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PHYSICAL ACTIVITY PROGRAMMES IN THE ELDERLY: A SUCCESSFUL STRATEGY FOR HEALTHY AGEING

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ABSTRACT

Background: Because the elderly are the most inactive and sedentary segment of the population, public institutions have created new programmes of regular and organised physical activity (PA). However, whether these programmes suffice to comply with the WHO recommendations on physical activity is unknown. In this study, we aim: a) to describe the levels of PA and sedentary behaviour in a group of elderly members of a PA programme organised by the City of Huesca (Spain); b) to evaluate their compliance with the recommended daily practice of PA; and c) to determine the sedentary activities that they spend the most time on, identifying factors that may influence both PA levels and sedentary behaviours. Methodology: A descriptive, cross-sectional study was performed, consisting in a questionnaire of sedentary behaviours. PA was measured by accelerometery. Results: International recommendations for PA are met by 84.4% of the subjects, evidencing higher levels of PA on the days when they attend fitness classes. The most common sedentary activity was watching television. Conclusions: The elderly participating in PA programmes organised by public institutions seem to benefit from higher levels of moderate to vigorous PA, evidenced by a high percentage of compliance with the international PA practice recommendations. We recommend continuing to foster the availability of PA programmes organised by municipal institutions.

Key words: accelerometery, elderly, sedentary behaviour, physical activity

PROGRAMAS DE ACTIVIDAD FÍSICA EN PERSONAS MAYORES: UNA ESTRATEGIA EXITOSA PARA EL ENVEJECIMIENTO SALUDABLE

RESUMEN

Introducción: Dado que los adultos mayores son el segmento más inactivo y sedentario de la población, las instituciones públicas han creado nuevos programas de actividad física (AF) regular y organizada. No obstante, desconocemos si a través de ellos se consigue que este grupo poblacional cumpla las recomendaciones de AF propuestas por la OMS. Este estudio propone a) conocer los niveles de AF y comportamiento sedentario de un grupo de adultos mayores pertenecientes a un programa de AF regular organizado por el Ayuntamiento de Huesca (España), b) estudiar el porcentaje de cumplimiento de las recomendaciones de práctica diaria de AF, y c) describir en qué comportamientos sedentarios invierten principalmente el tiempo e identificar aquellos determinantes que pueden influir tanto en sus niveles de AF como de comportamientos sedentarios. Metodología: Se llevó a cabo un estudio descriptivo transversal, consistente en un cuestionario de comportamientos sedentarios y medición de AF con acelerometría. Resultados: Un 84,4% de la muestra cumple las recomendaciones internacionales de AF, evidenciando mayores niveles de práctica de AF los días que asisten a las clases de gimnasia. En cuanto al comportamiento sedentario, la actividad realizada con mayor frecuencia es ver televisión. Conclusión: Los adultos mayores que participan en AF organizadas por instituciones públicas parecen beneficiarse de unos mayores niveles semanales de práctica de actividad física moderada a vigorosa, mostrando un elevado porcentaje de cumplimiento de las recomendaciones internacionales de prácticas de AF. Se recomienda seguir fortaleciendo la oferta de AF organizada por parte de las instituciones municipales.

Palabras clave: acelerometría, adulto mayor, comportamiento sedentario, actividad física

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INTRODUCTION

Spain, as well as other developed countries, is currently undergoing a process called "demographic transition" (Lesthaeghe, 2014). This process is related to the populational changes that the country has suffered, and is mainly determined by an increase in the population aged 65 and above, more than 2% in the last fifteen years. According to data obtained from the National Statistics Institute, the population aged 65 and above currently accounts for 18.2% of the total population (Abellán, Vilches & Pujol, 2014). An increase in this tendency has been predicted and, proportionally, the greatest growth will take place in the group aged eighty and above. This growth of the older population has its consequences, such as an increase in the cost of pensions and health expenditure (González & San Miguel del Hoyo, 2001), caused by an increase in the prevalence of chronic diseases, injuries associated with falls, and the costs related to the dependence of the elderly (Bauman, Merom, Bull, Buchner & Fianatore, 2016).

Physical activity (PA) is one of the main factors available to delay the development of morbidity in the elderly (Lee, Shiroma, Lobelo, Puska, Blair & Katzmarzyk, 2012). Furthermore, PA is one of the main determining factors of "active ageing", a concept coined in 2002 by the World Health Organisation (WHO). This concept refers to healthy ageing, with a reduction in the prevalence of chronic diseases, higher levels of productivity and independence, and improved functional and cognitive capacities to carry out tasks, and enjoy social and cultural life (Kalache, Aboderin & Hoskins, 2002).

Despite the extensive knowledge available about the benefits of practicing PA (Vogel, Brechat, Leprêtre, Kaltenbach, Brthel & Londsdorfer, 2009), inactivity and sedentariness is a major problem in the elderly population. On average, between 65 and 80% of their waking time is spent carrying out sedentary activities (Harvey, Chastin & Skelton, 2013), and about 70% of the elderly spend more than 8.5 hours a day sitting down (Harvey, 2015). According to an international WHO report (Hallal et al., 2012) 31.1% of adults are physically inactive, and the most inactive segment is the group of over 65s. In Spain, 41.5% of the elderly do not meet PA recommendations (Balboa-Castillo, León-Muñoz, Graciani, Rodríguez-Artalejo & Guallar-Castillón, 2011). This behaviour in the older population can be explained by different reasons, varying from physical impediment to lack of motivation (Franco et al., 2015).

Given the above, the elderly are one of the most attractive groups in the field of research into PA and health. Over the last few years, public institutions have taken up this interest, converting this population group into a target group in terms of creating new regular and organised PA programmes (López, Moreno del Castillo, Zagalaz & Párraga, 2002).

These programmes are usually aimed at promoting active and healthy living habits, contributing, as a result, to the active ageing of older people. However, we do not know if those groups of the elderly who participate in these programmes are, indeed, active. In other words, if the practice of PA, organised by the public institutions, results in compliance by this population group with the PA recommendations proposed by the WHO (WHO, 2010).

Consequently, this study proposes: a) getting to know the levels of PA and sedentary behaviour of a group of the elderly who attend a regular PA programme organised by Huesca City Council, b) studying the percentage of compliance with the WHO's recommendations on the daily practice of PA, and c) describing what they mainly spend their time on when they are sitting down, and identifying the determining factors that may have an impact on their PA levels and on sedentary behaviours.

MATERIAL AND METHOD

Sample and study design

A descriptive cross-cutting study was conducted on a sample of elderly people who participate in the fitness class programme for the elderly along the academic year, promoted by the Municipal Sports Association of Huesca City Council. The group of elderly people was divided into two practice levels: intermediate and high demand levels. Fitness sessions lasted one hour in both levels and the programme did not contemplate any kind of formal evaluation about its effectiveness.

The study was divided into two stages: the first consisted in answering a questionnaire, and the second in objectively measuring PA and sedentary activity using an accelerometer.

The final sample included a total of 32 elderly people, 84.4% females and 15.6% males, with ages ranging between 61 and 86 (Figure 1).

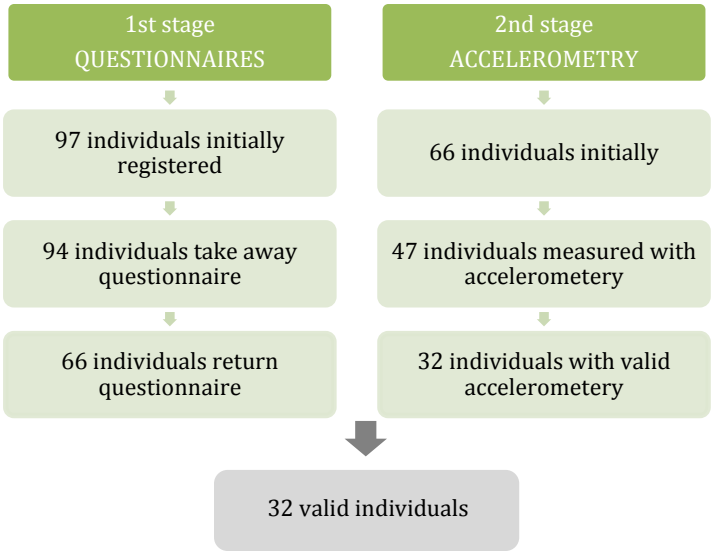

FIGURE 1: Evolution of sample according to study stages.

Description of variables and measurement instruments

A self-reporting questionnaire was used to measure both socio-demographic variables (i.e., age and sex) and self-perceived health and sedentary behaviour.

The self-perceived health question was taken from the Spanish National Health Survey: "Over the last twelve months, would you say that your health has been very good, good, normal, bad, very bad?" (Ministry of Health, Social Services and Equality, 2013).

As regards sedentary behaviour in the elderly, and taking the ASAQ (Adolescent Sedentary Activity Questionnaire) by Hardy, Booth & Okely (2007) as reference, a list of activities that the elderly could possibly carry out more often in their free time was prepared. Using the self-reporting method, the elderly people recorded the time spent on each one of the possible sedentary activities stipulated in the list, in hours and minutes per day, both on weekdays and at weekends.

PA and sedentary behaviours were measured by accelerometery. Actigraph GT3X accelerometers were used for this study, programmed using Actilife Software, version 6.11.9. The accelerometers were programmed with a 15-second epoch and they were worn for 8 days to thus be able to eliminate the first day of use from the analysis, as this day is considered as one of adaptation to the use of the device. The instrument had to be worn continuously on the

right hip and only removed for sleeping or to do aquatic activities, such as swimming or showering (Heil, Brage & Rothney, 2012; Matthews, Hagstromer, Pober & Bowles, 2012; Schrack et al., 2016).

Procedure

After being authorised by the review board of the University of Zaragoza and the Huesca City Council official, the group of elderly people was visited, informing them about the study and inviting them to participate. Later, the participants signed the informed consent and they were given the questionnaire to fill in.

The data obtained by accelerometery were analysed using the *Actilife* software, version 6.11.9. Since the review by Gorman, Hanson, Yang, Khan, Liu-Ambrose & Ashe (2014) on protocols of use of Actigraph accelerometers in the elderly suggested that the cut-off points of Freedson, Melanson & Sirard (1998) were the most commonly used in the elderly, it was decided to use this study to analyse the data.

After categorizing the data according to intensity levels, they were assessed to determine the daily hours of use and thus the number of valid accelerometery days. A day when the accelerometer was used for at least 10 hours was considered as a valid day (Matthews et al., 2012). To be able to include an accelerometer's weekly data in the data analyses, there had to be at least three valid accelerometery days during the week and at least one valid day at the weekend (Hart, Swartz, Cashin & Strath, 2011; Matthews et al., 2012). Only 32 of all the accelerometers received satisfied criteria to be considered valid. Of these, 15.6% corresponded to males and 84.4% to females.

Statistical analysis

To determine the distribution of variables to be analysed, a Kolmogorov-Smirnov normality test was conducted, as well as variance homogeneity by means of the Levene test. Afterwards, a descriptive analysis by frequencies, means and standard deviations was performed on the different variables that characterise the sample.

A one-factor ANOVA was conducted to seek possible significant differences according to determining factors (e.g., assistance to fitness class) for PA and sedentary behaviours. The relationships between moderate to vigorous physical activity (MVPA), sedentary behaviours and the group of socio-demographic as covariables, were analysed by means of univariate general linear models.

The differences in MVPA between both PA practice levels (high and intermediate) were determined through an independent sample student's T-

test. Regarding the differences between MVPA values and sedentary activity between weekdays and weekends, and the difference between the days they went to fitness classes and those they did not, a paired sample student's T-test was conducted. Finally, through Cochran's Q test, differences were sought between compliance with the 150-minute and 300-minute recommendations based on time reported by accelerometers. The analysis was performed by means of IBM SPSS statistical software, version 21.0, assuming differences with a value of $p< 0.05$ as significant.

RESULTS

The characteristics of the sample are shown in Table 1. Out of all the individuals, and in terms of level of the PA practice groups of the municipal sports association, 62.5% belonged to the high-level group and 37.5% to the intermediate level group. Regarding self-perceived health, 78.1% of the individuals of the sample considered their health to be good or very good.

TABLE 1
Sample characteristics.

Variables	Total
Age, mean (SD)	73.72 (6.53)
Gender, n (%)	
Male	5 (15.6)
Female	27 (84.4)
Level, n (%)	
High	20 (62.5)
Intermediate	12 (37.5)
Studies, n (%)	
Incomplete primary education	5 (16.1)
Complete primary education	17 (54.8)
First stage secondary education	6 (19.4)
Baccalaureate studies, occupational training	3 (9.7)
Weight, mean (SD)	61.80 (10.97)
Height, mean (SD)	1.55 (0.11)
BMI, mean (SD)	25.8 (3.89)
Self-perceived health, n (%)	
Very good	5 (15.6)
Good	20 (62.5)
Normal	6 (18.8)
Bad	0 (0)
Very bad	1 (3.1)

The differences in total MVPA, between weekdays and weekends, and between the days they went to fitness classes and those they did not, are shown in table 2. It is observed that the total mean, of high and intermediate levels, is greater during the week than at weekends, the difference of the total MVPA

mean only being statistically significant between weekdays and weekend (T (31) = 3.476, p=.002), proving to be more active during the weekday period. Both for high level and for intermediate level, the time means are higher for the days that they went to fitness classes, and the difference in total time between the days they went to fitness classes and the days they did not is only statistically significant (T (31) = 5.227, p <.01), in favour of the days they attended the classes.

TABLE 2
Mean and standard deviation of total sample and according to levels, of minutes of total moderate to vigorous physical activity (MVPA), of weekdays, weekends, of the days they go to fitness classes and of the days they do not go.

		Total	High level	Medium level
MVPA (minutes)	Total	62.56 (35.82)	67.96 (28.66)	53.56 (45.34)
	Weekdays	66.60 (35.11)[a]	73.65 (29.83)	54.85(41.18)
	Weekend	50.59 (42.47)	52.52 (31.09)	47.38 (58.27)
	Fitness days	74.20 (39.46)[b]	83.54 (33.75)	58.62 (44.70)
	Non-fitness days	54.20 (33.08)	58.75 (29.94)	46.62 (37.88)

[a] *Total MVPA differences between weekdays and weekend: (p= .002)*
[b] *Differences between days when they go to fitness classes and other days: (p< .01)*

With respect to the socio-demographic variables, the univariate linear model shows an inverse relationship between age and total amount of MVPA (B = -2.788), and is statistically significant (F (1.32) = 10.455, p = .003; η^2 = .258). No statistically significant differences were found regarding self-perceived health and MVPA, or between education level and MVPA.

Regarding compliance with the WHO recommendations on PA, with respect to carrying out at least 150 minutes of MVPA a week, it is seen that 84.4% of the total sample comply with that recommendation. After carrying out Cochran's Q, it was observed that the percentage of elderly people that carry out at least 300 minutes is less than the percentage of those that carry out at least 150 minutes a week (84.4% opposed to 59.4%). This difference is statistically significant (χ^2 = 8.0, p = .005).

Regarding sedentary activity, the total mean of minutes per week amounts to 441.96 ± 63.24 minutes, with no statistically significant differences between weekdays and weekends.

The type of sedentary activity carried out by the elderly can be seen in table 3. They spend most of their sedentary time watching television, mainly during the week (147.68 ± 83.83 minutes) rather than at weekends (106.09 ± 102.20 minutes), with a statistically significant difference (t(31) = 2.143, p = .040). This activity is followed by resting and relaxing (t (31) = -3.032, p = .005), time spent eating (t (31) = -2.066, p = .047), and being with friends (t

(31) = -3.124, p = .004). All these activities have statistically significant differences.

TABLE 3
Mean and standard deviation of self-reported minutes of sedentary activity according to activity.

Type of sedentary activity	Total	Weekday	Weekend
Watching TV	135.80 (74.47)	147.68 (83.83)[a]	106.09 (102.20)
Resting or relaxing	64.95 (110.31)	55.00 (108.62)	89.84 (126.93)[b]
Time seated whilst eating	63.43 (40.59)	60.93 (39.78)	69.68 (47.10)[a]
Being with friends	54.15 (48.83)	46.50 (48.64)	73.28 (64.11)[b]
Reading for pleasure	40.02 (32.46)	39.40 (39.38)	41.56 (45.51)
Doing manual work	34.82 (55.18)	39.00 (66.95)	24.37 (58.74)
Playing board games, cards, etc.	17.45 (33.55)	17.00 (35.33)	18.59 (35.42)
Listening to music	16.40 (45.59)	15.84 (44.67)	17.81 (48.70)
Using the computer or tablet	13.88 (24.40)	12.68 (23.76)	16.87 (41.69)
Studying	9.64 (21.06)	13.12 (29.95)[a]	0.93 (5.30)
Going to a religious centre	9.59 (12.29)	6.56 (11.91)	17.18 (17.91)[c]
Playing an instrument	3.75 (15.53)	4.50 (10.70)	1.87 (10.60)
Using transport	3.66 (12.66)	3.78 (13.05)	3.35 (13.31)
Activities with mobile	2.45 (7.27)	1.81 (6.68)	4.06 (15.88)

[a] *Differences in time between weekdays and weekends: (p< .05)*
[b] *Differences in time between weekdays and weekends: (p<.01)*
[c] *Differences in time between weekdays and weekends: (p<.001)*

When analysing sedentary activity with respect to the different socio-demographic variables, the univariate linear model shows a positive relationship between age and amount of sedentary activity (B = 4.371). This relationship is statistically significant (F (1.32) = 7.991, p = .008; η^2 = .210). In terms of self-perceived health and sedentary behaviour, no statistically significant differences were observed. No differences were observed either between education level and sedentary behaviour.

DISCUSSION

One of the objectives of this study was to find out the PA levels of a group of elderly people and study the percentage of compliance with the WHO's recommendations on daily PA practice. The results obtained show that 84.4% of the sample comply with the minimum PA recommendations of 150 minutes of MVPA per week. This percentage is higher than that found by other studies in the literature. One review, conducted by Sun, Norman & While (2013) on PA levels in the elderly, shows that only between 20 and 60% of the elderly comply with PA recommendations. When the studies with objective PA measurements by accelerometry were separated from the studies measured by questionnaires, lower percentages were found, with compliance ranging between 1.84% and 17.2%. Other studies show similar compliances to those described in the previous review (Ashe, Miller, Eng & Noreau, 2009; Hansen, Kolle, Dyrstad,

Holme & Anderssen, 2012). If we analyse compliance with 300 minutes a week in our study, the percentage of the elderly that respect the recommendations drops to 59.4% of the total sample. This percentage is still higher than that shown in literature (Sun, Norman & While; 2013). This is probably due to the regular practice of PA provided by public institutions, a hypothesis that can be reaffirmed by analysing the patterns of weekly physical activity of the elderly in our sample. Our study shows a larger amount of MVPA during the week (66.60 ± 35.11 minutes) than at weekends (50.59 ± 42.47 minutes). This difference is statistically significant ($p = .002$). Moreover, on analysing the distribution of MVPA carried out during the week, a greater amount of MVPA is observed on the days when the elderly go to fitness classes (74.20 ± 39.46 minutes) compared with the days when they do not go (54.20 ± 33.08 minutes). This difference is statistically significant. This difference helps show the relevance of regular practice of PA with the objective of reaching PA recommendations, and therefore supports the hypothesis put forward.

Regarding sedentary activity, the total mean time corresponded to 441.96 ± 62.24 minutes a day, less than that reported in other studies conducted with accelerometery, which reported mean daily sedentary activity times of more than 520 minutes a day (Berkemeyer et al., 2016; Gorman et al., 2014). This difference could be due to the type of population chosen in our study, (i.e.), a physically active population. It is likely that part of the time that other populations of elderly people spend on sedentary activities is, in this case, spent on light activity.

Regarding the sedentary activities reported by the elderly, most of the sedentary time corresponds to watching television. Few studies report the different sedentary activity types that the elderly carry out. The studies found coincide with the findings of our study (Leask, Harvey, Skelton & Chastin, 2015; Genusso, Thraen-Borowski, Gangnon & Colbert, 2015; Van Cauwenberg, Van Holle, De Boureaudhuij, Owen & Deforche, 2014). The other activities vary a great deal, including activities with cognitive implication such as reading or playing board games, in intermediate spaces. Recent studies on sedentary behaviour have shown that not only is the amount of time spent on these activities important, but also the type of sedentary activity carried out, as these activities may have different consequences on health (Sprod, Ferrar, Olds & Maher, 2015). One of these studies separates the types of sedentary activities into two groups: passive sedentary time (referring to activities such as watching television) and mentally active sedentary time (reading books or newspapers). Longer passive sedentary activity times were associated with higher overweight levels and with lower MVPA levels (Kikuchi et al., 2014). This is interesting when promoting health and carrying out interventions

whose objective focuses on modifying sedentary activity, as not only would it be important to achieve a decrease in time spent on these activities, but it would also be important to modify the type of activities they carry out during this time.

Regarding age and MVPA levels, our study found an inverse relationship between both variables. This result agrees with the result of other articles found (Koeneman, Verheijden, Chinapaw & Hopman-Rock, 2011; Takagi, Nishida & Fujista, 2015). In terms of sedentary activity, our study found a positive direct relationship between both variables. Findings in literature in this regard vary considerably. Van Cauwenberg, De Donder et al. (2014) found that the time spent watching television decreased from 65 years old onwards, whilst other authors (Godfrey, Lord, Mathers, Burn & Rochester, 2014; Shiroma, Freedon, Trost & Lee, 2013) reported that sedentary activity and age had a positive direct relationship. This difference between the findings of the different studies could be related to the way sedentary behaviour is measured. Literature indicates that self-reported sedentary behaviour tends to underestimate the number of weekly minutes spent on a sedentary activity when compared with the use of objective measurements such as accelerometery (Van Cauwenberg, Van Holle et al., 2014). This could explain the differences found between these studies. Further research is required to be able to solve this question.

If we analyse our results in terms of other socio-demographic variables, no significant differences were found regarding amount of MVPA, sedentary activity and education level, despite literature showing a positive relationship between education level and PA (Koeneman et al., 2011). The findings presented by Chastin et al. (2015), in their review on factors that determine sedentary behaviour, showed an inverse relationship between sedentary activity and education level. We believe that the fact that these differences are not shown in our study could be due to the small sample size.

Regarding self-perceived health, different studies find a positive relationship between high levels of PA and improved self-reported health (Arnardotir et al., 2013; Beyer, Wolff, Warner, Schüz & Wurm, 2015; Cimarras-Otal et al., 2014; Ogwumike, Adeniyi & Orogbemi, 2015). The study developed by Södergren, McNaughton, Salmon, Ball & Crawford, 2012) did not find statistically significant relationships between sedentary behaviour and self-perceived health, but this was not the case with PA, where this study showed that higher levels of PA were associated with better self-reported health. Our study did not report significant differences in this regard, probably due to the sample size. Evidence points to health perception being more related to the level of PA than to the level of sedentary behaviour, which makes sense insofar

as PA improves not only our physical health, but also our mental health, which could have a direct influence on the self-perception of our state of health. However, more specific studies are required to be able to determine if there is a relationship between perceived health and the level of sedentary behaviour.

Insofar as the limitations of the study are concerned, one of the main limitations is the small sample size caused by the loss of individuals during the data compilation process. This determined that the sample would be asymmetric in terms of the proportion of men and women, which prevented us from being able to analyse the differences of MVPA and sedentary activity according to gender, despite this being generally reported as a determining factor both in PA and sedentary activity (Chastin et al., 2015; Koeneman et al., 2011). Another limitation is the use of a questionnaire designed for adolescents.

The main strength of this study is measuring PA and sedentary behaviours of individuals through an objective measurement such as accelerometery. However, it is noteworthy that there is no consensus regarding the protocol of use of accelerometers in the elderly. A recent review conducted by Schrack et al. (2016) on the different devices that exist to measure PA in the elderly, and their use, places emphasis on the need to unify the protocols of use in future studies, with a view to being able to homogenise the results in studies on the older population.

Concluding, it can be highlighted that elderly people who participate in PA organised by public institutions seem to benefit from higher weekly levels of MVPA, showing a high percentage of compliance with the international recommendations on PA practice. This fact can significantly contribute to active ageing of this population group, deriving in improved health and well-being. To further our knowledge of the implications of correct active ageing, it would be interesting to undertake new research studies on the prevalence of different types of sedentary behaviours that do or do not involve cognitive work, and their implications both on physical health and on psychological and social health of the elderly.

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