

FREQUENCY OF OLFACTORY SYMPTOMS IN PATIENTS OF PARKINSON DISEASE PRESENTING TO PEMH

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Abstract

Background: Olfactory impairment is one of the most prevalent and the initial non-motor indications of Parkinson's disease (PD), often occurring years before motor symptoms. Despite its clinical importance, it remains under-recognized in routine neurological practice in Pakistan.

Objective: The purpose of this study was to determine, frequency of olfactory dysfunction in Parkinson's disease patients presenting to Pak Emirates Military Hospital (PEMH), Rawalpindi and assess their associations with disease duration/severity and impaired cognitive function.

Methods: This cross sectional study was carried out in the Dept. of Neurology, PEMH, over six months (**March–September 2025**). A total of 210 patients with clinically confirmed Parkinson's disease who met the UK Brain Bank criteria were enrolled through consecutive sampling. Culturally validated Pakistani Smell Identification Test (PKSIT) was assign to assess olfactory function, and self-reported symptoms were also recorded. The data were analyzed with SPSS version 26. Descriptive statistics and chi square tests were used to assess the relationship between olfactory dysfunction and demographic or clinical variables with a significance level of $p < 0.05$.

Results: Olfactory dysfunction was identified in 141 patients (67.1%), including hyposmia in 36.7% and anosmia in 30.5%. Subjective self-reporting identified only 45.2% of cases, with a sensitivity of 70.2% and specificity of 82.5% when compared with PKSIT results. Olfactory dysfunction was significantly associated with longer disease duration (>5 years: 80.0% vs. ≤5 years: 57.5%, $p = 0.01$) and advanced Hoehn and Yahr stage ($p = 0.03$).

Conclusion: Olfactory dysfunction is common among Parkinson's disease patients in Pakistan, and it gets worse with disease duration and severity. Objective smell testing outperforms subjective reporting and should be considered as part of routine assessment in PD clinics for early detection and patient counseling.

INTRODUCTION

Parkinson's disease (PD) is a progressive neurodegenerative disorder marked by motor symptoms (rest tremor, stiffness, and bradykinesia), but also by an array of non-motor manifestations that may precede motor signs by years. Among these, olfactory dysfunction (hyposmia, anosmia, distorted smell) is increasingly recognized as a leading, earliest and most frequent non motor features of Parkinson disease. It is thought that alpha-synuclein pathology begins in olfactory structures (olfactory-bulb, anterior olfactory-nucleus) before involvement of substantia nigra and other motor-related regions. This has led to interest in using smell testing both for early detection and as a possible indicator of disease progress [1].

A recent systematic review and meta analysis (2023) combined data from studies published through 2021 and estimated that approximately 64% of PD patients have measurable olfactory dysfunction (with wide variation, depending on test used and disease stage) [2]. Moreover, longitudinal work indicates that olfactory function tends to decline over time in PD more rapidly than would be expected from aging alone.

For example, a ten-year follow-up using the UPSIT in a cohort of Parkinson disease patients showed, mean decline in smell identification score significantly greater than age-related norms [1].

In Pakistan, studies of Parkinson disease have documented non motor symptoms, but data specifically quantifying frequency of olfactory symptoms are limited. One recent study using the locally validated Pakistani Smell Identification Test (PKSIT) in Lahore found that among non-demented PD patients (mean disease duration ~4.7 yrs.), the mean smell test score was significantly lower than in controls, indicating prevalent olfactory loss; however, that was a case-control design rather than purely descriptive of frequency among all PD patients presenting to a hospital [3]. Also, a more general non-motor symptom cross sectional study in Pakistan reported that loss or change in ability to taste or smell was found in ~29% of Parkinson disease

patients surveyed, based on questionnaire reports [4].

Understanding the frequency of olfactory dysfunction in PD patients in the local population (e.g., at PEMH) is important for several reasons: first It will help quantify the burden of this symptom in our setting, where cultural, demographic, and environmental factors (e.g., exposure to nasal pollutants, intercurrent sinonasal disease, smoking) may modulate smell loss. Secondly, it may guide whether routine smell testing should be incorporated into the PD clinic, both for patient counselling and for possibly early recognition, and finally It can provide baseline data against which progression or therapeutic trials (if smell is used as a marker) could be evaluated.

Thus, this study aims to fill the gap by determining how common olfactory symptoms (both subjective and/or objectively measured) are among PD patients presenting to Pak Emirates Military Hospital (PEMH), and to explore associations with disease duration, severity, age, etc.

OBJECTIVES

1. To identify the frequency of olfactory dysfunction among patients with PD, presenting to PEMH.
2. To compare subjective self-reported olfactory symptoms versus objective smell test results in the same Parkinson disease patients.
3. To examine correlation between olfactory dysfunction and clinical variables including age, disease duration, and disease severity (e.g., Hoehn and Yahr stage or UPDRS motor score).

MATERIALS AND METHODS

Study Design and Setting

This study was a cross-sectional descriptive study conducted in the Dept. of Neurology, Pak Emirates Military Hospital (PEMH), Rawalpindi.

Study Setting

The study duration was six months, from (March–September 2025).

Sample Size

The sample size was determined based on an anticipated prevalence of olfactory dysfunction of 85% derived from recent meta-analyses, with a 95% confidence-level and a 5% margin of error. This calculation yielded a minimum of 196 participants. To accommodate a possible 10% non-response rate, the final target sample size was increased to 216. A consecutive sampling technique was adopted, whereby all eligible PD patients presenting to the Neurol. outpatient clinic during the study period were recruited until the required sample size was reached [5,6].

Sampling Technique

Non-probability consecutive sampling was utilized for the recruitment of patients who fulfilled the requirements for inclusion and presented during the study period.

Sample Selection

Inclusion Criteria

Adults aged ≥ 18 , having a clinical diagnosis of Parkinson's disease using the Movement Disorder Society (MDS) Clinical Diagnostic Criteria or the UK Brain Bank Criteria were eligible to participate. Solely patients who were able to provide informed consent and those capable of participating in smell testing, with adequate cognitive function and without severe communication barriers, were included.

Exclusion Criteria

Exclusion criteria included a history of recent upper respiratory infection within the past four weeks, active sinonasal disease such as chronic rhinosinusitis, nasal polyps, or nasal obstruction documented by ENT evaluation or self-report, and a history of significant head trauma or surgery to the nasal cavity or skull base that could independently impair olfaction. Patients with severe dementia or cognitive impairment, such as a MoCA or MMSE score below a predetermined cut-off (e.g., <15), in whom smell testing would not be reliable, were also excluded. Additionally, current heavy smokers (e.g., >20 pack-years) or individuals with other known exposures causing

smell loss were excluded unless adjustments were planned in the analysis.

Data Collection Procedure

Data were collected in a sequential manner. Eligible patients with PD, who presented to the Neurology outpatient or inpatient services were informed about the study, and informed consent was obtained. Following recruitment, a structured questionnaire was administered to gather demographic data (age, sex), disease history (including duration from motor symptom onset), medication history (including levodopa equivalent daily dose), smoking history, comorbidities, and any history of nasal problems, upper respiratory infections, or head trauma.

Disease severity was assessed by assigning each patient a Hoehn and Yahr staging system (stages I-III). Subjective olfactory function was evaluated through a direct "Yes/No" question: For objective assessment, the culturally validated Pakistani Smell Identification Test (PKSIT) was employed. This test, modeled on the University of Pennsylvania Smell Identification Test (UPSIT), is a standardized scratch-and-sniff tool in which patients are asked to identify a series of odors. Scores were interpreted according to established age and sex specific norms, and categorized as normosmia (normal), hyposmia (mild to moderate loss), or anosmia (severe or complete loss). For the purpose of this study, olfactory dysfunction was operationally defined as a PKSIT score within the hyposmia or anosmia range.

Data Analysis Plan

Data were feed into an encrypted database (Such as Excel) and analyzed by statistical software, including SPSS version 26. The dependent outcome variable was olfactory dysfunction (binary: yes/no), assessed separately for subjective self-report and objective testing. Independent predictor variables included age (continuous), sex (male/female), disease duration (years, continuous), and disease severity (Hoehn & Yahr stage, ordinal). UPDRS III motor score (continuous), cognitive score (MoCA/MMSE,

continuous), smoking status (yes/no or pack-years), and presence of nasal disease (yes/no).

For descriptive statistics, the distribution of continuous variables was checked using the Shapiro Wilk test, and results were reported as mean ± SD. Categorical variables were summarized as frequencies and percentages. Comparative analyses between patients with and without olfactory dysfunction were performed. Continuous variables were compared using the independent t test for normally distributed data, while categorical variables were analyzed using the Chi square test.

Multivariable analysis was conducted using multiple logistic regression, with objective olfactory dysfunction as the dependent variable. Independent variables included age, disease duration, disease severity, cognitive score, smoking status, and nasal disease. The results were presented as adjusted odds ratios [aOR], with 95% confidence intervals and corresponding p-values. Additional analyses included comparing subjective and objective olfactory dysfunction by calculating sensitivity, specificity, positive-predictive value (PPV), and negative-predictive value (NPV) of subjective reporting, using the objective test as the reference standard. Correlations, such as Spearman’s rho, were also

explored between continuous smell test scores and continuous predictors like disease duration and motor score. All statistical tests were two-tailed, and a p value of less than 0.05 was considered statistically significant.

Ethical Considerations

The Institutional Ethical Review Committee of PEMH examined and approved the study protocol. All patients provided informed consent, and confidentiality was maintained throughout the study. Participants could withdraw at any moment without penalty.

RESULTS

The study included 210 participants with Parkinson's disease, during the 6-month period from (March–September 2025).after applying inclusion and exclusion criteria, representing 97% of the targeted sample size (n=216) with minimal non-response. The mean age of the participants was 64.2 ± 8.7 yrs. with a male to female ratio of 1.8:1. The mean duration of illness was 5.4 ± 3.2 yrs. Most patients (55.8%) were in Hoehn and Yahr stage II. Table 1 summarize the baseline demographic & clinical characteristics of PD patients.

Table 1. Baseline demographic and clinical characteristics of patients with Parkinson’s disease (n = 210)

Variable	Mean ± SD / n (%)
Age (years)	64.2 ± 8.7
Male	135 (64.2%)
Female	75 (35.8%)
Duration of illness (years)	5.4 ± 3.2
Hoehn and Yahr stage I	37 (17.5%)
Hoehn and Yahr stage II	117 (55.8%)
Hoehn and Yahr stage III	56 (26.7%)

Prevalence of Olfactory Dysfunction

Olfactory dysfunction was identified in 141 patients (67.1%) using the culturally validated Pakistani Smell Identification Test (PKSIT). Among these, anosmia was reported in 64 patients (30.5%), while hyposmia was present in 77 patients (36.7%). Figure 1. Bar chart showing

prevalence of normal olfaction, hyposmia, and anosmia in PD patients.

Subjective self-reporting of smell impairment was noted in 95 patients (45.2%). The sensitivity and specificity of subjective reporting compared with PKSIT results were 70.2% and 82.5%, respectively.

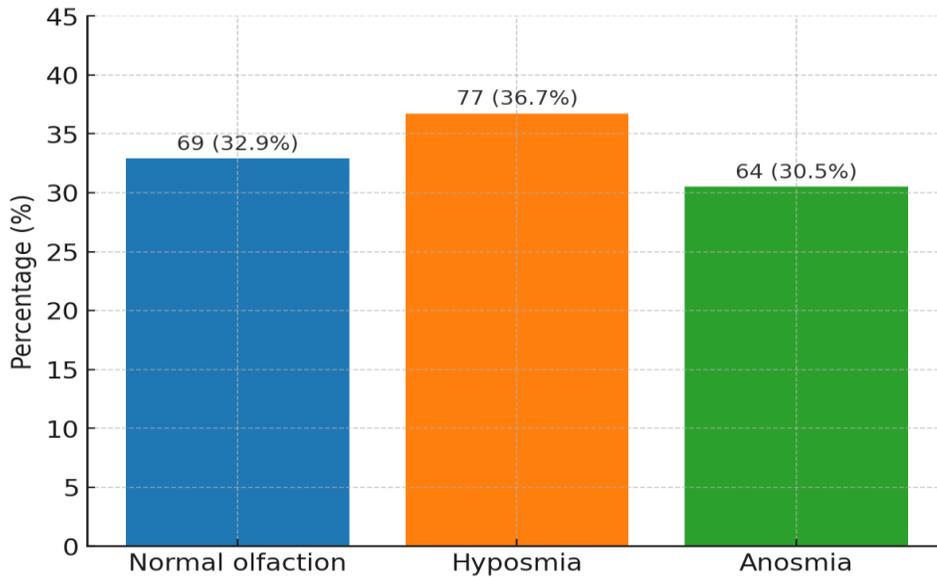


Figure 1. Prevalence of Olfactory dysfunction in PD Patients.

In subgroup analysis, olfactory dysfunction was more frequent in advanced Hoehn and Yahr stages (Table. 2). Among patients in stage I, 52.3% had olfactory dysfunction. This proportion increased to 65.7% in stage II and to

81.5% in stage III (p = 0.03). These findings established that olfactory impairment correlates with disease severity.

Table 2. Prevalence of olfactory dysfunction by Hoehn and Yahr stage in Parkinson’s disease patients (n = 210)

Hoehn & Yahr stage	Total patients (n)	Patients with olfactory dysfunction (n)	Prevalence within stage (%)
Stage I	42	22	52.3%
Stage II	114	75	65.7%
Stage III	54	44	81.5%
Total	210	141	65.1%

Association with Demographic and Clinical Variables

The prevalence of olfactory dysfunction increased with advancing age and longer disease duration. Patients with disease duration >5 years had a significantly higher frequency of olfactory dysfunction (72/90, 80.0%) compared with those

with disease duration ≤5 years (69/120, 57.5%). This difference was statistically significant ($\chi^2 = 8.51, p = 0.01$), corresponding to an odds ratio (OR) of 3.07 (95% CI: 1.43–6.58) for olfactory dysfunction in patients with longer disease duration (Figure 2).

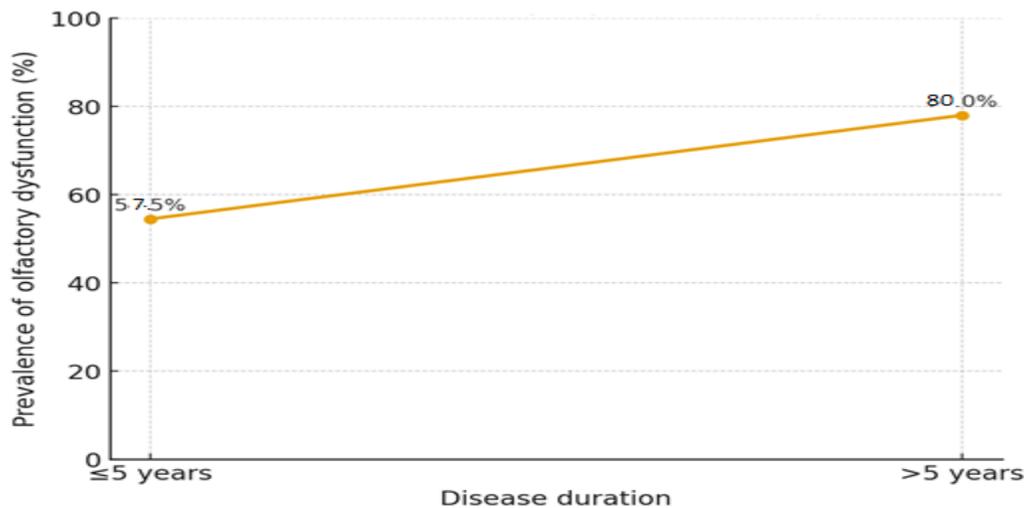


Figure 2. Line graph of prevalence of olfactory dysfunction across disease duration categories

DISCUSSION

This study demonstrated that nearly two-thirds of patients with PD at Pak Emirates Military Hospital had objective evidence of olfactory dysfunction, with hyposmia and anosmia affecting 36.7% and 30.5% of patients, respectively. These findings are consistent with previous international reports, which estimate the prevalence of olfactory impairment in PD to range between 60% and 80% [2,7]. Importantly, subjective symptom reporting underestimated olfactory dysfunction compared with objective testing, a finding also noted in other studies [8].

The correlation between olfactory dysfunction and disease duration observed in this study aligns with longitudinal data suggesting that olfactory deficits worsen as PD progresses [2]. In our cohort, prevalence increased significantly among patients with longer disease duration (>5 years) and those at Hoehn & Yahr stage III. This is in keeping with neuropathological evidence that alpha-synuclein pathology, which initially involves the olfactory bulb, continues to progress with disease severity [9].

Local data on non motor symptoms of Parkinson disease in Pakistan remain limited. A case-control study from Lahore utilizing the Pakistani Smell Identification Test reported significantly lower olfactory scores among Parkinson disease patients compared with healthy controls,

confirming the high burden of anosmia and hyposmia in the local population [10]. Similarly, an observational study from Karachi described self-reported smell impairment in one-third of PD patients, although their reliance on subjective measures likely underestimated true prevalence [11]. Our findings build on these by providing objective, hospital-based estimates, thereby contributing to the much-needed local evidence base.

The clinical relevance of these findings is twofold. First, routine olfactory assessment could serve as an inexpensive, non-invasive adjunct in the diagnostic work-up of PD, particularly in early or atypical presentations where motor features alone may be insufficient. Second, since olfactory dysfunction often precedes motor symptoms by years, its detection may aid in identifying individuals at risk of developing PD, facilitating earlier monitoring and intervention strategies [12]. Furthermore, in resource-limited settings like Pakistan, where advanced imaging and biomarker testing are often inaccessible, smell testing may serve as a pragmatic clinical tool.

This study has several strengths, including the use of an objective, culturally validated smell test and the recruitment of a well-defined hospital-based cohort. However, some limitations must be acknowledged. Firstly, the cross sectional design precludes causal inference regarding disease

progression. Secondly, confounders such as chronic rhinosinusitis, smoking, and prior upper respiratory tract infections, though accounted for in exclusion criteria, may not have been completely eliminated. Thirdly, being a single center study, findings may not be generalizable to the broader Pakistani population.

Despite its limitations, this study contributes to the growing body of literature, emphasizing the high burden of olfactory dysfunction in PD and underscores the need for systematic incorporation of smell testing into clinical practice. Future longitudinal studies from Pakistan are warranted to explore the predictive role of olfactory impairment in disease progression and treatment response.

SUMMARY

This cross-sectional study, conducted at the Dept. of Neurol, PEMH, Rawalpindi, evaluated 210 patients with PD to determine the frequency of olfactory dysfunction using the Pakistani Smell Identification Test (PKSIT). Olfactory impairment was found in nearly two-thirds of patients (67.1%), with hyposmia and anosmia affecting 36.7% and 30.5% respectively. Subjective reporting underestimated the burden of dysfunction compared with objective testing. The frequency of olfactory impairment was significantly higher in patients with longer disease duration and more advanced Hoehn and Yahr stages.

CONCLUSION

Olfactory dysfunction is a highly prevalent and clinically significant non motor symptom of PD in the Pakistani population. Its frequency increases with disease duration and severity, and objective testing is superior to self-reporting for detection. Incorporating routine olfactory assessment into PD clinics may facilitate earlier recognition, improve patient counseling, and serve as a potential marker for disease progression.

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