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Health in Spanish older people: Dietary habits, lifestyles and related socioeconomic factors

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ABSTRACT

Objective: To measure diet quality in the population aged over 65 years in Spain and its autonomous communities and to identify sociodemographic, health and lifestyle factors related to diet quality based on 2017 Spanish National Health Survey.

Methods: To estimate diet quality, we used the Healthy Eating Index for Spanish Population (IASE). A multiple linear regression analysis (regression coefficients and 95 % CIs) was used to determine the relationship between socio-demographic, health and lifestyle factors and IASE. This index was our dependent variable and as independent variables: sex, chronic diseases, age, level of education, engagement in physical activity, marital status and Body Mass Index.

Results: A total of 6325 participants were included in the sample. The diet quality rating in Spain revealed that 0.46 % of our population had an unhealthy diet, 87 % needed to make changes, and 12.3 % were following a healthy diet. Being female (Regression coefficient = 1.6, 95 % CI = 1.14;-1.97), being physically active several times a month (Regression coefficient = 1.6, 95 % CI =0.63–2.48) and several times a week (Regression coefficient = 2.2, 95 % CI =1.36–3.10), having chronic disease (Regression coefficients =0.7, 95 % CI =0.08–1.29), being overweight (Regression coefficient = 0.5, 95 % CI =0.06–0.95) and being aged between 70 and 74 (Regression coefficient = 0.5, 95 % CI =0.01–1.07) and 75–79 (Regression coefficient = 0.9, 95 % CI =0.33–1.50) were associated with higher IASE scores.

Conclusion and implications: These results help to identify risk groups or situations and to design health prevention programs.

1. Introduction

Health is a broad concept that includes physical, mental, and social well-being. Effective health interventions, such as health and disease prevention programs, can keep the population healthy in old age (Lopreite and Mauro, 2017). Understanding the relationship between diet and sociodemographic and lifestyle factors can improve health policies (Friel et al., 2015; Gardner et al., 2023). Dietary pattern-based assessment considers foods within an overall diet and updates dietary recommendations and guidelines, facilitating the role of primary care in promoting healthy diets (Aranceta-Bartrina et al., 2019; Van Achterberg et al., 2011). In 2018, the Spanish Society of Community Nutrition (SENC, in its Spanish acronym) presented an updated food pyramid, with the recommended frequency of food intake and healthy habits. The Mediterranean diet has been the diet with the most positive effects on health. Studies have associated it with longer life expectancy, lower incidence of chronic diseases and cardiovascular benefits (Ramón-Arbués et al., 2019; Norte Navarro and Ortiz Moncada, 2011; Pardo-García et al., 2017). There is no single Mediterranean diet, as foods vary between countries and regions. In addition to the Mediterranean diet, regular physical exercise improves blood sugar and cholesterol levels, and reduces obesity and cardiovascular risk (Ekelund et al., 2016; Rovira Martínez et al., 2021; Urquiaga et al., 2017).

Aging involves physical and psychosocial changes that affect diet. In

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addition, there are geographic inequalities in healthy habits. Studies have shown that age, being female and active, and educational level are related to a better diet (de Paula Matos Souza et al., 2019; Gomes et al., 2016; Martinez-Lacoba et al., 2018). Having a chronic disease may protect against poor diet due to the care and supervision received (Bray et al., 2016; Choi et al., 2022; Hu et al., 2020; Morze et al., 2020; Riou et al., 2011). In Spain, the quality of diet in the elderly has been studied and its association with sociodemographic and economic factors (Cubas de Basterrechea et al., 2020; Hernández Galiot and Goñi Cambrodón, 2015; Martínez Valero et al., 2021; Norte Navarro and Ortiz Moncada, 2011). But Spain has regions with diverse customs and climates, and each thus has its own corresponding dietary pattern related by the local availability of food and the culture and history of the region (Aranceta-Bartrina et al., 2019; Martos Barrachina et al., 2019; Varela Moreiras et al., 2008). Therefore, understanding the relationship between sociodemographic and health factors, lifestyles, and diet in each area is key to designing health policies (Friel et al., 2015). Norte Navarro and Ortiz Moncada (2011) calculated the Healthy Eating Index for Spanish Population (IASE) in Spain and associated socioeconomic factors, using regions as a variable. Our study examines the relationship between diet quality and sociodemographic, health and lifestyle factors (sex, age, marital status, educational level, diseases, physical activity and body mass index) for the whole population and for each region. The aim is to analyse diet quality with the IASE, adherence to the SENC guidelines, and to identify the factors associated with diet in Spain and its regions. This allows us to identify risk groups or situations, and to design health prevention programs with nutritional strategies for the national and regional population, and to evaluate the impact of healthy eating initiatives.

2. Methods

2.1. Study participants

We analysed diet quality in persons aged 65 and over and identified the related sociodemographic, health and lifestyle factors. The database used was the, 2017 Spanish National Health Survey (ENSE, 2017, in its Spanish acronym), conducted by the Spanish Ministry of Health, Consumer Affairs and Social Welfare. Data collection was conducted between October 2016 and October, 2017, with a sample size of 29,195 interviews.

We included all the individuals from this sample aged 65 or over, and, within this population group, we excluded all those who responded "do not know" or did not answer one or more of the questions used in the present work.

2.2. Measurements

To estimate diet quality, we used the IASE. An analysis and discussion of this tool as a measure of diet quality can be consulted in a previous study (Martínez Valero et al., 2021). This index collects data on the frequency of consumption of cereals and cereal products, vegetables, fruit, dairy products, meat (comprising meat, eggs, and fish), legumes, processed meats, sweets and soft drinks; diet variety is also assessed. The IASE variables were scored on a scale from 0 to 10, where the maximum score means the SENC guidelines are complied with (Aranceta-Bartrina et al., 2019). Some of the variables were coded to facilitate the application of the index, such that the ENSE, 2017 food group of "pasta, rice, potatoes, bread and cereals" was coded as "cereals and cereal products" and "meat, eggs and fish" was coded as "meat". The rest remained the same.

It was also necessary to modify the frequency of consumption to be able to apply the IASE, such that "once or more than once a day" from the ENSE, 2017 was coded as "daily", "from four to six times a week and three times a week" was coded as "three or more times a week", while the answer "do not know or no answer" was not taken into account. The other variables remained the same.

In the IASE, three broad categories were established: healthy diet (>80 points), changes required (50–80 points) and unhealthy diet (<50 points). The percentage of the population included in each category was calculated for the country overall and for each of the autonomous communities.

Additionally, to determine in which food groups changes were needed, we calculated the percentage of individuals that complied with the recommended intake of each of the food groups. If the percentage was below 50 %, it was considered "unhealthy"; between 50 % and 80 % was considered "changes required"; and above 80 % was considered "healthy".

2.3. Statistical analysis

A descriptive analysis was performed to determine the characteristics of age and sex of the sample.

Using multiple linear regression models, we estimated the association of the sociodemographic, health and lifestyle factors on the IASE for Spain, and its 17 autonomous communities and the autonomous cities of Ceuta and Melilla.

The IASE was our dependent variable, and following previous studies (Colillas-Malet et al., 2024; de Souza et al., 2017; You et al., 2024a; You et al., 2024b), as independent variables, we incorporated the sociodemographic, health and lifestyle factors that might be related to the quality of an individual's diet (Table 1).

Excel 2016 and SPSS V.24 were used for the statistical analysis.

This study has used data from Spanish National Health Survey. This survey is conducted by the Spanish Ministry of Health, Consumer Affairs and Social Welfare and belongs to the European Health Interview Survey. Since the study worked with anonymized and publicly available data by this institution (www.ine.es), ethical approval is not required to this study.

3. Results

A total of 6325 participants were thus included in the sample.

Table 2 shows a descriptive analysis of the sample at national level and for each of the autonomous communities and the IASE by autonomous communities and the percentage of population in each of the categories established.

The percentage of individuals following a healthy diet is low, with the lowest percentage corresponding to Galicia (2.8 %), and the highest being found in the Canary Islands (32.3 %). As regards the communities whose population need to change their diet, Galicia presented the highest percentage (97.2 %), followed by Castilla-La Mancha (93.9 %). In the category of unhealthy diet, Ceuta and Melilla presented the highest percentage (2.2 %), while for the rest the proportion was below 1 %.

Table 3 shows the percentage of individuals that meet the recommended intake in each food group (Fruit, Cereals, Vegetables, Dairy products, Meat, Legumes, Processed meat, Sweets and, Soft drinks) and diet variety, following the SENC guidelines at the national level and for each of the autonomous communities.

Finally, using multiple linear regression analysis, we associated the IASE with sociodemographic, health and lifestyle variables for each of the autonomous communities. At the national level, the multiple linear regression analysis (Table 4) reveals a positive association ($p < 0.05$) between being a woman and the IASE. Furthermore, this association is replicated for other variables: engaging in physical activity, both various times a week and various times a month, being aged between 70 and 79, and being overweight. Additionally, having a chronic disease is also associated with this index, while having completed primary education and being single is inversely related to the IASE.

These associations identified at the national level between certain sociodemographic, health and lifestyles variables and the IASE are not

Table 1
Coding of the Independent variables involved in the multiple linear regression: Sex, Age, Presence or absence of chronic or long-term diseases or health problems, Level of education, Physical activity, Marital status, Body mass index, based on 2017 Spanish National Health Survey.

Independent variables	Coded	Remarks
Sex	woman man	
Age	1: Individuals aged 65–69 years 2: Individuals aged 70–74 years 3: Individuals aged 75–79 years 4: Individuals aged 80 years or over	
Presence or absence of chronic or long-term diseases or health problems		
Level of education	1: No completed studies	Including those that could not read or write and those that had not completed primary education;
	2: Primary education	Those that had completed primary education or any other first stage of education
	3: Secondary education.	Those that had completed higher secondary education or lower or higher vocational training
	4. University education	
Engagement in physical activity	1: None or occasional 2: At least once a month 3: At least once a week	
Marital status	1: Single 2: Married 3: Separated/ divorced 4. Widowed	
Body Mass Index (BMI)	Underweight (BMI <18.5) Normal weight (BMI 18.5–24.9) Overweight (BMI 25–29.9) Obesity (BMI >30)	Defined as a person's weight in kilograms divided by the square of their height in metres, was calculated using individuals' self-reported weight and height.

found in all the Spanish regions, as the samples in these territories are smaller. Consequently, the regional analysis was conducted according to the number of variables related to the IASE. Table 5 shows the factors associated with IASE in each region.

At the national level, the model shows that being a woman, engaging in physical activity, having a chronic disease, being overweight, and being aged between 70 and 79 years are associated with higher IASE scores. In contrast, only having completed basic education and being single are associated with lower scores on this measure.

If we look at the autonomous communities, in five (Aragon, Asturias, Valencian Community, Extremadura and Ceuta and Melilla), the sociodemographic, health and lifestyle factors are not associated with the IASE, that is, with diet quality.

Furthermore, being a woman is the most predominant factor related to IASE, given that it was found to be statistically significant in 9 of the 18 communities analysed (Balearic Islands, Canary Islands, Cantabria, Castilla and Leon, Catalonia, Galicia, Murcia, Navarre and the Basque Country). Age is another factor related to IASE in some autonomous communities (Cantabria, Catalonia, Galicia). Marital status also appears as a factor linked to IASE, but, in this case, being single, separated or divorced is associated with lower IASE scores (Cantabria and Navarre), while being married or living with a partner is linked to higher scores (Catalonia and Madrid). The engagement in physical activity factor, both various times a month and various times a week, is one of the most important factors with a positive relationship with the IASE, reaching statistical significance in Cantabria, Castilla and Leon, Castilla-La Mancha, Catalonia, Madrid and La Rioja. Finally, BMI has a slightly significant relationship with the IASE in Andalusia and the Basque Country.

Drawing on these results, the autonomous communities were classified into three groups.

Group 1: Communities where sociodemographic, health and lifestyle factors are unrelated to their quality of diet (Aragon, Asturias, the Valencian Community, Extremadura and Ceuta and Melilla).

Group 2: Communities where one or at most two sociodemographic, health and lifestyle factors are related to their quality of diet (Andalusia, the Balearic Islands, the Canary Islands, Castilla and Leon, Castilla-La Mancha, Galicia, Murcia, the Basque Country and la Rioja).

Group 3: Communities where three or more sociodemographic, health and lifestyle factors are associated to their quality of diet (Cantabria, Catalonia, Madrid and Navarre).

Fig. 1 shows the results.

4. Discussion

This study analysed diet quality in individuals aged 65 years and older, using the IASE, compliance with guidelines for a healthy diet and differences between regions in Spain, as well as sociodemographic, health and lifestyle factors associated with the IASE. In so doing, it expands knowledge for the promotion of healthy dietary patterns and lifestyles. The results of the IASE showed that the study population needs to effect changes in their diet, with a mean index score of 72.1 points (Standard Deviation 7.6). The diet quality rating revealed that 0.46 % of our population had an unhealthy diet, 87 % needed to make changes in their diet, and only 12.3 % were following a healthy diet. In terms of adherence to guidelines for a healthy diet by food group, fruits (79.7 %), cereals (89.8 %) and dairy products (87.7 %) scored highest, followed by vegetables (43.8 %), legumes (60.6 %) and soft drinks (65.7 %). The lowest percentages were found in terms of meeting the recommended consumption of meat, eggs, and fish (20 %), sweets (14.8 %) and processed meat (9.8 %). In sum, this study provides important information on the foods groups where consumption needs improvement.

A total of 87 % of the study population was found to need changes in their diet. Previous studies have delved into diet quality. In Mexico, a study using the modified version of the IASE found that 80.2 % of individuals had an unhealthy diet, 19.7 % needed to make changes and 0.1 % followed a healthy diet (Muñoz-Cano et al., 2015). A study conducted in Spain, also using the IASE for a sample of individuals aged over 80 years, obtained a mean score of 78.38 points, suggesting that dietary changes were required (Hernández Galiot and Goñi Cambrodón, 2015). The study also found that none of the participants had an unhealthy diet, suggesting that compliance with the guidelines was better than that found in our study. In another study conducted in Spain with adults aged over 65 years, it was found that only 8.2 % followed a healthy diet, with 89.6 % of the sample needing to make changes, coinciding with the results of the present study (Martínez Valero et al., 2021).

Numerous studies have analysed the frequency of consumption of food and adherence to a healthy diet. A global study showed that consumption of healthy foods fell below optimal levels (Afshin et al., 2019). Of the foods recommended for daily consumption, 23 % of the sample consumed cereals and 16 % consumed dairy products. However, for foods whose intake is only recommended on an occasional basis, the percentage was significantly higher than advocated. On the one hand, these results run counter to ours in that the consumption of cereals, dairy products and fruit have higher percentages and meet the recommended levels, while on the other hand, they coincide with our findings with

Table 2
Sample statistics and Diet quality measured by means of the Healthy Eating Index for Spanish Population aged 65 and over and the percentage of the population in each of the categories, for the country as a whole and by autonomous community based on 2017 Spanish National Health Survey.

Autonomous Community	% of participants	Mean age (SD)	% women	Mean IASE (SD)	unhealthy	changes required	healthy
Andalusia	11.4	75.6 (7.4)	59.4	71.9 (7.6)	1.0	86.1	12.9
Aragon	4.9	75.55 (3.4)	56.3	72.2 (7.7)	1.0	91.3	7.8
Asturias	4.5	75.2 (7.3)	64.9	72.6 (8.1)	0.4	84.9	14.7
Balearic Islands	3.3	75.2 (6.9)	85.9	71.3 (7.7)	0.5	89.3	10.2
Canary Islands	3.6	75.6 (7.3)	50.9	74.4 (7.4)	0.0	67.7	32.3
Cantabria	3.2	75.4 (7.3)	56.6	73.3 (6.0)	0.5	88.8	10.7
Castilla and Leon	6.5	75.6 (7.4)	56.3	72.1 (7.6)	0.2	93.2	6.6
Castilla-La Mancha	4.4	75.6 (7.4)	46.8	71.9 (7.6)	0.0	93.9	6.1
Catalonia	10.7	75.6 (7.4)	56.7	71.9 (7.7)	0.8	90.2	9.1
Valencian Community	8.4	75.6 (7.4)	59.4	72.1 (7.7)	0.4	75.9	23.8
Extremadura	4.7	75.7 (7.5)	54.0	71.1 (7.5)	0.3	89.3	10.4
Galicia	6.8	75.5 (7.3)	57.8	71.9 (7.5)	0.0	97.2	2.8
Madrid	8.9	75.5 (7.4)	56.7	73.0 (7.4)	0.0	84.9	14.1
Murcia	4.1	75.7 (7.4)	60.5	71.4 (8.1)	0.4	88.0	11.6
Navarre	3.4	74.6 (7.0)	55.8	71.8 (7.8)	0.9	88.4	10.7
Basque Country	7.0	75.6 (7.4)	60.1	72.1 (7.6)	0.2	87.4	12.4
La Rioja	2.9	75.7 (7.3)	60.1	71.2 (7.7)	0.6	88.5	10.9
Ceuta and Melilla	1.5	75.3 (7.7)	60.2	71.8 (9.1)	2.2	82.8	15.1
Total Spain	100	75.6 (7.4)	57.3	72.1 (7.6)	0.5	87	12.27

Note: SD: Standard deviation; IASE: Healthy Eating Index for Spanish Population.

Table 3
Percentage of persons aged 65 and over following the Spanish Society of Community Nutrition guidelines on intake for each food group and diet variety for Spain and each autonomous community based on 2017 Spanish National Health Survey.

Autonomous Communities	Daily diet variety (%)	Weekly diet variety (%)	Fruit (%)	Cereals (%)	Vegetables (%)	Dairy products (%)	Meat (%)	Legumes (%)	Processed meat (%)	Sweets (%)	Soft drinks (%)
Andalusia	21.4	16.7	80.1	93.5	26.8	87.2	32.4	49.7	11.0	16.1	67.6
Aragon	54.0	6.2	89.0	91.6	66.3	91.6	7.8	74.8	8.4	11.0	46.0
Asturias	21.4	9.5	84.6	94.0	25.6	94.4	21.4	40.7	10.3	31.2	75.8
Balearic Islands	43.2	10.2	71.4	94.7	62.6	80.6	21.4	52.9	8.3	17.0	83.0
Canary Islands	32.3	44.3	87.6	79.2	48.2	87.6	60.2	69.9	12.4	28.8	80.1
Cantabria	9.3	26.3	26.8	98.1	11.7	90.2	31.2	87.8	1.0	15.1	57.6
Castilla and Leon	36.6	3.2	91.5	92.2	46.3	90.5	5.9	52.0	7.6	8.1	39.3
Castilla-La Mancha	20.0	7.9	94.3	92.5	27.5	88.2	9.6	78.2	3.9	5.7	43.2
Catalonia	45.8	9.6	82.4	88.3	63.6	86.2	16.3	56.3	7.6	12.3	51.3
Valencian Community	49.2	7.2	87.0	78.9	83.6	79.2	12.5	55.3	17.7	21.3	77.7
Extremadura	6.0	42.6	86.2	92.3	7.1	91.6	68.5	59.7	5.0	6.0	75.8
Galicia	2.3	4.5	57.8	90.2	3.0	93.2	7.7	49.4	4.0	14.1	69.6
Madrid	38.9	11.5	90.8	90.1	50.6	92.0	14.0	73.4	14.2	13.9	68.4
Murcia	28.3	7.8	55.8	74.8	42.6	51.9	15.5	38.8	12.8	24.8	75.2
Navarre	57.7	2.8	87.4	95.4	74.9	91.6	5.1	58.6	11.6	13.5	70.2
Basque Country	50.1	8.4	85.8	93.0	63.9	91.9	12.6	67.0	9.9	7.2	83.8
La Rioja	35.5	3.3	82.0	91.3	44.8	94.0	4.3	81.4	12.6	8.2	73.2
Ceuta and Melilla	29.0	21.5	74.2	91.4	37.6	87.1	22.6	74.2	16.1	7.5	51.6
Total Spain	33.2	12.3	80.5	89.8	45.5	87.4	19.6	60.1	9.8	14.8	65.8

Compliance with guidelines below 50% | Compliance with guidelines between 50% and 80% | Compliance with guidelines above 80%

regard to processed meats and soft drinks. A further study conducted in Mexico reported 37 % daily fruit consumption, which is much lower than that in our study. Consumption of vegetables once or twice a week was 47 %, which is very similar to the rate in our study (45.5 %) (Muñoz-Cano et al., 2015).

In Spain, one study found that only 19.6 % of respondents met the recommended levels in the cereal and related product groups, 72 % for fruit, 45.1 % for vegetables, 91.1 % for dairy products, 8.5 % for meats, eggs and fish, 58.3 % for legumes, 19.1 % for sweets, 52.4 % for soft drinks and 17.6 % for processed meats (Norte Navarro and Ortiz Moncada, 2011). These results are consistent with those of the present study for fruit, vegetables and dairy products, but not for cereals. A study conducted in Spain with a sample of individuals aged over 80 showed that the guidelines for cereals and dairy products were met at a similar rate to the findings of our study, while the results for vegetables were slightly lower (Hernández Galiot and Goñi Cambrodón, 2015). The results for meat, eggs and fish (55.9 %) and fruit (94.96 %) were higher. Guidelines for the consumption of sweets were also met (74.5 %), with the percentage being much higher than in the present study. Consequently, healthy diet adherence was globally higher in this study, which

Table 4
Regression coefficients of the Healthy Eating Index for Spanish Population aged 65 and over and confidence intervals for multiple linear regression models in Spain and its autonomous communities based on 2017 Spanish National Health Survey.

	Spain	Andalusia	Aragon	Asturias	Balearic Islands	Canary Island	Cantabria	Castilla and Leon	Castilla-La Mancha	Catalonia	Valencian Community	Extremadura	Galicia	Madrid	Murcia	Navarre	Basque Country	La Rioja	Ceuta and Melilla
Sample size	6325	719	309	285	206	226	205	410	280	675	530	298	427	556	258	215	443	183	93
Multiple Linear Regression																			
Woman	1.6 (1.14;1.97) *	0.5 (-0.86;1.92)	-0.8 (-2.00;1.85)	1.5 (-0.67;3.67)	3.6 (1.17;6.12) *	3.8 (1.71;5.80)*	2.2 (0.39;3.98)*	2.3 (0.77;3.90)*	-0.2 (-1.36;1.75)	2.4 (1.03;3.78)*	1.3 (-0.14;2.75)	1.1 (-0.54;2.84)	1.4 (0.21;2.58)*	0.9 (-0.52;2.13)	2.8 (0.45;5.07)*	-2.7 (-5.15;-0.18)*	3.9 (2.38;5.46)*	1.9 (-0.49;4.39)	2.7 (-2.10;7.45)
Chronic disease-yes	0.7 (0.08;1.29)*	-0.4 (-2.02;1.21)	0.7 (-2.97;4.32)	-1.5 (-5.43;2.40)	1.8 (-2.57;6.22)	-0.0 (-3.21;3.18)	-0.9 (-4.28;2.50)	1.5 (-0.68;3.76)	0.6 (-2.01;3.20)	0.2(-1.28;1.67)	1.8 (-0.85;4.37)	2.8 (-0.04;5.75)	4.3 (-2.35;11.01)	1.9 (0.37;3.46)*	3.5 (-1.03;7.98)	-1.0 (-5.13;3.10)	-0.3 (-3.09;2.53)	1.1 (-2.01;4.22)	-2.8 (-8.57;2.88)
65-69 years (ref)																			
70-74 years	0.5 (0.01;1.07)*	0.5 (-1.21;2.22)	-0.1 (-2.62;2.47)	-0.6 (-3.38;2.12)	-0.1 (-4.03;2.03)	-0.6 (-3.25;2.10)	1.2 (-1.05;3.40)	-0.3 (-2.34;1.71)	1.2 (-0.77;3.23)	2.4 (0.70;4.05)*	0.5 (-1.43;2.49)	1.6 (-0.60;3.72)	1.6 (-0.02;3.17)	1.1 (-0.61;2.91)	0.2 (-2.65;3.03)	-0.7 (-3.47;2.04)	0.5 (-1.39;2.42)	-2.3 (-5.49;0.94)	-0.5 (-7.43;6.38)
75-79 years	0.9 (0.33;1.50)*	0.5 (-1.36;2.38)	-2.0 (-4.76;0.68)	1.2 (-1.83;4.20)	0.4 (-3.04;3.85)	2.4 (-0.40;5.25)	1.5 (-1.13;4.04)	-0.2 (-2.42;2.00)	1.0 (-1.51;3.55)	1.1 (-0.84;3.00)	1.0 (-0.95;3.03)	1.8 (-0.66;4.25)	2.6 (0.74;4.45)*	1.6 (-0.20;3.44)	-0.8 (-4.15;2.45)	-0.5 (-3.61;2.65)	1.7 (-0.42;3.85)	-0.3 (-3.89;3.30)	1.1 (-4.53;8.49)
80 years or above	0.5 (-0.04;1.05)	0.7 (-1.02;2.52)	-1.2 (-3.74;1.39)	-0.6 (-3.52;2.37)	0.4 (-2.57;3.32)	0.1 (-2.64;2.74)	2.4 (0.14;4.65)*	-0.5 (-2.52;1.55)	0.9 (-1.25;3.04)	1.0 (-0.73;2.72)	0.6 (-1.45;2.69)	0.9 (-1.30;3.06)	1.4 (-0.12;3.01)	1.8 (-0.05;3.70)	0.0 (-3.04;3.08)	-0.3 (-3.57;2.92)	0.8 (-1.23;2.81)	-3.0 (-6.40;0.37)	0.2 (-6.01;6.44)
Widowed (ref)																			
Single	-1.1 (-1.85;-0.33)*	-0.8 (-3.43;1.76)	-2.2 (-5.64;1.19)	-2.0 (-5.80;1.78)	0.2 (-4.78;5.21)	-0.1 (-5.07;3.20)	-3.4 (-7.15;0.38)	-1.5 (-3.93;1.00)	-0.2 (-3.23;2.85)	0.7(-2.01;3.37)	-1.1 (-4.98;1.10)	-1.1 (4.16;1.95)	1.4 (-0.77;3.49)	1.2 (-1.37;3.70)	-1.0 (-6.11;4.09)	-4.8 (-8.96;-0.65)*	-1.2 (-3.65;1.32)	2.0 (-1.77;5.75)	-8.4 (-19.17;2.43)
Married	0.5 (-0.00;0.91)	-0.4 (-1.96;1.08)	-0.4 (-2.54;1.78)	0.7 (-1.73;3.07)	0.3 (-2.42;2.99)	1.3 (-0.90;3.61)	-0.0 (-2.03;1.92)	0.7 (-1.09;2.44)	0.9 (-1.05;2.75)	2.0 (0.51;3.53)*	-0.1 (-1.83;1.60)	-1.0 (2.80;0.73)	0.7 (-0.63;2.00)	2.1 (0.55;3.60)*	-0.7 (-3.21;1.93)	1.7 (-0.95;4.34)	1.0 (-0.63;2.66)	-0.9 (-4.04;2.19)	-0.5 (-5.48;4.48)
Separate/divorced	-0.3 (-1.24;0.67)	-2.5 (-5.40;0.36)	-3.1 (-7.79;1.65)	-1.2 (-5.56;3.06)	-0.9 (-5.65;3.91)	4.3 (-0.17;8.84)	-5.2 (-10.16;0,30)*	1.1 (-3.31;5.51)	-0.9 (-5.15;3.32)	-0.4 (-3.61;5.87)	-0.8 (-4.04;2.43)	-4.0 (8.92;0.81)	1.5 (-1.46;4.55)	2.1 (-0.66;4.90)	0.1 (-5.73;6.01)	3.4 (-2.14;9.00)	-0.9 (-4.36;2.56)	1.8 (-7.55;11.12)	4.1 (-3.93;13.82)
No completed studies (ref)																			
Primary education	-0.5 (-0.93;-0.04)*	0.9 (-1.34;1.52)	-1.6 (-4.62;1.44)	-1.8 (-5.34;1.71)	-0.5 (-3.75;2.77)	-0.2 (-2.47;2.12)	-10.5 (-18.76;-2.24)*	-1.3 (-3.27;0.66)	-0.67 (-2.31;1.00)	-1.4 (-3.01;1.18)	-0.6 (-2.18;1.04)	0.7 (-0.95;2.35)	0.4 (-0.77;1.67)	-0.2 (-1.83;1.42)	0.1 (-3.37;1.42)	-2.04 (-4.86;0.78)	0.2 (-1.43;1.81)	-4.0 (-7.17;-0.77)*	-1.7 (-6.95;3.48)
Secundary education	-0.2 (-0.48;-0.89)	2.2 (-0.21;4.55)	-0.7 (-4.62;3.22)	-0.8 (-5.13;3.55)	2.1 (-1.98;6.18)	-0.4 (-3.39;2.56)	-8.5 (-17.05;-0.02)*	-0.9 (-3.81;2.05)	-1.7 (-4.62;1.27)	-1.8 (-4.11;0.42)	-1.9 (-4.87;1.03)	1.0 (-2.77;4.84)	2.33 (-0.35;5.02)	-0.9 (-3-01;1.14)	1.1 (-2.00;5.93)	-1.8 (-5.59;2.00)	0.3 (-1.83;2.50)	-0.1 (-5.74;5.43)	-1.7 (-9.27;5.86)
University education	0.2 (-0.60;0.84)	2.4 (-0.01;4.89)	0.7 (-3.30;4.75)	-0.9 (-5.44;3.62)	0.6 (-4.14;5.29)	1.1 (-2.53;4.84)	-13.1 (-21.94;-4.23)*	-0.1 (-3.22;2.95)	0.3(-2.63;3.16)	-0.1 (-3.57;1.62) *	0.4 (-2.25;3.10)	1.7 (-1.60;5.53)	0.2 (-2.36;2.82)	-1.8 (-3.79;0.23)	1.4 (-3.63;6.43)	-4.4 (-8.49;-0.35)*	-0.1 (-2.56;2.34)	-2.5 (-7.17;2.15)	-2.2 (-9.85;5.41)
Physical activity-occasional or none (ref)																			
Several times a month	1.6 (0.63;2.48)*	-0.7 (-4.23;2.82)	0.3 (-3.50;4.08)	2.0 (-1.70;5.79)	5.3(-1.15;11.68)	5.1 (-2.21;12.36)		3.4 (0.08;6.62)*	0.1 (-4.14;4.38)	3.4 (0.86;5.99)	1.0 (-2.29;4.38)	-0.1 (-4.93;3.05)	2.1 (-0.61;4.93)	2.2 (-2.11;6.46)	4.4 (-2.36;11.22)			-7.3 (-13.81;-0.69)*	-8.4 (-29.13;12.34)
Several times a week	2.2 (1.36;3.10)*	2.1 (-0.47;4.72)	-3.6 (-9.62;2.46)	0.1 (-4.08;4.26)		-0.374 (-3.37;2.63)	3.3 (1.03;5.59)*	4.7 (0.68;8.64)*	5.7 (1.92;9.42)*	3.3 (-1.50;8.04)	-0.5 (-4.49;3.41)	-3.6 (-10.89;3.64)	2.7 (-9.00;14.33)	-0.7 (-7.30;5.84) *	-3.1 (-8.81;2.53)	2.4 (-0.69;5.50)	2.0 (-0.76;4.83)	-1.3 (-6.45;3.77)	5.2 (-1.73;12.07)
Normal weight (ref)																			
Underweight	0.6 (-1.21;2.33)	-1.4 (-8.18;5.30)	-0.7 (-7.90;6.43)	-0.9 (-7.85;6.12)	1.0 (10.11;12.16)	-6.6 (16.69;3.41)		5.3 (-2.74;13.39)	3.3 (-3.85;10.53)	2.6 (-5.30;10.58)	-2.0 (-7.97;3.97)	2.1 (-3.45;9.43)	5.7 (-1.00;12.38)	-0.7 (-7.30;5.84)	9.2 (-2.09;20.53)	-0.2 (-5.58;5.12)	0.8 (-3.69;5.23)		-7.5 (-27.37;12.37)
Overweight	0.5 (0.06;0.95)*	1.6 (0.11;3.16)*	-0.5 (-2.59;1.50)	0.9 (-1.51;3.42)	0.2 (-2.31;2.70)	1.0 (-1.23;3.32)	-1.1 (-2.93;0.70)	0.8 (-0.72;2.38)	0.2(-1.65;2.04)	1.3 (-0.10;2.73)	0.9 (-0.69;2.51)	0.6 (-1.15;2.39)	-0.8 (-2.16;0.53)	0.3 (-1.14;1.69)	-0.6 (-3.21;1.96)	-1.7 (-4.33;0.83)	1.3 (-0.23;2.87)	-2.4 (-5.24;0.49)	1.0 (-3.84;5.69)
Obesity	0.4 (-0.08;0.95)	2.0 (0.33;3.67)*	1.7 (-0.80;4.31)	-1.2 (-3.88;1.49)	0.4 (-2.41;3.27)	-0.1 (-2.71;2.52)	-0.1 (-3.29;1.36)	-0.9 (-3.04;1.13)	-0.2 (-2.22;1.75)	0.6 (-1.13;2.37)	0.4 (-1.43;2.19)	1.9 (-0.23;4.03)	0.2 (-1.35;1.72)	-0.7 (-2.46;1.08)	1.2 (-1.58;4.07)	-2.9(-5.78;0.13)	1.9(0.02;3.71)*	-2.5 (-5.57;0.62)	-0.5 (-6.01;5.03)

p-values are generated using the *t*-test for each individual regression coefficient.
* $P < 0.05$, confidence interval 95 %.

might be related to the age of the sample. A further study conducted in Spain, which analysed adherence to a healthy diet in just one municipality in the north of the country, showed 12.9 % of the study population followed the guidelines for cereal consumption, 16.7 % for vegetables, 50.2 % for fruit, 39.1 % for dairy products, 17 % for meat, 19.9 % for eggs and 12 % for fish, all representing a lower adherence compared to our study, with the exception of the consumption of legumes, for which the percentage was 75.1 % (Cubas de Basterrechea et al., 2020). This difference could also be attributed to the age of the sample.

The geographical area in which the study was carried out must also

Table 5
Spain and Autonomous Communities: sociodemographic, health and lifestyle factors associated significant with the Healthy Eating Index for Spanish Population aged 65 and over based on 2017 Spanish National Health Survey.

Socioeconomic and lifestyle variables	Autonomous Communities
Woman	Spain, Balearic Islands, Canary Islands, Cantabria, Castilla and Leon, Catalonia, Galicia, Murcia, Navarre, Basque Country
Chronic disease-yes	Spain, Madrid
65–69 years (ref)	
70–74 years	Spain, Catalonia
75–79 years	Spain, Galicia
80 years or above	Cantabria
Widowed (ref)	
Single	Spain, Navarre
Married	Catalonia, Madrid
Separate/divorced	Cantabria
No completed studies (ref)	
Primary education	Spain, Cantabria, La Rioja
Secundary education	Cantabria
University education	Cantabria, Catalonia, Navarre
Physical activity- occasional or none (ref)	
Several times a month	Spain, Castilla and Leon, La Rioja
Several times a week	Spain, Cantabria, Castilla and Leon, Castilla-La Mancha, Madrid
Normal weight (ref)	
Underweight	
Overweight	Spain, Andalusia
Obesity	Andalusia, Basque Country

be considered, finding that the lowest score was for Extremadura with 71.12 points and the highest being 74.41 points for the Canary Islands. Another study also analysed Spanish regions using the IASE (Norte Navarro and Ortiz Moncada, 2011) obtaining a similar range of scores to those in our research, where the lowest average IASE score was 69.9 for Ceuta and Melilla, and the highest 74.6 points for Aragon. In both studies, the percentage of the population requiring dietary changes was much higher than in the other categories.

This study analysed the association between the IASE score and sociodemographic, health and lifestyle factors, finding that being a woman and having a healthy diet were related to a higher score on the index. This coincides with a study in conducted in Brazil (de Paula Matos Souza et al., 2019) analysed sociodemographic, health and lifestyle factors affecting diet quality, reporting that low educational level, being male, low weight, oral health problems and difficulties in purchasing food are related to poor diet quality. This finding is in line with those of the present study, where being overweight was found to be associated with higher IASE scores. Other studies in Spain have also focused on socioeconomic and lifestyle factors, with one study finding an association between higher IASE scores and occasional physical activity (Martínez Valero et al., 2021) while another analysed the importance of physical activity and eating habits (Pardo-Garcia et al., 2021).

Preventable chronic diseases are a problem in all countries. Various studies have shown that good diet quality is associated with a lower incidence of chronic diseases (Bray et al., 2016; Hu et al., 2020; Morze et al., 2020). A study conducted in the US related reduced incidence of chronic diseases to the combination of diet quality and physical exercise (Riou et al., 2011) while a study carried out in Spain found that Mediterranean diet was associated with a 30 % decrease in cardiovascular disease and the main factors for cardiovascular risk (Pardo-García et al., 2017). The present study also analysed the association between diet quality and chronic diseases, finding a relationship between IASE scores and chronic disease. This's because individuals with chronic disease seek to follow a healthy diet to reduce the morbidity and mortality of their disease. In this regard, a study conducted in Spain demonstrated the relationship between Mediterranean diet adherence and a reduction in the rate of chronic diseases, enhancing their prevention (Martinez-Lacoba et al., 2018).

In general, Mediterranean food environments are unique, with factors such as food availability, accessibility, affordability, agricultural policies, marketing, urban development and culture are associated with diet (Díez et al., 2018). However, such differences are not relevant at the regional level in Spain, given that the Mediterranean regions share similar cultural and social values (Martos Barrachina et al., 2019).

Nutrition, physical activity, and sleep, as the three pillars of health, have synergistic effects on the overall health of the elderly. Appropriate nutrition provides the energy needed for physical activity and helps maintain weight and improve metabolic function (You et al., 2024c). Therefore, future health interventions should integrate the management of diet and physical activity, among other factors, adopting a comprehensive lifestyle adjustment strategy to improve the overall health of the elderly population (You et al., 2024d).

4.1. Implications for research and practice

Our study seeks to identify and modify the causes of health problems, not just the symptoms. The findings indicate that the elderly population should change their diet and that policy measures are the most effective for this purpose (Pardo-Garcia et al., 2021; Webster et al., 2014). It is recommended that health professionals evaluate diet and educate on healthy habits, taking advantage of consultations to detect and prevent the effects of poor diet. The study also reports on the consumption of food groups. Consumption of sweets and processed meats was very low. Preventive measures should focus on these groups, which are of occasional consumption and have cardiovascular risk and other health problems (Pardo-Garcia et al., 2021). We suggest positive marketing for healthy foods, coupled with complementary measures. Information is not enough, and professional and social support is needed (Gardner et al., 2023). Also, taxes on occasional foods could be increased and taxes on healthy staple foods could be reduced. Being female and physically active is related to IASE in most regions. Since sex cannot be changed, it is concluded that regular physical activity is associated with a healthy diet. These results argue for health programs that encourage physical activity in the elderly, tailored to their abilities and needs. These programs could include education, exercise, recreation or fall prevention, among others. Our findings reinforce the idea that the health of the elderly requires a holistic approach that considers nutrition, physical activity, social and physical environments, and disease prevention, to improve quality of life in a comprehensive manner.

4.2. Limitations

We used cross-sectional data from the, 2017 ENSE to analyse sociodemographic, health and lifestyle determinants of diet quality. We could not infer causality due to lack of longitudinal data.

The 2017 ENSE data are based on self-reported surveys. These self-reported data have limitations due to introspection bias or variability in accuracy (not all individuals are equally able to assess themselves), recall bias (the ability to accurately recall past events may be limited) (Hammersley, 1994), response bias or response styles (some people may be extreme in their responses - always choosing the highest or lowest options - or may be neutral - avoiding the extreme options) (Tempelaar et al., 2020), social desirability bias (Durmaz et al., 2020; Tempelaar et al., 2020) (people tend to respond in ways that are viewed favourably by others, which can lead to responses that fail to reflect reality), and problems of missing data (some individuals refuse to answer certain questions) (Audet et al., 2022), all of which can affect the validity and interpretation of results. To minimise biases in self-reported data, certain strategies can be used, such as asking clear and neutral questions to avoid influencing responses; diversifying the response scale or using reverse questions to detect response patterns; assuring participants that their responses will be treated anonymously and confidentially; providing detailed instructions on how to answer questions; and, of course, training survey administrators to understand and avoid biases

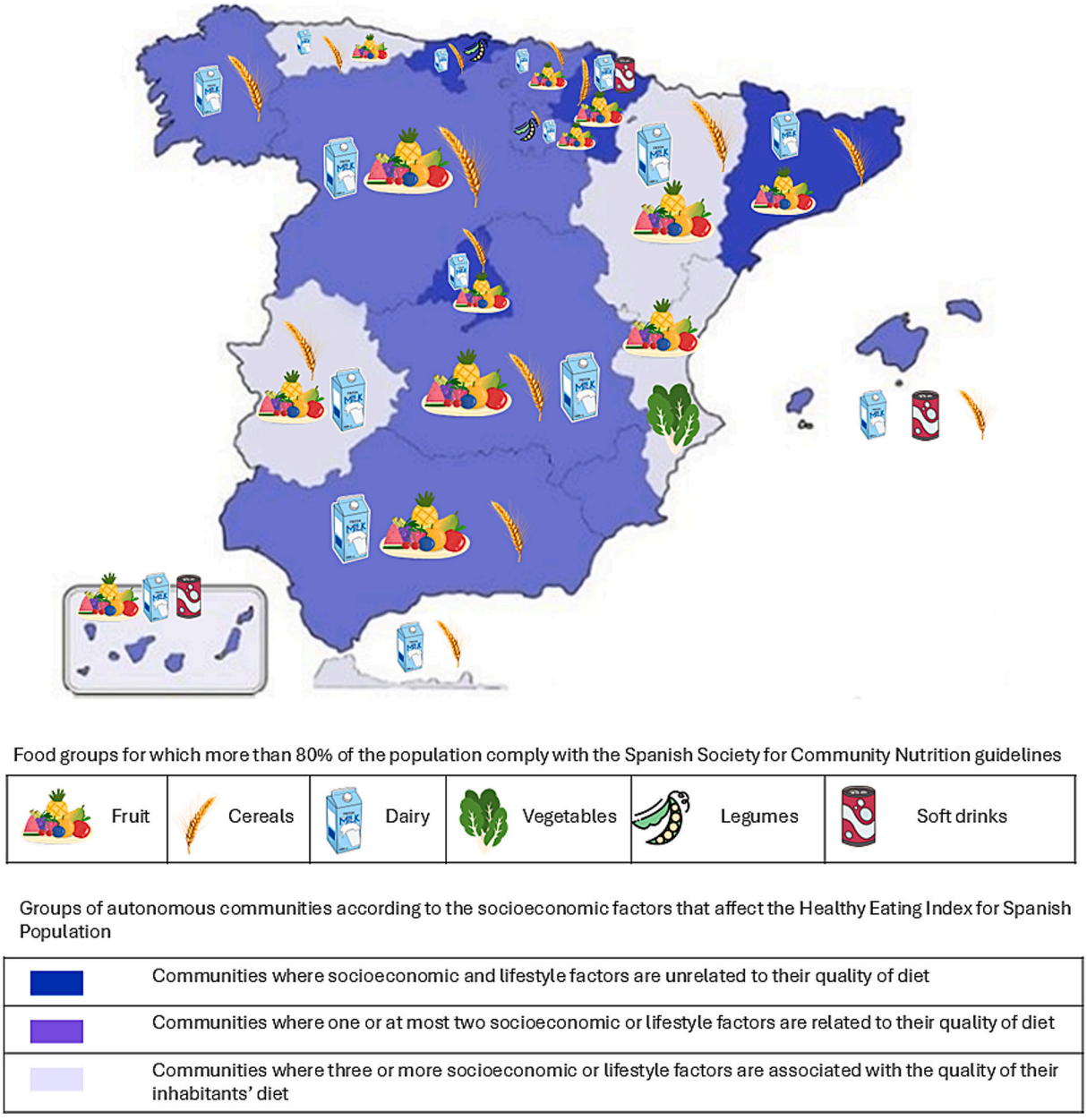

Fig. 1. Eating habits, sociodemographic, health and lifestyle factors in Spanish Population aged 65 and over based on 2017 Spanish National Health Survey.

during data collection (Ministerio de Sanidad Servicios Sociales e Igualdad & Instituto Nacional de Estadística, 2017).

Despite these limitations, self-reported dietary data can be valuable as a basis on which to establish dietary guidelines and public health policies (Subar et al., 2015).

The number of factors studied was limited by the small sample size when stratifying by autonomous communities.

5. Conclusions

Analysing diet quality with the IASE as well as the factors related to it allows us to identify risk groups or situations and to design health prevention programs with nutritional strategies.

Our results indicate that, both at the national and regional levels, the Spanish population is in need of dietary changes. However, at the national level, being a woman, engaging in physical activity, having a chronic disease, being overweight, only having completed basic education and being aged between 70 and 79 years are associated with a better diet.

However, these results should be taken with caution as this is a cross-sectional study.

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CRediT authorship contribution statement

Elisa Amo-Saus: Writing – review & editing, Writing – original draft, Validation, Supervision, Software, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Isabel Pardo-García:**

Writing – review & editing, Writing – original draft, Validation, Supervision, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Ana Pilar Martinez-Valero:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Data curation. **Francisco Escribano-Sotos:** Writing – review & editing, Writing – original draft, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

We have shared the link to the data

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