



## Research review

# Body weight and food intake in Parkinson's disease. A review of the association to non-motor symptoms



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## ABSTRACT

Research on eating behaviours has extensively highlighted that cognitive systems interact with the metabolic system in driving food intake and in influencing body weight regulation. Parkinson's disease is a good model for studying these complex interactions since alterations in both body weight and cognitive domains have been frequently reported among these patients. Interestingly, even if different non-motor symptoms may characterize the course of the disease, their contribution to weight and food preference has been poorly investigated. This review describes body weight alterations and eating habits in patients with Parkinson's disease, including those who underwent deep brain stimulation surgery. In particular, the review considers the link between non-motor symptoms, affecting sensory perception, cognition, mood and motivation, and food intake and weight alterations. The take home message is twofold. First, we recommend a comprehensive approach in order to develop effective strategies in the management of patients' weight. Second, we also suggest that investigating this issue in patients with Parkinson's disease may provide some useful information about the mechanisms underlying food and weight regulation in healthy subjects.

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## Introduction

In recent years, much attention has been directed to alterations in food intake and body weight that are commonly experienced in healthy aging and neurological disorders (Aziz et al., 2008; de Boer, Ter Horst, & Lorist, 2013). In particular, several studies have reported alterations in body weight and food preference in

patients with Parkinson's Disease (PD), a complex neurodegenerative disorder characterized by the loss of dopaminergic neurons in the substantia nigra (SN) pars compacta, and a deficiency of dopamine in the striatum and in other structures of the basal ganglia (Bachmann & Trenkwalder, 2006; Kashihara, 2006; Kistner, Lhommée, & Krack, 2014). However, the mechanisms underlying such alterations are not yet well understood. The purposes of the present review are, first, to summarize the studies that assessed the weight and eating habits in PD patients and, second, to examine the possible contribution of some non-motor symptoms to weight and food intake alterations. In particular, the review will consider non-motor symptoms affecting sensory perception, cognition, mood and

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motivation, while it will not make reference to other non-motor symptoms such as autonomic dysfunctions, sleep disorders/fatigue, etc.

### Weight status in patients with Parkinson's disease

By and large, PD patients have been observed to lose weight and to be more frequently underweight (Body Mass Index, BMI < 20 kg/m<sup>2</sup>; Bachmann & Trenkwalder, 2006; Kashihara, 2006; Kistner et al., 2014, for recent reviews), with a high risk of malnutrition (Fereshtehnejad et al., 2014; Sheard, Ash, Mellick, Silburn, & Kerr, 2013a; Sheard, Ash, Silburn, & Kerr, 2013b). The weight loss has been described even before diagnosis (Chen et al., 2003). A recent meta-analysis (van der Marck et al., 2012) involving 871 PD patients confirmed that their BMI was lower than that of controls. The association between PD and weight loss has also been observed in the transgenic MitoPark mouse exhibiting the cardinal features of PD: at 16 weeks, transgenic mice, whose locomotor activity is already reduced, also start to lose weight relative to control mice and at 22 weeks such difference becomes significant (Li et al., 2013). Weight loss is also associated with lower level of leptin (Fischer et al., 2010; Lorefält, Toss, & Granérus, 2009; Rocha et al., 2014), a hormone involved in the regulation of appetite and whose level depends on the amount of body fat mass (Palmiter, 2007), though not consistently (Evidente, Caviness, Adler, Gwinn-Hardy, & Pratley, 2001).

Even if a low body weight is the most common finding, PD patients with normal weight and even overweight have been surveyed. For example, Barichella, Marczevska, Vairo, Canesi, and Pezzoli (2003) found that 62% of 364 PD patients was overweight/obese and only 3% underweight, and Bachmann, Zapf, Brunner, and Trenkwalder (2009) reported that among 166 patients with advanced Parkinson's disease and dyskinesia, 4.2% were underweight, 33.7% overweight and 15.7% obese, although they showed a lower body weight when compared to the general healthy population. Moreover, in Morales-Briceño, Cervantes-Arriaga, Rodríguez-Violante, Calleja-Castillo, and Corona (2012) overweight and normal weight were more prevalent among 177 PD patients than among 177 healthy

controls matched for gender and age. Methodological limitations can account for such inconsistent findings. For instance, disease duration and severity of the illness, which have been shown to be associated with body weight or BMI (van der Marck et al., 2012), differed across studies. In addition, age, gender and characteristics of the control-matched sample might have influenced the results. For instance, some studies enrolled a group of healthy subjects that did not always match the patient groups for BMI, age, gender, etc., while others relied on data derived from national surveys or did not include controls at all. In addition, in many studies the information about patients' weight has been collected retrospectively in different ways, including self-reports, which are considered highly inaccurate (Dahl & Reynolds, 2013). On the other hand, the history of PD may be characterized by both weight gain and loss occurring at different stages: patients may experience weight loss prior to diagnosis, weight gain in the first 10 years after diagnosis and, as the disease advances, also weight loss (Barichella, Cereda, & Pezzoli, 2009).

Two recent longitudinal studies documented that PD patients experience weight alterations at the beginning of the disease (Giorelli et al., 2014; Vikdahl, Carlsson, Linder, Forsgren, & Håglin, 2014). In particular, Giorelli et al. showed that diagnosis-naïve PD patients reported significant weight changes at 1 year from the initial evaluation, compared to a group of patients with essential tremor evaluated after the same period of time, while Vikdahl et al. (2014) observed that, after three years from the first diagnosis, 48 patients (out of 58 PD) gained weight and fat mass while 10 lost weight after the same period (for more longitudinal studies see Table 1). These results suggest that there seem to be individual differences in weight regulation among patients. Indeed, it has also been proposed that different weight alterations during the course of PD may correspond to different phenotypes of the disease (Sharma & Turton, 2012): a *phenotype A* associated with a severe olfactory deficit, a higher initial body weight and a history of body weight loss as the disease progresses, and a *phenotype B*, associated with a mild olfaction deficit, and characterized by an initial lower body weight and a tendency to gain weight during the course of the disease.

**Table 1**  
Description of longitudinal studies measuring weight change in patients with Parkinson's disease.

References	Sample		Time interval	Results
	Composition	PD characteristics		
Vikdahl et al. (2014)	58 PD 24 HC	Age: 68.4 ± 8 38% Female	At diagnosis – at 3 yrs	No difference at baseline in BW between PD and HC At 3 yrs, PD gained weight while HC did not.
Sharma and Turton (2012)	99 PD	55 Anomic (aged 72 ± 8; 36% fem) and 44 hyposmic (aged 65 ± 9; 25% fem)	At baseline and at previous 5	Anomic PD had lost weight during the previous years while hyposmic PD had gained weight.
Politis et al. (2011)	34 PD	Age: 64.7 ± 7.4 17% female	At baseline – at 1 yr	17 PD showed an abnormally changed BMI: 12 lost BMI and 5 gained BMI.
Lorefält et al. (2004)	26 PD 26 HC	12 medicated and 14 newly diagnosed Age: 74.0 ± 5.7 34% female	At baseline – at 1 yr – at 2 yrs	No difference at baseline in BW between PD and HC. At 2 yrs, 73% of PD had weight loss (more pronounced in the newly diagnosed). At 2 yrs, PD showed a lower BW than controls.
Uc et al. (2006)	49 PD 78 HC	Age: 57.5 ± 1.6 30% female	Pre-diagnosis- before medication at baseline – last visit	No difference at baseline in BW between PD and HC. A higher proportion of PD (75.5%) compared to HC (50%) lost weight over time. No weight loss in the pre-diagnosis period.
Pålhagen et al. (2005)	G1: 15 PD and 15 HC  G2: 13 PD and 13 HC	Newly diagnosed PD (aged: 70 ± 5.1; 73% fem)  advanced PD (aged 77 ± 3.9; 53% fem)	Before medication – at 1 yr – at 2 yrs  At baseline – at 1 yr	At 2 yrs, PD G1 lost weight while HC gained weight.  At 1 yr, no differences were detected compared to baseline in both PD G2 and HC.
Chen et al. (2003)	from 24 to 174 PD	Age: 30 to 75 yrs	At 12 yrs, 8 yrs, 4 yrs bef. diagnosis, at baseline, at 4 yrs, 8 yrs aft. diagnosis	Weight loss starting from 2 to 4 yrs before the diagnosis.

HC, healthy Controls; BW, body weight; BMI, body mass index.

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