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Food Preference in Parkinson's Disease

Michika Sakamoto, Kentaro Suzuki, Hiroshi Nagayama and Kazumi Kimura

Department of Neurology, Nippon Medical School Hospital, Tokyo, Japan

Background: Several studies have reported that persons with Parkinson's disease (PD) exhibit a preference for sweet foods. However, because many people favor such foods, this study investigated whether the preference for sweet foods was stronger among patients with PD than among those without PD.

Methods: We analyzed 150 patients treated in the neurology department of Nippon Medical School Hospital between July 2021 and November 2021. Forty-nine (33%) had PD and 101 patients (control group) did not. Participants were asked to rate three sweet foods, three salty foods, and three bitter foods (total, nine foods) on a questionnaire where a score of 3 indicated "like", 2 indicated "neutral", and 1 indicated "dislike". The score for each taste preference was defined as the sum of the scores for the three foods representing each taste. Differences in baseline characteristics and taste preference scores between patients with and without PD were then statistically analyzed.

Results: The PD group was significantly older than the control group. The PD group obtained a significantly higher sweetness score than the control group (8 [6-9] vs. 7 [3-9], $p<0.01$). There was no difference in scores for either saltiness (7 [3-9] vs. 7 [3-9], $p=0.49$) or bitterness (7 [4-9] vs. 7 [3-9], $p=0.25$). The sweetness score was not significantly correlated with L-dopa dose, L-dopa equivalent dose, or PD disease duration.

Conclusion: Patients with PD were more likely than those without PD to prefer sweet foods. These results are important new information on the taste preferences of persons with Parkinson's disease.

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Key words: Parkinson's disease, non-motor symptoms, sweet food preference, taste

Introduction

Parkinson's disease (PD) is diagnosed on the basis of motor symptoms and non-motor symptoms. These include olfactory disturbances and orthostatic hypotension, as well as bradykinesia and tremor.

Several studies reported that PD patients consume more sweet foods[1–6]. A study of 60 PD patients indicated that 5% of PD patients began to consume greater amounts of sweet snacks after levodopa initiation, although hyperphagia was not always present[1]. Earlier studies using self-report questionnaires suggested that patients with PD consume more sweet foods, such as sugary snacks, chocolate, ice cream, fruit, cooked vegetables, cereals, and baked items than did patients without PD[2–6].

This study examines whether the preference for sweet food is stronger among PD patients than among those without PD.

Methods

Study Overview and Patient Consent

This cross-sectional study enrolled consecutive patients who had been hospitalized or attended the neurology department of Nippon Medical School Hospital between July 2021 and November 2021. Data on the following baseline clinical information were obtained from medical records: age, sex, medical history of PD, hypertension, diabetes mellitus, medications, disease duration, Hoehn-Yahr classification, and results of the odor stick identification test for Japanese (OSIT-J), which is used in general practice to assess olfactory impairment in patients with suspected PD[7]. Taste preferences were assessed using

Correspondence to Kentaro Suzuki, MD, PhD, Department of Neurology, Nippon Medical School Hospital, 1–1–5 Sendagi, Bunkyo-ku, Tokyo 113–8603, Japan
E-mail: kentarow@nms.ac.jp
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	Chocolate	Potato Chips	Coffee
Like			
Neutral			
Dislike			
	Cake	Pizza	Grapefruit
Like			
Neutral			
Dislike			
	Cookies	Hamburger	Green bell pepper
Like			
Neutral			
Dislike			

Fig. 1 Questionnaire used to assess taste preference
Three foods were included in the questionnaire for each of the three tastes (total, nine foods): sweetness, saltiness, and bitterness. The patients were asked to describe their preference for each food as like, neutral, or dislike.

questionnaires. Participants were divided into two groups: those with PD (PD group) and those without PD (control group). Data from the two groups were then analyzed to identify differences in taste preference between the groups. Informed consent was obtained from all patients or their relatives. This study was approved by the local Institutional Review Board (approval number: 2023-1476).

Questionnaire

To assess their taste preferences, all enrolled patients completed the questionnaires shown in **Figure 1**. Three foods were included in the questionnaire for each of three tastes (total, nine foods), namely, sweetness, saltiness, and bitterness. The foods were: (i) chocolates, cake, and cookies for sweetness, (ii) potato chips, pizza, and hamburgers for saltiness, and (iii) coffee, grapefruit, and green bell pepper for bitterness. Participants chose "like", "neutral", or "dislike" for each food. We assigned 3 points for "like", 2 points for "neutral", and 1 point for "dislike". The score for each taste preference was defined as the sum of the scores of the three foods representing each taste. Therefore, the taste preference score ranged from 3 to 9.

Statistical Analysis

Participants were divided into two groups: a PD group and control group. A descriptive analysis of the baseline characteristics and taste preference scores between the two groups was performed using the Brunner-Munzel test, two-tailed Fisher's exact test, and Mann-Whitney U test for non-normally distributed continuous and categorical variables. To determine whether sweet scores were related to the duration of PD treatment, L-dopa dose, and L-dopa equivalent dose (LED)[8], Spearman's rank correlation coefficients were used. In all tests, $p < 0.05$ indicated statistical significance. All statistical analyses were performed with EZR (Saitama Medical Center, Jichi Medical University), a graphical user interface for R (The R Foundation for Statistical Computing, version 2.13.0). More precisely, it is a modified version of R commander (version 1.6-3) that includes statistical functions frequently used in biostatistics[9].

Results

Characteristics of Patients

A total of 150 patients were enrolled: 49 patients (33%) in the PD group and 101 patients (67%) in the control group. The control group consisted of patients diagnosed as having transient ischemic attack or stroke (14), epilepsy (9), neuropathy (8), headache (7), myelopathy (5), myasthenia gravis (5), and other conditions (53). The characteristics of the patients are shown in **Table 1**. The sex distribution and prevalence of hypertension and diabetes were similar between groups. However, the patients in the PD group were significantly older than those in the control group (72 [45-93] vs. 63 [13-89], p=0.02).

Taste Scores

The taste preference scores are shown in **Figure 2**. Sweetness scores were significantly higher in the PD group than in the control group (8 [6-9] vs. 7 [3-9], $p< 0.01$). There were no significant differences between the two groups in saltiness (7 [3-9] vs. 7 [3-9], p=0.49) and bitterness scores (7 [4-9] vs. 7 [3-9], p=0.25). The scores for each food are shown in **Table 2**. The scores for chocolates and cake were significantly higher in the PD group than in the control group, but no differences were observed in the scores for other foods. There was no significant correlation between sweetness score and age (Spearman's rank correlation coefficient −0.0809, p=0.325).

Correlation of Clinical Variables and Sweetness Score

Sweetness score was not significantly correlated with L-dopa dose (Spearman's rank correlation coefficient 0.104, p=0.48), LED (Spearman's rank correlation coefficient 0.077, p=0.60), or disease duration (Spearman's rank correlation coefficient 0.010, p=0.95).

OSIT-J had been measured in 14 patients: 13 in the PD group and 1 in the control group. In all cases, the OSIT-J and questionnaire were administered on different days. No association was found between the OSIT-J and the respective taste scores (sweetness score: Spearman's rank correlation coefficient 0.212, p=0.467; saltiness score: Spearman's rank correlation coefficient 0.297, p=0.302;

Table 1 Baseline characteristics of the patients

	PD (n=49)	Control (n=101)	P
Age (years), median [IQR]	73 [65-79]	67 [52-78]	0.017
Male, n (%)	24 (49)	49 (49)	1
Medical history*			
Hypertension, n (%)	15 (31)	36 (36)	0.586
Diabetes mellitus, n (%)	4 (8)	9 (9)	1
Hoehn-Yahr classification†			
1, n (%)	14 (27)		
2, n (%)	20 (40)		
3, n (%)	13 (27)		
4, n (%)	2 (4)		
5, n (%)	1 (2)		

IQR, interquartile range.
*Medical history data were obtained from medical records.
†Hoehn-Yahr classification ranges from 1 to 5, with higher scores indicating more-severe neurological deficits.

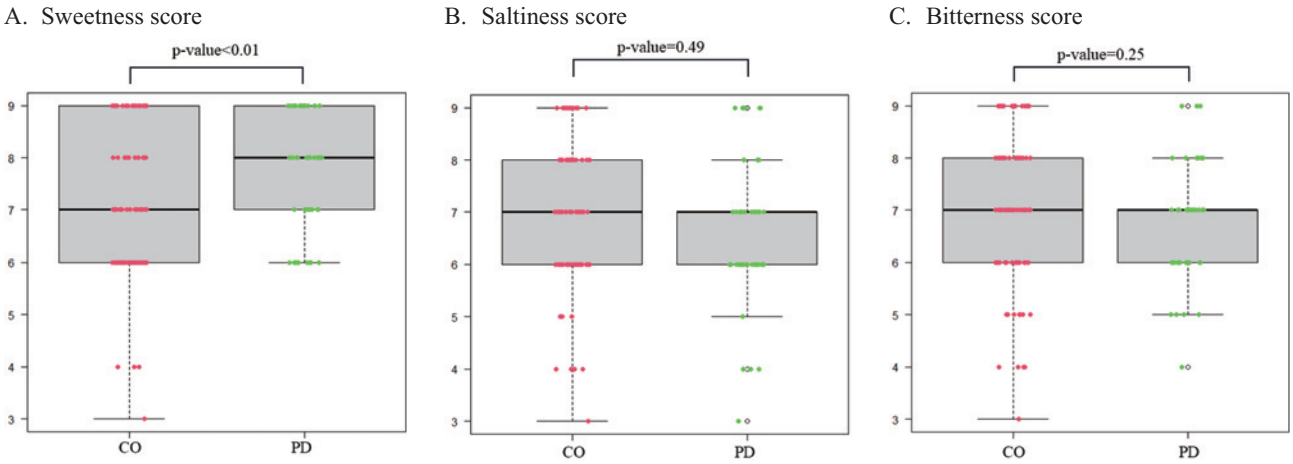

Fig. 2 Taste preference scores in the control group and PD group
The vertical axis of each figure shows the taste preference score. The PD group had significantly higher sweetness scores than the control group (8 [6-9] vs. 7 [3-9], p<0.01). There were no significant differences between the two groups in saltiness (7 [3-9] vs. 7 [3-9], p=0.49) or bitterness scores (7 [4-9] vs. 7 [3-9], p= 0.25).
CO, control group; PD, PD group.

bitterness score: Spearman's rank correlation coefficient 0.352, p=0.217).

Discussion

This study yielded two major findings. First, patients with PD were more likely to prefer sweet foods but not salty or bitter foods. Second, the preference for sweet foods in patients with PD was not correlated with L-dopa dose, LED, or disease duration.

Our findings are consistent with those of several previous studies that used questionnaires and showed a tendency for patients with PD to consume more sweet foods[1–4], including sugar[3], chocolate[5], and ice cream[6]. Among these studies, two[2,4] used a food frequency test, and three asked questions about the consumption of and/or preference for sweet foods such as chocolate and ice cream[3,5,6]. By exploring the degree of preference for foods representing each taste among the PD and non-PD groups, our study revealed that patients with PD tend to favor sweet foods but not bitter or salty ones.

Some studies reported a correlation between use of PD drugs and increased consumption of sweet food. In a study by Miwa and Kondo[1], 60 patients with PD were asked if their consumption patterns had changed after starting levodopa. Five patients noted an increased preference for sweet snacks, although this change was not al-

Table 2 Scores for each food

	PD	CO	p-value
Chocolate	2.75 [3-3]	2.47 [2-3]	<0.01
Cake	2.67 [2-3]	2.38 [2-3]	<0.01
Cookies	2.41 [2-3]	2.26 [2-3]	0.13
Potato Chips	2.18 [2-3]	2.31 [2-3]	0.31
Pizza	2.22 [2-3]	2.26 [2-3]	0.23
Hamburger	2.22 [2-3]	2.21 [2-3]	0.74
Coffee	2.39 [2-3]	2.56 [2-2]	0.05
Grapefruit	2.16 [2-3]	2.07 [2-2]	0.36
Green bell pepper	2.16 [2-3]	2.29 [2-3]	0.22

The mean ± SD of the score for each food is presented for both groups, along with the p-value comparing the scores for each food between the PD and control groups. The PD group had significantly higher scores for chocolate (p=0.002) and cake (p=0.002), as compared with the control group. There were no significant between-group differences for the other foods.

ways associated with hyperphagia or a specific anti-parkinsonian drug[1]. Meyers et al.[6] examined the amount of ice cream and other sweet foods consumed by patients with PD and normal controls, and dopaminergic drug use and sweet food consumption were significantly positively correlated. However, that study was likely affected by selection bias, as men were not included in the analysis because of the small number of male controls.

Although our study did not show a significant correlation between sweet preference and disease duration, previous studies have indicated a positive correlation between disease duration and the amount of sweet food consumed[3,4]. In a study of consumption of high sugar-content food in patients with PD and normal controls, patients with PD who consumed large amounts of chocolate and other sweet foods had a significantly longer disease duration than those who consumed less[3]. In a study of dietary habits in patients with PD, disease duration was associated with increased consumption of sweet foods such as milk pudding and custard[4]. In summary, past and present findings suggest that disease duration does not correlate with sweet preference but with the amount of sweet food consumed.

Past studies could not determine why patients with PD tend to consume more sweet foods. Perhaps they consume sweet foods to compensate for depleted dopamine in their brains. Several past studies have suggested that insulin, which is elevated after ingestion of sweet foods, acts on central insulin receptors and increases dopamine production in the substantia nigra[10]. To our knowledge, there are no direct studies indicating that sweet foods increase dopamine in the brain. However, some studies provide indirect evidence. One such study showed that striatal dopamine release reflects the perceived pleasantness of a meal[11]. Furthermore, palatable food elevates the extracellular dopamine concentration in the nucleus accumbens of the ventral striatum[12].

This study has several limitations. Random error and measurement bias may have occurred because the questionnaire was created by the authors and did not undergo a process to confirm its reproducibility. In addition, response bias and recall bias are a concern, as the environment and mood at the time the questionnaire is answered could have influenced the responses. In this study, questionnaires were completed during a consultation and were not submitted later. Furthermore, the small sample size, especially for the analysis of the correlation between OSIT-J and taste scores, may have caused selection bias and affected statistical validity.

Conclusions

Patients with PD preferred sweet foods over salty and bitter foods. However, the intensity of the preference for sweetness was not correlated with disease duration, L-dopa dose, or LED. These findings may lead to a better understanding of the pathogenesis of PD.

Conflict of Interest: The authors declare no conflicts of interest associated with this manuscript.

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