



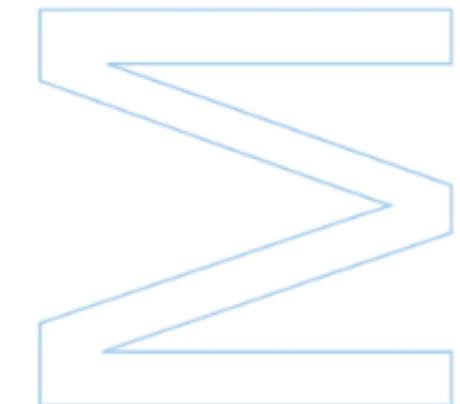
The relationship between health self-perception, food consumption and nutritional status among Portuguese older adults.

Ana Margarida Moniz Babo

Dissertação de Mestrado apresentada à Faculdade de Ciências da Universidade do Porto e Faculdade de Ciências da Nutrição e Alimentação da Universidade do Porto

Mestrado em Ciências do Consumo e Nutrição

2018



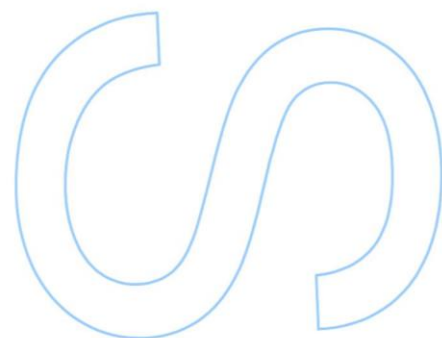
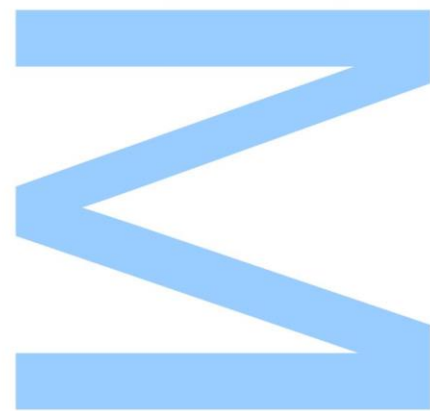
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Mestrado em Ciências do Consumo e Nutrição
Departamento de Geociências, Ambiente e Ordenamento do Território
2018

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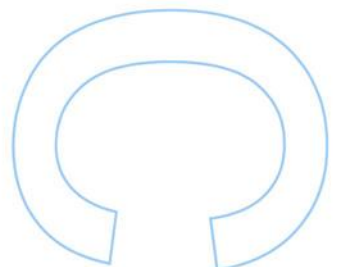
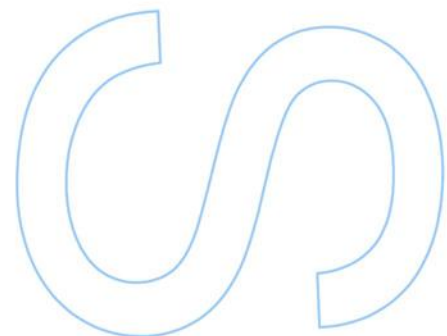
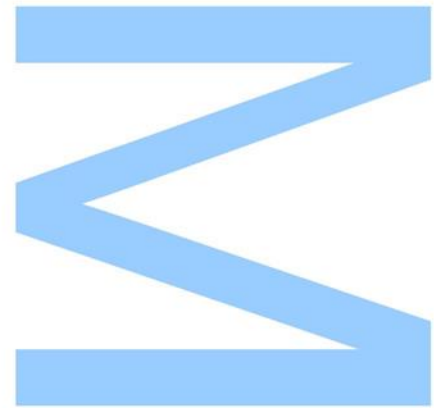


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Todas as correções determinadas pelo júri, e só essas, foram efetuadas.

O Presidente do Júri,

Porto, ____/____/____



“One must always be careful of books and what is inside them, for words have the power to change us.”

-Cassandra Clare

Agradecimentos

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Resumo

Em Portugal, tal como na União Europeia, as pessoas com mais de 65 anos constituem o segmento populacional com a maior taxa de crescimento durante as próximas décadas. Tendo em consideração que o envelhecimento saudável constitui um desafio, a relação entre a auto-perceção de saúde, o consumo alimentar e o estado nutricional permitirá compreender os fatores que determinam e influenciam a perceção da saúde dos idosos. Este estudo utiliza dados do projeto Pronutrisenior. Foram avaliados 459 idosos (com idade igual ou superior a 65 anos), quanto às características sociodemográficas, família e rede social, perceção geral da saúde, atividades da vida diária (AVD), caracterização clínica, inquérito alimentar às 24 horas anteriores e hábitos alimentares; O risco de desnutrição foi avaliado pelo Mini Nutritional Assessment (MNA), foi igualmente avaliada, a qualidade de vida relacionada com a alimentação e foram colhidos dados antropométricos. Quase metade dos participantes apresentou uma auto-perceção de saúde positiva, sendo que os homens apresentaram melhor auto-perceção de saúde (Mdn = 4) que as mulheres (Mdn = 3), $p = 0,003$. O MNA mostrou que 1,1% dos casos apresentavam desnutrição e que 25,9% dos casos estavam em risco de desnutrição. Os hábitos alimentares dos idosos demonstraram que apenas 8,5% faziam três refeições completas por dia, a amostra apresentava, em média, sobrepeso. O maior preditor da auto-perceção de saúde foi o estado nutricional, mas a independência na realização de compras teve maior impacto sobre como os idosos se comparavam a outros da mesma idade. Dada a importância destes resultados, as intervenções devem ser focadas em fatores como estado nutricional, independências nas AVD, qualidade de vida relacionada com a alimentação e medicação, de forma a modificar a auto-perceção de saúde negativa e as atitudes em relação ao envelhecimento e à saúde em geral. Estas mudanças podem facilitar, não só uma adaptação bem-sucedida ao envelhecimento, mas também maximizar todos os aspetos positivos da vida dos idosos.

Palavras-chave Auto-perceção da saúde, Atividades da vida diária, Portugal, Cuidados de saúde, idosos, não institucionalizados

Abstract

In Portugal, as in the European Union, people aged 65 and above will be the populational group with the highest growth rate of the next decades. Since healthy ageing constitutes a challenge, the relationship between health self-perception (HSP), food consumption and nutritional status will allow an understanding of which factors influence and determine the perception of health among older adults. This study uses data from the Pronutrisenior project. A total of 459 older adults (age 65 and above) were assessed regarding: Socio-demographic characteristics; Family and social network; HSP; Activities of Daily Living (ADL); Clinical characterisation, 24-hour recall and food habits; Nutritional status was evaluated by the Mini Nutritional Assessment (MNA), Satisfaction with Food-Related Life Scale (SWFoL) and anthropometry. Almost half of the respondents had a positive HSP, that was higher in men (Mdn=4) than women (Mdn=3, $p = 0.003$). MNA showed that 1,1% were malnourished, and 25,9% were at risk of malnutrition. The food habits of older adults have shown that only 8,5% did three full meals per day and the sample was classified as overweight. The most significant predictor of HSP was nutritional status, but independence in shopping had the largest impact on how they compared to other people of the same age. Interventions need to focus on factors like nutritional status, independency on ADL, SWFoL, medication and utilize them to modify the negative HSP and attitudes towards ageing and health. These changes may facilitate, not only a successful adaptation to the ageing process but also maximize the positive aspects of old age.

Keywords: Health Self-perception, Activities of Daily Living, Portugal, Healthcare, Older adults, non-institutionalised

Table of contents

Agradecimentos	I
Resumo e Palavras-chave	II
Abstract and Keywords	III
List of tables	V
List of Abbreviations	VI
Introduction	1
Theoretical Framework	1
Health self-perception	2
Food consumption and nutritional status	3
Objectives	6
Methodology	7
Data analysis	8
Results	9
Discussion	15
Limitations	18
Conclusion	19
References	20
Annexe	26
Paper - The relationship between health self-perception, food consumption and nutritional status among Portuguese older adults.	27

List of tables

Table 1. Tools selected to reach the objectives of the current paper	7
Table 2. Descriptive analysis of the sample (n=459)	9
Table 3. General Health Self-Perception	10
Table 4. Activities of Daily Living	11
Table 5. Body Mass Index (BMI)	12
Table 6. Nutritional Status (MNA score)	12
Table 7. Energy and nutrient intake (24h recall)	13
Table 8. Correlations between variables	14
Table 9. Binary logistic Regression model for factors significantly associated with General Health Perception	15

List of abbreviations

ADL – Activities of Daily Living

BMI – Body Mass Index

EU- European Union

EJCN - European Journal of Clinical Nutrition

HSP – Health self-perception

Mdn - Median

MNA – Mini Nutritional Assessment

MNE – Mini-Mental Exam

NVFHU - Family Health Unit Nova Via

SD - Standard Deviation

SWFoL - Satisfaction with Food-related Life

Introduction

Theoretical Framework

In Portugal, as in the European Union (EU) in general, people aged 65 and above, will be the populational segment with the highest growth rate of the next decades. In 2015, around 20% of the total population in the EU was composed of older adults, and in 2080 it is likely to constitute more than 30% (1, 2).

Portugal fits this projection since the Portuguese older adults, aged 65 and above, in 2016 were 2.1 million. This number will keep growing since it is predicted that in 2080 there will be 2.8 million older adults. Even though the number of older adults is higher than the number of younger people (less than 15 years old) since 2000, the index of ageing will duplicate from 147 older adults in 2017, to 317 older adults per 100 younger people in 2080 (2).

Although it is known that successive generations are living longer, the health status of the EU's ageing population has been often measured through life expectancy at birth and used as a proxy of the general health, partly because it is based on a characteristic that is easy and simple to understand: death (3). However, this characteristic is not able to fully answer the question if the extra years of life gained through increased longevity are spent in good or bad health. Therefore, to focus on the quality of life rather than quantity, indicators of health expectancies, called "Healthy life years", have been developed (3).

The World Health Organisation first defines health as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" (4). However, good health is an asset in itself, as it does not only have in consideration the value of the individual, the cultural and social environment as major determinants of quality of life, but also the functioning of the healthcare services. So a better definition of health is the one that considers that "health is a state of balance, an equilibrium that an individual has established within himself and between himself and his social and physical environment" (4).

Having in mind the quality versus quantity, if healthy life years increase faster than life expectancy, then not only are people living longer, but they are also living a more significant proportion of their lives free from health problems. This change would

not only improve the situation of the older adults but also lead to lower public health care expenses.

Thus, healthy ageing constitutes a challenge as not only the number of years lived are essential, but also the quality of life spent on those years becomes a priority (5-7).

The functional decline that is part of the ageing process or due to sequela from diseases has shown to be a risk factor for hospitalisation, institutionalisation, additional expenses with health and poor quality of life (8-10). This risk is highly intensified when it comes to dependency on the activities of daily living (ADL) (11, 12).

Therefore, and knowing that psychosocial and physical changes are inevitable with age, these changes do not necessarily characterise the older adult experience of ageing. The perception, attitudes and behaviours that the older adults demonstrate to those changes can dramatically affect their quality of life and life satisfaction (5-7, 9).

Health self-perception

Health self-perception (HSP) describes the perception that each individual has of his/her health, including any essential or significant dimensions of his/her own life (13).

Some studies found that Portuguese older adults associate the concept of quality of life as to be in good health, to have a good social network and being independent (6, 14). However, Portuguese older adults perceived their health as bad and presented the worst HSP and quality of life when compared to other countries (14, 15).

A positive attitude towards life and health allows for better acceptance of the disease as part of life, and so, the subject regarding HSP is commonly found in the medical and social investigations and has proven to be important, not only in the prediction of morbidity and mortality but also in the loss of functional capacities (8, 16-18).

However, it is usually used as a covariable and not often as one of the main targets of a study since it is evaluated with a single question, in which the individuals are asked to rate their overall health on a scale (7, 9, 19).

HSP has been found to be associated with chronic diseases, sociodemographic characteristics, social network and functional status (12, 18-21). The effect and magnitude of each factor, however, depends on the study design and variables assessed (population, social and cultural environment), though not all the studies included all the variables mentioned.

Nevertheless, the studies that focus on the HSP found that a negative HSP demonstrated to have a negative impact in self-care and health, such as having higher serum concentration of triglycerides, cholesterol, low-density lipoprotein and glucose (21).

A positive HSP had a protective effect towards mortality and morbidity, which suggests, even more, its importance (5, 8, 17). A relationship between a positive HSP with an improvement of self-efficacy, health care, self-esteem, nutrition and sleep hygiene was found (17, 18, 21). Also, functional status and HSP are essential indicators, not only of health but also of the determinants of quality of life and mortality.

Functional status has proven to be a powerful determinant of HSP, but their role may be undervalued when studied with other factors that also relate to HSP. This may explain why there was less information regarding HSP when the older adults presented an excellent functional status (20, 22).

The assessment of other factors like food consumption and nutritional status may provide relevant information for health strategies and the promotion of health.

Food consumption and nutritional status

Nutritional recommendations for older adults do not differ greatly from the common recommendations for adults, although they do have special nutritional needs since ageing affects the absorption, use and excretion of nutrients. A healthy diet, with adequate energy and appropriate levels of macro and micronutrients, is needed to maintain physical and mental functions but it is also an essential part of a healthy

lifestyle that involves eating as a social activity. However, as age goes by, the lifestyle and appetite of the older adults' change, and this can affect the type and amount of food that they eat (23-26).

A decreased appetite is a serious health concern for older adults, as it can lead to inadequate nutrition, which subsequently may cause health problems, shorten life expectancy and reduce the quality of life. Between 11 % and 15 % of older adults, who live independently, are estimated to have a poor appetite (26). Furthermore, some studies found changes when it comes to food consumption, such as eating fewer complete meals after retirement or when the older adult lives or eats alone. Food habits may also change when women become widows since they used to choose and cook food according to the husband's preferences (24, 27). Studies have also shown that men who participated in shopping for groceries made healthier food choices (28, 29).

Additional factors that can affect nutritional intake and status include disabilities, such as problems with eyesight and physical mobility, which can make shopping for food difficult and also may affect the ability to prepare and eat food (25, 27).

Subsequently, mobility problems have a negative impact on food purchase and cooking. Therefore food consumption is more likely to be based on ready-to-eat, smaller and unhealthy meals. A reduced ability to prepare and buy food can lead the older adult to a food consumption where he/she does not get enough essential nutrients, and this can contribute to several problems or even aggravate some chronic illness (11, 20, 22, 24). Consequently, being dependent on the ADL can be a risk factor for malnutrition.

The nutritional status of older adults is influenced by the physiological alterations that occur with ageing (23, 30), like a reduced sense of smell and taste, delayed gastric emptying, reduced lean body mass, but also by socioeconomic factors like income and lifestyle, by chronic illness and by psychological factors like depression, social isolation and cognitive deficit (30, 31). Promoting a healthy nutritional status of the older adults requires adaptations to life circumstances, as this age group is more vulnerable to nutritional deficits, due to function deterioration, loss of appetite, change in taste and drug-nutrient interactions (25, 30, 31).

All these factors contribute to malnutrition, which implies that screening is vital to identify such risk factors in time (32).

On the other hand, obesity may also be a problem. Up the age of 70 people's average Body Mass Index (BMI) increases, and accordingly, there is a corresponding increase in the percentage of overweight or obese people. Since the fat percentage increases, older adults, on average, have more fat and less muscle mass than adults.(33, 34).

In recent studies, quality of life has been the main objective of health promotion in older adults, where results have shown a positive link between HSP and quality of life (5, 18, 20, 31, 35). The association between HSP and nutritional status was found in some studies (36-39). However, the link between HSP and food consumption was found in very few studies (20, 40).

The relationship between HSP, nutritional status and food consumption can be used, not only by health authorities to understand which health care the older adult needs, but also by other societal sectors like urban planning, transportation, equipment, social and others to give older adults a social environment that they can use independently and safely.

Objectives

General objective

Contribute to an increase in the knowledge in the relationship between health self-perception, capacity to carry out activities of daily living, nutritional status and food consumption to promote a better quality of life of older adults

Specific objectives of this work were to:

Identify the relationship between food consumption and nutritional status;

Identify if a relationship between the independence on carrying out activities of daily living exists, like food preparation and shopping, with food consumption and nutritional status;

Identify if health self-perception of older adults correlates with clinical characteristics;

Identify the relationship between health self-perception and nutritional status;

Identify the relationship between health self-perception and food consumption;

Identify if a relationship between health self-perception and the independence to carry out activities of daily living exists.

Study what other variables have a relationship with health self-perception, food consumption and nutritional status.

Methodology

This study uses data from the Pronutrisenior¹ project. The sample is representative of the Family Health Unit Nova Via (NVFHU) users aged 65 or above that live in the geographical area of Vila Nova de Gaia and non-institutionalised. It includes a heterogenic population, living in urban, semi-urban and rural, inland and coastal environments, with different educational levels and socioeconomic status.

The questionnaire comprehends a total of eighteen sections that included both qualitative and quantitative methods, aiming at a comprehensive and holistic approach to the older adults living in the community.

From the complete dataset, the information in Table 1, regarding socio-demographic characteristics, family and social network (41), general perception of health, ADL (42), clinical characterization, 24-hour recall and food habits, Satisfaction with Food-Related Life Scale (SWFoL) (43), nutritional status from the Mini Nutritional Assessment (MNA) (44, 45) and anthropometry was selected to reach the objective of the current paper.

Table 1. Tools selected to meet the objectives of the current paper	
Socio-demographic characteristics	Age, sex, education level, marital status, professional situation and living conditions.
Family and social network	Fillenbaum Social Network: evaluates social integration and the risk of social isolation (33).
General perception of health	It includes two questions: 1) health self-perception; 2) perception of health when compared to others of the same age.
Clinical characterization	Self-reported diseases and medication.
24-hour recall and food habits	Total Energy, Macronutrients, Fibre, Water and Alcohol intakes.
SWFoL (35)	It includes a total of 5 statements that express the importance of food for satisfaction or dissatisfaction with life. The participants were asked how much they agreed or disagreed with what was being stated.
Anthropometry	BMI (weight and height measured during the interview).
Nutritional status	MNA was used to assess the older adults that are malnourished or at risk of malnutrition (36,37).
ADL (34)	Measures the dependence or independence in different activities of daily living. Level of independence in eating, medication, shopping, cooking and food preparation

¹ The PRONUTRISENIOR project was financed by Iceland, Liechtenstein and Norway through the EEA Grants (PT06 – Public Health Initiatives Program reference 81NUS).

From the total of 3073 older adults registered at NVFHU, identified as potential participants, 602 were interviewed with a structured questionnaire, in a face-to-face situation by trained interviewers.

Firstly, the participant's cognitive function was assessed by the Mini-Mental State Examination (47): 143 were classified as having a cognitive deficit and were therefore excluded from this study. As a result, our final sample comprises a total of 459 participants.

More information regarding the complete methodology of the project can be found in Afonso et al, 2016.

Data analysis

The data regarding the 24-hour recall was first analysed with the ESHA's Food Processor® Nutrition Analysis software. The entire data, including the 24-hour recall, was then analysed with IBM SPSS Statistics© version 25.0 for Windows.

For the descriptive analysis, categorical variables are presented as frequencies (n and %). Continuous variables are presented as means with standard deviations (SD), for variables with normal distribution, and as median (Mdn) for variables without a normal distribution, minimum and maximum were also presented.

The normality was analysed using the kurtosis and skewness. The t-test and Mann-Whitney's test were used to compare, respectively means and mean ranks of independent groups. The association between variables was measured using Spearman's correlation coefficient (ρ).

Binary logistic regression models were used to predict a better HSP ("Healthy" or "Very healthy") and a better perception of health compared to others of the same age ("As good" or "Better"). The independence with medication and eating (corresponding to the ADL) were removed because in both variables one of the groups of the dependent variables had a low number of participants.

A value of $p < 0.05$ was taken into consideration for the statistical significance of the hypothesis tested.

Results

Characteristics of the study participants, housing, family and social network can be found in Table 2. Of the 459 participants, 54.2% were women, and their age ranged from 65 to 94 years. Most of them were married (70.8%), retired (94.6%) and with an average of 5.2 years of education. The results showed that 18.5% were living alone. However, all of them reported having someone to contact every day, even if not everyone had someone to talk about personal issues. More than half reported having a vegetable garden where they could grow vegetables for domestic consumption, and 18.3% breed animals for self-consumption.

Table 2. Descriptive analysis of the sample (n=459)		
Variables		Value or number
Socio-demographic characteristics		
Sex (%)	Women	54.2
	Men	45.8
Age (years)	Mean(\pm SD)	73.3(5.95)
	Minimum	65
	Maximum	94
Marital Status (%)	Single	2.2
	Married or living as married	70.8
	Divorced or living apart	3.7
	Widow(er)	23.3
Education (years) ^a	Mean(\pm SD)	5.20(3.46)
	Minimum	0
	Maximum	20
Professional situation (%)	Retired	94.6
	Active/unemployed/domestic	5.4
Characteristics of housing, family and social network		
Living situation (%)	Alone	18.5
	Accompanied	81.5
Vegetable garden (%) ^b		56.2
Animals (%) ^c		18.3
Spent time alone (%) ^d		37.9
Someone to contact day-to-day (%)		100
Someone to talk about personal issues (%)		87.4
Pet (%)		54.2
Social Network (score)	Mean(\pm SD)	3.16(1.20)
	Minimum	0
	Maximum	4
^a Number of years attended at school.		
^{b,c} Growth of vegetables or raising animals for self-consumption.		
^d Considering day and night.		

From the clinical characterisation, there was a mean(\pm SD) of 5.18(2.51) number of reported diseases or health problems. The five most frequently reported were: hypertension (n=343), dyslipidaemia (n=287), osteoarticular diseases or problems (n=254), gastrointestinal diseases or problems (n=186) and *Diabetes Mellitus* (n=155). Medication was common amongst the sample with a mean(\pm SD) of 4.81(2.98) different drugs taken per day.

When asked about their HSP, as seen in Table 3, 44,9% perceived themselves as healthy or very healthy and, when compared to others of the same age, 77,1% perceived themselves as being as in good or better health.

Table 3. General Health Self-Perception		
	Health Self-Perception	
	“Unhealthy”	“Healthy” or “Very Healthy”
Women (%)	60.6	39.4
Men (%)	48.6	51.4
Total (%)	55.1	44.9
	Perception of health compared to others of the same age	
	“Worse”	“Good” or “Better”
Women (%)	26.5	73.5
Men (%)	18.6	81.4
Total (%)	22.9	77.1

From the Mann-Whitney test we could conclude that men have a higher HSP (Mdn=4) than women (Mdn=3), $U=22126$, $p=0.003$. However, there is no significant difference between men and women when comparing their health to other people of the same age $U=24414$, $p=0.187$; A moderate positive correlation was observed between HSP and how they compare themselves to others of the same age $r=0.430$, $n=459$, $p<0.001$.

From the ADL scale, in Table 4., women presented a mean(\pm SD) of 7.53(1.14) and men a mean(\pm SD) of 4.78(0.544). When it comes to being responsible for their medication 98.5% were independent, in what food preparation is concerned 14.1% needed to have most, or even all the meals prepared and served, on the other hand, 99.3% were able to eat independently.

Regarding shopping for groceries, 83% mentioned that they shopped independently, but 61.2% were frequently accompanied by someone.

Table 4. Activities of Daily Living (ADL)		
	Medication	
	Independent	Dependent
Women(%)	98.4	1.6
Men(%)	98.6	1.4
Total(%)	98.5	1.5
	Food preparation	
	Independent	Dependent
Women(%)	94.4	5.6
Men(%)	75.7	24.3
Total(%)	85.9	14.1
	Eating	
	Independent	Dependent
Women(%)	99.2	0.8
Men(%)	99.5	0.5
Total(%)	99.3	0.7
	Shopping	
	Independent(accompanied)	Dependent
Women(%)	88.8(57.9)	1.6
Men(%)	76.2(65.6)	23.8
Total(%)	83(61.2)	17

Of the 459 participants, 14 declined to have their measures taken, so regarding BMI, only 445 measures were obtained. According to the BMI distribution, in Table 5., the sample on average is classified as overweight since the mean(\pm SD) is 29.28(4.74) kg/m². There is a significant difference in the BMI of men mean(\pm SD) 28.37(3.87) and women mean(\pm SD) 30.08(5.26); $t(431.523)=3.938$, $p<0.001$.

Table 5. Body Mass Index (BMI)			
	Women	Men	Total
Mean(\pm SD)	30.08(5.26)	28.37(3.87)	29.28(4.74)

MNA showed, in Table 6., that the sample presented a median of 25, so most of the sample is not malnourished, but 1,1% of the cases presented a score that points to malnutrition, and 25,9% of the cases are at risk of malnutrition. From the Mann-Whitney test, we could conclude that men have a higher MNA score (Mdn=25) than women (Mdn=24.5), $U=21007$, $p<0.001$.

Table 6. Nutritional Status (MNA score)

	Normal	Risk of malnutrition	Malnutrition
Women(%)	67.5	31.3	1.2
Men(%)	79.5	19.5	1
Total(%)	73	25.9	1.1

The SWFoL total score presented a mean(\pm SD) of 14.62(2.74). There is a significant difference in the total score for men mean(\pm SD) 15.02(2.37), that presented a higher score than women mean(\pm SD) 14.28(2.98); $t(452.324)=-2.989$, $p=0.003$.

We can observe. in Table 7. the food consumption regarding the 24hour recall.

Of the 459 participants, 46% were identified as non-drinkers, as they did not drink alcohol in the 24 hours prior to the interview. Therefore the results regarding alcohol consumption were analysed taking into consideration only the ones that drank ($n=248$).

Table 7. Energy and nutrient intake (24h recall)

		Kcal	% ^a	Gram
Total Energy	Mean(\pm SD)	1587.36(513.48)		
	Minimum	471.11		
	Maximum	3069.31		
Carbohydrates	Mean(\pm SD)	768.44(275.14)	49.32(11.18)	192.11(68.78)
	Minimum	189.52	18.32	47.38
	Maximum	2178.96	83.15	544.74
Fat	Mean(\pm SD)	417.04(213.63)	25.48(8.20)	46.33(23.71)
	Minimum	25.56	4.31	2.84
	Maximum	1253.53	49.70	139.28
Protein	Mean(\pm SD)	273.46(128.14)	17.16(5.37)	68.37(32.03)
	Minimum	17.68	3.58	4.42
	Maximum	863.36	38.85	215.84
Alcohol	Mean(\pm SD)	150.66(129.54)	9.52(7.21)	21.59(18.51)
	Minimum	0.07	0.23	0.01
	Maximum	716.8	37.37	102.4
Fiber	Mean(\pm SD)			15.38(10.71)
	Minimum			1.42
	Maximum			141.33
Water	Mean(\pm SD)			1662.01(560.07)
	Minimum			514.17
	Maximum			3823.65

^aPercentage of the Total Energy

The food habits of older adults have shown that only 8,5% did three full meals per day and 30,9% ate only one full meal per day. Moreover, 73,2% ate at least one serving of dairy products every day; 73,9% ate two or more servings of legume or eggs

per week; 96,5% ate meat, fish or poultry every day; 91,7% consumed two or more servings of fruits or vegetables per day, and 31,4% drank less than three glasses of fluid (water, juice, coffee, tea, milk) per day.

Correlations regarding MNA and BMI, are presented in Table 8. MNA correlates positively with education, social network, independence with shopping and eating, satisfaction with food related life, the number of full meals per day and fibre intake, on the other hand, correlates negatively with age, number of diseases and medication. BMI correlates positively with the number of glasses of liquid per day, the number of diseases and medication, on the other hand, correlates negatively with the number of full meals per day, education and age.

Table 8. Correlations between variable

Variables	MNA		BMI	
	Spearman's (ρ)	<i>p</i>	Spearman's (ρ)	<i>p</i>
MNA	1		0.007	0.888
BMI	0.007	0.888	1	
Age (years)	-0.132	0.004	-0.111	0.019
Education ^a	0.112	0.016	-0.155	0.001
Fillenbaum (social network)	0.196	<0.001	-0.038	0.419
Independent (shopping)	0.231	<0.001	-0.029	0.541
Independent (medication)	0.058	0.218	0.065	0.17
Independent (eating)	0.104	0.026	-0.031	0.514
Independent (cooking)	0.039	0.405	0.036	0.449
Number of medication ^b	-0.461	<0.001	0.226	<0.001
Number of diseases	-0.442	<0.001	0.282	<0.001
SFwoL score	0.221	<0.001	-0.036	0.447
Full meals per day	0.371	<0.001	-0.136	0.004
Glasses of liquid per day	0.206	<0.001	0.115	<0.001
Total Energy (Kcal)	0.04	0.394	0.051	0.28
Protein (Kcal)	0.025	0.558	0.072	0.131
Carb (Kcal)	0.04	0.389	0.031	0.519
Fat (Kcal)	0.005	0.91	0.068	0.68
Fibre (g)	0.194	<0.001	0.001	0.982
Water (g)	0.021	0.658	-0.041	0.384
Alcohol (just drinkers) (g)	-0.098	0.129	0.06	0.364
^a Number of years attended at school				
^b Number of drugs taken per day				

On table 9, regarding the binary logistic regression, we can see that four factors had significant associations with better HSP: A higher MNA score, fewer drugs taken per day, higher education and more water consumption. On the other hand, from the four factors that had significant associations with better HSP, only higher education had a significant association to a better perception of health when compared to other of the same age, since the other three were independence in the activities of shopping for food, a higher SWFoL and older age ($p < 0,05$ in all cases).

Table 5. Binary logistic Regression model for factors significantly associated with General Health Perception

Nage/kerke R ²	Health self-perception						Perception of health compared to others of the same age						
	Unadjusted Model			Adjusted Model			Unadjusted Model			Adjusted Model			
	n	OR	95% CI	p	OR	95% CI	p	OR	95% CI	p	OR	95% CI	p
Age	459	0.96	0.930;0.992	0.013	1.007	0.971;1.045	0.706	1.09	1.020;1.166	0.012			
Sex	249	1	(ref.)	0.01	1	(ref.)	0.045						
Social network	210	1.631	1.125;2.365	0.134	1.581	1.011;2.474	0.124						
Education	459	1.126	0.964;1.316	<0.001	1.146	0.963;1.363	0.108						
MNA	459	1.113	1.052;1.178	<0.001	1.058	0.988;1.134	0.108						
BMI	459	1.382	1.234;1.547	<0.001	1.206	1.090;1.333	<0.001						
Diseases	445	0.976	0.938;1.015	0.229	0.953	0.910;0.988	0.043						
Medication	459	0.754	0.692;0.821	<0.001	0.801	0.732;0.876	<0.001						
Independence shopping	74	0.717	0.657;0.783	<0.001	0.853	0.793;0.917	<0.001						
Independence cooking	385	0.428	0.249;0.739	0.002	1	(ref.)	<0.001						
SWFoL	3	1	(ref.)	0.166	0.355	0.209;0.602	0.104						
Full meals per day	456	1.467	0.854;2.520	<0.001	1.616	0.906;2.882	0.003						
Meat, fish	142	1.15	1.069;1.238	0.135	1.127	1.041;1.220	0.142						
Legumes and eggs	278	0.833	0.425;1.631	0.594	2.141	0.776;5.906	0.133						
Fruit and vegetables	39	1	(ref.)	0.006	2.117	0.796;5.633	0.133						
Dairy	443	0.398	0.126;1.252	0.115	1	(ref.)	0.165						
Number of glasses of liquid	16	1	(ref.)	0.692	0.48	0.170;1.352	0.057						
Energy	339	1	(ref.)	0.30	0.632	0.394;1.015	0.045						
Fat	120	0.919	0.604;1.398	0.641	0.538	0.265;1.093	0.829						
CHO	421	1	(ref.)	0.921	1	(ref.)	0.875						
Protein	38	0.696	0.350;1.382	0.787	1.055	0.648;1.720	0.608						
Fibre	336	1	(ref.)	0.921	1	(ref.)	0.875						
Water	123	0.906	0.597;1.373	0.787	1	(ref.)	0.875						
Alcohol (just drinkers)	144	1	(ref.)	0.921	1	(ref.)	0.875						
	196	1.061	0.689;1.635	0.787	1.143	0.687;1.901	0.608						
	119	0.97	0.595;1.582	0.903	1.094	0.617;1.942	0.759						
	459	1.000	1.000;1.000	0.972	1.000	1.000;1.001	0.032						
	459	1.000	0.978;1.023	0.981	1.000	0.974;1.027	0.979						
	459	1.009	0.992;1.025	0.315	1.006	0.987;1.026	0.518						
	459	0.974	0.974;1.008	0.137	0.979	0.940;1.019	0.291						
	459	1.008	0.990;1.026	0.373	1.022	0.994;1.050	0.127						
	459	1.001	1.000;1.001	0.053	1.000	1.000;1.001	0.113						
	240	0.982	0.947;1.018	0.316	0.989	0.948;1.032	0.61						

Discussion

This project focus on non-institutionalised older adults living in the community in Vila Nova de Gaia, a northern Portuguese region as part of the Pronutrisenior project.

Almost half of the older adults presented a positive HSP, but women, like in other studies showed a lower HSP compared to men (39, 48). Most of the older adults also saw themselves to be better than others of the same age. Moreover, those with a higher HSP were also more likely to perceive themselves as being better than others of the same age.

The current sample reported, not only, having high independence when it comes to ADL, high satisfaction with food related-life, but additionally, the majority presented a normal nutritional status. However, most of them took a considerable number of different drugs per day, reported numerous diseases and health problems and more than half presented overweight.

All these characteristics seem to be linked since the most significant impact to a better HSP emerged from the MNA, in which an older adult with a normal nutritional status is 1.28 times more likely to have a better HSP, which goes with what was found in recent studies regarding nutritional status (36-38). The number of drugs taken per day was the 2nd most important determinant of HSP, as older adults that took fewer drugs were 1.26 times more likely to have a positive HSP. Polypharmacy, use of multiples medicines, was common among our older adults, and studies that focused more on clinical variables found that older adults with polypharmacy perceived their health as poor or worst than older adults with non-polypharmacy (20, 49). Higher education was also found to have an impact on a better HSP, like in other studies (39, 40).

The most significant impact on how they compare to others of the same age was the independence on shopping activities, in which an independent older adult was 4.17 times more likely to compare his/her health as being better than others of the same age. A similar result was also found in other studies when it comes to independent older adults. However, in these studies, HSP was analysed by only one question, and the older adults where not asked how they compared to others of the same age (19, 36, 40, 50, 51).

This can also be explained by the fact that our sample is all non-institutionalized, and being independent allows the older adults to get out of the house more, and in consequence be more aware of the environment they live.

The SWFoL, in which an older adult more satisfied with food-related aspects of his/her life was 1.19 times more likely to also compare his/her health as being better than others of the same age. This result can be compared to other studies that found that when it comes to being satisfied with food-related aspects of their lives, older adults felt that they also had more quality of life (18, 22, 27, 37). This gives more importance when it comes to nutritional aspects of the older adults lives since, the more satisfied with the food they were, the better they perceived themselves in general.

Ageing was not found to be a characteristic that affected HSP, which is in line with some studies (51), but is not in line with other studies (19, 36). However, we did find that age impacts on how older adults compare to others of the same age. Meaning that as age goes by, the older adults perceived themselves “as good” or “better” than others of the same age.

Since different predictors for HSP and the perception of health when compared to others of the same age were found, the general perception of health should not be investigated as being a single aspect but rather a complex issue, in which the individual views himself/herself not only in an absolute way but also in contrast to others. This indicates that when an older adult is comparing his/her health to others, he/she takes into consideration not only himself/herself, as being independent and how satisfied he/she is with food and life, but also what surrounds them and people of the same age group.

Older adults with normal nutritional status, like on other studies were found to be independent in ADL (36, 37), in particular being independent in shopping for food and eating; the fact that MNA and the ADL positively correlated gives more strength to the results regarding the impact that the nutritional status has on HSP.

Considering the energy and nutrient intake for this age group, the sample reported average consumption of total protein, carbohydrates and alcohol above the recommendations; total fibre intake below the recommendations and total fat intake in line with the recommendations. The consumption of water was found to be in the lowest limit of the recommendations (the minimum recommended for an elderly is 1500 ml of water per day).

Food consumption, like in some papers, was not associated with HSP (37, 50). However, it is important to note that a higher consumption of water was found to be a predictor of a positive HSP. On the other hand, some studies found an association between a low consumption of vegetables, fruit, meat, fish, water with a bad HSP (20, 39, 52). A positive correlation was found between satisfaction with food-related

aspects, fibre intake, full meals per day and the number of glasses of liquid per day with nutritional status.

A higher BMI was found to be negatively associated with fewer meals per day and, on the contrary, with drinking more glass of liquid (tea, water, coffee, juice, milk) per day.

Taking into consideration the aim of this study, some of our results are in line with what was found before, in that various characteristics like sociodemographic and clinical health influence the general perception of health (20, 36, 39, 51). Moreover our results also bring more information regarding the way older adults are influenced in their self-perception of health by nutritional factors and how independence levels in activities that older adults carry out in their day to day lives can predict how they compare to others of the same age.

Limitations

The results concerning food consumption, that despite not being null, may be explained by the fact that the information regarding these variables were collected by a single 24-hour recall, and the limitations associated with this tool.

The fact that most of the variables derived from self-reported data, they are to a certain extent, affected by the subjective perception of each respondent. Despite this, they can be considered essential and reliable estimators of health status and good predictors of health care needs.

Conclusion

The present study contributes to the knowledge on HSP and has implications for future research and healthcare practices. Interventions need to focus on factors like nutritional status, independence to carry out daily activities, satisfaction with food, medication and apply them to modify the negative HSP and attitudes towards ageing and health. Such interventions may facilitate, not only a successful adaptation to ageing but also maximise all the positive aspects of old age. Therefore, our results help predict, plan and develop which health care the older adults need, according to their self-perception of health and how they compared themselves to others in order to promote a better quality of life of older adults.

References

1. Instituto Nacional de Estatística. Projeções de População residente em Portugal: 2015-2080 [press release]. Lisboa, 29-03-2017 2017.
2. European comission. The 2015 Ageing Report: Economic and budgetary projections for the 28 EU Member States (2013-2060). European Economy. 2015.
3. Mathers CD, Sadana R, Salomon JA, Murray CJ, Lopez AD. Healthy life expectancy in 191 countries, 1999. *The Lancet*. 2001;357(9269):1685-91.
4. (WHO) WHO. Constitution of WHO: principles 2018 [Available from: <http://www.who.int/about/mission/en/>].
5. Charoenpoom S. Perceptions of quality well-being among the elderly in the Dusit District, Bangko. *Procedia-Social and Behavioral Sciences*. 2015;197:1570-4.
6. Marques EMBG, Serdio Sánchez C, Palacios Vicario B. Perceção da qualidade de vida de um grupo de idosos. *Revista de Enfermagem Referência*. 2014(1):75-84.
7. Scult M, Haime V, Jacquart J, Takahashi J, Moscovitz B, Webster A, et al. A healthy aging program for older adults: effects on self-efficacy and morale. *Advances in mind-body medicine*. 2015;29(1):26.
8. Cesari M, Onder G, Zamboni V, Manini T, Shorr RI, Russo A, et al. Physical function and self-rated health status as predictors of mortality: results from longitudinal analysis in the iSIRENTE study. *BMC geriatrics*. 2008;8(1):34.
9. Del Pilar Díaz-López M, Aguilar-Parra JM, López-Liria R, Rocamora-Pérez P, Vargas-Muñoz ME, Padilla-Góngora D. Skills for Successful Ageing in the Elderly. Education, well-being and health. *Procedia-Social and Behavioral Sciences*. 2017;237:986-91.
10. Spillman BC. Changes in elderly disability rates and the implications for health care utilization and cost. *The Milbank Quarterly*. 2004;82(1):157-94.

11. Hu Y-N, Hu G-C, Hsu C-Y, Hsieh S-F, Li C-C. Assessment of individual activities of daily living and its association with self-rated health in elderly people of Taiwan. *International Journal of Gerontology*. 2012;6(2):117-21.
12. Levy BR, Slade MD, Murphy TE, Gill TM. Association between positive age stereotypes and recovery from disability in older persons. *Journal of the American Medical Association*. 2012;308(19):1972-3.
13. Menec VH, Chipperfield JG, Perry RP. Self-perceptions of health: A prospective analysis of mortality, control, and health. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*. 1999;54(2):P85-P93.
14. Ermel RC. *Qualidade de vida da pessoa idosa: comparação Brasil-Portugal [Pós graduação]*: Universidade de São Paulo; 2012.
15. Brandão MdPM, Martins L, Szewczyczak M, Talarska D, Philp I, Cardoso MF. Threats to Health and Well-Being Perceived by Older People in Poland and Portugal. *Acta medica portuguesa*. 2018;31(7-8):409-15.
16. Freeman AT, Santini ZI, Tyrovolas S, Rummel-Kluge C, Haro JM, Koyanagi A. Negative perceptions of ageing predict the onset and persistence of depression and anxiety: Findings from a prospective analysis of the Irish Longitudinal Study on Ageing (TILDA). *J Affect Disord*. 2016;199:132-8.
17. Mackenbach JP, Simon JG, Looman CW, Joung IM. Self-assessed health and mortality: could psychosocial factors explain the association? *International Journal of Epidemiology*. 2002;31(6):1162-8.
18. Tkatch R, Musich S, MacLeod S, Kraemer S, Hawkins K, Wicker ER, et al. A qualitative study to examine older adults' perceptions of health: keys to aging successfully. *Geriatric Nursing*. 2017;38(6):485-90.
19. Damian J, Ruigomez A, Pastor V, Martin-Moreno JM. Determinants of self assessed health among Spanish older people living at home. *Journal of Epidemiology & Community Health*. 1999;53(7):412-6.
20. Machón M, Vergara I, Dorronsoro M, Vrotsou K, Larrañaga I. Self-perceived health in functionally independent older people: associated factors. *BMC geriatrics*. 2016;16(1):66.

21. Mendoza-Núñez VM, Sarmiento-Salmerón E, Marín-Cortés R, de la Luz Martínez-Maldonado M, Ruiz-Ramos M. Influence of the Self-Perception of Old Age on the Effect of a Healthy Aging Program. *Journal of clinical medicine*. 2018;7(5).
22. Machón M, Larrañaga I, Dorronsoro M, Vrotsou K, Vergara I. Health-related quality of life and associated factors in functionally independent older people. *BMC geriatrics*. 2017;17(1):19.
23. De Morais C, Oliveira B, Afonso C, Lumbers M, Raats M, De Almeida M. Nutritional risk of European elderly. *European journal of clinical nutrition*. 2013;67(11):1215.
24. Gustafsson K, Andersson J, Andersson I, Nydahl M, SjöEdén P-O, Sidenvall B. Associations between perceived cooking ability, dietary intake and meal patterns among older women. *Scandinavian Journal of Nutrition*. 2002;46(1):31-9.
25. Maynard M, Blane D. Dietary assessment in early old age: experience from the Boyd Orr cohort. *European journal of clinical nutrition*. 2009;63(S1):S58.
26. van der Meij BS, Wijnhoven HA, Lee JS, Houston DK, Hue T, Harris TB, et al. Poor Appetite and Dietary Intake in Community-Dwelling Older Adults. *Journal of the American Geriatrics Society*. 2017;65(10):2190-7.
27. Gustafsson K, Sidenvall B. Food-related health perceptions and food habits among older women. *Journal of advanced nursing*. 2002;39(2):164-73.
28. Hardin-Fanning F, Gokun Y. Gender and age are associated with healthy food purchases via grocery voucher redemption. *Rural and remote health*. 2014;14(3):2830.
29. Whitelock E, Ensaff H. On Your Own: Older Adults' Food Choice and Dietary Habits. *Nutrients*. 2018;10(4):413.
30. Donini LM, Scardella P, Piombo L, Neri B, Asprino R, Proietti AR, et al. Malnutrition in elderly: social and economic determinants. *The Journal of Nutrition, Health & Aging*. 2013;17(1):9-15.
31. Kvamme J-M, Olsen JA, Florholmen J, Jacobsen BK. Risk of malnutrition and health-related quality of life in community-living elderly men and women: The Tromsø study. *Quality of Life Research*. 2011;20(4):575-82.

32. Ahmed T, Haboubi N. Assessment and management of nutrition in older people and its importance to health. *Clinical interventions in aging*. 2010;5:207.
33. Mathus-Vliegen EM, Basdevant A, Finer N, Hainer V, Hauner H, Micic D, et al. Prevalence, pathophysiology, health consequences and treatment options of obesity in the elderly: a guideline. *Obesity facts*. 2012;5(3):460-83.
34. Grzegorzewska A, Wołejko K, Kowalkowska A, Kowalczyk G, Jaroch A. Proper BMI ranges for the elderly in the context of morbidity, mortality and functional status. Prawidowe zakresy wskaźnika BMI dla osób starszych w kontekście zachorowalności, śmiertelności oraz statusu funkcjonalnego. *PRACE ORYGINALNE/ORIGINAL PAPER*. 2016:114.
35. Ferrer A, Formiga F, Almeda J, Alonso J, Brotons C, Pujol R. Calidad de vida en nonagenarios: género, funcionalidad y riesgo nutricional como factores asociados. *Medicina clínica*. 2010;134(7):303-6.
36. Heuberger R, van Eeden-Moorefield B, Wong H. Perceived versus actual health and nutritional status: Results from a cross sectional survey of rural older adults. *Journal of Gerontology & Geriatric Research*. 2013;3:1-6.
37. Jiménez-Redondo S, De Miguel BB, Banegas JG, Mercedes LG, Gomez-Pavon J, Vives CC. Influence of nutritional status on health-related quality of life of non-institutionalized older people. *The Journal of Nutrition, Health & Aging*. 2014;18(4):359-64.
38. Johansson Y. Self-perceived health and nutritional status among home-living older people: a prospective study: Linköping University Electronic Press; 2009.
39. Garcia CdAM, Moretto MC, Guariento ME. Associação entre autopercepção de saúde, estado nutricional e qualidade de vida de idosos. *Revista de Ciências Médicas*. 2018;27(1):11-22.
40. Abuladze L, Kunder N, Lang K, Vaask S. Associations between self-rated health and health behaviour among older adults in Estonia: a cross-sectional analysis. *British Medical Journal*. 2017;7(6):e013257.
41. Fillenbaum GG, Organization WH. Troisième âge et bien-être: approches d'une évaluation multidimensionnelle. 1986.

42. Lawton MP, Brody EM. Assessment of older people: self-maintaining and instrumental activities of daily living. *The Gerontologist*. 1969;9(3):179-86.
43. Grunert KG, Dean M, Raats MM, Nielsen NA, Lumbers M. A measure of satisfaction with food-related life. *Appetite*. 2007;49(2):486-93.
44. Guigoz Y, Jensen G, Thomas D, Vellas B. The mini nutritional assessment (mna®) review of the literature-what does it tell us?/discussion. *The Journal of Nutrition, Health & Aging*. 2006;10(6):466.
45. Kaiser MJ, Bauer JM, Ramsch C, Uter W, Guigoz Y, Cederholm T, et al. Validation of the Mini Nutritional Assessment short-form (MNA-SF): a practical tool for identification of nutritional status. *The Journal of Nutrition, Health & Aging*. 2009;13(9):782-8.
46. Afonso C, Poínhos R, Sorokina A, Oliveira BM, Sousa M, Fonseca L, et al. PRONUTRISENIOR: a holistic approach to the older adults living in the community; a rationale and methodology. *Sociedade Portuguesa de Ciências da Nutrição e Alimentação: Alimentação humana*. 2016;22.
47. Guerreiro M, Silva AP, Botelho MA, Leitão O, Castro-Caldas A, Garcia C. Adaptação à população portuguesa da tradução do Mini Mental State Examination (MMSE). *Revista Portuguesa de Neurologia*. 1994;1(9):9-10.
48. Falk H, Skoog I, Johansson L, Guerchet M, Mayston R, Hörder H, et al. Self-rated health and its association with mortality in older adults in China, India and Latin America—a 10/66 Dementia Research Group study. *Age and ageing*. 2017;46(6):932-9.
49. Schroyen S, Marquet M, Jerusalem G, Dardenne B, Van den Akker M, Buntinx F, et al. The link between self-perceptions of aging, cancer view and physical and mental health of older people with cancer: A cross-sectional study. *Journal of geriatric oncology*. 2017;8(1):64-8.
50. Fernandez-Martinez B, Prieto-Flores M-E, Forjaz MJ, Fernández-Mayoralas G, Rojo-Pérez F, Martínez-Martín P. Self-perceived health status in older adults: regional and sociodemographic inequalities in Spain. *Revista de Saúde Pública*. 2012;46(2):310-9.

51. Schneider G, Driesch G, Kruse A, Wachter M, Nehen H-G, Heuft G. What influences self-perception of health in the elderly? The role of objective health condition, subjective well-being and sense of coherence. *Archives of gerontology and geriatrics*. 2004;39(3):227-37.

52. An R, Xiang X, Liu J, Guan C. Diet and self-rated health among oldest-old Chinese. *Archives of gerontology and geriatrics*. 2018;76:125-32.

Annexe

This dissertation includes a manuscript submitted for publication in which I collaborated in the definition of objectives, data collection, data analysis, interpretation and discussion of the results. I was also the responsible for writing the first draft and actively participated in the elaboration of the final version of this article.

Paper

Margarida Babo, Rui Poinhos, Bela Franchini, Cláudia Afonso, Bruno M. P. M. Oliveira, Maria Daniel Vaz de Almeida. The relationship between health self-perception, food consumption and nutritional status among Portuguese older adults. [Submitted for publication at EJCN].

1 **The relationship between health self-perception, food**
2 **consumption and nutritional status among Portuguese**
3 **older adults.**

4 Margarida Babo, Rui Poínhos, Bela Franchini, Cláudia Afonso, Bruno M. P. M. Oliveira,
5 Maria Daniel Vaz de Almeida

6

7 **Abstract**

8 **Background/Objectives** In Portugal, as in the European Union, people aged 65 and above will
9 be the populational group with the highest growth rate of the next decades. Since healthy
10 ageing constitutes a challenge, the relationship between health self-perception (HSP), food
11 consumption and nutritional status will allow an understanding of which factors influence and
12 determine the perception of health among older adults.

13 **Methods/Subjects** This study uses data from the Pronutrisenior project. A total of 459 older
14 adults (age 65 and above) were assessed regarding: Socio-demographic characteristics; Family
15 and social network; HSP; Activities of Daily Living (ADL); Clinical characterisation, 24-hour recall
16 and food habits; Satisfaction with Food-Related Life Scale (SWFoL); Nutritional status and
17 anthropometry.

18 **Results** Almost half of the respondents had a positive HSP, that was higher in men (Mdn=4)
19 than women (Mdn=3, $p=0.003$). MNA showed that 1,1% were malnourished, and 25,9% were
20 at risk of malnutrition. The food habits of older adults have shown that only 8,5% did three full
21 meals per day and the sample was classified as overweight. The most significant predictor of
22 HSP was nutritional status, but independence in shopping had the largest impact on how they
23 compared to other people of the same age.

24 **Conclusion** Interventions need to focus on factors like nutritional status, independency on
25 ADL, SWFoL, medication and utilize them to modify the negative HSP and attitudes towards
26 ageing and health. These changes may facilitate, not only a successful adaptation to the ageing
27 process but also maximize the positive aspects of old age.

28

29 **Keywords:** Health Self-perception, Activities of Daily Living, Portugal, Healthcare, Older adults,
30 non-institutionalised

31

32

33 **Introduction**

34 In Portugal, as in the European Union in general, people aged 65 and above, will be the
35 populational segment with the highest growth rate of the next decades. In 2015 around 20% of
36 the total population was composed of older adults, and in 2080 it is likely to constitute more
37 than 30% (1, 2).

38 Healthy ageing constitutes a challenge as not only the number of years lived are
39 essential, but also the quality of life spent on those years becomes a priority (3-5). The
40 functional decline that is part of the ageing process or due to sequela from diseases has shown
41 to be a risk factor for hospitalisation, institutionalisation, additional expenses with health and
42 poor quality of life (6-8). This risk is highly intensified when it comes to dependency on the
43 activities of daily living (ADL) (9, 10).

44 **Health self-perception**

45 Health self-perception (HSP) describes the perception that each individual has of
46 his/her health, including any essential or significant dimensions of his/her life (11). A positive
47 attitude towards life and health allows for better acceptance of the disease as part of life, and
48 so, the question regarding HSP is commonly found in the medical and social investigations and

49 has proven to be important, not only in the prediction of morbidity and mortality but also in
50 the loss of functional capacities (6, 12-14).

51 However, it is usually used as a covariable and not often as one of the main targets of a
52 study (5, 7, 15).

53 Nevertheless, the studies that focus on the HSP found that a positive HSP had a
54 protective effect towards mortality and morbidity, which suggests, even more, its importance.
55 Also, functional status and HSP are essential indicators not only of health but are also
56 determinants of the quality of life and mortality (3, 6, 13).

57 **Food consumption and nutritional status**

58 Nutritional recommendations for older adults do not differ significantly from the
59 standard recommendations for adults, although they do have special nutritional needs since
60 ageing affects the absorption, use and excretion of nutrients (16-19). Furthermore, some
61 studies found changes when it comes to food consumption, such as loss of appetite, eating
62 fewer complete meals after retirement and when the older adult lives or eats alone. Food
63 habits may also change when women become widows since they used to choose and cook
64 food according to the husband's preferences (20-22).

65 Studies have also shown that men who participated in shopping for groceries made
66 healthier food choices (23, 24).

67 On the other hand, mobility problems have a negative impact on food purchase and
68 cooking. Therefore, food consumption is more likely to be based on ready-to-eat, smaller and
69 unhealthy meals. Consequently, being dependent on the ADL can be a risk factor for
70 malnutrition (9, 17, 18, 25-27).

71 The nutritional status of older adults is influenced by the physiological alterations that
72 occur with ageing (16, 28), by socioeconomic factors like income and lifestyle and by
73 psychological factors like depression and cognitive deficit (28, 29). Promoting a healthy
74 nutritional status of the older adults requires adaptations to life circumstances, as this age

75 group is more vulnerable to nutritional deficits, due to function deterioration, loss of appetite,
76 change in taste and drug-nutrient interactions (18, 28, 29).

77 In recent studies, quality of life has been the main objective of health promotion in
78 older adults, where results have shown a positive link between HSP and quality of life (3, 14,
79 27, 28, 30). An association between HSP and nutritional status was found in some studies (20-
80 22, 31).

81 However, the link between HSP and food consumption was found in very few studies
82 (27, 32).

83 This information can be used, not only by health authorities to understand which
84 health care the older adult needs, but also by other societal sectors like urban planning,
85 transportation, equipment, social and others to give the older adult a social environment that
86 he/she can use independently and safely.

87

88 **Methodology**

89 This study uses data from the Pronutrisenior² project. The questionnaire includes a
90 total of eighteen sections that included both qualitative and quantitative methods, aiming at
91 a comprehensive and holistic approach to the older adults living in the community. From the
92 complete dataset, the information regarding socio-demographic characteristics, family and
93 social network (33), general perception of health, Activities of Daily Living (ADL) (34), clinical
94 characterization, 24-hour recall and food habits, Satisfaction with Food-Related Life Scale
95 (SWFoL) (35), nutritional status from the Mini Nutritional Assessment (MNA) (36, 37) and
96 anthropometry was selected to meet the objective of the current paper (Table 1). More
97 information regarding the complete methodology of the project can be found in Afonso et al.,
98 2016.

² The PRONUTRISENIOR project was financed by Iceland, Liechtenstein and Norway through the EEA Grants (PT06 – Public Health Initiatives Program reference 81NUS).

99 The sample is representative of the Family Health Unit Nova Via (NVFHU) non-
100 institutionalised users aged 65 or above that live in the geographical area of Vila Nova de Gaia.
101 It includes a heterogenic population, living in urban, semi-urban and rural, inland and coastal
102 environments, with different educational levels and socioeconomic status.

103 From the total of 3073 older adults registered at NVFHU, identified as potential
104 participants, 602 were interviewed with a structured questionnaire, in a face-to-face situation
105 by trained interviewers.

106 Firstly, the participant's cognitive function was assessed by the Mini-Mental State
107 Examination (39): 143 were classified as having a cognitive deficit and were therefore excluded
108 from this study.

109 As a result, our final sample comprises a total of 459 participants.

110 **Data analysis**

111 The data regarding the 24-hour recall was first analysed with the ESHA's Food
112 Processor® Nutrition Analysis software.

113 The entire data, including the 24-hour recall, was then analysed with IBM SPSS
114 Statistics© version 25.0 for Windows. For the descriptive analysis, categorical variables are
115 presented as frequencies (n and %) and continuous variables as means with standard
116 deviations (SD) for variables with normal distribution, and as median (Mdn) for variables
117 without normal distribution, minimum and maximum were also presented. The normality was
118 analysed using the kurtosis and skewness. The t-test and Mann-Whitney's test were used to
119 compare, respectively means and mean ranks of independent groups.

120 The association between variables was measured using Spearman's correlation
121 coefficient (ρ). Binary logistic regression models were used to predict a better HSP ("Healthy"
122 or "Very healthy") and a better perception of health compared to others of the same age ("As

123 good” or “Better”). The independence with medication and eating (corresponding to the ADL)
124 were removed because in both variables one of the groups of the dependent variables had a
125 low number of participants. A value of $p < 0.05$ was taken into consideration for the statistical
126 significance of the hypothesis tested.

127

128 **Results**

129 Characteristics of the study participants, housing, family and social network can be observed in
130 Table 2. Of the 459 participants, 54.2% were women and age ranged from 65 to 94 years. Most
131 of them were married (70.8%), retired (94.6%) and with an average of 5.2 years of education.
132 The results showed that 18.5% were living alone. However, all of them reported having
133 someone to contact every day, even if not everyone had someone to talk about personal
134 issues.

135 More than half reported having a vegetable garden where they could grow vegetables for
136 domestic consumption, and 18.3% raised animals for self-consumption.

137 When asked about their HSP, 44,9% perceived themselves as healthy or very healthy and,
138 when compared to others of the same age, 77,1% perceived themselves as being as in good or
139 better health. Men presented a higher HSP (Mdn=4) than women (Mdn=3), $U=22126$, $p=0.003$.
140 However, there is no significant difference between men and women when comparing their
141 health to other people of the same age $U=24414$, $p=0.187$; A moderate positive correlation
142 was observed between HSP and how they compare themselves to others of the same age
143 $r=0.430$, $n=459$, $p < 0.001$.

144 From the ADL scale, women presented a mean(\pm SD) of 7.53(1.14) and men a mean(\pm SD) of
145 4.78(0.544). When it comes to being responsible for their medication 98.5% were
146 independent, in what food preparation is concerned 14.1% needed to have most or all the
147 meals prepared and served, in contrast, 99.3% were able to eat independently. Regarding

148 shopping for groceries, 83% shopped independently, but 61.2% were frequently accompanied
149 by someone.

150 From the clinical characterisation, there was a mean(\pm SD) of 5.18(2.51) number of reported
151 diseases or health problems. The five most frequently reported were: hypertension (n=343),
152 dyslipidaemia (n=287), osteoarticular diseases or problems (n=254), gastrointestinal diseases
153 or problems (n=186) and Diabetes Mellitus (n=155). Medication was common amongst the
154 sample with a mean(\pm SD) of 4.81(2.98) different drugs taken per day.

155 The SWFoL presented a mean(\pm SD) of 14.62(2.74). Men present a significant higher mean(\pm SD)
156 15.02(2.37) than women mean(\pm SD) 14.28(2.98); $t(452.324)=-2.989$, $p=0.003$.

157 Energy and nutrient intake obtained from the 24hour recall is described in Table 3. Of the 459
158 participants, 46% were identified as non-drinkers, as they did not drink alcohol in the 24 hours
159 prior to the interview. Therefore, the results regarding alcohol consumption were analysed
160 taking into consideration only drinkers (n=248).

161 The food habits of older adults showed that only 8,5% did three full meals per day and 30,9%
162 ate only one full meal per day. Moreover, 73,2% ate at least one serving of dairy products
163 every day; 73,9% ate two or more servings of legumes or eggs per week; 96,5% ate meat, fish
164 or poultry every day; 91,7% consumed two or more servings of fruits or vegetables per day,
165 and 31,4% drank less than three glasses of fluid (water, juice, coffee, tea, milk) per day.

166 Of the 459 participants, 14 declined to have their measures taken, so regarding BMI, data were
167 obtained from only 445 older adults. According to the BMI distribution, the sample on average
168 is classified as overweight since the mean(\pm SD) is 29.28(4.74) kg/m². There is a significant
169 difference in the BMI of men |mean(\pm SD) 28.37(3.87)| and women |mean(\pm SD) 30.08(5.26)|;
170 $t(431.523)=3.938$, $p<0.001$.

171 MNA showed that the sample presented a median of 25, so most of the sample is not
172 malnourished, but 1,1% of the cases presented a score that points to malnutrition, and 25,9%

173 of the cases are at risk of malnutrition. From the Mann-Whitney test, we could conclude that
174 men have a higher MNA score (Mdn=25) than women (Mdn=24.5), $U=21007$, $p<0.001$.

175 Correlations regarding MNA and BMI, are presented in Table 4. MNA correlates positively with
176 education, social network, independence with shopping and eating, satisfaction with food-
177 related life, fibre intake and the number of full meals per day. On the other hand, it correlates
178 negatively with age, number of diseases and medication. BMI correlates positively with the
179 number of glasses of liquid per day, the number of diseases and medication but it correlates
180 negatively with the number of full meals per day, education and age.

181 In table 5, regarding the binary logistic regression, we can see that four factors score had
182 significant associations with a better HSP: a higher MNA score, fewer drugs taken per day,
183 higher education and higher water consumption. On the other hand, from the four factors
184 score that had significant associations with a better HSP, only higher education had a
185 significant association to a better perception of health when compared to other people of the
186 same age, since the other three were independence in the activities of shopping for food, a
187 higher SWFoL and older age ($p<0,05$).

188

189 **Discussion**

190 This project focus on non-institutionalized older adults living in the community in Vila
191 Nova de Gaia, a northern Portuguese region as part of the Pronutrisenior project³.

192 Almost half of the older adults presented a positive HSP, but women, like in other
193 studies showed a lower HSP compared to men (31, 40). Most of the older adults also saw
194 themselves to be better than others of the same age. Moreover, those with a higher HSP were
195 also more likely to perceive themselves as being better than other people of the same age.

³The PRONUTRISENIOR project was finance by Iceland, Liechtenstein and Norway through the EEA Grants (PT06 – Public Health Initiatives Program reference 81NUS).

196 The current sample reported, not only, having high independence when it comes to
197 ADL, high satisfaction with food related-life, but additionally, the majority presented a normal
198 nutritional status. However, most of them took a considerable number of different drugs per
199 day, reported numerous diseases and health problems and more than half were overweight
200 (41).

201 All these characteristics seem to be linked since the most significant impact to a better
202 HSP emerged from the MNA, in which an older adult with a normal nutritional status is 1.28
203 times more likely to have a better HSP, which goes with what was found in recent studies
204 regarding nutritional status (20-22). The number of drugs taken per day was the 2nd most
205 important determinant of HSP, as older adults that took fewer drugs were 1.26 times more
206 likely to have a positive HSP. Polypharmacy, use of multiples medicines, was common among
207 our older adults, and studies that focused more on clinical variables found that older adults
208 with polypharmacy perceived their health as poor or worst than older adults with non-
209 polypharmacy (27, 42). Higher education was also found to have an impact on a better HSP,
210 like in other studies (31, 32).

211 The most significant impact on how they compare to others of the same age was the
212 independence on shopping activities, in which an independent older adult was 4.17 times
213 more likely to compare his/her health as being better than others of the same age. A similar
214 result was also found in other studies when it comes to independent older adults. However, in
215 these studies, HSP was analysed by only one question, and the older adults were not asked
216 how they compared themselves to others of the same age (15, 20, 32, 43, 44).

217 This can also be explained by the fact that our participants are non-institutionalized
218 and being independent allows the older adults to get out of home more, and, in consequence,
219 be more aware of the environment where they live.

220 The SWFoL, in which an older adult more satisfied with food-related aspects of his/her
221 life was 1.19 times more likely to also compare his/her health as being better than others of

222 the same age. This result can be compared to other studies that found that when it comes to
223 being satisfied with food-related aspects of their lives, older adults felt that they also had more
224 quality of life (14, 21, 25, 26). This gives more importance when it comes to nutritional aspects
225 of the older adults' lives since, the more satisfied with the food they were, the better they
226 perceived themselves in general.

227 Ageing was not found to be a characteristic that affected HSP, which is in line with
228 some studies (44), but not with other studies (15, 20). However, we did find that age impacts
229 on how older adults compare to others of the same age. Meaning that as age goes by, the
230 older adults perceived themselves "as good" or "better" than others of the same age.

231 Since different predictors for HSP and the perception of health when compared to
232 others of the same age were found, the general perception of health should not be
233 investigated as being a single aspect but rather a complex issue, in which the individual views
234 himself/herself not only in an absolute way but also in contrast to others. This indicates that
235 when an older adult is comparing his/her health to others, he/she takes into consideration not
236 only himself/herself, as being independent and how satisfied he/she is with food and life, but
237 also what surrounds them and how they compare themselves with people of the same age
238 group.

239 Older adults with normal nutritional status, like on other studies were found to be
240 independent in ADL (20, 21), in particular being independent in shopping for food and eating;
241 the fact that MNA and the ADL positively correlated gives more strength to the results
242 regarding the impact that the nutritional status has on HSP.

243 Considering the energy and nutrient intake for this age group, the sample reported an
244 average consumption of total protein, carbohydrates and alcohol above the
245 recommendations; total fibre intake below the recommendations and total fat intake in line
246 with the recommendations. The consumption of water was found to be in the lowest limit of

247 the recommendations (the minimum recommended for an elderly is 1500 ml of water per
248 day).

249 Food consumption, like in some papers, was not associated with HSP (21, 43).
250 However, it is important to note that a higher consumption of water was found to be a
251 predictor of a positive HSP. On the other hand, some studies found an association between a
252 low consumption of vegetables, fruit, meat, fish, water with a bad HSP (27, 31, 45).

253 A positive correlation was found between fibre intake, full meals per day, the number
254 of glasses of liquid per day and the satisfaction with food-related aspects with nutritional
255 status.

256 A higher BMI was found to be negatively associated with fewer meals per day and, on
257 the contrary, with drinking more glass of liquid (tea, water, coffee, juice, milk) per day.

258 These results may be explained by the fact that the information regarding food
259 consumption was collected by a single 24-hour recall and the limitations associated with this
260 tool.

261 Regarding the fact that most of the variables derived from self-reported data, they are
262 to a certain extent, affected by the subjective perception of each respondent.

263 Despite this, they can be considered essential and reliable estimators of health status
264 and good predictors of health care needs.

265 The present study contributes to the knowledge of HSP and has implications for future
266 research and healthcare practices. Interventions need to focus on factors like nutritional
267 status, independence to carry out daily activities, satisfaction with food, medication and apply
268 them to modify the negative HSP and attitudes towards ageing and health. Such interventions
269 may facilitate, not only a successful adaptation to ageing but also maximise all the positive
270 aspects of old age.

271 Therefore, our results help predict, plan and develop which health care the older
272 adults need, according to their self-perception of health and how they compare themselves to
273 others.

274

275 The authors, at this moment represented by the corresponding author, declare that
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279

280

281 **References**

- 282 1. Coelho E, Magalhães MG, Peixoto J, Bravo J. Projeções de População residente em
283 Portugal: 2015-2080. Lisboa: Instituto Nacional de Estatística. 2017.
- 284 2. European comission. The 2015 Ageing Report: Economic and budgetary projections for
285 the 28 EU Member States (2013-2060). European Economy. 2015.
- 286 3. Charoenpoom S. Perceptions of quality well-being among the elderly in the Dusit
287 District, Bangko. Procedia-Social and Behavioral Sciences. 2015;197:1570-4.
- 288 4. Marques EMBG, Serdio Sánchez C, Palacios Vicario B. Perceção da qualidade de vida de
289 um grupo de idosos. Revista de Enfermagem Referência. 2014(1):75-84.
- 290 5. Sculpt M, Haime V, Jacquart J, Takahashi J, Moscovitz B, Webster A, et al. A healthy
291 aging program for older adults: effects on self-efficacy and morale. Advances in mind-body
292 medicine. 2015;29(1):26.
- 293 6. Cesari M, Onder G, Zamboni V, Manini T, Shorr RI, Russo A, et al. Physical function and
294 self-rated health status as predictors of mortality: results from longitudinal analysis in the
295 iISIRENTE study. BMC geriatrics. 2008;8(1):34.

- 296 7. Del Pilar Díaz-López M, Aguilar-Parra JM, López-Liria R, Rocamora-Pérez P, Vargas-
297 Muñoz ME, Padilla-Góngora D. Skills for Successful Ageing in the Elderly. Education, well-being
298 and health. *Procedia-Social and Behavioral Sciences*. 2017;237:986-91.
- 299 8. Spillman BC. Changes in elderly disability rates and the implications for health care
300 utilization and cost. *The Milbank Quarterly*. 2004;82(1):157-94.
- 301 9. Hu Y-N, Hu G-C, Hsu C-Y, Hsieh S-F, Li C-C. Assessment of individual activities of daily
302 living and its association with self-rated health in elderly people of Taiwan. *International*
303 *Journal of Gerontology*. 2012;6(2):117-21.
- 304 10. Levy BR, Slade MD, Murphy TE, Gill TM. Association between positive age stereotypes
305 and recovery from disability in older persons. *JAMA*. 2012;308(19):1972-3.
- 306 11. Menec VH, Chipperfield JG, Perry RP. Self-perceptions of health: A prospective analysis
307 of mortality, control, and health. *The Journals of Gerontology Series B: Psychological Sciences*
308 *and Social Sciences*. 1999;54(2):P85-P93.
- 309 12. Freeman AT, Santini ZI, Tyrovolas S, Rummel-Kluge C, Haro JM, Koyanagi A. Negative
310 perceptions of ageing predict the onset and persistence of depression and anxiety: Findings
311 from a prospective analysis of the Irish Longitudinal Study on Ageing (TILDA). *J Affect Disord*.
312 2016;199:132-8.
- 313 13. Mackenbach JP, Simon JG, Looman CW, Joung IM. Self-assessed health and mortality:
314 could psychosocial factors explain the association? *International Journal of Epidemiology*.
315 2002;31(6):1162-8.
- 316 14. Tkatch R, Musich S, MacLeod S, Kraemer S, Hawkins K, Wicker ER, et al. A qualitative
317 study to examine older adults' perceptions of health: keys to aging successfully. *Geriatric*
318 *Nursing*. 2017;38(6):485-90.
- 319 15. Damian J, Ruigomez A, Pastor V, Martin-Moreno JM. Determinants of self assessed
320 health among Spanish older people living at home. *Journal of Epidemiology & Community*
321 *Health*. 1999;53(7):412-6.

- 322 16. De Morais C, Oliveira B, Afonso C, Lumbers M, Raats M, De Almeida M. Nutritional risk
323 of European elderly. *European journal of clinical nutrition*. 2013;67(11):1215.
- 324 17. Gustafsson K, Andersson J, Andersson I, Nydahl M, SjöEdén P-O, Sidenvall B.
325 Associations between perceived cooking ability, dietary intake and meal patterns among older
326 women. *Scandinavian Journal of Nutrition*. 2002;46(1):31-9.
- 327 18. Maynard M, Blane D. Dietary assessment in early old age: experience from the Boyd
328 Orr cohort. *European journal of clinical nutrition*. 2009;63(S1):S58.
- 329 19. van der Meij BS, Wijnhoven HA, Lee JS, Houston DK, Hue T, Harris TB, et al. Poor
330 Appetite and Dietary Intake in Community-Dwelling Older Adults. *Journal of the American*
331 *Geriatrics Society*. 2017;65(10):2190-7.
- 332 20. Heuberger R, van Eeden-Moorefield B, Wong H. Perceived versus actual health and
333 nutritional status: Results from a cross sectional survey of rural older adults. *Journal of*
334 *Gerontology & Geriatric Research*. 2013;3:1-6.
- 335 21. Jiménez-Redondo S, De Miguel BB, Banegas JG, Mercedes LG, Gomez-Pavon J, Vives
336 CC. Influence of nutritional status on health-related quality of life of non-institutionalized older
337 people. *The journal of nutrition, health & aging*. 2014;18(4):359-64.
- 338 22. Johansson Y. Self-perceived health and nutritional status among home-living older
339 people: a prospective study: Linköping University Electronic Press; 2009.
- 340 23. Hardin-Fanning F, Gokun Y. Gender and age are associated with healthy food
341 purchases via grocery voucher redemption. *Rural and remote health*. 2014;14(3):2830.
- 342 24. Whitelock E, Ensaff H. On Your Own: Older Adults' Food Choice and Dietary Habits.
343 *Nutrients*. 2018;10(4):413.
- 344 25. Gustafsson K, Sidenvall B. Food-related health perceptions and food habits among
345 older women. *Journal of advanced nursing*. 2002;39(2):164-73.

- 346 26. Machón M, Larrañaga I, Dorronsoro M, Vrotsou K, Vergara I. Health-related quality of
347 life and associated factors in functionally independent older people. *BMC geriatrics*.
348 2017;17(1):19.
- 349 27. Machón M, Vergara I, Dorronsoro M, Vrotsou K, Larrañaga I. Self-perceived health in
350 functionally independent older people: associated factors. *BMC geriatrics*. 2016;16(1):66.
- 351 28. Donini LM, Scardella P, Piombo L, Neri B, Asprino R, Proietti AR, et al. Malnutrition in
352 elderly: social and economic determinants. *J Nutr Health Aging*. 2013;17(1):9-15.
- 353 29. Kvamme J-M, Olsen JA, Florholmen J, Jacobsen BK. Risk of malnutrition and health-
354 related quality of life in community-living elderly men and women: The Tromsø study. *Quality*
355 *of Life Research*. 2011;20(4):575-82.
- 356 30. Ferrer A, Formiga F, Almeda J, Alonso J, Brotons C, Pujol R. Calidad de vida en
357 nonagenarios: género, funcionalidad y riesgo nutricional como factores asociados. *Medicina*
358 *clínica*. 2010;134(7):303-6.
- 359 31. Garcia CdAM, Moretto MC, Guariento ME. Associação entre autopercepção de saúde,
360 estado nutricional e qualidade de vida de idosos. *Revista de Ciências Médicas*. 2018;27(1):11-
361 22.
- 362 32. Abuladze L, Kunder N, Lang K, Vaask S. Associations between self-rated health and
363 health behaviour among older adults in Estonia: a cross-sectional analysis. *BMJ open*.
364 2017;7(6):e013257.
- 365 33. Fillenbaum GG, Organization WH. Troisième âge et bien-être: approches d'une
366 évaluation multidimensionnelle. 1986.
- 367 34. Lawton MP, Brody EM. Assessment of older people: self-maintaining and instrumental
368 activities of daily living. *The Gerontologist*. 1969;9(3):179-86.
- 369 35. Grunert KG, Dean M, Raats MM, Nielsen NA, Lumbers M. A measure of satisfaction
370 with food-related life. *Appetite*. 2007;49(2):486-93.

- 371 36. Guigoz Y, Jensen G, Thomas D, Vellas B. The mini nutritional assessment (mna[®]) review
372 of the literature-what does it tell us?/discussion. *The journal of nutrition, health & aging.*
373 2006;10(6):466.
- 374 37. Kaiser MJ, Bauer JM, Ramsch C, Uter W, Guigoz Y, Cederholm T, et al. Validation of the
375 Mini Nutritional Assessment short-form (MNA-SF): a practical tool for identification of
376 nutritional status. *J Nutr Health Aging.* 2009;13(9):782-8.
- 377 38. Afonso C, Poínhos R, Sorokina A, Oliveira BM, Sousa M, Fonseca L, et al.
378 PRONUTRISENIOR: a holistic approach to the older adults living in the community; a rationale
379 and methodology. *Sociedade Portuguesa de Ciências da Nutrição e Alimentação : Alimentação*
380 *humana.* 2016;22.
- 381 39. Guerreiro M, Silva AP, Botelho MA, Leitão O, Castro-Caldas A, Garcia C. Adaptação à
382 população portuguesa da tradução do Mini Mental State Examination (MMSE). *Revista*
383 *Portuguesa de Neurologia.* 1994;1(9):9-10.
- 384 40. Falk H, Skoog I, Johansson L, Guerchet M, Mayston R, Hörder H, et al. Self-rated health
385 and its association with mortality in older adults in China, India and Latin America—a 10/66
386 Dementia Research Group study. *Age and ageing.* 2017;46(6):932-9.
- 387 41. Grzegorzewska A, Wołejko K, Kowalkowska A, Kowalczyk G, Jaroch A. Proper BMI
388 ranges for the elderly in the context of morbidity, mortality and functional status Prawidowe
389 zakresy wskaźnika BMI dla osób starszych w kontekście zachorowalności, śmiertelności
390 oraz statusu funkcjonalnego. *PRACE ORYGINALNE/ORIGINAL PAPER.* 2016:114.
- 391 42. Schroyen S, Marquet M, Jerusalem G, Dardenne B, Van den Akker M, Buntinx F, et al.
392 The link between self-perceptions of aging, cancer view and physical and mental health of
393 older people with cancer: A cross-sectional study. *Journal of geriatric oncology.* 2017;8(1):64-8.
- 394 43. Fernandez-Martinez B, Prieto-Flores M-E, Forjaz MJ, Fernández-Mayoralas G, Rojo-
395 Pérez F, Martínez-Martín P. Self-perceived health status in older adults: regional and
396 sociodemographic inequalities in Spain. *Revista de Saúde Pública.* 2012;46(2):310-9.

397 44. Schneider G, Driesch G, Kruse A, Wachter M, Nehen H-G, Heuft G. What influences
398 self-perception of health in the elderly? The role of objective health condition, subjective well-
399 being and sense of coherence. Archives of gerontology and geriatrics. 2004;39(3):227-37.

400 45. An R, Xiang X, Liu J, Guan C. Diet and self-rated health among oldest-old Chinese.
401 Archives of gerontology and geriatrics. 2018;76:125-32.

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403

404

Table 1. Tools selected to meet the objectives of the current paper

Socio-demographic characteristics	Age, sex, education level, marital status, professional situation and living conditions.
Family and social network	Fillenbaum Social Network: it evaluates social integration and the risk of social isolation (33).
General perception of health	It includes two questions: 1) health self-perception; 2) perception of health when compared to others of the same age.
Clinical characterization	Self reported diseases and medication
24-hour recall and food habits	Total Energy, Macronutrients, Fibre, Water and Alcohol intakes
Satisfaction with Food-Related Life Scale (SWFOL)	It includes a total of 5 statements that express the importance of food for satisfaction or dissatisfaction with life (35). The participants were asked how much they agreed or disagreed with what was being stated.
Anthropometry	BMI was calculated from weight and height measured during the interview.
Nutritional Status	MNA was used to assess the older adults that are malnourished or at risk of malnutrition (36,37). Measures the dependence or independence in different activities of daily living (34).
ADL	Level of independence in eating, medication, shopping, cooking or food preparation

Table 2. Descriptive analysis of the sample (n=459)		
Variables		Value or number
Socio-demographic characteristics		
Sex (%)	Women	54.2
	Men	45.8
Age (years)	Mean(\pm SD)	73.3(5.95)
	Minimum	65
	Maximum	94
Marital Status (%)	Single	2.2
	Married or living as married	70.8
	Divorced or living apart	3.7
	Widow(er)	23.3
Education (years) ^a	Mean(\pm SD)	5.20(3.46)
	Minimum	0
	Maximum	20
Professional situation (%)	Retired	94.6
	Active/unemployed/domestic	5.4
Characteristics of housing, family and social network		
Living situation (%)	Alone	18.5
	Accompanied	81.5
Vegetable garden (%) ^b		56.2
Animals (%) ^c		18.3
Spent time alone (%) ^d		37.9
Someone to contact day-to-day (%)		100
Someone to talk about personal issues (%)		87.4
Pet (%)		54.2
Social Network (score)	Mean(\pm SD)	3.16(1.20)
	Minimum	0
	Maximum	4
^a Number of years attended at school.		
^{b,c} Growth of vegetables or raising animals for self-consumption.		
^d Considering day and night.		

Table 3. Energy and nutrient intake (24h recall)

		Kcal	% ^a	Gram
Total Energy	Mean(\pm SD)	1587.36(513.48)		
	Minimum	471.11		
	Maximum	3069.31		
Carbohydrates	Mean(\pm SD)	768.44(275.14)	49.32(11.18)	192.11(68.78)
	Minimum	189.52	18.32	47.38
	Maximum	2178.96	83.15	544.74
Fat	Mean(\pm SD)	417.04(213.63)	25.48(8.20)	46.33(23.71)
	Minimum	25.56	4.31	2.84
	Maximum	1253.53	49.70	139.28
Protein	Mean(\pm SD)	273.46(128.14)	17.16(5.37)	68.37(32.03)
	Minimum	17.68	3.58	4.42
	Maximum	863.36	38.85	215.84
Alcohol	Mean(\pm SD)	150.66(129.54)	9.52(7.21)	21.59(18.51)
	Minimum	0.07	0.23	0.01
	Maximum	716.8	37.37	102.4
Fiber	Mean(\pm SD)			15.38(10.71)
	Minimum			1.42
	Maximum			141.33
Water	Mean(\pm SD)			1662.01(560.07)
	Minimum			514.17
	Maximum			3823.65

^aPercentage of the Total Energy

Table 4. Correlations between variables

Variables	MNA		BMI	
	Spearman's (ρ)	<i>p</i>	Spearman's (ρ)	<i>p</i>
MNA	1		0.007	0.888
BMI	0.007	0.888	1	
Age (years)	-0.132	0.004	-0.111	0.019
Education ^a	0.112	0.016	-0.155	0.001
Fillenbaum (social network)	0.196	<0.001	-0.038	0.419
Independent (shopping)	0.231	<0.001	-0.029	0.541
Independent (medication)	0.058	0.218	0.065	0.17
Independent (eating)	0.104	0.026	-0.031	0.514
Independent (cooking)	0.039	0.405	0.036	0.449
Number of medication ^b	-0.461	<0.001	0.226	<0.001
Number of diseases	-0.442	<0.001	0.282	<0.001
SWFoL score	0.221	<0.001	-0.036	0.447
Full meals per day	0.371	<0.001	-0.136	0.004
Glasses of liquid per day	0.206	<0.001	0.115	<0.001
Total Energy (Kcal)	0.04	0.394	0.051	0.28
Protein (Kcal)	0.025	0.558	0.072	0.131
Carb (Kcal)	0.04	0.389	0.031	0.519
Fat (Kcal)	0.005	0.91	0.068	0.68
Fibre (g)	0.194	<0.001	0.001	0.982
Water (g)	0.021	0.658	-0.041	0.384
Alcohol (just drinkers) (g)	-0.098	0.129	0.06	0.364

^aNumber of years attended at school

^bNumber of drugs taken per day

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Table 5. Binary Logistic Regression model for factors significantly associated with General Health Perception

	Health self-perception						Perception of health compared to others of the same age					
	Unadjusted Model			Adjusted Model			Unadjusted Model			Adjusted Model		
	n	OR	95% CI	p	OR	95% CI	p	OR	95% CI	p		
Age	459	0.96	0.930;0.992	0.013								
Sex	Years	1	(ref.)	0.01								
	Women	249	1.631	1.125;2.365	0.013	1.007	0.971;1.045	0.706	1.09	1.020;1.166	0.012	
Social network	Men	210	1.125	0.821;1.547	0.134	1.581	1.011;2.474	0.045				
	Score	459	1.126	0.964;1.316	<0.001	1.146	0.963;1.363	0.124				
Education	Years	459	1.113	1.052;1.178	<0.001	1.058	0.988;1.134	0.108	1.179	1.022;1.361	0.024	
	MVA	459	1.382	1.234;1.547	<0.001	1.206	1.090;1.333	<0.001				
BMI	Score	445	0.976	0.938;1.015	0.229	0.953	0.910;0.988	0.043				
	Number	459	0.734	0.692;0.821	<0.001	0.801	0.732;0.876	<0.001				
Diseases	Number	459	0.717	0.657;0.783	<0.001	0.853	0.793;0.917	<0.001				
	Medication	74	1	(ref.)	0.002	1	(ref.)	<0.001	1	(ref.)	0.003	
Independence shopping	Dependent	385	0.428	0.249;0.739	0.166	0.355	0.209;0.602	0.104	4.166	1.647;10.540	0.006	
	Independent	3	1	(ref.)	0.002	1	(ref.)	0.104				
Independence cooking	Score	456	1.467	0.854;2.520	<0.001	1.616	0.906;2.882	0.003				
	SWFOL	142	1.733	0.843;3.560	0.135	1.127	1.041;1.220	0.142				
Full meals per day	One meal	278	0.833	0.425;1.631	0.594	2.141	0.776;5.906	0.133				
	Two meals	39	1	(ref.)	0.006	2.117	0.796;5.633	0.133				
Meat, fish	Three meals	443	1	(ref.)	0.115	1	(ref.)	0.303				
	No	16	0.398	0.126;1.252	0.692	0.48	0.170;1.352	0.165				
Legumes and eggs	Yes	339	1	(ref.)	0.692	1	(ref.)	0.057				
	No	120	0.919	0.604;1.398	0.30	0.632	0.394;1.015	0.045				
Fruit and vegetables	Yes	421	1	(ref.)	0.641	1	(ref.)	0.829				
	No	38	0.696	0.350;1.382	0.641	0.538	0.265;1.093	0.045				
Dairy	Yes	336	1	(ref.)	0.921	1	(ref.)	0.875				
	No	123	0.906	0.597;1.373	0.921	1.055	0.648;1.720	0.875				
Number of glasses of liquid	Less than three	144	1	(ref.)	0.787	1	(ref.)	0.608				
	Three to five	196	1.061	0.689;1.635	0.787	1.143	0.687;1.901	0.608				
Energy	More than five	119	0.97	0.595;1.582	0.903	1.094	0.617;1.942	0.759				
	Kcal	459	1.000	1.000;1.000	0.972	1.000	1.000;1.001	0.032				
Fat	% energy	459	1.000	0.978;1.023	0.981	1.000	0.974;1.027	0.979				
	% energy	459	1.009	0.992;1.025	0.315	1.006	0.987;1.026	0.518				
CHO	% energy	459	0.974	0.974;1.008	0.137	0.979	0.940;1.019	0.291				
	% energy	459	1.008	0.990;1.026	0.373	1.022	0.994;1.050	0.127				
Protein	% energy	459	1.001	1.000;1.001	0.033	1.000	1.000;1.001	0.113				
	% energy	459	1.001	1.000;1.001	0.033	1.000	1.000;1.001	0.113				
Fibre	% energy	459	1.001	1.000;1.001	0.033	1.000	1.000;1.001	0.113				
	% energy	459	1.001	1.000;1.001	0.033	1.000	1.000;1.001	0.113				
Water	% energy	459	1.001	1.000;1.001	0.033	1.001	1.000;1.001	0.02				
	% energy	459	1.001	1.000;1.001	0.033	1.001	1.000;1.001	0.02				
Alcohol (just drinkers)	% energy	240	0.982	0.947;1.018	0.316	0.989	0.948;1.032	0.61				
	% energy	240	0.982	0.947;1.018	0.316	0.989	0.948;1.032	0.61				

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