, do tipo antes e depois. Em 25 idosos, amostra não probabilística por cotas, foram realizadas intervenções de enfermagem que consistiam em exercício físico onde foram abordadas cinco rotinas correspondentes a força, flexibilidade, equilíbrio, marcha e resistência cardiovascular. Foram utilizados o instrumento FRAIL e o teste cronometrado Get Up and Go. A análise estatística foi pelos testes McNemar, Chi2 e t de Student para amostras relacionadas e o efeito foi calculado usando d de Cohen. **Resultados:** Oitenta e oito por cento eram mulheres e 12% homens. A prevalência de fragilidade era de 80% em adultos mais velhos antes da intervenção. Os critérios de fragilidade mais frequentes foram: cansaço, incapacidade de subir escadas e dificuldade para deambular. Após a intervenção, a prevalência foi de 4% para frágeis e 64% para pré-frágeis. Todos os participantes apresentavam distúrbios de marcha; apenas 12% apresentaram redução na massa muscular. O efeito da intervenção acabou sendo grande e estatisticamente significativo. **Conclusões:** Existem benefícios de acordo com o programa de exercício físico que são notáveis e reconhecíveis em idosos com fragilidade.

Palavras-chave: Idoso; Fragilidade; Exercício físico; Enfermagem (DeCS).

Introduction

Nowadays, there are many older adults in the world's population than in the past, i.e., this part of the population is growing at an accelerated pace. It is estimated that between the year 2000 and 2050, the number of people over 60 years of age will double from 11% to 22% [(1)]. Therefore, it is important to focus on the older adults (OA) population, people who will require various types of care throughout their aging process, since this population shows a loss of functional reserve, and is conditioned to greater susceptibility, a decrease in response mechanisms and efficiency in maintaining homeostasis [(2)].

Frailty in OA is a term in geriatric medicine that describes the presence of multisystemic impairment and implies adverse events, increasing need for care, and risk of progressing to disability, dependency and mortality [(3)]. The consequences of frailty include the risk of falls and fractures in older adults, as well as disability, dependency and hospitalization, associated with poor quality of life and increased costs related to their care [(4, 5)]. It is usually a consequence of chronic disease; however, it also occurs in the absence of chronic disease. Other risk factors implicated in

frailty include gender, where women have a higher prevalence than men, age, malnutrition, sedentary lifestyle, depression, social support, as well as chronic diseases and decreased body mass [5-7]. It has been pointed out that frailty is due to a decrease in the reserve of multiple physiological systems that are normally responsible for a healthy response to the stress condition [5]. Additionally, it is considered that frailty is due to a deregulation in signaling pathways and the subsequent depletion of homeostatic reserves, as well as the reduced capacity for both molecular and cellular compensation associated with aging [5]. Therefore, the people most affected are those older individuals who have been under high levels of stress and with lower capacity for resilience.

The prevalence of frail OA in non-institutionalized Latin America ranges from 7.7% to 39.3%, being one of the most affected regions [6]. In Mexico, frailty represents a current and upcoming public health problem that requires immediate attention. A prevalence of 39% has been reported, with a higher frequency in women with 45%, as opposed to men with 30% [8]. Among the clinical manifestations of frailty are general slowness, low muscle strength, decreased balance and mobility, fatigue and involuntary weight loss. It is necessary to adopt strategies such as training of healthcare personnel in the diagnosis, through the presence of any of the above manifestations, as well as in the timely care of this geriatric syndrome or its prevention, from the first level of care.

Physical exercise is an alternative to maintain physical and mental well-being in OA. It contributes to the improvement of muscle mass, balance, cardiorespiratory endurance and to the maintenance of independence and autonomy, as well as to the improvement of quality of life [9-11]. In a study it was reported as a favorable fact that most of the participants who participated in the survey were interested in developing physical exercise and had the health conditions to do it, and all of them recognized the usefulness of physical activity to keep good health [12].

Currently, there are several physical exercise programs for frail OA [13]. Programs combining endurance, balance, gait and strength exercises have shown the best results [14, 15]. A significant

association has been demonstrated between aerobic exercise and increased upper limb strength and flexibility, balance and self-confidence for walking in OA [10].

Minimizing the prevalence and/or severity of frailty is likely to lead to major benefits for OAs, their families, and society. Frail patients who received comprehensive geriatric assessment and special care are more likely to return home with less functional and cognitive decline and they also show decreased mortality rates [16].

Healthcare professionals provide care to an increasingly older population with greater comorbidity and/or disability, so it is necessary to diagnose frailty syndrome and individualize its management according to the patient's needs. It is important for the nursing staff to know the different interventions that can be implemented to comprehensively care for the frail MA and guarantee good health care, thus ensuring a good quality of life. The objective of this study is to determine the effect of a nursing intervention based on physical exercise in frail MA, where it is expected that physical exercise will help to prevent frailty in older adults.

Methodology

Quantitative study of quasi-experimental design. The population was the OA of the Gerontological Center of the municipality of Tetepango, Hidalgo, Mexico. The sample was non-probabilistic by quotas and included 25 participants. The inclusion criteria were OAs aged 65 years and older, attending at least twice a week at the Gerontological Center and with ambulatory independence. The exclusion criteria were MA with visual impairment or with health problems that prevented them from participating in physical exercise.

The FRAIL instrument was used as an evaluation tool, which consists of five simple questions to detect frailty syndrome. The instrument categorizes participants into three levels which are: Robust patient: 0 points, pre-fragile patient: 1-2 points and frail patient: 3 or more points. It has a

Cronbach's reliability of 0.825 and a feasibility of 98.5% in the Mexican population [17]. These data are consistent with the reliability of the present study, which was 0.812, where no modification or cultural adaptation was conducted.

Furthermore, measurements of arm and calf circumference were taken as a determinant for the decrease in muscle mass. In addition, the timed get Up and Go test was used to quantify walking time in seconds, with the help of a stopwatch. This test categorizes participants as fragile and at risk of falling with a time between 10 and 20 seconds, without functional limitation and low risk of falling less than 10 seconds; and with functional limitation and a high risk of falling with more than 20 seconds. The test has been validated with a sensitivity of 87% and a specificity of 87% [18].

A nursing intervention based on a weekly physical exercise program has been implemented. The design of the intervention was based on the analysis of different articles where physical exercises were performed in MA to treat frailty [13-15]. This program consisted of 7 sessions distributed over 4 weeks; each session consisted of 50 minutes of exercises focused on strength training, cardiovascular endurance workout, flexibility, balance and gait. Table 1 shows the exercises performed for each of the training sessions. After the workout, the FRAIL questionnaire was applied again to the participants who completed the physical exercise program.

Table 1. Physical exercise program, implemented for older adults, 2021 (n=25).

Activity	Practical contents	Resources	Number of sessions
Strength Workout	Muscle warm-up (5 minutes) Raise your arms until they are parallel to the ground (3 seconds). Shoulder flexion with elastic bands Get up from a chair Rest (2 minutes) Triceps extension with elastic bands Leg lift to the sides Knee flexion and extension Hip flexion and extensión	Elastic bands Dumbbells Small balls chairs	2

Cardiovascular endurance workout	Muscle warm-up (5 minutes) 10-meter walk in different directions and paces 30-meter walk in different directions and at different paces Climbing stairs Rest (2 minutes)	Posters	2
Flexibility workout	Warm-up (3 minutes) Plantar flexion Knee flexion Hip flexion Stretching the thigh hamstrings Ankle stretching Wrist stretches Rest (2 minutes)	Small balls or barbells Mats Chairs	1
Balance workout	Pre-warm-up On a chair, lift one leg for 10 seconds and follow with the other leg. Facing forward walk in a straight line 20 steps one foot next to the other. Rest for 2 minutes	Chairs	1
Gait workout	Warm-up (3 minutes) Walking in different directions and pace Rest (2 minutes)	None	1

Source: Own development

The Statistical Package for the Social Sciences (SPSS) version 25 software package was used for data analysis. Descriptive statistical analysis, frequency and percentage for categorical variables, as well as mean and standard deviation for numerical variables, were performed. For the inferential statistical analysis, McNemar statistical tests were used to compare dichotomous categorical variables and Chi^2 for nominal variables; Student's t test for related samples was used to compare means before and after the intervention, as well as Cohen's d to estimate the size of the effect.

The present research was approved by the ethics committee of the University with registration 2019/01/P23, in addition, it was conducted under the guidelines of the declaration of Helsinki [19] at the international level and at the national level of the general health law on research for health [20]. The research was classified as minimal risk according to article 17 of the aforementioned law. Each participant signed an informed consent form explaining the objectives of the research and its

risks, taking into account that the participants have the right to withdraw at any time or the investigators can suspend the research in case of injury (articles 20 and 21).

Results

The gender in the study was predominantly female with 88%. The variable age was in the range of 60 to 90 years, with a mean of 73.4 ± 7.3, with a predominance of 70 to 79 years of age. With respect to the variable marital status, married adults accounted for 40%. Twenty percent of the OA reported not suffering from any disease, while another 40% reported having systemic arterial hypertension, which was the most prevalent disease, and 24% reported having more than 1 disease. Significant statistical differences ($p<0.05$) were found between frailty and gender; however, it should be considered that the number of male OA was lower than the number of female OA. On the other hand, no statistically significant differences were found between frailty and age, marital status and diseases ($p>0.05$), (Table 2).

Table 2. Sample characteristics and comparison with their frailty status before the intervention, 2021 (n=25).

			Frailty				
	Total n=35		Frail		Pre-frail		
	f	%	f	%	f	%	Chi^2 p-value
Gender							
Male	3	12	0	0	3	60	0.04
Female	22	88	20	100	2	40	
Age							
60-69	9	36	8	40	1	20	
70-79	11	44	8	40	3	60	
80-90	5	20	4	20	1	20	0.66
Marital Status							
Married	10	40	7	35	3	60	
Single	5	20	4	20	1	20	0.290
Widow	8	32	8	40	0	0	
Divorcee	2	8	1	5	1	20	
Illnesses							
Type 2 diabetes	1	4	1	5	0	0	
Hypertension	10	40	8	40	2	40	
Lupus erythematosus	1	4	1	5	0	0	0.125
Cardiac arrhythmia	1	4	0	0	1	20	
Hearing impairment	1	4	0	0	1	20	
More than 1 illness	6	24	6	30	0	0	
None	5	20	4	20	1	20	

Source: Own development

In general, before the intervention, there was a predominance of fragile OAs with 80% and after the intervention, there was a predominance of OAs in the pre-fragile category with 64%. In addition, there was an increase in the robust category post-intervention, from 0% of OAs to 32% in this category. These differences before and after the intervention proved to be statistically significant (<0.001). Comparing frailty with respect to gender after the intervention, 18.8% of men did not modify their condition, that is, they continued to be pre-fragile, while in women, 100% of

them continued to be fragile, 81.3% became pre-fragile and 100% improved their condition to robust (Table 3).

Table 3. Frequency and percentage comparison after physical exercise, 2021 (n=25).

	Frail		Pre-frail		Robust	
	f	%	f	%	f	%
Total MA	1	4	16	64	8	32
Male	0	0	3	18.8	0	0
Female	1	100	13	81.3	8	100

Source: Own Development

We obtained the effect that the exercise conducted in the MAs had on the frailty they presented, finding that the intervention had a large significant effect ($p<0.001$), since Cohen's d value was greater than unity, (Table 4).

Table 4. Effect of physical exercise-based intervention on frailty in MA, 2021 (n=25).

	Mean	Standard deviation	Student t	p value	Δ Cohen
Pre-intervention	1.20	0.408	-7.11	<0.001	1.4
Post-intervention	2.28	0.542			

Own development

It was seen post-intervention that 76% of the OAs seemed more able to climb a stair floor, and 96% were able to walk a block. In addition, 92% of the OAs reported not feeling tired. In these items, significant statistical differences were found before and after the intervention ($p<0.05$), (Table 5).

Table 5. Frequency and percentage of responses per question of the FRAIL instrument before and after physical exercise, 2021 (n=25).

Questions	Pre intervention				Pre intervention				p value McNemar
	Yes		No		Yes		No		
	f	%	f	%	f	%	f	%	
Are you tired?	21	84	4	16	2	8	23	92	<0.001
Are you unable to climb a stair floor?	23	92	2	8	6	24	19	76	<0.001
Are you unable to walk a block?	17	68	8	32	1	4	24	96	<0.001
Do you have more than 5 illnesses?	2	8	23	92	2	8	23	92	1
Have you lost more than 5% of your weight in the last six months?	10	40	15	60	10	40	16	60	1

Source: Own Development

In order to evaluate the muscle mass of OA and whether this condition was a factor that would indicate the presence of frailty syndrome, anthropometric measurements were taken. Measurements revealed that no OA were below 22 centimeters for arm circumference. However, it was detected that 12% of the OA were below 31 centimeters for calf circumference, which means that they presented a decrease in their muscle mass; however, this decrease in muscle mass was not found to be statistically related to the frailty presented in the OA ($p>0.05$). In the walking time measured in the OAs, it was observed between 10 and 20 seconds for all participants, which means that all of them were at risk for falls. Although there was no statistically significant relationship with frailty data ($p>0.05$), (Table 6).

Table 6. Characterization of walking time and arm and calf circumference of the MAs by means of measures of central tendency, 2021 (n=25).

	Walking time (seconds)	Arm circumference (centimeters)	Calf circumference (centimeters)
Mean	18.30	31.84	33.56
Standard deviation	1.75	2.54	2.58
Median	13	32	34
Mode	12	32	33
Maximum	18	37	38
Minimum	12	27	28

Source: Own Development

Discussion

On the basis of the determination of the physical effect as a nursing intervention in frail older adults, it was possible to identify that the intervention proposed in this study had a large and statistically significant effect on the frailty of the OAs, reducing the percentage of frail OAs. However, this result should be taken with caution, since the study is limited by the absence of a control group that would help to analyze with greater precision the effect of the intervention on the frailty of the OA, and thus reduce possible biases in the study.

Moreover, according to the results of the present research, one fifth of the sample corresponded to frail OA. The data obtained was very similar to the average percentage reported for Latin America and the Caribbean with 19.6% [8] and to a study carried out in Peru with a prevalence of 20.7% [6]. However, the prevalence worldwide is varied, fluctuating between 14 and 43% [22]. It has been mentioned that the variability of the prevalence of frailty found in different studies may be due to the difference in sociocultural characteristics of the populations evaluated, as well as to the geographic location and the impact of the frequency of chronic diseases, which is increasing as the years go by [23]. In a research conducted, it is highlighted that for each year the presence of frailty increases 8% in elderly people and comorbidities seem to be an important factor [24].

This research found significant statistical differences in frailty between men and women; and although no significant statistical differences were found with respect to age, the findings are in agreement with other researches [25-27].

In relation to the criteria for frailty, this research found mainly exhaustion and weakness, in contrast to another research which reported mainly weakness and weight loss [25]. No relationship was found between frailty and weight loss, although it should be taken into account that the number of participants was small, so it would be recommended to expand the sample in future research to have a representative sample. Another limitation of the study is the absence of comparison of

objective measures that would strengthen the results found, since the questionnaire used is an indirect measure to obtain frailty in OA and could not be answered as closely as possible to reality, so it is suggested that in future studies, walking time and anthropometric measures should be used as the main variables to be contrasted before and after the intervention. Gait speed is associated with falls, cognitive impairment, functional capacity and institutionalization of the OA [28, 29]. Gait time measured in the gerontological center OAs was indicative of frailty in all participants, suggesting obtaining cognitive impairment data for further research. The frailty phenotype is identified by 5 markers: reduced walking speed, unintentional weight loss, self-portrait of exhaustion and fatigue, decreased grip strength, and low physical activity [21].

The research conducted using a dynamic program of physical exercises adequate for the age and condition of the research subjects, in relation to other researches where the existence of physical therapy programs adapted to the level of functionality of the OA is highlighted and exercise is encouraged [11,30]. The effect of the physical exercise performed revealed an improvement in flexibility, muscular strength, as well as in the aerobic resistance of the OA, at the end of the intervention the participants reported being able to perform activities that require this condition, in addition to not feeling tired, so it is suggested for a future implementation of the intervention for a longer period of time to evaluate its benefits over time.

Currently, several researches can be found where the benefits of physical exercise to improve frailty syndrome are seen, including improvements in walking speed, balance and activities of daily living [13, 31-33]. The frequency of exercise reported was varied and ranged from one to five times a week with times ranging from 20 minutes at home without supervision to 90 minutes in groups under the supervision of health professionals [33]. The aforementioned invites us to reflect on the aging process that OA with frailty are undergoing, emphasizing health promotion in particular by resuming physical exercise in OA as an easy and effective way to contribute to this type of

syndrome, without neglecting the importance of performing routine checkups to OA to detect other conditions that may go hand in hand with frailty such as cognitive impairment, depression, risk of falls, among others.

Conclusions

The research allows us to affirm that the OA residents in the gerontological center of the municipality of Tetepango, Hidalgo were detected as frail patients according to the criteria established by the FRAIL questionnaire. The choice of this predictive instrument of frailty in OA provides a faster application, without the need for a differentiated environment, in addition it is able to reduce the use of specific equipment to detect frailty in OA. A nursing intervention based on a physical exercise routine was proposed as part of a program to respond to the needs of patients with frailty. Favorable results were obtained with the application of this program, so it is concluded that physical exercise is an effective method to reduce the level of frailty in the OA of the gerontological center, contributing to the improvement of muscular strength, flexibility, aerobic endurance of the OA and general wellbeing. Most of the OA require a daily physical activity program to strengthen their health, which is possible, and the nursing area plays an important role in order to conduct the detection and timely treatment of this syndrome by means of physical activity, respecting the condition of the OA. The results obtained indicate that the exercise routine established in this research positively modifies frailty in the OA.

Conflicts of interest

The authors stated that there is no conflict of interest.

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