

## Assessment of nutritional status in patients with Parkinson's disease and its relationship with severity of the disease

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### Abstract

**Background:** Malnutrition, loss of body weight, muscle and fat mass wasting are common in patients with Parkinson's disease, and are associated with disability, longer length of hospital stay, impaired immune system and increased risk of mortality. The aim of this study was to assess the nutritional status in patients with Parkinson's disease and its relation to the severity of the disease.

**Methods:** This cross-sectional study was conducted on 130 patients with Parkinson's disease, with a mean (SD) age of 59.1 (12.9) years in disease stages of 1 to 4. In this study, the Mini Nutritional Assessment (MNA) questionnaire was used along with anthropometric measurements (Body Mass Index (BMI), Mid-arm circumference (MAC), Calf Circumference (CC)) to evaluate the nutritional status, and they were applied by a trained nutritionist. Hoehn and Yahr Scale were used to determine the severity of the disease. One-way ANOVA test was used to assess the relationship between anthropometric indices, nutritional status and severity of disease. Assessment of the relationship between age, duration of disease and nutritional status was categorized according to MNA score, and was performed, using one-way ANOVA. Chi - Square test was utilized to assess the relationship between education level and nutritional status. SPSS Version 18 was used for data analysis.

**Results:** In this study, 30% (n=39) of the participants were diagnosed with normal nutritional status, 58.5% (n=76) were at risk of malnutrition and 11.5% (n=15) were malnourished according to MNA. Reduction of weight, and muscle mass wasting was observed in different disease stages. Muscle mass wasting and worsening nutritional status, based on MNA score, showed a significant increase as the disease progressed, MAC (p=0.009), MNA score (p<0.001). After assessing the relationship between education level, age, duration of disease with nutritional status, the results revealed a significant relationship between age (p=0.008), education level (p<0.001) with nutritional status according to MNA score.

**Conclusion:** Reduction of BMI, depletion of muscle mass, and worsening of nutritional status according to MNA, was observed in many patients along with an increase in the severity of the disease. Assessing nutritional status in those with Parkinson's disease to provide information to identify necessary nutritional intervention is highly recommended.

**Keywords:** Nutritional Status, Parkinson's Disease, Anthropometric Indices, Mini Nutritional Assessment.

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### Introduction

Parkinson's disease is a progressive, disabling and degenerative disorder of the nervous system. The most symptoms are tremor at rest, rigidity, slowness of move-

ment, difficulty while walking and postural instability. Parkinson's disease is one of the most common neurologic diseases, affecting 1% of the population older than 65 years of age (1). Nearly 66% of the pa-

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tients are disabled within five years, and 80% are disabled after 10 years. Parkinson's disease is rarer in women compared to men (2).

The motor symptoms of Parkinson's disease result from the death of dopamine generating cells and the cause of this cell death is unknown, but genetics and environmental factors are being investigated in this field (1). Nutrient related factors, such as folate deficiency and high plasma homocysteine levels, fiber and caloric deficits, oxidative stress (1), anemia (3), and iron overload may contribute to the pathogenesis of Parkinson's disease (1).

Individuals with Parkinson's disease have been found to have a higher incidence of malnutrition and weight loss because the medications used to treat Parkinson's disease have such side effects as xerostomia, loss of appetite, constipation and progression of disease (4, 5). While the severity of disease progresses, rigidity of the extremities may influence the patient's ability to perform self-eating. Rigidity interferes with the ability to control the position of the head and trunk, and eating is slowed; meal times can take up to an hour and difficulty occurs in handling cooking and eating utensils (4,5). Weight loss is a prevalent characteristic of Parkinson's disease (6).

Dysphagia is another complication in Parkinson's disease that results in serious health problems like malnutrition (7). In addition, impairment of movement in these patients were also associated with more energy expenditure and weight loss (8,9). Malnutrition is related to an increase in mortality, prolonged length of hospital stay and hospital readmission, functional impairment, weakening of immune system (10), worsening quality of life and, loss of independency (11). In spite of prevalence and importance of malnutrition and weight loss, there is scarce data related to these patients (8).

Malnutrition is a condition accompanied with more susceptibility to unfavorable outcomes, and early detection of the malnutrition risks in patients and timely interven-

tion may decrease these consequences and improve health status (12,13).

Mini Nutritional Assessment (MNA) is a nutrition-screening tool, which determines patient's nutritional status. A low MNA score is associated with an increase in mortality and prolonged length of hospital stay. The MNA detects the risk of malnutrition before severe changes occur in weight or serum proteins (10). A study on patients with Parkinson's disease revealed a relationship between MNA score and duration of the disease; as the MNA score diminished, the percentage of patients at risk of malnutrition increased with duration of disease (14). The aim of this study was to identify nutritional status in patients with Parkinson's disease, using Mini Nutritional Assessment (MNA) and to assess its relationship with the severity of disease.

### Methods

This cross-sectional study was performed in Hazrat Rasoul Medical Complex in Tehran, Iran, on 130 patients with Parkinson's disease. All participants were diagnosed with Parkinson's disease by a neurology specialist. Exclusion criterion was the presence of other neurological disturbances other than Parkinson's disease. Hoehn and Yahr scale was used to assess the severity of Parkinson's disease for all patients. Hoehn and Yahr scale included Stages 1 through 5 (15,16).

The Mini Nutritional Assessment (MNA) questionnaire was used along with anthropometric measurements (Body Mass Index (BMI), Mid-arm circumference (MAC), Calf Circumference (CC)) to evaluate the nutritional status, and a trained nutritionist applied them.

All participants were informed and signed a written consent prior to taking part in the study.

### *Anthropometric Indices*

Body weight was assessed with a beam scale to the nearest 0.1 kg, with the participants standing barefoot and in light clothing. Height was measured by a clinical sta-

diometer in bare or stocking feet. BMI, defined as weight (kg) divided by the square of height (meters), was calculated. Mid arm circumference (MAC) was measured midway between olecranon and acromion (17), calf circumference (CC) was measured on the left leg in a sitting position, with the knee and ankle at a right angle and feet resting on the floor. The CC was measured at the point of greatest circumference (18). We used non-elastic tape to measure MAC and CC.

#### *Mini Nutritional Assessment (MNA)*

MNA is a tool for predicting nutritional status. The Persian version of MNA is a valid questionnaire (19). MNA includes 18 items grouped in 4 parts, comprising anthropometric measurements (BMI, mid-arm and calf circumference, and weight loss), dietary intake (number of meals consumed, food and fluid intake, and independency of feeding), global assessment (lifestyle, medication, mobility, presence of acute stress, and presence of dementia or depression) and self-assessment (self-perception of health and nutrition). Each item consists of four sections and each answer has a special point. At the end, the calculated score determines which patients require nutritional intervention. A score of 24-30 indicates the person is well nourished and needs no further intervention, while a score of 17-23.5 indicates the person is at risk of malnutrition, and a score of less than 17 indicates the person is malnourished (20). MNA has been well validated in international studies in a variety of settings and as an appropriate, valid and reliable nutrition screening tool in elderly people and patients, and it has been used extensively (12,21).

Means of anthropometric indices (BMI, MAC, CC) and nutritional status, according to MNA scores, were compared between stages of Parkinson's disease, using one-way ANOVA test, and if the difference was significant, Scheffe test was for slighter assessment. To assess the relationship between nutritional status, categorized ac-

ording to MNA score, with the mean age and duration of disease, One-Way ANOVA test was also used. We used independent samples t-test to compare the means of nutritional status between the two groups, one group using dietary supplements and another group not taking any dietary supplements. Chi-square test was used to assess the correlation between nutritional status with education levels. Statistical analysis was performed, using SPSS Version 18 (SPSS Inc., Chicago, IL, USA). A p-value less than 0.05 was considered statistically significant.

#### **Results**

The cross-sectional study was performed on 130 patients with Parkinson's disease, including 91 men (70%) and 39 women (30%), with a mean (SD) age of 59.4 (12.1) years in disease stages 1 to 4. These patients were classified in stages 1 to 4, 6.9% (n=9), 46.2% (n=60), 40% (n=52) and 6.9% (n = 9), respectively. Our results revealed that 59.2% (n=77) of the patients were less than 65 years of age and 40.8% (n=53) were equal or more than 65 years old. In this study, 30% (n=39) of the participants were diagnosed with normal nutritional status, 58.5% (n=76) at risk of malnutrition and 11.5% (n=15) malnourished according to MNA. The mean±SD MNA score was 21.5±4.3 and was well correlated to BMI ( $r=0.439$ ,  $p<0.001$ ), CC ( $r=0.450$ ,  $p<0.001$ ) and MAC ( $r=0.470$ ,  $p<0.001$ ).

Mean values of Anthropometric indices (BMI, CC, MAC) and MNA scores categorized by Parkinson's stages are demonstrated in Table 1.

Mean values of MAC and MNA scores decreased significantly as the severity of the disease increased. Patients in stage 4 showed a lower mean value of MAC compared to those in stage 1 ( $p=0.01$ ). Patients in stages 4 and 3 showed significantly lower mean value of MNA score than patients in stage 1 ( $p=0.04$ ,  $p<0.001$ ).

According to the mean value of MNA score, we found a significant relation between age and duration of disease with nutri-

Table 1. Descriptive Statistics of Anthropometric Indices and MNA Scores Categorized by Parkinson's Stages

Variables	Stages of Disease (Mean±SD)				p
	1	2	3	4	
MNA (scores)	24.5 ± 3.5	22.8 ± 3.8	22.4 ± 3.7	15.3 ± 4.3	<0.001
BMI (kg/m <sup>2</sup> )	27.7 ± 3.8	25.2 ± 3.1	24.5 ± 3.4	24.9 ± 3.3	NS
MAC (cm <sup>2</sup> )	30.7 ± 5.6	27.3 ± 3.4	27 ± 3.8	24.6 ± 3.3	0.009
CC (cm <sup>2</sup> )	36.3 ± 3.9	31.8 ± 3.6	32 ± 3.6	30.8 ± 3.3	NS

NS Means not Significant. MNA (Mini Nutritional Assessment) BMI (Body Mass Index), MAC (Mid Arm Circumference), CC (Calf Circumference)

Table 2. Mean Values of Duration of Disease and Patients' Age based on Nutritional Status Categorized by MNA Score

Variable	Nutritional Status Categorized by MNA Score (Mean±SD)			p
	Normal	at Risk of Malnutrition	Malnourished	
Age (year)	54.6 ± 10.9	60.9 ± 12.1	64.1 ± 11.6	0.008
Duration of disease (year)	6.1 ± 5.9	6.6 ± 4.5	8.4 ± 5.1	NS

MNA (Mini Nutritional Assessment) , P value<0.05 is significant

Table 3. The Correlation between Patients' Education Levels with Nutritional Status Categorized According to MNA Score

Education Levels	Nutritional Status Categorized According to MNA Score N (%)			p
	Normal	At Risk and Malnourished	Total	
Less than diploma	13 (10)	53 (40.8)	66 (50.8)	<0.001
Diploma	7 (5.4)	24 (18.5)	31 (23.8)	
College graduate	19 (14.6)	14 (10.8)	33 (25.4)	
Total	39 (30)	91 (70)	130 (100)	

MNA (Mini Nutritional Assessment), p-value<0.05 is significant

tional status, respectively ( $p=0.02$ ,  $r=-0.19$ ), ( $p=0.01$ ,  $r=-0.2$ ).

Deterioration of the nutritional status, as categorized according to MNA score, was accompanied by the increase of mean value of age (Table 2). Patients in normal nutritional status showed lower mean value of age compared to those in at risk of malnutrition and malnourished people ( $p=0.02$ ,  $p=0.03$ ).

In this study, participants consumed different supplements such as Vitamin D, Ca, Fe, Vitamin E, omega 3 fatty acids, folic acid, B complex, multi vitamin and mineral; and due to the variety of supplements consumed by patients, we categorized the patients into supplement consumer (29.2%) and no consumer (70.7%).

No significant differences were observed in nutritional status between the two groups according to the MNA score.

The results of the study revealed a significant relationship between nutritional status categorized according to MNA score and education levels ( $p<0.001$ ) (Table 3).

## Discussion

Results of this study revealed that 70% of the participants were classified as malnour-

ished and at the risk of malnutrition. The mean value of nutritional status, according to MNA score, decreased as the disease became more severe.

Patients with Parkinson's disease are prone to a higher risk of malnutrition because of the symptoms related to the disease and the side effects of the drugs prescribed to treat it. Nutritional status may deteriorate, and this deterioration is connected to many adverse outcomes and unfavorable influences on the health and quality of life. Studies reporting the prevalence of malnutrition in the patients are scarce. In addition, due to the variety of the methods used to assess nutritional status and the various definitions of malnutrition, there was a large degree of discrepancy among the studies reporting the true extent of malnutrition from 0% to 24% in patients with Parkinson's disease, and 3-60% of the patients were reported to be at risk of malnutrition (22).

Weight loss is a common problem observed in patients with Parkinson's disease, and its prevalence increases as the disease progresses. Reduced appetite, a decline in hand-mouth coordination, difficulty in chewing and dysphagia, nausea, and in-

creased muscular rigidity, which lead to higher energy requirements and involuntary movements, are possible reasons for weight loss (22).

Barichella and coworkers found 22.9% of the patients with Parkinson's disease to be at risk of malnutrition; however, based on their MNA score, none of them was malnourished (14). Using MNA questionnaire, Wang et al. found that 78%, 19.7% and 1.7% of the participants were in normal, at risk of malnutrition, and malnutrition groups, respectively (21).

Considering BMI of less than 18.5 as an indicator for malnutrition in Parkinson's disease, another study found that 3% were underweight (23).

In this study, according to the MNA score, 30%, 58.5% and 11.5% of the patients were in normal, at risk of malnutrition and malnutrition groups, respectively. The rate of "at risk of malnutrition" and "malnutrition" in this study was higher than that reported previously, and this may be due to the complications: In this study, 40% of the patients reported severe and moderate decrease in food intake, 30.8% were disabled and could not leave home. Inability to eat without assistance and difficulty self-eating were observed in 7.7% and 30.8% of the patients, respectively. The results of self-assessment of nutritional status revealed that 8.5% of the patients viewed themselves as being malnourished, and 50.8% were uncertain of nutritional state; neuropsychological problems were reported by 9.2% of the patients.

Our results revealed a significant negative relationship between duration of disease (years) and worsening of nutritional status according to MNA score.

Jaafar et al. reported that the risk of malnutrition in Parkinson's disease increased with disease duration (24), and a three-year longitudinal study revealed a negative correlation between MNA score and duration of disease; they showed that MNA score diminished and the percentage of patients at risk of malnutrition increased from 22.9% to 34.3% during the study (14).

Lorefät et al. investigated food habits and nutrient intake in elderly patients with Parkinson's disease. The patients reduced the intakes of daily high quality snacks and nutritious meals and required more help with buying and cooking food with progression of the disease (25). We also observed the same results.

In this study, we found that the means of MAC significantly diminished with the progression of disease. In addition, we observed a non-significant reduction of BMI and calf circumference with worsening of the disease.

Warren et al. reported the same results about losing weight in more severe stages of the disease, and found no weight loss in stages 1 and 2. An increase in the severity of the disease appeared to correlate with the percentage of weight loss. In the study, women lost 2.92 kg on average, while men lost 1.43 kg (26).

In this study, a negative relationship was found between nutritional status and age; i.e., malnutrition and older age were related. Even when older adults are living individually,

shifts in appetite, restricted ability to move, social isolation and economic restrictions, often associated with chronic diseases and consumptions of multiple medications, can all negatively influence nutritional status. Therefore, identifying nutritional problems in older adults is very important in improving nutritional status and quality of life (11).

In a study, assessing nutritional status, according to MNA, in 10000 older persons showed that 1 to 5% of elderly outpatients, 20% of hospitalized older patients, and 37% of elderly individuals living in nursing homes were malnourished (12).

In addition, we observed a significant relationship between nutritional status and education levels.

The results of a study performed on individuals older than 65 years of age showed that the education level of the persons caring for these old people was a determining factor for the nutritional status of the elder-

ly (27).

Klepac et al. found that the more years of education a patient with Parkinson's disease had, the less the risks of dementia, depression and sleep disturbances and the better the cognitive abilities (28). Another study revealed that lower education levels were associated with a more disease severity and a higher risk of disability in patients with the Parkinson's disease (29).

### Conclusion

In this study, we assessed nutritional status and its relationship with the severity of disease in patients with Parkinson's. Weight loss, muscle and fat mass depletion are common nutritional problems in these patients. A decline in nutritional status is also associated with many adverse outcomes, such as an increase in the length of hospital stay, and symptoms' exacerbation, increasing disability, weakening immune system, and increasing mortality rate.

Using MNA questionnaire, we found that weight loss, muscle wasting and deterioration of nutritional status in participants increased with the severity of the disease. Our results pointed to the need to assess nutritional status in patients with Parkinson's disease, so that nutritional problems are detected and treated more swiftly, and the patients' health and quality of life are improved.

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