Health-related Physical Fitness in Older Adult Europeans: The IN COMMON SPORT Study

Jose M Cancela (chemacc@uvigo.es)
Galicia Sur Health Research Institute (IIS Galicia Sur). Sergas-UVIGO. HealthyFit Research Group, Faculty of Education and Sports Science, University of Vigo, Spain

Irimia Mollinedo-Cardalda
HealthyFit Research Group, Faculty of Physiotherapy, University of Vigo, Spain

Manuela Ferreira
Camara Municipal of Vilanova da Cerberia; Portugal

Pedro Bezerra
Escola Superior de Desporto e Lezer, Instituto Politécnico de Viana do Castelo,

Research Article

Keywords: Aging, fitness test, health, database, physical activity

DOI: https://doi.org/10.21203/rs.3.rs-153079/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License. Read Full License
Abstract

Background

This comparative descriptive study analysed the physical fitness and the anthropometric data of senior citizens participating in "IN COMMON SPORTS" project, in accordance with their place of residence.

Methods

A total of 418 participants divided into two groups: Eastern European Group (EEG) and Southern European Group (SEG). Each participants' anthropometric characteristics (body mass index, body fat and waist hip ratio) and fitness (Senior Fitness Test and Hand grip) were studied.

Results

The Subjects from the SEG showed significantly lower anthropometric values than those from the EEG. The SEG subjects presented significant differences in physical fitness, with best values for upper and lower limb strength and aerobic resistance, while those from the EEG presented significantly better values for lower limb flexibility.

Conclusion

Senior citizens aged 60+ years present differences in physical fitness in accordance with their country of residence; the Southern Europeans having the best physical fitness.

Keypoints

There is inequality in the levels of physical condition between southern and eastern Europe. The fitness level is worse in women than in men. Physical activity practice oriented towards health is more practiced by women. It is necessary to develop policies to promote physical activity in Eastern Europe.

Background

The European Union is one of the unique supranational entities among international organisations where citizens from 28 countries with great cultural, ethnic, artistic and religious diversity reside. Marked differences in economic and social policies in these 28 countries come to light upon analysing economic growth using gross domestic product (GDP). Countries from Southern Europe have a higher annual GDP (2018) and per capita GDP than those from Eastern Europe. The per capita public expenditure on education and health is higher in countries from Southern Europe than in the Eastern European countries [1]. An analysis of sporting activity among European citizens shows how climatic & environmental conditions, and sports infrastructure & policies differ greatly from one country to another. Citizens from
Northern and Central Europe do less physical activity nowadays as compared to those in Southern Europe, this being due to climatic, topographic, cultural, street design and crime factors [2].

Population ageing is a well-known challenge to society and science, where an increase in life expectancy is unfortunately not linked with high quality of life but, quite to the contrary, is associated with a progressive increase in disability rates in older persons [3]. Ageing in the European population presents a trend that began several decades ago. At present, 19.4% of the population is 65 + years old — an increase of 2.4 points compared to 10 years ago [4]. Therefore, a disability-free increase in life expectancy is relevant to both society and individuals. On the social front, it implies a reduction of social and health care costs whilst providing greater well-being and quality of life to citizens [3]. On the individual front, it implies improved functionality and independence of these senior citizens. Knowing what ageing is and what causes it in humans is the first step towards solving this problem. Ageing is associated with loss of neuromuscular function, which leads to a reduction of strength [5, 6], loss of muscular mass [7, 8], decreased walking speed, greater risk of falls, and reduced capacity to perform the activities of daily life. All these contribute to loss of independence and are detrimental to the quality of life of older adults [9].

The World Health Organization (WHO) uses the term "Active Ageing" to denote the process that achieves this goal [10]. The active ageing approach recognises the human rights of senior citizens, as well as the United Nations principles of independence, participation, dignity, support, and realization of one's desires. The WHO [11] recommends that adults aged 65 + years do at least 150 minutes of moderate-intensity aerobic physical activity throughout the week, to maintain functionality and quality of life of the ageing population, and to improve cardiorespiratory and muscular fitness, bone and functional health, and reduce the risk of NCDs, depression and cognitive decline. The European Union [12] data shows that in most countries, adults aged 75 + years do less physical exercise/week as compared to the 65–74 age bracket, and results in increasing levels of illness and weakness among older adults.

This is why projects that promote and develop physical activity for senior citizens such as "Living with vitality"[3], "Vivifrail" [13] and the Comprehensive plan to promote sport and physical activity in the older adults [14] have been created over the last two decades. The European Erasmus+ "IN COMMON SPORTS" [15] project was born within this framework with the participation of countries such as Hungary, Bulgaria, Italy, Portugal and Spain. Its aim is to promote the active ageing of older people through the practice of competitive sports and to ascertain whether competition increases the greater adhesion of older people to the programs. Before starting an intervention program with older adults, it is necessary to know their physical fitness in order to individualize the training program and be able to compare its effect [14]. In this study, this evaluation is very important due to the different socio-economic profile of the countries involved: Bulgaria and Hungary vs Portugal, Italy and Spain [1, 2]. Therefore, the objective of this research has been to analyse the physical fitness of senior citizens participating in the "IN COMMON SPORTS" project, in accordance with their place of residence (Eastern Europe and Southern Europe), besides determining whether the cut-off point of 150 minutes/week based on the WHO criteria physical fitness of the older adults.
Methods

Subjects

A sample of 418 participants: 318 women (76%; 69.29 ± 7.62) and 100 men (24%; 68.97 ± 7.09) was recruited for the European Erasmus+ "IN COMMON SPORTS" project in which 5 European countries participated: Bulgaria, Hungary, Portugal, Italy and Spain. This project promotes physical activity in 60+ year old residents of Europe, in line with the ethical principles of the Declaration of Helsinki. Table 1 shows the descriptive characteristics of the sample divided into two groups: Eastern Europe (Bulgaria and Hungary) and Southern Europe (Italy, Spain and Portugal). The inclusion criteria taken into account were the same as those used when implementing the European project: 1) Age 60+ years, 2) Residents in the city where program is implemented or in its vicinity, 3) Have a medical certificate to participate in the "IN COMMON SPORT" training program, and 4) Ability to walk continuously of a minimum of 6 minutes, 5) Don’t play competitive sports. The ethical standards contained in the Declaration of Helsinki were followed in this study and this study was approved by the Ethics committee of XXXX. In addition, all participants signed an informed consent prior to participation in the program. The “IN COMMON SPORTS” program recruited participants voluntary through the websites and press advertisements that each municipality spread, and where the project and the steps to be followed to sign up it were announced.
Table 1
Comparative analysis of demographic, anthropometric and Fitness measures of residence in Eastern Europe and Southern Europe

|                      | Eastern Europe | Southern Europe |
|----------------------|----------------|-----------------|
|                      | n = 124        | n = 294         |
|                      | Mean           | SD              | Mean           | SD              |
| Demographic data     |                |                 |
| Age (years)          | 68.63          | 7.33            | 69.63          | 9.04            |
| Gender (female, %)   | 82.25          | 73.46           |                |                 |
| Physical activity (min/week) | 133.90   | 8.12            | 136.63         | 8.34            |
| Antropometric data   |                |                 |
| Height (cm)          | 161.43         | 150.33          | 39.91**        |
| Weight (kg)          | 76.59          | 72.35           | 14.01**        |
| Body mass index (kg/m2) | 29.42      | 27.98           | 5.20           |
| Fat body (%)         | 36.98          | 31.25           | 6.80           |
| WHR                  | 0.87           | 0.90            | 0.13*          |
| Fitness data         |                |                 |
| Right handgrip (kg)  | 23.83          | 29.15           | 9.13**         |
| Left handgrip (kg)   | 20.46          | 27.79           | 10.31**        |
| 30 s chair stand (n) | 14.58          | 17.98           | 5.88**         |
| 6 min walk (m)       | 498.96         | 533.16          | 121.02*        |
| Chair sit and reach (cm) | 2.41           | 0.34            | 10.26*         |
| 8 Foot up and go (s) | 8.02           | 8.96            | 38.53          |
| Back scratch (cm)    | -9.26          | -9.15           | 13.89          |

WHR = Waist to hip ratio

**p < 0.001; * p < 0.05

Demographic measures

The demographic data collected included age, sex and place of residence of the participants on an ad hoc record sheet. Information recorded included quantity, type of activity/exercise carried out in minutes/week by participants during a typical week.

Anthropometric measures
The height (cm) of the patients was collected using a 1.0 mm Handac model stadiometer, while the weight (kg), body mass index (kg/m²), and body fat (%), were recorded using the Tanita model MC-780MA body composition analyzer [16]. Hip and waist circumferences were measured using a 6mm Lufkin W606PM anthropometric tape, and the waist-to-hip ratio (WHR) was found using the "Waist/Hip" formula. The WHR is used as an indicator of health and the risk of developing serious health disorders, as well as evaluating abdominal obesity [17].

**Handgrip**

The Handgrip, is an instrument that evaluates the strength of upper limbs through manual pressure. The test is performed with the subject standing, with the elbow in 90° flexion and slightly separated from the trunk [18]. Three measurements are taken for each limb and the average is calculated. In this study we used the hydraulic handgrip model SH5001 from Saehan Corporation, which measures the force in kilograms.

**Senior Fitness Test**

The Senior Fitness test is a battery of test for the assessment of the functional fitness of older adults. This test assesses the physiological capacity for carrying out normal daily activities independently and safely without the appearance of fatigue. Test validity has been published by Rikli and Jones [19]. The test consists of six measures of functional fitness, although we only use 5 because the arm curl test is replaced by the Handgrip test, and both these tests evaluate the strength of the upper limbs.

- 30 seconds chair stand test: This test assesses lower body strength and endurance. The subject will have to pass one hand over the same shoulder, and the other hand will touch the middle of the back, trying to get both hands to touch. The distance between the tips of the fingers of each hand is measured (positive if the fingers overlap, or negative if they do not touch).

- 8 foot up and go: This test assesses speed, agility and dynamic balance. Starting from sitting, the subject will have to get up and walk to the cone, turn around and sit down again. The cone will be 2.44 meters from the chair. The subject will perform the test twice and the score will be the average of the two times.

**Procedure**

The representatives of each country belonging to the European project "IN COMMON SPORTS", contacted the participants to make a first assessment of the individuals in March 2018. Within one week all subjects were summoned simultaneously in all countries (Italy, Spain, Portugal, Bulgaria, Hungary). The assessments were made in sports centers (gym, sports hall) were carried out their training, and the data were dumped into the common SPSS statistical system for all countries, where the different statistical analyses were performed. In the statistical analysis the sample was divided into two groups, subjects belonging to Eastern European countries (Bulgaria and Hungary) and Southern European countries (Spain, Portugal and Italy).

**Statistical analysis**
Descriptive statistics were performed for all measures of the participants. Between groups, differences were evaluated using student t for independent data, segmenting such analysis by sex and physical activity level (≥ 150 min/week, < 150 min/week) and place of residence. Previously, the sample was checked for normality, through the Kolmogorov-Smirnov test. The significance level was set at 0.05. All data analyses were performed with the Statistical Package for the Social Sciences Version 24 (IBM-SPSS, Chicago, IL, USA).

Results

A total of 418 older people participated in the first assessment of the project, being divided into two groups according to European location, culture and lifestyle, these being: Eastern European countries (Hungary and Bulgaria), and Southern European countries (Spain, Portugal and Italy). As can be seen in Table 1, the Eastern Europe group (GEE) is made up of 124 people (85% female) aged 68.63 ± 7.33 years who do 133.90 ± 8.12 minutes/week of physical activity, while the Southern Europe group (GES) is made up of 294 people aged (73% female) 69.63 ± 9.04 years who undertake 136.63 ± 8.34 minutes/week of physical activity. These groups are homogeneous in terms of age and physical activity. Regarding anthropometric measurements, it was observed that the subjects of the GES are significantly lower, and less heavy than the GEE, showing a body mass index and a percentage of body fat significantly lower than the GEE. Likewise, in the measurement of perimeters it is shown that the GES presents significantly lower values for the waist and hip perimeter than the GEE, but if we observe the WHR index, the GEE presents a significantly lower value.

Table 2 shows the division of the sample by group (GEE vs GES) and by sex (Male vs Female), where it can be seen that in the male older adult population the amount of physical activity they do per week is significantly lower in the GEE than in the GES, while in women no significant differences are observed, although the trend of the male older adult population continues. As for the physical data, in the male population significant differences are observed in the strength of upper limbs and in dynamic balance, with men belonging to GES demonstrating greater strength and better balance. As for women, the data follow the same lines as in the male population, GES presents significantly higher values of strength and balance than GEE.
Table 2
Results for physical fitness tests for gender.

| Male | Female |
|------|--------|
| n = 100 | n = 318 |

| Region | Eastern Europe | Southern Europe | Eastern Europe | Southern Europe |
|--------|----------------|-----------------|----------------|-----------------|
|        | n = 22         | n = 78          | n = 102        | n = 216         |
| Mean   | 29.46          | 39.09           | 21.56          | 25.61           |
| SD     | 9.98           | 9.01**          | 6.74           | 6.65**          |
| Mean   | 26.02          | 37.76           | 17.86          | 24.26           |
| SD     | 11.97          | 9.36**          | 6.95           | 9.23**          |
| Mean   | 15.89          | 17.11           | 14.25          | 16.11           |
| SD     | 3.71           | 4.84            | 3.27           | 5.38**          |
| Mean   | 519.36         | 528.26          | 469.85         | 481.73          |
| SD     | 222.28         | 93.35           | 226.36         | 97.55           |
| Mean   | -3.21          | -2.47           | 2.23           | 0.77            |
| SD     | 6.38           | 10.78           | 7.72           | 9.28            |
| Mean   | 8.34           | 6.73            | 8.59           | 7.23            |
| SD     | 2.99           | 2.13*           | 2.54           | 2.20**          |
| Mean   | -13.61         | -13.87          | -9.56          | -9.40           |
| SD     | 13.54          | 15.38           | 8.74           | 13.18           |

**p < 0.001; * p < 0.05

Table 3 shows a division by group (GEE vs GES) by gender (female vs male) and by the amount of weekly physical activity performed (≥ 150min/week vs < 150 min/week). This table shows a comparison between intra- and inter-groups, the latter depending on the physical activity performed. Therefore, in the intra-group analysis, referring to the EEG, who perform < 150 minutes/week, women had significant differences in strength and flexibility of lower limbs, aerobic resistance and dynamic balance than those who performed of physical activity. While men who practice < 150 minutes/week of physical activity showed lower strength of the right hand and lower limb, less aerobic resistance, balance and flexibility of the lower limbs than those who carry out ≥ 150min/week of physical activity. Referring to the GES, people who carry out < 150 minutes/week, women showed significant differences in strength in the left hand and lower limbs, aerobic resistance and balance than those who carried out ≥ 150min/week of physical activity. While men who practice < 150 minutes/week of physical activity showed lower strength of the left hand and lower limbs strength, aerobic and flexibility resistance of upper and lower limbs than those who carried out ≥ 150min/week of physical activity.
Table 3
Physical fitness results by gender in relation to the physical activity level

|                  | Female |                                                   |                                                   |
|------------------|--------|---------------------------------------------------|---------------------------------------------------|
|                  | Eastern Europe (n = 102) | Southern Europe (n = 216) |                                                   |
|                  | ≥ 150 min/week | < 150 min/week | ≥ 150 min/week | < 150 min/week |
|                  | n = 48 | n = 54 | n = 107 | n = 109 |
| Mean             |        |        |        |        |
| SD               |        |        |        |        |
| Fitness data     |        |        |        |        |
| Right handgrip   | 22.70  | 20.42  | 26.53  | 24.69  |
| (kg)             | 4.83   | 4.28   | 11.78##| 8.72## |
| Left handgrip    | 17.98  | 17.74  | 26.15  | 22.37  |
| (kg)             | 6.03   | 5.05   | 12.06##| 14.6*  |
| 30s chair stand  | 16.64  | 11.86  | 17.55  | 14.67  |
| (n)              | 2.54   | 2.72*  | 5.42   | 5.69## |
| 6 min walk       | 583.54 | 356.16 | 595.3  | 368.16 |
| (m)              | 137.96 | 100.15*| 80.42  | 114.02*|
| Chair sit and    | 4.39   | 0.07   | 0.96   | 0.58   |
| reach (cm)       | 11.69  | 6.38** | 7.43#  | 9.93   |
| 8 Foot up and go | 7.60   | 9.58   | 6.37   | 8.09   |
| (s)              | 2.44   | 2.57*  | 1.39## | 2.8*   |
| Back scratch     | -9.45  | -9.67  | -8.1   | -10.7  |
| (cm)             | 6.27   | 5.41   | 10.88  | 13.07  |
|                  |        |        |        |        |
| Male             |        |        |        |        |
| Eastern Europe   |        |        |        |        |
| (n = 22)         |        |        |        |        |
| ≥ 150 min/week   | n = 12 | n = 10 | n = 47 | n = 31 |
| Mean             |        |        |        |        |
| SD               |        |        |        |        |
| Fitness data     |        |        |        |        |
| Right handgrip   | 30.78  | 28.14  | 39.97  | 38.21  |
| (kg)             | 8.03   | 3.18*  | 7.66##| 9.34## |

Obs: **p < 0.001, * p < 0.05, intra-group differences (Eastern Europe; Southern Europe); ##p < 0.001, #p < 0.05, inter-group differences (Eastern vs Southern Europe)
| Female                  |                |                |                |                |                |                |                |                |
|------------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| Left handgrip (kg)     | 26.48          | 11.59          | 25.56          | 5.31           | 41.15          | 7.32##          | 34.37          | 9.90##         |
| 30s chair stand (n)    | 17.4           | 3.50           | 14.38          | 2.88*          | 19.01          | 4.50           | 15.21          | 5.01##         |
| 6 min walk (m)         | 636.15         | 126.78         | 402.57         | 111.87*        | 644.82         | 98.50          | 411.70         | 86.26*         |
| Chair sit and reach (cm)| -1.75          | 6.73           | -4.67          | 7.46*          | -1.56          | 10.95          | -3.38          | 10.69*         |
| 8 Foot up and go (s)   | 7.42           | 3.38           | 9.26           | 3.37*          | 6.25           | 1.37#          | 7.21           | 2.54##         |
| Back scratch (cm)      | -13.85         | 15.13          | -13.37         | 13.21          | -12.92         | 16.86          | -14.82         | 14.11*         |

Obs: **p < 0.001, * p < 0.05, intra-group differences (Eastern Europe; Southern Europe); ##p < 0.001, #p < 0.05, inter-group differences (Eastern vs Southern Europe)

In the inter-group comparison relating to the amount of weekly physical activity undertaken, it is observed that the GES female presents significant differences in upper and lower limb strength, and balance, with better values than the GEE in the population that carries out ≥ 150min/week. Likewise, in the population that carries out ≥ 150min/week the GES female shows that people who practice < 150min/week present significantly different results, with higher values for strength - both of upper and lower limbs, and also of balance. It should be noted that there are significant differences in terms of age, with a significantly younger population undertaking less physical activity in GEE than in GES. In the case of men, significant differences were observed in men who practice < 150min/week, showing greater strength in upper and lower limbs, and in balance for GES. While those who carried out ≥ 150 min/week showed significant differences with greater strength upper limbs and balance for the GES.

**Discussion**

The latest data collected in the Eurobarometer [2] indicate an increase in physical inactivity in Eastern Europe compared to Southern Europe, information that confirms the data obtained in our study, since significant differences physical fitness have been observed between the population of Eastern Europe and Southern Europe. To know the effects that physical inactivity causes on the physical fitness is key to defining corrective policies for each of the country, thus improving the health status and quality of life of older adults and reducing health expenditure.

The socio-cultural and economic contexts in which the European population carries out its daily activities are key, and show the way that the society of the future will develop. At present, the European population over 60 years of age shows country-based differences, these differences being a reflection of social and
economic policies, the welfare state, food, education, climate, etc [12]. As mentioned in the introduction, the countries of Eastern Europe have a lower annual and per capita GDP than the countries of Southern Europe, and this fact has repercussions on education, health and, in short, on the welfare of citizens [1]. Because of this, it is necessary and of vital importance to develop programs such as "IN COMMON SPORTS", to motivate and provide resources for older people to continue to be physically active throughout their lives, since European data [12] show that from the age of 75, people stop being physically active. This is why programs such as these are necessary to keep older people active, functional and autonomous, both to guarantee their quality of life and to save costs for the State [20].

As for anthropometric variables, the inhabitants of Eastern Europe are higher than the inhabitants of Southern Europe, and this is in line with other previous studies [21]. Older people living in Southern Europe have a lower fat content and WHR ratio than those living in the East, which may be due to diet, since Southern Europe advocates a Mediterranean diet with abundant vegetables, fruits and fish [22]. Likewise, the climate can also be an important variable in this case, since the climate in southern Europe favours outdoor activities.

Differences were also observed in terms of fitness capacities according to the region and the hours of physical exercise per week. Firstly, it should be noted that one of the most significant phenomena of aging is sarcopenia (loss of muscle mass and strength), thus bringing about the loss of functional abilities in such vital gestures as climbing stairs or getting up from a chair [23]. The decline in both muscle mass and strength that occurs with aging is well documented. Thus, muscle function is of greater importance than muscle mass, validating manual dynamometry as an indicator of functionality in the older adult [24]. In fact, the study by Mancilla et al. [18] establishes the degree of independence of the subject as a function of the levels of strength collected by means of a dynamometer, according to the age range, although it should be highlighted that the sample of this study is self-validating regardless of the region and sex, if we take this study as a reference. As for the strength of the lower limbs, Jones and Rikli [25] creators of the Senior Fitness Test battery, established normative values, which the average of the sample complies with. Although both groups, GES and GEE, comply with the normative values of strength, it is necessary to emphasize that people who live in southern Europe present a greater muscular strength of both upper and lower limbs, which may allow greater functionality, and thus, favor the quality of life of the subject.

It should be noted that authors such as Castañeda et al. [26] relate lower limb strength to balance and therefore a lack of it to the risk of suffering a fall. Cadore et al. [27] suggest that muscle strength work accompanied by high intensity activities, aimed at improving muscle power, improves walking speed, the ability to get up from a chair, balance, and reduces the incidence of falls. García-Flores et al. [28], state that the most important components associated with balance are muscle strength and walking speed. These are the factors responsible for maintaining the autonomy of older people during aging, which is also reflected in this study, where the population of Southern Europe showed better levels of strength and also balance, in relation to that of Eastern Europe, regardless of gender.
Finally, it should be noted that in this study 50% of the population over 60 years of age carried out physical exercise for more than the 150 minutes per week recommended by the WHO, regardless of the region of residence. Eurostat [12], stratified its study by age groups (50–64; 65–74; + 75) showing the percentage of the population that does more than 3 hours per week of physical exercise. Spain presented the highest values (48%, 51%, and 32% respectively), followed by Italy (25%, 32%, and 20%), Bulgaria (32%, 30%, and 16%), Portugal (23%, 25%, and 16%), and Hungary (25%, 22%, and 15%). As can be seen in this study, from the age of 75 onwards, the percentage of people who undertake physical exercise for at least 3 hours a week is significantly reduced. That is why it is necessary to implement projects, such as “IN COMMON SPORTS”, to offer the opportunity and motivation to the older population to exercise, which will benefit the individual, because they will maintain their autonomy, as well as benefiting the state by saving health and dependency costs.

In addition, this study supports the WHO [11], which establishes the duration of weekly physical exercise that older people must do in order to maintain their functionality, autonomy and thus an active and quality lifestyle. There are significant differences in limb strength and balance when the amount of weekly exercise is considered, although there are also significant differences in upper limb strength and aerobic capacity in Southern Europe. This may be because the type or load of physical exercise this population does is not the same. Therefore, in future research it would be advisable to establish what type and load of physical exercise is advisable in order to establish changes and improvements in the physical fitness of that population.

This research presents a series of limitations that we will now indicate. The first limitation to highlight is the cross-sectional design, which makes it impossible to track the physical fitness of older adults. Another limitation is that the sample used was chosen for convenience and is not representative of the population of each country, although it may indicate a trend. The third limitation is the small size of the sample used. The number of men who have participated in the study is very small. The researchers have decided to keep the analysis planned, as these data reflect the reality of sports physical practice by men. The fourth limitation is related to the evaluation team, which despite using the same protocols, was different for each country, and an interobserver bias may appear.

Therefore, it can be concluded that there are significant differences in anthropometric and physical fitness parameters between the population over 60 years of age living in Eastern and Southern European countries. It is necessary to implement physical exercise programmes in people over 60, especially in Eastern European countries, as well as the amount of weekly physical exercise carried out according to WHO criteria, in order to keep older people active and autonomous.

Declarations

Ethics approval and consent to participate

The ethical standards contained in the Declaration of Helsinki were followed in this study and this study was approved by the Polytechnic Institute of Viana do Castelo Ethical Committee (IPVC-ESDL180417).
addition, all participants signed an informed consent prior to participation in the program. The “IN COMMON SPORTS” program recruited participants voluntary through the websites and press advertisements that each municipality spread, and where the project and the steps to be followed to sing up it were announced.

Consent for publication

Not applicable.

Availability of data and materials

Not applicable.

Competing interests

The authors declare that they have no competing interests.

Funding

Erasmus+ Programme: Support for Collaborative Partnerships in the field of Sport. Nº 2017-2356/001/001. “IN COMMON SPORTS”: Intergenerational Competition as Motivation for Sport and Healthy Lifestyle of Senior Citizens.

Authors’ contributions

JMC contributed to the conceptual design of the study, conducted the methodological support, data analysis, and wrote the manuscript.

IM contributed to the conceptual design of the study, provided data collection and analysis.

PB and MF contributed to the conceptual design of the study, conducted the methodological support, critical reviewing, and revised the manuscript. All authors have read and approved the manuscript.

Acknowledgments

To all the people from the five countries that were part of the project, both the participants and the staff in charge of carrying out the classes and evaluations.

Authors’ information (optional)

HealthyFit Research Group, Faculty of Physiotherapy, University of Vigo, 36005, Pontevedra, Spain

Irimia Mollinedo-Cardalda,

Camara Municipal of Vilanova da Cerveira, Vila nova de Cerveira, Portugal
Manuela Ferreira

Escola Superior de Desporto e Lezer, Instituto Politécnico de Viana do Castelo, Portugal. Research Center in Sports Sciences, Health Sciences and Human Development, CIDESD, Portugal

Pedro Bezerra

Galicia Sur Health Research Institute (IIS Galicia Sur). Sergas-UVIGO. HealthyFit Research Group, Faculty of Education and Sports Science, University of Vigo, Spain

JM. Cancela-Carral

References

1. Expansión. Datos Macro. España: Datosmacro.com. URL: https://datosmacro.expansion.com/paises/comparar/espana/portugal . 2019
2. Special. Sport and physical activity. Brussels: TNS Opinion & Social. 2014.
3. Fernández-Ballesteros R, Caprara MG, Iñiguez JY, García LF. Promoción del envejecimiento activo: efectos del programa «Vivir con vitalidad»®. Rev Esp Geriat Gerontol 2005;40:92-103. https://doi.org/10.1016/S0211-139X(05)74834-4.
4. E Estructura demográfica y envejecimiento de la población. Eurostat Statistics Explained. 2018. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Population_structure_and_ageing/es
5. Carville SF, Perry MC, Rutherford OM, Smith ICH, Newham DJ. Steadiness of quadriceps contractions in young and older adults with and without a history of falling. Eur J Appl Physiol 2007;100:527-33. https://doi.org/10.1007/s00421-006-0245-2.
6. Macaluso A, De Vito G. Muscle strength, power and adaptations to resistance training in older people. Eur J Appl Physiol 2004;91:450-72. https://doi.org/10.1007/s00421-003-0991-3.
7. Walston JD. Sarcopenia in older adults. Curr Opin Rheumatol 2012;24:623-625. https://doi.org/10.1097/BOR.0b013e328358d59b.
8. Shaffer SW, Harrison A. Aging of the somatosensory system: a translational perspective. Phys Ther 2007; 87:193-207. https://doi.org/10.2522/ptj.20060083.
9. Doherty TJ. Aging and sarcopenia. J Appl Physiol 2003;95:1717-27. https://doi.org/10.1152/japplphysiol.00347.2003.
10. OMS (Organización Mundial de la Salud). Envejecimiento activo: un marco político. Rev Esp Geriatr Gerontol 2002;37:74-105.
11. World Health Organization. Recomendaciones mundiales sobre actividad física para la salud. Organización mundial de la Salud, 2019. Download: https://www.who.int/dietphysicalactivity/factsheet_recommendations/es/
12. Eurostat. Ageing Europe. Looking at the lives of older people in the EU. Luxemburgo: Publications Office of the European Union, 2019.

13. Izquierdo M, Casas-Herrero A, Martínez-Velilla N, Alonso-Bouzón C, Rodríguez-Mañas L. An example of cooperation for implementing programs associated with the promotion of exercise in the frail elderly. European Erasmus+«Vivifrail» program. Rev Esp Geriatr Gerontol 2017;52: 110-11.

14. CSD (Consejo Superior de Deportes-Gobierno de España). Plan integral para la actividad física y el deporte en personas mayores. Download: http://envejecimiento.csic.es/documentos/documentos/varios-plandeporte-01.pdf.

15. Website: In Common Sport Project. (2018-2020). Olympic 4all: http://www.olympics4all.eu/

16. Granic A, Hurst C, Dismore L, Davies K, Stevenson E, Sayer A, Aspray T. Milk and resistance exercise intervention to improve muscle function in community-dwelling older adults at risk of sarcopenia (MilkMAN): protocol for a pilot study. BMJ open 2019; 9: e031048.

17. Srikanthan P, Seeman TE, Karlamangla A. Waist-hip-ratio as a predictor of all-cause mortality in high-functioning older adults. Ann Epidemiol 2009;19:724-31. https://doi.org/10.1016/j.annepidem.2009.05.003.

18. Mancilla E, Ramos S, Morales P. Fuerza de prensión manual según edad, género y condición funcional en adultos mayores Chilenos entre 60 y 91 años. Rev Med Chil 2006;144:598-603. https://doi.org/ 10.4067/S0034-98872016000500007.

19. Rikli R, Jones C. Development and validation of a functional fitness test for community-residing older adults. J Aging Phys Act 1999;7:129-61.

20. Landinez-Parra N, Contreras-Valencia K, Castro-Villamil Proceso de envejecimiento, ejercicio y fisioterapia. Rev Cub Salud Pública 2012;38:562-80.

21. Martínez-Carrión JM. La talla de los europeos desde 1700: tendencias, ciclos y desigualdad. Madrid, 2011.

22. Dussaillant C, Echeverría G, Urquiaga I, Velasco N, Rigotti A. Evidencia actual sobre los beneficios de la dieta mediterránea en salud. Rev Med Chil 2016;144:1044-52. https://doi.org/ 10.4067/S0034-98872016000800012.

23. Bean J, Kiely D, LaRose S, Goldstein R, Frontera W, Leveille S. Are changes in leg power responsible for clinically meaningful improvements in mobility in older adults? J Am Geriatr Soc 2010;58:2363-8. https://doi.org/10.1111/j.1532-5415.2010.03155.x.

24. Arroyo P, Lera L, Sánchez H, Bunout D, Santos JL, Albala C. Indicadores antropométricos, composición corporal y limitaciones funcionales en ancianos. Rev Med Chil. 2007;135:846-54. https://doi.org/10.4067/s0034-98872007000700004.

25. Jones J, Rikli R. Measuring functional. J Activ Aging 2002;1:24-30.

26. Castañeda M, Gómez JM, Avellaneda L, Caballero L, Delgado Condición física funcional y riesgo de caídas en adultos mayores. Rev Cub Invest Biomédicas 2019; 37 (3):1-10.
27. Cadore EL, Casas-Herrero A, Zambom-Ferraresi F, Idoate F, Millor N, Gómez M, et al. Multicomponent exercises including muscle power training enhance muscle mass, power output, and functional outcomes in institutionalized frail nonagenarians. Age 2014;36:773-85. https://doi.org/10.1007/s11357-013-9586-z.

28. García-Flores FI, Rivera-Cisneros AE, Sánchez-González JM, Guardado-Mendoza R, Torres-Gutiérrez JL. Correlación entre velocidad de marcha y fuerza muscular con equilibrio para reducir caídas en ancianos. Cirugía y Cirujanos 2016; 84:392-97. https://doi.org/10.1016/j.circir.2015.12.005.