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VALIDATION OF QUESTIONNAIRES TO ESTIMATE ADHERENCE TO THE MEDITERRANEAN DIET AND LIFE HABITS IN OLDER INDIVIDUALS IN SOUTHERN SPAIN

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Abstract: *Objective:* The aim of the present study was to determine the nutritional behaviour of an elderly urban population in Southern Spain, estimating their degree of adherence to the Mediterranean. *Diet Design:* A population-based cross-sectional nutritional survey, recruiting a representative sample of elderly inhabitants. The study sample comprised 260 people. The mean age was 73.60 yrs for the men and 72.25 yrs for the women. Around 70% lived with their family. *Results:* The questionnaires used were first validated by using the Bland-Altman plot and the Wilcoxon test for paired samples. The degree of adherence to the Mediterranean Diet was around 50%, similar to findings in other Mediterranean populations. We highlight the mean consumption of milk and milk products (300-317 g/day) and of fruit/vegetables (250 g/day), which are slightly below recommendations. Our study subjects were all autonomous in their movements and were physically independent: 80% reported that they performed some type of physical activity. *Conclusion:* In this study, both adherence to the Mediterranean Diet and physical activity were considered as components of a healthy life. In summary, a majority of this elderly population was slightly overweight, considered themselves to be in good health.

Key words: : Elderly people, mediterranean dietary pattern.

Introduction

Individuals experience biological and life style changes as they grow older. Anthropometric and body composition modifications have implications for nutritional status, functional capacity and risk factors for the development of chronic-degenerative diseases. Various studies have reported that body weight increases between the age of 20 and 50 yrs and progressively declines after the age of 70 yrs (1-3). Many age-related changes that influence energy requirements occur continually throughout the adult life cycle. The decline is not linear, and a breakpoint has been proposed at around 40 yrs of age in men and 50 yrs in women (4-6). Even after adjusting for changes in fat-free mass, it has been suggested that basal metabolic rate (BMR) is 5 percent lower in the elderly compared with young adults (7).

Elderly people are often affected by malnutrition due to an inadequate intake of nutrients, especially micronutrients, and as the result of chronic diseases with a negative impact on nutritional status. This situation can be exacerbated by difficulties in chewing, swallowing and digesting food. Diet and health are closely related in all individuals but especially in the elderly. An adequate diet can delay the onset of degenerative diseases, improving the quality of life and increasing life expectancy (8).

The practice of regular physical activity is also important to maintain appropriate body weight, cardiovascular and respiratory health and fitness and to reduce the risk of chronic non-communicable diseases associated with diet and lifestyle (9-14). There is consensus that at least 30 min of moderate to vigorous activity should be performed three or more days per week to promote general health. Increasing age is associated with declining physical activity and with changes in various physiological parameters. The decline in total energy expenditure with age is mainly a reflection of a decline in physical activity. Exercise training has the potential to develop and maintain strength, flexibility and cardiovascular fitness and may delay age-associated changes in body composition, i.e., the loss of fat-free mass and gain in fat mass or body fat. However, data are not yet available from long-term exercise intervention studies based on accurate measures of activity-induced energy expenditure. Any discussion of the potential benefit of exercise is still based on cross-sectional data, although total energy expenditure (TEE) and BMR are now assessed using the double-labelled water technique (15).

It is generally accepted that moderate exercise can significantly reduce blood pressure levels in patients with mild to moderate essential hypertension (16-18) and can be related to food intake (19). Regular physical activity has frequently been associated with a reduced risk of coronary heart disease, even in middle-aged men (20, 21). In the above studies, physical activity is defined as any type of non-occupational physical exercise performed at least once weekly over the past year, and is classified as light (4 kcal/min), moderate (4–7 kcal/min) or vigorous (7 kcal/min) (22, 23).

There is extensive scientific evidence on the relation between diet and the incidence of coronary and other diseases (21, 24-27). Dietary factors exert their influence largely through their effects on blood lipids and lipoproteins and on other established modifiable risk factors, with the exception of

cigarette smoking. A study by Pitsavos et al. (17) supported the hypothesis that the adoption of a Mediterranean diet by hypertensive subjects is associated with a significant reduction in the risk of acute coronary syndrome.

Changes have been detected in the eating habits of populations in Southern Europe, and it has been suggested that younger individuals are following less closely the traditional Mediterranean diet as a wider range of different foods have become available (28). With this background, the aim of the present study was to determine the nutritional behaviour of an elderly urban population in Southern Spain, estimating their degree of adherence to the Mediterranean Diet.

Subjects and Methods

A population-based cross-sectional nutritional survey was conducted between February 2008 and May 2009, recruiting a representative sample of elderly inhabitants of the city of Granada (Southern Spain) from day centres in each of the eight administrative districts of the city. The study sample comprised 260 people (28% males and 72% females) aged 60-85 yrs old, who gave their informed written consent to participate in the study, which was approved by the ethics committee of the University of Granada (Spain).

Sessions were held in day centres for administration of the survey (see below) and measurement of the height and weight of subjects, using a model 214 Seca portable stadiometer and model 872 Seca digital floor scale (Seca Medical Scales and Measuring Systems, Birmingham, UK), respectively. The body mass index (BMI) was calculated as the weight (kg) divided by square of the height (m), and subjects were classified as normal weight (BMI ≤ 25 kg/m^2) or overweight (BMI >25 kg/m^2) (4).

Questionnaires

The survey comprised four sections: socio-demographic; food frequency questionnaire (FFQ); nutrition-related life habits, including both qualitative and quantitative variables; and a 24-h diet recall (three times). Questionnaires were administered at the day-centre by a trained dietician between Tuesday and Friday. Days after the weekend or after a public holiday were avoided to ensure that all 24 h-recalls reported on a normal weekday.

The socio-demographic questionnaire gathered data on sex, age, educational level and physical activity. The duration of physical exercise was taken into account. Any work-related exercise was recorded but not considered in the analysis because of evaluation and standardisation difficulties. The FFQ covered breakfast, mid-morning snack, lunch, afternoon snack and evening meal, gathering data on the consumption or not of an item, the number of times it was consumed per week, and the amount consumed each time in household measures (plates, glasses, spoons, etc.). The 24-h diet recall was an open-format questionnaire that gathered information on the diet followed before the day of the interview; data were gathered on the time of the intake, the amount of food consumed in household measures, its preparation and the day of the week.

The NOVARTIS-DIETSOURCE v.1.2 programme was used to convert foods into nutrients (29).

Statistical analysis

Means were compared using the Student's t-test or chi-square test. Bland-Altman plot and Wilcoxon test. SPSS-15 (SPSS Inc. Chicago, IL, USA) was used for the statistical analysis. $P<0.05$ was considered significant in all tests.

Questionnaire validation

The questionnaires used were first validated by using the Bland-Altman plot and the Wilcoxon test for paired samples (30-32).

Mediterranean dietary pattern (MDP)

The MDP was defined according to a previously described score (MDS) indicating the degree of adherence to the traditional Mediterranean diet (3), which was converted to relative percentage of adherence as described elsewhere (33). Briefly, an energy-adjusted value was obtained for each individual for the daily consumption of pulses, cereals, fruit and nuts, vegetables, fish, meat (and meat products), milk (and milk products), and alcohol. The ratio of monounsaturated to saturated fatty acids (MUFA/SFA) was calculated. All values were standardized as z values (observed intake reference population mean intake/standard deviation of the reference population). The total MDS was computed by adding together all z scores obtained for the favourable or 'more Mediterranean' dietary components (legumes, cereals, fruit, vegetables, fish, moderate alcohol, MUFA/SFA ratio) and subtracting the z value obtained for the consumption of meat and milk.

Results

Table 1 shows the characteristics of the study population. Table 2 lists the macronutrient and energy values obtained. Figure 1 depicts the comparison of the results obtained with the FFQ and 24-h recall, which were validated by applying the Bland-Altman plot and Wilcoxon test.

After validation, the data obtained with the FFQ were used to estimate the adherence of this elderly population to the Mediterranean Diet. Table 3 shows the mean consumption of the food groups considered in the Mediterranean Diet. The degree of adherence to the Mediterranean Diet was calculated to be around 50% in this population. The influence of social and physical activity factors on the MDS are shown in Table 4. WHO/FAO (4) equations for individuals over 60 yrs old were used to calculate physical activity level (PAL: BMR/total energy). Subjects with an MD adherence <50% were estimated to have a mean (SD) PAL of 1.416 (0.425) and those with an adherence of ≥50% a PAL of 1.691 (0.379) (Student's t test: $F=-5.197$, $p=0.001$).

Table 1

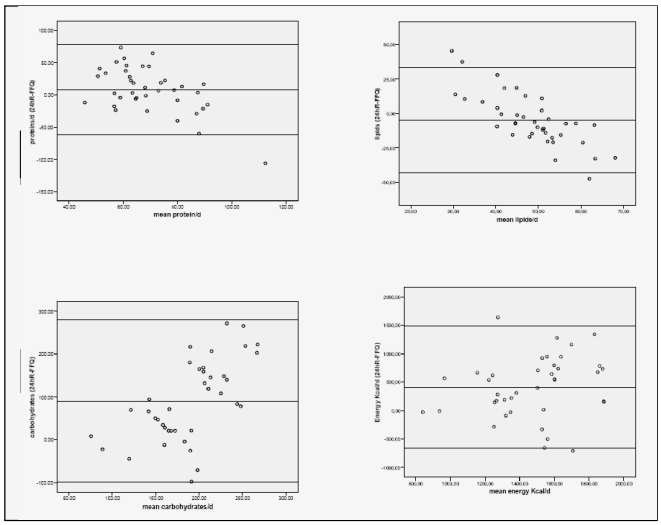
Characteristics of the study population expressed en %

Characteristics	Male (28%)		Female (72%)	
	mean	SD	mean	SD
Age (years)	73.59	7.34	70.25	7.01
BMI (kg/m2)	27.96	3.80	28.56	3.62
Distribution of the population	%		%	
Normal weight	18.8		15.1	
Overweight	81.2		84.9	
Diabetes	21.9		17.8	
Osteoporosis	20.5		22.2	
Hypertension	39.7		50.3	
Vascular disease	23.3		26.5	
Arthrosis	31.5		48.6	
Hypercholesterolemia	4.1		2.7	
Single	0		5.3	
Widowed/separated	23.3		46.0	
Married	76.7		48.7	
Living alone	21.9		36.4	
Low educational level	76.7		84.3	
Medium educational level	12.3		10.8	
High educational level (university)	11.0		4.9	

BMI = body mass index.

Figure 1

Bland-Altman plot for questionnaire validation a) protein intake: b) lipid intake, c) carbohydrate intake, d) energy intake



Discussion

The elderly population in this study was autonomous and regularly visited a day centre run by the social service department of the local council. The mean age was 73.6 yrs for the men and 72.25 yrs for the women. Around 70% lived with their family, and the mean educational level was medium-low, with only 11% of the men and 5% of the women having an university education, similar to previous reports on this age group in our setting (34, 35).

The Wilcoxon test and Bland & Altman plot were used to validate the study questionnaires, which were adapted from models developed by our group (36-40). The results of this validation permit application of either questionnaire to study the diet of this population.

A large majority (70.4%) of this elderly population considered themselves to be in good health, with only 5.8% reporting a poor health status. The mean BMI was 27.96 kg/m2 for the men and 28.56 kg/m2 for the women, and around 80% were classified as overweight, similar to previous findings in a Spanish elderly population (8). The most frequent chronic diseases in this population were type 2 diabetes, arthrosis and hypertension, all reported to be under current medical treatment, similar to previous reports on the elderly (41, 42).

The degree of adherence to the Mediterranean Diet was around 50%, similar to findings in other Mediterranean populations (43, 44). We highlight the mean consumption of milk and milk products (300-317g/day) and of fruit/vegetables (250 g/day), which are slightly below recommendations (45). They consumed olive oil regularly and ate fish 2-3 times a week, achieving an MUFA/SFA ratio >1, similar to previous reports in the Mediterranean area (38, 44, 45).

Our study subjects were all autonomous in their movements and were physically independent: 80% reported that they performed some type of physical activity; 48% walked for at least 2 h per week and 45% practised gymnastic activities at local authority centres under expert supervision.

One important feature of the traditional Mediterranean way of life is open-air activity, and the WHO recommends at least 30min of walking daily (46). In this study, both adherence to the MD and physical activity were considered as components of a healthy life. Around 70% of this population was in the second tertile of adherence to the MD.

Table 2

Questionnaire validation in sample of 260 participants

Energy/nutrient	FFQ		24h recall				Bland- Altman	
	Median	Interquartile amplitude	Median	Interquartile amplitude	Wilcoxon test*	P	Mean 24h recall-FFQ	Limits of agreement
Energy (MJ)	6.49	2.70	5.13	1.61	-2.921	0.65	415.50	241.01 to 589.98
Protein (g)	74.1	22.34	64.00	36.33	-1.758	0.79	8.27	-3.07 to 19.62
Fat (g)	45.05	10.83	52.25	21.72	-1.828	0.68	-4.82	-11.00 to 1.35
Carbohydrate(g)	201.75	114.33	141.32	47.54	-1.452	0.72	90.21	59.64 to 120.78

*Wilcoxon test for FFQ vs. 24-h recall

Table 3
Mean consumption of food groups by sex and the mean degree of adherence to the Mediterranean Diet

g/day	Men			Women		
	Mean	SD	Median	Mean	SD	Median
Meat	36.55	15.29	28.57	36.57	15.81	28.57
Fish	54.20	21.42	42.86	66.61	23.71	85.71
Pulses	19.41	7.10	20.00	20.57	7.78	20.00
Eggs	17.94	7.83	20.00	16.86	8.08	20.00
Pastries	7.98	9.58	0.00	8.78	9.55	11.43
Milk products	271.90	70.60	300.00	294.59	59.28	317.86
Vegetables	126.84	44.94	142.86	135.82	40.20	142.86
Fruit	103.36	13.82	107.14	103.71	15.88	107.14
Cereals	579.05	177.27	667.14	535.08	207.68	667.14
SFA	13.47	2.55	13.73	14.01	2.57	14.10
MUFA	20.91	1.41	21.14	21.10	1.41	21.11
MUFA/SFA	1.60	0.27	1.57	1.55	0.23	1.48
ADHERENCE-MDS (%)	51.24	14.77	52.96	51.83	16.14	53.08

MUFA = monounsaturated fatty acids; SFA = saturated fatty acids.

Table 4
Distribution of population according to their degree of adherence to the Mediterranean Diet

Category	ADHERENCE (%)		Chi^2	P
	<=50.0	50.0+		
Male	28.8	27.7	0.290	0.865
Female	28.8	27.7		
Single	2.9	4.3	1.630	0.201
Widowed/separated	39.4	39.0		
Married	57.7	56.7		
Low educational level	86.4	79.3	2.384	0.123
Medium educational level	9.7	12.9		
High educational level	3.9	7.9		
Living alone	36.5	29.1	1.525	0.217
Living in family	63.5	70.9		
Good health	64.4	76.6	4.690	0.030
Moderate health	26.9	19.1		
Poor health	8.7	4.3		
Normal weight	15.6	17.4	0.135	0.714
Overweight	84.4	82.6		
Have appetite	23.1	14.5	3.280	0.055
No appetite	76.9	85.1		
Physical activity (PA)	75.0	85.1	3.943	0.047
No PA	25.0	14.9		
PAL <=1.68	69.4	36.3	24.872	0.001
PAL >1.69+	30.6	63.7		
PA <3days/week	15.4	14.2	0.718	0.698
PA 3days/week	58.7	63.8		
PA >3days/week	26.0	22.0		
Type of Physical Activity (%)				
Walking (48.1)	47.1	48.9	1.740	0.419
Gym (45.4)	46.2	43.3	0.201	0.653
Tai-chi (4.4)	4.8	3.5	1.682	0.431
Cycling (3.1)	1.0	4.3	2.330	0.127
Hiking (3.1)	2.9	3.5	0.083	0.774
Swimming (6.2)	7.7	5.0	0.886	0.347
Health status (%)				
Diabetes (19)	20.4	18.6	2.655	0.103
Osteoporosis (21.5)	21.4	21.4	0.001	0.990
Hypertension (47.3)	54.4	41.4	3.990	0.046
Arthrosis (43.8)	45.6	39.3	3.721	0.156
Hypercholesterolemia (3.1)	2.9	2.8	0.770	0.380

A significant association was observed between PAL and adherence to the Mediterranean diet (p=0.001), with a lower adherence among those with a PAL<1.68 in comparison to more physically active individuals. No significant associations were found between MDS and lower BMI or a lesser presence of chronic disease, as also reported in other populations (47).

In summary, a majority of this elderly population was slightly overweight, considered themselves to be in good health and showed 50% adherence to the MD. The absence of significant difference among these individuals may reflect the homogeneous although representative nature of this sample of elderly individuals, randomly selected from day centre users in our city, who enjoyed a high degree of independence.

Conflict of interest: The authors declare that there are no conflicts of interest.

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