Factors Affecting Malnutrition in Parkinson's Disease Patients Using Mini Nutritional Assessment at H. Adam Malik Hospital and Network Hospitals

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ARTICLE INFO	ABSTRACT
	Introduction: Parkinson's Disease (PD) is a progressive neurodegenerative disorder characterized by the loss of motor control due to the degeneration of dopamine neurons in the brain and the formation of Lewy bodies. The exact cause of PD is still unknown, but factors such as free radicals, mitochondrial dysfunction, and protein degradation are believed to play a role. To identify the factors that influence malnutrition in patients with Parkinson's disease. **Method**: This study is an observational analytical study with a cross-sectional design, conducted at RSUP H. Adam Malik Medan and its hospital network. The subjects were 45 Parkinson's patients selected consecutively from March to June 2024. The data in this study used primary data using the Mini Nutritional Assessment (MNA) questionnaire obtained from anamnesis, physical examination and nutritional status examination using body weight, height, calf circumference and upper arm circumference. **Results**: Statistical analysis showed no significant results between gender, therapy regimen, and symptoms such as bradykinesia, rigidity, hyposmia, and dysphagia on malnutrition with values of $p = 0.157$, $p = 0.377$, $p = 0.173$, $p = 0.173$, $p = 0.264$, and $p = 0.154$, respectively. However, the results of the statistical analysis showed significant results between age and malnutrition with a p-value of 0.003 and a substantial relationship between disease duration, severity, and symptoms such as postural instability and constipation on malnutrition with the same p-value of $p < 0.001$. **Conclusion**: There was an association between age, disease duration, severity, and symptoms such as postural instability and constipation in Parkinson's disease patients with malnutrition status.
Keywords	

INTRODUCTION

Parkinson's disease (PP) is a progressive neurodegenerative disorder characterized by parkinsonism, which results from the loss of dopamine-producing neurons in the brain, specifically in the substantia nigra pars compacta.[1] Although the exact cause is unknown, various factors such as loss of trophic factor support, free radical release, and mitochondrial disruption have been identified.[2-4] PP is more common in men at a ratio of 3:2 compared to women, and the incidence increases with age.[4-6]

Globally, the prevalence of PP continues to increase. In 2016, 6.1 million cases were reported, with a 21.7% increase in prevalence since 1990.[7] Factors contributing to this increase include better detection, a growing elderly population, and environmental exposures such as pesticides and heavy metals.[8,9]

Indonesia has a high mortality rate from PP, with more than 200,000 cases, and men are more commonly affected.[10]

Nutrition plays a major role in developing PP, where an unbalanced diet can affect mitochondrial function and energy metabolism. Macronutrient intake, such as high protein and low fatty acids, affects energy production and can lead to mitochondrial dysfunction, as well as affect the composition of the gut microbiota that contributes to neuroinflammation.[11] Malnutrition in PP patients varies depending on the duration of the disease.[12] Studies show that approximately 23.9% of Parkinson's patients are at risk of malnutrition, and 11.1% are malnourished.[13] In China, it was found that 69.2% of Parkinson's patients had abnormal nutritional status. Malnourished patients tend to have longer disease duration, more severe motor symptoms, and higher nonmotor symptoms.[14]

Weight loss and malnutrition result from a negative energy balance, meaning energy output exceeds energy input. In the early stages of PP, non-motor symptoms have been associated with weight loss in PP patients due to decreased food intake.[15] Whereas the non-motor symptoms of Parkinson's disease are many such as autonomic disorders, neuropsychiatric disorders, sleep disorders, sensory disorders, and other non-motor symptoms.[1] However, research shows that loss of smell and/or taste, impaired swallowing function, and constipation are the most common non-motor symptoms that can lead to malnutrition.[11] As the disease progresses, motor symptoms such as tremors, rigidity, and dyskinesia appear, which can contribute to increased energy expenditure. Several studies have reported that although PP patients tend to lose weight in the early stages, there will be an increase in caloric intake as well. Increased energy expenditure may play a role in the early stage and increased caloric intake is compensation for weight loss.[15]

METHOD

This study was an observational analytic study with a cross-sectional design. The study was conducted at H. Adam Malik Medan Hospital and Network Hospital. The inclusion criteria for this study were all patients who had been diagnosed with Parkinson's disease and who sought treatment at the Neurology Polyclinic of Hajj Adam Malik Medan Hospital and network hospitals from March to June 2024. Based on these criteria, a total of 45 patients were obtained using a consecutive nonrandom sampling method.

The data in this study used primary data using the Mini Nutritional Assessment (MNA) questionnaire obtained from anamnesis, physical examination, and examination of nutritional status using body weight, height, calf circumference, and upper arm circumference. The characteristics assessed in this study included demographic characteristics (gender, age, and disease duration), disease severity, therapy regimen, and motor symptoms and non-motor symptoms in Parkinson's disease patients. Statistical tests included chi-square, Fisher's test, and Kruskal-Wallis test depending on the variables tested.

RESULTS

Frequency distribution data were obtained in (Table 1). The majority of subjects in this study were male (64.4%). The mean age of the subjects was 65.53 years with the youngest age being 52 years and the oldest being 83 years.

Most patients had experienced Parkinson's disease for ≥ 5 years (64.4%). Based on the severity of Parkinson's disease, there were most degrees 2 and 3 with the same number (33.3%), and most patients received polytherapy (86.7%). Based on symptoms, all patients had tremors (100%), followed by bradykinesia (95.6%) and rigidity (95.6%), constipation (51.1%), postural instability (42.2%), dysphagia (22.2%) and hyposmia (20%).

This study also looked at the results of malnutrition examination based on MNA. Where, in this study malnutrition status is divided into 2 categories, namely normal and malnutrition. Where, the criteria for malnutrition consist of mild, moderate, severe risk, risk of malnutrition, and malnutrition. The following are the results of the analysis which can be seen in Table 2.

Table 1. Characteristics of Malnutrition Status Based on MNA

Demographic Characteristics	n = 45
Gender, n (%)	
Male	29 (64,4)
Female	16 (35,6)
Age, years	
Mean (SD)	65,53 (8,88)
Median (Min – Max)	65 (52 – 83)
Duration of disease, n (%)	
< 5 years	16 (35,6)
≥ 5 years	29 (64,4)
Disease severity, n (%)	
Degree 1	3 (6,7)
Degree 2	15 (33,3)
Degree 3	15 (33,3)
Degree 4	12 (26,7)
Therapy regimen, n (%)	
Monotherapy	6 (13,3)
Politherapy	39 (86,7)
Symptoms, n (%)	
Bradykinesia	43 (95,6)
Rigidity	43 (95,6)
Tremor	45 (100)
Postural instability	19 (42,2)
Hyposmia	9 (20)
Dysphagia	10 (22,2)
Constipation	23 (51,1)

Table 2. Malnutrition Examination Results Based on MNA

Measurement Method	n = 45
MNA, n (%)	
Normal	19 (42,2)
Malnutrition	26 (57,8)

The results of the examination of malnutrition status using MNA showed that more patients experienced malnutrition (57.8%) compared to patients with normal nutritional status (42.4) in Parkinson's disease patients.

This study also aims to determine the relationship between demographic characteristics, disease severity, therapy regimens, and motor and non-motor symptoms of Parkinson's disease with malnutrition status in patients with Parkinson's disease based on MNA. After the analysis, the following results were obtained which can be seen in Table 3.

On bivariate analysis of 29 male patients, there were 19 people (65.5%) with malnutrition. While of the 16 female patients, there were 7 people (43.8%) with malnutrition. The results of the analysis using the Chi-Square test showed that there was no significant relationship (p=0.157) between gender and malnutrition. The mean age of subjects with malnutrition was 68.85 years while in subjects with normal malnutrition status, the mean age was 61 years. Using the Mann-Whitney test showed that there was a significant relationship between age and malnutrition (p=0.003). Of the 29 patients who had Parkinson's ≥ 5 years, there were 24 people (82.8%) with malnutrition. While of the 16 with a disease duration < 5 years there were 2 patients (12.5%) with malnutrition. The results of the analysis using the Chi-Square test showed that there was a significant relationship (p<0.001) between disease duration and malnutrition with a value of

PR = 6.62 (95% CI: 1.79 -24.4) which means that patients with a disease duration of > 5 years have a risk of 6.62 times malnutrition compared to patients with a duration of < 5 years.

Table 3. Relationship between Demographic Characteristics, Disease Severity, Therapy Regimen, Motor and Non-Motor Symptoms of Parkinson's with Malnutrition Status

Variabel	Malnutrition Status		pr (95% CI)	p
	Malnutrition	Normal		
Gender, n (%)				
Male	19 (65,5)	10 (34,5)	1,49 (0,81 - 2,77)	0,157[a]
Female	7 (43,8)	9 (56,2)		
Age, Years				
Mean (SD)	68,85 (8,74)	61 (7,02)	-	0,003[b]
Median (Min – Max)	69 (52 – 82)	59 (52 – 83)		
Duration of disease, n (%)				
≥ 5 years	24 (82,8)	5 (17,2)	6.62 (1.79 -24.4)	<0,001[a]
< 5 years	2 (12,5)	14 (87,5)		
Disease severity, n (%)				
Degree 1	0	3 (100)	-	<0,001[c]
Degree 2	1 (6,7)	14 (93,3)		
Degree 3	13 (86,7)	2 (13,3)		
Degree 4	12 (100)	0		
Therapy regimen, n (%)				
Politherapy	24 (61,5)	15 (38,5)	0,54 (0,17 - 1,72)	0,377[d]
Monotherapy	2 (33,3)	4 (66,7)		
Bradykinesia, n (%)				
Yes	26 (60,5)	17 (39,5)	-	0,173[d]
No	0	2 (100)		
Rigidity, n (%)				
Yes	26 (60,5)	17 (39,5)	-	0,173[d]
No	0	2 (100)		
Postural Instability, n (%)				
Yes	19 (100)	0	3,71 (1,97 - 6,99)	<0,001[d]
No	7 (26,9)	19 (73,1)		
Hyposmia, n (%)				
Yes	7 (77,8)	2 (22,2)	1,47 (0,92 - 2,34)	0,264[d]
No	19 (52,8)	17 (47,2)		
Dysphagia, n (%)				
Yes	8 (80)	2 (20)	1,55 (0,99 - 2,43)	0,154[d]
No	18 (51,4)	17 (48,6)		
Constipation, n (%)				
Yes	21 (91,3)	2 (8,7)	4,01 (1,84 - 8,77)	<0,001[a]
No	5 (22,7)	17 (77,3)		

Note: a, Chi Square; b, Mann Whitney; c, Kruskal Wallis; d, Fischer's Exact

Based on the severity of the disease, in patients with degree 1, all of them did not experience malnutrition. Of the 15 patients with grade 2, there was 1 person (6.7%) with malnutrition. Of the 15 patients with degree 3, there were 13 people (86.7%) with malnutrition. All patients with degree 4, totaling 12 people, all had malnutrition. Using the Kruskal Wallis test showed that there was a significant relationship between the severity of Parkinson's disease and malnutrition (p<0.001). Of the 39 patients who received a polytherapy regimen, there were 24 people (61.5%) with malnutrition. While from 6 patients who received monotherapy, there were 2 people (33.3%) with malnutrition.

The results of the analysis using Fischer's Exact test showed that there was no significant relationship (p=0.377) between therapeutic regimens and malnutrition Of the 43 patients with bradykinesia symptoms, 26 people (60.5%) were malnourished. Whereas from 2 patients who did not have bradykinesia symptoms, all of them had normal nutritional status. The results of the analysis using Fischer's Exact test showed that there was no significant relationship (p=0.377) between bradykinesia symptoms and malnutrition. Of the 43

patients with symptoms of rigidity, there were 26 people (60.5%) with malnutrition. Whereas from 2 patients who did not have symptoms of rigidity, all of them had normal nutritional status. The results of the analysis using Fischer's Exact test showed that there was no significant relationship (p=0.377) between rigidity symptoms and malnutrition. All patients experienced tremor symptoms, and there were 26 people (57.8%) with malnutrition. It was not possible to analyze the relationship between tremor and malnutrition because there were no patients who did not have tremor, causing homogeneous data. Of the 19 patients with postural instability, all were malnourished. While from 26 patients who did not have symptoms of postural instability, there were 7 patients (26.9%) with malnutrition. The results of the analysis using Fischer's Exact test showed that there was a significant relationship (p<0.001) between symptoms of postural instability and malnutrition with a value of PR = 3.71 (95% CI: 1.97 - 6.99) which means that patients with postural instability are at risk of 3.71 times malnutrition compared to patients without postural instability Of the 9 patients with symptoms of hyposmia, there were 7 people (77.8%) with malnutrition.

Meanwhile, of the 36 patients who did not have symptoms of hyposmia, there were 19 patients (52.8%) with malnutrition. The results of the analysis using Fischer's Exact test showed that there was no significant relationship (p=0.264) between hyposmia symptoms and malnutrition. Of the 10 patients with dysphagia symptoms, there were 8 people (80%) with malnutrition. Whereas from 35 patients who did not have dysphagia symptoms, there were 18 patients (51.4%) with malnutrition. The results of the analysis using Fischer's Exact test showed that there was no significant relationship (p=0.154) between dysphagia symptoms and malnutrition. Of the 24 patients with constipation symptoms, there were 21 people (91.3%) with malnutrition. Meanwhile, of the 22 patients who did not have constipation symptoms, there were 5 patients (22.7%) with malnutrition. The results of the analysis using the Chi-Square test showed that there was a significant relationship (p<0.001) between constipation and malnutrition with a value of PR = 4.01 (95% CI: 1.84 - 8.77) which means that patients with constipation have a risk of 4.01 times malnutrition compared to patients without constipation.

DISCUSSION

Parkinson's disease is most common in the elderly and rarely under the age of 30. It usually starts at the age of 40-70 years and peaks in the sixth decade. There is an increase in the incidence of Parkinson's disease with age, both in men and women. This study is in line with studies conducted by Heidiyana et al (2022) and Susanti et al (2023) conducted at the Neurology Polyclinic of H. Adam Malik Medan Hospital which reported that the study subjects had a mean age of 64.82 ± 9.52 years and 67.38 ± 9.52.[17,18]

The aging process induces the pre parkinsonism stage and the cellular mechanism of dopaminergic neuron death becomes accelerated or aggregated in Parkinson's disease along with genetic and environmental factors. The pathophysiology of Parkinson's disease is also related to the oxidative stress process due to mitochondrial dysfunction that causes ROS production and mediates lysosome autophagy. With age, there is accumulation of damage and degradation of mitochondria by the lysosome system which is associated with damage to dopamine neuron cells.[19]

The incidence of PP is higher in men than women with a ratio of 3: 2.6 The dominance of men is in line with previous research conducted by Susanti et al (2023) which reported that the number of patients with Parkinson's disease at H. Adam Malik Medan Hospital was dominated by men by 56.8% compared to women who were only 43.2%.[18] Cohort research by Yang et al (2020) in China also showed a greater incidence in men as much as 58.3% while in women 41.7%.[13] This study is also in line with that conducted by Kacprzyk et al (2022) who reported the majority of people with Parkinson's disease were men at 57.3%.[12] The decreased incidence in women is likely due to the protective effects of estrogen, which increases dopamine levels and has anti-inflammatory properties. Although the exact reason Parkinson's is more common in men is unclear, toxin exposure and work-related head injuries are thought to be risk factors.[20-22]

The degree of disease severity in Parkinson's disease is divided into 5 degrees. In this study, the most degrees 2 and 3 were found, namely 15 subjects (33.3%). This is in line with research conducted previously

by Nasution et al (2023) who reported that most patients with Parkinson's disease at HAM Medan Hospital were stage 2 and stage 3, namely 15 subjects (38.5%). Tambun et al (2021) who conducted research on Parkinson's patients at the Polyclinic of Dr. Mohammad Hoesin Palembang Hospital also reported that the majority of Parkinson's disease patients who control the hospital with degree 3 (35%) and degree 2 (30%). In Hoehn and Yahr's first-degree Parkinson's patients, the average patient has not complained about the symptoms experienced so they have not come to the hospital to seek treatment, while in degrees 2 and 3 the patient has been bothered by the symptoms experienced so they tend to seek medical treatment. At degrees 4 and 5 the patient has experienced severe disability so it is difficult to take treatment to the hospital.[23,24]

Based on the frequency distribution obtained in this study, it was found that based on the therapy regimen, most received polytherapy as much as 86.7%. This study is in line with previous research conducted by Susanti et al (2023) and Heidiyana et al (2022) who reported that patients with Parkinson's disease at HAM Medan Hospital mostly used polytherapy as many as 36 subjects (97.3%) and 35 subjects (74.5%). In the early stages of the disease, symptomatic therapy response is very effective for controlling symptoms, both levodopa and dopamine agonists, in monotherapy or combination. This is referred to as the "honeymoon period which can last for 3-6 years. However, during the advanced stages, this response diminishes and motor complications arise. Long-term use of levodopa, motor complications may occur.[10-18]

In this study, the examination of malnutrition based on MNA found 57.8% with malnutrition and 42.2% with normal malnutrition status. Where in this study subjects with risk of malnutrition, mild, moderate, and severe malnutrition were grouped into malnutrition. This is in line with research conducted at the Medan Human Rights Hospital by Ritonga et al (2023) where it was found that 63.2% experienced the risk of malnutrition and as many as 12.3% experienced malnutrition.[25] In general, some evidence has shown that PP patients have lower body weight compared to age-appropriate healthy controls. PP patients appear to be four times more likely to experience weight loss than the control group. The amount of weight loss in PP patients documented in the literature varies from 52 to 65%, with an average loss of 3-6 kilograms.[24] The occurrence of weight loss in PP has been associated with malnutrition and other clinical problems such as falls, fractures, infections, and worsening quality of life.[26]

In this study, there was a significant association between age and malnutrition status (p=0.0.003). This result is also in line with the research of Shidfar et al (2016), where based on the average value of the MNA score, a significant relationship was found between age and disease duration with nutritional status, respectively (p= 0.02, r = -0.19), (p = 0.01, r = -0.2). A decrease in nutritional status, as categorized by MNA score, was accompanied by an increase in mean age. Patients with normal nutritional status showed a lower mean age compared to those at risk of malnutrition and those who were undernourished (p=0.02, p=0.03).[27]

In this study, there was a significant association between the duration of Parkinson's disease and malnutrition status (p=<0.001). This is in line with cross-sectional research conducted by Jiang et al (2021) where subjects who experienced malnutrition were more in subjects with longer disease duration and a significant relationship was found between disease duration and malnutrition status (p=0.01). Disease duration regardless of age is associated with malnutrition in PP patients. Weight loss and changes in body composition with age are reported as potential mechanisms of old age as a risk factor for malnutrition.[28]

Based on the Kruskal Wallis test, there was a significant relationship between malnutrition status and the severity of Parkinson's disease (p < 0.001). Research conducted by Ritonga et al (2023) found that there was a significant relationship (p<0.001) and a strong correlation (r=0.779) between nutritional status and the severity of Parkinson's disease.[10] In a study conducted by Shidfar et al (2016) who also found similar results there was a significant relationship p<0.001 between nutritional status, namely the risk of malnutrition to the severity experienced in patients with Parkinson's disease. Where the MNA score results were obtained, 30% for the normal group, 58.5% for the malnutrition risk group, and 11.5% for the malnutrition group. The malnutrition risk group and malnutrition were reported to be higher than the previous one and this may be due to the complications experienced. It was found that 40% of patients

reported a severe and moderate decrease in food intake, experienced disability were unable to leave the house, and were unable to feed themselves without assistance. Patients with Parkinson's disease are susceptible to a higher risk of malnutrition due to symptoms associated with the disease and the side effects of drugs prescribed to treat it. Nutritional status may deteriorate, and this deterioration is associated with many adverse effects and unfavorable influences on health and quality of life.[25-27]

Based on Fischer's Exact correlation test in this study, it was found that there was a significant relationship between postural instability symptoms and malnutrition status in patients with Parkinson's disease (p<0.001). However in contrast to other motor symptoms such as bradykinesia, rigidity, and tremor, where no significant relationship was found with malnutrition status. These results are much different from other studies conducted by Jiang et al (2021). Where there is a significant relationship between all motor symptoms and malnutrition status, which means that increasing motor symptoms will increase the risk of malnutrition.[14] The difference in the results of this study with other studies is thought to be due to the uneven distribution of samples which causes homogeneous data so that analysis cannot be carried out. Several other studies have found that lower BMI levels may be associated with worsening motor symptoms, autonomic nerve dysfunction, and poor survival prognosis in Parkinson's disease patients. Whether malnutrition is involved in the above process needs further investigation.[29-31]

Based on the Chi-Square correlation test in this study, there was a significant relationship between constipation and malnutrition status in patients with Parkinson's disease (p<0.00). This is in line with prospective observational research conducted by Paul et al (2019) which found a highly significant relationship between constipation and malnutrition status in patients with Parkinson's disease (p=0.0004).[32] Constipation is the most common gastrointestinal symptom in PP, whose prevalence varies between 24.6 and 63%.[14] The pathophysiological basis of constipation is the slow transit of feces through the colon, which results in symptoms such as bloating, abdominal discomfort, hard stools, and straining. By these results, another study that examined malnutrition in PP patients in the community, showed that constipation is one of the risk factors for malnutrition.[33] During defecation, normally the intestinal wall muscles push the feces to the anus. In Parkinson's patients, rigidity and bradykinesia are also experienced by the gut, resulting in slow-moving feces in the colon.[34]

CONCLUSION

There is no association between gender, treatment regimen, and symptoms such as bradykinesia, rigidity, hyposmia, and dysphagia in Parkinson's disease patients with malnutrition status. The majority of Parkinson's disease patients were male (64.4%) with a mean age of 65.53 years, had suffered from the disease for > 5 years (64.4%), received polytherapy (86.7%), and the degree of disease was grade 2 and 3 respectively (33.3%). Based on motor symptoms, all subjects had tremors.

There was a significant relationship between malnutrition and age (p=0.003), disease duration (p=0.001), disease severity (p<0.001), and symptoms such as postural instability (p<0.001) and constipation (p<0.001) in Parkinson's disease patients.

DECLARATIONS

Ethics approval and consent to participate. Permission for this study was obtained from the Ethics Committee of the University of North Sumatra, Haji Adam Malik General Hospital, and Network Hospital.

CONSENT FOR PUBLICATION

The Authors agree to publication in Journal of Society Medicine.

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The authors declare that there is no conflict of interest in this report.

AUTHORS' CONTRIBUTIONS

All authors significantly contribute to the work reported execution, acquisition of data, analysis, and interpretation, or in all these areas. Contribute to drafting, revising, or critically reviewing the article. Approved the final version to be published, agreed on the journal to be submitted, and agreed to be accountable for all aspects of the work.

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