

# Evaluation of physical fitness in spanish people over 80 years of age using the senior fitness test and the body mass index

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## Summary

Life expectancy has increased significantly in western societies. Physical exercise adapted to the elderly is a key factor in achieving active ageing.

**Objectives:** Main objective was to assess the functional fitness of active, independent, over 80 years of age, Spanish subjects enrolled in a Senior Physical Fitness program using the Senior Fitness Test (SFT), and to compare the results with the SFT reference intervals. The secondary objective was to analyse the sample's results when distributed according to age and sex.

**Material and method:** A transversal study was conducted in 162 participants (142 women, 87%). They were administered the SFT to determine their physical abilities and their BMI was calculated in order to find out its influence on their physical condition.

**Results:** Our Spanish sample performed better in strength and agility but presented lower outcomes in endurance and flexibility when compared to the US target population. In the Spanish sample significant differences between the two sexes were only found in the resistance score, where men performed better than women, ( $p=0.006$ ). Participants over 85 presented lower results in BMI ( $p=0.007$ ), upper body strength ( $p=0.01$ ) and lower body flexibility ( $p=0.02$ ). The mean BMI of our sample was higher than that of the American population.

**Conclusions:** The Spanish population is stronger and has more agility, but it's also less flexible and has lower endurance when compared to the American population. The Fitness condition in our population > 80 is similar in men and women.

## Key words:

Senior Fitness Test. Physical activity. Elderly. Ageing.

## Valoración de la condición física mediante el *senior fitness test* y el índice de masa corporal en una muestra española de personas mayores de 80 años

### Resumen

La esperanza de vida se ha incrementado notablemente en las sociedades occidentales. El ejercicio físico adaptado a personas mayores es clave para conseguir un envejecimiento activo.

**Objetivos:** El objetivo principal fue determinar los niveles de condición física con el *Senior Fitness Test* (SFT) en sujetos españoles, mayores de 80 años, activos e independientes, adscritos a un programa de Condición Física de Mayores (CFM) y compararlos con los valores estadounidenses de referencia del SFT. El objetivo secundario fue analizar los resultados de nuestra población distribuidos por sexo y edad.

**Material y método:** Se realizó un estudio transversal en 162 participantes, (142 mujeres, 87%), a los que se les aplicó el SFT para evaluar su condición física y se les midió el Índice de Masa Corporal (IMC) para valorar su influencia sobre la condición física.

**Resultados:** En el SFT, la muestra española presentó mejor desempeño en fuerza y agilidad y niveles más bajos en flexibilidad y resistencia que la población estadounidense de referencia. No se encontraron diferencias significativas entre sexos en la población española, excepto en la prueba de resistencia a favor de los hombres ( $p=0,006$ ). El grupo mayor de 85 años presentó resultados inferiores del IMC ( $p=0,007$ ), de la fuerza del tren superior ( $p=0,01$ ) y de la flexibilidad del tren inferior ( $p=0,02$ ). La media del IMC de la muestra estudiada fue superior a la media de la población estadounidense.

**Conclusiones:** La muestra española es más fuerte y ágil, pero menos flexible y resistente que la población estadounidense de referencia. La capacidad funcional en nuestra población mayor de 80, es similar en ambos sexos.

## Palabras clave:

Senior Fitness Test. Actividad física. Mayores. Envejecimiento.

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## Introduction

Life expectancy in western countries has risen notably over the last century thanks to improvements in social and health conditions<sup>1</sup>. In Spain, life expectancy stands at 85.8 for women and 80.3 for men<sup>2</sup>. The percentage of the population over 65 in the country is currently 18.7% and is expected to reach 25.6% and 34.6% by 2031 and 2066, respectively<sup>3</sup>.

The European Commission promotes the idea of keeping older people active and independent<sup>4</sup>, and if we know their physical activity habits, we can influence and improve their behaviour patterns. Functional capacity for day-to-day activities diminishes with age; strength, flexibility and aerobic endurance are the factors most affected<sup>5</sup>. Physical activity is positively related to degree of independence<sup>6</sup> and prolonged periods of immobility increase death due to disease in this population<sup>7</sup>. Various studies have found that a suitable physical activity programme improves muscle strength<sup>8,9</sup>, aerobic endurance, agility, balance and flexibility<sup>10,11</sup>, which are associated with a greater ability to perform everyday activities<sup>12</sup>.

Studies have shown that physical exercise programmes improve the degree of independence of the over-60s<sup>5,9,12</sup>, but we have not found any studies specifically focussing on populations aged over 80 in Spain or anywhere else. The Senior Fitness Test (SFT) is a validated test widely used to quantify the physical condition of the elderly<sup>13-15</sup>.

The main aim of our study was to use the SFT and BMI to identify the fitness level of a population of active subjects aged over 80 taking part in Senior Physical Fitness programmes in the last quarter of 2017 and to compare the results obtained with the reference values of a US population aged over 80. The secondary objective was to analyse the SFT results of our population by sex and age.

## Material and method

### Population

People over 80 years of age, not in care homes and taking part in a Málaga City Council Senior Physical Fitness programme in the last quarter of 2017 were included. They all presented medical reports indicating that they did not suffer from any acute or chronic condition (cardio-pulmonary, renal, orthopaedic, neurological, etc.) which would make the SFT inadvisable. The characteristics of the study were explained to all the participants beforehand and they all signed an informed consent form. Those who did not wish to take part and those with one of the conditions mentioned were excluded from the study.

### Material

The material used to conduct the study consisted of:

- Aluminium measuring rod.
- Jata non-digital scales.
- Analogue stopwatch for the strength, agility and endurance tests.

- 2.5 kg and 4 kg weights were used for women and men, respectively, instead of the 2.27 kg (5 lb) and 3.63 kg (8 lb) ones originally used in the SFT.
- A 150 cm flexible tape measure to measure flexibility.
- A plastic cone measuring 45.5 cm in height and with a 20x20 cm base for the agility test.
- A bench or chair without armrests.
- A rectangular 47.5 m perimeter for the endurance test.

## Methodology

The study was cross-sectional with the prospective collection of the following variables: sex, age and BMI.

The other variables studied were obtained from the different tests included in the usual SFT battery<sup>16</sup>:

- *Arm curl test* (ACT): upper body strength.
- *Chair stand test* (CST): lower body strength.
- *Back scratch test* (BST): upper body flexibility.
- *Chair-sit and reach-test* (CRT): lower body flexibility.
- *Foot up-and-go test* (FT): agility.
- *6-minute walk test* (6-MWT): endurance.

In order to study the influence of age in our population, the subjects were divided into two age groups: one for those aged between 80 and 85, and the other for over-85s.

## Statistical analysis

Los datos fueron recogidos en el programa SPSS (v 25) y se utilizó el software The data were collected in SPSS (v 25) and Excel 2000 software was used for graphic data processing. The quantitative variables were expressed as means plus standard deviation. Mean and variance weighting was carried out to obtain the US reference values. The Kolmogorov-Smirnov test was used to test the normality of the variables. Because we were unable to assume normality, the nonparametric Mann-Whitney U test was applied to study the possible differences between sexes and age groups. A p-value of  $\leq 0.05$  was considered to be statistically significant.

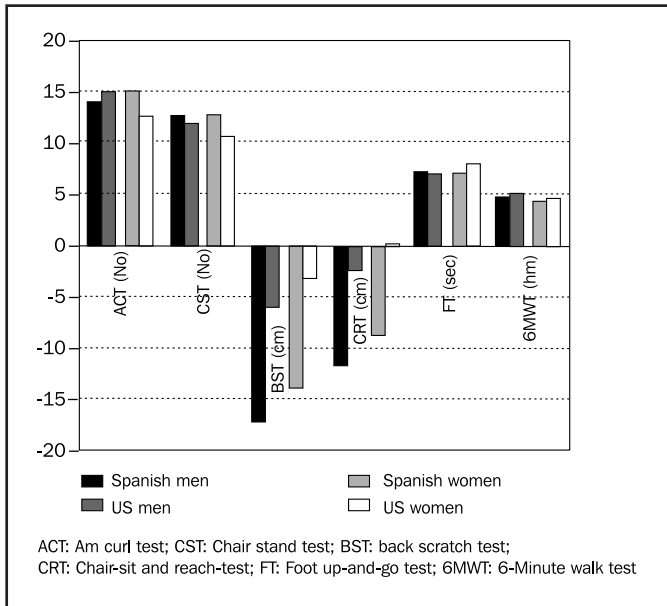
## Results

The participants in the study were people over 80 years of age of Caucasian origin. 162 subjects were included, 20 men and 142 women. They all completed the SFT and their BMIs were calculated without incident. The age range was between 80 and 95. The mean age of the men was slightly higher than that of the women ( $84 \pm 3.4$  vs  $83 \pm 2.6$ ). The mean BMI of the population was  $28.63 \pm 4.20$  kg/m<sup>2</sup> for the women and  $26.82 \pm 3.81$  kg/m<sup>2</sup> for the men.

Figure 1 shows the results of the SFT of the Spanish and US populations by sex. The Spanish women gave better strength test results than the American women.

Table 1 shows the BMI and SFT results by age group. As can be seen, all the age groups in the Spanish population obtained higher upper body (ACT) and lower body (CST) strength values. However, the

**Figure 1.** SFT results of the Spanish population and US population by sex.



Spanish sample obtained lower upper body (BST) and lower body (CSR) flexibility values than the American population<sup>17</sup>.

Table 2 shows the SFT results by percentiles, split into 'low' (p0-p25) 'normal' (p25-p75) and 'excellent' (p75-p100), in line with Rikli and Jones<sup>15,16</sup>. Figures 2 and 3 show the same results by sex. In terms of upper (ACT) and lower body (CST) strength, 75% and 95% of our male sample, and 90% and 96.5% of our female sample achieved 'normal' and 'excellent' results, respectively. When it came to both lower body (CSR) and upper body (BST) flexibility, however, our sample scored worse than the reference sample, especially the Spanish women compared to the American women. When comparing the results of our population by sex, no significant differences were found, except for the endurance

**Table 2.** Spanish sample results by sex according to Rikli and Jones' reference percentiles.

Tests	Sex	Mean± SD	SFT result			p-value
			Low	Normal	Excellent	
Arm Curl Test (ACT)	M:	13.95±4.45	25%	70%	5%	>0.05
	F:	14.71±3.83	9.9%	47.9%	42.3%	
Chair Stand Test (CST)	M:	12.66±6.11	5%	45%	50%	>0.05
	F:	12.49±3.46	3.5%	46.5%	50%	
Back Scratch Test (BST)	M:	-17.32±10.18	30%	60%	10%	>0.05
	F:	-14.14±12.91	49.3%	35.2%	15.5%	
Chair-sit and Reach-test (CRT)	M:	-11.82±11.45	40%	60%	0%	>0.05
	F:	-8.86±10.55	62.7%	35.2%	2.1%	
Foot up-and-go Test (FT)	M:	7.06±3.12	15%	60%	25%	>0.05
	F:	6.93±2.00	13.4%	66.2%	20.4%	
6-Minute walk test (6MWT)	M:	463.61±148.21	15%	65%	20%	>0.05*
	F:	406.31±82.90	19%	66.9%	14.1%	

\*Statistically significant.

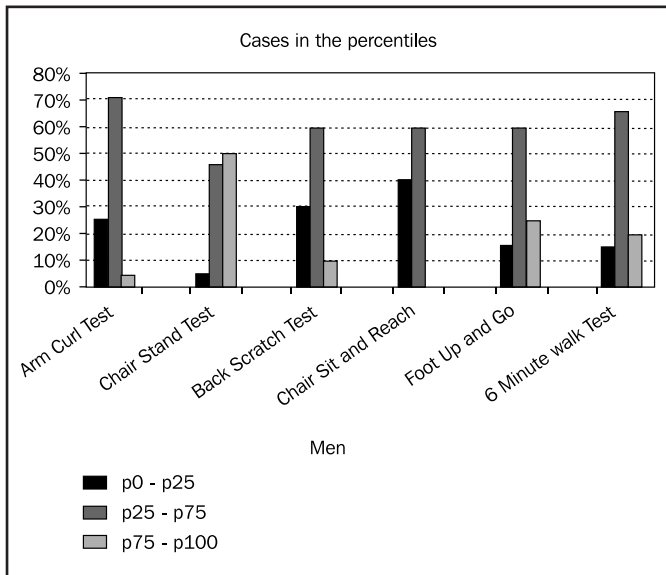
**Table 1.** SFT results of the Spanish population and US population by age.

Tests	Age	US population Mean±SD	Spanish population Mean±SD
BMI	80-85	25.14±3.84	28.93±4.27
	85-90	24.45±3.42	26.90±3.66
	>90	24.35±4.26	26.29±2.11
Arm curl test (ACT)	80-85	13.93±4.16	15.05±3.72
	85-90	12.56±3.93	13.19±4.20
	>90	11.26±3.70	14.25±4.79
Chair stand test (CST)	80-85	11.64±4.11	12.80±13.15
	85-90	10.50±4.17	11.72±5.26
	>90	8.57±4.70	10.78±7.84
Back scratch test (BST)	80-85	-3.54±4.59	-14.13±11.83
	85-90	-4.49±4.58	-15.85±15.71
	>90	-5.39±5.07	-15.07±1.68
Chair-sit and reach-test (CRT)	80-85	-0.28±4.15	-8.12±9.79
	85-90	-0.68±3.83	-11.35±12.20
	>90	-2.32±4.10	-24.01±10.90
Foot up-and-go test (FT)	80-85	6.95±2.08	6.65±1.46
	85-90	7.72±2.53	7.75±3.37
	>90	8.96±3.10	9.09±3.79
6-Minute walk test (6MWT)	80-85	481.85±117.97	420.89±93.35
	85-90	440.43±132.81	396.32±91.90
	>90	374.38±134.74	38.18±134.38

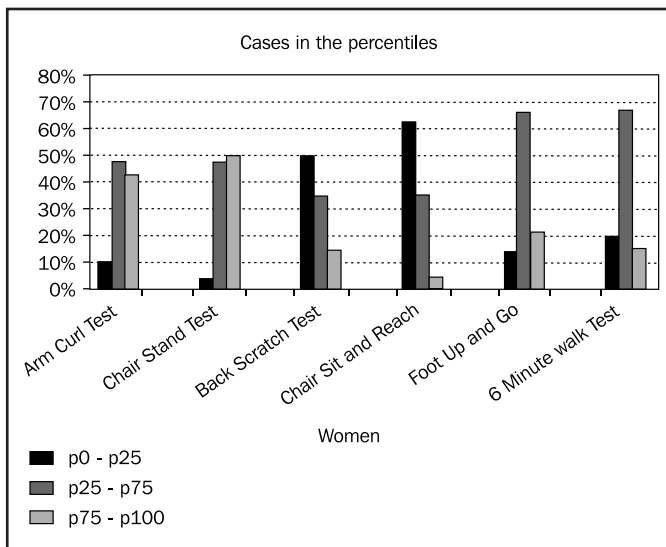
test (6-MWT, p=0.006), where the men obtained better results than the women (Table 2).

Table 3 shows the SFT and BMI results of our population by age group. A decrease in BMI (p=0.007), upper body strength (ACT, p=0.01)

**Figure 2. Results of the Spanish men according to the SFT reference percentiles.**



**Figure 3. Results of the Spanish women according to the SFT reference percentiles.**



and lower body flexibility (CRT,  $p=0.02$ ) was observed as age increased, the other differences detected being statistically insignificant.

## Discussion

According to estimates accepted by all social actors, life expectancy is expected to continue to follow an upward trend in the future. The lack of research on physical activity in people aged 80-95 was one of the main reasons why this research was conducted. Physical fitness

**Table 3. SFT and BMI results in the Spanish sample by age.**

Tests	Age	n	Mean± SD	p level
BMI	80-85	122	28.93±4.27	< 0.01*
	>85	40	26.84±3.52	
Arm Curl Test (AMC)	80-85	122	15.05±3.72	< 0.05*
	>85	40	13.30±4.21	
Chair Stand Test (CST)	80-85	122	12.80±3.15	> 0.05
	>85	40	11.63±5.45	
Back Scratch Test (BST)	80-85	122	-14.13±11.83	> 0.05
	>85	40	-15.77±14.90	
Chair-sit and Reach-test (CRT)	80-85	122	-8.12±9.79	< 0.05*
	>85	40	-12.61±12.55	
Foot up-and-go Test (FT)	80-85	122	6.65±1.46	> 0.05
	>85	40	7.88±3.38	
6-Minute walk test (6MWT)	80-85	122	420.88±93.35	> 0.05
	>85	40	390.51±96.33	

\*Statistically significant; BMI: Body Mass Index.

was determined by means of the SFT, a widely validated test<sup>15</sup> used to highlight the weaknesses and strengths of Senior Physical Fitness programmes.

Comparing the SFT and BMI variables of the two populations (Spanish and US), which was the chief objective of the study, we found that (Figure 1, Table 1):

- Our sample gave moderately higher strength values in all age groups compared to the American sample, especially for women. The Spanish population achieved higher upper limb strength values (ACT) despite using heavier dumbbells (change from lb to kg), which has had a negative impact in other studies<sup>18</sup>. Similar results were obtained in the measurement of lower body strength (CST), with all the participants scoring higher than the reference population.
- As for agility (FT), the Spanish and American populations gave similar results, although the Spanish women did slightly better. This difference could be due to greater lower body strength, a direct relationship between strength and agility having been observed in other studies<sup>19</sup>.
- The levels of flexibility (CRT and BST) of the sample were considerably lower than the US population, especially for women (Table 2). It is striking that our population obtained worse results in flexibility despite taking part in a Senior Physical Fitness programme, in which stretching exercises are included at the end of each session.
- As for endurance (6MWT), although not appreciable due to the adjustment of the measurement unit in Figure 1 (from metres to hectometres), there were significant differences in favour of the US population. Waist circumference is inversely related to aerobic endurance<sup>20</sup>. The higher BMI found in our population could justify its poorer performance in the endurance test.

Considering it still a simple, valid method, the BMIs of the two populations were also compared in order to relate body fat percentage and cardiovascular risk<sup>20</sup>. 78.39% of our subjects were overweight or obese, especially the women<sup>21</sup>. However, our population aged >85 had a lower BMI than the population aged <85 ( $p=0.007$ ), suggesting that the increase in BMI in our population tends to disappear with age<sup>22</sup>. New studies evaluating nutritional status or even questioning the validity of BMI when evaluating people of such advanced ages would be very useful.

As for the secondary objective, we compared the SFT results of our population by age and sex. A significant decrease was observed in the tests measuring upper body strength (ACT  $p=0.01$ ) and lower body flexibility (CSR  $p=0.022$ ) in the > 85 group (Table 3), perhaps due to the drop in physical capabilities as age increases<sup>5</sup>. Other studies<sup>12,21</sup> have applied a cut-off point of 70-75 years of age, which is when functional decline is most marked. Because our sample had an age range limited to 80-95, it is difficult to find other significant differences. A comparison of the SFT results by sex shows no significant difference except in the endurance test (6MWT,  $p=0.006$ ) (Table 2). Further studies to justify the similarity in the results of the active population aged > 80 when compared by sex are needed.

The strengths of this study lie in the fact that we have found no other studies analysing the SFT in a population similar to ours, the subjects demonstrated great tolerance and readiness to carry out the SFT, no side effects at all were recorded and these results may be useful in order to improve the Senior Physical Fitness programmes used.

The imbalance in the sample between the number of men and women should be noted as a weakness.

## Conclusions

Assessing the physical fitness of our population, by comparing it with the normative SFT values and the results within the population itself leads us to the following conclusions:

- The Spanish sample would appear to be stronger and more agile, but to be less flexible and to have less endurance than the reference population.
- The difference in functional capacity between men and women tends to disappear in the population aged over 80.
- The BMI may not be a reliable anthropometric parameter in populations aged >80.

## Conflict of interest

The authors declare that they are not subject to any type of conflict of interest.

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  - **Strength and Conditioning** <sup>(1)</sup>
- **Audiología** <sup>(2)</sup>
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<sup>(1)</sup> Presencial    <sup>(2)</sup> Semipresencial