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Research Paper

Effects of a multicomponent physical exercise programme on perceived health-related quality of life and on depressive symptoms in older adults living in long-term nursing homes

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ABSTRACT

Objectives: This study aimed to investigate the impact of a multicomponent exercise programme on perceived health-related quality of life (HRQoL) and depressive symptomatology in older people living in a long-term nursing home (LTNH).

Methods: A quasi-experimental study was conducted. Forty-one older people were conveniently selected from the largest LTNH in the Basque Country. The participants were assigned to either an intervention group ($n = 21$) or a control group ($n = 20$). The intervention group participated in 50-min moderate intensity multicomponent physical exercise sessions (strength and balance, three sessions a week for 3 months). The control group participants continued their usual activities in the LTNH. Assessments were completed at baseline and reassessed after the 12-week intervention by the same nurse researchers who filled out the questionnaires: the 36-item Short Form Survey (SF-36) and the Geriatric Depression Scale (GDS).

Results: Thirty-eight participants completed the study (19 participants in each group). In the SF-36 parameters, physical functioning increase in the intervention group tends with a mean increase of 11.06 units (a 17.2% increase over the pre). In the role-emotional, the increase in the intervention group is with a mean increase of 5.27 units (a 29.1% increase over the pre) ($P < 0.05$). In social functioning, the increase in the control group is significant with a mean increase of 13.16 units (a 15.4% increase over the pre) ($P < 0.05$). There are no significant changes in the rest of the parameters, there are no differences between groups in the evolutionary pattern either.

Conclusions: As for the effects of the multicomponent exercise programme on HRQoL and depressive symptomatology, no statistically significant effects were obtained in the outcome data among older adults living in LTNHs. An increase in the sample size could confirm the trends obtained. The results may help inform the design of future studies.

What is known?

- The aging process associated with a sedentary lifestyle leads to emotional, social, and physical dependence. In contrast, physically active people enjoy a better quality of life and have less depression.
- There is evidence on the efficacy of physical exercise on the global perceived health-related quality of life (HRQoL), particularly of community-dwelling older people.

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What is new?

- The intervention tends to increase the role-emotional score of the 36 item Short Form Health Survey (SF-36) in the intervention group with respect to the control group.
- Three-month, individualized and progressive multicomponent exercise program of moderate intensity is viable and well tolerated in older adults from long-term nursing home.

1. Introduction

In 2019, 20.3% of the population in the European Union (EU) was older than 65 years, and by 2100 it is expected to be 31.3%. Likewise, between 2019 and 2100 the population of people over 80 is expected to grow from 5.8% to 14.6% [1]. The number of people who will need long-term residential care will increase in the coming years [2,3]. It is estimated that between 2% and 5% of older persons live in long-term nursing homes (LTNHs) [4]. Residential care is an alternative that provides adequate health care, especially for older adults who have the poor functional capacity, advanced chronic diseases, and dependency [3]. Being older and residential care can be a significantly traumatic event that requires adaptability. The loss of independence and space are two notable challenges that can trigger depressive symptoms and lower their self-esteem, well-being, and quality of life [5]. Today, it seems that reaching a high level of perceived health-related quality of life (HRQoL) has priority over longevity [2]. In addition, residents who live in LTNHs tend to be fairly inactive, engaging in sedentary activities most of the day [6]. Poor health, fear of injury, and lack of motivation are barriers that prevent older adults from leading a physically active life [7]. Consequently, the aging process associated with a sedentary lifestyle leads to emotional, social, and physical dependency [8]. In contrast, physically active people enjoy a better quality of life and mental health than those who lead a sedentary lifestyle [9], as well as active people, are less depressed [10]. It has also been seen that the type of physical activity and/or intensity of physical exercise performed are important factors to consider to obtain these benefits [11–13]. Therefore, discovering effective and viable interventions to achieve this objective becomes a great challenge for health [2]. However, there are few studies available on these factors to increase HRQoL and depressive symptoms in LTNH residents. Therefore, the purpose of this study was to analyze the effect of a 12-week moderate-intensity multicomponent exercise programme on each of the parameters that make up HRQoL and depressive symptoms in older people living in a LTNH.

2. Methods

2.1. Study design

A quasi-experimental study was conducted in 2017. Participants were conveniently selected from the targeted population and randomly divided into an intervention group (IG) and a control group (CG) to analyze the effect of a 12-week multicomponent exercise programme on every single parameter of HRQoL and depressive symptoms in older adults living in a LTNH.

2.2. Study setting and participants

The participants were recruited from a LTNH of 303-place for dependent older people in San Sebastian (Basque Country, Northern Spain), the largest and one of the most important LTNHs in the Basque Country. LTNHs in Spain provide their residents with 24-h residential care to physically and/or cognitively impaired older adults, including on-site medical and nursing support, rehabilitation and entertainment services. The required sample size was calculated using the G-power version (3.1). Given a mixed-design (within groups and between groups) repeated measures general linear models (GLM), power of 0.90, the moderate effect size of 0.25, and α of 0.05, the required sample size was 30 participants. A sample size of 38 participants is needed, with an expected attrition rate of around 20% and an additional 5% for mortality. The resulting sample size is 38 participants, allocating 19 participants to each group (IG and CG). The flowchart presented in Fig. 1 describes the recruitment of participants.

The inclusion criteria were as follows: living in LTNH for at least six months, age $\geq$65 years and were judged clinically stable by the medical staff specializing in geriatric medicine and familiar with the health history of the participants, functional capacity to perform the Basic Activities of Daily Living (BADL) with a score $\geq$60 on the Barthel Index (0–100) [11], the cognitive state with a score $\geq$14 on the Mini-Mental State Examination (MMSE) (0–30) [12], and ability to stand upright and walk independently for at least 10 m. Participants will not be eligible for the study if they are judged clinically unstable by the medical professionals of the center, or have any other condition in which entering the study would not be in the participant's best interests.

2.3. Ethical considerations

This study was approved by the Ethics Committee for Research on Human Beings of the University of the Basque Country, UPV/EHU (Code No. CEISH/126/2012). All participants and their families received detailed oral and written information about the study from the research team and signed the informed consent form.

2.4. Intervention procedure

2.4.1. Intervention group

Participants in the IG performed a three-month long multicomponent physical exercise intervention. The programme included strength and balance exercises and was designed by physical activity professionals. Fifty-min supervised group sessions (ranged from 4 to 5 participants at a time) directed to improve strength and balance were conducted three times a week nonconsecutive (Table 1). All sessions began with a warm-up of 5-min and after 40-min training, the session finished with 5 min of breathing and relaxing exercises, drinking water, and/or eating fruit. Program adherence was considered when they participated in at least 70% of the sessions.

The exercises were designed by professionals in physical activity and geriatrics and adapted to the particular requirements of the functional capacity of each participant. The sessions began with a brief warm-up of 5 min of joint range-of-motion exercises. Strength training comprised exercises of moderate intensity for the upper and lower body, which were performed individually and progressively with external weights. They could use the hand for support if necessary. Strength exercises were focused on lower extremity strengthening (calf raises, sit to stand from a chair, lateral lunge, forward lunge, and stair climbing). Volume and execution velocity increments were used to achieve training progression and based on the perceived effort of the individual using the Borg Rating of Perceived Exertion (RPE) 6–20 scale [14], increasing or decreasing the number of repetitions, the speed and the loads. Physical exercise of moderate intensity was to be maintained according to the perceived effort measured by the Borg scale in a range of 12–15. Therefore, when reaching 15, the intensity level was decreased, and then increased again if able to repeat two sets at a perceived effort of 12. Balance training exercises were included to progress in

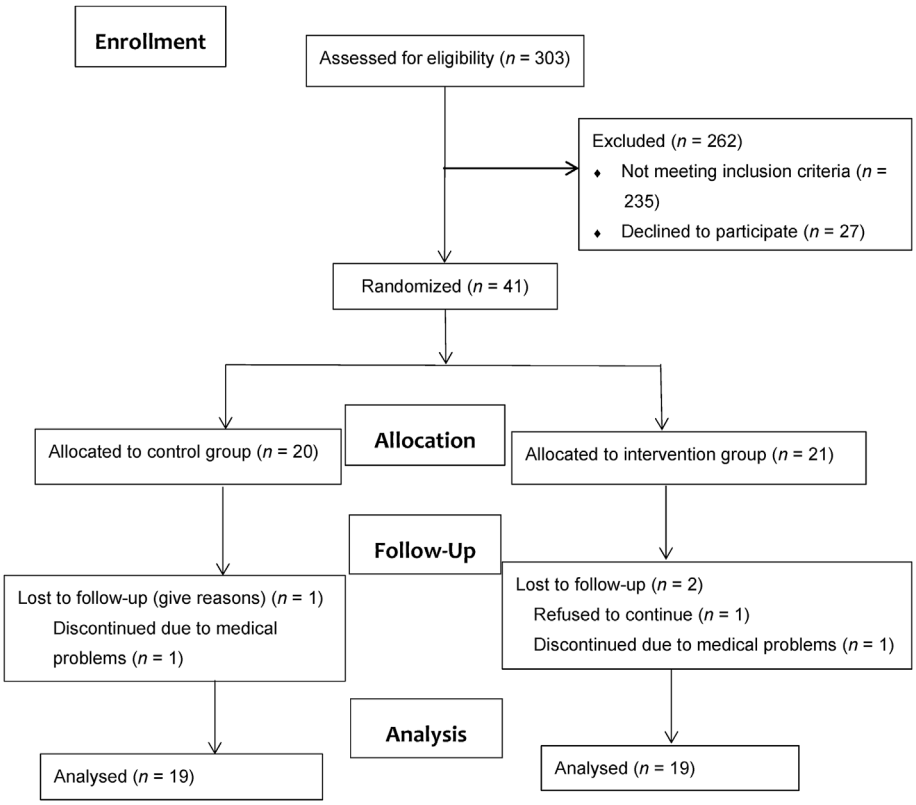

Fig. 1. Study flow diagram for the study participants.

Table 1
Programme of the multicomponent exercise intervention.

Contents	Monday (strength 25 min and balance 15 min)	Wednesday (balance 40 min)	Friday (strength 40 min)
Warm-up(5 min)	Range of motion of different joints	Range of motion of different joints	Range of motion of different joints
Strength training	Calf raises: 2 sets, 10–15 rep	–	Calf raises: 2 sets, 10–15 rep
	Sit to stand from chair: 2 sets, 10 rep	–	Sit to stand from chair: 2 sets, 10 rep
	Lateral lunge: (maximal length) 2/3 leg length from ASIS to internal malleolus, 2 sets, 10–15 rep	–	Lateral lunge: (maximal length) 2/3 leg length from ASIS to internal malleolus, 2 sets, 10–15 rep
	Forward lunge: (maximal length) 2/3 Leg length from ASIS to internal malleolus, 2 sets, 10–15 rep	–	Forward lunge: (maximal length) 2/3 Leg length from ASIS to internal malleolus, 2 sets, 10–15 rep
	Stair climbing: upstairs downstairs, 2 sets, 10 rep	–	Stair climbing: upstairs downstairs, 2 sets, 10 rep
Balance training	Hold stable: parallel legs/Semi-tandem/tandem/one legged stand, 2 sets 6–20 s	Hold stable: parallel legs/semi-tandem/ tandem/one legged stand, 2 sets 6–20 s	–
	Reach front objects: shoulder level/above shoulder/ below shoulder, 2 sets 6–20 s	Reach front objects: shoulder level/above shoulder/below shoulder, 2 sets 6–20 s	–
	Reach objects lateral: shoulder level/above shoulder/ below shoulder, 2 sets 6–20 s	Reach objects lateral: shoulder level/above shoulder/below shoulder, 2 sets 6–20 s	–
	Forward: right/left leg, 2 sets, 6–20 s	Forward: right/left leg, 2 sets, 6–20 s	–
	Lateral: right/left leg, 2 sets 6–20 s	Lateral: right/left leg, 2 sets 6–20 s	–
	Turn 90°: right/left leg, 2 sets, 6–20 s	Turn 90°: right/left leg, 2 sets, 6–20 s	–
	Turn 180°: right/left leg, 2 sets, 6–20 s	Turn 180°: right/left leg, 2 sets, 6–20 s	–
Close of training session (5 min)	Breathing and relaxing exercises/drink water and/or fruit	Breathing and relaxing exercises/drink water and/or fruit	–

Note: ASIS = anterior superior iliac spine.

difficulty starting with increased arms support (firstly using two hands, then, one hand, and finally without using hands) and decreasing the base of support (feet together, semi-tandem, and tandem stance) and as they were progressing, the complexity was higher. Each participant's physical function was used to adapt to the balance exercises. The program of the intervention and the training exercises are detailed in Table 1.

2.4.2. Control group

Participants in the CG continued their usual activities that the LTNH typically offered (gymnastics, walks, and other low-intensity activities). Activities were low intensity in all cases.

2.5. Measures

2.5.1. Perceived health-related quality of life

The HRQoL was assessed with the 36-item Short Form Health Survey (SF-36) [15], particularly with the validated Spanish version [16] containing 36 items. It consists of 8 scales physical functioning, role-physical (role limitations due to physical health problems), bodily pain, general health, vitality, social functioning, role-emotional (role limitations due to personal or emotional problems), mental health [17] which are grouped into two summary measures, the physical component summary (PCS) and the mental component summary (MCS). It also includes the item "health change", that is, changes in health compared to the previous year. For each dimension, the items are coded, aggregated, and transformed into a scale from 0 (worst health status) to 100 (best health status) using the algorithms and indications provided in the scoring and interpretation manual of the questionnaire [18].

2.5.2. Depressive symptoms

Depressive symptomatology was evaluated through a personal interview with the validated Spanish version of the short-form Geriatric Depression Scale (GDS) [19]. It is one of the most commonly used scales, of public domain and free use, and is specifically designed to identify signs of depression in older people [20]. The short version includes 15 items. A score of 1 point is given for each item indicating the presence of depressive symptoms (Yes or No in bold). High scores indicate more symptoms of depression. The maximum score of this scale is 15 points, with scores from 0 to 4 points considered normal and over 5 points suggesting depression; specifically, from 5 to 8 points mild depression, from 9 to 11 moderate depression, and from 12 to 15 severe depression [21,22].

2.6. Data collection

Data were completed at baseline and reassessed after the 12-week intervention, which took place between February and April 2017. All assessments were conducted by the same nurse researchers from the research team with special training in geriatric assessments. Measurements were assessed on-site at the residence and these nurses filled out the questionnaires through individual interviews.

2.7. Data analysis

Sociodemographic and clinical data are presented as the *Mean* ± *SD*. The normality of the distribution was verified through the Shapiro-Wilk test (sample $\leq$50). Descriptive analysis was performed, and proportions and means were compared between two groups in the baseline phase of the exercise programme using Pearson Chi^2, *t*-test for unpaired samples, or the Mann-Whitney test.

To check the evolution of the pre-post parameters, GLM repeated measures with Kenward Roger approximation have been estimated, which are useful in small sample conditions and to handle model assumption violations. The GLM model provides several results called fixed effects (change between pre-post in general, differences between pre-post changes of both groups) for which it uses the *F*-statistic. But it also provides other derived subresults that are analyzed by *t*-student such as pre-post change within each group. They, therefore, will provide information on the evolution over time of the parameters, as well as on the influence of the intervention in the evolutionary patterns. The estimated marginal means by the models and their 95% confidence intervals (95% CI) will be shown in the tables. The level of significance used in the analyses was 5% ($\alpha = 0.05$). The statistical analysis was performed using the statistical software IBM SPSS Statistics 25 (SPSS, Inc., Chicago, IL).

3. Results

3.1. Characteristics of participants

The mean age of the participants was 80.2 ± 7.65 years (age range = 67–95 years), and 52.6% were women, with a mean score for the Barthel Index of 91.3 (mild dependence for BADL) and the MMSE of 26.1 (without cognitive impairment). The comparison of baseline characteristics among the two groups is shown in Table 2.

3.2. Effectiveness of the intervention

The comparison of data before and after the intervention is supplemented in Table 3. In the SF-36 parameters, although for physical functioning the results note that the increase in the IG with a mean increase of 11.06 units (a 17.2% increase over the pre) and the CG does not occur ($P = 0.283$), the global comparison of both variations indicates that there are no significant differences between both patterns of variation ($P = 0.639$) (Table 3).

Although in the social functioning, it is observed that the increase in the CG is significant ($P = 0.046$) with a mean increase of 13.16 units (a 15.4% increase over the pre) and in the IG this does not happen ($P = 0.313$), the global comparison of both variations indicates that there are no significant differences between both patterns of variation ($P = 0.474$) (Table 3). In the role-emotional of SF-36, it can be seen that the increase in the IG with a mean increase of 5.27 units (a 29.1% increase over the pre) ($P < 0.05$). The overall comparison of both variations indicates that there is a tendency for both patterns of variation to be different (Table 3) with an increase in the IG and invariance in the CG. There are no significant changes in the rest of the parameters, there are no differences between groups in the evolutionary pattern either.

4. Discussion

This study analyzed the effects of a moderate-intensity multicomponent physical exercise program, individualized and progressively more difficult, on the HRQoL and depressive symptomatology of a group of older people living in a LTNH. As for the effects of the multicomponent exercise program on HRQoL and depressive symptomatology, no benefits were obtained in older adults living in LTNHs. These findings are not consistent with the results published by other authors [9,23,24]. The study by Espejo-Antúnez et al. [23] whose objective was to determine the effect of a 4-week aerobic exercise programme (2 sessions/week of 50 min) in older from LTNH with knee osteoarthritis found positive outcomes in functional and psychological aspects. Likewise, Lok et al. [24] showed that with their physical activity programme consisting of rhythmic exercises and walking (4 days/week) for 10 weeks for LTNH residents, only the IG improved in the 8 scales and the two summary components of the SF-36. In other studies, while some authors such as Rezola-Pardo et al. [25] observed that HRQoL improved significantly, other authors who compared the effects of a multicomponent exercise program on global HRQoL in older adults living in LTNHs found no significant differences between IG and CG [26,27].

However, with the present multicomponent exercise program of the present study, we observed that the SF-36 role-emotional score tends to increase in the IG with respect to the CG. In this study, the failure to achieve positive results may be associated with the size of our sample and it is possible that an increase in the sample size, could confirm some of the trends obtained.

Table 2
Descriptive characteristics of the study participants.

Characteristics	Sample (n = 38)	IG (n = 19)	CG (n = 19)	χ^2/t	P
Age (years)	80.2 ± 7.7	80.4 ± 6.9	80.0 ± 8.5	−0.12	0.901
Sex				0.420	0.529
Women	20 (52.6)	11 (57.9)	9 (47.4)		
Men	18 (47.4)	8 (42.1)	10 (52.6)		
Weight (kg)	69.6 ± 12.9	66.0 ± 10.8	73.4 ± 14.2	1.790	0.082
BMI (kg/m^2)	28.3 ± 4.8	27.4 ± 4.7	29.3 ± 4.9	1.200	0.237
MNA	22.4 ± 2.4	22.4 ± 2.5	22.3 ± 2.5	−0.14	0.887
Blood pressure					
Systolic	130.0 ± 16.8	130.0 ± 16.7	130.0 ± 17.3	0.090	0.928
Diastolic	70.2 ± 10.3	72.4 ± 10.4	67.9 ± 9.9	−1.350	0.185
Barthel (0–100)	91.3 ± 10.6	91.6 ± 10.5	91.0 ± 10.9	−0.150	0.863
MMSE (0–30)	26.1 ± 3.4	25.5 ± 3.7	26.8 ± 3.1	1.190	0.232

Note: Data are *Mean* ± *SD* or *n* (%). IG = intervention group. CG = control group. MNA = Mini-Nutritional Assessment. MMSE = Mini-Mental State Examination.

Table 3
Evolution of pre-post parameters and influence of the intervention.

Variables	Group	Pre	Post	Post-Pre Diff.	t [a]	P	F [b]	P
		Mean (95% CI)	*Mean* (95% CI)	*Mean* (95% CI)				
SF-36								
Physical functioning	IG	64.14 (55.11, 73.16)	75.19 (66.17, 84.22)	11.06 (−1.58, 23.68)	1.747	0.085	0.221	0.639
	CG	48.50(39.50, 57.49)	55.34 (46.34, 64.33)	6.85 (−5.79, 19.47)	1.081	0.283		
Role - physical	IG	20.54 (16.78, 24.31)	21.53 (17.76, 25.29)	0.99 (−4.28, 6.26)	0.374	0.710	0.497	0.483
	CG	18.18 (14.43, 21.94)	21.80 (18.05, 25.55)	3.62 (−1.65, 8.89)	1.371	0.175		
Bodily pain	IG	71.44 (58.41, 84.47)	80.65 (67.62, 93.68)	11.67 (−6.89, 30.22)	1.008	0.317	0.003	0.960
	CG	60.43 (47.45, 73.42)	68.99 (56.00, 81.97)	11.01 (−7.55, 29.56)	9.133	0.352		
General health	IG	64.96 (55.98, 73.93)	71.80 (62.82, 80.77)	5.68 (−7.10, 18.46)	1.088	0.281	0.638	0.427
	CG	66.38 (57.44,75.33)	66.12 (57.17,75.06)	−1.43 (−14.20,11.35)	0.042	0.967		
Vitality	IG	80.12 (67.69, 92.55)	86.37 (73.94, 98.8)	6.26 (−11.14, 23.64)	0.717	0.476	0.001	0.979
	CG	79.51 (67.13, 91.9)	85.44 (73.05, 97.82)	5.93 (−11.47, 23.31)	0.680	0.499		
Social functioning	IG	85.7 (76.47, 94.93)	92.28 (83.05, 101.51)	6.58 (−6.33, 19.49)	1.017	0.313	0.517	0.474
	CG	85.34 (76.15, 94.54)	98.50 (89.30, 107.7)	13.16 (0.26, 26.07)	2.034	0.046*		
Role - emotional	IG	18.1 (14.8, 21.41)	23.37 (20.06, 26.67)	5.27 (0.64, 9.89)	2.271	0.026*	3.025	0.086
	CG	23.62 (20.32, 26.91)	23.18 (19.88, 26.48)	−0.44 (−5.07, 4.19)	0.189	0.850		
Mental health	IG	79.28 (67.39, 91.17)	84.81 (72.92, 96.7)	5.53 (−11.11, 22.16)	0.663	0.510	0.241	0.625
	CG	83.91 (72.06, 95.76)	83.65 (71.79, 95.5)	−0.27 (−16.90, 16.37)	0.032	0.975		
Health change	IG	56.57 (45.31, 67.83)	69.72 (58.47, 80.98)	13.16 (−2.60, 28.91)	1.667	0.100	1.126	0.292
	CG	45.06 (33.84, 56.28)	46.37 (35.15,57.6)	1.32 (−14.44, 17.07)	0.167	0.868		
PCS	IG	55.27 (49.02, 61.51)	62.29 (56.05, 68.54)	7.03 (−1.72, 15.76)	1.604	0.113	0.142	0.707
	CG	48.37 (42.15, 54.6)	53.06 (46.84, 59.29)	4.69 (−4.05, 13.43)	1.071	0.288		
MCS	IG	65.8 (58.07, 73.53)	71.71 (63.98, 79.44)	5.91 (−4.91, 16.72)	1.090	0.280	0.029	0.865
	CG	68.10 (60.39,75.8)	72.69 (64.99, 80.40)	4.60 (−6.22, 15.41)	0.848	0.400		
GDS	IG	3.37 (2.03, 4.72)	2.27 (0.93, 3.61)	−1.11 (−2.99, 0.78)	1.173	0.245	0.272	0.604
	CG	3.30 (1.92, 4.67)	2.89 (1.55,4.23)	−0.41 (−2.32, 1.51)	0.424	0.673		

Note: *$P<0.05$. SF-36 = Health-related Quality of Life Questionnaire Short Form-36. PCS = physical component summary. MCS = mental component summary. GDS = Geriatric Depression Scale. IG = intervention group. CG = control group. Models adjusted by age, sex, Barthel, Mini-Mental State Examination (MMSE). Model-estimated marginal means and 95%CI: in a multifactor design, the marginal means for each level of a factor are the means for that factor, averaged across the levels of the other factors, i.e., the means corrected to eliminate effects of other factors (masked effects). [a] t statistic and P-value from TIME effect in every group: if there is significant change between pre and post. [b] F statistic and P from the time*GROUP effect: if there are differences in evolutionary patterns according to GROUP. [a] and [b] are from the same general linear model repeated measures model.

All these analyzed studies show, on the one hand, that the frequency of the weekly sessions that are carried out influences the HRQoL, with all the multicomponent exercise programmes carried out being effective and supervised at least 2 days a week. On the other hand, although any physical activity intensity seems to be better than none for the HRQoL of LTNH residents, moderate physical activity provides greater benefits in perceived physical functioning [13]; as we have verified in the present study. However, this statement is not black and white, since we also found studies based on moderate-intensity physical activity which did not yield improvements in HRQoL. This may be related to the method used to measure intensity, since the aforementioned authors based their measurements on objective methods such as the percentage of one-repetition maximum (% 1RM) and the metabolic equivalent of task (MET), while in our study, we used the Borg scale of perceived exertion. These methods are considered valid to verify the intensity of training. 1RM measures the greatest amount of weight that can be moved with a correct technique only once [28]. MET is the amount of oxygen necessary for maintaining 1 min of the metabolic functions of the organism with the individual at rest and sitting and is equivalent to 3.5 ml /(kg· min) [29]. The Borg scale measures the effort that the individual perceives when exercising and adjustments can be made in intensity [14]. However, despite being a subjective method, in the long run, the Borg scale seems to provide better results since it allows the development of a greater awareness of training and a greater perception of the limitations and capacities of the body, easily adapting to the physical and psychological state at the moment of training [30].

The health and social care received by the residential population could have a positive impact on HRQoL, as concluded by Alonso-Sardón in his research [31]. In a recent systematic review and meta-analysis carried out by De Medeiros et al. [32], they also concluded

that although residential care negatively influences the QoL of older adults, more well-designed studies are needed to confirm this evidence. Therefore, it is necessary to continue researching this topic to determine, on the one hand, the effect of residential care on QoL and, on the other hand, how to improve HRQoL.

Given the high prevalence of depressive symptoms in older people from LTNHs [33], exercise is a promising low-risk intervention for depression in this population [34], and there is evidence that demonstrates the positive effects of physical activity in the reduction of depressive symptoms in residents non-living in LTNHs [35]. In the present study, the multicomponent physical exercise program improved GDS scores for depressive symptomatology, although not significantly, nor did it produce differences between CG and IG. In older people living in LTNHs, the evidence also seems contradictory, while some studies have shown a significant improvement in participants after completing the physical exercise programme [24,36], others have not obtained benefits [25,26,34,37,38], such as that of Rezola-Pardo et al. [25] and Arrieta et al. [26]. Likewise, the results of the study by Underwood et al. [34] do not support the effectiveness of an exercise programme for two days/week of moderate intensity for 12 months in reducing depressive symptoms in residents from LTNHs; while it is important to point out that, in this case, the participants only attended approximately half of the possible sessions. As well, Justine et al. [37] who analyzed the effects of a programme consisting of strength, balance, resistance, and flexibility exercises of moderate-intensity three days/week (1 h/session) for 12 weeks showed no improvement in the depressive symptomatology of the IG, although the CG worsened. In this case, they used the Malay version of the 12-item GDS scale. Finally, Chin et al. [38] examined the effect of several exercise programmes performed two days/week (45–60 min/session) for 6 months and concluded that neither the strength training programme (increased intensity after completing 2 sets of 12 repetitions during 2 consecutive sessions) nor the integrated functional programme that worked strength, speed, endurance, coordination and flexibility (intensity increased by the number of repetitions) nor the combination were effective in improving the symptoms of depression, which in this study was measured with the GDS-30 scale.

After analyzing the interventions that were carried out in these studies (type of exercise, intensity, duration, number of weekly sessions), as well as the methods used to assess the symptoms of depression, we have not found a clear explanation that may be related to the intervention. There are other aspects, however, such as personal interests, individual expectations, ties maintained in the programme, the emotional aspects of the individual, and the loyalty to the programme that could interfere with improving the depressive symptomatology of residents from LTNHs.

Regarding the study's limitations, the small sample size reduces the statistical power of the tests to detect significant results. So, it could be possible that an increase in the sample size would confirm some of the trends obtained. The results also cannot be directly applied to all residents, nor can we determine whether participants who declined to participate or were excluded because of their low level of physical function or severe cognitive deficits would also benefit from physical activity. We should be cautious about generalizing the results of this study too since it is a sample of residents with specific characteristics; however, they could apply to older people living in LTNHs with a functional and health status similar to our sample.

5. Conclusions

In conclusion, this study has shown that a three-month, individualized and progressive multicomponent exercise program of moderate intensity is viable and well tolerated in older people from LTNHs. Therefore, it would be recommended as an essential part of the daily routine of older people living in a LTNH. As for the effects on HRQoL and depressive symptomatology, no benefits have been obtained in older adults living in LTNHs. One of the strengths of this study is the analysis of the effects of a multicomponent exercise program on each of the parameters that make up the HRQoL in LTNH residents. The results may help inform the design of future studies, such as studying the effects of physical exercise programs offered by LTNHs on HRQoL of institutionalized older people and being able to design more effective evidence-based activity programs.

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CRediT authorship contribution statement

Maider Ugartemendia-Yerobi: Formal analysis, Investigation, Data Curation, Writing – original draft, Funding acquisition. **Maider Kortajarena**: Validation, Formal analysis, Writing – review & editing. **Udane Elordi**: Investigation, Data curation. **Nagore Zinkunegi-Zubizarreta**: Software, Formal analysis, Data curation. **Idoia Zarrazquin**: Investigation, Visualization. **Juan J Calvo-Aguirre**: Conceptualization, Methodology, Resources, Supervision, Project administration. **Amaia Irazusta**: Conceptualization, Methodology, Resources, Writing – review & editing, Supervision, Project administration.

Data availability statement

The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

Declaration of competing interest

The authors have declared no conflict of interest.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ijnss.2022.12.015.

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