

Research article

Prevalence of frailty, pre-frailty and geriatric syndromes in people aged 60 or more that use the Cofrentes spa: a pilot study

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Abstract: A longevity and balneotherapy treatment program has been initiated at the Cofrentes Medical Spa, including the development of the Rosita Longevity App. The objective of this study is to determine the health profiles (degree of frailty and pre-frailty) by means of Fried Frailty Phenotype questionnaire and the prevalence of geriatric syndromes in people over 60 doing balneotherapy at the spa, considering that the thermal environment is an ideal place to treat these types of syndromes and to delay their progress. Thermal/spa facilities often receive older patients with osteo-articular and musculoskeletal conditions. To assess the grade of the functionality, quality of life, depression, nutritional risk, cognitive state, insomnia, and the risk of falls, specific questionnaires were used. Out of a total of 43 participants, 30 were women (69.7%), and 22 older than 70 y (51.1%). There were 2 frail (4.6%) and 20 prefrail (46.5%). Conclusions: more than half of the people older than 60 who visit the Cofrentes spa present a functionality deficit condition. Women present a lower quality of life than men. The more affected items in the prefrail population were grip strength and physical activity. Health Resort Medicine is an ideal place to detect these aspects.

Keywords: frailty, elderly, geriatric assessment, health resort medicine, balneology

1. Introduction

Frailty consists of a loss of homeostatic balance leading to a state of vulnerability, predominantly because of ageing [1]. The most used frailty criteria and its three possible categories: frail, pre-frail and robust were proposed by Linda Fried and colleagues [2].

Those considered frail are at a higher risk not only of mortality, but also of serious adverse events such as hospitalization, falls and, of course, an increased risk of developing dependency during daily activities [3-5]. Those in the pre-frail category are also at a higher risk of becoming frail in the next three years and have a great risk of mortality than those

considered robust [2]. Going a step further, longitudinal studies have demonstrated that the frail phenotype is related to sex, age, and socioeconomic characteristics. Thus, it increases at an older age, in women, and in low socio-economical groups [1].

Many research groups and organizations have performed some studies in order to investigate the profile of frailty in European Union populations, in order to develop strategies for healthy and active ageing process. These include: the FRADEA, a cohort study based in the Albacete community from 2007 and an extended follow-up [3,6]; MACVIALR, a program that promotes active and healthy ageing including community studies that characterizes frailty phenotypes in different environments and also test new treatment strategies [7]; and recently the ADVANTAGE joint action [8-9].

According to the WHO (World Health Organization), the number of people aged 60 and above is increasing worldwide and is expected to double its number by 2050 [10]. Frailty, but mainly pre-frailty may be reversible states. Holistic treatments are considered the best way to provide solutions, in order to decrease polypharmacy and adverse events, considering them also as strategies for primary and secondary prevention [11].

Balneotherapy and the spa environment are considered non-invasive, non-pharmacological treatments for chronic diseases [12]. Spa centers receive a high number of older people annually [12]. There are different studies that describe the frailty profiles of spas users in Europe, but in Spain, there is a lack of them [5,11,13].

Cofrentes spa is the umbrella organization for an interconnected and integrated project concerning active and healthy ageing: it promotes prevention and health, care, and cure using balneotherapy, and active and independent living of elderly people [14]. The team has the vision that the prevention and management of diseases are essential to promote active and healthy people [7]. Each year, over 10,000 people attend a 10-day program that combines balneotherapy and sub-activities that includes: a falls prevention initiative, the prevention of frailty, chronic respiratory diseases, chronic diseases with multimorbidities, inactivity, disability and promotes independent living.

A pilot cross-sectional study was designed, as the first stage of a longitudinal one whose main goal is to determine the prevalence of health profiles of subjects older than 60 that are attending balneotherapy in Cofrentes spa according to the Fried classification (pre-frail, frail or healthy). We also examined: the quality of life, the grade of depression, nutritional risk, cognitive state, insomnia, and the risk of falls using specific questionnaires to assess these aspects as secondary objectives. Our ultimate goal is to understand the complex interrelationship between balneotherapy and the thermal environment better. Our perspective is that it is an ideal setting for psychosocial intervention, physical intervention, and intervention through educational applications and, thereby, to establish that a spa is an ideal place to detect pre-fragile patients.

2. Materials and Methods

2.1. Study design and sample

This is an observational non-interventional pilot study with a small sample obtained from a bigger cohort as part of a prospective, longitudinal, and descriptive study.

People aged 60 or more who signed the informed consent were randomly selected from the total number of patients (350) who formed a treatment group at the Cofrentes Thermal Center. Those with a life expectancy lower than three months, those that recently had an stroke or had been doing chemotherapy or radiotherapy (in the last three months) or that had had major surgery in the last three months were excluded. Initially, 75 accepted, just 21 per cent. One of them was not yet 60 years old, twelve did not presented at all the assessments, nine refused to participate, and ten do not complete all the evaluations. Finally, 43 patients were included (Figure 1).

2.2. Population characterization

The patients were evaluated using questionnaires and scales at the thermal center in an ISO 9001 compliant medical consultation [15]. Demographic data (sex, age, origin, educational level, and marital status), comorbidities and any drugs used were also registered.

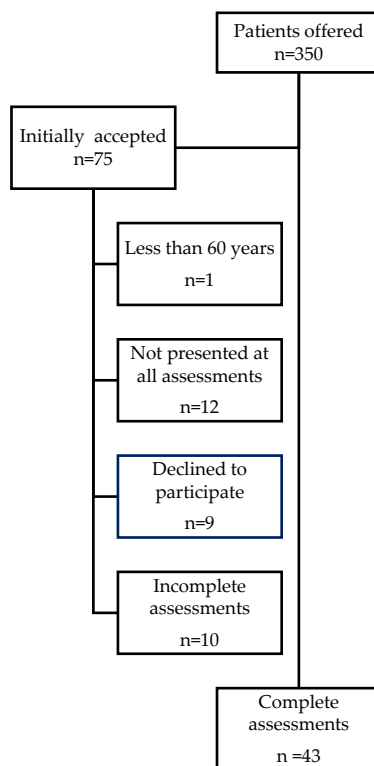


Figure 1. Study design flow chart.

2.3. Frailty profile

Fried [2] criteria were used including: weight loss, weakness, fatigue, slowness and decreased physical activity to classify this population into frail, pre-frail or robust, as follows:

1. Weight loss was considered when there had been a loss of 4.6 kg or greater, or a loss of 5% or more of body weight in the past year.
2. Weakness: grip strength in the lowest 20% at baseline, adjusted for gender and body mass index with JAMAR dynamometer.
3. Slowness: by measuring gait speed in m/s. Based on time to walk 15 feet, adjusting for gender, and standing height.
4. Low physical activity level: The level of physical activity over the past 7 days was assessed by the IPAQ questionnaire.
5. Poor endurance and energy were identified by self-reporting of exhaustion identified by the CES-D scale.

Participants were classified as frail if three or more criteria were present, and pre-frail when two or fewer were found.

2.4. Quality of life assessment

Quality of life was measured by the EuroQol 5-D score (EQ-5D). It is an instrument that measures quality of life with one question for each of the following five dimensions: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression. It also includes a Visual Analog Scale by which the perceived health status can be reported from 0 (the worst possible health status) to 100 (the best possible health status).

2.5. Functionality and daily activities

Functionality when performing daily life activities was evaluated using the Barthel Index [16] and Lawton index [17].

The Barthel index is a score from 0 to 100, where lower scores indicate reduced ability to perform basic activities of daily living, including bathing, grooming, dressing, eating, toileting, urinary and fecal continence, ambulation, transferring, and stair use.

The Lawton index assesses limitations in instrumental daily living activities. This index consists of 8 items: shopping, cooking, cleaning, laundry, use of telephone, medication control, finances, and transport.

2.6. Nutritional status and risk of sarcopenia

The nutritional status and risk were assessed applying Mini Nutritional Assessment (MNA) [18]. It includes 6 items with a maximum score of 14 points, and evaluates decrease in food intake (anorexia), weight loss during the last three months, mobility, acute health status (psychological stress or acute disease), neuropsychological problems (dementia or depression) and anthropometric data (BMI or calf circumference). The recommended cut-off point for nutritional risk is lower than 12 points.

The SARC- F (Strength, Assistance in walking, Rising from a chair, Climbing stairs, and Falls) scale was used to evaluate the risk of sarcopenia [19]. It is a self-administered questionnaire used to determine the level of difficulty experienced in 5 components comprised of: strength, assistance in walking, rising from a chair, climbing stairs, and history of falls; a score of 0–2 points is assigned for each item.

2.7. Depression and cognitive status

The risk of depression was assessed by the Yesavage questionnaire [20]. It includes 15 questions regarding life satisfaction, mood, fall in activities, emptiness, helplessness, hopelessness, energy, and feelings of boredom, being afraid of bad things, and memory problems, with a score between 0 and 15.

Cognitive status was evaluated using the Mini-Mental State Examination test (MMSE). This tool assesses orientation, memory, and attention in the first section with a maximum of 21 points. It also tests the ability to name objects, follow verbal and written commands, write a sentence spontaneously, and copy a complex polygon like a Bender-Gestalt Figure with a maximum score of nine points.

2.8. Statistical analysis

The participants' characteristics were summarized by frequency and percentage for categorical variables and by mean and standard deviation for continuous variables.

Comparisons between gender and age ranges of the categorical variables were made with Chi-square hypothesis tests and Fisher's exact test, considering their applicability for each case. For the comparisons of continuous variables, the Student's t-test was performed for the variables with normal distribution, while for the variables that did not present normal distribution, the Wilcoxon test was used. It is necessary to clarify that the Shapiro-Wilk test was used to determine the normality of the sample.

Statistical analysis was developed in SciPy, a free and open-source library for Python.

3. Results

3.1. Population characterization

As may be observed in Table 1 regarding demographic characteristics, in a total of 43 participants 30 were women (69.7%) and 22 were over 70 years old (51.1%).

In terms of nutritional state, only one out of the 43 participants had a profile of malnutrition, and 12 were at risk of malnutrition (27.9%). Two of the 43 were at risk of sarcopenia (4.65%).

Five patients had moderate depression based on the Yesavage score (11.6%). Just three people had moderate to severe clinical insomnia (7%). In terms of cognitive status,

based on de MMSE, six demonstrated low impairment (14 %) and only two demonstrated mild cognitive impairment (4.6%).

Table 1. The study population's characteristics are described by: age, sex, and living condition. Scores and scales results from: Mini Nutritional Assessment, Quality of life-5 Dimensions, Yesavage geriatric depression scale, Insomnia severity index, Freid Frailty Criteria, Barthel Index, Time up and go test, international activity questionnaire, Mini-Mental State Examination, and Short Mental State Questionnaire.

Variables	Sample (n = 43)
Age, years	70.9 (6.9)
Sex, women	30 (70%)
Living alone	15 (45%)
Mini Nutritional Assessment,	
Normal nutritional status	30 (70%)
Malnutrition risk	12 (28%)
Malnutrition	1 (2%)
Quality of Life-5 Dimensions	82.9% (14,2%)
Yesavage -geriatric depression scale	
Normal	38 (88%)
Moderate depression	5 (12%)
Insomnia Severity Index	
No insomnia	29 (67%)
Subthreshold insomnia	11 (26%)
Moderate severity clinical insomnia	2 (5%)
Severe clinical insomnia	1 (2%)
Freid frailty Criteria	
Robust	21 (49%)
Prefrail	20 (46%)
Fail	2 (5%)
Barthel Index of Activities of Daily Living	
Independent	38 (88%)
Mild dependency	5 (12%)
Timed Up and Go Test	
Low risk of falling	30 (70%)
Frailty, moderate risk	8 (19%)
International physical activity questionnaire	
High level	12 (28%)
Moderate level	19 (44%)
Low level	12 (28%)
Mini Mental State Examination	
Normal	28 (65%)
Slight deterioration	13 (30%)
Moderate deterioration	2 (5%)
Short-portable Mental State Questionnaire	
Normal cognitive assessment	38 (88%)
Slight deterioration	3 (7%)
Moderate deterioration	2 (5%)

The functional profile of the participants was as follows: five people were in the mild dependence range following the Barthel index and only two participants were classified as dependent during daily life activities according to the Lawton index (4.6%).

Finally, 12 patients had a low physical activity performance (28%) and eight participants had a mild to low fall risk profile (19%).

Cardiovascular diseases led the pathologies recorded in the evaluations carried out in the group studied together with osteoarticular diseases (osteoarthritis and osteoporosis). If we follow the criteria of the WHO that considers that more than three drugs should be classified as polypharmacy, more than a quarter of the group would belong to that group (27%). The average drug use was 2.5.

3.2. Frailty among participants

Based on Linda Fried's criteria, two participants were classified as frail (5%), 20 pre-frail (46%), and 21 robust (49%) among the population studied.

Once samples were split by age as in Figure 2, there were a higher number classified as pre-frail in the group aged more than 70.

Low physical activity level and weakness were the two Fried criteria occurring more frequently among the participants Figure 3, and this is shown more prominently in the pre-frail group (60%).

No significant differences were observed between gender in terms of frailty.

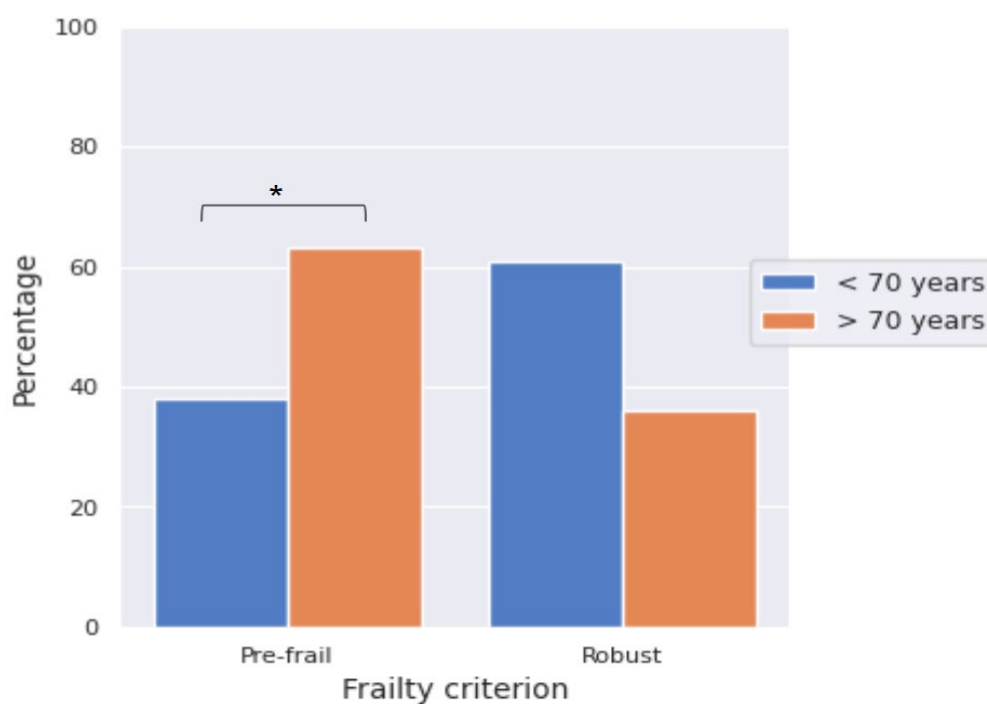


Figure 2. Frailty profiles in the population by age. * Significant difference (p value:0.09)

3.3. Quality of life among participants

The mean value of quality of life in the sample was 82.9. If we compare by sex, there was a significant difference between them showing a worse quality of life in women (EQ-5D: mean: 78.6) than in men (EQ-5D: mean: 92.7) No significant differences were observed when age is considered.

3.4. Other outcomes: Functionality, Nutritional status, risk of sarcopenia, and Depression and cognitive status

There were no significant differences in terms of functionality, depression, nutritional risk, cognitive status, insomnia and risk of falls between sex and age groups.

In terms of nutritional state, only one participant had a profile of malnutrition (2.32%), and 12 were at risk of malnutrition (27,9%). Two were at risk of sarcopenia (4.65%).

Five patients were in moderate depression based on the Yesavage score (11.62%). Just 3 people suffered from moderate to severe clinical insomnia (6.97%). In terms of cognitive status, and based on MMSE, six people showed low impairment (14 %) and only 2 people showed mild impairment (4.6%).

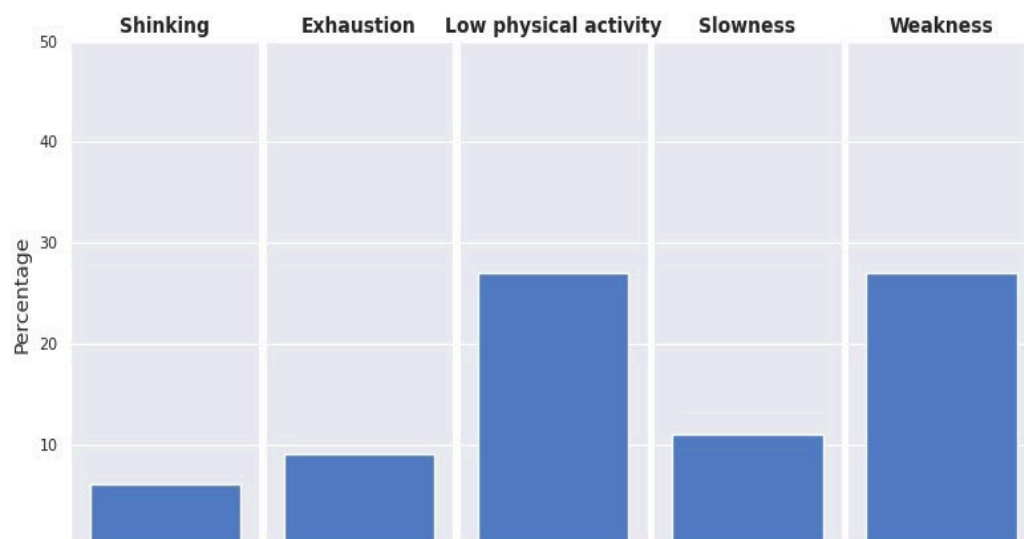


Figure 3. Frailty criteria among participants. Values are shown in percentages.

The functional profile of the participants was as follows: five people were in the range of mild dependence according to the Barthel index and only two participants were classified as dependent in daily life activities using the Lawton index (4.6%).

Finally, 12 patients had a low physical activity performance (28%) and eight participants had a mild to low fall risk profile (19%).

4. Discussion

As this is a pilot study, this analysis has allowed us to observe any possible trends in the data and results when applying the frailty criteria to the population of older adults attending the Cofrentes medical spa. The studies published in Spain so far have been from populations attending specialized primary health care units [21] or populations with 21.3% institutionalized older adults, as shown in the FRADEA study on frailty and dependence in the population of Albacete [3-4,22].

4.1. Population characterization

Regarding demographic characteristics, if we compare this study with other carried out on the general Spanish population, the percentage of women is higher in spa users: (69.7%) in our study, (60.5%) in the FRADEA study [3-4]. With regard to the study carried out on the population of the Frances de Balaruc-les-Bains spa, 67% of women underwent the tests [7]. Two reasons can explain this, there is a greater tendency for women to use thermal centers and experimental studies have indicated that women are more likely than men to be fragile [15,23-24].

The maximum age recorded was 87 years, the minimum 60 and the mean 71; 21 were under 70 years old (48.8) and all of them were, by the inclusion criteria, 60 or older. In the

FRADEA study [3-4] the mean age was 79.4 ± 6.4 years, in contrast with the study carried out in France where the age is close to what was recorded in our pilot study (72.45 years ± 5.10) [7]. The prevalence of frailty and prefrailty in these studies [2,21,25] is higher because of the age of the population studied. This allows us to reflect on how relevant the spa environment is to detect, treat and prevent frailty, since half of the patients are under 70 years old.

We should bear in mind, when interpreting the rest of the results, that to participate in a balneotherapy program in Spain, the subjects must, theoretically, be self-sufficient. Perhaps that is the reason why most of the other scales evaluated (quality of life, depression, nutritional risk, cognitive state, insomnia, and the risk of falls) demonstrate only a small percentage of people with alterations ranging from 14% (low cognitive impairment), 11.62 (moderate depression based on the Yesavage score), 6.97% (moderate to severe clinical insomnia) and, 4.6% (mild impairment in terms of cognitive status).

In this study, twelve patients had a low physical activity performance (28%). The level of physical activity was also considered low for 20% of the subjects in the Balaruc-les-Bains study, with no significant differences regarding gender. The problems of a sedentary lifestyle and its risks are well known, as well as their harmful consequences for health. The spa environment is a place of care but should also be considered as a privileged space for education. This context is ideal to educate a participant about the various non-pharmacological interventions available, specifically, physical activity, to engage him or her in a more active lifestyle. An analysis of the profiles of our thermal spa subjects allowed us to identify the reasoning and behaviors that may support therapeutic education. [7].

Finally, eight participants had the profile of a mild to low risk of falling (19%) in our study. In a specific investigation on the prevalence of falls for patients older than 65 in a thermal environment [5,7] a prevalence of 33% in the 12 months prior to initiation of treatment, 34.8% in women and 29.2% in men was found. These results highlight the importance of implementing a fall prevention program during balneotherapy.

4.2. Frailty among participants

Frailty has been gaining more and more scientific attention in recent decades. As we have mentioned before, frailty is generally considered to be a state characterized by reduced physiological reserve and a loss of resistance to stressors caused by accumulated age-related deficits [26-27]. It has been shown that those who are frail are predisposed to various negative health outcomes, such as: falls, fractures, hospitalisation, placement in nursing home, disability, poor quality of life, and dementia [28-29]. Frailty is a dynamic state and known to change over time, mostly worsening rather than improving [30]. For this reason, we consider our results may be important, because we could work to maintain a robust phenotype and improve the pre-frail phenotype at the thermal center. The spa would also be a good place to study any eventual changes over the years in the health status of its users from late middle age since they usually have a high rate of repeated use of the spa year after year.

In the study in Balaruc-les-Bains, 10.2% of the total population undergoing treatment programs was considered frail and 54% pre-frail according to Fried's criteria, versus 5% and 46% in the Cofrentes one. In the literature reviewed, longer follow-up periods were found to demonstrate that as participants age they generally become more fragile [31].

We found that a low level of physical activity and weakness were the two Fried's frailty criteria most prevalent among the participants and this is most prominently shown in the pre-frail group (60%). In the study in Balaruc-les-Bains, they observed that 24.27% had a significant loss on the manual grip strength test and, 37% revealed a loss of energy and 20% were much slower and had a reduced level of physical activity.

No significant differences were observed in our study regarding sex in terms of frailty. In general, women live longer but have more disabilities than men, known as the male-female health survival paradox. [32]. This fact may be conditioned by our sample size.

Understanding the medical, biological, and environmental factors that contribute to the phenomenon of frailty is the main goal of current research in this field [33]. Older people who are frail or pre-frail could be offered an opportunity to benefit from more complete, multidisciplinary care compared to the usual care. [34-35]. We propose that prospective research is required to determine whether facility-based intervention programs targeting pre-frail individuals can delay or reverse disability and loss of autonomy.

4.3. Quality of life among participants

Many studies have demonstrated an overall increase in the participants' autonomy regarding daily living and quality of life and conclude that the integrated thermal approach holds promise regarding the therapeutic rehabilitation of disabilities [36]. Balneotherapy plus physical therapy was more effective than physical therapy alone in knee osteoarthritis patients aged over 65, but it is also important to highlight, the positive contributions to functionality and quality of life [37].

Other studies have investigated the effect of inpatient versus outpatient spa therapy on the quality of life and anxiety in elderly patients with generalized osteoarthritis [38]. Inpatient spa therapy may be more beneficial than outpatient spa therapy on anxiety and quality of life in geriatric patients with generalized osteoarthritis. Moreover, when the side effects of pharmacological treatments are taken into account, spa therapy may be considered as an interesting and promising option for the elderly.

4.4. Other outcomes: Functionality, Nutritional status and risk of sarcopenia.

The FRADEA study included 993 patients over 70 years of age and assessed frailty, nutritional status, and functionality, among other variables. Functionality and disability were assessed by the Barthel and Lawton indices. The baseline Barthel index showed a mean of 82.1 and the Lawton index a mean of 5.1. It was observed that 27.8% of the participants had some disability in activities of daily living. This contrasts with the data found in our work, only five people were categorised as experiencing mild dependence according to Barthel (12%) and 2 were dependent for activities of daily living according to Lawton (4.6%).

Frail subjects have a higher degree of disability in basic or instrumental activities of daily living when compared to the prefrail or non-frail group. They also have an increased risk of losing independence in at least one daily living activity in the next year of follow-up [2,39].

This study (FRADEA) included institutionalized patients with a higher number of patients with comorbidities and a profile of frailty than the current study. This could be related to a higher level of dependency. They also included older patients (over 70 years old) compared to our study where the age limit began at 60 or above.

Some similar population studies have been conducted in the thermal environment in France published in 2020, 2021 [5,40] and 2022 [13]. The first as part of the MACVIA study analyzed 1471 patients who attended Balaruc-les-Bains and the second considered 197 patients in seven health centers. They assessed the participants' frailty and morbidity profiles, but functionality was not assessed, or it was not analyzed using different scales or parameters. Therefore, it is not possible to compare it with ours. It is recommended that the scales, and questionnaires used in the spa environment should be standardized in the future to make comparisons among them and with general population studies possible. This could contribute to developing strategies to retard the onset of adult dependency or to train patients in daily life activities in the thermal environment for future use.

In terms of nutritional state, only one participant had a profile of malnutrition (2.32%), and 12 were at risk of malnutrition (27.9%). There is a high prevalence of nutritional deficiencies in older adults probably due to inadequate nutrient and energy intake, and several age-related pathophysiological, psychosocial, and pharmacological factors also determine changes in dietary habits, intake, and use of nutrients, which lead to specific deficits. Different studies have described a prevalence of malnutrition or risk of malnutrition in older adults in the community of between 24 and 46%, between 30 and 50%

in hospitalized patients and between 50 and 70% in institutionalized patients. There are some similarities, in the case of the risk of malnutrition, with our study. In addition, some recent studies have introduced the idea that being underweight rather than overweight, or being obese predicts higher mortality rates in older people [41]. Many studies carried out in spas are related to weight loss interventions [42] and are not studying malnutrition. The most important conclusion from these studies is that while spa therapy alone initiated positive changes concerning weight loss, it was the patient's therapeutic educational program that enhanced this effect. It is a challenge to develop educational programs to prevent malnutrition in those who are at risk.

Finally, only five percent of the population analyzed was at risk of sarcopenia. [43]. Importantly, a significant increase in physical activity was observed at the health center and in long-term studies there was a significant improvement after therapeutic education programs.

Limitations and strengths:

This is only a pilot study, with a limited number of patients, because it was designed as a sample to evaluate the spa population and then design a prospective study. There was a high percentage of users who refused to participate, an aspect that should be considered when designing similar studies. It is novel because it complements the study of the functional profile of spa users with scales that measure cognitive status, depression and nutritional states that provided a broader vision of the participants. Unlike the FRADEA study that analyzes most of the institutionalized population, ours concerns an autonomous population that must fend for itself.

5. Conclusions

More than half of the people over 60 who visit the Cofrentes spa have a functionality deficit. Women have a lower quality of life than men. The items most affected in the pre-frálgile population were the categories of grip strength and physical activity. Health Resort Medicine is an ideal place to spot these aspects.

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Conflicts of Interest: Except Clara Fernandez-Porta and Miguel Angel Fernandez-Toran, the authors declare that they have no conflict of interest.

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