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Health status, lifestyle and quality of life in older adults of rural and urban areas of Tarragona province (Catalonia, Spain): a cross-sectional descriptive study

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Abstract

Background People over 60 years old represent 26.5% of the world's population, and enhancing health emerges as an opportunity. Thus, this study aims to describe and compare the health status (sarcopenia parameters), lifestyles, quality of life, and malnutrition risk of older adults from rural and urban areas of Tarragona province (Catalonia, Spain).

Methods The study was a cross-sectional study comparing rural and urban areas of Tarragona province, including 14 of 61 villages as rural areas (500-≤2,000 inhabitants) and 5 of 8 cities as urban areas (≥20,000 inhabitants). The variables assessed were: sarcopenia parameters (muscle mass, muscle strength, and physical performance) and lifestyles (diet, physical activity, sleep quality), quality of life and risk of malnutrition. A total of 291 older adults, $n = 189$ (rural areas) and $n = 102$ (urban areas), including 80% women with a mean age of 67.37 (rural areas) and 69.12 (urban areas), were studied.

Results The mean of muscle mass (kg) is higher in men from rural areas (57.59 ± 7.01 vs. 53.48 ± 6.82 ; $p = 0.047$) than in urban areas. Compared with urban areas, more people from rural areas accomplish the recommendations of consumption of fruits and vegetables (13.8% vs. 4.9%; $p = 0.019$), and dairy products (95.8% vs. 88.2%; $p = 0.015$) along with their high-intensity physical activity (76.7% vs. 65%; $p = 0.046$). Additionally, in rural areas, more people presented better sleep and quality of life, including physical and emotional roles dimensions, than the urban areas individuals ($p \leq 0.05$). No difference among groups was shown in nutritional status.

Conclusion Sarcopenia parameters of urban and rural older adults are similar, except for the highest muscle mass of older adults from rural areas compared to urban ones. In addition, older adults living in rural areas show healthier

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lifestyles and better quality of life than urban individuals, reinforcing the importance of adapting actions according to the people's environment.

Keywords Lifestyle, Older adults, Ageing, Quality of life, Sarcopenia

Introduction

Nowadays, people over 60 years old represent 26.5% of the world's total population [1], and in Spain, the percentage of this population is around 20% [2]. According to National Institute of Statistics, around 2030 is predicted that the population ≥ 65 years old will reach a maximum of 30% in Spain [3]. This quickly aged population is rising in Spain due to the increase in life expectancy and the reduction of mortality of old people [4, 5].

Ageing is a natural multifaceted physiological process that progressively accumulates cellular and molecular damage leading to a gradual deterioration in tissue functions, and consequently, a decline in physical and mental capacity [6]. It is from the age of 60 when a greater impact of the ageing process is observed causing less quality of life and an increase in diseases due to a rise in risk factors related to social changes such as isolation, familiar dispersion, income situation, and loss of deceased close familiar members [7, 8]. Thus, the enhancement of health among older adults emerges as an opportunity.

Ageing is characterized by an increase in body total fat mass and a decrease in lean mass due to skeletal muscle lipid infiltration [9]. From the age of 60, there is a physiological loss of muscle mass of 3% per year [10]. Thus, ageing is associated with the development of sarcopenia, a complex multifactorial process defined by the European Working Group on Sarcopenia in Older People (EWG-SOP2) as the loss of muscle mass, muscle strength, and physical performance [11, 12]. The presence of low muscle strength is defined as probable sarcopenia. Sarcopenia is diagnosed with low muscle strength and low muscle quantity or quality. Finally, severe sarcopenia is defined as low muscle strength, low muscle quantity or quality, and low physical performance [12]. Sarcopenia increases the risk of falls, fractures, physical disability and mortality [12]. Diet can play an important role in the prevention of sarcopenia, ensuring the protein intake recommendation (1.0–1.2 g/kg/day) [13–15], which is diminished by age, and vitamin D and antioxidant requirements, are considered key aspects of sarcopenia prevention [16].

Lifestyle including dietary habits, physical activity, and sleep quality are key factors that affect the ageing process and quality of life [17–20]. A healthy dietary pattern including more fruits and vegetables, whole grains, legumes, nuts and dairy products, white meat and fish, and less sugar-sweetened beverages and processed meats is associated with greater longevity [21]. In addition, the practice of physical activity reduces the risk of cardiovascular mortality, breast and prostate cancer, fractures,

falls, cognitive decline, and dementia, among others [22]. Also, it has been observed that poor sleep quality in the elderly leads to a deterioration of cognitive, psychological, and physical functions [23].

Moreover, ageing implies some physiologic decline such as oral problems, chewing difficulties, loss of dental pieces, deterioration of the senses such as smell and taste, and digestive and constipation problems, which are associated with the risk of malnutrition [24, 25].

Dividing disparities in healthy lifespans between the rural and urban environments are stated in ageing [26]. Since 1960, Spain has been in a demographic transition dominated by rural-urban migration processes, which cause an increasing depopulation of rural areas and centralisation in urban areas, causing different lifestyle dynamics [27]. In rural areas, the limited accessibility to sports centres, hospitals, health clinics, supermarkets, etc., can have an impact on people's lifestyle [28], and in urban areas, the population density, busy lifestyle, stress, and pollution [29].

Previous international studies analysed the difference in sarcopenia parameters and lifestyles of older people from urban and rural areas. Some studies concluded that people between 40 and 94 years old from rural areas have a higher prevalence of sarcopenia than in urban areas [30–32]. Cross-sectional studies showed that the population from urban areas had higher levels of physical activity than in rural areas [33, 34]; also, a higher intake of fat, meat, sugar, dairy products, and legumes, without differences in fruit and vegetable intake [35]. On the other hand, older adults from rural areas presented a higher perception of bad health than rural ones, but older adults from rural areas reported a lower quality of life compared to urban ones [36]. Focusing on previous studies located in the region of the present study, a cross-sectional study in Catalonia that compared rural (<2,000 inhabitants), semi-rural (2,000–20,000), and urban areas (>20,000) showed that older adults (>65 years old) from rural areas practised as moderate-vigorous physical activity as urban areas older adults. Still, in rural areas, people slept more hours and had better emotional well-being than in urban areas [37]. However, the majority of research assessed people over the age of 65 years, and people from 60 years are underrepresented, and there is a lack of evidence of older adults from Tarragona province, especially for the difference in sarcopenia parameters between urban and rural areas. For all mentioned above, new evidence about the main factors that affect health status, lifestyle, and quality of life in older adults (60–74 years old) living in

rural compared to urban areas is needed. Consequently, current information could help to design recommendations adjusted to the real necessities of the population as a base to reduce health inequalities according to the living area.

Therefore, the present study aims to describe and compare the health status (sarcopenia parameters), lifestyles (diet, physical activity, and sleep quality), quality of life, and malnutrition risk of older adults aged 60 to 74 years old living in rural and urban areas of Tarragona province (Catalonia, Spain).

Materials and methods

Study design

The present study is a cross-sectional descriptive observational study based on: (1) the rural area data from the baseline data for a Randomized Controlled Trial (RCT) intervention study “Earlier Elderly People in Rural Areas (Ref. PR15-020289-2)”; carried out according to the Declaration of Helsinki and the Good Clinical Practice guideline of the International Conference on Harmonization; and (2) the baseline urban area data from a cross-sectional study “Earlier Elderly People in Urban Areas (Ref: 2021PGR-DIPTA-URV03)”. These studies were approved by the Ethics Research Committee of Pere Virgili Health Institute (Ref. CEIm 176/2021) and were registered to the Clinical Trials: (1) Trial registration number: NCT05273502, date registration: 2022-02-17; (2) Trial registration number: NCT05268146, date registration: 2022-02-11. The present study is described following the STROBE criteria [38].

Population and sampling

Participants from rural areas were selected from a baseline random population sample recruited in a RCT stratified by age and sex, drawn from different community settings in rural areas such as town halls, civic centres, senior citizens’ associations, women’s associations, and the country council of populations from 500 to 2,000 inhabitants of the province of Tarragona taking into account the last bill of Catalonia government about different types of villages and cities according to the inhabitants number [39, 40]. The selected villages (rural areas) were: Bot, Botarell, Caseres, El Masroig, El Montmell, Horta de Sant Joan, L’Aleixar, La Fatarella, La Pobla de Massaluca, Masdenverge, Maspujols, Pinell de Brai, Porrera, Vilalba dels Arcs and Vilanova d’Escornalbou. Participants from urban areas were selected from a baseline random population recruited in a cross-sectional study stratified by age and sex, from community settings such as town halls, civic centres and senior citizens’ associations of cities of $\geq 20,000$ inhabitants of Tarragona province taking into account the Statistical Institute of Catalonia (Idescat) classification by inhabitants number

[41]. The cities (urban areas) were: Reus, Tarragona, Cambrils, Valls and Tortosa.

There are 184 municipalities in Tarragona province, 61 of them have between 500 and ≤ 2000 inhabitants (rural areas), and the present study includes 14 of 61 as rural areas, representing 23% of the sample. According to urban areas, in the Tarragona province, there are 8 cities with $\geq 20,000$ inhabitants, and the present study included 5 of the 8, representing 62.5% of the sample. In the participant recruitment sessions, the study was explained and the information sheet was given to the participants. All participants signed an informed consent after being fully informed of the objectives and procedure of the study.

The inclusion criteria of participants of the study were men and women aged ≥ 60 years and ≤ 74 years, living independently in villages ($\leq 2,000$ inhabitants) or cities ($\geq 20,000$ inhabitants) of Tarragona province, who have signed the informed consent and can follow the study. Non-compliance with any inclusion criterion was considered an exclusion criterion.

Variables of the study

The study variables were assessed in 2022 and are the same in both rural and urban areas.

These variables were:

Sarcopenia parameters:

- Muscle quantity can be determined by bioimpedance (BIA) with the appendicular skeletal muscle mass (ASM) [12]. However, the model of TANITA SC-330 used in the present study determined the muscle mass and did not allow obtaining the ASM. For this reason, it is not possible to determine the cut points of this sarcopenia parameter.

- Muscle strength was assessed by the handgrip test using a calibrated Jamar® plus +200lb hydraulic dynamometer. Two measurements were made for both hands, but the average dominant hand strength was considered. The grip strength cut points are $< 27 \text{ kg/m}^2$ for men and $< 16 \text{ kg/m}^2$ for women [12].

- To determine physical performance, the walking speed test counted the time taken by the participants to walk 4 m, at their usual walking pace, with a stopwatch [42]. The walking speed cut points are $\leq 0.8 \text{ m/s}$ for men and women [12].

Food consumption: the people percentage who follow the current dietary recommendations of each food group according to “Agencia Española de Seguridad Alimentaria y Nutrición” (AESAN) 2022 [43], except for red and processed meat food group based on the sustainable Mediterranean Diet Pyramid [44].

The diet was assessed by a validated Food Frequency Questionnaire (FFQ), including 32 questions about food consumption on a daily or weekly basis [45]. Based on the FFQ, the following 10 food groups were created

concerning the achievement of consumption recommendations of each food group established by the AESAN and sustainable Mediterranean Diet Pyramid [43, 44]: fruits and vegetables (≥ 5 servings/day); dairy products (≤ 3 servings/day); cereals (≥ 3 servings/day); white meat (≤ 3 servings/week); red meat (≤ 2 servings/week); processed meat (≤ 1 serving/week); fish and seafood (≥ 3 servings/week); eggs (≤ 4 servings/week); legumes (≥ 4 servings/week); sweets (≤ 1 serving/week).

Physical activity: The validated International Physical Activity Questionnaire (IPAQ) was used to assess the physical activity levels. Physical activity was categorized as low, medium, and high based on seven questions about the frequency, duration, and intensity of activity, walking time, and sedentary time during the last week [46].

Sleep quality: the validated Pittsburgh Questionnaire (PSQI) was used to assess sleep quality, which contains 19 questions grouped into 7 areas with a score from 0 to 3 for each area, where 0 indicates good sleep quality and 3 severe difficulties. The total score ranges from 0 to 21, where 0 means good sleep quality and 21 means there are severe difficulties in all areas of sleep quality [47].

Quality of life: the quality of life was assessed by an SF-36 validated questionnaire with 36 items to obtain information about eight dimensions: Physical Function, Physical Role, Body Pain, General Health, Vitality, Social Function, Emotional Role, and Mental Health. For each of these dimensions, a score can be calculated from 0 to 100; the higher the value obtained, the better the quality of health [48].

Malnutrition risk: the validated Mini Nutritional Assessment short form (MNA-SF) screening test was used to assess the participants' risk of malnutrition quickly and easily [49]. This test contains questions about the nutritional state, dependency, quality of life, mobility problems, physiologic stress or acute disease, and neuro-physiologic problems, among others. The punctuations are: ≥ 12 points (well-nourish, non-malnutrition risk); 8 to 11 points (malnutrition risk) and ≤ 7 points (malnutrition established).

Other variables: Sex and age were collected. Anthropometric measurements of the participants such as weight, height, and body mass index (BMI) were determined.

Weight was measured without shoes and determined using a bioimpedance scale (Tanita SC 330-S; Tanita Corp., Barcelona, Spain). Height was measured with a wall-mounted stadiometer (Tanita Leicester Portable; Tanita Corp., Barcelona, Spain). BMI was determined through collected measurements of weight and height [51].

Statistical analyses

The total sample size of 291 older adults in the present cross-sectional study comes from: 1) baseline data of 190 rural area older adults recruited in a RCT ("Earlier Elderly People in Rural Areas Study"; Trial registration number: NCT05273502, date registration: 2022-02-17), with a required total sample size of at least 176 individuals; 2) data from 102 urban area older adults recruited in a cross-sectional study ("Earlier Elderly People in Urban Areas"; Trial registration number: NCT05268146, date registration: 2022-02-11), with a required sample size of at least 77 individuals.

Continuous variables are represented as mean \pm Standard Deviation (SD) and categorical variables are shown as percentages.

Comparisons of continuous variables with normal distribution were analysed based on a univariate General Linear Model adjusted for age. Comparisons of categorical variables were analysed using a Chi-square (Pearson) analysis, also adjusted for age.

Statistical significance was considered with a p -value ≤ 0.05 . Statistical analysis was carried out using the SPSS program version 28 for Windows.

Results

In the present study, a total of 291 older adults were analysed, 189 people from the rural area and 102 people from the urban area of Tarragona province.

Table 1 shows the principal characteristics of the participants included in the analysis, in total and separately by rural or urban area. More than 80% of participants in both rural and urban areas are women. The mean age of participants in rural areas is statistically lower (mean \pm SD = 67.37 \pm 3.97) than in urban areas (mean \pm SD = 69.12 \pm 3.38), $p = 0.001$. Related to the BMI,

Table 1 Principal characteristics of participants

	TOTAL (n = 291)	RURAL (n = 189)	URBAN (n = 102)	p-value
	Mean \pm SD	Mean \pm SD	Mean \pm SD	
Age ¹	67.98 \pm 3.86	67.37 \pm 3.97	69.12 \pm 3.38	0.001
% women ²	82.1 (239)	82 (155)	82.4 (84)	0.860
BMI (kg/m ²) ¹	28.55 \pm 4.84	28.92 \pm 4.78	27.86 \pm 4.90	0.074

SD, Standard deviation; BMI, Body Mass Index

¹T-student

²Chi-quadrat (Pearson)

Significant p -value ($p \leq 0.05$) in bold

Table 2 Sarcopenia parameters of participants from rural and urban areas

	TOTAL (n=291) Mean ± SD	RURAL (n=190) Mean ± SD	URBAN (n=102) Mean ± SD	p-value ¹
Muscle mass (kg)				
Male	56.16±7.15	57.59±7.01	53.48±6.82	0.047
Female	40.75±4.64	40.97±4.21	40.35±5.33	0.336
Total	43.54±7.88	44.02±8.06	42.67±7.51	0.166
Muscle strength (kg)				
Male	36.19±7.82	36.09±7.18	36.37±9.14	0.906
Female	21.28±4.81	21.30±5.45	21.25±3.37	0.931
Total	23.94±7.91	23.96±8.11	23.92±7.55	0.965
Physical performance (m/s)				
Male	1.17±0.23	1.20±0.22	1.11±0.24	0.176
Female	1.08±0.23	1.09±0.24	1.06±0.22	0.442
Total	1.09±0.23	1.11±0.24	1.07±0.22	0.211

SD, Standard deviation

¹T-studentSignificant p-value ($p \leq 0.05$) in bold**Table 3** Food consumption accomplishment based on AESAN recommendations of participants from rural and urban areas

FOOD GROUPS	TOTAL (n=291) % (n)	RURAL (n=189) % (n)	URBAN (n=102) % (n)	p-value ¹
Fruit and vegetables (≥ 5 servings/day)	10.7 (291)	13.8 (26)	4.9 (5)	0.019
Dairy products (≤ 3 servings/day)	93.1 (271)	95.8 (181)	88.2 (90)	0.015
Cereals (≥ 3 servings/day)	4.5 (13)	3.2 (6)	6.9 (7)	0.146
White meat (≤ 3 servings/week)	76.5 (215)	76.7 (138)	76.2 (77)	0.935
Red meat (≤ 2 servings/week)	83.6 (229)	84.5 (147)	82 (82)	0.593
Processed meat (≤ 1 serving/week)	12.7 (37)	11.1 (21)	15.7 (16)	0.264
Fish and seafood (≥ 3 servings/week)	80.1 (233)	79.4 (150)	81.4 (83)	0.683
Eggs (≤ 4 servings/week)	82.2 (221)	84 (142)	79 (79)	0.298
Legumes (≥ 4 servings/week)	7.1 (20)	6.5 (12)	8.2 (8)	0.576
Sweets (≤ 1 serving/week)	28.5 (83)	25.9 (49)	33.3 (34)	0.182

AESAN, Agencia Española de Seguridad Alimentaria y Nutrición

¹ Chi-squared (Pearson) adjusted by ageSignificant p-value ($p \leq 0.05$) in bold

in both populations the mean is greater than 27 kg/m² (overweight) [50] without statistically significant differences between rural and urban areas participants ($p = 0.074$).

Variables results

Based on the cut-off points to determine the sarcopenia, the muscle strength and physical performance in both, males and females, from urban and rural areas, are not altered (Table 2) However, no significant differences between the participants from rural and urban areas in both sexes and the total population are found. Focusing on muscle mass (kg), in males, the mean ± SD was statistically higher in rural areas (57.59 kg ± 7.0) than in urban areas (53.48 kg ± 6.82) ($p = 0.047$) (Table 2).

Table 3 shows the people percentage who accomplish the AESAN frequency of food consumption recommendations between rural and urban areas [43]. The daily consumption of fruit and vegetables was higher in rural

areas, with 13.8% ($n = 26$) of participants that accomplish the fruit and vegetables daily consumption, compared to urban areas, with 4.9% ($n = 5$) of participants ($p = 0.019$).

The 95.8% ($n = 181$) of participants from rural areas and 88.2% ($n = 90$) of participants from urban areas achieved the recommended consumption of dairy products (≤ 3 servings/day), being higher in rural than urban areas ($p = 0.015$).

Regarding the other food groups, no statistical differences were found between groups.

Table 4 describes physical activity intensity, indicating that more than half of the participants from both areas engaged in high-intensity physical activity, with a higher proportion of participants from rural areas practising high-intensity physical activity ($p = 0.046$).

Table 5 shows sleep quality and more than half of the participants from both areas had poor sleep quality, presenting severe difficulties with sleep quality. A greater percentage of participants from urban areas (65.7%;

Table 4 Physical activity intensity of participants from rural and urban areas

Intensity of physical activity	TOTAL (n = 291) % (n)	RURAL (n = 189) % (n)	URBAN (n = 102) % (n)	p-value ¹
Low	3.8 (11)	4.2 (8)	3 (3)	0.046
Moderate	23.5 (68)	19 (36)	32 (32)	
High	72.7 (210)	76.7 (145)	65 (65)	

¹ Chi-squared (Pearson) adjusted by age

Significant p-value ($p \leq 0.05$) in bold

Table 5 Sleep quality of participants from rural and urban areas

Sleep Quality	TOTAL (n = 291) % (n)	RURAL (n = 189) % (n)	URBAN (n = 102) % (n)	p-value ¹
Good sleep quality	41.9 (122)	46 (87)	34.3 (35)	0.05
Severe difficulties with sleep quality	58.1 (169)	54 (102)	65.7 (67)	

¹ Chi-squared (Pearson) adjusted by age

Significant p-value ($p \leq 0.05$) in bold

Table 6 Quality of life of participants from rural and urban areas

Dimensions of quality of life	TOTAL (n = 291) Mean \pm SD	RURAL (n = 189) Mean \pm SD	URBAN (n = 102) Mean \pm SD	p-value ¹
Physic function	77.24 \pm 21.75	77.14 \pm 22.69	77.42 \pm 19.93	0.585
Physical role	60.33 \pm 44.41	76.60 \pm 37.43	29.75 \pm 40.31	< 0.001
Corporal pain	62.71 \pm 23.10	63.28 \pm 22.59	61.63 \pm 24.09	0.561
General Health	62.41 \pm 18.81	62.32 \pm 18.21	62.56 \pm 19.98	0.681
Vitality	64.71 \pm 19.25	65.29 \pm 20.15	63.61 \pm 17.49	0.439
Social Function	83.97 \pm 20.65	84.92 \pm 19.32	82.18 \pm 22.94	0.347
Emotional role	62.27 \pm 45.51	80.07 \pm 35.68	28.28 \pm 42.95	< 0.001
Mental Health	72.74 \pm 18.04	73.45 \pm 18.11	71.45 \pm 17.94	0.456

SD, Standard Deviation

¹ Univariate General Linear Model adjusted for age

Significant p-value ($p \leq 0.05$) in bold

Table 7 Malnutrition risk of participants from rural and urban areas

	TOTAL (n = 291) % (n)	RURAL (n = 189) % (n)	URBAN (n = 102) % (n)	p-value ¹
Non-malnutrition risk	65.5 (180)	66.7 (120)	63.2 (60)	0.457
Risk of malnutrition	33.8 (93)	32.2 (58)	36.8 (35)	
Malnutrition	0.7 (2)	1,1 (2)	0 (0)	

¹ Chi-quadrat (Pearson)

$n = 67$) presented severe difficulties with sleep quality, compared to participants from rural areas (54%; $n = 102$) ($p = 0.05$).

Table 6 shows the mean \pm SD of dimensions of quality of life and the difference between rural and urban areas. In rural areas, the dimensions of physical role (76.6 \pm 37.4 in rural area vs. 29.75 \pm 40.31 in urban area; $p < 0.001$) and emotional role (80.07 \pm 35.68 in rural area vs. 28.28 \pm 42.95 in urban area; $p < 0.001$) were higher than in the urban areas. However, the other dimensions did not show significant differences between areas.

Focusing on malnutrition risk from health status, more than 60% of participants from both areas had a non-malnutrition risk, and approximately 30–40% had a risk

of malnutrition, without difference between both areas ($p = 0.457$) (Table 7).

Discussion

The results of the present study show that the sarcopenia parameters of urban and rural older adults from Tarragona Province (Catalonia, Spain) are similar, except for the muscle mass of older adults from rural areas compared to urban ones. In addition, in rural areas, there is a higher percentage of older adults who reached the dietary recommendations for fruit, vegetables, and dairy products consumption compared to the urban areas older adults. Also, older adults from rural areas have high-intensity physical activity, better sleep quality, and better quality

of life, specifically physical and emotional role than older adults from rural areas.

Focus on sarcopenia parameters, a systematic review and meta-analysis that compared the prevalence and associated factors of sarcopenia in 40–87 years population from rural and urban areas, showed the biggest prevalence of sarcopenia in rural areas due to some reasons: (a) the lower socioeconomic status of elders in rural areas affecting the individuals' lifestyles, (b) the higher risk of malnutrition of elders in rural areas, (c) the lower practise of physical activity of elders in rural areas, (d) the most elders suffer of osteoporosis in rural areas, etc [51]. This evidence is not confirmed in the present study because the only difference identified was a higher muscle mass in men living in rural areas compared to urban areas; a higher practice of high-intensity physical activity in rural individuals than in urban individuals, and a similar risk of malnutrition in both areas. In addition, this manuscript contributes to the lack of evidence about the differences in sarcopenia parameters between rural and urban areas in older adults from Spain, considering that previous evidence only showed the prevalence of sarcopenia in urban areas and the comparison with other countries [52, 53].

Regarding dietary patterns, despite the differences found in fruit, vegetable, and dairy consumption, older adults from both areas followed a similar diet. However, the percentage of participants that achieved the fruit, vegetables, and dairy products recommendation was significantly higher in rural areas, despite being a small percentage that complies with the recommendations of five servings per day of fruit and vegetables. These results are in line with a previous study published in 2007 which compared urban and rural populations of adults and older adults (19–72 years old) from the Madrid region. In those populations, fruit and vegetable consumption was higher in rural than in urban individuals (fruit: 33% vs. 23% and vegetables: 50% vs. 19%). Also, in line with the results of the present study, the participants of both areas did not achieve the recommendation of five servings per day [54]. However, in the study developed in Madrid, the accomplishment of these lifestyles was higher than in the present manuscript, and one possibility is that included adult and older adult populations. Concerning dairy products, in both studies, the accomplishment of this food group is achieved by a higher percentage of participants [54].

These fruit, vegetables, and dairy products consumption differences between rural and urban individuals may be due to the distances of the urban population from the primary production, distribution, and accessibility of non-processed food [55]. Consequently, this may complicate the availability of vegetables and fruits, especially for older adults who could have some physical problems in urban areas [56].

It is known that the daily consumption of fruit, vegetables, and dairy products is associated with a lower risk of fragility [57–59]; and the development of sarcopenia with the improvement of skeletal muscle mass, in the case of dairy protein [60]. The results of the present study showed significantly more muscle mass in males from rural areas than in urban areas but did not show differences in the female group, with higher representation in the present study, and in other sarcopenia parameters between both areas. In the present study, regarding the protein food groups, more than 70% of participants from both areas achieved the recommendation on white and red meat, fish and seafood, and eggs. Whereas more than 90% of participants from both areas did not achieve the recommendation for legume consumption. These legume recommendation results are in line with the actual Spanish dietary pattern, with a predominantly consumption of animal protein [61]. For this reason, in 2019, the “Sociedad Española de Nutrición Comunitaria” led programs to reverse the consumption dynamic, reducing animal protein and increasing vegetal protein [61]. On the other hand, in rural and urban participants, more than 80% exceeded the recommendation of ≤ 1 serving/week of processed meat (including cold meat) consuming more than 4 servings per week. Additionally, a study in 2020 showed that only 21% of the >65-year-old Spanish population achieved the occasional recommendation of cold meat [62]. It is worrying data due to the health consequences of red and processed meat consumption, such as increased risk of fragility, non-communicable diseases, and cancer, especially colorectal cancer [63].

Moreover, more than 65% of older adult participants from both areas exceeded the ≤ 1 serving/week of sweets, consuming more than 5 servings per week. The consumption of sweets has been related to the increase in fragility and higher risk of cardiovascular diseases, diabetes, overweight, and obesity; and, consequently, with a worse quality of life and an increased risk of mortality [64–67]. For this reason, strategies to achieve the occasional consumption of processed meat and sweets in this age population are needed.

In the present study, more participants from rural areas practised significantly high-intensity physical activity than those from urban areas (76.7% vs. 65%). These results are supported by evidence that showed a major achievement of physical activity in old people from rural areas [68–70]. This fact can be due to the geographic characteristics, urbanization, mechanization of daily life activities, decrease in free time, and the excessive use of vehicles to move in urban areas [71]. Additionally, the rural tasks are more physically strict like agricultural and ranching tasks, and domestic activities [70]. Likewise, the present results agree with some studies that associate the practice of physical activity of old people in rural

areas with a better quality of life and physical performance (sarcopenia parameter) compared to urban areas with inactivity and sedentary behaviour tendencies [72]. Physical activity can attenuate or prevent age-related decreases in muscle degeneration so, it is an essential part of healthy ageing [73]. In line with this evidence, the present study showed a better physical role and emotional role, dimensions of quality of life, in rural areas than in urban areas. The physical role assesses the limitation of the individual when working and performing daily activities due to physical health [48], which can limit the disposition and ability to do physical activity. In the present study, more participants from rural areas have greater achievement of physical activity recommendations suggesting fewer limitations due to physical health problems than urban individuals.

The emotional role is associated with the diet and physical activity; anxiety, worries, and depression can influence dietary choices, nutritional status, and the predisposition to do physical activity [74–76]. Therefore, the differences in these two dimensions of the quality of life can lead to significantly better lifestyles presented by the participants from rural areas.

Other key factors influencing the quality of life and sarcopenia parameters are sleep quality and nutritional state [77–79]. In the present study, a higher percentage of older adults from rural areas showed better sleep quality than those from urban areas. In the last years, evidence highlighted the global tendency of increasing severe sleep difficulties, especially in the adult population from urban areas [80]. Sleep is determined by a physiological pattern of the sleep-wake cycle influenced by social patterns and sun exposure. In rural areas, the sleep-wake cycle is suited to solar time due to agricultural tasks, so the population of rural areas tends to go to sleep earlier and have more hours of sleep than the urban population [81, 82]. Furthermore, the urban population is exposed to external factors that affect sleep quality, such as noise pollution and social jet lag, which influence alterations in the sleep-wake cycle causing sleepiness, daytime dysfunctions, effects in the sleep pattern, and a decrease in the hours of sleep [83].

An interesting result of the present study is that 30–40% of older adults from both areas presented a similar risk of malnutrition. This result is a little higher than previous cross-sectional studies that analyse the prevalence of risk of malnutrition, from 15 to 23%, in over 65 years old Spanish population [84, 85]. Malnutrition can affect daily dairy activities, muscular catabolism, and increased fragility causing the increment of mortality [86–88]. For this reason, future actions to stop the development of malnutrition should be carried out.

The present study provides new evidence about the health status (sarcopenia parameters), lifestyles, quality

of life, and malnutrition risk comparison of older adults from rural and urban areas because most previous literature compared the general population (adult population). Regarding of limitations of the present study. Firstly, one limitation is the age and sex of participants because the participants from urban areas had an average age higher than those from rural areas; for this reason, the analyses have been adjusted for the age of the participants. The dominant sex in both areas was the female, therefore there was no sex equality. In addition, the rural areas of Tarragona province are represented with 23% and urban areas with 62.5%. So, these results could not be generalizable to the general population, of Tarragona province. Secondly, the population from rural was selected from the baseline database of participants recruited for a RCT and the urban population was from the baseline database of participants recruited for a cross-sectional study, stratified by age and sex, introducing a selection bias in the present cross-sectional study. Thirdly, to assess the risk of sarcopenia in individuals according to EWGSOP2 is necessary to assess the appendicular muscle mass.

Finally, participants' socioeconomic information from both areas was not collected, this could act as a confounding variable because evidence shows that people with low socioeconomic status have poorer lifestyles, quality of life, and health status [89–91].

Conclusions

In conclusion, the sarcopenia parameters of urban and rural older adults are similar, except for the highest muscle mass of older adults from rural areas compared to urban ones. In addition, older adults living in rural areas have healthier lifestyles and better quality of life than older adults from urban areas.

These findings highlight the importance of promoting healthy lifestyle actions adapted to rural or urban in older adults facing old age, especially quality of life and health, in older adults from urban areas for a better life.

Abbreviations

AESAN	Agencia Española de Seguridad Alimentaria y Nutrición
BMI	Body Mass Index
EWGSOP2	European Working Group on Sarcopenia in Older People
FFQ	Food Frequency Questionnaire
RCT	Randomized Controlled Trial
ASM	Skeletal muscle mass.
SD	Standard Deviation

Acknowledgements

The authors acknowledge Diputació de Tarragona; City halls of de Vilanova d'Escornalbou, Maspujols, Masroig, Vilalba dels Arcs, Masdenverge, Botarell, Pinell de Brai, La Fatarella, El Montmell, L'Aleixar, Bot, Caseres, Horta de Sant Joan, La Pobla de Massaluça and Porrera; and associations of pensioners of Cambrils, Reus, Tarragona, Tortosa and Valls, for their invaluable support for the study implementation.

Author contributions

C.J., J.Q., A.S., J.T. and E.L. contributed to the conceptualisation, data curation, formal analysis, investigation, methodology, project administration, resources

and writing of the original draft of the manuscript; M.B., L.T., R.M.V., A.P. and R.S. contributed to the conceptualisation, data curation, investigation, methodology, project administration, resources and, review and editing manuscript. E.L., A.P. and R.S. contributed to the supervision; and R.S. contributed to funding acquisition. All authors read and approved the final manuscript.

Funding

The research leading to these results is about “Earlier Elderly People in Rural Areas” project, operation “Formació i Tecnologia” (Ref: PR15-020289-2) and belongs to RIS3CAT and FEDER Catalonia 2014–2020, is co-financed by the Agencia de Gestió de Ayudas Universitarias y de Investigación (AGAUR), Generalitat de Catalunya and Diputació de Tarragona with the project code 2021-SGR-00817. Also, the research work presented in this paper is the outcome of a project funded by both institutions under the collaboration framework agreement between the Diputació de Tarragona and the Universitat Rovira i Virgili for the period 2020–2023 with the project code 2021PGR-DIPTA-URV03: “Earlier Elderly People in Urban Areas”.

Data availability

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

This project was approved by the Ethics Committee of the IISPV (Ref. CEIM: 176/2021). Informed consent was obtained from all participants involved in “Earlier Elderly People in Rural Areas” and “Earlier Elderly People in Urban Areas”. All participants signed the informed consent.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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Received: 17 October 2024 / Accepted: 20 February 2025

Published online: 06 March 2025

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