



The Effect of Physical Exercise on Functional Capacity and Perception of Well-Being in Older Adults

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Abstract

Study purpose. The study aimed to evaluate the effect of strength training exercises on functional capacity, quality of life and perception of well-being in elderly people.

Materials and methods. It was used a mixed study with sequential explanatory design, in which 25 elderly females between 62 and 85 years participated in a physical exercise program for eight weeks, with a frequency of 3 days and sessions of 58 minutes on average. The Senior Fitness Test battery of test item was conducted with a grip strength test, heart rate monitoring in a 6-minute test, SF-36 health questionnaire and post-intervention focus group oriented to well-being analysis.

Results. Cardiorespiratory capacities, strength and flexibility improved significantly ($p < 0.05$), but agility and heart rate did not change ($p > 0.05$). Scores increased in the 8 quality of life dimensions analyzed, and in subjective well-being, health improvement was identified in both the self-perception and autonomy of daily activities related to vitality, motivation, social interaction and adherence to physical activity. The findings indicate that physical exercise based on strength training improves functional capacity, health-related quality of life and the well-being of seniors.

Conclusions. The findings of this study show that eight weeks of physical exercise based on strength training with affordable means (own body weight, elastic bands and dumbbells) with a frequency of 3 days a week, contribute to improving the functional capacity of strength and flexibility in upper and lower limbs, and cardiorespiratory endurance in older females. This intervention was also found to have a positive impact on quality of life, as well as on the perception of well-being.

Keywords: human physical conditioning, sickness impact profile, physical fitness, emotions, ageing.

Introduction

The percentage of seniors in the world has increased considerably in a relatively short period of time and the physiological changes produced by age increase the incidence of chronic diseases and issues surrounding daily tasks and dependence on third parties (World Health Organization & International Telecommunication Union, 2018). The predominant causes of death due to pathologies are cardiovascular diseases and cancer (World Health Organization, 2019). One of the most relevant risk factors

is physical inactivity, given that one in four adults does not meet the global recommendations for physical activity (Pan American Health Organization, 2019) and in older adults this compromises health and quality of life (Ahangar et al., 2017). In Latin America and the Caribbean, the first cause of death in older adults is related to cardiovascular diseases that represent about 25% (Aranco et al., 2018). These are associated with physical inactivity and being overweight, a situation that generates alarm since the rates of insufficient physical activity in older people in South America is between 30-56% in men and 36-69% in women (World Health Organization, 2016).

In Colombia, approximately 6.5 million people were over 60 years by 2019, representing about 13.2% of the total population of which 20.6% accessed the health system due

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to circulatory system diseases, 11.1% for musculoskeletal diseases and 2.4% for organic disorders and stress related to mental health (Cubillos et al., 2020).

Regular physical activity has been implemented as one of the strategies at the international level and has been shown to help prevent and treat noncommunicable diseases (NCDs), improve mental health, quality of life, well-being, functional capacity and decrease mortality (Font-Jutglà et al., 2020; Gallegos et al., 2019); these strategies and guidelines have been directed from the recreational, leisure and physical exercise spheres (Ramírez-Villada et al., 2015). In Colombia, the policy on human aging and old age, headed by the National Council of Older Persons, has proposed guidelines focused on the promotion of health and quality of life (QOL), as well as disease prevention, wellbeing, healthy lifestyles and protection of this population group (Minsalud, 2021).

Different studies have shown that targeted physical exercise programs for the elderly improve functional fitness (Escalante et al., 2019), gait (Font-Jutglà et al., 2020) and upper and lower extremity muscle strength, especially those that include multicomponent training, evidencing a decrease in body mass index (BMI) (Vargas-Vitoria et al., 2021), mental illnesses such as depression and even dementia, thus contributing to comprehensive well-being (Durán-Agüero et al., 2017). In this sense, such programs stand out in promoting actions that generate an increase in quality of life justified in the perceptions from physical and mental well-being, independence and social integration (Vargas-Vitoria et al., 2021); however, despite the fact that several researches have focused on the link physical activity has with functional condition and health-related quality of life (Castro-Coronado et al., 2021; Poblete et al., 2015), studies focusing on the possible relationship between physical activity and well-being are limited.

However, it is of utmost importance to analyze studies that combine physical exercise, functional capacity, quality of life and well-being in older people from a holistic perspective by integrating quantitative and qualitative approaches for a broader understanding of the phenomenon. The objective of this study was to evaluate the effect of physical exercise based on strength training on functional capacity, quality of life and perception of well-being in older adults in a locality of the city of Bogotá, Colombia.

Materials and Methods

Study Participants

Twenty-five elderly female volunteers between the ages of 62 and 85 years (74.20 ± 6.40 years), residents of the Engativá district of the city of Bogotá participated in the study. Prior to inclusion in the study, it was verified that the candidates did not participate in regular physical exercise programs with a frequency of two or more days per week in the last 6 months and those who presented some type of contraindication for the practice of moderate and vigorous physical activity were excluded; particularly uncontrolled heart failure and arrhythmias, myocardial infarction, stroke, angina pectoris, uncontrolled blood pressure, uncontrolled diabetes or persons physically unable to perform physical exercise. The initial sample consisted of 37 candidates,

eight of whom were excluded for not attending 80% of the scheduled sessions, which is equivalent to 19 sessions of the 24 planned in eight weeks; four were also excluded due to health limitations that they presented during the intervention, despite having met all the inclusion criteria. The volunteers were informed of the objective as well as the specific procedures of the study and after understanding their participation, they accepted and signed an informed consent form. They were also informed of the possibility of voluntarily terminating their participation at any time. In addition to this, the participants attached a copy of a medical certificate attesting to their health conditions for the performance of physical activity.

Study Organization

The intervention consisted of an eight-week physical exercise program with a frequency of 3 sessions and an average duration of 58 minutes. These sessions were carried out on the same days of the week with one rest day between sessions and two between the last session of the week and the first of the following week. The exercises applied were based on functional training, using body weight, elastic bands and dumbbells as means, under the supervision of 3 professionals specialized in physical exercise. The planning of the sessions was organized according to the level of physical condition of the participants.

The activities were carried out at the Center for Research and Practices in Physical Activity and Sports (CIPAD) of the Corporación Universitaria Minuto de Dios where the information on the variables and categories that are the object of this study was collected before and after the intervention; the program was conducted at the Quirigua Park, sector C, located in the Engativá district of the city of Bogotá, where the training sessions were held taking into account the residential proximity of the participants, as well as the environmental and logistical conditions for its execution. The Structure of the Physical Exercise Program, Pre: Battery Senior Fitness Test (SFT) and Health-related quality of life (SF36), Intervention: 3 sessions/week – 58 minutes, Heat intake: 15 minutes, Functional exercise: 24-32 minutes Sequence: 3 upper limb exercises and 3 lower limb exercises, Means: Own weight – elastic bands – dumbbells, Load: 3 sets between 6 and 8 repetitions with 50-60 s of recovery. Post: Battery Senior Fitness Test (SFT), Health-related quality of life (SF36) and Focus group perception of well-being and its relationship with physical exercise.

Each session was divided into three moments: 1) warm-up consisting of movements integrating the largest number of muscles followed by dynamic stretching for 15 minutes; 2) functional exercises lasting between 24 and 32 minutes, using own body weight, elastic bands and dumbbells as training means in accordance with the participants' level of progress; the selected exercises emphasized the muscles of the appendicular skeleton, and in the same action, the core muscles as stabilizers of the movements; the progression of the load was based on periodization by stages, adaptation of the exercises, incorporation of external resistances, difficulty in the base of support and the combination of increased function with resistances (Heyward, 2008).

The sessions were organized so that the first three exercises were performed on the lower limbs, followed by

Table 1. Periodization and Organization of the Load during the Intervention

Week	1-2	3-5	6-8
Stadium	Conditioning	Progress 1	Progress 2
Exercises	MMSS: Triceps extension on the wall, Triceps extension with fit-ball, Biceps flexion fixed bar. MMII: Get up from the chair, Free squat, Lunge with chair support	MMSS: Triceps extension, Curl biceps, Lateral shoulder flexion, Lateral shoulder extension. MMII: Free squat, Unsupported Lunge, Side steps.	MMSS: Curl biceps, triceps extension overhead, Knee shoulder press, Shoulder abduction. MMII: Free squat, Unsupported lunge, Dead weight.
Volume	3 series x 6 rep	4 series x 8 rep	5 series x 8 rep
Series duration	20 s	30 s	30 s
Rest	60 s	50 s	50 s
Intensity	OMNI-GSE 5-6	OMNI-GSE 7-8	OMNI-GSE 7-8
Middle	Body weight	Bands	Bands - dumbbells
Total duration	24 min	27 min	32 min

MMSS = Upper Extremity Exercises; MMII = Exercises for lower extremities; repetition = repetitions; s = series duration in seconds; OMNI-GSE = effort perception scale adapted for group classes with older people; min = total duration of the session in minutes.

three exercises on the upper limbs, thus completing a series. In relation to the load, the number of series was initially established at three, the number of repetitions per exercise at six, and the recovery time of one minute during the first two weeks; subsequently, the load was increased every three weeks until reaching four series of eight repetitions with a recovery of 50 seconds in each exercise, aspects that can be observed in more detail in table 1.

As an element of subjective control of intensity, we used the OMNI-GSE effort perception scale, adapted for group classes with elderly people (Da Silva-Grigoletto et al., 2013). 3) once the CORE phase was finished, stretching was performed for 15 minutes allowing a return to calm and relaxation. The intervention was based on the general principles of exercise prescription: frequency, intensity, duration, type, volume and progression of exercise (Heyward, 2008).

Three variables were the object of this study: functional capacity, quality of life and well-being; also, basic anthropometric measurements were taken to characterize the participants.

Anthropometric Parameters: The data collection of basic anthropometric measurements was performed based on the guidelines of the Nutrition Group of the Spanish Society of Geriatrics and Gerontology (Camina- Martín et al., 2016) and those of the Ministry of Health and Social Protection of the Republic of Colombia (2021) related to nutritional assessment in older adults; these measurements were height determined with a portable stadiometer (SECA 213) with an accuracy of 0.1 cm, total body mass with an Omron scale (HBF-514C) with an accuracy of 0.01 kg and body mass index (BMI).

Functional Capacity: For the functional capacity variable, the Senior Fitness Test (SFT) battery was used, consisting of seven tests that allowed the evaluation of muscular strength and endurance (elbow flexion; sitting down and getting up from the chair), cardiorespiratory capacity (stationary walking for two minutes; walking for 6 minutes), flexibility (joining hands behind the back; sitting down and reaching for the foot) and agility (getting up, walking and sitting down again), whose protocol was subject to the provisions of Rikli and Jones (2013). In addition to this battery, the

prehensile strength test was applied, carrying out the ACSM protocol (Ligouri, 2021) using a digital prehensile dynamometer (Camry model EH101) with an accuracy of 0.1 kg. As for the 6-minute test, which is part of the SFT battery, heart rate was monitored with Polar® A300 heart rate monitors to establish the maximum average heart rate reached (in beats per minute [bpm]). The tests were performed one week before starting the physical exercise program and one week after its completion at times between 8:00 and 10:00 in the morning.

Health-Related Quality of Life: For the collection of information on this variable, the survey technique was used by means of the SF-36 questionnaire in its standard version developed by Ware et al. (1993), consisted of 36 questions divided into 8 dimensions in which the degree of physical function (10 items), physical role (4), bodily pain (2), general health (5), vitality (4), social function (2), emotional role (3), mental health (5) and health transition (one item) were measured. They were completed by means of a personal interview guided by the professionals responsible for the study, prior to the anthropometric and functional tests programmed before and after the intervention. To estimate the degree of health status in each dimension, the score was standardized from 0 to 100 so that the higher the score, the better the health status.

Perception of well-being: As a qualitative category of this study, the perception of well-being was developed under a phenomenological design using the post-intervention focus group as a data collection technique, to interpret the experiences lived by the participants of the physical exercise program. The focus group was organized based on the construction of a semi-structured guide composed of nine questions distributed in two categories: functional status (four questions) and emotional well-being (five questions), so that they were representative for the study in relation to the objective (Ñuapas et al., 2018); these were validated by three experts in the areas of sociology, human development and physical education, by means of the indicators of sufficiency, clarity, coherence and relevance (Hernández-Nieto, 2011); the result of the total content validity coefficient was good (CVC 0.89) understanding that to a high degree, the questions were accepted by the three experts.

The sample was divided into two groups, one of 13 and the other of 12 participants, to include enough elderly people so that the information collected would be diverse, but taking care that there would be no discomfort in sharing opinions and experiences (Onwuegbuzie et al., 2009); each older person authorized their participation and the recording of the session through informed consent; the session lasted approximately two hours, moderated by an expert in qualitative research; a mobile device with a sound recorder application was used to record the sessions; for the transcription of the data, the “Word” application of the Microsoft Office 365 package was used, in which a file was created for each session to later load them and conduct a thematic analysis of the data collected in this study.

This study was conducted in accordance with the parameters for research on human subjects defined by the Helsinki Declaration of the World Medical Association (WMA, 2013) as well as the considerations outlined in the scientific, technical and administrative standards for health research (Ministry of Health and Social Protection Republic of Colombia, 1993). All procedures applied were approved by the Research Ethics Committee of the Corporación Universitaria Minuto de Dios (code: 24_06_20).

Statistical Analysis

The G*power software version 3.1.9.7 was used to calculate of the estimate of statistical power and sample size, in which a large effect size (0.8) determined from the review of similar studies, an expected power (β) of 0.95 and a probability of error (α) of 0.05 were indicated. As a result, the minimum estimated sample was 23 participants, which corresponds to the sample size of this study of 25 participants. For the statistical analysis of functional capacity and health-related quality of life (HRQL), the IBM SPSS Statistics software version 23.0 was used, and additionally, the G Power program version 3.1.9.7 was used to determine the effect size of the differences in the inferential tests. For all quantitative variables under study, the mean (M) and standard deviation (SD) were calculated; for the comparison of M before and after the intervention, the t Student test for related samples was used after checking the assumption of normality using the Shapiro-Wilk test; in relation to the effect size derived from the intervention, the Cohen's d test was used. The significance level (α) established in the analysis was .05. Regarding the qualitative analysis of the category of well-being, a hermeneutic structure was developed based on the proposal of Hernández and Mendoza (2018), which consisted of the transcription of recordings of the

interviews in the focus groups by means of a double-entry matrix (group-responses). Subsequently, open coding was carried out, which consisted of the organization and selection of key quotes articulated in the theoretical categories; then the axial coding technique was applied, determined by the resulting hierarchical relationships between the semantic families (social, physical and psychological spheres) and the emerging categories (companionship, family, inclusion, health, exercise, physical condition, self-perception, motivation, spirituality, vitality, emotionality, and learning). Finally, relational networks were structured between each category for the holistic understanding of the appraisals and social experience in the participation of the physical exercise program (Rivera et al., 2014).

Results

The results are presented in two sections: the first is focused on report the basic characteristics, functional capacity and perception of quality of life of the participants through the analysis of quantitative data before and after the intervention; the second section examines the perception of well-being through the interpretation of the narrative of the participants from the experience after participation in the physical exercise program. Table 2 presents the initial anthropometric characteristics of the 25 participants who completed all phases of the study.

Functional Capacity

Table 3 presents the results of the functional capacity variables strength and flexibility in lower and upper limbs, agility and cardiorespiratory endurance with their respective descriptive statistics based on means, pre- and post-intervention standard deviation and mean differences (Dif-M), as well as the comparative inferential statistic (t), p-value and effect size (d). After eight weeks of intervention, we found an increase in right upper extremity muscle strength (ESD) in the dynamic elbow flexion test, with a large effect size (95% CI [1.53-3.03]); similar results were found in the left upper extremity (ESI) with a medium effect size (95% CI [0.32-1.21]). Regarding prehensile strength, the tension exerted (kg) in both limbs increased after the intervention with statistical significance, ESD 95% CI [0.33-1.23] and ESI considering a large effect size, 95% CI [0.430-1.36]). Regarding the sit-to-stand test which assessed lower limb strength, the results show that the number of repetitions increased with statistically significant difference and a large effect size, 95% CI [0.69-1.72].

Table 2. Anthropometric characteristics of the participants (n=25)

	M	Me	SD	Rank	EE	CI 95%	
						Li	Us
Age, years	74.20	74.12	6.40	22.65	1.28	71.56	76.84
Stature, cm	150.31	150.00	7.07	28.00	1.41	147.39	153.23
Body mass, kg	63.64	64.80	11.96	42.80	2.39	58.71	68.58
BMI, kg/m ²	28.14	27.54	4.81	16.06	0.96	26.15	30.12

cm = centimeters; kg = kilograms; BMI = body mass index; M = Mean; Me = Medium; SD = Standard deviation of the mean; EE = Standard error of the mean; CI 95% = effect size confidence interval from the lower (Li) and upper (Us) limits.

Table 3. Variables of functional capacity and behavior after eight weeks of intervention (n=25)

Capacity	Test	Extremity	Pre-intervention	Post-intervention	Dif-M	East	d
			M ± SD	M ± SD			
Strength	PRF [kg]	Right hand	14.87 ± 2.81	15.71 ± 2.81**	0.84	3.92	0.78
		Left hand	15.23 ± 3.56	16.38 ± 3.51**	1.15	4.52	0.90
	ELF	Right arm	14.32 ± 3.44	17.88 ± 3.46**	3.56	11.43	2.29
		Left arm	14.32 ± 3.38	16.72 ± 3.26**	2.40	3.86	0.77
	SL [s]	bilateral	14.68 ± 3.60	17.40 ± 3.32**	2.72	6.06	1.21
Flexibility	CHB [cm]	Right arm	-13.52 ± 6.57	-11.28 ± 6.67**	2.24	6.44	1.29
		Left arm	-20.06 ± 8.13	-17.40 ± 6.93**	2.66	4.05	0.81
	SRF [cm]	Right foot	-10.40 ± 10.13	-7.84 ± 8.63*	2.56	3.47	0.69
		Left foot	-9.11 ± 8.25	-5.92 ± 7.75**	3.19	6.24	1.25
Agility	GWS [s]	bilateral	5.53 ± 0.68	5.41 ± 0.70	-0.12	685.00	-0.28
C. capacity	M2M [Rep.]	Bilateral	68.08 ± 16.71	76.20 ± 17.27**	8.12	4.86	0.97
	W6M [m]	Bilateral	455.37 ± 89.01	570.59 ± 120.33**	115.22	6.81	1.36
	HR6M [ppm]	Not applicable	117.44 ± 10.76	115.80 ± 11.40	-1.64	-1.65	-0.33
	%HR6M	Not applicable	75.12 ± 7.33	74.08 ± 7.79	-1.04	-1.62	-0.32

C. capacity: Cardiorespiratory capacity; M: Medium; DS: Standard deviation; Dif-M = difference between the means of the dimension; Est = Test statistic; **: significant values, $p < 0.001$; *: significant values, $p < 0.05$; d = Cohen's d effect size; PRF: Prehensile Force; ELF: Elbow flexion; SL: Sit back and get up from the chair; CHB: Clasp your hands behind your back; SRF: Sit and reach the foot in sedation; LCS: Getting up, walking, and sitting again; M2M: Stationary march in 2 minutes; W6M: Walk 6 minutes; HR6M: Maximum heart rate at the end of the Test walk 6 minutes; %HR6M: % HRmax at the end of Test walk 6 minutes.

In the flexibility capacity of the upper extremities (shoulder joint), a decrease in the distance between the fingers was identified in the test of joining the hands behind the back, which assumes an improvement in the two extremities with a large effect size (ESD: 95% CI [0.75-1.81]; ESI: 95% CI [0.35-1.26]). In relation to lower limb flexibility (hip joint) from the sit and reach test, it is evident that the distance between the distal phalanx of the toes and the tip of the foot decreased, considered statistically significant with moderate (EID: 95% CI [0.25-1.13]) and high (EII 95% CI [0.71-1.77]) effect sizes.

For agility, it was observed that, when comparing the means of the time used in the test of standing up, moving and sitting down again, there were no significant changes between the initial test and the post-intervention. When observing the effects of physical exercise on this capacity, the results showed that, in the 2-minute stationary walking test, the number of repetitions performed increased significantly with a large effect size (95% CI [0.49-1.44]). Along the same lines, in the 6-minute walk test, a statistically significant increase in the distance covered by the participants was observed with a large effect size (95% CI [-0.81-0.12]). Additionally, during the 6-minute test, the heart rate was recorded at the end of the test, the results of which show that when comparing the initial test of maximum heart rate with the recording at the end of the intervention, no significant changes were found ($p > 0.05$).

Health-related Quality of Life (HRQOL)

Table 4 presents the effects of physical exercise on the dimensions of health-related quality of life (HRQOL) of the 25 participants from the descriptive statistics of the

standardized scores of the SF-36 questionnaire mean (M), standard deviation (SD) pre- and post-intervention, and the differences of these (Dif-M), as well as the comparative inferential statistic (t), the p-value, the effect size (d) and the confidence interval of the effect size (CI95%).

The results of the perception of HRQOL indicate that the scores in the eight dimensions increased significantly ($p < 0.05$), highlighting that general health, physical role, physical function, emotional role and social function were those with the highest scores, with large effect sizes ($d > 0.80$), while the dimensions bodily pain, mental health and vitality, although they improved, obtained medium effect sizes ($d \Rightarrow 0.5$). Regarding the overall quality of life score, it was observed that it increased significantly with large effect sizes.

Perception of Well-being

The qualitative results of this study based on the perception of well-being are presented in Figure 1, which exposes the theoretical categories (TC) functional status for quality of life and emotional well-being, which were the starting point for the interpretation of the narrative resulting from the focus groups; consequently, 3 semantic families (SF) and 12 emergent categories (EC) were identified.

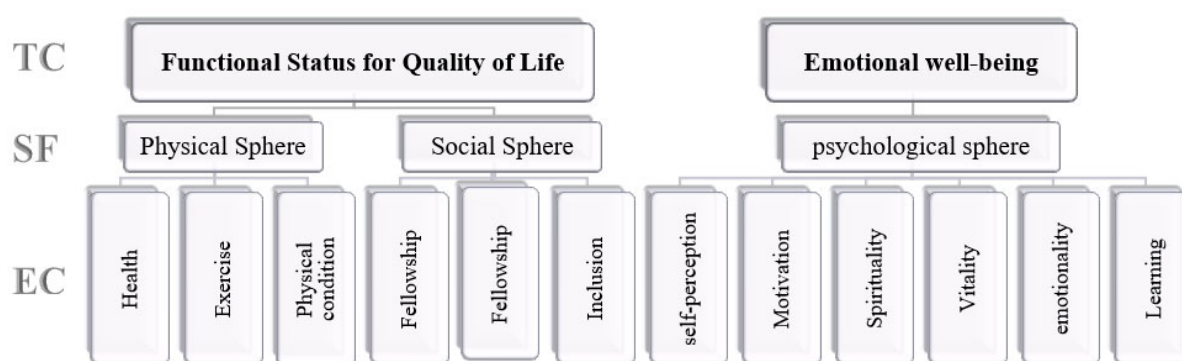
Functional Status for Quality of Life

In this TC, the participants perceived the degree of performance when carrying out activities of daily life, this is interpreted as the levels of performance capacity and its relationship with being healthy. Two SF were identified

Table 4. Health-related quality of life dimensions before and after the intervention

Dimension	Pre Score	Post Score	Dif-M	t	gl	d	CI 95%	
	M±SD	M±SD					Li	Is
Physical Function	42.00±14.22	58.00±11.27**	16.00	9.65	24	1.93	1.25	2.59
Physical Role	39.00±14.58	59.00±17.50**	20.00	4.90	24	0.98	0.49	1.45
Body Pain	64.08±20.34	71.88±16.47**	7.80	3.97	24	0.79	0.34	1.24
General Health	29.60±6.67	57.28±11.25**	27.68	11.94	24	2.39	1.60	3.16
Vitality	76.40±11.50	80.80±11.43*	4.40	2.53	24	0.51	0.08	0.92
Social Function	71.50±12.25	83.50±8.63**	12.00	4.10	24	0.82	0.36	1.27
Emotional Role	23.99±24.58	38.65±15.77**	14.66	4.34	24	0.87	0.40	1.32
Mental health	81.44±9.58	87.36±7.89**	5.92	3.82	24	0.76	0.31	1.20
Global Score	58.53±5.53	71.32±5.39**	12.79	16.99	24	3.40	2.36	4.43

Dif-M = difference between the means of the dimension; t = Statistic of the student's parametric test t for related samples selected according to the result of the Shapiro Wilk normality test; gl = degrees of freedom; p = value that is contrasted with the proposed significance level of 0.05; **: significant values, $p < 0.001$; *: significant values, $p < 0.05$; d = Size of the effect obtained from Cohen's d test; CI 95% = effect size confidence interval from the lower (Li) and upper (Is) limits.

**Fig. 1.** Categories resulting from the focus group.

Note: TC = theoretical category; SF = semantic family; EC = emergent category

based on recurrence: Social sphere (14.3%) and physical sphere (24.8%). The former contains the SGs companionship (5.5%), inclusion (4.4%) and family (4.4%). Companionship arises from the interaction and harmony of relationships among the participants: "it is very beneficial and satisfying to spend time with classmates and all of you teachers"; as for the EC inclusion, the elderly participants indicated that they are a fundamental part of the group due to the recognition of individual capacities: "we have noticed that there is no discrimination because if one person can do the exercises well, and the other can't, they take us all into account, they are very patient with us and help us to improve"; finally, the participants associate the interaction as a manifestation of the EC family since they state: "we are not really a group but like a family and I feel very happy to be spending time with you".

Regarding the SF physical sphere (frequency 24.8%), it groups the SGs health (17.1%) exercise (4.4%) and physical condition (3.3%), and it is observed that they have an influence on the perception of autonomy. This is interpreted considering that the appreciation of QoL in older adults is directly related to personal satisfaction, and the optimal state of physical health (Ferradas & Freire, 2016). From this SF, it is highlighted that in the EC of Health there is an outstanding recurrence with respect to the other

EC, in which it is interpreted that the elderly manifest an estimation of health improvement after the participation in the program: "now I feel that my health has improved a lot" which is articulated with the EC exercise that denotes the improvement of functional autonomy from the changes perceived during and after the intervention: "the exercises have helped me a lot because my bones were very stiff and in the short time I have been doing them I have felt much better". The physical condition EC aspects associated with the perception of weight reduction are highlighted: "I started losing weight little by little and with you I have lost 3 kilos"; and participants say they are feeling healthy thanks to the practice "stretching has strengthened me a lot it has helped me a lot for my health I do not feel sick". These appreciations become a decisive element for the participants to adhere to the program, since a good physical condition favors independence, obtaining better results in the quality of life, through various collective activities that include physical exercise (Villarreal-Angeles et al., 2021).

Emotional Well-being

The TC Emotional well-being (frequency 60.9%) in the SF of the psychology sphere is directly related to mental

health and the perception that the older person has of his/her current situation, i.e. psychological well-being; this SF groups together the SGs of self-perception (15.5%), spirituality (12.2%) motivation (12.2%) vitality (10%), emotionality (6.6%) and learning (4.4%). In terms of frequency in this SF, the EC of Self-perception is evidenced as relevant in which the discursive recurrence in specific states is highlighted and is articulated with the multidimensional model of psychological well-being from the dimensions of acceptance with oneself, psychosocial links, autonomy and control of situations, expressing “feeling alive, feeling that despite my years I feel very well and I feel fulfilled”. Particularly present are the emergent relational networks which denote the appreciation of older adults in aspects such as feeling ready for action from the EC motivation: “wanting to do things, feeling good, feeling active, feeling alive”; the EC of vitality from the openness to practice: “I am an active person, my physique allows me to do many more sports activities”; physical factors associated with the EC emotionality: “feeling better because I have gained a lot of flexibility, balance and mentality”. These three emerging categories are articulated indicating that people feel more satisfied with their lives and willing to do physical exercise, likewise, participating in the program on a continuous basis tends to the understanding of the routines and the EC learning: “well after the exercises we learn, I feel that I can repeat them and now I practice them at home”.

On the other hand, it is evident that for the participants the Spirituality EC is fundamental: from this, guidelines regarding gratitude and possibility stand out: “I thank God because first he has given me life, second he has given me strength to do my exercises” and it is related to the motivation EC for participation: “thanks to God for giving me the joy to get up and have that incentive to get ready to go out and exercise”. The above is essential for the practice of physical-recreational activities by older adults who, from their self-perception and beliefs, recognize themselves as more vital and emotionally.

Discussion

The aim of this study was to evaluate the effect of physical exercise on functional capacity, HRQOL and PB in apparently healthy elderly females. The proposed training consisted of functional strength exercises using training aids easily acquired by the participants, the exercise progression was differentiated by the number of repetitions and sets, materials used, total time of the sessions and the subjective perception of effort by means of the OMNI-GSE scale. The main findings indicate that eight weeks of physical exercise based on functional training triggers improvements in cardiorespiratory capacity, improving the independence of elderly women, which has an impact on the quality of life (Da Silva et al., 2020). Therefore, it is deduced that, from the proposed intervention, not only is cardiorespiratory endurance related to static walking and 6-minute walk is improved, but also a greater life expectancy can be achieved an important aspect for the participants of this type of program and their close relatives or caregivers by contributing to their health (Yin et al., 2020).

In muscular endurance in upper limbs, a significant improvement is denoted, which is inversely related to

cardiovascular risks and mortality (Figueroa et al., 2019). A significant increase in prehensile strength was also evidenced, which, accompanied with lower limb assessment, is considered a practical and relevant biomarker in concurrent general strength for the elderly (Bohannon, 2019).

Regarding strength in lower limbs, the findings indicate that functional muscular resistance training significantly improved this capacity, which coincides with other studies related to the increase of muscular strength, by means of resistance training on unstable bases for 10 weeks and combined exercise of traditional balance and virtual reality for 8 weeks in which in addition to improving strength, so did balance and functional mobility (Eckardt, 2016; Sadeghi et al., 2021); this has a close correspondence with emotional states by counteracting the degree of depression when strength training is combined with aerobic training and a positive influence on levels of health perception (Solà et al., 2019).

In upper and lower limb flexibility, significant changes are observed after participation in the program; data similar to those found in other studies, are associated with the improvements observed in strength training and with studies that demonstrate high performances in joint amplitude ranges in active older adults (Concha et al., 2017; Escalante et al., 2019); likewise, differences between limbs were evidenced, reflecting improvements in the lower limbs (Vaca et al., 2017), which allows the effectiveness of the implemented program to be verified. When referring to HRQOL, older persons directly relate their social role to participation in community activities, which indirectly contributes to physical and emotional stability. Likewise, these programs for the community are oriented to the practice of physical exercise from institutionalized or integrated service projects (Gallegos et al., 2019), as well as in the subjective perception through the pre and post application of the SF-36 questionnaire. At the conclusion of the intervention of the physical exercise program, scores in the dimensions of health perception in general stand out with a significant improvement in the dimensions of role and physical function, results similar to other studies (Gallegos et al., 2019; Ramírez & Triana, 2007).

The effect of functional training programs originates a significant improvement in physical fitness and in the dimensions of quality of life related to health and well-being associated with happiness (Solà et al., 2019; Vargas-Vitoria et al., 2021). With respect to well-being, the resulting discursive interpretation is aligned with other studies that denote the increase of parameters regarding the perception of general health, vitality and social functioning in participants of programs associated with exercise, and others performed as activities in leisure time and that contribute to the establishment of social relationships or friendships, benefiting the physical and mental health of older adults and in turn, well-being (Paggi et al., 2016). On the other hand, physical activity levels can increase when older adults are allowed activities that contribute to social relationships, i.e., conservation or establishment of friendships, generating improvements not only in physical activity but also in life satisfaction, an aspect observed in another research (Huxhold et al., 2013).

Likewise, this type of physical training has a positive impact on older adults reflected in functional independence (Mora-Vicente et al., 2007), a situation that is related

to subjective well-being and activities of daily living (Almonacid et al., 2021). This aspect was observed by Sotelo et al. (2014) in a group of 150 older adults who participated in a physical activity program, finding an inverse association between muscle mass and frailty criteria, those with less muscle mass in the lower limbs presented lower levels of functional independence.

Another aspect to take into account is that the normal biological process of the older adult conditions to the involution of physical skills, however, physical exercise is devised as a relevant factor in the decrease of such condition (Figueroa et al., 2019); similarly, the process of programs for the promotion health from physical activity, strengthen functional capacity, as well as contribute to positive conditions of subjective well-being and quality of life in the older adults (Honório et al., 2021; Poblete-Valderrama et al., 2015). In this framework, physical exercise programs are oriented by age and gender, taking as a reference the cardiovascular vascular risk factors in participants (Ramírez-Villada et al., 2015), projecting the benefits it brings in functional independence (Alvarez & Alud-Sorao, 2017). Likewise, programs that combine multicomponent physical activity, including aerobic strength, stretching and balance exercises, reduce the level of depression, strengthen cognitive processes (Da Silva et al., 2020). Their systematic application and practice enable the improvement of various physical abilities (Font-Jutglà et al., 2020; Vaca et al., 2017).

Regarding the qualitative analyses performed in the category of functional status for quality of life and the semantic family of physical sphere, it can be understood that QOL in older person is directly related to personal satisfaction, and the optimal state of physical health (Ferradas & Freire, 2016). In addition, to contribute to the adherence to physical activity programs in this population, considering physical, social, economic and psychological particularities of this population (Assumpção et al., 2014). In addition, it highlights the importance of targeted and systematic physical activity programs, proposed by professionals who consider the various factors that may be limiting or facilitating the practice, permanence and adherence to this type of program (Jefferis et al., 2014).

Limitations of the study

This study had limitations in the research design, the monitoring of heart rate and the multicomponent aspect in the training sessions, this factor sometimes means that physiological intensity the subjects are being exposed to is not known. Using subjective methods to solve this difficulty it is suggested that for future research, controlled clinical trials be developed to increase the internal methodological validity, propose multicomponent physical exercise interventions and monitor heart rate as an indicator of internal load control during the sessions. Likewise, it is recommended that male participants be included since this study did not have the minimum required according to the estimation of the statistical power of the sample ($n=23$).

Interpretation and Generalizability

This study can be a reference to contribute to local and regional programs of physical activity in the elderly using

strength training, and to incorporate the methodology applied to multicomponent physical exercise plans. Likewise, and simultaneously, to follow-up on the perception of quality of life and well-being as fundamental axes of active aging by means of the techniques and instruments referenced in this study.

Conclusions

The findings of this study indicate that eight weeks of physical exercise based on strength training with affordable means (own body weight, elastic bands and dumbbells) with a frequency of 3 days a week between 54 and 62 minutes of duration, improve the functional capacity of strength and flexibility in upper and lower limbs, and cardiorespiratory endurance in older women; however, no significant changes were observed in agility and maximum heart rate during the 6-minute test of the SFT battery. It was also found that this intervention had a positive impact on HRQOL as well as on the perception of well-being, which confirms that the systematic practice of physical exercise contributes to maintaining a healthy physical and mental life during aging.

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Conflict of Interest

The authors declare that there is no conflict of interest.

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Вплив фізичних вправ на функціональну спроможність та сприйняття стану здоров'я у осіб похилого віку

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Авторський вклад: А – дизайн дослідження; В – збір даних; С – статаналіз; D – підготовка рукопису; Е – збір коштів

Реферат. Стаття: 11 с., 4 табл., 1 рис., 51 джерело.

Мета дослідження. Метою дослідження було оцінити вплив силових тренувальних вправ на показники функціональних можливостей, якість життя та сприйняття стану здоров'я у осіб похилого віку.

Матеріали та методи. Було застосовано змішаний метод дослідження з секвенційним пояснювальним плануванням, в якому взяли участь 25 жінок похилого віку від 62 до 85 років, які протягом восьми тижнів займалися фізичними вправами з частотою 3 рази на день і тривалістю занять в середньому 58 хвилин. Батарея тестів для визначення рівня фізичної підготовленості осіб похилого віку (Senior Fitness Test) включала тест на силу хвата, моніторинг серцевого ритму протягом 6-хвилинного тесту, опитувальник SF-36 з метою оцінки стану здоров'я та фокус-групу після інтервенції, орієнтовану на аналіз самопочуття.

Результати. Показники кардіореспіраторних можливостей, сили та гнучкості значно покращилися ($p < 0,05$), проте рівень спритності та частоти серцевих скорочень залишився незмінним ($p > 0,05$). Також спостерігалось підвищення результатів у 8 проаналізованих вимірах якості життя, а в суб'єктивній оцінці самопочуття покращення стану здоров'я було виявлено як у самосприйнятті, так і в забезпеченні автономії повсякденної діяльності, пов'язаної з життєздатністю, мотивацією, соціальною взаємодією та дотриманням режиму фізичної активності. Отримані дані свідчать про те, що фізичні вправи на основі силових тренувань покращують функціональну спроможність, якість життя, пов'язану зі здоров'ям, і стан загального самопочуття осіб похилого віку.

Висновки. Результати цього дослідження показують, що фізичні вправи протягом восьми тижнів, засновані на силовому тренуванні з використанням доступних засобів (власної ваги, еластичних стрічок і гантелей) з частотою 3 дні на тиждень, сприяють поліпшенню показників функціональних можливостей сили та гнучкості верхніх і нижніх кінцівок, а також кардіореспіраторної витривалості у жінок старшого віку. Також було встановлено, що дана інтервенція має позитивний вплив на якість життя, а також на сприйняття стану здоров'я.

Ключові слова: фізичний стан людини, профіль впливу захворювання, фізична підготовленість, емоції, старіння.

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