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Relationship of moderate alcohol intake and type of beverage with health behaviors and quality of life in elderly subjects

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Abstract
Purpose This work was aimed to study the relationships of moderate alcohol intake and the type of beverages consumed with health behaviors and quality of life in elderly people.
Methods In this observational study, 231 subjects (55–85 years) voluntarily answering to advertisements were enrolled and divided in three study groups: abstainers and occasional consumers (ABS; $n = 98$), moderate drinkers of beer (BEER; $n = 63$) and moderate drinkers of all sorts of alcoholic beverages (MIXED; $n = 70$). Variables assessed included physical activity, activities of daily living, Mediterranean diet-adherence score, tobacco consumption, quality of sleep, body composition, medication and perception of health through the SF-36 questionnaire. Their relationship with alcohol consumption was assessed through general linear models including confounding variables (age, sex, chronic disease prevalence and socioeconomic status). ABS were also compared to moderate drinkers (MOD = BEER + MIXED).
Results The mean daily alcohol consumption in each group was (mean ± SD): ABS: 0.7 ± 1.1; BEER: 12.7 ± 8.1; MIXED: 13.9 ± 10.2 g/day. MOD and MIXED showed significantly higher physical activity (metabolic standard units; METs) than ABS ($p = 0.023$ and $p = 0.004$, respectively). MOD spent significantly less time doing housework activities than ABS ($p = 0.032$). Daily grams of alcohol consumption were significantly associated with METs ($B = 21.727$, $p = 0.023$). Specifically, wine consumption (g/day) was associated with METs ($B = 46.196$, $p = <0.001$) and showed borderline significant relationships with mental health ($B = 0.245$, $p = 0.062$) and vitality perception ($B = 0.266$, $p = 0.054$).
Conclusion Moderate alcohol consumption, and in particular wine consumption, is associated with a more active lifestyle and better perception of own health in the Spanish elderly subjects studied.

Keywords Moderate alcohol consumption · Physical activity · Quality of life · Health behaviors · Elderly

Abbreviations

PA	Physical activity
METs	Metabolic standard units
CATPCA	Categorical principal component analysis
ABS	Abstainers group
MOD	Moderate drinkers group
BEER	Moderate drinkers of beer group
MIXED	Moderate drinkers of all short of alcoholic drinks group

Introduction

In recent years, the relationship between moderate alcohol intake and health outcomes has obtained increasing attention [1, 2]. Some scientific evidence has been reported in the literature showing that moderate alcohol consumption is positively associated with lower mortality [3], fewer cardiovascular events [4–6], diabetes [7, 8], functional

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limitation [1], inflammatory status [9, 10] and positive effects on health during the aging process [11, 12].

On the other hand, it is known that healthy lifestyles are key to prevent chronic diseases [13] and, especially among the elderly, to preserve the functional capacity and well-being. In this sense, the link between alcohol consumption by older adults and the risk of becoming disabled is not clear [14], but light to moderate alcohol consumption has been associated with a protective effect toward functional limitation [1], which might be linked to the protective effects of moderate alcohol intake on inflammatory status [9, 10] since this is a well-established risk factor for functional decline and disability. Interestingly, a recently published epidemiological longitudinal study has shown in Spanish subjects aged 60 and older that certain drinking patterns are associated with a lower risk of frailty [15]. In relation with cognitive functioning, moderate drinking has also been associated with a decreased risk of cognitive impairment [16–19] and dementia [17, 20], although so far, the evidence is greater for women than men perhaps due to differences in the lifetime intakes which might be more moderate in the former [16–18]. The criteria used to define moderate alcohol consumption vary among studies; however, a frequent practice is to include all amounts of alcohol intake inferior to the threshold set by the WHO for heavy drinking, which is 40 g/day for men and 24 g/day for women [21].

One important aspect to consider when analyzing the beneficial effects of alcohol consumption on health is the fact that alcohol consumers' demographic and lifestyle characteristics might be different from those of abstainers [8, 22]. Thus, it is necessary to take into account how those potentially confounding factors are contributing to the relationships between moderate drinking and health benefits. Although traditional confounding factors (demographic, number of chronic conditions, smoking, obesity) are usually accounted for in the statistical analysis in prospective risk studies, other non-traditional confounding factors are also increasingly being included in order to clearly establish whether alcohol is the leading cause of decreased health risks or there are other intrinsic protective factors in moderate drinkers, for example, related to a certain lifestyle, social relationships, psychosocial factors, etc. [1, 17, 23].

Since associations occur in the population between the different health behaviors, such as diet, physical activity (PA), sleep and resting habits [24], it seems relevant to also explore their associations with moderate alcohol consumption. These correlates are mainly unexplored; however, if associations are confirmed, it would support the participation of moderate drinking within a healthy lifestyle. This would be especially relevant for the elderly since preserving health behaviors as people age is associated with better quality of life [25]. Although an association does not prove a causal relationship, it is still necessary to assess what determinants of health-related quality of life are more highly associated with moderate alcohol intake and also what type of alcoholic beverages shows the strongest relationships. Therefore, the aim of the present work is to study the associations of moderate alcohol intake with health behaviors and quality of life (QoL) and to assess any possible difference in the revealed relationships between the two most frequent drinking patterns in Spanish people consuming alcohol in moderate amounts [26]: (1) predominantly beer consumers and (2) mixture consumers including wine, beer and miscellanea.

Materials and methods

Study subjects

In this observational study, 240 participants were recruited between April 2012 and June 2013. All participating subjects gave written informed consent. Individuals were women and men aged 55–85 years and body mass index between 18.5 and 30.0 who answered to advertisements placed in sociocultural center's notice boards or were attracted into participation by word of mouth. Exclusion criteria were: (1) any history of alcohol abuse, (2) higher than moderate alcohol intake and (3) suffering any of the following pathologies: type I diabetes, cancer, renal failure, serious respiratory diseases like chronic obstructive pulmonary disease and respiratory support, and neurological diseases such as Alzheimer's, Parkinson's, fibromyalgia or multiple sclerosis. The study protocol was reviewed and approved by the Ethics Committee of the Puerta de Hierro University Hospital (Madrid, Spain).

Alcohol intake assessment

Only subjects with moderate alcohol consumption habit were included. We assumed moderate alcohol intake as consumption lower than 25 g of alcohol per day for women and less than 40 g of alcohol per day for men. If we consider that 10 g of pure alcohol is the content in a standard drink [27], then the threshold set was equivalent to no more than two and a half drinks per day for women and no more than four drinks per day for men. This is consistent with an exclusion threshold for heavy drinking among the sample according to the WHO [21] and other published studies on moderate alcohol intake [15]. In order to assess participant's alcohol consumption, they were interviewed by a trained nutritionist with an ad hoc frequency recall questionnaire specific for alcoholic drinks and dealcoholized beer based on the SUN Study Questionnaire [28]. The

questionnaire included wine, beer, champagne, cider, liquors, spirits and all the mixtures, and the volunteers were requested to base their estimates in the last year period. Non-alcoholic beer was also specifically addressed. The amounts were recorded by asking the alcohol quantity and frequency of intake using as reference the habitual sizes available for each drink and also other commonly used doses in mixtures with non-alcoholic beverages like soda. Frequency of intake was registered using a continuous scale as follows: never or almost never; 1–3 times per month; 1–6 times per week or number of times per day that the reference dose of each particular drink was consumed. Habitual intake was recorded for working days and separately for weekends. Total grams of alcohol intake per day were then calculated according to the following grams of alcohol content per 100 mL of each alcoholic beverage: wine 11 g, beer 4.5 g, cider 5 g, liquors and distilled beverages 20 g. Behavioral questions regarding alcohol consumption were also included (drinking during meals/outside meals, with friends and family or alone, etc.).

Subjects were then classified into three groups according to their alcohol intakes: (1) abstainers and occasional consumers (defined by an intake of less than 4 alcohol drinks per month) (ABS); (2) beer consumers (BEER), including those persons whose alcohol intake was provided by beer in an amount $\geq$80 %, and (3) mixed beverage consumers (MIXED), including individuals who consumed a significant amount of varying types of alcoholic beverages (mainly wine, beer and liquor). A recruitment table was designed in order to get balanced distribution of subjects (N) in terms of age categories (55–64; 65–74; $\geq$75) and both sexes across the study groups. A significant number of subjects consumed a large amount of non-alcoholic beer. These consumers were included in groups 1 or 2, depending on the frequency and quantity of intake of alcohol containing drinks. Subjects were asked whether their alcohol intake pattern had changed in the last year, and if so, the reason for this change. Those subjects that reported quitting alcohol intake for health issues ($n = 9$) were excluded from the analysis to avoid bias. All questionnaires were subsequently filled in by the interviewer in a face-to-face interview with the volunteer that took on average 90 min.

Socioeconomic characteristics

Capital, level of education, employment status and marital status were assessed by the modified AFINOS Study questionnaire [29]. Four socioeconomic status categories were considered based on total capital amount: (1) "low status" for a capital less to 10,000€, (2) "low-intermediate" for a capital between 50,000 and 200,000€, (3) an "intermediate-high" for a capital between 200,000 and 600,000€ and (4) "high" socioeconomic status for a capital higher than 600,000€. Level of education has been divided into (1) "elementary," for those with no school grade, school graduates and professional training and (2) "higher education" for subjects with high school education or university studies. Employment status was divided into four groups: (1) "currently working," (2) "retirees," (3) "housewives" and (4) "other," category comprising subjects with permanent disability, subjects off work for more than three months and unemployed. Finally, marital status was classified into three categories (1) "married," (2) "singles" and (3) "other," which includes widowed, divorced and separated subjects.

Health behaviors

The Minnesota Leisure-Time Physical Activity Questionnaire (MLTPAQ, Spanish version) was employed for the assessment of PA. For each individual, METs (metabolic standard units) were estimated using the coefficients published in the Compendium of Physical Activities [30] and computed for weekly periods. Time spent in daily household activities (cleaning—light, moderate or intense—reading and watching TV) was assessed by the modified AFINOS Study questionnaire [29]. The dietary pattern proximity to the Mediterranean diet was analyzed by the 14-item Mediterranean diet-adherence score used in the PREDIMED study [31]. The score was calculated with only 13 items after excluding alcohol consumption since this was a factor in our study. Tobacco consumption was assessed by asking the following question: "Which defines your tobacco consumption?" I smoke daily/I smoke but not daily/I don't smoke but I did in the past/I have never smoked. Any affirmative answer of the following questions: "I smoke daily" or "I smoke but not daily," was then computed as current smoke consumption.

QoL variables

Information on disease and medication was obtained with the National Health Survey questionnaire [32]. Prevalence of chronic disease was defined as having a diagnosis for any of the following: hypertension, type II DM, heart attack or stroke, or, alternatively, suffering two other among the following diseases: rheumatoid arthritis, asthma, bronchitis, gastric or duodenal ulcer, constipation, depression, migraine, constipation/hemorrhoids, osteoporosis or anemia. Subject's perception of their physical and emotional health and pain was measured with the Short Form-36 Health Survey questionnaire [33]. Information related to the individual's quality of sleep was obtained by a modification of the National Health Survey questionnaire [32]. A dichotomous classification of sleep quality as

"good" or "bad" was created by recoding the answers given to the questions "Do you regularly have difficulties to fall asleep?" and "Do you regularly wake up too early?" as follows: never/occasionally/sometimes = "no," and frequently/always = "yes." Any affirmative answer was then computed as "bad" quality of sleep.

Finally, height was measured using a stadiometer Seca 222 with a range 6–230 cm and weight was obtained with the electronic scale integrated in the Omron HBF-500 BIA device that has a precision of ±0.4 kg until 40 kg and ±1 % between 40 and 150 kg. Body mass index was then calculated as weight (kg)/height $(cm)^2$.

Statistical analysis

Sociodemographic characteristics were compared across alcohol consumption groups through univariate general linear model (ANOVA) and Bonferroni posttest for continuous variables and Chi-square tests for categorical variables.

An exploratory factor analysis was performed using a categorical principal component analysis (CATPCA) to understand the relationships between 14 different variables of QoL and health behaviors including alcohol intake. The method is particularly suited to analyze nominal (qualitative) and ordinal data, combined with numeric data, and the relationships among observed variables are not assumed to be linear [34]. Following the analysis, the original 14 variables are reduced into only two non-correlated components that represent most of the information found in those variables. Variables related to lifestyle with a higher coefficient of relation with alcohol consumption were later analyzed in detail.

The relationship of alcohol consumption with behavioral and QoL factors was further analyzed through univariate general linear model (ANOVA) and Bonferroni posttest. To study this relationship, two models were used. The first model considered the three consumer groups defined above (ABS, BEER and MIXED). The second model considered only two groups to reflect alcohol consumption independently of the type of alcoholic drink consumed, ABS and "Moderate Drinkers" (MOD: BEER + MIXED). Both models were adjusted by age, sex, chronic disease prevalence and socioeconomic status. Finally, in order to find out the association between quantity of alcohol intake (g/day) within the moderate range and behavioral and QoL factors, general linear models were used adjusted by confusion factors; only age and sex in the first model were added while prevalence of chronic disease and socioeconomic status were added in the second model.

All analyses were performed using the SPSS for Windows statistical software package version 20 (SPSS Inc., Chicago, IL, USA), and the significance level was set at $p < 0.05$.

Results

Characteristics of the participants

No significant differences were found among alcohol consumption groups in age, gender proportions, chronic disease prevalence, overweight prevalence, education level or employment status (Table 1). Smoking was significantly more prevalent in MOD than in ABS ($p = 0.013$). MOD also reported a significantly higher socioeconomic status compared with ABS ($p = 0.024$).

The average consumption of alcohol among participating women was 10.8 g per day, which is equivalent to one small beer or a standard dose of wine. Among men, the average consumption of alcohol was 15.8 g per day, which is approximately 300 ml serving of beer or around 150 ml serving of wine. In the MIXED consumers, the amount of alcohol derived from wine accounted for 75 and 76 % of total daily alcohol intake in men and women, respectively.

Associations between alcohol intake and health-related QoL

Exploring 14 behavioral and QoL factors through CATPCA, we found that the variables that were more related to alcohol intake were PA (METs) and the general and specific components of health measured by the SF-36 questionnaire, mainly mental health and vitality (Fig. 1). This model explained 39.01 % of the variance. Although the observed correlations are not excessively high, they allow for a multivariate approximation of the main relationships between our study variables in order to further explore them with more precise models. The variable "alcohol consumption group" is segmented as follows: ABS, BEER and MIXED. The mixed consumption, located in the upper end of the vector, is leading to the relationships mentioned above (Fig. 1).

Subsequent analysis regarding QoL markers revealed that only PA showed significant differences among moderate alcohol consumption groups ($p = 0.004$). The difference was significant when comparing MIXED versus ABS but not BEER versus ABS (Table 2). In the event that heterogeneity among groups in terms of occupation might have had an influence, the analysis was repeated including only retired subjects, and interestingly, the results were even more significant. No differences were found between groups for body mass index, number of medications, the Mediterranean diet-adherence score, the sleep assessment or the SF-36 variables. However, a trend was found toward

Table 1 Characteristics of the study subjects

	ABS ($n = 98$)	BEER ($n = 63$)	MIXED ($n = 70$)	MOD ($n = 133$)	$p^{\#}$	$p^{\wedge}$
Age, mean ± SD	68.80 ± 9.28	68.02 ± 7.80	67.25 ± 8.45	67.61 ± 8.13	0.601	0.384
Alcohol consumption (g) ±SD	0.69 ± 1.05	12.65 ± 8.13	13.96 ± 10.26	13.34 ± 9.31	**<0.001**	**<0.001**
Wine (g) ±SD	0.30 ± 0.66	1.07 ± 2.16	10.44 ± 9.06	6.03 ± 8.21	**<0.001**	**<0.001**
Beer (g) ±SD	0.18 ± 0.45	11.18 ± 7.24	2.89 ± 4.22	6.78 ± 7.14	**<0.001**	**<0.001**
Liquor (g) ±SD	0.05 ± 0.22	0.30 ± 0.65	0.56 ± 1.26	0.44 ± 1.02	0.050	0.056
Women %	59.2	50.8	47.9	49.3	0.308	0.134
Overweight %	42.2	26.0	31.8	57.8	0.796	0.980
Currently smoking %	11.2	22.3	18.3	20.1	0.072	**0.013**
Chronic disease prevalence %	48.0	49.2	50.7	50.0	0.940	0.759
Employment status %						
Currently working	28.6	28.6	27.1	27.8	0.293	0.081
Housewife	10.0	4.8	5.7	5.3		
Retired	47.9	60.3	62.8	61.7		
Other[a]	13.3	6.3	5.7	6.0		
Socioeconomic status %						
Low	8.2	0.0	2.8	1.5	0.119	**0.024**
Low-intermediate	9.2	12.7	12.7	12.7		
Intermediate-high	46.9	39.7	36.6	38.1		
High	35.7	47.6	47.9	47.8		
Education %						
Elementary	36.7	20.7	33.8	27.6	0.160	0.114
Higher/university	63.3	79.4	66.2	72.4		
Marital status %						
Married	64.3	60.3	69.0	64.9	0.251	0.092
Single	17.3	9.5	7.0	8.2		
Other[b]	18.4	30.4	24.0	26.8		

ABS abstainers and occasional consumers, *BEER* moderate drinkers of beer, *MIXED* moderate drinkers of all sorts of alcoholic beverages, *MOD* moderate drinkers (BEER + MIXED), *SD* standard deviation

Significant p values (<0.05) are indicated in bold

[a] This includes subjects with permanent disability, subjects off work for more than 3 months and unemployed

[b] This includes divorced, separated and widowed

[#] ANOVA or Chi-square tests for continuous and categorical variables, respectively, among three groups (ABS, BEER and MIXED)

[^] ANOVA or Chi-square tests for continuous and categorical variables, respectively, between ABS and MOD. [#] and [^] significance calculations are not independent since the MOD group merges BEER and MIXED

a higher vitality perception in MIXED ($p = 0.069$) than in ABS and a higher mental health perception in MOD than in ABS ($p = 0.058$) (Table 2). Further analyses were performed to check whether the associations of METs and mental health with alcohol consumption group were independent of each other, and both associations remained similar after including the corresponding additional variable in the analysis ($p = 0.042$ and $p = 0.091$ for METs and mental health with alcohol consumption, respectively), thus confirming their independence.

In relation to the pattern of PA, the following activities were significantly more practiced in both alcohol-consuming groups than in ABS group: walking for pleasure ($p = 0.018$), playing with kids ($p = 0.039$), swimming in the sea ($p = 0.001$), swimming in the pool ($p = 0.021$) and, only as a trends, climbing stairs ($p = 0.094$) (Table 3). In relation to the weekly time spent on the activities studied, no significant differences were found by group of consumption.

On the other hand, MIXED drinkers spent significantly less time per week doing housework activities of any kind than ABS and the difference was significant for moderate-effort housework activities like cleaning windows, scrubbing floors and gardening (Table 4). In relation to sedentary activities in the leisure time, a different pattern between MIXED and ABS was also observed for reading habit. ABS showed a more even distribution among

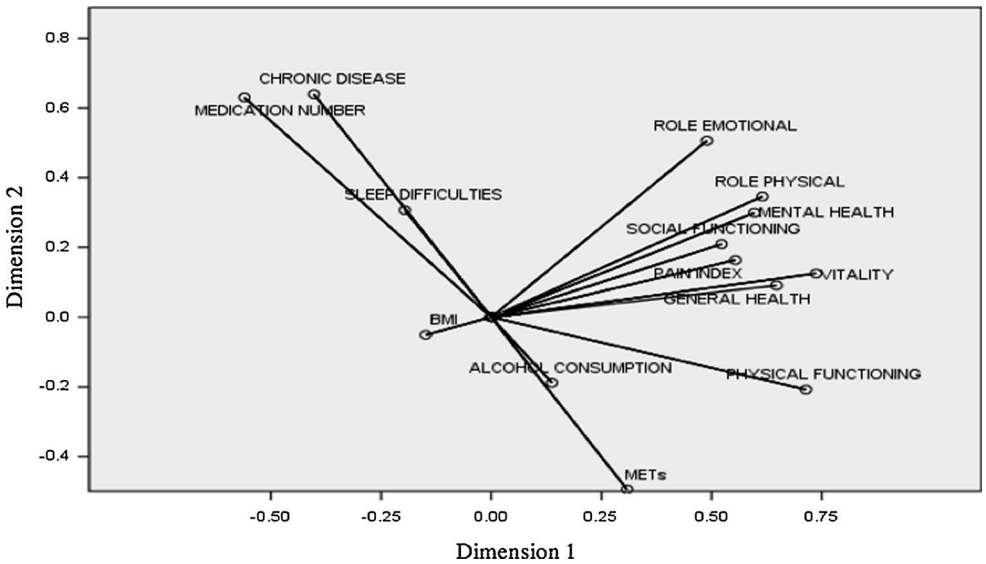

Fig. 1 Principal component analysis of health behaviors and QoL variables in adults in the 55–85 age range with a variable pattern of alcohol consumption from abstinence to moderate drinking. Plot of component loadings in a bidimensional model. Dimensions 1 and 2 are the representation of the two unrelated components that hold the majority of the information of the 14 variables included in the analysis. Long and close vectors represent the most related variables. *METs* metabolic equivalents (measure of physical activity), *BMI* body mass index. The figure was performed using the SPSS for Windows statistical software package version 20 (SPSS Inc., Chicago, IL, USA)

categories of low, moderate and regular reading habit, while most of MIXED subjects had a moderate reading habit (from 2 to 7 h per week) (Table 4).

Table 5 presents data on the relationship between daily grams of alcohol intake and the relevant behavioral and QoL variables. In the fully adjusted regression model, the results showed a significant and positive association of daily grams of total alcohol consumption with PA ($p = 0.023$, $B = 21.727$). In addition, a borderline significant and positive association was observed between daily grams of alcohol consumption and perception of mental health ($p = 0.065$, $B = 0.179$). When each source of alcohol was separately considered in the analysis, only the grams of alcohol from wine were positively associated with PA ($p < 0.001$, $B = 46.196$). In addition, trends were observed between daily grams of alcohol intake from wine and both, vitality ($p = 0.054$, $B = 0.266$) and perception of mental health ($p = 0.062$, $B = 0.245$). When regression analysis was performed separately in men and women, the results were similar in both sexes (data not shown). No association was observed between alcohol consumption from beer or liquor and METs.

Discussion

The association between moderate alcohol consumption and QoL variables, including health behaviors, has been evaluated in a sample of 231 Spanish elderly subjects. The main result in this study showed that moderate drinkers of alcohol perform significantly more PA (METs) than abstainers while spending less time in house-cleaning tasks. They also tend to score higher in mental health evaluation compared to abstainers. All three features are more significant in alcohol consumers that have a mixed beverage drinking pattern, with wine accounting for 75 % of total daily alcohol intake, than in those drinking mainly beer.

The majority of the QoL markers evaluated in our population did not show an association with the consumption of alcohol. Important markers such as body mass index, medication number, sleep quality or adherence to Mediterranean diet showed similar values between groups.

Alcohol intake and physical activity

Significant associations were found between a moderate drinking habit including a mixture of alcoholic drinks and an increased practice of PA during leisure time, both compared to abstainers and those drinking predominantly beer. Moreover, a significant positive association was found between daily grams of alcohol intake and PA. These results are consistent with Smothers and Bertolucci work [35] which showed that PA increased with alcohol intake in a dose-dependent manner from abstinence to moderate drinking, before declining at heavier drinking. In our study, MOD, independently of the drinking pattern, practiced more outdoor activities like walking for pleasure, climbing

Table 2 Measures of quality of life and health behaviors in moderate consumers of alcohol and abstainers

	ABS ($n = 98$)	BEER ($n = 63$)	MIXED ($n = 70$)	MOD ($n = 133$)	$p^{\#}$	$p^{\wedge}$
Body mass index (kg/m^2)	25.9 ± 2.4	25.7 ± 2.6	26.2 ± 2.8	26.0 ± 2.7	NS	NS
Chronic use of medications (%)						
None	35.7	36.5	42.3	39.6	NS	NS
One drug	27.6	34.9	28.2	31.3		
Two drugs	21.4	14.3	21.1	17.9		
Three or more drugs	15.3	14.3	8.5	11.2		
SF36 questionnaire (scores)						
Physical functioning	92.0 ± 10.3	92.9 ± 8.9	93.8 ± 7.1	93.4 ± 7.9	NS	NS
Role physical	95.4 ± 12.1	95.6 ± 12.7	96.1 ± 11.7	95.9 ± 12.1	NS	NS
Pain index	90.8 ± 17.3	90.5 ± 20.3	92.6 ± 14.1	91.6 ± 17.3	NS	NS
Role emotional	97.6 ± 8.9	95.5 ± 13.8	96.2 ± 11.7	95.9 ± 12.7	NS	NS
Mental health	73.4 ± 13.4	75.5 ± 13.1	78.2 ± 14.1	77.0 ± 13.7	0.090	0.058
Vitality	73.0 ± 14.1	73.3 ± 15.9	78.2 ± 14.1	75.8 ± 15.1	0.069	NS
Social functioning	93.3 ± 14.1	90.5 ± 16.0	92.8 ± 13.6	91.7 ± 14.8	NS	NS
General health	81.3 ± 18.5	80.1 ± 18.3	82.4 ± 18.7	81.4 ± 18.7	NS	NS
Physical activity (PA) (METs—min/week)	2868.7 ± 1210.4a	3102.1 ± 1316.7a	3674.63 ± 1858.6b	3409.9 ± 1649.2	0.004	0.023
PA women (METs—min/week)	$N = 58$	$N = 32$	$N = 34$	$N = 66$	0.069	0.038
	2460.5 ± 779.2	2862.8 ± 1343.8	3167.1 ± 1636.1	3019.6 ± 1497.9		
PA men (METs—min/week)	$N = 40$	$N = 31$	$N = 36$	$N = 67$	0.021	0.106
	3460.7 ± 1466.0a	3399.8 ± 1251.3a	4260.2 ± 1917.1b	3868.1691.8 ± 1691.8		
PA retired subjects (METS—min/week)	$N = 47$	$N = 38$	$N = 43$	$N = 81$	<0.001	0.010
	2544.4 ± 552.8a	2989.9 ± 1135.2b	3686.7 ± 1761.2c	3363.8 ± 1535.4		
Mediterranean diet-adherence score[a]	4.6 ± 1.6	4.7 ± 1.3	5.0 ± 1.5	4.9 ± 1.4	NS	NS
Bad quality of sleep %	17.3	12.7	14.1	13.4	NS	NS

Different letters indicate significant differences between three consumption groups (ABS, BEER and MIXED). Bonferroni test. $p < 0.05$. Model adjusted (simultaneously) for age, gender, socioeconomic status and chronic disease prevalence

ABS abstainers and occasional consumers, *BEER* moderate drinkers of beer, *MIXED* moderate drinkers of all sorts of alcoholic beverages, *MOD* moderate drinkers (BEER + MIXED). Mean ± SD. *PA* physical activity, *METs* metabolic equivalents (minutes per week), *NS* nonsignificant

[#] ANOVA or Chi-square tests for continuous and categorical variables, respectively, among three groups (ABS, BEER and MIXED)

[^] ANOVA or Chi-square tests for continuous and categorical variables, respectively, between two groups (ABS and MOD)

[a] Score based on 13 of the original 14 items (alcohol item was excluded from the score)

stairs, playing with kids and swimming compared with ABS. A number of population-based studies have previously reported the association between leisure-time PA and moderate alcohol consumption, and it has been considered as an evidence for a health-promoting lifestyle [35–39]. The associations have been found between alcohol and amount of PA practice or METs [39, 40], intensity [35, 41] or minutes per week PA practice [38].

Since the practice of physical activity decreases progressively with age, both in women and in men [42–44], it is, therefore, very important to identify the correlates of physical activity in a health behavior pattern in older adults. Our regression analyses with daily grams of alcohol from beer and from wine confirmed that the relationship of PA practice and alcohol consumption is driven by wine intake and is a dose-dependent relationship that is not observed with daily grams of beer intake. In this sense, two French studies showed similar results about the type of alcohol beverage. In Touvier et al.'s [40] study, wine intake was related to a higher physically active lifestyle, in contrast with beer and spirits intake. Another French study on 1110 men showed that PA was higher among wine drinkers than among beer or mixed drinkers [45].

Walking has been identified in this study as the most commonly practiced PA in all groups and is the most recommended PA for all ages [46, 47] and a determinant of well-being [48]. Brisk walking is considered moderate-intensity physical exercise [30], and the WHO recommendation [49] is that people 65 years and older should accumulate 150 min of moderate-intensity aerobic PA

Table 3 Percentage practice and average time spent in different leisure-time physical activities in moderate consumers of alcohol and abstainers

	ABS ($n = 98$)	BEER ($n = 63$)	MIXED ($n = 70$)	MOD ($n = 133$)	$p^{\#}$	$p^{\wedge}$
Walking for pleasure, slow pace (%)	22.4	36.5	42.3	39.6	**0.018**	**0.006**
Minutes/week	221.7 ± 193.1	290.9 ± 218.4	280.5 ± 249.5	285.1 ± 234.4	0.888	0.671
Walking % practicing	55.1	52.4	52.1	52.2	0.911	0.666
Minutes/week	370.2 ± 216.9	350.4 ± 237.8	347.9 ± 212.2	349.1 ± 223.0	0.676	0.379
Walking carrying shopping cart (%)	9.2	7.9	14.1	11.2	0.448	0.619
Minutes/week	27.02 ± 25.1	39.0 ± 31.3	36.7 ± 52.0	37.46 ± 44.9	0.986	0.960
Walking carrying bags (%)	9.2	14.2	18.3	16.4	0.220	0.110
Minutes/week	64.44 ± 90.9	49.44 ± 63.5	94.38 ± 163.1	76.0 ± 131.3	0.992	0.628
Walking as exercise (%)	11.2	11.1	21.1	16.4	0.136	0.263
Minutes/week	238.9 ± 181.2	244.6 ± 189.5	257.6 ± 181.1	253.5 ± 179.3	0.964	0.825
Hiking (%)	3.1	9.5	8.5	8.9	0.191	0.071
Minutes/week	180.0 ± 103.9	120.3 ± 172.5	20.7 ± 11.9	70.5 ± 127.6	0.188	0.240
Climbing stairs (%)	10.2	20.6	21.1	20.9	0.094	**0.030**
Minutes/week	55.5 ± 25.9	54.9 ± 33.2	71.4 ± 67.5	63.8 ± 54.1	0.663	0.721
Exercise at home (%)	9.2	7.9	14.1	11.2	0.448	0.619
Minutes/week	111.7 ± 54.5	141.0 ± 161.6	87.3 ± 55.8	105.2 ± 100.7	0.265	0.582
Health club exercise (%)	19.4	22.2	29.6	26.1	0.294	0.231
Minutes/week	118.1 ± 80.2	128.4 ± 95.6	143.3 ± 77.7	137.3 ± 84.3	0.847	0.546
Aerobic (%)	4.1	9.5	7.0	8.2	0.380	0.207
Minutes/week	91.2 ± 57.6	326.9 ± 340	144.0 ± 68.4	243.8 ± 262.7	0.191	0.450
Playing with kids (%)	9.2	20.6	22.5	21.6	**0.039**	**0.011**
Minutes/week	144.6 ± 101.7	381.4 ± 465.1	149.5 ± 136.8	253.4 ± 341.3	0.155	0.582
Sea swimming (%)	3.1	14.3	22.5	18.7	**0.001**	**<0.001**
Minutes/week	10.9 ± 10.5	10.1 ± 10.3	125.6 ± 446.6	84.02 ± 357.7	0.629	0.493
Pool swimming (%)	23.5	25.4	42.2	34.3	**0.021**	0.074
Minutes/week	62.9 ± 87.6	69.7 ± 79.5	61.9 ± 54.7	64.65 ± 63.6	0.991	0.970
Rock or mountain climbing (%)	6.1	7.9	5.6	6.7	0.850	0.856
Minutes/week	261.7 ± 231.7	155.4 ± 252.4	113.9 ± 133.4	136.9 ± 197.5	0.082	0.177
Cycling (%)	9.2	9.5	5.6	7.5	0.639	0.637
Minutes/week	170.1 ± 122.7	126.7 ± 120.5	222.5 ± 206.9	165.0 ± 157.4	0.053	0.477
Dancing (%)	8.2	14.3	12.7	13.4	0.435	0.209
Minutes/week	77.5 ± 39.1	114.9 ± 126.7	105.5 ± 72.3	110.2 ± 100.2	0.751	0.520
Jogging (%)	6.1	3.2	4.2	3.7	0.671	0.397
Minutes/week	257.5 ± 322.9	270.0 ± 212.1	143.3 ± 90.7	194.0 ± 142.6	0.258	0.122
Weight lifting (%)	4.1	3.2	7.0	5.2	0.530	0.686
Minutes/week	81.2 ± 31.7	52.5 ± 24.8	42.0 ± 21.7	45.0 ± 21.01	0.437	0.046

Different letters indicate significant differences between three consumption groups (ABS, BEER and MIXED). Bonferroni test. $p \leq 0.05$. Model adjusted (simultaneously) for age, gender, socioeconomic status and chronic disease prevalence. # and ^ significance calculations are not independent since the MOD group merges BEER and MIXED

ABS abstainers and occasional consumers, *BEER* moderate drinkers of beer, *MIXED* moderate drinkers of all sorts of alcoholic beverages, MOD, moderate drinkers (BEER + MIXED)

Significant p values (<0.05) are indicated in bold

ANOVA or Chi-square tests for continuous and categorical variables, respectively, among three groups (ABS, BEER and MIXED)

^ ANOVA or Chi-square tests for continuous and categorical variables, respectively, between ABS and MOD

throughout the week. In our study, around 53 % of the subjects studied walked an average of 50 min per day. This suggests that at least half of the sample is meeting WHO recommendation; however, pace was not specified when registering this activity, and thus, this interpretation is only speculative.

Regarding household activities, the main finding is that ABS spend more time doing housework activities. The

Table 4 Measures of different daily activities in moderate consumers of alcohol and abstainers

	ABS ($n = 98$)	BEER ($n = 63$)	MIXED ($n = 70$)	MOD ($n = 133$)	$p^{\#}$	$p^{\wedge}$
Time spent watching TV (%)						
<30 min/day	18.3	19.0	18.6	18.8	0.977	0.992
<30 min–3 h/day	62.2	58.7	65.7	62.4		
>3 h/day	19.4	20.6	17.1	18.8		
Time spent reading (%)						
<1 h/week	29.6	30.1	12.8	21.0	**0.009**	**0.021**
2–7 h/week	36.7	47.6	62.8	55.6		
>7 h/week	33.7	22.2	25.7	24.0		
Housework (h/week)	13.3 ± 9.9	10.5 ± 9.1	9.3 ± 8.9	9.8 ± 8.9	0.082	**0.032**
Multiple household tasks, light effort (h/week)	10.1 ± 7.5	8.5 ± 7.7	7.4 ± 7.2	7.9 ± 7.4	0.247	0.144
Multiple household tasks, moderate effort (h/week)	3.2 ± 3.6a	2.1 ± 3.1a	1.8 ± 2.5b	1.9 ± 2.8	**0.032**	**0.010**
Multiple household tasks, vigorous effort (h/week)	0.09 ± 0.4	0.06 ± 0.3	0.05 ± 0.2	0.05 ± 0.3	0.536	0.275

Different letters indicate significant differences between three consumption groups (ABS, BEER and MIXED). Bonferroni test. $p < 0.05$. Model adjusted (simultaneously) for age, gender, socioeconomic status and chronic disease prevalence. # and ^ significance calculations are not independent since the MOD group merges BEER and MIXED

ABS abstainers and occasional consumers, *BEER* moderate drinkers of beer, *MIXED* moderate drinkers of all sorts of alcoholic beverages, *MOD* moderate drinkers (BEER + MIXED)

Significant *p* values (<0.05) are indicated in bold

ANOVA or Chi-square tests for continuous and categorical variables, respectively, among three groups (ABS, BEER and MIXED)

^ ANOVA or Chi-square tests for continuous and categorical variables, respectively, between ABS and MOD

Table 5 Unstandardized regression coefficients (*B*) and confidence intervals (CI) between alcohol intake from different drinks and physical activity and quality of life variables

	Model 1			Model 2		
	B	95 % CI	*p*	*B*	95 % CI	*p*
Total alcohol intake (g/day)						
PA (METs—min/week)	22.607	3.750, 41.464	**0.019**	21.727	3.014, 40.440	**0.023**
SF-36 mental health	0.174	−0.013, 0.361	*0.069*	0.179	−0.011,0.369	*0.065*
SF-36 vitality	0.145	−0.054, 0.344	0.153	0.158	−0.042, 0.358	0.112
Wine intake (g alcohol/day)						
PA (METs—min/week)	45.882	20.581, 71.183	**<0.001**	46.196	21.223, 71.170	**<0.001**
SF-36 mental health	0.239	−0.016, 0.493	*0.066*	0.245	−0.013, 0.503	*0.062*
SF-36 vitality	0.243	−0.27, 0.514	*0.078*	0.266	0.005, 0.537	*0.054*
Beer intake (g alcohol/day)						
PA (METs—min/week)	−8.314	−36.352, 19.725	0.561	−11.799	−39.306, 15.708	0.401
SF-36 mental health	0.049	−0.228, 0.326	0.728	0.047	−0.232, 0.326	0.740
SF-36 vitality	0.014	−0.280, 0.308	0.924	0.006	−0.287, 0.299	0.969
Liquor intake (g alcohol/day)						
PA (METs—min/week)	15.962	−209.260, 241.184	0.890	57.853	−163.654, 279.360	0.609
SF-36 mental health	1.970	−0.241, 4.180	*0.081*	2.033	−0.193, 4.260	*0.073*
SF-36 vitality	1.346	−1.009, 3.702	0.263	1.526	−0.823, 3.875	0.203

Model 1 adjusted (simultaneously) for age and gender

Model 2 adjusted (simultaneously) for age and gender, socioeconomic status and chronic disease prevalence

PA physical activity, *METs* metabolic equivalents (minutes per week)

Significant *p* values (<0.05) are indicated in bold

importance of non-exercise domains, such as walking and housework to the total daily energy expenditure, has been pointed out [37] although the MET values of housework activities mainly correspond to light-intensity activity. These authors found that some of the associations of PA domains with sociodemographic and lifestyle variables were in opposite directions for exercise/sports and non-exercise physical activities. This is in line with our finding of MIXED practicing more exercise but being less likely to do housework activities and the opposite being true for ABS.

Alcohol intake and perception of own health

The group of MIXED consumers in our study showed a trend for a positive relationship with vitality perception as compared with the other groups studied. A Japanese cross-sectional study including 4521 adults also showed a significantly higher vitality score in moderate drinkers, compared to abstainer subjects [50]. Other studies reported better scores at several subscales of the SF-36 questionnaire in moderate drinkers than in abstainers or occasional drinkers. In a Brazilian study, elderly individuals who consumed alcohol at least once a week showed significantly better scores at all scales of SF-36 except for role emotional and social functioning [39]. In another US elderly population study, moderate alcohol intake was significantly and positively associated with the SF-36 global health status, as well as scores for the mental health subscale in men [51]. Also in elderly women, an Australian population study showed similar results [52]. These findings are consistent with the trend toward a higher positive mental health perception found in MOD in the current study. As with PA, regression analysis showed that only wine, but not beer, contributed significantly to the higher perception of mental health and vitality.

Moderate alcohol consumption is positively associated with the number of social contacts among older adults [20, 52], social support and networking [51]. Thus, its protective mental health effect might arise from alcohol use in itself or from social factors connected with drinking behavior [53]. The fact that, in our study, the findings were observed with wine intake and no clear signs of these with beer intake, suggests that the associations between health markers and consumption of fermented alcoholic drinks are not dependent on alcohol intake per se but more likely on other factors linked to wine consumption that make people more prone to practice physical activity and exhibit higher vitality. In the speculative level, these might be perhaps sociocultural factors, personality traits of wine consumers or even components in wine not present in beer.

Some limitations should be considered in our study. First of all, the cross-sectional design does not allow establishing cause–effect relationships for the associations observed. Thus, either, for those persons that have enjoyed more satisfactory life conditions (due to genetic, environmental or other unknown determinants), moderately drinking alcohol is more appealing, or the other way round, alcohol consumption might contribute to their more active life and mental health. Another limitation is that our subjects self-reported the alcohol intake, which could lead to underestimation; however, this is more frequent in heavy drinkers [54]. Regarding PA, although a direct measure was not taken, the questionnaire used was interviewer-administered and provided a comprehensive picture of PA patterns during the leisure time, which in the case of older people, not engaged in occupational activities, might be particularly useful. The Minnesota Leisure-Time Physical Activity Questionnaire is a valid instrument to measure the quantity and quality of PA, which is widely used in other observational studies such as PREDIMED [55]. Finally, participants were not selected based on criteria to make a representative sample of the Spanish population, but were voluntarily responding to the study recruitment dissemination methods. Thus, the sample might be biased in some way, i.e. including people with relatively better health and more free time, which might be in fact the case, since the distribution of the study subjects across socioeconomic and educational categories is overrepresented in the higher ones compared to the population studied by Ortolá et al. [15] in their Spanish representative sample of community-dwelling older adults. Thus, the results cannot be extrapolated to the general population.

In conclusion, our findings show that moderate alcohol consumption, and in particular wine consumption, is associated with a more active lifestyle in elderly subjects. This outcome should be borne in mind in order to design further prospective, well-controlled population studies.

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Informed consent Informed consent was obtained from all individual participants included in the study.

References

1. Maraldi, C., Harris, T., Newman, A. B., Kritchevsky, S. B., Pahor, M., Koster, A., et al. (2009). Moderate alcohol consumption and risk of functional decline: Is there a causal relationship? The Health, Aging, and Body Composition. *Journal of the American Geriatrics Society, 57*(10), 1767–1775.
2. Nova, E., Baccan, G. C., Veses, A., Zapatera, B., & Marcos, A. (2012). Potential health benefits of moderate alcohol consumption: Current perspectives in research. *Proceedings of the Nutrition Society, 71*, 307–315.
3. Klatsky, A. L., & Udaltsova, N. (2007). Alcohol drinking and total mortality risk. *Annals of Epidemiology, 17*, 63–67.
4. Rimm, E. B., & Moats, C. (2007). Alcohol and coronary heart disease: Drinking patterns and mediators of effect. *Annals of Epidemiology, 17*, 3–7.
5. Mukamal, K. (2007). Alcohol intake and noncoronary cardiovascular diseases. *Annals of Epidemiology, 17*(5), 8–12.
6. Klatsky, A. L. (1999). Moderate drinking and reduced risk of heart disease. *Alcohol Research and Health, 23*(1), 15–23.
7. Howard, A. A., Arnsten, J. H., & Gourevitch, M. N. (2004). Effect of alcohol consumption on diabetes mellitus: A systematic review. *Annals of Internal Medicine, 140*(3), 211–219.
8. Joosten, M. M., Grobbee, D. E., Verschuren, W. M., Hendriks, H. F., & Beulens, J. W. (2010). Combined effect of alcohol consumption and lifestyle behaviors on risk of type 2 diabetes. *American Journal of Clinical Nutrition, 91*(6), 1777–1783.
9. Volpato, S., Pahor, M., Ferrucci, L., et al. (2004). Relationship of alcohol intake with inflammatory markers and plasminogen activator inhibitor-1 in well-functioning older adults: The Health, Aging, and Body Composition Study. *Circulation, 109*, 607–612.
10. Romeo, J., Wärnberg, J., Nova, E., Díaz, L. E., Gómez-Martinez, S., & Marcos, A. (2007). Moderate alcohol consumption and the immune system: A review. *British Journal of Nutrition, 98*(11), 111–115.
11. Bridevaux, I. P., Bradley, K. A., Bryson, C. L., McDonell, M. B., & Fihn, S. D. (2004). Alcohol screening. Results in elderly male veterans: Association with health status and mortality. *Journal of the American Geriatric Society, 52*(9), 1510–1517.
12. Stranberger, T. E., Stranberger, A. Y., Salomaa, V. V., Pitka, K., Tilvis, R. S., & Miettnen, T. A. (2007). Alcoholic beverage preference, 29-year mortality, and quality of life in men in old age. *The Journals of Gerontology Series A, Biological Sciences and Medical Sciences, 62*(2), 213–218.
13. World Health Organization. (2009). *Global health risks: Mortality and burden of disease attributable to selected major risks*. Geneva: World Health Organization.
14. Reid, M. C., Boutros, N. N., O'Connor, P. G., et al. (2002). The health-related effects of alcohol use in older persons: A systematic review. *Substance Abuse, 23*(3), 149–164.
15. Ortolá, R., García-Esquinas, E., León-Muñoz, L. M., Guallar-Castillón, P., Valencia-Martín, J. L., Galán, I., et al. (2015). Patterns of alcohol consumption and risk of frailty in community-dwelling older adults. *The Journals of Gerontology Series A: Biological Sciences & Medical Sciences*. doi:10.1093/gerona/glv125.
16. McGuire, L. C., Ajani, U. A., & Ford, E. S. (2007). Cognitive functioning in late life: The impact of moderate alcohol consumption. *Annals of Epidemiology, 17*(2), 93–99.
17. Nooyens, A. C., Bueno-de-Mesquita, H. B., van Gelder, B. M., van Boxtel, M. P., & Verschuren, W. M. (2014). Consumption of alcoholic beverages and cognitive decline at middle age: The Doetinchem Cohort Study. *British Journal of Nutritoin, 111*(4), 715–723.
18. Stampfer, M. J., Kang, J. H., Chen, J., Cherry, R., & Grodstein, F. (2005). Effects of moderate alcohol consumption on cognitive function in women. *The New England Journal of Medicine, 352*, 245–253.
19. Baum-Baicker, C. (1985). The psychological benefits of moderate alcohol consumption: A review of the literature. *Drug and Alcohol Dependence, 15*(4), 305–322.
20. Mukamal, K., Kuller, L., Fitzpatrick, A., Junior, L., Mittleman, M., & Siscovick, D. (2003). Prospective study of alcohol consumption and risk of dementia in older adults. *JAMA, 289*(11), 1405–1413.
21. World Health Organization. (2000). *World Health Organization 2000 international guide for monitoring alcohol consumption and related harm*. http://whqlibdoc.who.int/hq/2000/WHO_MSD_MSB_00.4.pdf.
22. Klatsky, A. L. (1999). Moderate drinking and reduced risk of heart disease. *Alcohol Research & Health, 23*(1), 15–23.
23. Lee, S. J., Sudore, R. L., Williams, B. A., Lindquist, K., Chen, H. L., & Covinsky, K. E. (2009). Functional limitations, socioeconomic status, and all-cause mortality in moderate alcohol drinkers. *Journal of the American Geriatric Society, 57*, 955–962.
24. Duncan, M. J., Kline, C. E., Vandelanotte, C., Sargent, C., Rogers, N. L., & Di Milia, L. (2014). Cross-sectional associations between multiple lifestyle behaviors and health-related quality of life in the 10,000 Steps cohort. *PLoS ONE, 9*(4), e94184.
25. Peel, N. M., McClure, R. J., & Bartlett, H. P. (2005). Behavioral determinants of healthy aging. *American Journal of Preventive Medicine, 28*(3), 298–304.
26. World Health Organization. (2010). *European status reports on alcohol and health*. http://www.euro.who.int/__data/assets/pdf_file/0004/128065/e94533.pdf. Accessed August 13, 2013.
27. González-Gross, M., Lebrón, M., & Marcos, A. (2000). Revisión bibliográfica sobre los efectos del consumo moderado de cerveza sobre la salud. Ed. Centro de Información cerveza y salud. Madrid.
28. Sánchez-Villegas, A., Irala, J., & Martínez-González, M. A. (2002). Dieta mediterránea y enfermedad cardiovascular: Resultados del estudio piloto del proyecto SUN [Mediterranean diet and cardiovascular disease: Results of the SUN pilot study]. *Revista de Medicina-Universidad de Navarra, 46*(3), 9–16.
29. Martínez, D., Eisenmann, J., Gómez, S., Veses, A., Marcos, A., & Veiga, O. (2010). Sedentarismo, adiposidad y factores de riesgo cardiovascular en adolescentes. Estudio AFINOS [Sedentarism, adiposity and cardiovascular risk factors in adolescents. The AFINOS study]. *Revista Española de Cardiología*, *63*(03), 277–285.
30. Ainsworth, B. E., Haskell, W. L., Herrmann, S. D., Meckes, N., Bassett, D. R, Jr, Tudor-Locke, C., et al. (2011). Compendium of physical activities: A second update of codes and MET values. *Medicinal Sciences in Sports and Exercise, 43*(8), 1575–1581.
31. Martínez-González, M. A., García-Arellano, A., Toledo, E., Salas-Salvadó, J., Buil-Cosiales, P., et al. (2012). A 14-item Mediterranean diet assessment tool and obesity indexes among high-risk subjects: The PREDIMED trial. *PLoS ONE, 7*(8), e43134. doi:10.1371/journal.pone.0043134.
32. Encuesta Nacional de Salud [Spanish National Health Survey]. (2011). *Ministry of Health, Spain*. http://www.msps.es.
33. Lugo, A., García, G., & Gómez, R. (2006). Confiabilidad del cuestionario de calidad de vida en salud SF-36 en Medellín, Colombia [Confiability of the health-related wuality of life questionnaire SF-36 in Medellín, Colombia]. *Revista de la Facultad Nacional de Salud Pública, 24*(2), 37–50.
34. Linting, M., & van der Kooij, A. (2012). Nonlinear principal components analysis with CATPCA: A tutorial. *Journal of Personality Assessment, 94*(1), 12–25.

35. Smothers, B., & Bertolucci, D. (2001). Alcohol consumption and health-promoting behavior in a US household sample: Leisure-time physical activity. *Journal of Studies on Alcohol, 62*(4), 467–476.
36. Barrett, D. H., Anda, R. F., Croft, J. B., Serdula, M. K., & Lane, M. J. (1995). The association between alcohol use and health behaviours related to the risk of cardiovascular disease: The South Carolina Cardiovascular Disease Prevention Project. *Journal of Studies on Alcohol, 56*(1), 9–15.
37. Bjurj, A. L., Wen, W., Gao, Y. T., Matthews, C. E., Yang, G., Li, H. L., et al. (2007). Patterns and correlates of physical activity: A crosssectional study in urban Chinese women. *BMC Public Health, 21*(7), 213.
38. French, M., Popovici, I., & Maclean, J. (2009). Do alcohol consumers exercise more? Findings from a National Survey. *American Journal of Health Promotion, 24*(1), 2–10.
39. Lima, M., Barros, M., César, C., Goldbaum, M., Carandina, L., & Alves, M. (2011). Health-related behavior and quality of life among the elderly: A population-based study. *Revista de Saúde Publica, 45*(3), 485–493.
40. Touvier, M., Druesne-Pecollo, N., Kesse-Guyot, E., Andreeva, V. A., Galan, P., Hercberg, S., & Latino-Martel, P. (2014). Demographic, socioeconomic, disease history, dietary and lifestyle cancer risk factors associated with alcohol consumption. *International Journal of Cancer, 134*(2), 445–459.
41. Guallar-Castillón, P., Santa-Olalla Peralta, P., Banegas, J. R., López, E., & Rodríguez-Artalejo, F. (2004). Physical activity and quality of life in older adults in Spain. *Medicina Clinica (Barcelona), 123*(16), 606–610.
42. Elizondo-Armendáriz, J. J., Guillén Grima, F., & Aguinaga Ontoso, I. (2005). Prevalencia de actividad física y su relación con variables sociodemográficas y estilos de vida en la población de 18 a 65 años de Pamplona [Prevalence of physical activity and its relationship with sociodemographic variables and lifestyles in the 18–65 year old population of Pamplona]. *Revista Española de Salud Pública, 79*, 559–567.
43. Palacios-Ceña, D., Alonso-Blanco, C., Jiménez-Garcia, R., Hernández-Barrera, V., Carrasco-Garrido, P., Pileño-Martinez, E., & Fernández-de-Las-Peñas, C. (2011). Time trends in leisure time physical activity and physical fitness in elderly people: 20 year follow up of the Spanish population national health survey (1987–2006). *BMC Public Health, 11*, 799.
44. Sun, F., Norman, I. J., & While, A. E. (2013). Physical activity in older people: A systematic review. *BMC Public Health, 6*(13), 449.
45. Ruidavets, J. B., Bataille, V., Dallongeville, J., et al. (2004). Alcohol intake and diet in France, the prominent role of lifestyle. *European Heart Journal, 25*, 1153–1162.
46. Kim, K., & Taylor, L. (2005). Factors associated with physical activity among older people—A population-based study. *Preventive Medicine, 40*, 33–40.
47. Merom, D., Bowles, H. R., & Bauman, A. (2009). Measuring walking for physical activity surveillance the effect of prompts and respondents' interpretation of walking in a leisure-time survey. *Journal of Physical Activity and Health, 6*, 81–88.
48. Strawbridge, W. J., Cohen, R. D., Shema, S. J., & Kaplan, G. A. (1996). Successful aging: Predictors and associated activities. *American Journal of Epidemiology, 144*, 135–141.
49. World Health Organization. (2010). *Global recommendations on physical activity for health*. http://whqlibdoc.who.int/publications/2010/9789241599979_eng.pdf. Accessed January 30, 2011.
50. Saito, I., Okamura, T., Fukuhara, S., Tanaka, T., Suzukamo, Y., Okayama, A., et al. (2005). A cross-sectional study of alcohol drinking and health-related quality of life among male workers in Japan. *Journal of Occupational Health, 47*(6), 496–503.
51. Chan, A., Von-Mühlenemail, D., Kritz-Silverstein, D., & Barrett-Connor, E. (2009). Regular alcohol consumption is associated with increasing quality of life and mood in older men and women: The Rancho Bernardo Study. *Maturitas, 62*(3), 294–300.
52. Byles, J., Young, A., Furuya, H., & Parkinson, L. (2006). A drink to healthy aging: The association between older women's use of alcohol and their health-related quality of life. *Journal of the American Geriatric Society, 54*, 1341–1347.
53. Rodgers, B., Korten, A., Jorm, A., Christensen, H., Henderson, S., & Jacomb, P. (2000). Risk factors for depression and anxiety in abstainers, moderate drinkers and heavy drinkers. *Addiction, 95*, 1833–1845.
54. Perrine, M., Mundt, J., Searles, J., & Lester, L. (1995). Validation of daily self-reported alcohol consumption using interactive voice response (IVR) technology. *Journal of Studies on Alcohol, 56*(5), 487–490.
55. Hu, E. A., Toledo, E., Diez-Espino, J., Estruch, R., Corella, D., Salas-Salvado, J., et al. (2013). Lifestyles and risk factors associated with adherence to the Mediterranean diet: A baseline assessment of the PREDIMED trial. *PLoS ONE, 8*(4), e60166.