# Impact of Plant-Based Diets and Associations with Health, Lifestyle, and Healthcare Utilization: A Population-Based Survey Study

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This is an Accepted Manuscript for Public Health Nutrition. This peer-reviewed article has been accepted for publication but not yet copyedited or typeset, and so may be subject to change during the production process. The article is considered published and may be cited using its
DOI 10.1017/S1368980025100669

## Abstract

**Objective**: To determine the prevalence and characteristics of plant-based patterns in the Spanish population and assess their potential impact on individuals with similar sociodemographic backgrounds.

**Design**: We estimated vegetarian and vegan individuals' national and regional prevalence and analyzed their sociodemographic characteristics and weekly dietary intake patterns. Individuals with a plant-based dietary pattern were matched to a control group (1:4) with similar sociodemographic characteristics. Associations with the prevalence risk of common chronic diseases, self-reported health status, lifestyle, and healthcare use were analyzed with unadjusted and adjusted logistic regression models.

**Setting**: A population-based survey of individuals residing in Spain.

**Participants:** Data from 22,072 participants were examined**.**

**Results:** The prevalence of plant-based diets was 5.62‰ (95% CI: 4.33–7.28), and adherents were female (68.6%), single (62.3%), and university-educated 41.8%) (P< 0.001). They reported higher rates of "never" consuming snacks (50% vs 35%), fast food (58% vs 36%), and sweets (33% vs 14%). Lifestyle factors did not differ between the plant-based and omnivorous groups; however, adherence to plant-based diets was associated with a prevalence risk of depressive symptoms (OR 2.58, 95% CI: 1.00–6.65), stroke (OR 7.08, 95% CI: 1.27–39.46), and increased consultations for mental health and complementary medicine (OR 3.21, 95% CI: 1.38–7.43).

**Conclusions:** Plant-based diets are uncommon and are associated with specific sociodemographic profiles, particularly sex. When comparing individuals with similar sociodemographic characteristics, individuals with plant-based diets and omnivores had similar lifestyles. Addressing patient concerns regarding diet and personal well-being might prioritize healthy behaviors over specific dietary patterns.


**Keywords**: Plant-based diet, vegan, vegetarian, lifestyle, chronic diseases, survey-design

## Introduction

Plant-based dietary patterns are increasingly accepted for ethical concerns and environmental sustainability [(1)], and when appropriately planned, can provide adequate nutrition across all stages of life [(2)]. While some vegetarian diets may include some animal-derived products such as dairy, eggs, and honey, both vegetarian and vegan diets exclude the intake of animal products such as meat, poultry, and fish. Vegan diets further exclude all animal-based foods and byproducts[(3)]. The prevalence of plant-based dietary patterns has been scientifically studied using health survey data. In Canada, a prevalence of 2.8% was reported [(4)], and in the USA, a prevalence of 4.0% [(5)]. In the New Zealand health survey, a 2.04% prevalence of vegetarians and a 0.74% of vegans was reported [(6)], and in Europe, studies reported prevalences <1% [(7,8)]. However, studies using representative population surveys have not applied survey-weighting factors, which allows accurate prevalence estimation to correct for sample bias, adjust for imbalances, and allow for generalizable results in underrepresented groups, such as plant-based individuals [(9)].

Individuals with plant-based diets have been reported to have healthier habits like consuming less alcohol or not smoking [(10)]. Compared with omnivores, vegetarians and vegans often exhibit lower body mass index, total cholesterol, low-density lipoprotein, triglyceride, and blood glucose levels[(11,12)]. These reductions in risk factors are linked to a decreased likelihood of developing chronic diseases, including cardiovascular disease, diabetes, obesity, chronic kidney failure, and various cancers[(13)]. Predominantly, plant-based diets improve metabolic control in individuals with diabetes[(14)] and metabolic syndrome, reducing the risk of conditions such as ischemic heart disease[(15)], hypertension[(16)], chronic kidney disease[(17)], obesity[(18)], fatty liver disease[(19)], and cancer onset[(20,21)]. However, plant-based diets can be associated with nutrient deficiencies if not adequately performed. A strict plant-based diet is associated with increased susceptibility to experiencing bone fractures, osteoporosis, and hemorrhagic stroke[(16)]. Despite evidence suggesting health advantages associated with plant-based adherence, comprehensive studies remain lacking in integrating individuals' health status and lifestyle factors perspective (e.g., physical activity, alcohol drinking habit, or tobacco consumption habit). Moreover, few studies have compared these individuals to nonvegetarians with similar social determinants of health (e.g., educational level, household income, or marital status).

https://doi.org/10.1017/S1368980025100669 Published online by Cambridge University Press

Comparing individuals with an omnivore diet and a plant-based dietary pattern has explored the physiological outcomes associated with plant-based diets; however, these studies often failed to account for lifestyle habits and sociodemographic characteristics. Therefore, this study aimed to (i) determine the prevalence of vegetarian and vegan plant-based diets in the Spanish population and (ii) assess the impact of these dietary patterns on perceived quality of life, lifestyle, prevalence risk of common diseases, and healthcare service utilization in individuals with similar sociodemographic backgrounds.

## Methods

### Study design

We conducted a two-phase study: first, we assessed the prevalence of individuals adhering to a plant-based diet (vegetarians and vegans) in a representative sample of Spanish adults living in their households. We also examined the sociodemographic characteristics of the plant-based and omnivore groups. In the second phase, we conducted a matched cross-sectional analysis with all plant-based diet individuals matched to a sample of participants with similar sociodemographic characteristics and an omnivorous diet to study the association of plant-based diets with perceived quality of life, lifestyle factors, diseases, and healthcare service utilization in the last year.

### Source of data and context.

The European Health Interview Survey in Spain (EHIS), conducted by the Spanish Statistics Institute and the Ministry of Health, is a household survey conducted every five years that collects health-related information on the population residing in Spain aged ≥15 years old, using a standard European questionnaire[22,23]. The EHIS data is a source of information for countrywide statistics on health, morbidity, the extent of access to and use of healthcare services, and the factors influencing health-related outcomes[22]. The EHIS collects a countrywide sample. It uses the family dwelling as the basic unit, gathering information voluntarily and anonymously. The sampling of the EHIS used a multistage clustering method with proportional random selection and independent samples from different Spanish regions. The survey was conducted in participants' homes using face-to-face, computer-assisted personal interviews with trained interviewers. The methodology allows the delivery of long questionnaires, and the interviewer can assist in explaining the questions and demonstrating examples of how to complete the items.

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Data collected through this methodology is self-reported by the participants. The latest available data from 2020 included responses from 22,072 individuals. Further methodological details are available elsewhere[24].

**Participants and matching criteria**

We selected all individuals from the EHIS in Spain in the last available year (2020) with a complete form of a weekly Food Frequency Questionnaire (FFQ) included in the survey module on the dietary habits of the EHIS. It is a practical and standardized instrument that has been compared against a 7-day food diary and a 74-item FFQ with strong reliability[25]. It asks for 14 food groups with six answer categories (Once or more times a day, 4 to 6 times a week, three times a week, once or twice a week, less than once a week, and never). We considered vegetarian to those participants reporting "never" consuming meat, fish, or processed meat products (e.g., salami, sausages, hot dogs); vegans if answered “never” on meat, fish, processed meat, dairy, or eggs; and omnivores if answered “never” to meat, fish, and processed meat groups. The control participants (omnivores) did not avoid meat or other animal-derived foods in their diet (omnivores), according to the FFQ.

**Study variables**

Data on sociodemographic variables were collected on age (years), sex, living situation (living with a spouse, with cohabitating partner, or living alone), marital status, completion of higher academic studies, household income, and social class, categorized with the six-group classification adopted by the Spanish Society of Epidemiology, which is based on the occupation of the household reference person[26], and health insurance coverage used.

The prevalence of chronic diseases was examined using the item "*Has a physician diagnosed any of the following diseases?"*. We used the Patient Health Questionnaire (PHQ-8) for depression symptoms. The PHQ-8 is a valid instrument for monitoring depression and studying its prevalence[27]. Self-perceived health was studied with the EHIS question "*How is your health in general?"* reported as very good, good, fair, bad, and very bad. The variables on lifestyle habits included tobacco consumption (non-smokers, smokers, and ex-smokers), and hazardous alcohol drinking, which were measured using the Standard Drink Units (SDU). In Spain, one fermented beverage (e.g., beer, wine) is set to one 1 SDU, and a distilled beverage (e.g., spirit, liquor) is set to two SDU [28]. We studied the weekly hazardous drinking (weekly alcohol intake

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>28 SBU in men or >17 SBU in women)[29]. Physical activity was measured according to the WHO enhancing physical activity recommendations (1): aerobic compliance (≥150 minutes of at least moderate-intensity aerobic physical activity per week), muscle-strengthening compliance (≥2 times per week), and aerobic and muscle-strengthening if both. Variables on the use of healthcare services included a reported consultation (yes/no) during the preceding year with a General Practitioner (GP), a physician specialist (not a GP), a physiotherapist, a kinesiotherapist, a chiropractor or osteopath, a psychologist, psychotherapist or psychiatrist, a registered nurse or nurse practitioner, and a complementary medicine practitioner (homeopathist, naturopath or acupuncturist). Consumption of medicines was studied using the following questions: (*During the past two weeks, have you used any medicines prescribed by a doctor*? (yes/no), and *have you used any medicines, herbal medicines, or vitamins for the past two weeks?* (yes/no), we also examined the reported consumption of vitamins, minerals, or tonics and naturopathic or homeopathic products.

**Statistical analysis.**

All participants were classified as vegetarians, vegans, or omnivores according to their FFQ answers. We examined the frequency of weekly intake in the 14 food groups. The prevalence of plant-based diets was computed using the whole EHIS sample, and population estimates with its 95% confidence intervals (CI) were calculated using weighting factors for the entire Spanish population and 18 Spanish regions. The sociodemographic characteristics of participants with plant-based and omnivore diets were described using central and frequency statistics, and differences between groups across sociodemographic characteristics were examined using ANOVA or chi-square tests.

In the second phase, the matching process of participants with a plant-based diet to a sample of participants with an omnivore diet based on sociodemographic factors that showed statistically significant differences in the first phase (P-value<0.05) was carried out using a propensity score analysis with the nearest neighbor criteria (Caliper=0.08, r=1:4). The matching method was used to reduce confounding bias and dependence by balancing the group of participants with omnivore and vegetarian diets in selected covariates. After matching, the final data were expected to be closer to a block-randomized design, and we examined the balance with the standardized mean differences of the propensity scores[30,31].

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The association of plant-based diets with the prevalence of chronic diseases, self-perceived general health (bad or very bad categories), lifestyle and risk factors, and use of healthcare services and medicine consumption were calculated using logistic regression models in two steps: Initially, we computed logistic regression models with the plant-diet or omnivore diet as the response factor. Subsequently, we adjusted the association for the influence of residual differences and variance between groups by introducing the sociodemographic covariates from the first analysis into the models. The results are presented as Odds-Ratio (OR) and adjusted ORs with their respective 95% confidence intervals (CIs) and P-values. In all analyses, the level of statistical significance was set at $\alpha$=0.05. All analyses were performed using R version 4.2.2[32].

**Results.**

We identified 86 individuals following a plant-based diet, with a population prevalence in Spain of 5.62‰ (95% CI: 4.33–7.28). Of these, 18 reported consuming a vegan diet (prevalence 1.31‰, 95% CI: 0.70–2.20), and 68 followed a vegetarian diet (prevalence 4.31‰, 95% CI: 3.18–5.69). Three regions had no vegetarians, and eight had no vegans. Due to the small sample sizes of the vegan and vegetarian groups, we combined both groups. The Iberian Peninsula's northern and central Mediterranean regions had higher prevalences, ranging from 10 to 12.23, respectively, whereas the central and southern regions had lower rates, between 1.52 and 6.64. Figure 1 presents a map of prevalence distribution across Spanish regions, with detailed regional data in Tables A, B, and C in the online appendix.

Figure 2 presents a stacked bar chart illustrating weekly food intake, with color intensity indicating the intake frequency by food group. Darker shades represent higher weekly intake (e.g., daily consumption). Individuals adhering to a plant-based dietary pattern had higher proportions in the *never* category across all food groups, with differences in snacks (50% vs. 35%), fast food (58% vs. 36%), and sweets (33% vs. 14%). Individuals following a plant-based dietary pattern reported higher intake frequencies of vegetables, salads, and greens, with 82.6% consuming them *once or more times per day* compared to 43.9% of omnivores. Additionally, over two-thirds (66.2%) of plant-based individuals consumed legumes three or more times per week, compared to 33.3% of omnivores. In contrast, differences in the never consumption of staple plant-based foods—such as bread and cereals (6% vs. 1%), pasta, rice, or potatoes (6% vs.

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0%), and legumes (6% vs. 1%)—were minimal, as both groups showed relatively high overall consumption levels.

The sociodemographic characteristics in Table 1 show that individuals with a plant-based diet were more likely to be women than those with an omnivore diet (69.08% vs. 52.80%, P<0.001), they were younger (mean age 48.42 vs. 54.60 years, P<0.001), and more often not living with a partner (70.93% vs. 49.19%, P<0.001), with a majority being single (60.35% vs. 27.04%, P<0.001). Additionally, individuals on a plant-based diet had higher educational attainment (university degree or higher: 41.86% vs. 19.29%, P < 0.001). They also reported higher household incomes and social classes than those with an omnivorous diet (P<0.05) and a higher proportion of healthy weight than omnivores (42.76% vs. 67.47%, P<0.001). The matching process of 86 individuals following a plant-based diet to 342 matched omnivores (1:4 ratio) reduced to almost 0 the standardized mean differences in age (deciles), sex, household living situation, marital status, educational attainment, household income, body mass index, and social class. (Figure A in the online appendix). Additionally, we conducted a sensitivity analysis to assess whether body mass index differed between the omnivorous and vegetarian groups when it was not included in the matching process, and we did not find a statistically significant effect. This result is presented in Figure B in the online appendix.

The study on lifestyle factors, healthcare utilization, and medication use showed that individuals following plant-based diets were had a higher likelihood of visiting a mental health professional (Adjusted OR: 3.21, 95% CI: 1.38–7.43) and were more likely to consult complementary medicine practitioners, such as acupuncturists, naturopaths, or homeopaths (Adjusted OR: 3.00, 95% CI: 1.06–8.48). No significant differences in tobacco use, physical activity, weekly hazardous drinking, or consultations with other healthcare professionals (general practitioners, registered nurses, physician specialists, or physiotherapists) were observed; all these results are in Table 3.

Plant-based diets were associated with a higher proportion of depressive symptoms according to the PHQ8 questionnaire (Adjusted OR 2.58, 95% CI: 1.00 - 6.65) and an increased risk of stroke (Adjusted OR 7.08, 95% CI: 1.27 - 39.46) however, this result showed a small subgroup size and a wide confidence interval. No associations were found between plant-based diets and other

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examined diseases. Table 3 presents the prevalence risks and unadjusted and adjusted logistic regression results.

## Discussion

This study found a low prevalence of individuals following a plant-based diet in different regions. Those adhering to plant-based dietary patterns reported a high frequency of intake of bread and cereals, pasta, rice, potatoes, legumes, fruits, and vegetables. They were generally younger, female, single, with higher education levels and household incomes. However, when comparing plant-based and omnivorous individuals with similar sociodemographic characteristics and body mass index, lifestyle factors did not differ.

The proportion of individuals adhering to plant-based diets was 5.62 per 1,000 inhabitants. This is consistent with a previous study that combined data from national and European surveys covering the period from 2001 to 2011 and reported a sample prevalence of 0.2%[33]. In neighboring France, a web-based study reported a 3.4% prevalence of plant-based diets among its 93,823 participants[34]; however, this result might be interpreted cautiously due to the absence of a random sampling. Comparatively, the proportion of vegetarians is estimated at 4% in the United States and 9% in Italy, Germany, and the United Kingdom[35]. These figures, however, are derived from data provided by Western vegetarian societies and may be subject to bias, as individuals often overestimate their adherence to a plant-based diet[36]. Therefore, our study provides a reliable, population-based estimate of plant-based diet adherence, confirming that while this dietary pattern remains a minority, its prevalence is likely overestimated in self-reported data.

Regional differences in plant-based adherence in Spain, with the highest frequencies found in the northeast regions of the Mediterranean Sea (Catalonia and Valencia), the central northern regions (Basque Country and Navarre), and the Canary Islands. Conversely, the Southern and central regions had the lowest adherence to plant-based diets. These regional differences may reflect underlying cultural and economic disparities not associated with regional average meat consumption per person, where Navarra had the highest meat consumption. At the same time, Catalonia, Valencia, and the Basque Country ranked 8th, 10th, and 6th, respectively[37]. Regarding Regional Gross Domestic Product per capita for 2020, the Basque Country, Navarra, and Catalonia ranked 2nd, 3rd, and 4th, while Valencia ranked 12$^{th}$. The low adherence to plant-

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based diets and observed regional disparities highlight the need for more targeted studies to explore dietary patterns within the population in greater detail.

Individuals following a plant-based diet reported a higher frequency of "*never eat*" responses than omnivores, particularly regarding sweets, sugar-sweetened beverages, fast foods, and snacks. In contrast, the highest consumption frequencies among plant-based individuals were observed for bread and cereals, pasta, rice, potatoes, legumes, fruits, and vegetables. A systematic review analyzing the quality of plant-based diets reported that plant-based diets were of higher quality due to a greater intake of whole grains, total fruits, plant-based proteins, and seafood protein, along with a lower intake of refined grains and overall protein foods[38]. A study using the Modified Healthy Eating Index also reported that plant-based diet quality scored higher than an omnivore diet in food groups with high-energy density (fat), processed meat, and plant-based meat alternatives[39]. In our opinion, the dietary intake data obtained from the Spanish EHIS could be used in future research to analyze the quality of the Spanish diet in specific population groups. This approach could allow for adjustments based on lifestyle factors, sociodemographic variables, and other covariates that may influence dietary choices and composition.

As anticipated, we implemented a study design to compare individuals following a plant-based diet with omnivores of similar sociodemographic characteristics, and we did not find differences in lifestyle habits (tobacco use and physical activity and hazardous drinking), consultations with general practitioners, registered nurses, physician specialists, or physiotherapists. Social determinants of health shape nutritional patterns and influence health status[40]. However, studies on the impact of plant-based diets often overlook social determinants of health to assess the health outcomes of plant-based diets accurately. Our study's results showed that lifestyle factors were similar between the matched samples of participants adhering to plant-based diets and omnivorous diets. However, adherence to a plant-based diet was associated with a higher prevalence risk of depressive symptoms and an increased frequency of visits to mental health professionals. A recent meta-analysis reported that meat consumption was associated with lower depression[41]. A study involving a population-based cohort of 90,380 participants in France reported an association between depression and a lacto-ovo-vegetarian diet, with an adjusted odds ratio of 1.44 (95% CI: 1.08–1.92), and with a vegan diet, an OR of 1.18 (95% CI: 0.56–2.47)[42]. These results are comparable to our findings, which showed an adjusted OR of 2.58

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(95% CI: 1.00–6.65) for the association between depression and plant-based diets. Other studies also found that depression among individuals with plant-based diets, focusing on females or males, was associated with higher rates of depressive disorders[43,44]. While most studies, with few exceptions, suggest an association between plant-based diets and mental health issues, it is essential to note that causality cannot be established based on observational studies that do not account for participants' baseline mental health status. Disentangling why mental health status is associated with adherence to a plant-based diet compared with individuals with similar sociodemographic characteristics would require a different research approach (i.e., a qualitative study), given that an experimental design is not feasible in practice in humans.

We observed an association between the vegetarian diet and self-reported prevalence risk of stroke, with vegetarians showing a significantly higher adjusted odds ratio of 7.08 (95% CI: 1.27–39.46) compared with omnivores. This finding aligns with a large cohort study reporting a 17% increased risk of stroke among vegetarians compared with meat eaters (HR: 1.17, 95% CI: 1.00–1.40), and an HR of 1.35 for vegans, although the latter was not statistically significant [45]. Conversely, other extensive cohort studies and a meta-analysis indicated that vegetarian diets might reduce stroke risk, reporting a hazard ratio of 0.86 (95% CI: 0.67–1.11) for stroke among vegetarians [46–48]. The risk of stroke is primarily driven by chronic diseases and modifiable factors, such as hypertension, smoking, diet, physical activity, and alcohol consumption, which together account for >90% of the population-attributable risk[49]. However, we found no significant associations between plant-based diets and these diseases. Other expected impacts between omnivorous and vegetarian groups on cardiovascular risk factors, such as hypertension or cholesterol, might not have been observed because the sample of vegetarians was relatively young. Studying the impact of dietary patterns in older populations adhering to a vegetarian diet may better capture variations in these risk factors to examine with precision the effect of plant-based diets and increase our understanding of how they affect ischemic stroke risk and other cardiovascular diseases.

**Practical implications**

It should not be presumed that individuals adhering to a vegetarian diet are inherently healthier or experience better mental health status than those following other dietary patterns. Such assumptions must be evaluated within specific health and psychological outcomes, as dietary

https://doi.org/10.1017/S1368980025100669 Published online by Cambridge University Press

patterns alone do not necessarily correlate with improved health or increased mental health status. Policymakers and health professionals should prioritize personalized, culturally sensitive, inclusive, and evidence-based dietary guidance rather than promoting specific dietary patterns such as vegetarian, vegan, or omnivorous diets. Furthermore, public health initiatives promoting healthy eating should be accompanied by education on balanced nutrition to prevent potential deficiencies and manage expectations regarding health outcomes.

**Limitations**

Participants' recall biases may influence the study findings. However, because this bias likely affects all participants systematically, the reliability of the results remains intact. In addition, no cases were identified in small regions. Although this may raise concerns regarding prevalence estimates, the questionnaire did not directly ask participants whether they consistently exclude animal products but assessed consumption over a recent reference period. As such, it may not fully capture the true proportion of individuals who follow a strictly vegan or vegetarian diet. While the questioning method could be critiqued, the EHIS data is a valuable and reliable reference for the EU. We could not determine when participants began the plant-based diet or how long they maintained it. However, this limitation also affects the group of omnivores who could have followed plant-based diets in the past. Dietary classification was based on self-reported intake using six frequency categories ranging from “once or more times a day” to “never”. Participants who usually consume animal products but abstained during the reference period might be misclassified as vegetarians or vegans. Nevertheless, the use of the "never" category provides a relatively strong criterion, helping to minimize the inclusion of recent or inconsistent adopters in the vegetarian or vegan group.

**Conclusions**

The prevalence of plant-based diets remains relatively low. Individuals who adhered to plant-based diets were generally younger, female, single, and had higher education levels and household incomes. Self-perceived general health and lifestyle factors, such as tobacco consumption, hazardous drinking, and physical activity, were similar to those of individuals following omnivorous diets with similar sociodemographic profiles. These findings highlight the importance of prioritizing healthy behaviors over specific dietary patterns when addressing patient concerns regarding dietary patterns and personal well-being.

https://doi.org/10.1017/S1368980025100669 Published online by Cambridge University Press

## Disclosure statements

**Financial Support:** This study had not received any grant funding.

**Data Availability:** Data described in the manuscript, code book, and analytic code will be made publicly and freely available without restriction at https://www.sanidad.gob.es/en/estadEstudios/estadisticas/EncuestaEuropea/Enc_Eur_Salud_en_Esp_2020.htm

**Conflict of interest:** The authors declare no conflicts of interest.

**Ethical Standards Disclosure**: This study used information from public sources, including a public, anonymous dataset from an online repository. Therefore, under Spanish legislation and EU rules, the approval of the Ethics Committee was unnecessary.

**Authorship:** LGdP and NE designed, conducted the research, and wrote the paper; LGdP analyzed the data. All authors contributed to the writing of the first draft and read and approved the final manuscript.

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**Table 1.** Sociodemographic characteristics of individuals with plant-based diets and omnivores.

| Characteristics | Omnivores N=21,837 | Plant-based N=86 | P-Value |
|---|---|---|---|
| **Age (years)** | 54.59 (18.99) | 42.35 (17.76) | <0.001 |
| **Sex (female)** | 11550 (52.89%) | 59 (68.60%) | 0.005 |
| **Cohabitation in the household** | | | <0.001 |
| Living with a spouse | 10611 (48.94%) | 22 (25.58%) | |
| Living with a cohabiting partner | 396 (1.83%) | 3 (3.49%) | |
| Not living with a partner | 10674 (49.23%) | 61 (70.93%) | |
| **Marital status** | | | <0.001 |
| Single | 5887 (27.04%) | 53 (62.35%) | |
| Married | 11204 (51.45%) | 22 (25.88%) | |
| Widowed | 2867 (13.17%) | 4 (4.71%) | |
| Legally separated | 646 (2.97%) | 3 (3.53%) | |
| Divorced | 1171 (5.38%) | 3 (3.53%) | |
| **Academic studies have ended** | | | <0.001 |
| Primary education | 6267 (28.70%) | 9 (10.47%) | |
| High school has not finished | 5283 (24.19%) | 10 (11.63%) | |
| High-school finished | 2754 (12.61%) | 20 (23.26%) | |
| Vocational and professional studies | 3322 (15.21%) | 11 (12.79%) | |
| University degree of higher | 4211 (19.28%) | 36 (41.86%) | |
| **Household income** | | | 0.025 |
| <€1100 | 6647 (30.62%) | 30 (36.14%) | |
| €1100 to <€1650 | 4192 (19.31%) | 15 (18.07%) | |
| €1650 to <€2300 | 3954 (18.21%) | 5 (6.02%) | |
| €2300 to <€3800 | 4674 (21.53%) | 19 (22.89%) | |
| ≥€3800 | 2242 (10.33%) | 14 (16.87%) | |
| **Social Class** | | | 0.006 |
| I | 2266 (10.86%) | 13 (15.48%) | |
| II | 1655 (7.94%) | 14 (16.67%) | |
| III | 4182 (20.05%) | 22 (26.19%) | |
| IV | 3022 (14.49%) | 8 (9.52%) | |

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| | | | |
|---|---|---|---|
| V | 6870 (32.94%) | 19 (22.62%) | |
| VI | 2861 (13.72%) | 8 (9.52%) | |
| **Health insurance** | | | 0.087 |
| Private service | 2841 (13.01%) | 18 (20.93%) | |
| Public Health System | 18928 (86.68%) | 68 (79.07%) | |
| Others or does not have | 68 (0.31%) | 0 (0.00%) | |
| **Size of the municipality of the residence** | | | 0.575 |
| >500,000 inhabitants. | 2647 (12.12%) | 11 (12.79%) | |
| Provincial capital | 4611 (21.12%) | 16 (18.60%) | |
| >100,000 inhabitants | 1873 (8.58%) | 8 (9.30%) | |
| 50,000 to 100,000 inhabitants | 1990 (9.11%) | 10 (11.63%) | |
| 20,000–50,000 inhabitants | 3516 (16.10%) | 19 (22.09%) | |
| 10,000–20,000 inhabitants | 2366 (10.83%) | 9 (10.47%) | |
| <10,000 inhabitants | 4834 (22.14%) | 13 (15.12%) | |
| **Body Mass Index** | | | <0.001 |
| Underweight | 399 (1.93%) | 7 (8.43%) | |
| Healthy weight | 8853 (42.76%) | 56 (67.47%) | |
| Overweight | 8101 (39.13%) | 13 (15.66%) | |
| Obese | 3350 (16.18%) | 7 (8.43%) | |

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**Table 2:** Plant-based diets association with lifestyle factors, health care utilization, and medication**.** OR: Odds Ratio.

| **Lifestyle, use of health care services and medicine consumption.** | **Omnivores n=342** | **Plant-based n=86** | **Unadjusted OR** | **Adjusted OR†** | **95% CI** | **P-Value** |
|---|---|---|---|---|---|---|
| **Self-perceived general health (worse or very worse)** | 19 (5.56%) | 5 (5.81%) | 1.05 | 1.51 | 0.44 - 4.66 | 0.48 |
| **Tobacco consumption:** | | | | | | |
| No smoking | 216 (63.16%) | 48 (55.81%) | | | | |
| Smoker | 55 (16.08%) | 19 (22.09%) | 1.55 | 1.19 | 0.58 - 2.35 | 0.63 |
| Ex-smoker | 71 (20.76%) | 19 (22.09%) | 1.2 | 1.27 | 0.64 - 2.47 | 0.49 |
| **Weekly hazardous drinking** | 49 (14.33%) | 6 (6.98%) | 0.45 | 0.49 | 0.18 - 1.16 | 0.13 |
| **WHO-described enhancement of physical activity** | | | | | | |
| No compliance | 98 (28.65%) | 19 (22.09%) | | | | |
| Aerobic compliance | 52 (15.20%) | 15 (17.44%) | 1.49 | 1.91 | 0.82 - 4.47 | 0.13 |
| Muscle-strengthening compliance | 6 (1.75%) | 2 (2.33%) | 1.72 | 1.92 | 0.23 - 11.2 | 0.49 |
| Muscular or aerobic compliance | 186 (54.39%) | 50 (58.14%) | 1.39 | 1.53 | 0.80 - 3.03 | 0.21 |
| **At least one consultation in the last year** | | | | | | |
| General Practitioner | 72 (21.05%) | 13 (15.12%) | 0.67 | 0.68 | (0.34 - 1.35) | 0.272 |
| Physician specialist | 32 (9.36%) | 5 (5.81%) | 0.6 | 0.65 | (0.23 - 1.86) | 0.427 |
| Physiotherapist, kinesitherapist, chiropractor, or osteopath | 57 (16.67%) | 15 (17.44%) | 1.06 | 0.98 | (0.49 - 1.97) | 0.959 |
| Psychologist, psychotherapist, or psychiatrist | 20 (5.85%) | 13 (15.12%) | *2.87** | *3.21* | *(1.38 - 7.43)* | *0.007** |
| Registered nurse or Nurse Practitioner | 46 (13.45%) | 10 (11.63%) | 0.85 | 0.73 | (0.33 - 1.63) | 0.443 |
| Complementary medicine practitioner | 11 (3.22%) | 8 (9.30%) | *3.09** | *3* | *(1.06 - 8.48)* | *0.038** |
| **Consumed medicines in the last two weeks** | | | | | | |
| Prescribed by a physician | 186 (54.39%) | 54 (62.79%) | 1.42 | 1.39 | (0.77 - 2.53) | 0.276 |
| Not prescribed by a physician | 60 (17.54%) | 13 (15.12%) | 0.84 | 0.74 | (0.37 - 1.51) | 0.414 |
| Vitamins, minerals, and tonics | 31 (9.06%) | 12 (13.95%) | 1.63 | 1.85 | (0.83 - 4.14) | 0.132 |
| Naturopathic or homeopathic medicines | 9 (2.63%) | 5 (5.81%) | 2.28 | 2.31 | (0.65 - 8.29) | 0.197 |

†Adjusted by: sex, region, age, studies, household income, and social class. *: P-value<0.05.

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**Table 3:** Plant-based diets association with risk of chronic disease. OR: Odds Ratio. †Adjusted by Adjusted by sex, region, age, studies, household income, and social class. Diseases are self-reportes form the survey item: "*Has a physician diagnosed any of the following diseases?*" for depression symptoms, we used the Patient Health Questionnaire (PHQ-8). *: P-value<0.05.

| Self-Reported Diseases | Omnivores N=342 | Plant-based N=86 | Unadjusted OR | Adjusted OR† | 95% CI | P-value |
|---|---|---|---|---|---|---|
| Hypertension | 54 (15.79%) | 8 (9.30%) | 0.55 | 0.55 | (0.21 - 1.47) | 0.233 |
| Allergy | 44 (12.87%) | 16 (18.60%) | 1.55 | 1.11 | (0.54 - 2.27) | 0.774 |
| Asthma (including allergic asthma) | 23 (6.73%) | 5 (5.81%) | 0.86 | 0.6 | (0.19 - 1.88) | 0.381 |
| Heart disease | 10 (2.92%) | 3 (3.49%) | 1.2 | 1.97 | (0.44 - 8.76) | 0.373 |
| *Stroke* | *4 (1.17%)* | *4 (4.65%)* | *4.12** | *7.08* | *(1.27 - 39.46)* | *0.025** |
| Malignant tumors (if any) | 5 (1.46%) | 2 (2.33%) | 1.6 | 1.57 | (0.26 - 9.5) | 0.622 |
| Diabetes | 13 (3.80%) | 4 (4.65%) | 1.23 | 1.86 | (0.48 - 7.18) | 0.369 |
| Thyroid problems | 11 (3.22%) | 4 (4.65%) | 1.47 | 1.67 | (0.47 - 5.91) | 0.429 |
| High cholesterol | 39 (11.40%) | 3 (3.49%) | 0.28* | 0.29 | (0.08 - 1.08) | 0.064 |
| *Depression symptoms* | *20 (5.87%)* | *9 (10.59%)* | *1.9* | *2.58* | *(1 - 6.65)* | *0.049** |
| Migraine or frequent headaches | 25 (7.31%) | 6 (6.98%) | 0.95 | 1.12 | (0.4 - 3.12) | 0.833 |
| Hemorrhoids | 12 (3.51%) | 6 (6.98%) | 2.06 | 1.58 | (0.5 - 4.96) | 0.438 |
| Kidney problems | 9 (2.63%) | 2 (2.33%) | 0.88 | 0.81 | (0.15 - 4.45) | 0.812 |
| Varicose veins in the legs | 23 (6.73%) | 4 (4.65%) | 0.68 | 0.71 | (0.22 - 2.36) | 0.58 |
| Arthrosis (excluding arthritis) | 38 (11.11%) | 7 (8.14%) | 0.71 | 0.84 | (0.31 - 2.29) | 0.729 |
| Chronic back pain | 55 (16.08%) | 16 (18.60%) | 1.19 | 1.56 | (0.77 - 3.15) | 0.215 |
| Osteoporosis | 8 (2.34%) | 2 (2.33%) | 0.99 | 0.9 | (0.16 - 5.11) | 0.906 |
| Chronic skin problems | 16 (4.68%) | 6 (6.98%) | 1.53 | 1.57 | (0.56 - 4.42) | 0.389 |

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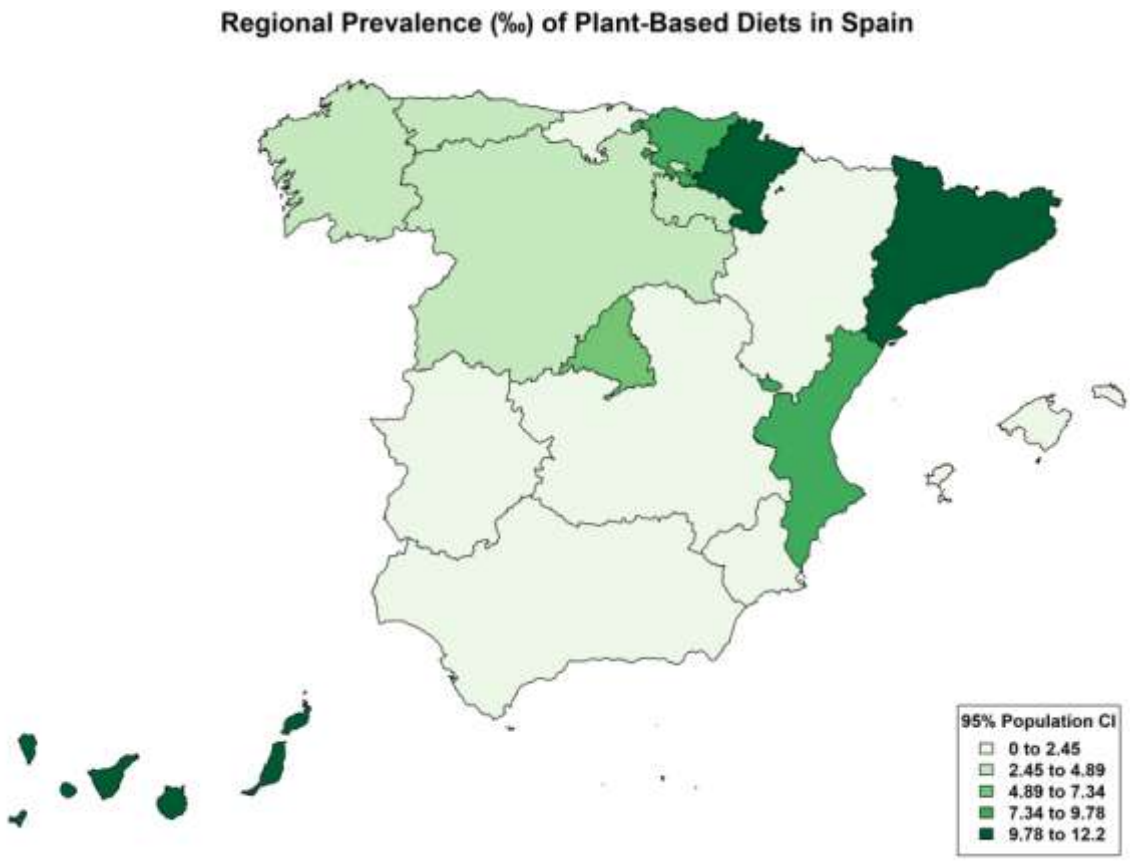


**Figure 1**: Population prevalence in Spanish regions.

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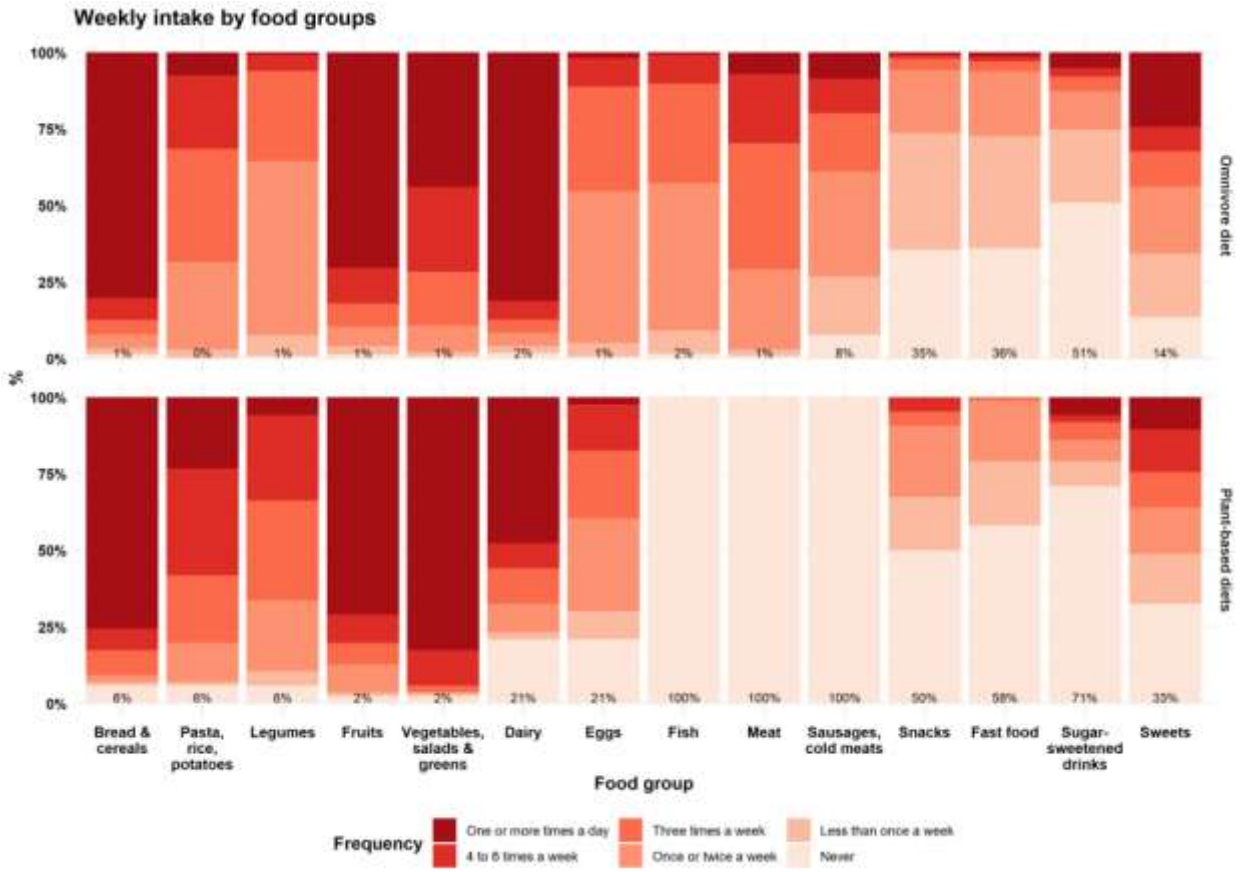


**Figure 2**: Weekly food intake by food groups, as reported by plant-based and omnivore participants

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