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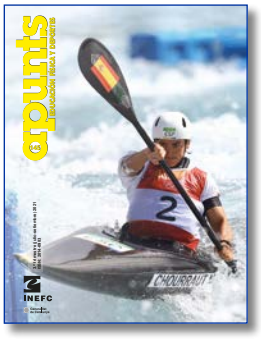

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Evaluation of a Physical Activity Programme in Elderly Non-institutionalised Adults

Javier Guillem-Saiz[1,2], Yang Wang[3,4], Hilary Piedrahita-Valdés[3*], Patricia Guillem-Saiz[5,6] & Carmen Saiz-Sánchez[3,6]

[1] Department of Psychology, International University of Valencia, Valencia (Spain).
[2] Valencia Neurosciences Institute (IVANN), Valencia (Spain).
[3] Department of Preventative Medicine and Public Health, Food Sciences, Toxicology and Legal Medicine, University of Valencia, Valencia (Spain).
[4] Editorial Department, Chinese General Practice Press, Beijing (China).
[5] Faculty of Biomedical and Health Sciences, European University of Valencia, Valencia (Spain).
[6] CIBER of Physiopathology of Obesity and Nutrition (CIBEROBN), Carlos III Institute of Health, Madrid (Spain).

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***Corresponding author:**
Hilary Piedrahita-Valdés
piedrahita_hil@gva.es

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Maialen Chourraut (ESP) competing in Rio de Janeiro Olympic Games (2016), Whitewater Stadium. Women's Kayak (K1) Semi-final. REUTERS / Ivan Alvarado

Abstract

Physical activity is one of the key habits that influence healthy ageing, according to WHO. The objective of this study was to evaluate the effect of a physical activity programme conducted in the context of an active ageing workshop on the functional sphere. The study had a single-group pre- and post-intervention design. It included 54 healthy, non-institutionalised adults aged 60 or over. The physical activity programme consisted of 90 twice-weekly group sessions lasting 45-60 minutes over 45 weeks. The participants did stretches and aerobic and muscle-toning exercises rising gradually in intensity throughout the programme. They were assessed with the Tinetti scale, the Timed Up and Go Test (TUG) and the Senior Fitness Test (SFT) at weeks 0 and 45 of the programme. At week 45, we found a significant improvement in mobility according to the TUG and in lower-limb strength evaluated by the SFT. Additionally, we found that gait and balance capacity, determined by the Tinetti scale, remained the same, as did upper-limb strength, aerobic endurance and upper and lower body flexibility, according to the SFT. The study results suggested that the physical activity exercises included in our programme may slow down the loss of functional sphere parameters in adults aged 60 or over.

Keywords: active ageing, elderly adult, functional capacity, healthy ageing, physical exercise.

Introduction

Ageing is a natural phenomenon comprised of "a series of biological, morphological, biochemical and physiological changes that appear as the consequence of the action of time on human beings" (Alvarado-García & Salazar-Maya, 2014).

A person is considered elderly after the age of 65. As of 1 January 2019, 19.3 % of the Spanish population was aged 65 or over (National Statistics Institute, 2020a), and this is forecast to rise to 29.4 % in 2068 (National Statistics Institute, 2020b).

This demographic ageing has a major economic, social and health impact. To reduce the negative social and health repercussions of old age, it is essential to promote active, healthy ageing. Peel et al. (2005) define healthy ageing as "a lifelong process optimizing opportunities for improving and preserving health and physical, social, and mental wellness; independence; quality of life; and enhancing successful life-course transitions".

On the other hand, the World Health Organization's (WHO) (2006) concept of "health" encompasses not only the absence of disorders or diseases but also physical, mental and social wellbeing. Therefore, in the framework of active ageing, health is achieved by policies and programmes aimed at promoting it in three spheres: physical, psychological and social. A healthy elderly person should have the following characteristics: absence of objectifiable diseases, well-conserved functional capacity, autonomy for basic activities of daily living and absence of mental or social problems stemming from their state of health (Sociedad Española de Geriatría y Gerontología, 2007).

WHO (2015) includes physical activity as one of the key habits that influence healthy ageing. Doing regular physical exercise in old age (150 minutes per week at intervals of at least 10 minutes each) helps to preserve cognitive function (World Health Organization, 2010), increase life expectancy and self-esteem, reduce depression and anxiety and the risk of developing different chronic diseases (World Health Organization, 2015).

However, 33 % of people between 70 and 79 and 50 % over 79 do not do the minimum physical activity recommended by WHO (Bauman et al., 2016). This means that it is essential to plan and implement physical activity programmes targeting the elderly.

For this reason, we implemented a physical activity programme in the context of an active ageing workshop for non-institutionalised people aged 60 or above. The objective of this study was to evaluate the effect of this physical activity programme on the participants' functional sphere.

Methodology

A quasi-experimental study was conducted with a single group with two measurements: pre- and post-intervention. The pre-intervention measurements were evaluated before the first session of the physical activity programme commenced and the post-intervention measurements were taken at week 45, after 90 sessions.

Participants

The study population was comprised of non-institutionalised patients seen at the Instituto Valenciano de Neurociencias (IVANN) in the city of Valencia. Non-probabilistic convenience sampling was performed with 54 individuals. The inclusion criteria were: be aged 60 or over, attend more than 75 % of the sessions, not present any problems of complete blindness or deafness, have a favourable report from the medical and psychological team in the preliminary examination and sign the informed consent to participate in the programme. The exclusion criteria were: be under of 60; have orthopaedic, cardiovascular or respiratory problems that would prevent them from following the programme; take medication that might cause gait instability and not agree to participate in the study.

All the participants were informed about the programme, voluntarily agreed to be included in the study and signed the informed consent. The project was approved by the Ethics and Research Committee in Humans of the University of Valencia.

Procedure and instrument

The physical activity programme consisted of 90 group sessions lasting 45-60 minutes held twice a week for 45 weeks. Each session was divided into three phases (Table 1): 1) welcome/warm-up phase, 2) development/main phase and 3) conclusion/cool-down phase.

All the participants in the study were evaluated using the Tinetti scale, the Timed Up and Go Test (TUG) and the Senior Fitness Test (SFT) at weeks 0 and 45 of the physical activity programme.

The Tinetti scale (Tinetti, 1986) is comprised of two subscales, one that evaluates gait (maximum score of 12 points) and another balance (maximum score of 16 points). The overall score determines the risk of falling: scores under 19 indicate a high risk of falling, 19-24 a moderate risk and 25-28 no risk.

The TUG (Abizanda-Soler et al., 2012) measures the time (in seconds) that a person needs to get up from a chair with an armrest, walk in a straight line for 3 metres, turn around, walk back to the chair and sit down. The result has a high inverse correlation with the

Table 1
Phases of the physical activity programme.

Phase	Description	Duration (minutes)
Welcome/warm-up phase	Aerobic activity, rotation of the major joints, stretches and specific warm-up exercises of each session depending on the joints that were to be used the most.	10-15
Development/main phase	Aerobic and muscle toning exercises within games, circuits and joint choreographies gradually rising in intensity throughout the programme.	30-40
Cool-down and stretching phase	Stretches, breathing and muscle-loosening exercises.	5-15

functional mobility level: < 10 seconds = independent mobility, 11-20 seconds = mostly independent mobility, 21-30 seconds = variable mobility, > 30 seconds = reduced mobility.

The SFT battery (Rikli & Jones, 2013) assesses the physical condition of adults over 60. It consists of six tests:

1. Sitting down and getting up from a chair without support: number of repetitions the patient can do in 30 seconds. It assesses the strength of the lower limbs (SLL).
2. Arm Curl: number of arm curls with weights that the person can do in 30 seconds. It reflects the strength in the upper limbs (SUL).
3. 2-Minute Step Test: number of full steps the person can complete in this time. It estimates aerobic endurance (MAE).
4. Trunk flexion seated in a chair with the legs and arms extended forward: distance in cm between the fingers and toes. It determines the flexibility of the lower limbs (FLL), especially the biceps femoris.
5. Back Scratch: distance in cm between the extended fingers of both hands. This shows the flexibility of the upper limbs (FUL), especially the shoulders.
6. Standing, walking and sitting (SWS): the time taken to complete the test in seconds. This indicates agility and dynamic balance.

Data analysis

The quantitative variables were described by means of measures of central tendency: mean, median and mode, and measures of dispersion: standard deviation and ranges. The results were analysed using non-parametric tests, as the variables presented a non-normal distribution. The non-parametric Mann-Whitney-Wilcoxon test was used to verify the homogeneity of the samples. For pre-intervention and post-intervention intrasubject comparisons, the Z statistic was calculated using the non-parametric Wilcoxon signed-rank test. Spearman's correlation coefficient was used for the correlational analysis between the results of different tests. In all cases, a p-value under .05 was established as the level of statistical significance. The SPSS v21 statistical package for Windows was used to process the data.

Results

Sociodemographic characteristics of the population

The study sample consisted of 54 participants aged between 60 and 89 with a mean age of 74. The age range with most individuals was 76 to 80. More women ($n = 35$) than men ($n = 19$) participated. Approximately half the participants had a university education (Table 2).

The main results of the pre- and post-intervention functional tests are shown in Table 3.

Tinetti scale

With regard to the risk of falling measured with the Tinetti scale, no significant differences were found ($p = .941$) between the pre-intervention and post-intervention results in either the aggregate data analysis or in the analysis broken down by sex.

Table 2
Sociodemographic characteristics of the population.

Variables		*n*	(%)
Age range	59-70 years	11	20.37
	71-75 years	17	31.48
	76-80 years	18	33.33
	> 80 years	8	14.82
Sex	Males	19	35.19
	Females	35	64.81
Educational level	Primary	14	25.92
	Secondary	15	27.78
	University	25	46.30

Table 3
Results of the pre- and post-intervention tests.

Test	P25	P50	P75	*Z*	*p*
Tinetti scale				-.073	.941
Pre-intervention	25	28	28		
Post-intervention	25	28	28		
Timed Up and Go Test				-5.023	< .001
Pre-intervention	8	13	18.25		
Post-intervention	8	12	16		
SFT-SLL				-2	.046
Pre-intervention	1.50	2	2		
Post-intervention	2	2			

Timed Up and Go

A statistically significant difference ($p < .001$) was found in the overall results of the TUG after the 90 sessions of the physical activity programme. The percentage of participants with variable mobility fell from 18.5 % ($n = 10$) to 9.3 % ($n = 5$) in favour of the groups with the greatest mobility. The group with mostly independent mobility went from accounting for 46.3% of the participants ($n = 25$) in the pre-test to 50 % of the sample ($n = 27$) in the post-intervention measurement. The participants with independent mobility rose from 33.3 % ($n = 18$) to 38.9 % ($n = 21$).

By mobility groups and sex, no significant changes were found in the men in the groups with reduced mobility ($n = 1$) and variable mobility ($n = 2$). Of the 10 men in the group with mostly independent mobility pre-intervention, 3 obtained post-intervention scores corresponding to the group with independent mobility. Therefore, the number of men with independent mobility increased from 6 (31.6 % of the men) to 9 (47.9 % of the men).

None of the women obtained scores equal to or higher than 30 (reduced mobility). Five women went from having variable mobility according to the TUG to having mostly independent mobility. The group with mostly independent mobility went from comprising 15 women (42.9 % of the women) in the pre-test period to 20 women (57.1%) in the post-intervention period. The 12 women (34.3 % of the women) with pre-test independent mobility maintained this degree of mobility.

Table 4
Cases by sex according to the results of the Senior Fitness Test (percentiles compared to reference value).

		Pre-intervention			Post-intervention			Difference
Test		P < 25 *n* (%)	P25-P75 *n* (%)	P > 75 *n* (%)	P < 25 *n* (%)	P25-P75 *n* (%)	P > 75 *n* (%)	*p*-value
SLL	F	7 (20%)	25 (71.43%)	3 (8.57%)	7 (20%)	24 (68.57%)	4 (11.43%)	.317
	M	6 (31.58%)	10 (52.63%)	3 (15.79%)	4 (21.05%)	11 (57.9%)	4 (21.05%)	.083
	Total	13 (24.07%)	35 (64.82%)	6 (11.11%)	11 (20.37%)	35 (64.82%)	8 (14.81%)	.045
SUL	F	9 (25.71%)	22 (62.86%)	4 (11.43%)	7 (20.00%)	23 (65.71%)	5 (14.29%)	.180
	M	6 (31.58%)	10 (52.63%)	3 (15.79%)	5 (26.32%)	10 (52.63%)	4 (21.05%)	.157
	Total	15 (27.78%)	32 (59.26%)	7 (12.96%)	12 (22.22%)	33 (61.11%)	9 (16.67%)	.059
MAE	F	12 (34.28%)	19 (54.29%)	4 (11.43%)	12 (34.28%)	19 (54.29%)	4 (11.43%)	1
	M	6 (31.58%)	12 (63.16%)	1 (5.26%)	6 (31.58%)	12 (63.16%)	1 (5.26%)	1
	Total	18 (33.33%)	31 (57.41%)	5 (9.26%)	18 (33.33%)	31 (57.41%)	5 (9.26%)	1
FLL	F	19 (54.29%)	8 (22.86%)	8 (22.86%)	19 (54.29%)	8 (22.86%)	8 (22.86%)	1
	M	12 (63.16%)	5 (26.31%)	2 (10.53%)	12 (63.16%)	5 (26.31%)	2 (10.53%)	1
	Total	31 (57.41%)	13 (24.07%)	10 (18.52%)	31 (57.41%)	13 (24.07%)	10 (18.52%)	1
FUL	F	20 (57.14%)	5 (14.29%)	10 (28.57%)	19 (54.29%)	5 (14.29%)	11 (31.43%)	.317
	M	14 (73.69%)	4 (21.05%)	1 (5.26%)	14 (73.68%)	3 (15.79%)	2 (10.53%)	.317
	Total	34 (62.96%)	9 (16.67%)	11 (20.37%)	33 (61.11%)	8 (14.82%)	13 (24.07%)	.180
SWS	F	14 (40%)	15 (42.86%)	6 (17.14%)	14 (40%)	16 (45.71%)	5 (14.29%)	.317
	M	11 (57.89%)	8 (42.11%)	0 (0%)	11 (57.89%)	7 (36.85%)	1 (5.26%)	.317
	Total	25 (46.30%)	23 (42.59%)	6 (11.11%)	25 (46.30%)	23 (42.59%)	6 (11.11%)	1

Note. F: female (n = 35); M: male (n = 19).

Senior Fitness Test

The scores in the pre- and post-intervention SLL test presented statistically significant differences ($p = .046$). No significant differences were found in the pre- and post-intervention scores in the other SFT tests. Table 4 shows the number of cases by sex according to the percentiles of their scores in the SFT compared to the reference values (Rikli & Jones, 2013). The men scored better in the SLL and SUL tests, while the women scored better in the other tests. The TUG and SFT results presented a significant correlation in both the pre-intervention period (correlation coefficient -0.579, $p < .001$) and the post-intervention period (correlation coefficient -0.666, $p < .001$).

Discussion

The study sample ($N = 54$) is larger than those of comparable studies (Aman & Thomas, 2009; Solà-Serrabou et al., 2019; Tappen et al., 2000). The sessions were conducted in groups of 12 to 15 individuals led by a psychogerontologist specialising in physical activity and sport, who stimulated the participants' engagement, persistence and performance in the programme. The number of participants included in each group matches the number chosen by other authors (Aman & Thomas, 2009; Tappen et al., 2000). In terms of sample distribution by sex, the predominance of female participants supports the concept of the feminisation of old age due to the higher death rate in men (Aartsen et al., 2004). The age group with the highest participation was 76 to 80, as in the study by Saiz-Llamosas et al. (2014). The lower participation of over-80s compared to other age groups may be due to the lower autonomy and a higher level of institutionalisation inherent in more advanced ages. In terms of educational level, it is noteworthy that almost half of our participants have a university education, compared to the predominance of primary school in the study by Saiz-Llamosas et al. (2014).

The length of the programme (McPhee et al., 2016), the length of each session (Saiz-Llamosas et al., 2014; Solà-Serrabou et al., 2019) and the frequency of the sessions (Solà-Serrabou et al., 2019) match those of similar studies. The time periods chosen are those recommended by Salazar-Pachón et al. (2014), and we believe they are sufficient to achieve the programme objectives and to maintain the participants' attention and motivation without fatiguing them. The tests applied are safe for the participants, socially accepted and easy to score.

The score on the Tinetti scale diminishes every year in healthy elderly people according to a longitudinal study lasting 8 years (Baloh et al., 2003). In our study, all the participants maintained a similar score in this test after 90 sessions of the physical activity programme. Our results indicate that the physical activity programme implemented may contribute to conserving gait and balance capacity in elderly adults.

The scores in the TUG improved significantly overall. By mobility and sex groups, the results in this test did not worsen in any case. This all suggests that physical activity programmes based on exercises involving motor coordination, balance, flexibility, strength and endurance are beneficial in maintaining and/or improving mobility in elderly adults. Our study supports the conclusions of Freiberger et al. (2007) on the effect of these types of exercises on the TUG score after they applied a physical activity programme with weekly one-hour sessions for four months with exercises similar to those of our intervention. The analysis of the 217 elderly participants over the age of 70 from the community found that this type of physical activity produces a significant improvement in scores in the TUG and Sit-to-Stand tests, in addition to reducing the number of falls in the intervention group compared to the control group. The improved mobility measured with the TUG was also demonstrated with other kinds of exercises, such as those based on the Pilates method (Garcia-Garcia et al., 2011) and aquatic exercises (Chou et al., 2012).

With regard to the SFT battery, it is one of the few validated tests for evaluating the physical condition of people over 60 (Rikli & Jones, 2013). In this study, we only found significant differences in one of the six tests, more specifically the evaluation of lower-limb strength, which is essential to maintaining gait. We should note that muscle strength and endurance fall between 15 % and 20 % on average per decade after the age of 50 (American College of Sports Medicine, 2017). Despite this, the scores in the upper-limb strength and muscle endurance tests did not worsen in the 90 sessions of the programme, and good or excellent levels of upper-body strength and optimal levels of aerobic capacity were maintained.

In our study, pre-intervention flexibility evaluated by the SFT fell within the low percentile (P25) compared to the reference values in 73.70 % of the men and 57.10 % of the women for the upper body and in 63.20 % of the men and 54.30 % of the women for the lower body. The percentage of individuals with scores corresponding to the pre-intervention high percentile ranged from 5 % to 20 %, according to sex. This distribution shows that elderly individuals tend to have limited flexibility, as reported in several publications (Latorre-Rojas et al., 2019; Rikli & Jones, 2013). We did not find significant gains in flexibility in either the lower or upper limbs after the intervention. The physical activity interventions designed by other authors obtained mixed results in flexibility, from zero to positive (American College of Sports Medicine, 2017). These discrepancies may be due to the particularities of each type of training and the different limitations presented by studies that evaluate the effect of physical exercise on flexibility in the elderly, such as a small sample size and the absence of control groups.

Finally, we found that the participants evinced an interest in knowing the reference values and how to improve their scores. In other words, the application of the tests within the context of the healthy ageing workshop helped to boost the participants' motivation and engagement in physical activity.

Conclusions

The study results suggest that the physical activity exercises included in our programme may slow down the losses in functional sphere parameters in adults over 60. All the participants were capable of maintaining balance both before and after the intervention. We observed gait and balance maintenance evaluated by the Tinetti scale after the 90 sessions of the programme. Similarly, we found no deterioration in upper-limb strength, aerobic endurance or flexibility of the upper and lower body according to the SFT. Particularly noteworthy is the significant overall improvement in mobility according to the TUG and in lower-limb strength evaluated with the SFT.

One limitation of our study was that there was no control group, preventing us from asserting that the changes are due to the intervention. Similarly, external validity is restricted by the participants' characteristics (belonging to the urban population, autonomous, non-institutionalised). However, this is a common problem in this type of study, as the intrinsic characteristics of physical activity programmes make it difficult to obtain samples that are representative of all population groups.

We continue to hold active ageing workshops with a follow-up programme in which we evaluate the long-term results. We periodically introduce new activities into the workshops to maintain the participants' enthusiasm and motivation. Additionally, we have begun an individual physical activity programme separate from group workshops, with a high degree of acceptance and motivation among the participants. The application of different evaluations of the functional sphere has enabled us to learn more about the participants' individual characteristics to tailor the exercises to their needs.

It is essential to continue implementing and evaluating physical activity programmes for the elderly in order to encourage them to engage in regular, systematic exercise, which is known to be beneficial in maintaining their functionality and independence and therefore in increasing their quality of life.

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