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CLINICAL RESEARCH:

Factors Associated with Olfactory and Gustatory Dysfunction in Post-COVID-19 Patients Treated at a Peruvian Hospital

Factores asociados a la disfunción olfatoria-gustativa en pacientes post COVID-19 atendidos en un hospital peruano

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ABSTRACT: To determine the association between sociodemographic, epidemiological, and clinical factors and olfactory-gustatory dysfunction (OGD) in post-COVID-19 patients treated at a Peruvian hospital. An observational, analytical, and cross-sectional study was conducted using the clinical records of adult patients treated for COVID-19 at the Hospital Militar Central (HMC) between July 2020 and December 2022. Data were collected in person using a structured form that recorded sociodemographic, epidemiological, and clinical variables, as well as the presence of OGD. Poisson regression with robust variance was performed using SPSS v25. A total of 237 post-COVID-19 patients were included. Of these, 53.2% presented OGD. Among those with dysfunction, 81% reported both olfactory and gustatory impairment, 12.7% reported olfactory impairment only, and 6.3% reported gustatory impairment only. Multivariate analysis revealed that age under 60 years (p=0.007; RPa=1.194), female sex (p=0.005; RPa=1.160) and having “other” comorbidities (p=0.027; RPa=1.214) were significantly associated and increased the prevalence of OGD. Patients with age age under 60 years, female sex and with other comorbidities were significantly associated with olfactory-gustatory dysfunction.

KEYWORDS: Olfactory disorders; Taste disorders; Sociodemographic factors; Epidemiological factors; Clinical factors; COVID-19.

RESUMEN: Determinar si existe asociación entre los factores sociodemográficos, epidemiológicos y/o clínicos y la disfunción olfatoria-gustativa (DOG) en pacientes post COVID-19 atendidos en un hospital peruano. Se realizó un estudio observacional, analítico y transversal a partir de historias clínicas de pacientes adultos atendidos por COVID-19 en el Hospital Militar Central (HMC) entre Julio del 2020 a diciembre del 2022. La información fue recabada a cada paciente de manera presencial, usando una ficha de recolección de datos sobre las características sociodemográficas, epidemiológicas y clínicas y así como la prevalencia de DOG. Para el análisis se usó la regresión de Poisson con varianza robusta en SPSS V.25. 237 pacientes post COVID-19 fueron incluidos en el estudio. Se evidenció que el 53.2% de los pacientes post COVID-19 tuvieron DOG. Entre los pacientes con DOG, el 81% demostró tener alteración del gusto y alteración de olfato a la vez, el 12.7% alteración al olfato y solo el 6.3% alteración del gusto. El análisis multivariado demostró que la edad <60 años (p=0.007; RPa=1.194), el sexo femenino (p=0.005; RPa=1.160) y tener "otras" comorbilidades (p=0.027; RPa=1.214) se asociaron e incrementaron de manera significativa la prevalencia de DOG. Aquellos pacientes que presentaron edad <60 años, sexo femenino y otras comorbilidades tuvieron una asociación significativa a la disfunción olfatoria-gustativa.

PALABRAS CLAVE: Trastornos del olfato; Trastornos del gusto; Factores sociodemográficos; Factores epidemiológicos; Factores clínicos; COVID-19.

INTRODUCTION

COVID-19 infection has resulted in high morbidity and mortality rates worldwide, primarily due to the severe systemic involvement it caused (1,2). According to the World Health Organization (WHO), by February 2021, a total of 109,068,745 confirmed cases of SARS-CoV-2 and 2,409,011 associated deaths had been reported globally (3).

In Peru, the National Center for Epidemiology, Disease Prevention and Control of the Ministry of Health (MINSA) reported that as of June 14, 2025, there were 3,623 confirmed COVID-19 cases, 1,553 hospitalizations, 144 intensive care unit (ICU) admissions, and 435 deaths (4). However, during the period from July 2020 to November 2022, the numbers were significantly higher, with 4,917,495 confirmed cases and 244,958 deaths (5).

Although many individuals recovered from the acute phase of the disease, lingering sequelae have had a considerable impact on the quality of life (QoL) and workforce reintegration of post-COVID-19 patients (6). In such cases, SARS-CoV-2 infection presented as asymptomatic or ranged from mild to severe clinical manifestations (7). Among the most frequently reported symptoms was olfactory-gustatory dysfunction (OGD), which includes anosmia (complete loss of smell) and hyposmia (reduced olfactory capacity) (8), both of which have significant implications in the oral domain (9).

Various studies have estimated the prevalence of olfactory dysfunction at 52.73% and gustatory dysfunction at 43.93% among SARS-CoV-2-infected individuals (10). Although, these percentages could vary if the analysis is limited to COVID-19 variants, since the omicron variant does not include loss of smell and/or taste among its five main symptoms, as in the case of delta and alpha variants (11, 12). This scenario is attributed to alterations in the omicron spike protein, cell membrane fusion, and less effective olfactory entry into host cells. Therefore, the recovery of smell and taste or the persistence of the symptom could follow a different course in each variant (11).

As an example, we can cite the british study by Vihta *et al*. (13), who found a prevalence of 13 to 16% for loss of smell and taste during the infection cycle of the omicron variant, compared to 44% recorded during the period of predominance of the delta variant. Meanwhile, Ota *et al*. (14), in Japan, reported a frequency of 17.63% for smell and/or taste disorders in patients with the alpha variant, 31.66% in the delta variant and 4.27% in the omicron variant.

Olfactory dysfunction may result from the degeneration of the olfactory epithelium secondary to viral infection or due to inflammation caused by the respiratory illness (10). Regarding taste impairment, it has been attributed to the virus's affinity for the oral mucosa, particularly the sialic acid receptors located in taste buds and salivary mucins, making the oral cavity a favorable environment for viral replication (15). Anosmia has been globally recognized as a hallmark symptom of COVID-19 (10), affecting approximately 60% of patients (8). Moreover, evidence indicates that these alterations can persist for more than two (16,17) and even up to three months (18) after the onset of symptoms. Although most patients experience a gradual recovery of smell and taste, around one-quarter report no improvement at all (19).

Among the smell and taste disorders that prevail after COVID-19 infection, stand out: anosmia (total loss of smell), dysosmia (distortion of perceived odors), ageusia (total loss of taste), dysgeusia (distortion in the perception of flavors), and trigeminal chemosensory alterations (20). Each of these generates dietary modifications that affect oral health, such as the consumption of excessively sweet, acidic, salty, or fatty foods, in an attempt to compensate sensory loss, which could increase the risk of enamel erosion and dental caries (21,22). In addition, they contribute to loss of appetite, inadequate intake of micronutrients and macronutrients, and malnutrition, which carries a higher risk of gum diseases (gingivitis, periodontitis aggravated by malnutrition, scurvy, glossitis, among others) and hyposalivation due to dehydration and salivary gland involvement. Hyposalivation is associated with dental caries and halitosis, since the decreased in saliva production prevents the neutralization of acids produced by bacteria and autoclysis (23).

In this context, it is essential to promptly identify the onset or worsening of OGD and oral conditions. Tetracyclines, particularly doxycycline or minocycline, have been shown to eliminate ageusia in the first week of COVID-19 treatment due to their anti-inflammatory (taste buds) and indirect antiviral activity, preventing damage to taste cells. Likewise, early administration of corticosteroids, such as triamcinolone oral paste, can reduce taste bud inflammation and contribute to the recovery of sweet, bitter, salty, and sour tastes after 5 days of treatment. Zinc supplementation also reduces COVID-19 symptoms, including loss of smell and taste, thanks to its anti-inflammatory, antioxidant, and viral replication inhibition properties (24).

Other therapeutic options involve blockade of the stellate ganglion and respective inhibition of the sympathetic nervous system, administration of phytochemicals with antiviral, anti-inflammatory, neuroprotective and antioxidant activity (curcuminoid, flavonoids and capsaicinoid), prescription of vitamin D (reduction of the severity of symptoms) and photobiomodulation (24).

It is important to note that the oral cavity, as a primary entry route for the virus, plays essential roles such as mastication and taste perception, both of which may be compromised by infection. Taste disturbances may lead to appetite loss, negatively impacting nutritional status, oral health and overall QoL (9). The SARS-CoV-2 virus not only affects taste buds but also salivary glands, interfering with the normal perception of smells

and flavors by reducing the dissolution of flavor molecules and the release of compounds for retronasal olfactory stimulation. Furthermore, hyposalivation makes chewing and swallowing difficult, as saliva is essential for lubricating food and forming the food bolus (24).

Despite the relevance of these findings, research on factors associated with OGD in post-COVID-19 patients remains limited nationwide and is virtually nonexistent in some Peruvian healthcare institutions (25, 26).

Therefore, this study aimed to determine the association between sociodemographic, epidemiological, and/or clinical factors and olfactory-gustatory dysfunction in post-COVID-19 patients treated at a Peruvian hospital.

MATERIALS AND METHODS

STUDY DESIGN

An observational, analytical, and cross-sectional study was conducted using clinical records from adult patients treated for COVID-19 at the Central Military Hospital (CMH) between July 2020 and December 2022.

STUDY POPULATION AND SAMPLE SIZE

A non-probabilistic, convenience sampling method was used. Sample size calculation was not performed, as all patients who met the inclusion criteria and were treated for COVID-19 between July 2020 and December 2022 (N=237). Eligible participants were adults aged 18 years and older, of both sexes, with a confirmed diagnosis of COVID-19 by reverse transcription polymerase chain reaction (RT-PCR), and who had recovered from the disease, from nineteen to forty-eight months. Patients were excluded if they had severe cognitive impairment, a neuropsychiatric diagnosis, a history of sinonasal surgery or pathology, reinfection history or self-reported olfactory or gustatory dysfunction before the onset of the pandemic.

DATA COLLECTION

One of the researchers reviewed institutional medical records to identify patients who met the predefined inclusion and exclusion criteria.

INSTRUMENT ADMINISTRATION

Selected patients were contacted by telephone to schedule an in-person appointment. During the call, the study objectives were explained, and voluntary participation was requested through the signing of an informed consent form. At the appointment, a self-reported data collection form was administered, which included sociodemographic variables (place of residence, alcohol and tobacco use), epidemiological variables (age, sex and comorbidity history), and clinical variables (COVID-19-related hospitalization, use of oxygen therapy, and ICU admission).

Age (<60 years, >60 years), sex (female, male), comorbidity history (none, allergic rhinitis, arteral hypertension, obesity, diabetes mellitus, heart disease, nasal trauma, asthma, knee chondromalacia, gastritis, overweight, tinnitus, others), origin (rural, urban), alcohol consumption (yes, no), tobacco consumption (yes, no), previous hospitalization for COVID-19 (yes, no), use of oxygen therapy (yes, no) and admission to the ICU (yes, no) were qualitative variables on a nominal scale. Alcohol consumption was considered when it was greater than or equal to 60 grams in the last 30 days (27) and tobacco consumption when the patient reported smoking at least 5 cigarettes per day (28).

ASSESSMENT OF OLFACTORY-GUSTATORY DYSFUNCTION (OGD)

The evaluation of this variable was carried out during the period July-August 2024 in those patients who overcame the infection (July 2020 to December 2022).To assess the presence and severity of olfactory-gustatory dysfunction (OGD), item 22 of the Sino-Nasal Outcome Test-22 (SNOT-22) questionnaire was used. This instrument, consisting of 22 items, has been translated into and validated in Spanish within the Chilean population. Although the full questionnaire is designed to assess the impact of sinonasal disorders on Qol, only item 22 was used in this study, as it specifically evaluates alterations in smell and taste perception.This item captures both the presence and severity of OGD on an ordinal scale from 0 to 5: 0=no problem; 1=very mild problem; 2=mild problem; 3=moderate problem; 4=severe problem; 5=as bad as it can be (29).

Therefore, it can be concluded that the variable under analysis is qualitative with an ordinal scale.

Additionally, the time elapsed from medical discharge due to COVID-19 to the date of questionnaire administration was recorded, expressed in months, the range of which in the study population was from 19 to 48 months. This variable was considered relevant for multivariate analyses, because time can influence the persistence or recovery of olfactory-gustatory dysfunction.

The use of item 22 as a standalone measure has been supported by previous research. Boscolo *et al*. (30) used this approach in 2019 to assess the presence and severity of olfactory and/or gustatory dysfunction in post-COVID-19 patients. In 2023, the same author, along with a different research team, used the item again to classify self-reported OGD two years after acute-severe SARS-CoV-2 infection, comparing results with objective psychophysical testing (31). Additionally, Spinato *et al*. (32) applied item 22 of the SNOT-22 in 2020 to determine the prevalence and severity of smell and taste disturbances in outpatients with mild COVID-19 symptoms.

Regarding its psychometric properties, the Spanish version of the SNOT-22 has demonstrated high reliability. A study conducted in the Chilean population reported a Cronbach's alpha greater than 0.95, an intraclass correlation coefficient (ICC) of 0.986, and a Pearson correlation coefficient of 0.84 (29), supporting its clinical and research utility in measuring OGD-related symptoms.

ETHICAL CONSIDERATIONS

This study was conducted following the ethical principles outlined in the Declaration of Helsinki and was registered under protocol POS-53-2023-00342. The research proposal was reviewed and approved by the Institutional Research Ethics Committee of the Universidad Científica del Sur. Before data collection, all participants signed an informed consent form, ensuring confidentiality and anonymity of the collected data. Participation was voluntary, and the data were used exclusively for academic and scientific purposes.

STATISTICAL ANALYSIS

Categorical variables were described using absolute and relative frequencies (%). The Chi-square test was used to compare proportions between groups. Prevalence ratios (PR) with 95% confidence intervals (CI) were calculated, with a significance level set at 5% ($p<0.05$). Statistical analyses were performed using SPSS version 25 (IBM Corp., Armonk, NY, USA).

Subsequently, a Poisson regression model with robust variance was applied to identify socio-demographic, epidemiological, and clinical factors associated with OGD. Variables with significant

coefficients were included in the multivariate model, and adjusted prevalence ratios (aPR) with 95% CIs were calculated. A p-value<0.05 was considered statistically significant.

Additionally, the time elapsed since recovery from infection (in months) was included in the models as an adjustment covariate, given that this period was not homogeneous across patients (range: 19 to 48 months). This variable was considered continuous in the main analysis.

RESULTS

A total of 237 adult patients diagnosed with COVID-19 by molecular testing (RT-PCR) and treated at the Central Military Hospital (HMC) between July 2020 and December 2022 were included in the study. The median age was 50 years (interquartile range: 13), and 86.1% of participants were under 60 years of age. Regarding sex, the majority were male (80.6%), and 76.4% were from urban areas. As for personal habits, 24.5% of participants reported alcohol consumption, while tobacco use was reported by only 6.3%.

With respect to comorbidities, the most frequently reported condition was allergic rhinitis (13.1%), followed by hypertension (10.1%) and obesity (9.3%). Nevertheless, more than half of the patients (52.0%) reported having no comorbid conditions.

Concerning clinical characteristics related to SARS-CoV-2 infection, only 7.2% of patients required hospitalization, 8.4% received oxygen therapy, and 3.4% were admitted to an intensive care unit (ICU) (Table 1).

Among the 126 post-COVID-19 patients who reported olfactory-gustatory dysfunction (OGD), 6.3% experienced taste impairment only, while 12.7% reported isolated smell dysfunction. The majority (81.0%) experienced a combination of both dysfunctions.

Regarding perceived severity of OGD, 42.9% of patients rated it as a very mild problem, 24.6% as mild, and 18.3% as moderate. A smaller proportion reported it as severe (9.5%) or "as bad as it can be" (4.8%). These findings were self-reported by patients during the administration of item 22 from the SNOT-22 questionnaire.

Olfactory-gustatory dysfunction corresponds to the state reported by patients at the time of the questionnaire administration, demonstrating their current condition and not the one perceived during the acute phase of the infection (Table 2).

Bivariate analysis showed that patients younger than 60 years of age were 1.691 times more likely to present olfactory-gustatory dysfunction (OGD) compared to those 60 years of age or older (p=0.014). Therefore, beiging younger than 60 years of age significantly increased the prevalence of OGD in this population. Furthermore, female sex was associated with greater involvement: women were 1.355 times more likely to present OGD than men (p=0.031). In contrast, sociodemographic factors such as place of residence, alcohol or tobacco consumption, as well as a comorbidity history (allergic rhinitis, hypertension, obesity, diabetes, among others) did not show statistically significant associations. Similarly, clinical factors, such as hospitalization, use of oxygen therapy, or ICU admission, did not show relevant differences between the groups with and without OGD (Table 3).

The time elapsed since patients recovered from COVID-19 did not show statistically significant differences between those who presented olfactory-gustatory dysfunction and those who did not report it (p=0.115). In patients who presented olfactory-gustatory dysfunction, the median was

21 months (IQR: 19-33), while in those without the dysfunction, it was 22 months (IQR: 19-36). Therefore, the persistence of the dysfunction does not appear to directly depend on the time in months since discharge (Table 4).

Multivariate Poisson regression analysis showed that age and sex were factors significantly associated with OGD. Specifically, patients younger than 60 years had a 19% higher prevalence of OGD compared with those who had 60 years or older (aPR=1.194; 95% CI: 1.051-1.357; p=0.007). Similarly, females showed a 16% higher prevalence of OGDD compared with males (aPR=1.160; 95% CI: 1.045-1.288; p=0.005). Furthermore, a history of comorbidities different from those analyzed individually was associated with a 21% higher prevalence of DOG compared to those without that history (aPR=1.214; 95% CI: 1.023-1.441; p=0.027). In contrast, the remaining sociodemographic, epidemiological, and clinical factors evaluated, including the time since the disease was overcome, did not show a statistically significant relationship with OGD (Table 5).

Table 1. Sociodemographic, epidemiological, and clinical characteristics of post-COVID-19 patients treated at the Central Military Hospital (HMC) between July 2020 and December 2022.

Characteristics	N	%
Sociodemographic characteristics		
Place of residence		
Rural	56	23.6
Urban	181	76.4
Alcohol consumption		
Yes	58	24.5
No	179	75.5
Tobacco use		
Yes	15	6.3
No	222	93.7
Epidemiological characteristics		
Age (Me; IQR) *	50; (13)	
<60 years	204	86.1
≥60 years	33	13.9
Sex		
Female	46	19.4
Male	191	80.6
Comorbidity history		
Allergic rhinitis	31	13.1
Arterial hypertensión	24	10.1
Obesity	20	8.4
Diabetes mellitus	13	5.5
Heart disease	4	1.7
Asthma	3	1.3
Knee chondromalacia	3	1.3
Gastritis	2	0.8
Overweight	2	0.8
Nasal trauma	2	0.8
Tinnitus	2	0.8
Others**	8	3.4
None	123	52.0
Clinical characteristics		
Previous hospitalization for COVID-19		
Yes	17	7.2
No	220	92.8
Use of oxygen therapy		
Yes	20	8.4
No	217	91.6
ICU admission		
Yes	8	3.4
No	229	96.6

* Me: Median/ IQR: Interquartile Range.
Source : Authors' elaboration based on data collected from the Central Military Hospital (CMH).

Table 2. Type and severity of olfactory-gustatory dysfunction (OGD) in post-COVID-19 patients treated at the Central Military Hospital (HMC) between July 2020 and December 2022.

OGD Type	**N**	**%**
Taste alteration only	8	6.3
Smell alteration only	16	12.7
Both taste and smell	102	81.0
Total	126	100.0
Severity of OGD (self-reported)	**N**	**%**
Very mild problem	54	42.9
Mild problem	31	24.6
Moderate problem	23	18.3
Severe problem	12	9.5
As bad as it can be	6	4.8
Total	126	100.0

Source: Authors' elaboration based on data collected from the Central Military Hospital (CMH).

Table 3. Association between sociodemographic, epidemiological, and clinical factors and the presence of olfactory-gustatory dysfunction (OGD) in post-COVID-19 patients treated at the Central Military Hospital (HMC) between July 2020 and December 2022.

Factors	**DOG**				**p***	**RP**	**IC (95%)**
	Si		**No**				
	N	**%**	**N**	**%**			
Sociodemographic factors							
Place of residence							
Rural	33	26.2	23	20.7	0.323	1.147	0.884 - 1.488
Urban	93	73.8	88	79.3	Ref.		
Alcohol consumption							
Yes	33	26.2	25	22.5	0.512	1.095	0.840 - 1.427
No	93	73.8	86	77.5	Ref.		
Tobacco use							
Yes	8	6.3	7	6.3	0.989	1.003	0.615 - 1.637
No	118	93.7	104	93.7	Ref.		
Epidemiological factors							
Age							
<60 years	115	91.3%	89	80.2%	0.014	1.691	1.028 - 2.781
≥60 years	11	8.7%	22	19.8%	Ref.		
Sex							
Female	31	24.6%	15	13.5%	0.031	1.355	1.059 - 1.734
Male	95	75.4%	96	86.5%	Ref.		

Factors	DOG				p*	RP	IC (95%)
	Si		No				
	N	%	N	%			
Comorbidity history							
Allergic rhinitis	19	15.1%	12	10.8%	0.331	1.18	0.866 - 1.607
Arterial hypertensión	12	9.5%	12	10.8%	0.743	0.934	0.614 - 1.421
Obesity	8	6.3%	12	10.8%	0.447	0.842	0.524 - 1.354
Diabetes mellitus	5	4.0%	8	7.2%	0.274	0.712	0.354 - 1.431
Heart disease	3	2.4%	1	0.9%	0.377	1.421	0.797 - 2.534
Asthma	0	0.0%	2	1.8%	-		
Knee chondromalacia	2	1.6%	1	0.9%	0.637	1.147	0.67 - 1.962
Gastritis	3	2.4%	0	0.0%	-		
Overweight	2	1.6%	0	0.0%	-		
Nasal trauma	2	1.6%	0	0.0%	-		
Tinnitus	2	1.6%	0	0.0%	-		
Others	5	4.0%	3	2.7%	0.590	1.183	0.682 - 2.051
None	63	50.0%	60	54.1%	Ref.		
Clinical factors							
Previous hospitalization for COVID-19							
Yes	9	7.1	8	7.2	0.985	0.995	0.625 - 1.585
No	117	92.9%	103	92.8	Ref.		
Use of oxygen therapy							
Yes	13	10.3	7	6.3	0.268	1.248	0.883 - 1.764
No	113	89.7	104	93.7	Ref.		
ICU admission							
Yes	3	2.4	5	4.5	0.366	0.698	0.283 - 1.722
No	123	97.6	106	95.5	Ref.		

* Chi cuadrado (p-valor<0.05 significant. PR: Prevalence Ratio, CI (95%): Confidence Interval for PR at 95%.
Source: Authors' elaboration based on data collected from the Central Military Hospital (CMH).

Table 4. Time elapsed since overcoming the disease y OGD in post COVID-19 patients treated at HMC, between July 2020 to december 2022.

	Olfactory-gustatory dysfunction		p*
	Yes	No	
	Me (IQR)	Me (IQR)	
Time elapsed since overcoming the disease (months)	21 (19-33)	22 (19-36)	0.115

* U de Mann Whitney (p-value<0.05 significant).

Table 5. Multivariate Poisson regression analysis of factors associated with olfactory-gustatory dysfunction (OGD) in post-COVID-19 patients treated at the Central Military Hospital (HMC) between July 2020 and December 2022.

				IC95% para RPa	
Factors	**B**	**p-valor**	**RPa**	**Inferior**	**Superior**
Sociodemographic factors					
Place of residence	0.042	0.417	1.043	0.942	1.154
Alcohol consumption	0.032	0.544	1.033	0.931	1.146
Tobacco use	0.004	0.971	1.004	0.828	1.216
Epidemiological factors					
Age < 60 years	0.177	0.007	1.194	1.051	1.357
Sex female	0.149	0.005	1.160	1.045	1.288
Comorbidity history					
Allergic rhinitis	0.093	0.148	1.098	0.967	1.246
Hypertension	0.093	0.270	1.097	0.930	1.295
Diabetes mellitus	-0.032	0.731	0.969	0.808	1.161
Obesity	-0.060	0.436	0.942	0.810	1.095
Heart disease	0.203	0.061	1.226	0.991	1.516
Others	0.194	0.027	1.214	1.023	1.441
Clinical factors					
Previous Hospitalization for COVID-19	-0.045	0.591	0.956	0.810	1.128
Use of oxygen therapy	0.121	0.167	1.129	0.951	1.340
ICU admission	-0.131	0.241	0.877	0.705	1.092
Time since overcoming disease	0.004	0.070	1.004	1.000	1.009

B=regression coefficient; aPR = adjusted prevalence ratio; CI = confidence interval.
Source: Authors' elaboration based on data collected from the Central Military Hospital (CMH).

DISCUSSION

This study aimed to determine the association between sociodemographic, epidemiological, and clinical factors and olfactory-gustatory dysfunction (OGD) in post-COVID-19 patients treated at a referral hospital in Peru.

More than half of the patients evaluated (53.2%) experienced some degree of OGD following SARS-CoV-2 infection. This high prevalence may be attributed to the virus's capacity to cause direct damage to olfactory receptor neurons and its neuroinvasive potential, particularly through the olfactory nerve and into the frontal lobe. This route of entry may lead to persistent neurosensory alterations, affecting not only the sense of smell but also, indirectly, the sense of taste, as the perception of complex flavors partially depends on olfactory input (33).

Our findings are comparable to those reported by Callejón-Leblic *et al*. (34), who found that 45.1% of patients experienced smell and taste loss 12 months after COVID-19 infection. However, other studies, such as Boscolo *et al*. (30), reported a lower frequency (21.3%) over the same period. This discrepancy could be attributed to differences

in assessment methods; in Boscolo's study, only self-reported data were used, with no objective psychophysical testing, potentially underestimating true prevalence.

In our study, no statistically significant association was found between sociodemographic factors (residence, alcohol, and tobacco use) and the presence of OGD (p>0.05). Nonetheless, slight differences were observed in the frequency of OGD among patients from rural areas (26.2% *vs*. 20.7%), those who consumed alcohol (26.2% *vs*. 22.5%), and smokers (8 vs. 7 cases), compared to those without OGD.

The lack of statistical significance may be explained by the limited direct influence of these factors on the immune system, as the chemosensory sequelae of COVID-19 appear to be more closely linked to the virus's ability to invade sensory nerve endings, especially when the immune system is compromised during the acute phase of infection (35).

A study in Malaysia compared the characteristics of cases with and without SARS-CoV-2, identifying an association between ageusia and anosmia with COVID-19 (36). Bussière *et al*. (37) in 2021, showed that after three to seven months, reduced olfactory and gustatory sensitivity was reported in post-COVID-19 patients (52.0% and 41.9%, respectively).

In line with these findings, Boscolo *et al*. (30) also found no association between smoking or alcohol use and the persistence of OGD in post-COVID-19 patients. Similarly, Hennawi *et al*. (38) concluded that although these habits were not direct risk factors, tobacco use was associated with prolonged ageusia (p=0.001), possibly due to the damaging effects of smoke on taste buds and oral mucosa.

In contrast, an association was found between epidemiological factors and GOD; specifically, it was found that patients under 60 years of age (91.3% *vs* 80.2%, RPa=1.194, p=0.007), female (24.6% *vs* 13.5%, RPa=1.160, p=0.005) and with "other" comorbidities (4% *vs* 2.7%, RPa=1.214, p=0.027) had a higher prevalence of presenting GOD. One possible explanation is that younger and middle-aged adults have better access to healthcare and tend to report their symptoms more accurately, particularly women, who are often more attuned to bodily sensations and sensory changes (39).

These results are partially consistent with the findings of Hennawi *et al.* (38), who reported a significant association between younger age and the duration of anosmia (p=0.0025), although no such association was found for ageusia (p=0.668). This difference may be due to the greater regenerative capacity and sensitivity of taste buds at younger ages, influenced by hormonal factors such as estrogen and androgens. Algahtani *et al*. (40) found that younger adults-particularly those aged 20-29 (43.2%) and 30-39 (23.4%)-were more likely to experience persistent anosmia (p=0.016), while persistent ageusia was significantly more common in women (69% *vs*. 49.9%, p=0.0001).

Other studies have also documented the persistence of OGD in post-COVID-19 patients. Boscolo *et al*. (30) reported a prevalence of 21.3% at 12 months post-infection, with a higher risk of persistent symptoms in those who required ≥22 days to obtain a negative swab (OR=2.18; 95% CI: 1.12-4.27) and those with severe OGD (OR=3.32; 95% CI: 1.32-8.36), as measured by item 22 of the SNOT-22 (score≥4). In the Peruvian context,

Dextre-Vílchez *et al*. (41) reported a prevalence of anosmia and ageusia of 22.2% and 19.9%, respectively, in a sample of 356 COVID-19 patients.

Regarding comorbidities, this study found no significant association with the presence of OGD, consistent with findings from Chen *et al*. (42). Although certain conditions such as hypertension, pulmonary disease, sinus problems, and neurological disorders were associated with greater sensory loss during the acute phase of the disease, no significant differences were observed in the recovery of smell or taste during the post-COVID-19 period. However, patients with seasonal allergies or allergic rhinitis experienced slower recovery of both senses (13.66 *vs*. 7.67 days; $p<0.001$ and 11.93 *vs*. 6.23 days; $p<0.001$, respectively), suggesting that chronic inflammatory conditions may impair the sensory regeneration process.

Although a significant association was identified between age younger than 60 years, female sex, and the presence of other comorbidities with OGD, these findings should be interpreted with caution. In particular, the small number of patients in some subgroups, such as those older than 60 years or those with "other" comorbidities, limits the validity of the comparison and may magnify the observed statistical effect. Despite this, the results are consistent with previous literature, reinforcing the plausibility of these associations.

Regarding clinical factors, no statistically significant differences were found between patients with and without OGD ($p>0.05$). However, slightly higher proportions of OGD were observed among those who had previously been hospitalized for COVID-19 (9 *vs*. 8 cases) and those who required oxygen therapy (13 *vs*. 7 cases), which may suggest that more severe clinical presentations tend to result in greater neurosensory sequelae. In contrast, ICU admission was more frequent in the non-OGD group (5 *vs*. 3 cases), suggesting that disease severity does not always correlate with long-term sensory dysfunction.

These findings are comparable to those reported by Hennawi *et al*. (38), who also found no significant associations between ICU admission and olfactory dysfunction ($p=0.35$), nor between hospitalization and gustatory dysfunction ($p=0.131$). However, they did report significant associations between hospitalization and olfactory dysfunction ($p=0.032$), ICU admission and gustatory dysfunction ($p=0.026$), as well as between the need for oxygen and the presence of OGD ($p<0.05$). The authors recommended conducting studies based on objective testing, rather than relying solely on self-reported data, to validate the implicated factors.

From a clinical standpoint, identifying factors associated with OGD in post-COVID-19 patients is crucial for a comprehensive dental care approach. This sensory alteration may increase the risk of oral diseases such as dental caries, gingivitis, periodontitis, and dental erosion due to changes in dietary habits, including a preference for sweet, processed, or acidic foods. Additionally, the loss of taste can lead to decreased appetite, compromising the intake of essential nutrients for oral health, such as calcium and vitamins D, C, A, and K, among others. Some patients even report that toothpaste tastes different or unpleasant, which may reduce both the frequency and quality of toothbrushing, as well as adherence to regular dental check-ups.

Finally, this study has some methodological limitations. As a retrospective study, it was not possible to control for exposure or outcomes, relying exclusively on clinical records and patient self-reporting of symptoms, which introduces recall bias. Furthermore, since the study was conducted in a single institution (Central Military Hospital), the results cannot be generalized to other popula-

tions. Multicenter studies with larger sample sizes and longitudinal follow-up are recommended, incorporating objective psychophysical tools to validate the findings observed. Likewise, a significant limitation of the study was the low number of patients in certain subgroups, such as adults over 60 years of age and those with a history classified as "other," which limits the ability to definitively establish the clinical relevance of the detected associations. However, this situation does not invalidate the findings; rather, it suggests the need for studies with larger sample sizes and a balanced distribution of categories to confirm the results.

CONCLUSIONS

More than half of the adult post-COVID-19 patients treated at a Peruvian hospital between July 2020 and December 2022 presented with olfactory-gustatory dysfunction (OGD). A significant association was found between sociodemographic factors-being under 60 years of age, female sex, having a certain history of comorbidities and a higher prevalence of OGD in this population.

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