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Nutrition and active ageing in a Spanish sample

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ABSTRACT

The aim of this study is to investigate the relationship between active ageing and nutritional status assessed by Mini Nutritional Assessment MNA, anthropometric variables and food habits, in a sample of young elderly Spanish adults. This is a cross-sectional study based on 456 home-living Spaniards, 169 men and 287 women, mean age 66.4 years (std=5.3). Trained interviewers in peoples' homes and in cultural and leisure centres performed individual measurements and interviews for older adults. Variables considered were, age, sex, anthropometric measurements, body composition, health indicators (diagnosed diseases and self-perceived health), Mini Mental State Examination (MMSE), Active Ageing (a dichotomous variable (yes/no) was created based on a questionnaire dealing with the major domains of active ageing: disability/physical functioning, subjective health, satisfaction with life and social activity performed and cognitive functioning) and MNA. Multivariate binary logistic regression was used to examine the association between Active Ageing and MNA.

There were no observed malnourished individuals and the prevalence of "malnutrition risk" was 15.7% in men and 25.1% in women. After calculating the "Active ageing" prevalence through multidimensional criteria, the probability of "Active Ageing" was higher in those individuals showing higher MNA values, when controlling for sex, education and age effects. In conclusion current and past nutrition, have an important impact on ageing. Adult height is useful to assess the poor alimentary conditions during childhood, body composition variables (Body Mass Index - BMI, waist circumference, and percentage of fat) are useful to understand the impact that the change in eating habits due to economic changes, has had on the health of older people in developed societies. Sex and education are important factors to take into account when older adults' nutritional status and health are investigated.

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RESUMEN

El principal objetivo de este estudio es analizar la relación entre el *Envejecimiento Activo* y el estado nutricional, valorado a partir del Mini Nutritional Assessment (MNA), de variables antropométricas y de hábitos alimentarios, en una muestra española. Se trata de un estudio transversal realizado con 456 personas, residentes en sus hogares, 169 hombres y 287 mujeres, cuya edad media fue de 66.4

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años (std = 5.3). Los individuos fueron medidos y entrevistados por antropometristas entrenados e investigadores, en sus propias casas o en centros culturales y de ocio para personas mayores. Se consideraron las siguientes variables, edad, sexo, medidas antropométricas, composición corporal, indicadores de salud (enfermedades diagnosticadas y salud autopercibida), Mini Mental State Examination (MMSE), *Envejecimiento Activo*, Mini Nutritional Assessment (MNA). Se realizó una regresión logística para examinar la asociación entre *Envejecimiento Activo*, MNA y otros indicadores del estado nutricional.

Ningún individuo presentó malnutrición, la prevalencia de riesgo de malnutrición fue del 15.7% en los hombres y del 25.1% en las mujeres. Una vez creada la variable *Envejecimiento Activo* a partir de criterios multidimensionales, la probabilidad de presentar *Envejecimiento Activo* fue más alta en aquellos sujetos que obtuvieron mayores valores para MNA, controlando el efecto del género, el nivel de educación y la edad. El estado nutricional presente y pasado tiene un importante impacto sobre el envejecimiento. La estatura adulta es útil para valorar condiciones de alimentación difíciles durante la infancia, las variables de composición corporal (BMI, circunferencia de cintura, porcentaje de masa grasa) son útiles para entender el impacto que el cambio en los hábitos alimentarios debido a cambios económicos ha tenido en la salud de las personas mayores de las sociedades económicamente más desarrolladas. El género y el nivel de estudios son factores importantes a tener en cuenta cuándo se investiga sobre el estado nutricional y de salud de las personas mayores.

Introduction

We are living in an ageing society; both population and individual ageing are a priority for research. The ageing process is life-long due to multidimensional determinants and it is characterized by a decline in the functionality and efficiency of biological tissues and organs. Consequently, loss of adaptation to environmental demands increases (Bernis 2007).

The ways of ageing are dependent on bio-psycho-social factors that occur across the life span (Adams & Whithe 2004). One of the most important characteristics of ageing is inter-individual variability; in other words, people age in different ways due to a very broad diversity of both personal (i.e. physical, psychological) and environmental (cultural, economic, educational,.) conditions and their interactions across the life span (Row & Khan, 1987) in usual and successful ageing. It is also necessary to emphasize the role of sex differences, which are expressed in all types of ageing characteristics (Lavery & Lee 2009; Montero et al. 2011).

The concept of active ageing is a relatively new concept used interchangeably with other terms such as successful, productive, optimal, or positive ageing, and it can be considered as a keyword opening a new paradigm in the study of ageing. Active ageing was proposed and used for the first time by the World Health Organization (WHO) in 2002 (WHO 2002). In the seminal booklet 'Active Ageing. A Policy framework' the UN Assembly (United Nations 2002) presented the International Plan of Action of Ageing-MIPAA. 'Active ageing' can be defined as the life long adaptation process for arriving at optimal health, high physical and cognitive functioning, positive mood and control, and high social participation (Rowe & Khan 1987; Fernández-Ballesteros 2008; Fernández-Ballesteros et al. 2011). 'Active ageing' is also a general policy as one of the most important avenues for overcoming problematic issues linked with population ageing. The United Nations Research Agenda on Ageing for the 21st Century stated the need for research into the determinants of this type of positive ageing as a priority (Andrews et al. 2006), and the year of 2012 has been declared by the European Commission as the European Year for Active Ageing.

Recently, evidence of delayed human senescence recorded in the last 150 years has been strongly linked with the increase in "Best practices" (Christensen et al. 2009; Vaupel 2010). Best practices refers to individual behaviour associated with health and ageing well, such as healthy eating and drinking, physical exercise, preventive health checks, cognitive fitness, positive affect, stress management and social involvement.

Therefore, among the determinants of active ageing, behavioural life style is one of the most important factors or "best practices". Diets high in saturated

fats and salt, low in fruit and vegetables and providing insufficient amounts of fibre and vitamins combined with sedentarism, are major risk factors for chronic conditions like diabetes, cardiovascular disease, high blood pressure, obesity, arthritis and some cancers (United Nations 2002).

Nutritional status is dependent not only on the individual cross-sectional life styles but across the entire life course (Owe et al. 2005). Nutritional conditions and energetic balance during the individual life span are expressed in anthropometric and body composition variables such as height, Body Mass Index (BMI), body fat composition (% fat mass), and fat distribution in old age. The Mini Nutritional Assessment (MNA) includes these variables. Several studies show that the MNA has better sensitivity and validity in evaluating nutritional status in older adults than other single indicators as BMI, waist circumference, arm circumference, energy intake or serum albumin (Montero et al. 2011; Lee & Tsai 2011; Vellas et al. 2006).

The aim of this study is to investigate the relationship between active ageing and nutritional status, as determined by anthropometry, food habits and MNA in a sample of older Spanish adults and to analyse the differences between men and women.

Methods

Sample

The sample is constituted by 456 home-living Spanish individuals, 169 men and 287 women, mean age 66.4 (std=5.3), the range of ages is 55-75 years both for men and women. For more details about the sample see Fernández-Ballesteros et al. (2011).

Design

Data were collected in 2006 in Madrid and Toledo (Spain) as part of the ELEA (Active Ageing Longitudinal Study). The only criterion for inclusion was the preservation of BADL (Basic Activity Daily Life). This study was conducted according to the guidelines laid down in the Declaration of Helsinki. It was approved by the Ethics Committee of University Autónoma de Madrid. Participants signed an informed consent after the confidentiality of data was ensured.

Individual interviews and measurements were performed in peoples' homes or in cultural and leisure centres. The Protocol administered was the ESAP (European Survey on Aging Protocol) which was used in the EXCEÑSA Project (Fernández-Ballesteros et al., 2004) assessing: anthropometry, walking speed, strength, pulmonary function, self-reported health, subjective physical capacity, life styles, physical and social activities, social relationships, cognitive abilities, personality, and sociodemographics, it included 450 bio-psycho-social variables. For this study only the following variables have been included:

Personal information: Age (years) and sex.

Anthropometric measurements: Height (cm), weight (kg), waist circumference (cm), arm circumference (cm), calf circumference (cm).

Body composition and indicators of nutritional status: Fat mass percentage (% FM) was measured by bipolar electrical bioimpedance. The Quetelet index (BMI) was calculated (Weight (kg)/Height (m^2)) and the participants were classified according to the following values (WHO, 2006): Underweight, BMI<18.50; normal weight, 18.50–24.99; overweight, 25.00–29.99; obesity type I, 30.00–34.99; obesity type II, 35.00–39.99; and morbid obesity, 40.00–44.99.

Health indicators: The number of diagnosed diseases was recorded, considering both physical disabilities and/or chronic conditions. Self-perceived health information was also collected and classified as: Very poor health, poor, good or very good.

Active ageing: A dichotomous variable (Yes/No) called active ageing was created based on a questionnaire, tested elsewhere (Fernández-Ballesteros et al., 2004), dealing with the major domains of active ageing: disability/physical functioning, subjective health, satisfaction with life and social activity performed and cognitive functioning. Cognitive functioning was

evaluated by the Mini Mental State Examination (Folstein et al. 1975). Information on the above variables was obtained through interviews carried out by trained interviewers.

Participants who, did not need any kind of help to manage in everyday life, rated their health as good or very good, were satisfied with their lives, carried out more productive activities (hours/day) (such as care for children or older or sick people, housework, etc.) than the sample average and had obtained a score ≥ 29 in the Mini Mental State Examination (MMSE), were characterized as individuals with active ageing.

Mini Nutritional Assessment (MNA) (Vellas et al. 1999): This was calculated using the 6 questions in this screening (decline of appetite, weight loss during the last 3 months, mobility, suffer psychological stress or acute disease, neuropsychological problems and body mass index) and the 12 assessment questions (type of living accommodation, use of medication, pressure sores or skin ulcers, full meals/day, consumption of dairy products/day, legumes and eggs/week, meat, fish or poultry/day, fruit and vegetables/day; fluid/day, ability to eat without help, self view of nutritional status, self perceived health, mid-arm circumference, calf circumference). The maximum MNA score is 30 points, <17 point indicating malnutrition, 17-23.5 points indicating risk of malnutrition, and ≥ 24 points indicating adequate nutritional status.

Statistical analysis

All descriptive statistical analyses were performed for the total sample and stratified by sex. T-student test and Chi-squared were used to analyse differences in the distribution of personal characteristics between men and women and between type of ageing and nutritional status. Differences in anthropometric and body composition between men and women were analysed by Mann-Whitney U test. Subsequently a logistic regression model was performed in which 'active ageing' was considered the dependent variable. The variables included in logistic regression analyses were chosen in order to see the combined Nutritional Status (MNA), education and gender effect on the presence of Active Ageing. MNA and Active Aging have two common variables: type of living accommodation and selfperceived health. In order to avoid the effect of those variables common to Active Ageing and Nutritional State, (item G 'lives independently nor in nursing home or hospital' and item P 'In comparison with other people of the same age, how does the patient consider his / her health status?'), a new variable referring to MNA (called 'MNAactageing) was developed without the common criteria. Statistical analyses were performed with SPSS 19.0.

Results

Table 1 shows the prevalence of 'Active Ageing'. For the total sample, around 28.1% of individuals were classified under 'Active Ageing' but significant differences could be observed between men and women, women presenting a lower proportion.

Table 1: Characteristics of the sample concerning active ageing by gender

	Active Ageing				
	Yes		No		
	N	%	N	%	χ^2
Men	65	38.50	104	61.50	
Women	63	22.00	224	78.00	p = 0.000
Total	128	28.10	328	71.90	
	N	Mean (std)	N	Mean (std)	t-student
Age	128	65.06 (5.28)	328	66.95 (5.24)	p = 0.001

Table 2 describes the nutritional status assessed by MNA. Although the prevalence of malnutrition was 0%, 21.8% of the total sample was at risk of malnutrition. Gender differences could be also observed: Women showed a higher prevalence of malnutrition risk than men; this difference could be attributed more to health (number of reported illnesses (t = -4.14; p = 0.000), perceived health (χ^2 = 13.96; p = 0.003) and to anthropometric conditions (BMI) than to diet. For more details see Montero et al. 2011.

In general, this sample had a healthy nutritional Mediterranean diet, 96% used only olive oil for cooking (2.5% both olive oil and sunflower oil and 1.5%

only sunflower oil); 68% ate fruit and 75% ate vegetables every day; 90% took milk products every day. But sex-related differences were observed, women took significantly more fruit ($\chi^2 = 13.23$; df = 5; p = 0.039), vegetables ($\chi^2 = 14.98$; df = 4; p = 0.005), yogurt ($\chi^2 = 24.87$; df = 4; p = 0.000) and milk ($\chi^2 = 12.07$; df = 4; p = 0.017) than men; thus, in spite of the higher prevalence of malnutrition risk in women, they had healthier alimentary habits than men.

Table 2: Characteristics of the sample concerning nutritional status assessed by MNA by gender

Mini Nutritional Assessment (MNA®)					
	Malnutrition Risk (17 - 23.5)		Normal - Not at risk (≥ 24)		
	N	%	N	%	χ^2
Men	22	15.70	118	84.30	
Women	65	25.10	194	74.90	p = 0.030
Total	87	21.80	312	78.20	
	N	Mean (std)	N	Mean (std)	t-student
Age	87	67.4 (4.97)	312	66.24 (5.3)	p = 0.070

Table 3 shows the anthropometric description of the sample. It can be observed that height is generally fairly low, and taking into account the BMI and fat percentage, there was a high proportion of overweight and obesity, especially among women. Moreover, fat distribution localization pointed to cardiovascular and metabolic risks (5).

Table 3: Anthropometric characteristics by gender

	Men			Women			
	N	Mean	STD	N	Mean	STD	U Man-Whitney
Weight (kg)	156	79.60	11.37	282	69.90	11.40	p = 0.000
Height (cm)	164	167.52	6.88	285	154.45	6.50	p = 0.000
Waist circumference (cm)	168	99.88	13.33	287	90.68	11.20	p = 0.000
Arm circumference (cm)	169	28.64	3.39	287	28.24	4.24	p = 0.168
Calf circumference (cm)	168	34.31	4.54	285	34.72	2.19	p = 0.147
BMI (kg/m^2)	155	28.30	3.51	282	29.35	4.74	p = 0.061
% Fat Mass	148	27.46	9.51	278	37.61	7.15	p = 0.001

Concerning nutritional status, mean total MNA score was 25.8 (std = 1.84) for men and 25.06 (std = 1.90) for women (t = 3.87; p = 0.000). Mean scores of MNAactageing were 23.33 (std = 1.57) and 22.66 (std = 1.73) for men and women (t = 3.86; p = 0.000).

Table 4 shows results yielded by all components of our classification variables, Active Ageing and Nutritional Status, in which individuals with better nutritional status showed a higher proportion of Active Ageing.

In order to know the effect of MNA on Active Ageing controlling age, sex and common variables, a multivariate binary logistic regression analysis was performed. Active Ageing was taken as dependent variable and MNAactageing, gender, age (years) and education (years of formal education) were taken as independent variables.

Results shown in Table 5 indicate that the probability of being classified under Active Ageing was significantly higher in those individuals with higher values in MNAactageing (OR = 3.155), and with more years of formal education (OR = 1.054). That probability was lower in women than in men (OR = 0.416) and decreased with age (OR = 0.953).

Discussion

Spain is one of the countries in Europe with highest life expectancy (EUROSTAT, 2011). The participants in our study were born between 1935 and 1955, a very difficult period for the Spanish population

Table 4: Relationship of nutritional status with age and different components of active ageing

Mini Nutritional Assessment (MNA®)						
		Malnutrition Risk (17 - 23.5)		Normal- Not at risk (≥ 24)		
		N	%	N	%	χ^2
Active aging	Yes	10	9.30	98	90.70	p = 0.000
	No	77	26.50	214	73.50	
Need any help for daily life activities	Yes	5	100.00	0	00.00	p = 0.000
	No	81	20.60	312	79.40	
Self perceived health	Bad	13	61.90	8	38.10	p = 0.000
	Regular	48	31.00	107	69.00	
	Good	20	12.10	145	87.90	
	Very good	6	10.30	52	89.7	
Satisfied with their lives	Not at all	8	34.80	15	65.20	p = 0.003
	Partly	19	34.50	36	65.50	
	A lot	52	21.40	191	78.60	
	To a great extent	8	10.30	70	89.70	
Carried out more productive activity age and gender matched group	Yes	35	24.30	109	75.70	p = 0.363
	No	52	20.4	203	79.6	
MMSE	< = 29	30	17.80	21	14.8	p = 0.292
	< 29	139	82.2	121	85.2	

Table 5: Predictive models of active ageing by MNA controlling for gender, age and education effect

Covariables	B	E.T	p-value	OR	95% CI
MNAactageing	1.149	0.384	0.003	3.15	(1.48 - 6.69)
Gender	-0.877	0.254	0.001	0.416	(0.25 - 0.68)
Age	-0.048	0.024	0.046	0.953	(0.91 - 0.99)
Years of formal education	0.052	0.022	0.016	1.054	(1.01 - 1.09)
Constant	-0.175	2.073	0.933	0.839	

Dependent variable: Active ageing (yes/no)
$\chi^2 = 42.25$; df = 4; p = 0.000
2 log likelihood = 384.37

with serious implications in the growth and development process of children and in their final adult height. Evidence of the relationship between height and economic development has been found in Spain (María-Dolores & Martínez-Carrión, 2011). During adulthood, historical changes in their life-styles affected their energy balance and contributed to increasing overweight and obesity prevalence and, subsequently (Vellas et al. 1999) the prevalence of cardiovascular and metabolic diseases (Grau et al. 2007; Schroder et al. 2007).

Our results on malnutrition risk are very close or even lower than those of other studies in Europe and beyond. The prevalence of well-nourished individuals is higher than the mean value reported by Guigoz (2006) in his review of 23 studies on the nutritional state of older adults in the world, and it is very close to those reported by Southern Mediterranean Countries in Europe. It is likely that a very healthy Mediterranean diet pattern (high intake of fruits and vegetables, almost exclusive use of olive oil for cooking) has contributed to counteracting the effect of positive energetic balance shown through a higher prevalence of overweight, obesity and visceral fat (Schroder et al. 2011). Moreover, our results pointed out important sex differences in malnutrition risk, 15.7% and 25.1% re-

spectively for men and women. The importance of taking into account gender when older adults' nutritional status and health is investigated must be emphasized (Crimmins et al. 2010; De Angelis et al. 2011).

Our key result regards the high level of association between Nutritional Status and Active Ageing (after controlling for age and gender). As emphasized in the Introduction, healthy eating is one of the behavioural life-styles considered by the WHO as determinants of active ageing (United Nations 2002; Fernández-Ballesteros 2008). Thus, the effect of nutritional status on active ageing is one of the most important conclusions. But, as has been stated, ageing is a lifelong process and therefore, cross-sectional older adults' nutrition could be important but must be taken into consideration together with the lifelong nutrition history of individual.

Nutrition has a major impact on aging, but other factors besides current eating patterns, such as the nutritional status of these individuals during childhood, adolescence and youth and changes in their living conditions in adulthood may also influence the aging process. Height is likely to express the poor alimentary conditions during childhood and BMI and waist circumference and percentage of fat reflect the impact on body composition of social changes during adulthood in a developed society. Gender is also an important factor to take into account when older adults' nutritional status and health is investigated.

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