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Original Article

Sex differences in the association between social frailty and diet quality among older adults in Spain

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ABSTRACT

Objective: The aim was to examine the association between social frailty and diet quality in adults over 65 years of age, and whether results differed by sex.
Design: Population-based cross-sectional study using data from the Spanish National Health Survey.
Participants: 5,071 community-dwelling people ≥65 years from Spain.
Measurements: Social frailty was deemed to exist when the person both lived alone and had low social support, measured with the Duke-UNC scale. Diet was assessed with the Spanish Healthy Eating Index (S-HEI), ranging from 0 to 100 points (highest diet quality). Means and 95% confidence intervals of the S-HEI score for each social frailty group were calculated using linear regressions, with socially robust people as reference. Analyses were adjusted for main confounders, including sociodemographic, lifestyle and morbidity variables.
Results: There were no differences in the S-HEI adjusted mean of socially frail (74.3 points, 95%CI: 73.4−75.2) compared to socially robust older adults (75.4 points; 95%CI: 75.1−75.7). In sex-stratified analyses, the S-HEI adjusted mean of socially frail men (71.9 points; 95%CI: 70.6−73.2) was lower than robust men (74.8 points; 95%CI: 74.4−75.3). Specifically, social frailty was associated with lower consumption of vegetables, fruits, dairy and lower diet variety in men. Differences were not observed according to social frailty among older women.
Conclusions: Social frailty was associated with poor diet quality in community-dwelling older men, but not in women in Spain. Gender differences in self-care could partly explain this association. Sex-specific interventions are required to minimize the impact of social frailty on diet quality.

1. Introduction

The pace of population aging has accelerated due to increasing life expectancy and low fertility rates. By 2050, it is estimated that over 2 billion people worldwide will be over the age of 60, and 434 million will be 80 years and older [1]. Achieving a parallel increase in healthy life expectancy is a challenge for all countries, as this may improve the quality of life of their inhabitants and limit social and health care costs due to premature morbidity, disability, and dependency. One of the definitions of healthy aging refer to "the process of optimizing opportunities for health, participation and security in order to increase quality of life as people age" [2]. In this construct, both psychological and social components are of great importance, since people with physical health problems can enjoy healthy aging if they have good individual and social coping skills to deal with the aging process [2,3].

In addition, when examining the basic definition of frailty -a decline in homeostatic reserves-researchers and clinicians recognize that numerous psychosocial factors not covered by the traditional operationalization of the frailty phenotype may play a substantial role [4]. Indeed, frailty is increasingly recognized as multidimensional and complex, i.e., frailty is a "biopsychosocial" syndrome [3,5]. The conceptual shift of frailty as a biopsychosocial syndrome has broadened the field to include social and behavioral scientists and clinicians from a wide range of specialties.

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Specifically, social frailty is the lack of social resources, social activities and self-management skills necessary to meet basic social needs across the lifespan [6], reducing the ability of older people to maintain their independence [4]. Thereby, social frailty is a broad construct, which includes not only social isolation and loneliness (social needs) but also social exercise and participation (social fulfillment), housing and food (resources), behavior and motivation (self-management) [4,6]. According to a meta-analysis of 40 articles, the pooled prevalence of social frailty in community-dwelling older people is 18.8% (CI: 14.9%–22.7%) [7]. This is important because social frailty has been linked to worse quality of life and poor health indicators during aging, including pain [8], physical frailty [9], dependence [10], cognitive decline [11], depression [12], and mortality [13,14].

Although the aging transition is often accompanied by healthy lifestyle changes (e.g., less tobacco and alcohol consumption, more physical activity, etc.), the mechanisms as to why social frailty may trigger adverse events during aging are poorly known [15]. Social frailty has been associated with worse health behaviors, which may contribute to the decline in the health of socially frail older adults. To date, few studies have examined the association between social frailty and diet: Pek et al. [16], found that social frailty was associated with poorer nutritional status, as measured by the Mini Nutritional Assessment (MNA) and the Simplified Nutritional Appetite Questionnaire (SNQ) in a sample of 229 older adults from Singapore. Van Assen et al. [17] studied 45,336 Dutch community-dwelling people aged 65 years and older and found that social frailty was associated with lower consumption of vegetables and hot meals. Finally, Huang et al. [18] were the first to report sex differences in the association between social frailty and diet, food and nutrient quantity, dietary diversity and MNA score were lower in men with social frailty, but not in women. Therefore, we examined the association between social frailty and diet quality in Spanish adults over 65 years of age, and whether results differed by sex.

2. Subjects and methods

2.1. Study design and participants

We used data from a cross-sectional study among a representative sample of the Spanish population: the 2017 Spanish National Health Survey (S-NHS) [19]. In brief, the S-NHS used a three-stage stratified sample design, first considering census tracts with probability proportional to their size; second, family households; and third, an adult in each household. Data collection was carried out by trained staff through a computer-assisted face-to-face interview. Of the 29,195 individuals that formed the sample, the 5,071 people ≥65 years of age were selected for the present analysis.

2.2. Study variables

2.2.1. Social frailty

Social frailty was the main independent variable. The operationalization of social frailty was developed by a group of medical doctors, public health nurses and sociologists, following the model proposed by Bunt et al. [6]. According to this concept of social frailty, four factors can be integrated in an overall framework, including social resources, general resources, social behavior, and the fulfillment of basic social needs. Social resources have been commonly resumed by household status (living alone vs. not living alone) [18] and the other three factors are usually included in social support scales.

In the present study, the panel of experts defined social frailty as the combination of living alone and having low perceived functional social support, assessed with the Duke-UNC scale [20], which was available in the dataset (Supplementary Table S1). The Duke-UNC scale is a self-administered scale with 11 items and a Likert-type response scale (5 options). The possible score range is between 11 and 55 points (maximum social support). According to the Spanish validation, a cut-off point at the 15th percentile was used [20]. In our study, comprising a representative sample of the Spanish population of older adults, the cut-off point was 41 points, which divided the population into two groups, people with low social support and people with adequate support.

We classified study participants into three groups according to their degree of social frailty (Supplementary Table S1): (1) socially robust, those living with others and having adequate social support; (2) socially pre-frail, those living with others but with low social support, or people living alone but with adequate support; and (3) socially frail, people who lived alone and with low functional social support.

Additionally, given the lack of validated screening tools to measure social frailty and in order to compare results with existing studies, we also resumed social frailty according to the criteria proposed by Yamada and Arai [21], and later used by Huang et al. [18]. In sum, we developed a questionnaire using four equivalent items from our data set, each compressing the assessment of social resources, general resources, social behavior, and fulfillment of basic social needs based on Bunt's social frailty consensus concept [6] (Supplementary Table S2).

2.2.2. Diet quality

Habitual food consumption was ascertained with the S-NHS food frequency questionnaire. Diet quality (the dependent variable of this study) was assessed with the Spanish Healthy Eating Index, (S-HEI) [22,23], which is a modification of the U.S. Healthy Eating Index [24]. In brief, the S-HEI measures the extent to which the diet meets the recommendations of the Spanish Society of Community Nutrition [25]. The score obtained for each individual comprises 10 components representing nine food groups (1-cereals and derivatives, 2-vegetables, 3-fruits, 4-milk and derivatives, 5-meats, 6-legumes, 7-packages and cold cuts, 8-sweets, and 9-sweetened snacks) and a measure of diet variety. Each component scores from 0 to 10 based on adequacy to the recommended consumption (Supplementary Table S3). The global score in the S-HEI ranges from 0 to 100 points (highest diet quality).

2.2.3. Other variables

This analysis considered many potential confounders of the study association. We used sociodemographic data as sex, age, educational level (primary school or less, secondary school, high school or vocational training, university studies), social class according to the Spanish Society of Epidemiology classification [26], marital status (single, married, widowed, separated/divorced) and country of birth (Spain, foreign). We also considered lifestyles, such as tobacco smoking (smoker, ex-smoker, non-smoker), alcohol intake and physical activity. To assess alcohol drinking, the S-NHS asked about the frequency and quantity of the main alcoholic beverages consumed. We assumed that each standard unit of fermented beverage contributed 10 g of ethanol and each unit of distilled beverage 20 g. Participants were classified as "abstainers" (0 g/week), "moderate drinkers" (<280 g/week in men or <170 g/week in women), and "risk drinkers" (≥280 g/week in men or ≥170 g/week in women). For measuring physical activity, individuals were classified as sedentary, with moderate physical activity, or with intense physical activity, respectively, according to the three following reports: (1) "I do not exercise, free time is spent in sedentary activities; (2) "I do some occasional physical or sports activity (walking, cycling, gardening, gymnastics, etc.)"; and (3) "I do physical activity or sports training several times a month (gymnastics, running, swimming, cycling, team games, etc.)".

Finally, two health status variables were included. First, functional dependence, according to the ability to carry out five basic activities of daily living -BADL- (eating, sitting, getting up from a chair or bed, dressing, using the toilet and showering), with "dependency" defined as having some difficulty in any of the tasks. Second, morbidity, as a report of having being diagnosed by a physician with any of the following diseases: cardiovascular disease (high blood pressure, myocardial infarction, angina pectoris, coronary heart disease, and other heart diseases), diabetes, stroke, chronic respiratory diseases (asthma, chronic bronchitis

and emphysema), musculoskeletal diseases (osteoarthritis, cervical/lumbar chronic pain and osteoporosis), cancer, and mental disease (depression, chronic anxiety and other mental disorders).

2.3. Data analysis

The analyses were performed using the STATA v.15 package (Stata Corp., College Station, TX) considering the complex design of the sample. Of the 5,071 individuals aged 65 years or older residing in Spain comprising the S-NHS sample, 191 were excluded because of missing data on some variables. Therefore, the analysis was conducted with 4,880 individuals.

We used multiple linear regressions to estimate the means and 95% confidence intervals of the S-HEI score for each social frailty group, among the whole sample and for men and women separately. A crude model was first built, and then another one with adjustment for sociodemographic, lifestyle and morbidity variables. Likewise, logistic regression analyses were performed to study the association between social frailty groups and the probability of having a diet quality below the median of the whole sample, which was found at 75 points in the S-HEI. Therefore, crude and adjusted odds ratios (ORs) and their 95%CIs were obtained. In all cases, social robustness was considered the reference category. P-values <0.05 were considered statistically significant.

3. Results

In Spain, 24.5% of the population ≥65 years of age can be considered socially prefrail and 3.6% socially frail. Pre-frailty and frailty were more frequent in women (30.4% and 4.1%, respectively) than men (17.2% and 3.1%, respectively). Furthermore, compared to the robust, the socially frail participants were older and more often had low social class, primary education, low physical activity, limitations in BADL and morbidity, especially mental disease (Table 1).

Table 2 shows the mean S-HEI scores in the study sample. Social frailty was not associated with diet quality in the total sample; however, in sex-stratified analyses, socially frail men scored lower than socially robust men (−3.1 points in S-HEI score). Similarly, the frequency of a diet quality below the median was higher in socially frail men (adjusted OR: 2.16; 95%CI: 1.50−3.10; P-trend = 0.002) but not in socially frail women (Table 3). Almost identical results were achieved when using the additional definition of social frailty (Supplementary Table S4).

Finally, the individual components of the S-HEI were examined in relation to social frailty groups according to the sex of the participants (Table 4). In men, but not in women, social frailty was associated with lower consumption of vegetables (P-trend <0.001), fruits (P-trend = 0.001), dairy (P-trend = 0.007) and lower diet variety (P-trend<0.001).

Table 1
Characteristics of study participants (n = 4,880).

	Total	Robust	Prefrail	Frail
Participants, n (%)	4,880 (100)	3,508 (71.9)	1,194 (24.5)	178 (3.65)
Women, n (%)	2,668 (55.1)	1,762 (50.2)	816 (68.4)	110 (62.1)
Mean age (ds)	75.3 (7.68)	74.8 (7.06)	76.8 (7.69)	76.7 (10.5)
Low social class, n (%)	2,430 (49.8)	1,695 (48.3)	628 (52.6)	108 (60.4)
Primary education or lower	3,260 (66.8)	2,333 (66.5)	802 (67.2)	125 (70.1)
Low physical activity, n (%)	2,150 (44.1)	1,500 (42.8)	556 (46.6)	94 (52.6)
Risk drinker, n (%)	213 (4.37)	152 (4.33)	52 (4.34)	9 (5.29)
Smoker, n (%)	442 (9.05)	324 (9.22)	101 (8.47)	17 (9.05)
Limitation BADL, n (%)	934 (19.1)	624 (17.8)	258 (21.6)	52 (29.3)
Morbidity, n (%)				
Cardiovascular	3,388 (69.4)	2,410 (68.7)	849 (71.1)	129 (72.2)
Diabetes	1,144 (23.4)	844 (24.1)	257 (21.6)	43 (24.0)
Stroke	250 (5.12)	178 (5.08)	61 (5.14)	10 (5.86)
Respiratory	1,150 (23.6)	809 (23.1)	298 (25.0)	44 (24.6)
Musculoskeletal	2,941 (60.3)	2,018 (57.6)	796 (66.7)	126 (60.3)
Cancer	494 (10.1)	366 (10.4)	112 (9.38)	16 (8.74)
Mental	1007 (20.6)	644 (18.4)	304 (25.5)	59 (33.1)

BADL: basic activities of daily living.

Table 3
Odds ratios (95% confidence intervals) for the association between social frailty groups and low diet quality[a], in the total sample and by sex (n = 4,880).

	Robust	Prefrail	Frail	*P*-trend
Total sample, n				
Crude model	1.00	1.09 (0.96−1.23)	1.22 (0.98−1.51)	0.050
Adjusted model[b]	1.00	1.13 (0.99−1.29)	1.20 (0.97−1.49)	0.027
Men, n				
Crude model	1.00	1.10 (0.89−1.35)	2.15 (1.52−3.04)	0.004
Adjusted model[b]	1.00	1.14 (0.92−1.42)	2.16 (1.50−3.10)	0.002
Women, n				
Crude model	1.00	1.17 (1.00−1.37)	0.92 (0.69−1.23)	0.226
Adjusted model[b]	1.00	1.13 (0.95−1.33)	0.85 (0.63−1.14)	0.573

[a] Diet quality score below the median (75 points).
[b] Model adjusted for sociodemographic variables (age, sex, educational level, social class, marital status, and country of birth), lifestyle (physical activity, tobacco and alcohol consumption) and health status (BADL limitations and morbidity).

Table 2
Means (95% confidence intervals) of the S-HEI score according to social frailty groups (n = 4,880).

	Robust	Prefrail	Frail	*P*- trend
Total sample, n				
Crude model	75.4 (75.0−75.7)	75.3 (74.9−75.7)	74.2 (73.2−75.1)	0.155
Adjusted model[a]	75.4 (75.1−75.7)	75.2 (74.8−75.6)	74.3 (73.4−75.2)	0.113
Men, n				
Crude model	74.8 (74.4−75.2)	74.4 (73.6−75.2)	71.7 (70.4−73.0)	0.003
Adjusted model[a]	74.8 (74.4−75.3)	74.2 (73.4−75.0)	71.9 (70.6−73.2)	0.001
Women, n				
Crude model	75.8 (75.3−76.2)	75.9 (75.4−76.4)	76.0 (74.7−77.2)	0.579
Adjusted model[a]	75.9 (75.4−76.3)	75.7 (75.2−76.2)	75.7 (74.4−77.0)	0.758

[a] Means adjusted for sociodemographic variables (age, sex, educational level, social class, marital status and country of birth), lifestyle (leisure physical activity, tobacco and alcohol consumption) and health status (limitations in BADL and morbidity).

Table 4
Adjusted means (95% confidence intervals)[a] of the score for each of the S-HEI components according to social frailty groups, in the total sample and by sex (n = 4,880).

	Robust	Prefrail	Frail	*P*-trend
Cereals				
Total sample	9.80 (9.77 −9.83)	9.77 (9.73 −9.81)	9.66 (9.53 −9.78)	0.020
Men	9.81 (9.77 −9.85)	9.82 (9.75 −9.88)	9.69 (9.52 −9.85)	0.454
Women	9.80 (9.76 −9.84)	9.74 (9.69 −9.80)	9.64 (9.47 −9.82)	0.030
Vegetables				
Total sample	8.43 (8.36 −8.49)	8.36 (8.26 −8.45)	8.01 (7.80 −8.22)	0.055
Men	8.33 (8.24 −8.43)	8.14 (7.97 −8.31)	7.79 (7.49 −8.09)	<0.001
Women	8.50 (8.41 −8.59)	8.50 (8.38 −8.61)	8.19 (7.90 −8.48)	0.427
Fruit				
Total sample	9.35 (9.29 −9.42)	9.29 (9.20 −9.38)	9.14 (8.95 −9.32)	0.004
Men	9.32 (9.24 −9.40)	9.06 (8.87 −9.24)	8.74 (8.40 −9.08)	0.001
Women	9.36 (9.28 −9.46)	9.43 (9.33 −9.53)	9.41 (9.19 −9.62)	0.289
Dairy				
Total sample	9.41 (9.34 −9.48)	9.32 (9.20 −9.43)	9.29 (9.09 −9.49)	0.131
Men	9.39 (9.29 −9.48)	9.13 (8.90 −9.36)	8.95 (8.56 −9.34)	0.007
Women	9.42 (9.31 −9.52)	9.43 (9.30 −9.55)	9.51 (9.30 −9.72)	0.690
Meat				
Total sample	4.80 (4.71 −4.89)	4.87 (4.74 −5.00)	5.16 (4.90 −5.42)	0.054
Men	4.77 (4.64 −4.89)	4.98 (4.75 −5.22)	5.06 (4.65 −5.46)	0.053
Women	4.84 (4.71 −4.97)	4.82 (4.67 −4.97)	5.20 (4.86 −5.54)	0.423
Legumes				
Total sample	8.63 (8.56 −8.71)	8.54 (8.43 −8.64)	8.40 (8.15 −8.64)	0.037
Men	8.65 (8.55 −8.76)	8.58 (8.42 −8.74)	8.25 (7.88 −8.61)	0.075
Women	8.61 (8.51 −8.71)	8.52 (8.38 −8.66)	8.50 (8.18 −8.82)	0.264
Cold meats				
Total sample	4.94 (4.84 −5.04)	5.16 (5.01 −5.30)	5.15 (4.86 −5.43)	0.013
Men	4.58 (4.44 −4.72)	4.82 (4.56 −5.08)	4.72 (4.29 −5.16)	0.110
Women	5.23 (5.09 −5.38)	5.43 (5.26 −5.61)	5.50 (5.12 −5.88)	0.056
Sweet foods				
Total sample	4.60 (4.48 −4.73)	4.63 (4.46 −4.81)	4.62 (4.29 −4.96)	0.769
Men	4.71 (4.54 −4.89)	4.82 (4.51 −5.12)	4.63 (4.07 −5.19)	0.764
Women	4.51 (4.34 −4.69)	4.50 (4.30 −4.71)	4.61 (4.19 −5.02)	0.911
Soft drinks				
Total sample	8.57 (8.48 −8.66)	8.56 (8.43 −8.69)	8.53 (8.26 −8.79)	0.843
Men	8.54 (8.42 −8.67)	8.49 (8.26 −8.72)	8.17 (7.72 −8.62)	0.233
Women	8.59 (8.46 −8.72)	8.61 (8.45 −8.77)	8.75 (8.42 −9.07)	0.592
Diet variety				
Total sample	6.84 (6.78 −6.90)	6.70 (6.61 −6.80)	6.35 (6.16 −6.55)	<0.001
Men	6.73 (6.65 −6.82)	6.40 (6.23 −6.57)	5.90 (5.63 −6.18)	<0.001
Women	6.92 (6.83 −7.01)	6.89 (6.78 −7.00)	6.68 (6.42 −6.93)	0.225

[a] Means adjusted for sociodemographic variables (age, sex, educational level, social class, marital status, and country of birth), lifestyle (physical activity, tobacco and alcohol consumption) and health status (BADL limitations and self-reported morbidity).

4. Discussion

Among a representative sample of community-dwelling people >65 years in Spain, social frailty was associated with worse diet quality in men, but not in women; the main drivers of this association were lower consumption of vegetables, fruits and dairy, and less diet variety.

Our results add consistency to some research reporting an association between social isolation or frailty and poor dietary and nutritional indicators in older people. Two analyses of the SHARE project (Survey of Health, Ageing and Retirement in Europe) found that social isolation was associated with poor diet, in terms of daily fruit and vegetable consumption, in 15 European countries [27,28]. This same association was also recently observed in the Netherlands [17], using the Tilburg Frailty Indicator to assess social frailty. The mechanisms underlying this association are not fully clear and may operate at several levels [29]. First, socially frail people would be less integrated in society, so they may not benefit from the positive social influence on eating behavior exerted directly and indirectly by people in the immediate environment, health workers or the social norm. Second, older people with a poor social network are more vulnerable to situations of dependency to perform ADLs, such as shopping or cooking. Third, having few social relationships reduces the possibility of sharing pleasurable situations around meals (e.g., eating in a restaurant or having a guest to eat at home). In addition, one of the main reasons of the age-associated increase in social frailty age is the death of a spouse [30]. Living alone can reduce diet variety for several reasons, including increased depressive symptoms, not having to reconcile culinary tastes with cohabitants, and having less motivation to maintain socially accepted habits, such as cooking or not repeating menus [16].

However, the results of our study go further and align with Huang et al. in Japan [18], by suggesting a differential link with sex, since the association between social frailty and worse diet quality was observed only in men. This allows to refine the role of the mechanisms proposed above. The most obvious explanation is that older men generally have less cooking skills, and therefore, when isolated, their ability to follow a quality diet and maintain adequate nutrient intake is lower than in women [18,31,32]. This could also affect other areas relevant to diet, such as the ability to program menus and to buy food. Differences could be also related with lower knowledge of the effects of diet on health, less effort by health professionals to provide nutritional interventions in men, or less use of primary care services by men [33]. Finally, Conklin et al. [34] found that the coexistence of low economic resources and poor social relationships was associated with poorer diet quality, compared having only one of such variables. Interestingly, in this study men more often had both variables simultaneously, which may contribute to our results. Unfortunately, the lack of data regarding household income in the S-NHS did not enable us to explore this hypothesis.

According to some qualitative studies, social frailty and loneliness negatively affected diet quality of men and women equally but by different ways. In the case of men, when they became socially frail, commonly due to the death of their spouse, they had to learn to manage meals autonomously, and for many of them this could be an overly demanding challenge that ended up affecting diet quality [35]. In the case of women, the loss of their husband reduced -even suppressed- the pleasure of cooking tasty and varied meals [36]. However, other qualitative studies support the same sex-differences found in our study for the association between social frailty and diet quality. According to Schladitz et al. [37], older men were less concerned about healthy eating and relied on women to maintain a varied and well-balanced diet during ageing. Additionally, Asamane et al. [38] found that men living alone, in comparison with women, expressed more often age-related pain and declines in senses, such as loss of taste, making cooking and eating difficult and less enjoyable.

An interesting feature of our work is the use of three categories of social frailty in all the analyses, since in most previous research pre-frailty and social frailty are combined [18,27]. Thus, we observed that only older

men in the social frailty group (i.e., living alone and with low social support) had a lower diet quality than socially robust men, since those in the prefrail status seem to be able to maintain the quality of their diet. Older men tend to receive more attention from their family or social environment than women, as they are considered more vulnerable, with more need for care and have a greater difficulty in carrying out household activities, such as shopping or cooking [39].

Our results could contribute to a better understanding of the "health survival paradox between men and women", also called the "sex-frailty paradox", according to which women live longer despite having higher rates of disability and worse health status [40,41]. In our study, as in many others, rates of social frailty were significantly higher in women than in men [7]. However, women were able to mitigate the detrimental effect of social frailty on diet quality. As with the "sex-frailty paradox," one possible explanation is the social expectation of the female gender role, which makes women more capable of taking care of themselves than men. Therefore, the distribution of tasks according to traditional gender roles has led to inequalities that can also be detrimental to men, which constitutes an additional argument for eliminating the gender gap in housework.

Health and social workers should identify men who are pre-frail and socially frail at an early stage and intervene to strengthen healthy dietary decisions. In general, there is a need for tailored interventions considering both social context and nutritional demands during ageing, that foster caregivers and communities to improve social interactions and diet quality for socially frail men. These interventions could include cooking and grocery shopping courses, or programs to exchange tasks and responsibilities between sexes to decrease the gender gap and help men become more competent in self-care. In addition, mobilizing community resources for older adults to maintain an active and strong social network of connections during aging, including charities, seniors' associations, social networks, and online communications, could prevent food deprivation and dietary monotony when the person enters a dependent situation and increase the ability and opportunities of socially frail men to share meals with others. In all cases, programs and policies that seek to foster social support for older adults as a means of ensuring a healthy diet should consider the different social support required by men (tangible support) and women (emotional/informational support) [42].

We consider that our study pushes the research agenda by addressing situational and sociocultural factors, among the diverse factors influencing diet quality and food choices during ageing. Other factors of interest, including the availability of low price nutrient-rich foods, easy-to-prepare meals and easy-to-chew products, along with physiological factors may also play relevant roles in the association between social frailty and diet quality [43]. Additionally, to verify some of the proposed underlying causes for gender-differences in the association between social frailty and diet quality, studies designed to evaluate interventions focused on older men, such us the potential impact of fostering their autonomy (e.g., cooking and grocery shopping courses), increasing socialization during mealtimes, or providing home assistance for socially frail men seem of great interest. Moreover, our hypothesis could be studied using the following generations of older adults. If there is a gradual reduction in the gap of diet quality of socially frail men and women, the main driver should be gains in gender equity, therefore sexism would have been the most likely cause of our findings. Finally, future longitudinal studies should include a life-course perspective of social frailty, examining differentially groups immersed in social frailty prior and after the old age [44].

The main limitation of this study is the cross-sectional design, which does not allow to establish the direction of the association with certainty. Although it is not likely that poor diet quality leads to social frailty, it cannot be totally ruled out. Indeed, a study in Japan posed that woman had higher levels of social relationships and social capital than men partly because they also had better cooking skills [45]. Second, there is neither a consensus definition nor a widely accepted tool for assessing social frailty, therefore, our findings may not be comparable to those of other studies. Finally, the dietary information from the S-NHS is limited, and did not allow to estimate the daily caloric intake of the participants.

In conclusion, social frailty was associated with poor diet quality in older men but not in women in Spain. Gender differences in self-care could partly explain this association. Identifying and implementing effective interventions to reduce social frailty in older adults might improve their diet and contribute to healthy aging.

Ethical standards

This study was conducted according to the guidelines of the Declaration of Helsinki. Moreover, the study complied with all legal requirements set out by Spain regarding the conduct biomedical research.

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Authors' contributions

AL designed the research; LC-A, SL-F and MdMF-A conducted the research; SL-F and AL created and managed the databases; FFC-D, EL-G and AL analyzed the data; LC-A and AL wrote the paper; FFC-D, FR-A and EL-G interpreted the results; and EL-G and AL had primary responsibility for final content. All authors critically reviewed the manuscript and read and approved the final version.

Conflict of interests

The authors declare no conflict of interest.

Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.jnha.2024.100346.

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