ORIGINAL

NUTRITIONAL STATUS AND PHYSICAL FITNESS IN ACTIVE VS. SEDENTARY ELDERLY PEOPLE

ESTADO NUTRICIONAL Y CONDICIÓN FÍSICA EN PERSONAS MAYORES ACTIVAS VS. SEDENTARIAS

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ABSTRACT

The objective of the study was to know the relationship between nutritional status, adherence to the Mediterranean diet and the level of physical displacement of older people. 168 people older than 65 years participated (control group = 84 active people and experimental group = 84 sedentary people). Adherence to the Mediterranean diet was measured with the MEDIS-FFQ questionnaire, the level of physical activity practice through a question created for that purpose, and the different physical tests with the specific instruments. The results revealed that 63.1% showed low adherence to the Mediterranean diet and 34.5% high, according to the sedentary subject's greater adherence than the active ones (p≤0.05, 46.4% versus 22.6%). Active subjects have better physical income than sedentary people (p≤0.001).

Therefore, most elderly people want to increase their adherence to the Mediterranean diet and the practice of physical activity as a mechanism to reduce their health.

KEY WORDS: Mediterranean diet. Physical activity. Health. Elderly people.

RESUMEN

El objetivo del estudio fue conocer la relación entre el estado nutricional, la adherencia a la dieta mediterránea y el nivel de condición física de personas mayores. Participaron 168 personas mayores de 65 años (grupo control=84 personas activas y grupo experimental=84 personas sedentarias). La adherencia a la dieta mediterránea fue medida con el cuestionario MEDIS-FFQ, el nivel de práctica de actividad física mediante una pregunta creada a tal efecto, y las diferentes pruebas físicas con los instrumentos específicos. Los resultados revelaron que el 63.1% manifestó baja adherencia a la dieta mediterránea y el 34.5% alta, teniendo los sujetos sedentarios mayor adherencia que los activos ($p≤0.05$; 46.4% vs. 22.6%). Los sujetos activos tienen mejor condición física que los sedentarios ($p≤0.001$). Por tanto, la mayor parte de las personas mayores deben incrementar su adherencia a la dieta mediterránea y la práctica de actividad física como mecanismo de mejora de su salud.

PALABRAS CLAVE: Dieta mediterránea. Actividad física. Salud. Personas mayores.

1. INTRODUCTION

Nowadays, there is a progressive ageing of population, which implies a constant increase of the number of people in a situation of dependency over the following decades (García, Graciani, Guallar, López, Rodríguez and Rodríguez, 2015). Quality of life is defined as the state of subjective well-being associated with good health and happiness (Huiguita, Arias and Antonio, 2015), within all aspects of the person's environment (Espada and Calero, 2015) and as an objective to be achieved for this population group. Therefore, the practice of physical exercise in elderly people has undergone a boom in recent decades, through specific physical activity (PA) programmes for elderly people that help them stay healthy (Castañer, Süch, Prat, Camerino and Anguera, 2016). These programmes also improve their mobility and minimise the potential risk of falling or of having accidents (Sherrintong, Fairball, Kirkham, Clemson, Howard, Vogler and Sonnabend, 2016), which can contribute to the improvement of the living standards of the elderly (Lera-López, Garrues, Ollo-López, Sánchez, Cabasés and Sánchez, 2017).

Furthermore, the physical fitness, which determines the ability to face a PA in the most efficient way (Duran, Orbegoz, Uribe-Rodríguez and Uribe, 2008), is the key factor that needs to be developed. For this purpose, there are different proposals of PA programmes for the elderly that need to be specific for this group, where qualities such as resistance, balance, and functional training must

be worked on, with a frequency of 2-3 times a week and with a duration of approximately 60 minutes per session (Weening-Dijksterhuis, Greef, Scherder, Slaets and Van Der Schans, 2011). Other proposals include strength training using weights, due to the improvements detected, since this training is more effective than the aerobic one when trying to prevent the cognitive and motor decline (Bossers, Vand Der Woude, Boersma, Horobágyi, Scherder and Van Heuvelen, 2015) or when trying to improve the bone mineral density of the whole body (Hinton, Nigh and Thyfault, 2015).

The influence of the physical fitness on the quality of life can be enhanced when they combine the usual practice of PA and an adequate diet. Both together can contribute not only to delay aging (Scarmeas, Gu, Schupf, Lee, Luchsinger, Stern and Honing , 2014), increasing life expectancy (De La Montaña, Areal and Míguez, 2009), but also to help control excess weight, reducing potential mobility problems associated with a body mass index (BMI) prone to obesity (Hergenroeder, Brach, Otto, Sparto and Jakicic, 2011). To this end, other studies describe the Mediterranean diet (MD) as a healthy eating alternative that prevents diseases (Martínez, 2016), prioritising the consumption of foods rich in fibre (Martínez, Veiga, cobo and Carbajal, 2011) and plant products (Escaffi, Miranda, Alonso and Cuevas, 2016), such as vegetables, legumes, fruits, nuts and cereals as sources of antioxidants, to which moderate wine intake is added (Trichopoulou, Costacou, Vamia and Trichopoulos, 2003). While in turn, this diet reduces the consumption of meats or sugars (Standard, 2016). This eating suggestion ensures an optimal caloric and nutritional contribution, preventing problems such as cancer, which is usually translated into an increase in longevity and greater quality of life (Lagiou, Trichopoulos, Sandon, Lagiou, Mucci, Wollk et al., 2006). However, illnesses or low socioeconomic level can sometimes negatively modify the adherence to this diet (Viñuales, Viñuales, Puzo and Sanclemente, 2015).

The objective of this study is twofold: 1) To discover the nutritional status and level of physical fitness of Spanish elderly people and their relationship with healthy habits; 2) to analyse whether participation in PA programmes is related to greater adherence to the Mediterranean diet and better values in gait speed, strength and balance.

2. MATERIAL AND METHOD

2.1. Sample

This is a longitudinal observational and non-interventional study of the nutritional status and physical fitness in elderly people. The total sample was 168 people over 65 years old, of which 84 people are classified as active (EG: experimental group) since they are enrolled in PA and sports programmes that take place in urban day centres, for a period of 6 months and based on the session model established by Matos-Duarte, Martínez de Haro, Sanz-Arribas, Andrade and Chagas (2017). The other 84 people are completely sedentary since they do not engage in any physical-sports activity.

The period under analysis covers from September 2016 to April 2017, both inclusive, and within said time interval, the period of inclusion of the participants in the PA programme was carried out. Subsequently, in May 2017 the data collection of the different tests was performed. The sample was selected on a basis of a simple random sampling method, avoiding possible risks on the results. A preliminary filtering regarding the physical fitness was carried out (discarding those subjects in a situation with a moderate-high level of dependency) as well as one concerning educational-cultural level (discarding people who did not know how to read or write correctly) in order to ensure a sufficient level of autonomy for the development of the different tests. We worked with a confidence level of 95% and a margin of error of 3%. The sociodemographic characteristics of the sample determine that 76.8% are women and that all participants were over 65 years old (73.57 ± 5.85). Their marital status shows that most of them are married (53%), followed by widowers (26.8%), single (18.5%) and separated (1.8%). Finally, with regard to the level of practice of PA, 50% perform at least 150 minutes per week of PA and the rest remains sedentary without doing any physical activity-sports.

2.2. Instrument

Two questionnaires were used to analyse the adherence to the MD, the frequency of food consumption and the level of PA practice, using different instruments to analyse parameters related to physical fitness. Information regarding socio-demographic aspects such as gender, age, place of residence and marital status was also collected.

a) The questionnaire "Prevention with a Mediterranean diet (PREDIMED)" was used in order to assess the degree of adherence to the MD. It has 14 items and was previously validated in Spanish population (Papadaki and Scott, 2002). Participants had to complete it based on their eating habits throughout the previous year in order to later compare their food consumption with the guidelines set by the Fundación Dieta Mediterránea (Mediterranean Diet Foundation).

b) The food questionnaire validated for the elderly population living in Mediterranean countries MEDIS-FFQ (Zaragoza, Ferrer, Cabañero, Hurtado and Laguna, 2014) was used to study the frequency of food consumption. Participants had to complete it based on their eating habits throughout the previous year.

c) A questionnaire was used to assess the level of PA practice. Participants were asked about the frequency of PA practice. In this study, participants are divided into 2 groups: the first group called "sedentary" in which we include those subjects whose physical practice is less than 150 minutes per week. In the second group called "active", subjects who perform PA over 150 minutes per week are included. This division is made based on the recommendations stipulated by the WHO (World Health Organization, 2010) on PA, which indicates 150 minutes per week as the minimum recommended amount of time.

d) The height of participants was measured with the seca 214 portable height rod.

e) The body composition was analysed by means of two methods: the BMI (weight/height (meters)2, adjusted for age and corresponding gender. The other instrument used was the Tanita, specifically the body composition meter, model BC-418-MA (instrument that also provides the weight of the subjects, used for the BMI).

f) Two photocells of Microgate kit racetime2 light radio (Microgate, Bolzano, Italy) were used as measuring instruments to assess the gait speed (GS). Participants stood two meters before the starting line, at the signal of the researcher, they had to start walking at the fastest possible speed but without running and going through the photocells, which measured the time elapsed between the step from one to the other. The length of the stretch assessed was of 4 meters, distance extracted from the specific Physical Fitness Test Battery (BCF, for its Spanish initials) for adults (Avila, Gray and Payete, 2006). Each subject had to go through it 3 times resting between each attempt for 1 minute. At the end, the evaluators registered the best time of the 3 measured ones.

g) The balance measurements were obtained thanks to a One-leg balance test (Da Silva, Bilodeau, Parreira, Teixeira and Amirim, 2013) in which participants had to maintain balance and stay stable as long as possible on one leg while the other remained high, forming the articulation of the knee an angle of 90º. In order to do so, they had 3 attempts with a 5 minute break between each of them. Subsequently, the researcher selected the best records.

h) The strength of the lower limb was estimated by the chair test used in the Physical Fitness Test Battery (BCF, for its Spanish initials) (Avila, Gray and Payete, 2006). In this test participants started in a standing stance and they had to get up and sit completely in a chair 5 times in the shortest possible time. In order to do so, they had 3 attempts (selecting the best of them) separated by 3 minutes so that they could rest.

i) For the measurement of the hand grip strength, an Adjustable Hand Dynamometer called Grip Strength Dynamometer TKK.5101.Grip-D has been used. With a precision of 0.1 Kg., they had to get to exert as much grip strength as possible in the instrument. The subject needed to be standing, with the arms outstretched, and laterally separated from the trunk, performing each one of the 3 attempts available to participants and then the best record out of the three attempts would be selected for research.

2.3. Procedure

All tests were evaluated by the same researcher. Each participant had to carry out a familiarisation session with the tests in order to minimise errors that usually arise from the lack of awareness of the test. Participation was completely voluntary and anonymous. The subjects did not receive any financial compensation for their contribution and they all signed an informed consent approving their participation. The research was developed following the ethical guidelines of the Declaration of Helsinki in force, complying at all times with the highest standards of safety and professional ethics for these types of studies.

2.4. Data analysis

Descriptive data analysis was performed by frequency analysis, using the Chi-square test to analyse the ratio differences between the categorical variable of the groups (control-experimental) and the adherence to the MD. Analysis of Variance (ANOVA) was also performed to analyse the differences between the categorical variable and the continuous variables of the groups (gait speed, strength and one-leg balance). All data were treated anonymously using a code system, using for all results a confidence level of 95% ($p < .05$). The analyses were carried out with the statistical programme SPSS, v. 21.0 for WINDOWS (SPSS Inc., Chicago, U.S.).

3. RESULTS

Table 1 shows the data related to the compliance with the dietary recommendations based on the pattern established in the MD pyramid of the Fundación Dieta Mediterránea (Mediterranean Diet Foundation), followed in a recent study (Zaragoza, Ferrer, Cabañero, Hurtado and Laguna, 2014), related to CG and EG in elderly people of Salamanca. In general, there is a high follow-up of recommendations on food consumption, especially in pulses (96.4%), potatoes (90.5%), oil (89.9%), fish (83.9%) and cereals (72.6%). On the contrary, low levels of follow-up are found in processed meat (8.3%) and red meat (14.9). According to the group they belong to, there are significant differences ($p \leq 0.05$), with greater compliance of the EG than in the CG, in foods such as fruits (72.6 vs. 32.1), oil (97.6 vs. 82.1) or nuts (48.8 vs. 32.1). In contrast, CG obtained greater follow-up than the EG in vegetable consumption (89.3 vs. 67.9) or eggs (46.4 vs. 8.3).

Table 1. Compliance with the recommendations according to the MD pyramid of the Fundación de Dieta Mediterránea (Mediterranean Diet Foundation) and by virtue of the degree of adherence to the MD according to the PREDIMED questionnaire.

	Classification by level of practice of PA (CG and EG)			Sample
	GC n (%)	GE n (%)	p	Total n (%)
Frequency of food consumption (obtained from the MEDIS-FFQ questionnaire)				
Consumed twice a day				
Fruits	27 (32.1)	61 (72.6)	.000	88 (52.4)
Vegetables	75 (89.3)	57 (67.9)	.001	132 (78.6)
Oil	69 (82.1)	82 (97.6)	.001	151 (89.9)
Cereals	60 (71.4)	62 (73.8)	.863	122 (72.6)
Consumed every day				
Milk & dairy products	48 (57.1)	46 (54.5)	.877	94 (56.0)
Nuts	27 (32.1)	41 (48.8)	.041	68 (40.5)
Consumed weekly				
White meat (2 servings)	42 (50)	28 (33.3)	0.42	70 (41.7)
Fish (≥2 servings)	75 (89.3)	66 (78.6)	.092	141 (83.9)
Red meat (<2 servings)	3 (3.6)	22 (26.2)	.000	25 (14.9)
Processed meat (≤1 serving)	9 (10.7)	5 (6.0)	.403	14 (8.3)
Eggs (2-4 servings)	39 (46.4)	7 (8.3)	.000	46 (27.4)
Pulses	81 (96.4)	81 (96.4)	1.00	162 (96.4)
Potatoes (≤3 servings)	72 (85.7)	80 (95.2)	.063	152 (90.5)
Sweets	18 (21.4)	11 (13.1)	.220	29 (17.3)
Degree of adherence to the Mediterranean diet (obtained from PREDIMED)			.138	
Low (0-8)	45 (53.6)	65 (77.4)		110 (65.5)
High (≥9)	39 (46.4)	19 (22.6)		58 (34.5)

The overall assessment of the MD shows an average score of 6.79 ± 1.98, of which 63.1% reported having low adherence and 34.5% high. The average results determine that the elderly of the CG (7.32 ± 2.16) have more adherence to the MD than the EG (6.26 ± 1.62), showing significant differences ($F_{(2,167)}$ = 6.37, p≤0.01).

The nutritional status of the elderly has also been analysed. 51.8% are overweight and 27.4% are obese, with significant differences in mean values in gender (p = 0.043), with women having a higher BMI than men (28.45 vs. 26.96). Significant differences according to the group they belong to have been found (p= .001) since the elderly people of the EG have higher values of normal weight than the CG (32.1% vs. 9.5%), increasing the overweight and obesity especially in the CG. Regarding the percentage of body fat, significant differences were found (p> 0.05) by gender and type of group, having men and elderly people of the EG lower percentages of total body fat and in each one of the body segments analysed (Table 2).

Table 2. Assessment of Nutritional status.

		Comparison by gender			Comparison by practice group		
		Male	Female	p	CG	EG	p
BMI	Total (mean)	26.96 ±2.76	28.45 ±4.27	.043	28.56 ±3.60	27.64 ±4.37	.139
	Normal weight (%)	23.1	20.2		9.5	32.1	
	Overweight (%)	61.5	48.8	.115	60.7	42.9	.001
	Obesity (%)	15.4	31.0		29.9	25.0	
Body fat	Total FM (%)	27.88 ±5.65	37.43 ±6.33	.000	37.24 ±5.84	33.19 ±8.19	.000
	Trunk FM (%)	24.67 ±4.72	38.37 ±8.31	.000	36.88 ±7.63	33.50 ±10.96	.021
	Right Leg FM (%)	23.56 ±5.71	42.83 ±5.43	.000	41.73 ±6.90	34.98 ±11.12	.000
	Left Leg FM I (%)	30.84 ±6.30	33.47 ±7.07	.039	34.19 ±6.12	31.54 ±7.54	.014

FM: fat mass

After the descriptive analysis of the results, it can be observed how the subjects of the EG have a better level of physical fitness in the different tests analysed compared to the ones of the CG. Table 3 shows how the subjects of the EG have a gait speed higher than the ones of the CG (2.463s. vs. 10.749s.) (F $(1,166) = 147.291$, p = .000), better test scores of the chair test (8.327s. vs. 17.251s.) (F$(1,166) = 225.728$; p = .000), more hand grip strength (15.309 vs. 8.571) (F $(1,166) = 46.410$; p = .000), and better balance (30.057 vs. 2.516) (F $(1,166) = 75.464$, p = .000).

Table 3. Descriptive analysis and analysis of variance of the different examined variables.

Proof	Descriptive data				ANOVA				
	Group	Mean	SD	Stand. Error	Sum of squares	DF (D,N)	Root mean square	F	Sig
Gait speed (sec.)	GC	10.749	6.193	.675	2883.661	1, 166	2883.661	147.291	.000
	GE	2.463	.889	.097	3249.950		19.578		
Lower limb Strength (sec.)	GC	17.251	4.829	.526	3344.555	1, 166	3344.555	225.728	.000
	GE	8.327	2.511	.273	2459.577		14.817		
Hand grip strength (kgs.)	GC	8.571	6.336	.691	1906.881	1, 166	1906.881	46.410	.000
	GE	15.309	6.482	.707	6820.524		41.087		
Balance (sec.)	GC	2.516	2.576	.281	31857.170	1, 166	31857.170	75.464	.000
	GE	30.057	28.942	3.157	70076.881		422.150		

4. DISCUSSION

This research has as fundamental objectives to discover the nutritional status and to analyse whether the participation in PA programmes is related to a greater adherence to the Mediterranean diet and better values in gait speed, strength and balance. In general, more than a third of the sample has a high adherence to the MD (34.5), a very positive and common result among the eldery, since as Norte and Ortiz noted in 2011, the elderly population usually have a healthier diet. In this study, the sedentary group showed a greater adherence, as they did in another study where subjects with greater adherence to the MD presented low- to-medium levels of PA (Talegawkar et al., 2012).

When analysing food intake, the elderly of the EG consume fruit and nuts more frequently. This trend has been previously analysed, associating this consumption with a higher level of practice of PA (Conklin, Forouhi, Suhrcke, Surtees, Wareham and Monsivais, 2014, Mäkinen et al., 2012). In the case of nuts (Hernández and Goñi, 2015), 25% of the Spanish elderly consume them weekly. These data are similar to those of our CG (32%) that are significantly exceeded (p = .041) by those of the EG (49%). The foregoing is quite important owing to the correlation between the consumption of this food and the decreased risk of heart disease (Scwingshackl, Hoffmann, Misshach, Stelmach and Boeing, 2016).

If we examine other items of the questionnaire, in the EG, the consumption of less than 2 servings a week of red and processed meat (26.2% and 6% respectively) stands out. This factor determines a correct MD (Ortiz, Norte, Zaragoza, Fernández and Davo, 2012). It should also be borne in mind that encouraging the exercise practice can act as an incentive in an increase of micronutrients (Martínez, 2016). Proof thereof is the fact that it can be observed a high intake of fruits (72.6%) and vegetables (67.9%) in the EG, and therefore, according to some authors (Martínez, 2016) the needs of micronutrients such as vitamins A, C and D, among others, are met. These data become more relevant when compared with those obtained in another previous study (Martí, Cascales, Martínez, Sánchez and Pérez, 2015), where even though the same questionnaire was used in active elderly people, a low intake of fruits (15%) and vegetables (55%) was observed in comparison with the one obtained in the current study. However, a much higher intake of red and processed meats, which was regularly ingested by around 50% of their sample, was indeed observed.

One of the objectives of this study has been to assess the physical fitness of the participants. Gait speed is established as a remarkably useful variable when predicting the risk of death (Hardy, Perera, Roumani, Chandler and Studenski, 2007). In this study, significant differences were obtained (p = .000) between both groups in terms of gait speed, having those of the EG a better speed. These data agree with the ones of other researchers who also affirm that in elderly people the gait speed increases to a great extent with the practice of PA (Barbat, Varvalho, Rolland, Vellas and Aubertin, 2016). Not in vain is it affirmed (Dodson et al., 2015) that there is more possibility of suffering accidents if there are poor gait speed levels (-0.8m / s).

The strength of the lower limb in the current investigation showed significant differences (p = .000) between both groups, having the EG the best values. This trend was similar to that one found by other researchers who observed significant differences (p = .002), presenting the active elderly better scores (Possamai, Zogo, Boni, Jacques, Dorst and Dorst, 2015).

On the other hand, the hand grip force found with the dynamometer shows significant differences (p = .000), with favourable results for the EG in comparisonwith the CG. However, the mean of the EG (15.3) is below the one deemed appropriate by Sallinen et al. (2010) who discussed that under 21 kg., the risk of suffering from a mobility problem increases.

The one-leg balance reveals significant differences (p = .000), having the EG the best average values (30,057) compared to the CG (2,516) and obtaining a score similar to the one in another study that dealt with active elderly people (Da Silva, Bilodeau, Parreira, Teixeira and Amorin, 2013). It has also been proven (Nicholson, Mckean and Burkey, 2015) that the one-leg balance of participants over 55 who carried out a programme based on resistance work improved by 24% while in the inactive group within the same period of time a decline of -7% was observed (p = .006).

5. CONCLUSIONS

This study was not free of limitations. For instance, one of them could be the possibility that the elderly people might misconstrue some of the items or tests, with or without intention. Nevertheless, this risk has been reduced, probably, because in the whole process the anonymity of the answers issued was guaranteed (in the case of the questionnaire), and also because all tests were exemplified and had the permanent supervision of the responsible researcher. With regard to future lines of research related to the subject, it could be interesting to include a quantitative assessment of dietary habits, in order to compensate for possible weaknesses of the questionnaire since it lacks this information. In the same way, it could be interesting to apply a test battery at different times, thus projecting a longitudinal study of greater duration.

In conclusion, more than a third of the elderly have optimal levels of adherence to the MD, being the active subjects (EG) the ones who most follow the MD in the average levels of adherence. In addition, the active elderly participants (EG) have a better physical fitness level than the sedentary subjects (CG).

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