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Fatores associados à Adesão ao Padrão Alimentar Mediterrânico numa amostra representativa de idosos Portugueses: resultados do projeto *Nutrition UP 65*

Adherence to the Mediterranean Dietary Pattern and associated factors among Portuguese older adults: results from the *Nutrition UP 65* cross-sectional study

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Resumo

Introdução A população Portuguesa está a envelhecer. A inadequação dos hábitos alimentares adotados é considerada a maior causa de anos perdidos prematuramente neste país. Assim, é importante estudar o Padrão Alimentar Mediterrânico (PAM), reportado como um modelo de saúde que permite um envelhecimento saudável.

Objetivo Avaliar quais os factores associados à adesão ao PAM na amostra de idosos portugueses do projeto *Nutrition UP 65*.

Desenho Estudo observacional de desenho transversal

População e métodos Foi analisada uma amostra nacional por *clusters* de 1407 individuos ≥ 65 anos. Os participantes foram classificados como aderindo ou não ao PAM através da versão portuguesa do questionário da prevenção com a Dieta Mediterrânica. A relação entre as características dos indivíduos e a adesão ao PAM foi analisada através de regressão logística.

Resultados O nível educacional foi o factor mais relacionado positivamente com a adesão ao PAM e o estado cívil e o Índice de Massa Corporal (IMC) estavam relacionados positivamente com a possibilidade do aumento da adesão ao PAM. Em contrapartida, os participantes que classificaram o seu estado de saúde como moderado e mau/muito mau ou que residiam na Madeira ou nos Açores tiveram menor possibilidade de aderir ao PAM em relação aos que a classificaram como boa/muito boa ou aos que residiam no Norte, respetivamente. Finalmente, participantes com valores superiores de perímetro geminal (PG) tiveram menor possibilidade de aderir ao PAM.

Conclusão Estes resultados permitem identificar grupos com baixa adesão ao PAM nomeadamente, indivíduos que residem na Madeira e nos Açores, indivíduos

que classificam o seu estado de saúde como moderado e mau/muito mau e aqueles que têm valores mais altos de PG.

Palavras Chave

Padrão Alimentar Mediterrânico, idosos, Portugal

Abstract

Introduction Portuguese population is ageing. The inadequacy of their food habits is considered the main factor responsible for years of prematurely lost life. Therefore it is important to study the Mediterranean Dietary Pattern (MDP), reported as a model of healthy eating for a successful ageing.

Objective To evaluate adherence to the MDP and its associated factors in Portuguese older adults from the *Nutrition UP 65* study.

Design Cross-sectional observational study

Population and methods A national cluster sample of 1407 Portuguese individuals ≥65 years old was analised. Participants were divided by adherence or not adherence to MDP that were evaluated with the Portuguese version of the Prevention with Mediterranean Diet tool. The association between individuals' characteristics and the adherence to this pattern was analysed through logistic regression analysis.

Results Education level was the factor more positivly related with adherence to the MDP. Furthermore, marital status and body mass índex (BMI) had markedly positive increased odds of adherence to the MDP. Otherwise, in this study, participants who rated their health as moderate and as bad/very bad had less possibility of adherence to the MDP than those rated their health as good/very good. Subjects who lived in Madeira and Azores had less possibility of adherence to the MDP than those who lived in the North. Participants with higher levels of calf circumference (CC) had less possibility of adherence to the MDP.

Conclusions The results of this study enables the identification of groups with lower adherence to the MDP: individuals living in Madeira and Azores, rating their heath as moderate and as bad/very bad and having higher levels of CC.

Key words

Mediterranean Dietary Pattern, older adults, Portugal

Acronyms

BMI – Body mass índex

CC – Calf Circumference

CI – Confidence interval

Exp ß – Exponential of the Regression Coefficent

MDP – Mediterranean Dietary Pattern

MAMC – Midarm Muscle Circumference

MNA-SF – Mini Nutritional Assessment Short Form

MMSE – Mini Mental State Examination

NUTS II – Nomenclature of Territorial Units for Statistical purposes

OR – Odds Ratio

PREDIMED – *Prevencíon con la Dieta Mediterránea*

WC – Waist Circumference

WHtR – Waist to height Circumference

WHO – World Health Organization

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1. Introduction

Longevity is a very complex phenomenon, because many environmental, behavioral, socio-demographic and dietary factors influence the physiological pathways of aging and life-expectancy.[1] In developed societies, the aging is one of the most relevant features of the second half of twentieth century[2]. In these older people are defined as 65 or more years old.[3] Throught out the world populations are ageing[4] and the Portuguese population faces a similar trend, mostly as a consequence of declining fertility and mortality in later life.[5] In Portugal, life expectancy at birth in 2015 was 81.3 years while in 2000 was 76,8 and in 1985 was 73 years old.[6] Due to this increased longevity, a relevant consequence must be considered: increases in health costs associated with the need to continue to improve the quality of life[7] of this vulnerable group.

Health promotion activities, including changes in dietary habits, can contribute to increase life expectancy and to better health and can be incorporated into routine care for all older adults.[8] According to the World Health Organization (WHO), 60% of factors associated with human health and quality of life are correlated to lifestyle.[9] Scientific evidence supports that a healthy nutrition is essencial to health, and is considered one of the major determinants of successful aging.[1, 2, 10]

Most food and nutrition recommendations is based on the investigation of the association between single nutrients or foods and the risk of chronic diseases. This is fraught with problems due to the complexity of people´s diet, the possible correlations in nutrients intake and the possible interactions in the effect of several food/nutrients. It is widely accepted that individuals do not consume isolated

nutrients or food but complex combinations of foods consisting of several nutrients and non-nutrients. For this reason, dietary pattern analysis has been suggested to evaluate the relationships between dietary patterns and health outcomes.[5, 10-13]

The Mediterranean Dietary Pattern (MDP) has been widely reported to be a model of healthy eating for its contribution to a favourable health status, a better biochemical profile and a better quality of life.[14-18] It´s consensual that the definition of MDP is not universal, partly because this dietary pattern is fairly heterogeneous among Mediterranean countries and also within the countries themselves.[19] However, the traditional MDP is typically based on a high ratio of monounsaturated to saturated dietary lipds (mainly olive oil); high consumption of vegetables, fruit, pulses, nuts, non refined cereals (including bread); low consumption of meat and meat products; moderate consumption of milk and dairy products; low salt consumption; use of aromatic herbs; water as the mainly bevereage and moderate consumption of alcohol, specially wine (mainly in main meals). Fish intake is also included in this pattern, but is dependent on the proximity to the sea.[16, 17, 20] Meals made with the whole family around the table are reported in the literature, based on regional products and on preparations that protect nutrients such as soups and stews. The well-know favourable health effects of a MDP indicates the high quality of this dietary pattern. In this context it is not surprising that the consequence of the adherence to the MDP is a healthy pattern of nutrients intake and decreased cardiometabolic risk.[21]

Prevención con la Dieta Mediterránea (PREDIMED) study is a primary prevention nutrition-intervention trial. Baseline adherence to the MDP was measured by the MEDAS (14-point Mediterranean Diet Adherence Screener), an adaptation of a previously validated 9-item index.[22] The 14-item screener includes

5 additional items that are critical to an assessment of adherence to the traditional MDP. The final PREDIMED score ranged from 0 to 14. The validation study inclued 7146 spanish participants who were aged 55-80 years old. [14, 23]

The inadequacy of food habits is considered the main factor responsible for the years of prematurely lost life in Portugal.[24] Regarding *Mediterranean Adequacy Index*, this country showed adherence to the MDP in the period of 1961-1968 but after that this index has been decreasing.[25] According to recent Portuguese data, 30.8% of the Portuguese population have a low adherence to the MDP, and 43.7% of the elderly have a high adherence to it.[26] Furthermore, in relation to the Portuguese Food Wheel,[27] the population consumes 10% more meat, fish and eggs and 2% more dairy products. On top of that they consume 12% less vegetables, non refined cereals and tubers, 6% less fruit and 3% less pulses.[26] Mediterranean countries, such as Portugal, are suffering from a process of westernisation, with changes in cultural, social, economic and political factors, largely due to integration into the European Center Area and the globalization of food markets, which are likely to have a heavy influence on changes in food habits.[19, 20, 28]

The *Nutrition UP 65* project was designed with the aim of identifying and reducing nutritional inequalities among older adults in Portugal.[29] Examination and monitoring of the dietary characteristics of older adults is important in identifying subgroups at risk of malnutrition or disease.[12, 13] To our knowledge, no previous study in Portugal has assessed the association between the adherence of MDP and the associeted factors among portuguese older adults.

2. Aim

The aim of this study was to evaluate the adherence of MDP and its associated factors in a nationally representative sample of Portuguese older aldults from the *Nutrition UP 65* sudy.

3. Population and Methods

Study design and sampling

A cross-sectional observational study was conducted in Portugal in a sample of 1500 Portuguese individuals ≥ 65 years old. A random, stratified and clustered sampling method was applied using data from Census 2011, regarding sex, age, educational level and regional area defined in the Nomenclature of Territorial Units for Statistical purposes (NUTS II) to achieve a nationally representative sample of Portuguese older adults. Data was collected between December 2015 and June 2016.

Individuals were considered to be Portuguese if they had Portuguese nationality and if their current tax residence was in Portugal, and were eligible to participate in this study if they were aged ≥ 65 years old. Potential participants were contacted by the interviewer, who provided information about the study purposes and the methodology and invited them to participate.

Detailed information about the *Nutrition UP 6*5 project methodology were previously published. [29]

Ethics

This research was conducted according to the guidelines established by the Declaration of Helsinki and the study protocol was approved by the Ethics Committee of the Department of “Ciências Sociais e Saúde” (Social Sciences and Health) from the “Faculdade de Medicina da Universidade do Porto” (PCEDCSS –

FMUP 15/2015) and by the Portuguese National Commission of Data Protection (9427/2015). All participants or two representatives per participant, were asked to read and to sign a duplicated 'informed consent' form.

Data collection

Demographic data, lifestyle, anthropometric measurements, clinical and nutritional status were collected using a structured questionnaire.

Sociodemographic data included information on sex, date of birth, residence geographical area, residence type, marital status, education and household income. The regional areas used are defined in NUTS II: Alentejo, Algarve, Azores, Lisbon Metropolitan Area, Centre, Madeira and North.[30] Education level was determined by the number of school years completed. Marital status was categorised as single, divorced, widowed, married or in a common-law marriage. Residence geographical area was defined as living at home or in an institution (nursing home).

Lifestyles data included information from smoking habits. Participants were asked if they were smokers or non-smokers.

Clinical data included subjects' self-perception of health status and congnitve performance. Subjects' self-perception of health status was categorised as very good, good, moderate, bad or very bad by the participants' classification of their own health. Cognitive performance was assessed by the Portuguese version of the Mini Mental State Examination (MMSE).[31, 32] Nutritional status was evaluated by the Portuguese version of Mini-Nutritional Assessment-Short Form (MNA-SF). [33, 34]

Anthropometric measurements were collected following standard procedures.[35] Standing height was obtained with a calibrated stadiometer (Seca 213, Germany) with 0,1cm resolution. For participants with visible kyphosis or when it was impossible to measure standing height due to participant's paralyses or due

to mobility or balance limitations, height was obtained indirectly from non-dominant hand length (in centimetres), measured with a calibrated paquimeter (Fervi Equipment, Italy), with 0,1 cm resolution.[36] Body weight (in kilograms) was measured with a calibrated portable electronic scale (Seca 803) with 0,1kg resolution. When it was not possible to weigh a patient, for the same reasons that standing height measurement was not possible, body weight was estimed from miduper arm and calf circumferences (CC).[37-40] Miduper arm, waist circumferences (WC) and CC were measured with a metal tape from Lufkin (Sparks, Maryland, USA), with 0,1cm resolution. Body mass índex (BMI) was calculated using the standard formula: [body weight (kg)/stature^2 (m)]. Waist to height ratio (WHtR) was calculated using the standard formula: [WC (cm)/ height (cm)]. [41, 42] Midarm muscle circumference (MAMC) was measured by the standard formula:[midarm circumference – (3,14 x tríceps skinfold thickness)]. [40]

Adherence to the MDP was evaluated with the Portuguese version of the Prevention with Mediterranean Diet tool[11] which consists of 14 questions, each scored with zero or one point. The criteria for assigning one point is established and a final score ≥ 10 points indicates a good adherence to the MDP.[11, 23]

Statistical analysis

Categorical variables were reported as frequencies. The normality of the distribution regarding quantitative variables was evaluated through Kolmogorov-Smirnov test, and results were described as median and interquartile distance, considering that variables presented non-normal distribution.

In order to homogenize the sample by categories. Age was categorized into: 65-69 years, 70-74 years, 75-79 years and ≥ 80 years. Furthermore, for the same reason education was categorized into four categories: 0 years of schooling,

between 1 to 3 years of schooling, 4 years of schooling (first cycle) and ≥ 5 years of schooling [which included second cycle (6 years of schooling), third cycle (9 years of schooling), secondary (12 years of schooling), post-secundary (>12 years of schooling but no higher educaction) and higher education]. Household income was summarised using the following cutoffs: ≤ €499, €500-999 and ≥ €1000. Around half of participants (50.6%) did not know or prefered not to declare their income and they were allocated into a separate category. The self-perception of health status categories used were three: very good/good, moderate, and bad/very bad.

Because of the small number of "at risk of undernutrition" categorie, MNA-SF was dichotomised into two categories: well-nourished and undernourished/at risk of undernutrition. For the same reason (small number of participants in underweight categories), participants were grouped according to BMI in three categories: normal (18.50-24.99 kg/m^2), preobese (25.00-29.99 kg/m^2) and obese (≥30.00 kg/m^2). [43]

Regarding to the MDP, participants were compared in several sociodemographic, lifestyle, clinical and nutritional characteristics using Mann-Whithney test for continuous variables or Person χ^2 test for categorical variables.

Before conducting the regression procedures, 17 missing data were deleted. From the inicial population 3 participants who were underweight and 73 with cognitive impairment who answered the questionnaire were removed. Consequently data from 1407 participants was analysed. Bivariable logistical regresssion models were conducted to identify the independent factors associated with the adherence to the MDP. Exp ß and respective 95% CIs were calculated. The following characteristics were considered into the procedure: sex (dichotomous), age (categorical), residence geographical area, (categorical), education (categorical), marital status (dichotomous), household income (categorical), self-perception of

health (categorical), BMI (categorical), MNA-SF (dichotomous), WC (continuous), WHtR (continuous), and CC (continuous).

Results were considered significant when p<0,05. Statistical analysis were conducted using the Software Package for Social Sciences for Windows V.23.0.

4. Results

The characteristics of the 1407 subjects, with a median age of 74 years old, according to adherence to the MDP are present in attachment A. Within this sample 43% of participants adhered to the MDP (n=609) and 57% did not (n=798).

Regarding sample distribution through the national territory, individuals living in the North, Centre and Lisbon Metropolitan Area were more likely to follow MDP (32.3%, 27.9% and 24.3% respectively) and those who lived in Madeira and Azores had the lower % of adherence (1.0% and 0.5%, respectively). As for education level, individuals who have 4 years of schooling followed more MDP (51.1%). In relation to marital status, people who are married or live in common-law marriege had higher proportions of adherence to the MDP (54.7%) than those who are single, divorced or widowed. With reference to self perception of health status, participants who rated their health as moderate adhere more to MDP (45.8%). According to nutritional status, people who are not undernourished have higher levels of adherence to the MDP (87.5%). In addition, concerning BMI, pre-obese and obese participants were more likely to have a higher adherence to the MDP (49.1% and 35.5% respectively). In this sample, people who do not adhere to the MDP had higher WC, CC and WHtR median. (attachment A)

Logistical regression are present in attachment B. ´

Using bivariable unadjusted analysis, participants aged ≥ 80 years old were associated with less 30.8% of possibility of adherence to the MDP than those aged

65-69 years old. After conducting an adjusted logistical analysis, this variable lost statistical significance. Regarding sample distribution through the national territory, subjets living in Madeira and Azores had less possibility of adherence to the MDP than subjets living in the North (less 66.9% and 76.6% respetively). After the adjusted analysis, these subjects were associated with higher and less odds than in unadjusted analysis for Madeira and Azores respectively (OR=0.356 and 95%CI: 0.139;0.912 and OR=0.187 and 95%CI: 0.052;0.675 respectively).

As far as education level is concerned, subjects with 4 years or 5 or more years of schooling had more 64.3% and 157% possibility of adherence to the MDP respectively than those with no formal years of education. After the adjusted analysis, only participants with 5 or more years of schooling preserved statistical significance (OR=1.995 and 95%CI: 1,267;3.141). According to marital status, individuals who were married or lived in common-law marriage had 60.9% more probablility of adherence to the MDP than those who are single, divorced or widowed. After the adjusted analysis, these people were associated with lower odds than in adjusted analysis (OR=1.494 and 95%CI: 1,161;1,921). In relation to household income, participants with an income ≥1000€ had 80.9% more probablility of adherence to the MDP than those with an income ≤499€. After adjusted analysis, this variable lost statistical significance.

Concerning self perception of health status, subjects who rated their health as moderate or as bad/very bad had less possibility of adherence to the MDP than those who rated their health as very good/good (38.8% and 46.4% respectively). After the adjusted analysis, participants were associated with less odds (OR=0.640 and 95%CI: 0.497;0.824 and OR=0.629 and 95%CI: 0.447;0.885, respectively). In relation to nutritional status, individuals who were at risk of nutrition or undernutrition

had less 30% possibility of adherence to the MDP than individuals who were not undernourished. After conducting an adjusted logistical analysis, this variable lost statistical significance.

In bivariable unadjusted analysis, the variable BMI did not have statistical significance. After the adjusted analysis, preobese and obese participants had more possibility of adherence to the MDP than those with normal range (68.3% and 98.2% respectively). In relation to WC, WHtR and CC, participants with higher value had less possilibity of adherence to the MDP (Exp ß=0.987 and 95%CI: 0.978;0.996, Exp ß =0.071 and 95%CI: 0.017;0.296, Exp ß =0.956 and 95%CI; 0.928;0.985, respectively). After the adjusted analysis, only the variable CC preserved statistical significance (Exp ß =0.929 and 95%CI: 0.889;0.971).

5. Discussion

The aim of this study was to evaluate the adherence of MDP and its associated factors in a national representative sample. In the present study, education level was the factor more positive associated with adherence to the MDP. Furthermore, marital status and BMI had markedly positive odds of adherence to this pattern. On the other hand, in this study, participants who rated their health as moderate and as bad/very bad or who lived in Madeira and Azores had less possibility of adherence to the MDP than those who rated their health as very good/good or who lived in the North respectively. Individuals with higher values of CC had less possibility of adherence to the MDP.

In the present study, smoking habits, cognitive performance, WC and WHtR (categoricals) were not related to adherence to the MDP (attachment A). Regarding smoking habits, apparently there is an inverse association between smoking habits and adherence to the MDP.[2, 14, 44] A possible explanation for the result of this study

is that we only have information on how many older people smoke and do not have on how many have smoked, and lifestyles change a lot in the elderly due to physical and health constraints.[45, 46] Concerning cognitive performance, a recent review shows that MDP has been associated with lower inflammatory and oxidative load and has been inversely associated with cognitive decline.[47-51] Our interpretation is that the small sample of individuals with cognitive impairment (n=26) may have misrepresented the results. All of this should be taken into account when generalising the results of the present study into other samples.

There are prevelence studies in older adults population which revealed that WC and WHtR have a strong inverse association with adherence to the MDP.[14, 23] Althought, in this study, this does not happen. These variables in categories were not associated with adherence to the MDP and the continuous variable did not have statistical significance in the adjusted model. Our interpretation is that the *Nutrition UP 65* project used the cut-offs values specified for adult population[41, 42, 52] that do not adjust to age-related physiological changes. However, one of the features of human age is the change in body composition that occurs with advancing age. In general, there is a decrease in lean body mass and an increase in the proportion of body fat. This increase in fat is not always visually evident because of the higher proportion of fat deposited in abdominal area.[53] One of the significant limitation of anthropometry is the lack of appropriate standards to compare results with. It is our opinion that it is therefore necessary to promote more investigation to understand the cut-offs adapted to older adults. The use of CC has been recommended as a more sensitive measure of the loss of total body muscle mass in older adults than MAMC.[7] In this study, participants with higher values of CC had less possibility of

adherence to the MDP. The WHO has recommended that CC should be included as a measure of nutritional status in older adults.[39, 54]

Obesity is a growing problem around the world. Moreover, the prevelence of obesity is higher in Mediterranean countries than in Nordic countries.[55] According to recent Portuguese data, 22.2% of the Portuguese population are obese and 39,2% of the older adults have BMI ≥ 30 kg/m^2. A study in Spain including 351 subjects over 60 years old reported that adherence to the MDP was associated with a higher IMC,[44] in agreement with the present study. In older adults, low BMI is associated with a decrease in functional abilities and increased mortality.[46, 56, 57] A recent study in 4259 individuals of the PREDIMED trial suggests that the effects of dietary energy density on weight change depend on the particular high dense food consumed, in a context of a specific dietary pattern.[58] In fact, if these energy dense foods are mainly sources of mono and polyunsaturated fat, then this diet may lead to body weight loss.[58] Furthermore, similar findings can be seen in several studies in older adults reporting an inverse association between BMI and adherence to the MDP.[14, 23] According to recent Portuguese data, although 43.7% of the Portuguese older people have a high adherence to the MDP, it should be noted that foods like biscuits, cakes, pastries, savory snacks and pizzas, soft drinks and alcoholic drinks, not represented in the Portuguese Food Wheel,[27] constitute about 21% of the Portuguese food. The average consumption of alcoholic beverege is higher in the elderly (298g/day) than in adults (195g/day).[26] Therefore, we can say that despite the good adherence to this pattern from older adults, there are still several points that can be improved.

Living in Madeira and Azores reduced the odds of adherence to the MDP. Indeed, similiar findings have been obtained showing that Azores had the lowest

adherence to the MDP in Portugal.[26] Nevertheless our results could be misrepresented by the small sample size (only 6.6% of the sample are from islands) in relation to the reference region in our adjusted model (North – 65% of the sample).

Concerning education level, it has been demonstrated that education is the strongest determinant of socioeconomic differences in food habits.[59, 60] In the present study having 5 or more years of schooling was the most impacting fact regarding the adherence to the MDP. Many studies have been obtained similar findings – adherence to the MDP directly associated with higher educational levels.[2, 23]

Regarding marital status, in the present study individuals who were married or lived in common-law marriage were more likely to adhere to the MDP than those who are single, divorced or widowed. This association may be explained by the fact that psychosocial factors, such as the loss of a spouse and social isolation, may lead to qualitative and quantitative changes in food ingestion through loss of appetite, refusal to eat or lack of motivation to prepare food, thus reducing the consumption of energy and, consequently leading to a higher risk of poor nutritional status.[2, 61, 62]

According to household income, in the adjusted model, this variable did not have statistical significance. This is probably explained by the fact that 50.6% of the participants did not know or prefered not to declare their income, which maybe had misrepresented the results. What is prevalent in most of studies, is that all have shown a linear inverse relationship between food cost and adherence to eating patterns.[63] By the end of the 2000s, the economic situation in many European countries started to deteriorate and there is evidence that many behaviours have changed during the past few years, leading people to worse health.[59] In addition,

the identification of the cost as determinant of food choice distinguishes us from the other countries.[2]

Regarding self perception of health status, in Portugal, the prevalence of adherence to the MDP is substantially higher in individuals with better health self perception, particularly in older adults (49.3%).[26] Indeed similar findings have been obtained in this study. In the present study, nutrition status did not have statistical significance in the adjusted model. Knowing that inadequate nutritional intake is the predominant cause of undernutrition in old age,[5, 64] our interpretation for our results is that there are many older people undernourished who did not have access to the questionnaire due to their conditions, which may have resulted in a better-than-average health and nutrition sample selection. Besides, severely malnourished are easier to identify than those who are mildly or moderately because the latter do not manifest overt signs of malnutrition. Therefore, subclinical and marginal nutritional deficits might go unnoticed or undocummented.[53] In order to avoid defeciency in specific nutrients, it is important that older adults eat foods that have a high nutrient density.[10]

As any investigation, the present study has some limitations. One possible limitation is the strict inclusion/exclusion criteria, which may possible have resulted in the selection of a sample with better-than-avarege health and nutritional status. Furthermore, the Mediterranean diet score is based on a traditional Mediterranean reference pattern defined *a priori*, which does not consider the overall correlation between foods.[49, 65] On top of that the PREDIMED score is not valideted specifically for the Portuguese population which can be a source of error. In addition, causality relationships remain often controversial. For this, more study dose response effects and with appropriate follow up and assessing midlife exposure need to be designed.

The main strengths of this study is the large number of studied individuals, the population-based recruitment of a nationally representative sample of Portuguese older adults. Furthermore, to our knowledge this is the first work to describe the adherence to the MDP and its associated factors in a nationally representative sample of older adults.

6. Conclusion

The present study illustrates the importance of a lifestyle approach in which the MDP is included. Individuals living in Madeira and Azores, rating their health as moderate and as bad/very bad and having higher values of CC were less likely to adhere to the MDP. As a consequence, in these groups it is necessary to reinforce the promotion of older adults' health, well-being and the quality of life through healthy patterns.

Inadequate diet might represent a relevant, modifiable risk factor for functional decline and the transition to disability. The findings of this research will have significant relevance to public health in Portugal and reinforce the need to establish guidelines for some anthropometrical itens for older adults. Food and nutrition more than a health factor are a determinant of quality of life, which should be valorized in older adults. We should never forget that in some way we really are what we eat.

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Attachment A

Baseline sociodemographic, clinical, and nutritional characteristics of 1407 older Portuguese ≥65 years old participating in a cross-sectional observationed study according adherence to the Mediterranean Dieatary Pattern (MDP) #			
	Adherence to MDP (PREDIMED score ≥10 points) n=609	**Not adherence to MDP (PREDIMED score <10 points) n=798**	**P**
Sex, n (%)			
Women	341 (56%)	468 (58,6%)	0,328*
Men	268 (44%)	330 (41,4%)	
Age, years, n (%)			
65-69	184 (30,2%)	213 (26,7%)	0.078*
70-74	158 (25,9%)	203 (25,4%)	
75-79	136 (22,3%)	163 (20,4%)	
≥80	131 (21,5%)	219 (27,4%)	
Regional area, n (%)			
North	197 (32,3%)	261 (32,7%)	**0,012***
Centre	170 (27,9%)	189 (23,7%)	
Lisbon Metropolitan Area	148 (24,3%)	206 (25,8%)	
Alentejo	59 (9,7%)	72 (9,0%)	
Algarve	26 (4,3%)	29 (3,6%)	
Madeira	6 (1,0%)	24 (3,0%)	
Azores	3 (0,5%)	17 (2,1%)	
Education, years, n (%)			
0	62 (10.2%)	132 (16.5%)	**<0,001***
1-3	104 (17.1%)	154 (19.3%)	
4	311 (51.1%)	403 (50.5%)	
≥ 5	132 (21.7%)	109 (13.7%)	
Residence, n (%)			
Home	582 (95.6%)	764 (95.7%)	0.895*
Institution	27 (4.4%)	34 (4.3%)	
Marital status, n (%)			
Single, divorced or widowed	276 (45.3%)	456 (57.1%)	**<0,001***
Married or common-law marriage	333 (54.7%)	342 (42.9%)	
Household income, €, n (%)			
≤ 499	94 (15.4%)	136 (17.0%)	**0,001***
500-999	139 (22.8%)	155 (19.4%)	
≥ 1000	95 (15.6%)	76 (9.5%)	
Does not know or does not declare	281 (46.1%)	431 (54%)	
Cognitive performence (MNSE), n (%)			

Normal	599 (98.4%)	782 (98.0%)	0.692*
Impairment	10 (1.6%)	16 (2.0%)	
Self perception of health status, n (%)			
Very good/good	235 (38.6%)	216 (27.1%)	**<0,001***
Moderate	279 (45.8%)	419 (52.5%)	
Bad/very bad	95 (15.6%)	163 (20.4%)	
Smoking habits, n (%)			
No	584 (95.9%)	757 (94.9%)	0.377*
Yes	25 (4.1%)	41 (5.1%)	
Nutritional status (MNA-SF), n (%)			
Not undernourished	533 (87.5%)	663 (83.1%)	**0.024***
Risk of undernutrition and undernutrition	76 (12.5%)	135 (16.9%)	
Body mass índex, kg/m^2, n (%)			
Normal range (18.5-24.99 kg/m^2)	94 (15.4%)	131 (16.4%)	**0.018***
Preobese (25.00-29,99 kg/m^2)	299 (49.1%)	333 (41.7%)	
Obese (≥30.00 kg/m^2)	216 (35.5%)	334 (41.9%)	
Waist circumference, cm, n (%)			
No risk	82 (13.5%)	91 (11.4%)	0.103*
Hight risk (women>80, men>94)	141 (23.2%)	158 (19.8%)	
Very high risk (women>88, men>102)	386 (63.4%)	549 (68.8%)	
Waist circumference, median (IQR), cm	98 (14.5)	101 (16.0)	**0.001ł**
Waist to height ratio, n (%)			
<0,5	9 (1.5%)	19 (2.4%)	0.253*
≥0,5	600 (98.5%)	779 (97.6%)	
Waist to height ratio, median (IQR)	0.623 (0.10)	0.637 (0.10)	**<0.001ł**
Calf circumference, cm, n (%)			
Normal (≥31)	568 (93.3%)	743 (93.1%)	0.253*
Lower (<31)	41 (6.7%)	55 (6.9%)	
Calf circumference, median (IQR), cm	35 (4.5)	36 (4.3)	**0.003ł**
Mid arm muscle circumference, cm, n (%)			

Normal (women>19.2, men>21.1)	524 (86.0%)	704 (88.2%)	0.154*
Lower (women≤19.2, men≤21.1)	83 (13,6%)	94 (11.8%)	
Without TCT	2 (003%)	0 (0.0%)	
Mid arm muscle circumference, median (IQR), cm	31 (4.3)	31 (4.9)	0.277ɬ

#Values may not add up 100.0% due to roding up.

*χ^2 test and Exact Fishers test.

ɬ Mann-Whithney test.

MMSE, Mini Mental State Examination; MNA-SF. Mini Nutritional Assessment

– Short-Form

Attachment B

Factors associated with adherence to a Mediterranean Dietary Pattern by bivariable logistic regression for 1407 older Portuguese ≥65 years old participating in a cross-sectional observational study				
	Crude Exp ß (95%CI)	**P**	**Adjusted Exp ß (95% CI)**	**p**
Sex				
Women	1	-	1	-
Men	1.115 (0.901-1.379)	0,319	0.820 (0.582-1.154)	0.255
Age, years				
65-69	1	-	1	-
70-74	0.901 (0.676-1.200)	0.476	0.971 (0.718-1.314)	0.850
75-79	0.966 (0.715-1.305)	0.821	1.226 (0.884-1.701)	0.221
≥80	**0.692 (0.517-0.928)**	**0.014**	0.984 (0.703-1.376)	0.923
Regional area				
North	1	-	1	-
Centre	1.192 (0.903-1.573)	0.216	1.272 (0.949-1.706)	0.108
Lisbon Metropolitan Area	0.952 (0.719-1.260)	0.730	0.762 (0.564-1.030)	0.078
Alentejo	1.086 (0.735-1.605)	0.680	1.038 (0.691-1.560)	0.856
Algarve	1.188 (0.678-2.081)	0.547	1.362 (0.749-2.477)	0.310
Madeira	**0.331 (0.133-0.826)**	**0.018**	**0.356 (0.139-0.912)**	**0.031**
Azores	**0.234 (0.068-0.809)**	**0.022**	**0.187 (0.052-0.675)**	**0.010**
Education, years				
0	1	-	1	-
1-3	1.438 (0.972-2.126)	0.069	1.318 (0.871-1.996)	0.192
4	**1.643 (1.174-2.299)**	**0.004**	1.430 (0.989-2.067)	0.057
≥ 5	**2.578 (1.738-3.824)**	**<0.001**	**1.995 (1.267-3.141)**	**0.003**
Marital status				
Single, divorced or widowed	1	-	1	-

Married or common-law marriage	**1.609 (1.301-1.989)**	**<0.001**	**1.494 (1.161-1.921)**	**0.002**
Household income, €				
≤499	1	-	1	-
500-999	1.297 (0.916-1.839)	0.143	1.070 (0.739-1.551)	0.719
≥1000	**1.809 (1.212-2.698)**	**0.004**	1.178 (0.751-1.847)	0.475
Does not know or does not declare	0.943 (0.697-1.277)	0.705	0.835 (0.603-1.158)	0.280
Self perception of health status				
Very good/good	1	-	1	-
Moderate	**0.612 (0.482-0.777)**	**<0.001**	**0.640 (0.497-0.824)**	**0.001**
Bad/very bad	**0.536 (0.392-0.773)**	**<0.001**	0.629 (0.447-0.885)	**0.008**
Nutritional status (MNA-SF), n (%)				
Not undernourished	1	-	1	-
Risk of undernutrition and undernutrition	**0.700 (0.517-0.948)**	**0.021**	0.774 (0.558-1.074)	0.125
Body mass índex				
Normal range (18.5-24.99 kg/m^2)	1	-	1	-
Preobese (25.00-29.99 kg/m^2)	1.251 (0.920-1.702)	0.153	**1.683 (1.159-2.445)**	**0.006**
Obese (≥30.00 kg/m^2)	0.901 (0.657-1.235)	0.518.	**1.982 (1.159-3.390)**	**0.012**
Waist circumference, cm				
	0.987 (0.978-0.996)	**0.004**	1.013 (0.982-1.046)	0.413
Waist to height ratio				
	0.071 (0.017-0.296)	**<0.001**	0.017 (0.000-2.071)	0.096
Calf circumference, cm				
	0.956 (0.928-0.985)	**0.003**	**0.929 (0.889-0.971)**	**0.001**