NURSING

Quality of Life and non-motor symptoms Improvement in Parkinson's Disease through Nutritional Intervention: a Case Study

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Keywords

Parkinson's disease • Non-motor symptomatology • Nutritional challenge • Sarcopenia • Quality of life

Summary

Non-motor symptomatology in Parkinson's disease (PD) is related to patients' quality of life (QoL). The Non-Motor Symptoms Scale (NNMS) assesses QoL by investigating numerous domains including nutritional status, which is represented by domain 6. Patients with PD commonly suffer from dysphagia, and consequently malnutrition, leading to sarcopenia and increasing motor deficits in relation to loss of muscle mass and energy deficit. The impact of dysphagia on PD patients' health status, makes it necessary to study the effectiveness of specific nutritional programs in addressing feeding needs, with the goal to improve clinical outcomes and the patient's perception of their QoL. The 'Weancare' Program was trialed on an 84-year-old PD patient suffering from dysphagia and the Tower of Pisa Syndrome. The first assessment of the patient showed an early overall deteriorating condition, particularly under a nutritional point of view. The patient was assessed before and after the intervention considering serological tests, and the QoL through the New Non-Motor Symptoms Scale (NNMS). We found a beneficial impact of the 'Weancare' program on the patient significantly improving the non-motor symptomatology and QoL and the investigated outcomes, enhancing a better subjective experience of mealtime lived by the patient.

Introduction

Parkinson's disease (PD) is the most widespread neurodegenerative disease, after Alzheimer's disease, with a global prevalence of six million people. Considering the last generation, the trend of incidence has grown by 2.5 times, making this affection one of the main causes of neurological disability [1]. PD predominantly affects individuals between the age of 50 and 60. Men have a slightly increased risk of developing the disease compared to women with a prevalence ratio of about 3:2. Additional risk factors include familiarity and exposure to pesticides [2].

PD is a degenerative disease of the Central Nervous System (CNS) mainly characterized by muscular rigidity and other motor and non-motor symptoms, such as cognitive, behavioral and dysautonomia symptoms. The onset of the disease is characterized by a prodromal phase that may precede motor symptoms even for several years. Usually, this phase may include constipation, hyposmia, sleep disorders, orthostatic hypotension, mood depression, urination disorders, and erectile dysfunction [3, 4]. On the other hand, motor symptoms, include tremor at rest, bradykinesia, stiffness, and postural instability [5]. In patients with PD, non-motor symptoms are related to the quality of life [4, 6]. This link could be observed through the Non-Motor Symptoms Scale (NNMS), especially in domain 6 on gastrointestinal tract and associated disorders [7].

Malnutrition in patients affected by PD is still a relevant variable that results in sarcopenia and increased motor deficits due to the loss of muscle mass and energy deficit. Indeed, European Society for Clinical Nutrition and Metabolism (ESPEN) guidelines recommend monitoring weight loss and implementing interventions to manage patients' weight or body mass loss [8].

Dysphagia is a common syndrome in patients with PD, even in early stages of the disease. The prevalence of dysphagia varies between 11% and 97% of the patients during the disease [9]. This condition impacts both the safety of feeding and the nutrition and hydration status of the patient, with the risk of affecting the patient's overall survival [10, 11]. Malnutrition can thus be caused by dysphagia as a result of reduced daily food intake, increased requirements related to a health condition or a preexisting state of malabsorption and excessive nutrient loss, or as a combination of these conditions. The consequences of these disorders on patients may vary and include increased infections, increased functional tissue loss (sarcopenia), increased comorbidities and mortality [11, 12]. Sarcopenia prevalence related to PD disease severity is recognized and this fact highlights the importance of screening for sarcopenia [13]. This type of clinical picture of

PD patients can be assessed thanks to specific scales, which enable, for example, to identify the syndromic dimension of the disease and the components that impact the patient's overall quality of life [7, 14] and, even, detect individuals with cognitive deficits [15]. Moreover, the application of a specific nutritional program for patients with swallowing-related problems is recommended in the prevention of malnutrition in patients with PD. Indeed, previous studies have demonstrated a rapid reversibility of malnutrition in hospitalized older patients with cognitive and functional decline enrolled in a specific nutritional program [16, 17]. Moreover Di Nitto et al. (2022) [18] have found that an Effective self-care behaviors, including adherence to medications, health surveillance, and seeking help, have been shown to improve outcomes in patients with chronic conditions, underscoring the importance of comprehensive care plans.

Case description

In April 2021, an 82-year-old-male presented to the Day Hospital service at the La Colletta hospital in Arenzano (Genoa, Italy). The patient had been affected by Parkinson's Disease for 2 years, with consequent dysphagia assessed using Fiberoptic endoscopic evaluation of swallowing (FEES). Additionally, the patient suffered from the Pisa Tower Syndrome [19]. The European Working Group on Sarcopenia in Older People (EGWSOP) Assessment tool confirmed the presence of sarcopenia in the patient, which included physical performance by measuring gait speed, muscle mass by assessing mass indices via vector impedance testing performed with Bioelectrical Impedance Vector Analysis (BIVA), and muscle strength using prehensile hand strength. The Walk Analysis parameters were mostly altered from normal ranges (Tab. I). Cadence (measured in steps per minute) and speed (measured in meters per second) showed higher average values than normal average values. These data show a slowing down of gait speed compared to physiological gait.

Materials and methods

To treat malnutrition and the related symptoms, the patient was offered a diet intervention, called the Weancare Domus food plan based on the Dhysphameal product line that is developed specifically for individuals with dysphagia, offers a nutritionally balanced range of foods designed to support safe and adequate nutrient intake while minimizing the risks associated with swallowing difficulties. These products are tailored to ensure appropriate texture and consistency according to the severity of dysphagia, thereby facilitating ingestion and digestion while preventing aspiration or choking risks.

Tab. I. Walk Analysis data.

Space-time parameters	Patient's values (mean ± standard deviation)	Normal values (mean ± standard deviation)
Test duration (s)	126.0	//
Cadence (steps/min)	131.89 ± 19.34	114.60 ± 8.40
Speed (m/s)	1.39 ± 0.11	1.19 ± 0.16

One of the critical features of Dysphameal products is their enhanced protein-energy density, aimed at mitigating muscle deterioration (sarcopenia) and nutritional deficiencies often observed in patients with dysphagia. The formulations provide a full spectrum of macronutrients and micronutrients necessary for daily intake, supporting overall health without reliance on pharmacological supplements.

In terms of formulation, these foods are crafted to maintain smooth consistency, stability in storage, and natural flavours, thereby catering to the specific dietary and sensory needs of patients. This approach is designed not only to fulfil nutritional requirements but also to improve compliance and quality of life for individuals with compromised swallowing functions. This was prepared with the collaboration of a nutritionist and consisted of lyophilized recipes to be rehydrated autonomously to constitute the serving dish, which, during the experimental period, would be the patient's prevalent nutritional intake. Everything that was needed for the meals was delivered to the patient's home, according to his personal preferences.

To observe the developments and results achieved by the Weancare domus diet program, the patient included in the study was followed-up. This involved the use of non-invasive, inexpensive and user-friendly devices, to measure body parameters, which have been used over the last ten years and have the potential to be used in future clinical health [21].

The study develops in two different phases: at the beginning of the study (Time 0, T0) and after 6 months (Time 1, T1).

At T0 the following anthropometric indexes were assessed: age, height, weight, arm circumference, Body Mass Index (BMI), the blood chemistry data, including cell blood counts, nutritional and inflammatory indexes and the Bioelectrical Impedance Vector Analysis (BIVA). BIVA versatility across various fields highlights its usefulness in assessing body composition and hydration status without relying on body weight, making it a valuable tool for healthcare and nutritional assessment. This analysis method uses a plot of resistance (Rz) and reactance (Xc) standardized by the subject's height to assess body composition and hydration status. It is particularly useful because it does not rely on population-specific formulas and can be applied across different groups, including patients with various health conditions and comorbidities, but also healthy individuals. The BIVA graphical representation, typically an RXc graph, features ellipses that represent different levels of hydration and body composition (Fig. 3). These ellipses serve as reference intervals to evaluate an individual's or group's bioelectrical impedance

against a healthy reference population [20]. The BIA 101 BIVA® PRO device was employed for analysis. The instrument runs at a frequency of 50 hertz and presents a resolution value of 0.1 ohm and an accuracy value of 1% for resistance (Rz) and reactance (Xc); it was used for these assessments, with data plotted to represent hydration levels and body composition. Monthly BIVA assessments provided non-invasive, bioelectrical measurements of body composition, capturing parameters such as Skeletal Muscle Mass (SMM), Skeletal Muscle Mass Index (SMI), Appendicular Skeletal Muscle Mass (ASMM), Total Body Water (TBW), Extra Cellular Water (ECW), and Phase Angle (PhA). All assessments were performed by trained professionals in a controlled setting, adhering to standardized protocols to ensure accuracy and consistency across data collection points.
The patient's non-motor symptoms (NMS) were assessed using the Italian version of the Non-Motor Symptoms Scale for Parkinson's Disease (NNMS). Also this scale was administered at baseline (T0) to evaluate the patient's initial quality of life (QoL) and again six months after starting the intervention (T1).
The NNMS assesses the impact of symptoms across nine domains: cardiovascular, falls, sleep and asthenia, mood and cognition, misperception and hallucinations, attention and memory, gastrointestinal function, urinary function, and sexual activity. Each domain score reflects the frequency and severity of symptoms, with higher scores indicating greater impairment in QoL.
To support adherence to the dietary plan, the patient was also monitored through regular phone consultations, which provided an opportunity to address any challenges related to the 'Weancare Domus' diet and maintain dietary compliance. These phone sessions complemented in-person evaluations, ensuring consistent support.
The patient's nutritional status was assessed using the Mini Nutritional Assessment scale (MNA).

Results

Treatment was started in September 2022 (Covid-19 pandemic invariably postponed the start of the trial).
At the beginning of the study (T0), the patient involved presented the following anthropometric parameters: age 82 years old, height 175 cm, weight 58 kg, right arm circumference 23 cm, BMI 18.94 (on the threshold of underweight), blood chemistry data including blood count, nutritional and inflammatory indices were generally in the normal range.
In T0 the patient had a MNA score of 18 points, confirming a real risk of malnutrition. At the end of the intervention, the patient completed the MNA scale again, and the total score improved from 18 points to 22.5 points (+4.5).
In T0 the NNMS total score was 93 points, so 26.7% of NNMS domains were compromised. In T1 the percentage of compromised domains drops to 10.1% (35 points) (Fig. 1).
After the intervention (T1), the score changes in various domains: in the cardiovascular domain it dropped from 1 to 0, in the second one (sleep/fatigue) from 13 to 4, in the third one (mood/cognition) from 28 to 2, in the fifth one (attention/memory) from 3 to 0, in the sixth one (gastrointestinal) from 6 to 1, in the seventh one (urinary) from 13 to 4, and in the ninth one (miscellaneous) from 5 to 0 (Fig. 2.).
At the beginning (T0) and at the end (T1) of the project, the patient underwent bioimpedance measurements, and the parameters of interest were compared before, during and after the intervention.
The parameters taken into account are shown below: the Skeletal Muscle Mass (SMM), shown in Figure 4, includes the total metabolically active lean body mass; the Skeletal Muscle Mass Index (SMI), is shown in Figure 5; the Appendicular Skeletal Muscle Mass (ASMM), shown in Figure 6, is the metabolically active lean body mass of arms and legs; Total Body Water (TBW) and the Extra Cellular Water (ECW), are shown

Fig. 1. Total score of the patient NNMS scale in relation to the percentage of impairment of quality of life. (a) Total score of the NNMS scale completed during the interview with the patient at the beginning (T0) and at the end of the intervention (T1); (b) percentage of impairment in quality of life compared to the NNMS scale score at the beginning and at the end of the intervention.

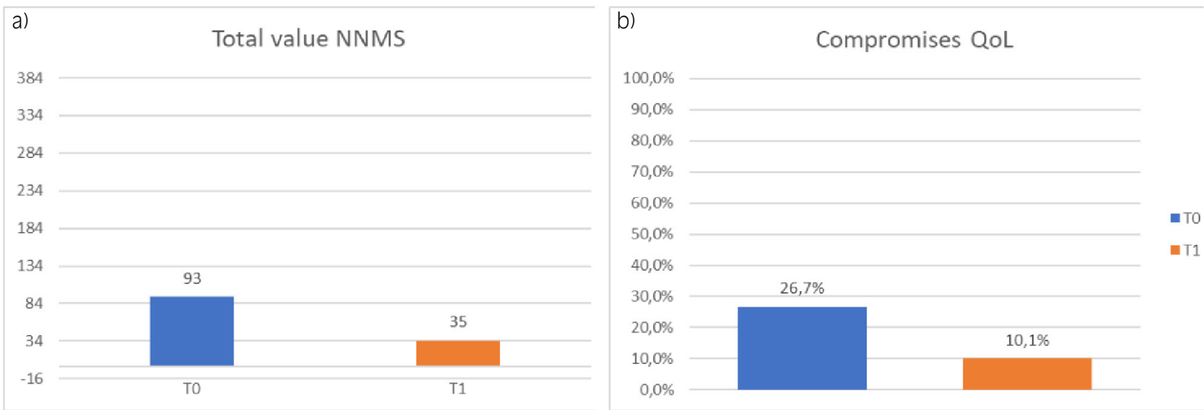


Fig. 2. NNMS Scale domains: pre- and post-intervention scores.

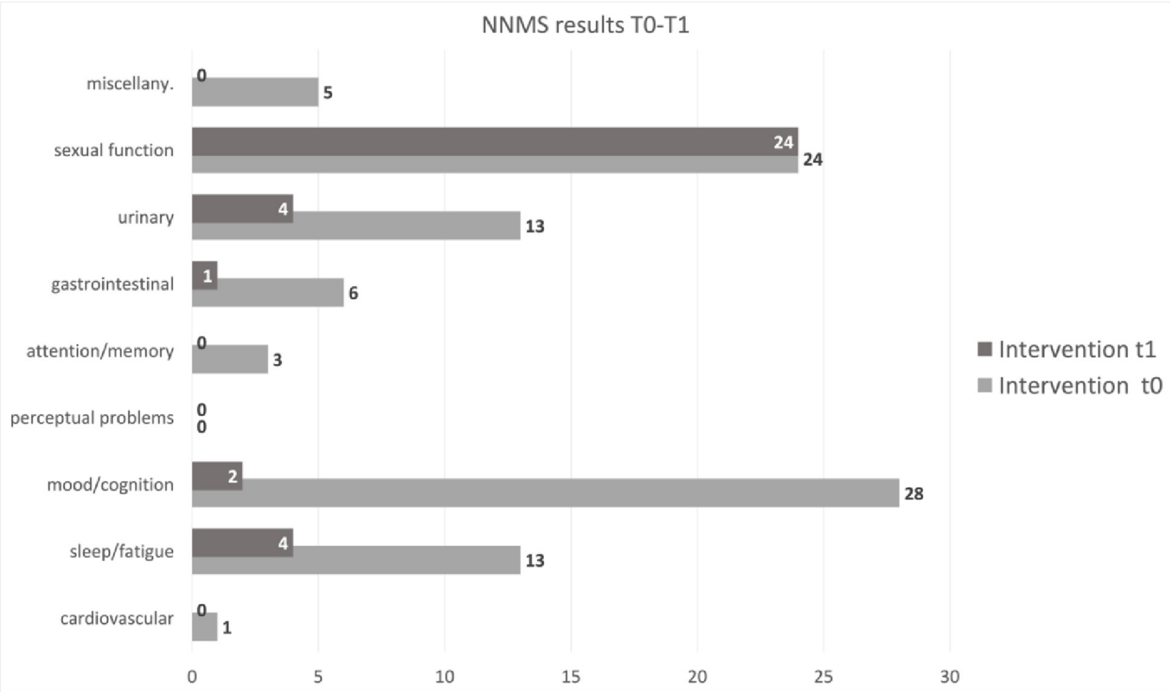


Fig. 3. Graphical representation: vector analysis of bioelectric parameters. The graph shows the measurements taken at T0 (red star, pre-intervention) and T1 (black dot, post-intervention).

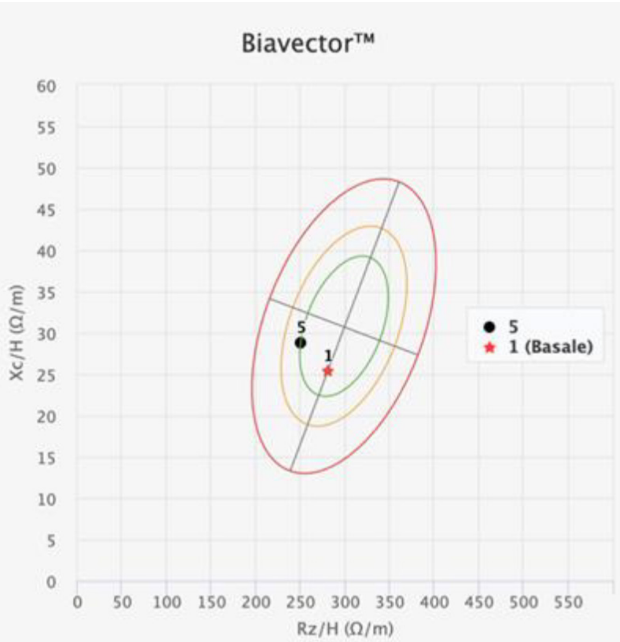
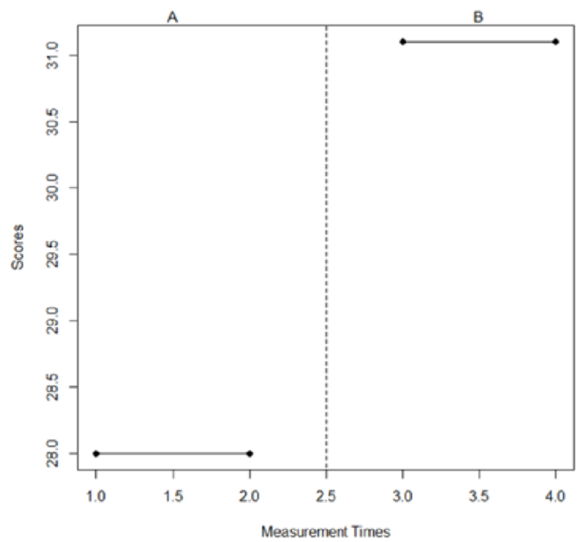


Fig. 4. Skeletal Muscle Mass: pre- and post-intervention scores.



in Figure 7; Phase Angle (PhA), shown in Figure 8, which highlights the relationship between Rz and Xc, so it indicates intra- and extra-cellular proportions. Other parameters included body cell mass (BCM), body cell mass index (BCMI), Free Fat Mass (FFM), and Fat Mass (FM).

Discussion

This study basically reflects the state of the art. The patient examined in the present study was affected by PD and suffered from dysphagia. The initial assessment confirmed an early condition of overall deterioration, impacting also on the nutritional aspects, confirmed by age-related changes in the patient's body composition, showing a higher risk of disease exacerbation and disability.

The overall data analysis enabled to identify the effects

Fig. 5. Skeletal Muscle Mass Index: pre- and post-intervention scores.

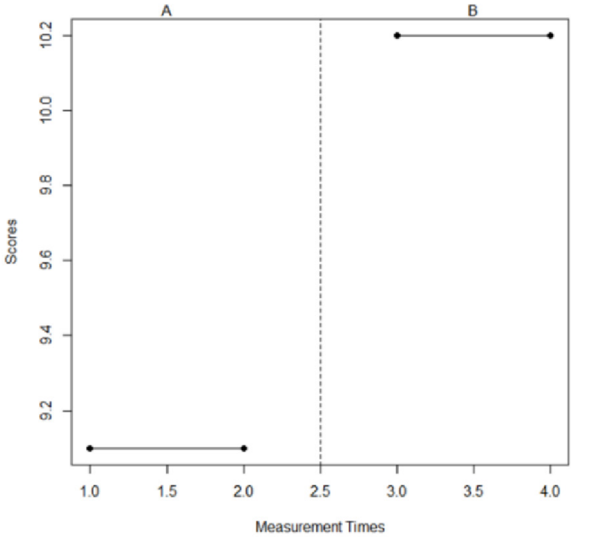


Fig. 6. Appendicular Skeletal Muscle Mass: pre- and post-intervention scores.

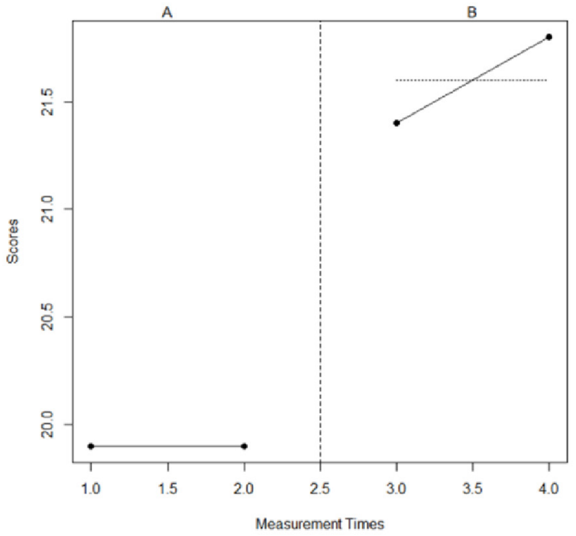


Fig. 7. Pre- and post-intervention scores: (a) Total Body Water; (b) Extra cellular Water.

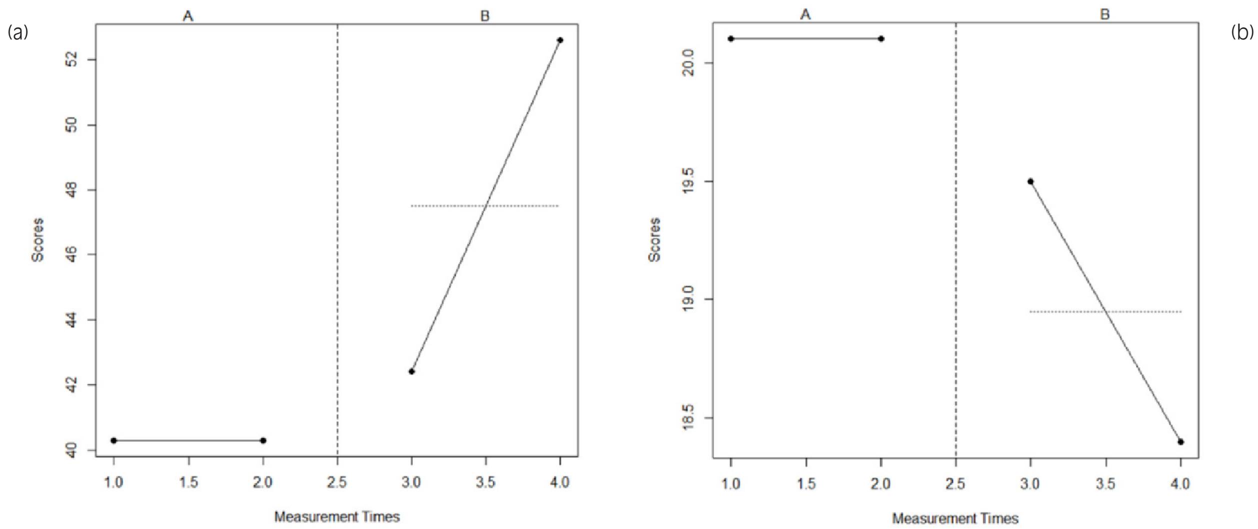
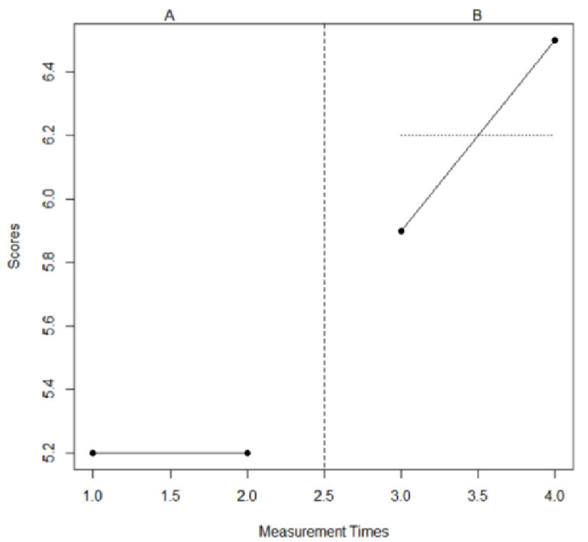


Fig. 8. Phase Angle: pre- and post-intervention scores.



of our intervention on the patient's body mass. In fact, BIVA's analysis showed a change in the comparative parameter, with an evident increase in SMM and consequently SMI. ASMM was also investigated because of its correlation with muscle strength and consequently QoL, and it increased considerably compared to its initial values. Concerning the patient's water component, an increase in TBW and a decrease in ECW was seen. This showed an improvement in the state of hydration with a consequent reduction of oedema.

Among all the parameters assessed, one of the most relevant ones was the PhA variable, which tends to decline with age and is highly predictive of a variety of adverse clinical outcomes and mortality [22, 23]. PhA is calculated through bioimpedance spectroscopy, which is free of calculation errors, and is known to reflect cellular integrity and health to assess the impact of sarcopenia on mortality risk in older people [23]. It is associated with muscle mass and power and has been linked to geriatric syndromes, such as malnutrition, sarcopenia and frailty [23]. Therefore, PhA may be used to predict mortality risk in older people. In other words, a low PhA value may indicate an increased risk of mortality, instead a high value may correspond to a reduced risk [23]. Several previous studies have reported that PhA is associated with clinical and predictive indices such as muscle mass quality, nutritional and functional status [25, 26]. The proposed intervention aimed to improve both the physical indicators, and the subjective experience of mealtime, since it is considered to impact clinical outcomes and consequently patients' and caregivers' QoL.

Considering the patient's QoL, the NNMS was reassessed after the intervention. The overall score dropped to 35 (101,1%), with a significant improvement in all domains, except for the sexual activity and misperception/hallucinations domains, which remained stable, at 24 and 0 respectively. Considering the focus of the intervention, the improvement of the scoring of the gastrointestinal tract domain from 6 to 1, was particularly interesting and noticeable.

Consistently with the NNMS results, the patient reported a substantial improvement of QoL in the conclusive interview. In fact, in this final interview he reported that he could do some light walking for up to two hours a day, as well as resuming home rehabilitation sessions with the physiotherapist for the Pisa Tower syndrome with benefit. In addition to this, during the study the patient completed a food diary, in which he described the meals he ate and the various sensations he considered useful to report. He reported statements such as: "Before I started the feedings my evacuations were solid and took about a quarter of an hour at different times during the day. Now they happen in the morning from 9 to 10 am every day, but the consistency in the first part is formed and quite firm while the remaining part is broken, it lasts 5'-10'. While before it was forced now it is natural".

This can be related to domain 6 of the NNMS scale (gastrointestinal) and also confirms an improvement in the correlated QoL.

At the end of the intervention, the patient completed the MNA scale again with an improvement in the total score from 18 points to 22.5 points. This score does not confirm the move from malnutrition risk to normal nutritional status but does highlight some improvements such as motor skills. In fact, at the beginning of the study the patient assessed himself as autonomous at home while at the end of the study the patient was able to go outdoors for a walk. In addition, problems related to the reduction of food intake due to loss of appetite, digestion problems and chewing/swallowing difficulties ceased. The patient considered his state of health to be the same that of other people of his age, whereas before he could not make a judgement.

With these goals in mind, the patient was offered the 'Weancare Domus' food plan, which consists of modified texture foods processed in a way that makes them both tasty and nourishing. The focus is mainly on the patient's personal experience of the meal, which should be addressed to ensure complete and appropriate meals. The results of the intervention impacted on all the investigated outcomes. Moreover, the patient's personal experience confirmed the findings of the study, including a better QoL due to improved energy and nutritional intake, the information received during the study, and the health education provided to him, all of which enabled him to solve many problems linked to the management of daily activities. The results were satisfying also for the patient's caregiver, who reported an improved quality of family life, mood, and overall autonomy.

Conclusions

The reported case highlights the fundamental role played by nutrition, especially in patients with conditions that may lead to malnutrition and sarcopenia. As in the case of our patient, an appropriate diet, used as a preventive and therapeutic intervention, has the potential to have a positive impact on specific clinical outcomes and perceived QoL for patients and their caregivers.

Limitations

This case study is limited by its single-subject design, focusing on an 84-year-old patient with Parkinson's disease (PD) and specific conditions like dysphagia and Tower of Pisa Syndrome. The generalizability of the results to the broader PD population is constrained. Additionally, the intervention period coincided with the COVID-19 pandemic, potentially influencing both the implementation and the outcomes of the 'Weancare' program. Future studies should include larger, more diverse samples and control groups to validate and extend these findings.

Future Development

Future research should explore the long-term effects of the 'Weancare' program and similar nutritional interventions on a larger cohort of PD patients. Investigating the program's impact on different stages of PD and in patients with varying degrees of dysphagia could provide more comprehensive insights. Additionally, integrating advanced nutritional assessments and personalized dietary plans based on individual metabolic needs could further enhance clinical outcomes and quality of life for PD patients. Exploring the role of interdisciplinary approaches involving nutritionists, neurologists, and speech therapists may also yield significant improvements in managing non-motor symptoms in PD.

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Informed consent statement

Not applicable.

Conflicts of interest statement

"The authors declare no conflicts of interest." "The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results".

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Authors' contributions

Conceptualization, MZ, GC, MS, AG and AB; methodology, MZ, GC and AB; software, MZ, LD; validation, MZ, GC and AB; formal analysis, MZ, GC and AB; investigation, MZ, LD; resources, MZ, GC, MS, AG and AB; data curation, MZ, LD; writing-original draft preparation, MZ, LD, GA; writing-review and editing, MZ, LD, GA; supervision, MZ, LS, AB; All authors have read and agreed to the published version of the manuscript.

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