

## ORIGINAL COMMUNICATION

# Is underweightness still a major problem in Parkinson's disease patients?

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**Objective:** To evaluate the current rate of underweightness amongst Parkinson's disease (PD) patients at an Italian referral centre.  
**Design:** Epidemiological study on consecutive patients presenting for the first time in a 16-month period.

**Setting:** Nutritional service of PD referral centre in Milan, Italy.

**Subjects:** Three-hundred and sixty-four PD patients diagnosed according to CAPIT criteria.

**Methods:** Anthropometric assessments: BMI and waist-to-hip ratio; evaluation of therapeutic physical activity (h/week).

**Results:** Three-hundred and sixty-four patients were included (180 female, 184 male), mean (s.d.) age 65.9 (8.9) y, mean (s.d.) duration of PD 10.6 (5.3) y; 134 patients (37%) were overweight and 92 (25%) were obese; 11 (3%) were underweight; 127 (35%) had normal BMI. No important differences in BMI according to sex and smoking status were observed. There was highly significant inverse correlation between duration of disease and BMI ( $P < 0.001$ ): mean (s.d.) duration of disease was 9.7 (4.7) y in overweight + obese patients, 11.1 (5.5) y in patients with normal BMI and 14.1 (7.2) y in underweight patients ( $P = 0.0059$ ). The waist-to-hip ratio was a cardiovascular risk factor in 47.7% of men and 73.8% of women. Mean (s.d.) therapeutic physical activity was 1.07 (1.59) h/week in overweight and obese patients vs 1.61 (2.04) h/week in patients with normal BMI (50.5% increase;  $P = 0.03$ ).

**Conclusions:** At present underweightness is uncommon in PD patients in Italy; this may be due to the increase in the prevalence of overweightness in the Italian population and to modern antiparkinsonian therapy.

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**Keywords:** Parkinson's disease; nutritional status; BMI; anthropometry

### Introduction

Parkinson's Disease (PD) is a common neurodegenerative disorder with a prevalence of 3–4:1000 in the general world-wide population (Zhang & Roman, 1993). It generally develops in the second half of life and is characterized by bradykinesia, rigidity, resting tremor and postural instability (Quinn, 1995). The disease results from degeneration of dopaminergic neurons in the substantia nigra located in the

midbrain; the degenerative process is progressive and inevitably leads to major disability and morbidity associated with high healthcare expenditure (Schapira, 1999). The currently accepted etiological hypothesis is that neuronal degeneration is produced by a number of environmental factors in genetically susceptible subjects (Sherer *et al*, 2001). Current therapy is symptomatic and consists in the administration of dopaminergic drugs, mainly levodopa and dopamine agonists, and surgery, such as the implantation of electrodes for deep brain stimulation in advanced cases that no longer respond to pharmacological therapy (Ahlskog, 2001).

A number of features of PD make normal dietary intake difficult, thus increasing the risk of undernutrition. The progressive impairment of motor function results in dysphagia, which in turn causes sialorrhea, and is thus associated with difficulty in the intake of both solid and liquid food in 50–75% of patients (Jost, 1997); indeed, it has been shown that dysphagia is related to weight loss and to abnormally low body mass index (BMI) (Nozaki *et al*, 1999). The involvement of the autonomic system innervating the gastrointestinal

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Contributors: BM and MA designed the study. PG critically reviewed the protocol and manuscript. BM and MA were the experts in clinical nutrition responsible for anthropometric assessments, recruitment of patients, data management and statistical analysis. VA was the dietician responsible for the collection of dietary data. CM was the neurologist responsible for the diagnosis of PD and neurological information.

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tract, associated with the appearance of the characteristic Lewy bodies, reduces gastric emptying and slows intestinal peristalsis leading to constipation, which in turn can result in early satiety and nausea; this complication may be exacerbated by diaphragm and abdominal muscle hypotonia and by the reduction in physical activity due to the impairment of motor function (Jost, 1997). Up to 30% of patients develop dementia (Mayeux *et al*, 1992), especially in the advanced phases of the disease and lose their normal dietary habits. Depression, which develops either as a reaction to the diagnosis of a chronic and progressive disease, or as a result of neurotransmitter deficiency in 25–30% of patients (Richard *et al*, 1997), is often associated with reduced food intake. Furthermore, it has been suggested that the disease promotes underweightness by increasing basal metabolism, but the results of metabolic studies have not been univocal: basal metabolism measured by indirect calorimetry was increased in three studies (Levi *et al*, 1990; Broussolle *et al*, 1991; Markus *et al*, 1992), but not in a fourth (Toth *et al*, 1997), which actually found a reduction in daily energy consumption in PD patients as compared to healthy controls using the technique based on double labeled water ( $^2\text{H}_2$ ,  $^{18}\text{O}$ ). What is more, the majority of PD patients are elderly and physiological aging is associated with functional losses that promote undernutrition, such as the reduction in digestive secretions, in intestinal absorption and in protein synthesis and with other factors that reduce dietary intake, such as impairment of the senses of smell and taste, and of mastication due to loss of teeth and poorly functioning dental prostheses (Jensen *et al*, 2001). The purpose of this study was to assess the rate of underweightness in a group of PD patients consulting the Nutritional Service of the Parkinson Institute in Milan, Italy.

## Methods

A total of 364 patients with a clinical diagnosis of PD according to CAPIT criteria (Langston *et al*, 1992), who consulted the neurologist CM at the Parkinson Institute of Milan and were referred to the Nutrition Service for the first time consecutively from January 1999 to April 2001, were included in the study.

They were examined by one of two physicians expert in nutrition, who collected information on the features of PD and medical history, with particular reference to concomitant diseases requiring dietary therapy (hypertension, glucose intolerance, dyslipidemia), smoking status and level of physical activity performed exclusively for therapeutic purposes (physiotherapy and/or gymnastics recommended by the physician), expressed as hours of physical activity per week. Thereafter the physician performed an anthropometric assessment including the following parameters: body weight and height plus calculation of BMI and its classification in normal ( $18.5\text{--}24.9\text{ kg/m}^2$ ), overweight ( $25.0\text{--}29.9\text{ kg/m}^2$ ), obese ( $\geq 30.0\text{ kg/m}^2$ ) and underweight ( $< 18.5\text{ kg/m}^2$ ); WHO, 1995; circumference of waist and

hips plus calculation of the waist-to-hip ratio to verify the presence or absence of a cardiovascular risk factor ( $> 1$  in men,  $> 0.85$  in women) (WHO, 1998).

A Wunder steelyard weighting machine was used in standardized conditions (fasting, without shoes and minimal clothing). Height was measured by a stadiometer in the standing position, barefoot, back perfectly aligned to the instrument and with head positioned so that gaze was horizontal. The waist circumference was measured using a flexible non-stretchable tape measure half way between the lower edge of the last rib and the upper edge of the iliac crest. The hip circumference was measured using the same tape measure at the height of the two trochanters.

Subjects were also interviewed by an experienced dietitian, who collected a comprehensive diet history.

The STATVIEW software version 5.01 (SAS Institute Inc.) installed on a Macintosh G4 computer was used for data processing and the statistical analysis. Anthropometric data were analysed descriptively, providing arithmetical means  $\pm$  standard deviation (s.d.) and a continuous frequency distribution. BMI and duration of disease were correlated by simple regression. The differences in BMI between sexes were assessed by factorial analysis of variance, and so were the differences in physical activity among the various BMI groups.

## Results

The patient population included 180 females and 184 males. Their mean (s.d.) age was 65.9 (8.9) y (range 35–93 y). In all, 63.3% of patients had never smoked, 27.2% were ex-smokers and 9.5% were smokers.

The mean (s.d.) duration of PD was 10.6 (5.3) y (range 2–31 y). The most frequent concomitant diseases were dyslipidemia in 52.2% of patients, arterial hypertension in 28.3% and glucose intolerance in 17.5%. More than half reported

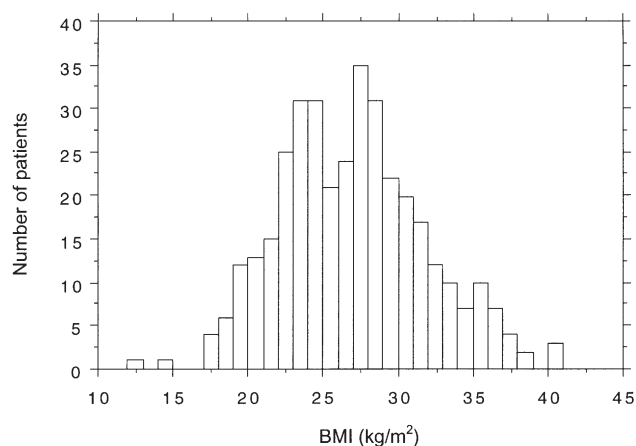


Figure 1 BMI distribution in PD population.

**Table 1** BMI categories in the PD study population according to sex

Category	General	Males	Females
Underweight	3%	2.7%	3.3%
Normal	35%	31.5%	39.4%
Overweight + obese	62%	65.8%	57.3%

constipation (51.4%), whereas very few reported diarrhea (1.3%).

In men mean (s.d.) body weight was 76.4 (13.7) kg and mean (s.d.) BMI was 27.0 (4.4) kg/m<sup>2</sup> (range 17.0–40.4 kg/m<sup>2</sup>). In women the corresponding values were 64.5 (14.1) kg and 26.9 (5.3) kg/m<sup>2</sup> (range 12.5–40.8 kg/m<sup>2</sup>), respectively. The difference in BMI between sexes was not significant.

The distribution of BMI is shown in Figure 1.

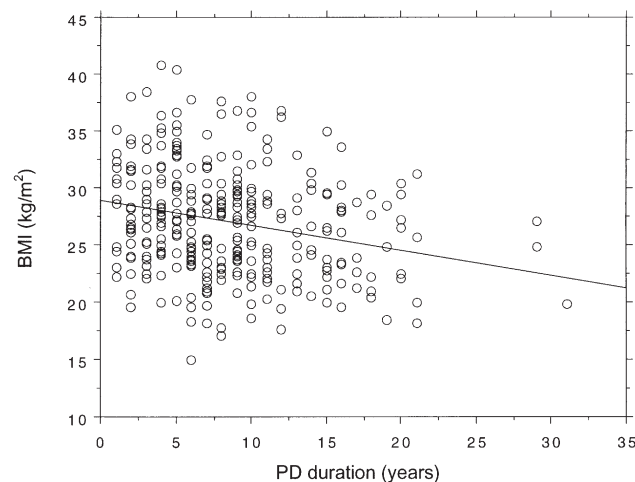
A total of 134 patients (37%) were overweight and 92 (25%) were obese. Only 11 (3%) were underweight. The remaining 127 patients (35%) had a normal BMI. There were no important differences in BMI according to smoking status, mean (s.d.) BMI being 26.3 (4.2) kg/m<sup>2</sup> in smokers, 27.2 (4.6) kg/m<sup>2</sup> in ex-smokers and 27.2 (4.9) kg/m<sup>2</sup> in non-smokers. There were no important differences in the distribution of BMI categories according to sex (Table 1).

There was a highly significant inverse correlation between duration of disease and BMI ( $P < 0.001$ ) (Figure 2).

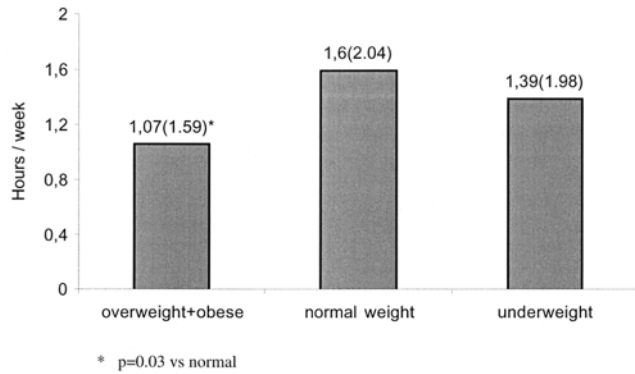
The mean (s.d.) duration of disease was 9.7 (4.7) y in the subgroup of overweight and obese patients, 11.1 (5.5) y in the patients with a normal BMI and 14.1 (7.2) years in the underweight patients ( $P = 0.0059$ ).

The waist-to-hip ratio was high, thus contributing towards an increase in cardiovascular risk, in 47.7% of men and 73.8% of women.

Mean (s.d.) therapeutic physical activity amounted to 1.07 (1.59) h per week in the overweight and obese patients,



**Figure 2** Correlation between PD duration and BMI.



**Figure 3** Physical activity according to body weight.

whereas the hours of physical activity were on average 1.61 (2.04) h per week in the patients with normal BMI—a 50.5% increase as compared with overweight and obese patients ( $P = 0.03$ ). Underweight patients exercised on average for 1.39 (1.98) h per week (Figure 3).

## Discussion

This study shows that the majority of PD patients attending a referral centre in the North of Italy suffered from nutritional abnormalities (65%), which generally consist in being overweight. Underweightness was uncommon (3%). It also shows that body weight of PD patients changes over time, BMI being inversely proportional to duration of disease. Thus, overweightness resulted to be the issue during the first 10 y of disease; weight loss ensued in the advanced phase of the disease, but underweightness was infrequent.

It should be noted that PD patients at the referral center in Milan consult the Nutrition Service for dietary advice routinely, because of the interference of protein-rich meals with the absorption of levodopa (Riley & Lang, 1988). Thus, the sample was not selected for nutritional disorders and is representative of the general PD population attending the center.

The data are consistent with the results of a recently published cross-sectional investigation on anthropometric measurements in 3356 subjects in the Italian elderly general population (Perissinotto *et al*, 2002). In this study in the 65–69 y and 70–74 y age brackets (to which most of the patients of our study belonged) in men, mean body weight was 74.6 (11.2)–74.4 (11.9) kg vs 76.4 (13.7) kg in our study and mean BMI was 26.8 (4.2)–27.0 (3.9) kg/m<sup>2</sup> vs 27.0 (4.4) kg/m<sup>2</sup> in our study. In women mean body weight was 66.2 (12.0)–64.8 (12.5) kg vs 64.5 (14.1) kg in our study and mean BMI was 28.0 (5.2)–27.9 (5.0) kg/m<sup>2</sup> vs 26.9 (5.3) kg/m<sup>2</sup> in our study. In the same study a disproportion was found between the percentage of obese women according to BMI criteria and the percentage that could be considered at cardiovascular risk according to waist circumference; this disproportion was not found in males. A disproportion was found also in our study,

as 57.3% of females were overweight or obese, whereas 73.8% had a waist-to-hip ratio indicative of cardiovascular risk. It is well known that adiposity is more centrally distributed in postmenopausal women and in the elderly in general, and this could be a manifestation of physiological aging (Perissinotto *et al*, 2002). The value we used to identify women at cardiovascular risk ( $>0.85$ ) may be inappropriately low in the elderly; however, no data are available on the association of waist-to-hip ratio and morbidity and mortality in the Italian elderly population and no specific cut-off values for the elderly have been established (Perissinotto *et al*, 2002).

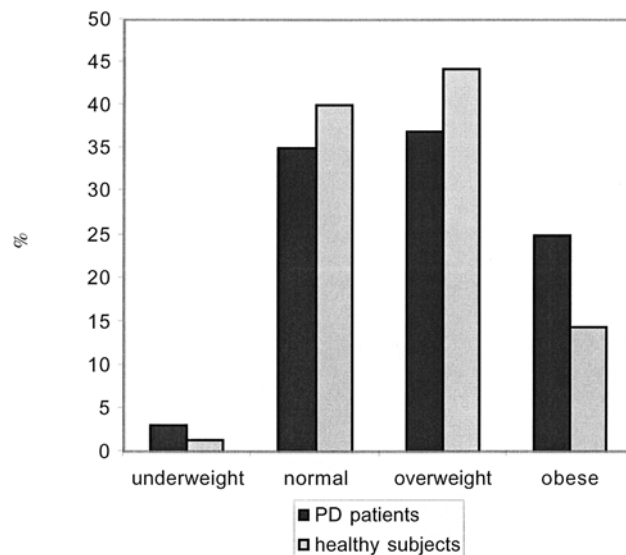
Other studies have been performed on the nutritional status of PD patients similar in age and duration of PD to our patient population, albeit smaller in size (range 15–281 patients).

The inverse correlation between duration of disease and BMI was found also by Markus *et al* (1993) in a cohort of 95 PD patients, who reported that significant reductions in BMI were confined to the subgroup of patients with a duration of disease of over 15 years. Beyer *et al* (1995) reported an inverse correlation between advancing of the disease and BMI, but significance was achieved by the correlation with severity of disease, not with duration of disease. Durrieu *et al* (1992) did not find a correlation between BMI and severity or duration of disease.

All the previous studies have reported lower mean BMIs than the mean values we found in this study (men 23.0–25.4 vs 27.0 kg/m<sup>2</sup>; women 22.0–22.6 vs 26.9 kg/m<sup>2</sup>; both sexes together 23.5–24.4 vs 27.0 kg/m<sup>2</sup>; Markus *et al*, 1993; Beyer *et al*, 1995; Durrieu *et al*, 1992; Jankovic *et al*, 1992). Also the proportion of overweight patients was lower than in our study (20–30% vs 62%) (Markus *et al*, 1993; Abbott *et al*, 1992). However, the difference versus normal controls was not always statistically significant.

We did not assess the proportion of patients with PD complications promoting malnutrition, such as dysphagia, so we cannot exclude that our results differ from the literature because fewer patients suffered from these complications. However, this is unlikely, as the diagnosis of PD was made using stringent clinical criteria and our patient population did not differ in mean chronological age and mean duration of disease.

It should be noted that three of the previous studies were submitted for publication 10 y ago and that the most recent one was published 6 y ago. It is well known that there has been a dramatic change in lifestyle in the last 10 y that has produced an important increase in the prevalence of overweightness. A recent survey on obesity in Italy in the first half of 1999 revealed that approximately 58% of the population within the same age range as the majority of patients in our study (from 55 to 74 y) was overweight or obese (Angeli, 2001)—a proportion that is very similar to the proportion of overweight plus obese patients found in our patient population (62%). However, the split between overweightness and obesity differed, the proportion of obese patients being actually higher amongst PD patients than in the general Italian population (25 vs 14%) (Figure 4).



**Figure 4** Distribution of BMI in PD patients and the general population in Italy.

Higher body weight at the onset of disease may compensate for the losses produced by the disease for many years. Moreover, one of the key signs of PD—bradykinesia—contributes towards a reduction in physical activity, an important component of body weight management, which was significantly reduced in overweight PD patients as compared to PD patients with normal BMI. Furthermore, the progressive impairment of postural reflexes associated with the risk of falls induces patients to abandon previous social activities and hobbies and stay at home, thus reducing physical activity even further. Therefore, two common manifestations of PD contribute towards weight gain. Another explanation for the low proportion of underweight patients and higher mean BMI is the change in antiparkinsonian therapy in the last decade. Traditional dopaminergic antiparkinsonian therapy consisted in levodopa alone, which frequently produces side effects that promote weight loss, i.e. nausea and vomiting in the short term and dyskinesia in the long term (Ahlskog, 2001). Dyskinesia consists of choreoathetotic movements that are difficult to control and increase energy consumption considerably; moreover, such movements can further impair the ability to eat by interfering with the transport of food and drink to the mouth.

The introduction of dopamine agonists has permitted initiation of antiparkinsonian therapy without levodopa (dopamine agonist monotherapy) in many patients and a reduction in the mean dosage of levodopa (Ahlskog, 2001) in the medium-term (combination of levodopa and dopamine agonists), thus producing a reduction in the extent of energy-consuming dyskinesia.

Our study did not include biochemical data or the measurement of body composition, so no data are available to

establish whether the high proportion of patients with malnutrition also had changes in the proportion of muscular and/or adipose tissue, or any particular alterations in micronutrient levels. These measurements should be made in future studies. Also the effects of dietary treatment associated with programmes of physical activity should be evaluated.

In conclusion, our study shows that underweightness is currently uncommon in PD patients in Italy. This observation may apply to other industrialized countries in which the prevalence of overweightness has increased and modern antiparkinsonian therapy has been introduced in the last decade.

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