

RESEARCH ARTICLE



OPEN ACCESS

Received: 09-05-2023

Accepted: 06-08-2023

Published: 16-09-2023

Citation: Mohan S, Venkatesh V, Ganesan C, Velraja S, Rajkumar (2023) Association of Parosmia and nutritional status in Post COVID Patients using PAST TOOL. Indian Journal of Science and Technology 16(35): 2807-2812. <https://doi.org/10.17485/IJST/v16i35.1106>

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Funding: Summer research fellowship grant was provided

Competing Interests: None

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Published By Indian Society for Education and Environment ([iSee](https://www.isee.in/))

ISSN

Print: 0974-6846

Electronic: 0974-5645

Association of Parosmia and nutritional status in Post COVID Patients using PAST TOOL

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Abstract

Objectives: To determine the association between normal dietary intake of patients suffering from parosmia and clinically relevant recovery of olfactory and gustatory function in patients with postinfectious COVID-19 using the PAST tool. **Method:** The study involved categorizing post-COVID patients into two distinct groups based on the presence or absence of parosmia. These groups were then subjected to a standardized questionnaire known as the "PAST TOOL" to determine the specific foods that elicited aversive reactions in the patients. The 24-hour recall was considered for calculating their energy and protein intake. **Findings:** The study revealed that the presence of an odd/unusual taste and odour significantly influences the dietary behaviour, energy, and protein intake of individuals afflicted with parosmia. The patients' energy and protein intake were notably lower, with mean values of 538.6 (\pm)148.9kcal and 26.17 (\pm)8.08g, respectively, and the difference was statistically significant ($p < 0.05$). Furthermore, the emotional well-being of the patients was adversely affected, leading to a significant impact on their overall quality of life. **Novelty:** This study aims to investigate the potential correlation between parosmia and nutritional status among post-COVID patients. The PAST tool was utilized to obtain data on the olfactory and gustatory responses and stimuli of individuals who have encountered parosmia following their recovery from COVID-19. The exploration of this association is considered as a novel area of research as it has not been extensively studied.

Keywords: Olfactory; Parosmia; Gustatory; Covid19; PAST Tool

1 Introduction

The COVID-19 pandemic has resulted in a significant impact on global society, with India reporting a current total of 44,990,054 cases and a mortality rate of 531,866 deaths as of the latest update in May 2023⁽¹⁾. This unprecedented event has brought about a transformative shift in our daily lives and overall physical and mental well-being⁽²⁾. Among the many challenging consequences of the effect of the virus, one intriguing occurrence has caught the interest of experts and individuals alike: parosmia. Parosmia is a sensory condition in which patients experience strange odours in reaction to familiar and unknown foods⁽³⁾. This olfactory illness has distorted the once-familiar fragrances of the world into unrecognizable, often unpleasant, odours for many COVID-19 patients⁽⁴⁾. This illness can significantly impact many aspects of daily life, including nutritional intake. Food selection and preference are intrinsically linked to olfactory and gustatory sensations. The presence of parosmia might impair the perception of Flavors, resulting in changes in eating habits and overall nutritional well-being^(5,6).

There has been considerable progress in developing reliable and effective methods for detecting and assessing the severity of parosmia. Odor threshold evaluations, for example, are advanced sensory testing techniques that give standardized approaches for diagnosing and monitoring this condition⁽⁷⁾. However, because testing for objective odour loss through prescribed laboratory or medical procedures is not usually possible or large enough for broad testing, and because self-document surveys aren't always valid, a readily available household odor sensitivity screening is necessary. As a result, we suggest this novel tool, PAST (perception assessment of smell and taste) based on the principles from the aforementioned studies^(6,7) to understand better how this condition influences food intake and diet quality. Despite substantial improvements in this study area, there are still knowledge gaps. More research is needed to completely understand the complexity of parosmia and its long-term consequences such as malnutrition, macronutrient, micronutrient, and vitamin and mineral deficiencies which may be the result of poor dietary intake caused by parosmia.

There is presently not an extensively recognized, standardized tool for evaluating parosmia. While it is thought that parosmia influences food preferences, intake, and enjoyment of food⁽⁸⁾, the processes and pathways behind this are unknown. Exploring the various physiological, psychological, and social aspects that contribute to nutritional status changes in Parosmia patients could provide useful insights into the complicated interplay between altered smell and taste perception and dietary intake. This study aims to look at the relationship between parosmia and dietary consumption, underlining the importance of using a scientific approach. To test sensory thresholds, this study proposes developing a novel tool called the Perception Assessment of Smell and Taste (PAST) tool.

This study helps to revive and strengthen the nutrition status of parosmia patients and enhance their smell and taste receptors and prove that the nutrition status can be corrected if identified earlier and can be changed for the better sustenance of life. The general aspect of the project is to comprehend the dietary factors associated with parosmia and poor nutritional status.

2 Methodology

It is a prospective interventional questionnaire-based study conducted at Sri Ramachandra Institute of Higher Education and Research among patients who were recently admitted with or recovered from SARS Covid-19. The study included 155 patients totally with a history of infection with covid-19 out of which 77 subjects were placed in the parosmia group and 78 in non-parosmia group. The intensity of the olfactory and gustatory issues/problems was assessed by the Perception and Assessment of Smell and Taste (PAST) tool. This PAST tool has been adapted from the Yale Jiffy test⁽⁹⁾, which assessed olfactory abilities, while this tool has been modified to examine both olfactory and gustatory abilities with five potent stimuli.

Table 1. Perception Assessment of Smell and Taste tool

Initial questions	Answers
Name	
Age	
Height	
Weight	
Gender	
How many weeks before you have been diagnosed with covid-19?	• 2 weeks • 4 weeks • 6 weeks • More than 6 weeks
Appetite levels observed during this period	• Dysphagia (decreased appetite) • Normal appetite • Polyphagia (increased appetite)
Have you noticed a reduction in your sense of smell in the past week?	Rate from: none, slight, moderate, severe
Have you noticed a reduction in your sense of taste in the past week?	Rate from: none, slight, moderate, severe

Continued on next page

Table 1 continued

Smell and taste test instructions	Smell and taste test questions	Smell and taste test answers
<ul style="list-style-type: none"> • Smell- Smell the substance that has been placed on your palm by holding it an inch from your nose and trying to inhale. • Taste- Try tasting the food by placing a teaspoon of it on your palm. 	Can you smell/taste them? 1. Coffee powder 2. Jam 3. Pain balm 4. Lime juice 5. Detergent powder How strong does it smell? Coffee powder Jam Pain balm Lime juice Detergent powder How strong does it taste? Coffee powder Jam Lime juice	Yes/no Yes/no Yes/no Yes/no Yes/no Rate them from 0 being no sensation and 10 being strong sensation. 0-10 0-10 0-10 0-10 0-10 0-10 0-10 0-10

The study population included patients above the age of 18 who had a history of Covid-19 or were currently infected with Covid-19. The sample was equally distributed between parosmia and non-parosmia groups. Statistical analysis was done using SPSS software. A detailed questionnaire was provided to the study population which assess the status of the gustation and olfaction along with the questions to assess their impact on nutritional status.

The volunteers irrespective of their gender were divided into two groups Group A and Group B. Group A was a parosmia group and Group B was a non-parosmia group. The questionnaire included two sections for assessment of the ability to smell and strength of smell in response to olfactory and gustatory senses. It is a self-administered questionnaire. We gave the subjects a questionnaire to rate their ability to smell and taste on a categorical scale (poor, average, good, very good) to report any reduction or distortion in smell and taste. The 24-hour recall i.e., the timings, food items, and quantity followed in the previous day were asked, and their energy and protein intake were calculated using the National Institution of Nutrition app and their total intake was calculated using these values. The coffee powder was used as it has the maximum olfactory stimulus. Additionally, items such as lime juice, pain relievers, jams, and detergent powder, were provided to the patients to sniff/taste to assess the severity of parosmia in these individuals.

Table 2. 24-hour recall

Timing	Food items	Quantity (g), (ml)	Energy (kcal)	Protein (g)	Intake	
					Energy (kcal)	Protein (g)

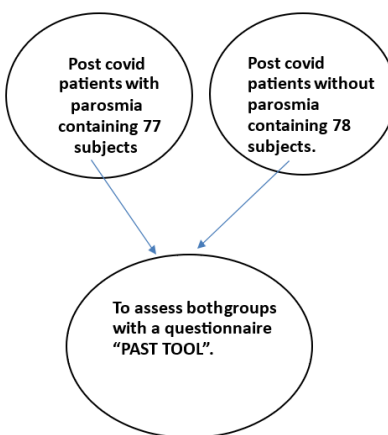


Fig 1. Flow chart describing the process of grouping the participants

2.1 Statistical Analysis

The analysis was done using the paired T-test method (categorical variable), and the results were obtained.

Table 3. Descriptive Statistics describes the relationship between variables

Mean	Defined as the average of a set of values
T- Test (Paired)	Determines significance between means of two groups
Statistical Significance	Defines the difference between two groups. It is determined by Paired T-test, if the p-value is less than 0.05 it will be considered as statistically significant.

The data analysis was done using an SPSS statistical package. A simple percentage was used to describe a qualitative variable.

3 Results and Discussion

Table 4. Mean and Standard Deviation of Age Among the Study Population

	The group suffering from parosmia	The group without parosmia	Total group
Sample size	77	78	155
Mean	35.12	42.05	55.66
Standard deviation	5.47	8.23	16.147

From the above Table 4, the age of our patients ranged from 18-60 years with a mean age of 55.66 ± 16.147 and mostly patients belonged to the age group ≤ 55 years ($n=155$) and there seems to be no difference in the intensity of patients who suffered from parosmia.

Table 5. Percentage distribution of samples based on gender

Gender	Sample size	Valid percent
Male	72	46.5
Female	83	53.5
Total	155	100.0

It was found that there was no discernible difference in sexual orientation and intensity of parosmia among patients who had a history of Covid-19. Although this may reflect a bias towards predisposition toward females with 53.5% introduced to our center for care, it might likewise highlight a higher risk of olfactory dysfunction in females. Furthermore, this finding is supported by recent studies⁽¹⁰⁾ which found that females suffered from parosmia (73.5%) and those who were suffering from parosmia had poor quality of life.

Table 6. Mean and standard deviation of energy and protein intake

	NORMAL MEAN \pm SD	PAROSMIA MEAN \pm SD	“T” VALUE	SIGNIFICANCE
ENERGY	826 \pm 118.6	538.6 \pm 148.9	12.23	0.014*
PROTEIN	32.41 \pm 9.04	26.17 \pm 8.08	3.82	0.004*

In the largest cohort studies, parosmia caused by Covid 19 is frequently reported affecting 7-11% of patients^(10,11). There was a statistically significant difference in the food intake levels of parosmia and non-parosmia patients. The protein and energy intake of parosmia patients is significantly low compared to non-parosmia patients with a P-value <0.05 . The hypothesis proves that there is no significant difference between the energy and protein intake of parosmia patients. There was a significant difference (p -value <0.05) in the energy and protein intake of parosmia patients, indicating that the energy and protein percent met calculated from a 24-hour recall is significantly low than the percent met from non-parosmia patients.

In the present study, we investigated the association between parosmia and nutritional status focusing on energy and protein intake. Prior medical and dietary research on smell and flavor loss has primarily focussed on the impact of food regimen choices, rather than establishing a correlation between food choices and their effect on energy and protein intake. In contrast to the findings of our investigation, Rawal et al. found that patients with olfactory impairment caused by COVID-19 had a higher consumption of calories, protein, and fat ($p<0.05$)⁽¹¹⁾. This may be attributed to less unpleasant reactions towards foods high in energy, protein, and fat content. This may be owing to their manner of regular dietary intake as well as cultural variances in the food selections available to them. In this present study analysis, the consumption of staple foods, including rice, fermented

batter, lentils, meat, and eggs, may have functioned as potent triggers for COVID-19 subjects suffering from parosmia. This could contribute to their low energy and protein consumption. In addition, triggers have a broader scope that transcends the domain of food and culinary practices, encompassing household and personal care commodities, as well as environmental fragrances, such as those present in water and air. The above-mentioned stimuli persistently exacerbate the distress of individuals undergoing parosmia, to such an extent that certain individuals may perceive a lack of a secure environment to live in^(12,13). This can lead to feelings of frustration and potentially pave the way for mental health issues. Strange taste and smell certainly lead to changes in eating behavior, and mental health and has profound consequences for the quality of life⁽¹⁴⁾. 72% of patients reported a loss in their enjoyment of food in the early research looking into how scent abnormalities affect nutrition⁽¹⁵⁾.

Jane K Parker⁽¹⁶⁾ has discussed the potential impact of SARS-CoV-2 on olfactory function, yet only a limited number have delved into the fundamental mechanisms of parosmia. This condition has occasionally been informally associated with intersecting between the regenerating olfactory and gustatory receptors and the glomeruli or olfactory bulb. A previous study by Butowt⁽¹⁷⁾ hypothesized the mechanism of parosmia to be the dysfunction in the epithelial cells, the support cells that produce the mucus to break down odorants, which was discovered to be one of the causes of why this condition arises in Covid patients. Host immunological responses that promote suppression of genes involved in the olfactory transmission of signals occur too late to generate anosmia but may prolong the olfactory dysfunction⁽¹⁸⁾. There has been a considerable inquiry into the reasons why olfactory distortions are typically perceived as unpleasant⁽¹⁹⁾. Some theories suggest that these distortions may be unappealing due to a deviation from the expected olfactory profile of a familiar food or beverage⁽²⁰⁾. Nonetheless, this observation implies that not all odors are distorted, and as a result, unexpected scents are perceived as unpleasant. Therefore, the mere presence of an unexpected scent may not necessarily be sufficient to elicit feelings of disgust. Given that the primary stimuli are perceived as having a repulsive scent, it is necessary to examine the nature of the malodorous compounds that elicit such disgust. Participants in the study have reported a distinct aroma, commonly referred to as the "COVID mucous scent," despite the use of analogies such as putrid, earthy, charred, or chemical odors. The salient findings suggest that beverages with strong taste and smell, such as coffee, are perceived as highly unpleasant, and that 24-hour recall data indicate a consequential impact on energy and protein consumption. It should be noted that while these effects may vary, there appears to be a positive association between the strong-smelling substances which was given to the subjects using the PAST tool and the degree of disgust experienced.

The present investigation centers on the role of nutritionists and healthcare professionals to alleviate the significantly modified encounter of food and eating patterns, the challenge of comprehending the altered experience, and the associations with the current altered food practices. The aim is to transform these food habits into healthier alternatives, promoting the consumption of nutritious food items from diverse food groups, and fostering a healthier community. The implications of altered smell and taste on food, eating, health, work, and well-being are of utmost importance.

The present investigation was subject to various constraints. The study cohort comprised of individuals who were hospitalized under the care of a physician for COVID-19 and those who had recovered from COVID-19 and exhibited olfactory dysfunctions that were associated with the disease. Moreover, variations in sample sizes and demographic profiles among studies may potentially affect the extent to which findings can be extrapolated to broader populations. The use of 24-hour recalls as a dietary assessment tool may pose a hindrance due to its dependence on the participants' memory, which may lead to an inaccurate representation of their energy and protein intake. Subsequent investigations should strive to surmount these constraints by employing more extensive and heterogeneous samples, as well as utilizing 3-day weighed food diaries. The research is constrained due to its dependence on self-reported responses provided by the participants through the survey instrument. Upon enrolment, subjects were given questionnaires to complete. However, it was observed that only seven patients responded to the initial section of the questionnaire and failed to provide adequate responses to the olfactory assessment and were excluded from the study.

4 Conclusion

In conclusion, the PAST tool used to investigate the relationship between parosmia and nutritional status in post-COVID patients gave interesting insights into the impact of this sensory distortion on the nutritional well-being of individuals recovering from COVID-19.

The results of this study suggest a connection between parosmia, or a distorted sense of smell and taste, and how it may affect people's intake of protein and calories, affecting their nutritional status. Individuals with parosmia who were post-covid had a higher chance of losing their appetite, eating less, and having trouble tasting food, all of which can result in inadequate nutrient intake and malnutrition. A thorough investigation of olfactory impairment and its connection to nutritional status was done in this present study using the PAST tool. By collecting 24-hour recalls of dietary consumption, and patient-reported data, including parosmia symptoms and eating patterns, this study captured the patient's subjective experiences and gathered

evidence of their nutritional well-being.

Further investigation into prospective treatment options and management strategies that could enhance the nutritional condition of post-covid patients with parosmia is required in the future studies. Longitudinal studies might also provide valuable insights into the long-term impact of parosmia on nutritional status and general health outcomes. Understanding and managing the influence of parosmia on nutritional well-being allows healthcare providers to optimize the process of recovery and improve the quality of life for those suffering from this condition.

5 Ethical Clearance

The present study has been approved by the Institutional Ethical Committee (IEC) and the reference number is CSP/21/AUG97/426.

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