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Understanding COVID-19 Pandemic, Impaired Smelling (anosmia) Incidence and Outcome among Patients in Dubai: Retrospective Study

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ABSTRACT

The onset of anosmia, or temporary loss of smell, has emerged as a prominent neurological manifestation and an early indicator of COVID-19 infection. This retrospective study, conducted by the Dubai Health Authority (DHA) staff at the DHA COVID-19 Command & Control Center in Dubai – UAE, from May to July 2020, aimed to investigate the prevalence and characteristics of anosmia in COVID-19 patients. A total of 1075 patients were enrolled in the study, comprising 878 males (81.4%) and 201 females (18.6%). The median age ranged from 31 to 40 years. Patients with anosmia were compared to those without, with a particular focus on gender disparities and associated comorbidities, including diabetes, hypertension, heart disease, lung disease, and thyroid disease. The study found that 22% of COVID-19 patients presented with anosmia, the initial symptom in 47% of cases. Notably, 95% of patients experiencing anosmia recovered within two months. While there was no significant correlation between anosmia and comorbidities, such as diabetes, hypertension, heart disease, lung disease, and thyroid disease, there was also no association observed between anosmia and other common COVID-19 symptoms, such as fever, cough, shortness of breath, and diarrhoea. Anosmia, occurring in approximately 22% of COVID-19 cases, is a noteworthy early indicator of the infection. Despite its prevalence, anosmia has no significant correlation with comorbidities or other symptomatic manifestations of COVID-19, which underscores the importance of recognising anosmia as a distinct clinical feature in diagnosing and managing COVID-19.

INTRODUCTION

The COVID-19 pandemic, stemming from the novel coronavirus (SARS-CoV-2), has presented an unprecedented global health crisis since its emergence in December 2019. Alongside its well-documented respiratory manifestations, COVID-19 has exhibited a spectrum of symptoms, ranging from mild to severe, with some patients experiencing atypical presentations. Among these symptoms, anosmia, or the temporary loss of smell, has emerged as a distinctive feature, prompting further investigation into its prevalence, pathophysiology, and clinical implications (Pollard *et al.*, 2020).

Anosmia following viral infections, often called post-viral olfactory loss, has been recognised in various viral illnesses, including influenza and coronaviruses such as HCoV-229E. In COVID-19, anosmia has gained considerable attention due to its frequency and potential diagnostic utility (Rebholz *et al.*, 2020). Previous literature has suggested that anosmia may precede other hallmark symptoms of COVID-19, such as fever and cough, and may persist as the sole manifestation of the disease in some individuals; this unique association underscores the importance of understanding the mechanisms underlying anosmia in COVID-19 patients (Daher *et al.*, 2020).

Recent investigations have shed light on potential mechanisms contributing to anosmia in COVID-19. Notably, the presence of angiotensin-converting enzyme 2 (ACE2) receptors in nasal epithelial cells has been implicated in facilitating viral entry and replication (Beyerstedt *et al.*, 2021). The nasal cavity serves as an accessible site for viral invasion, raising questions about the direct effects of SARS-CoV-2 on olfactory neurons and supporting cells. Additionally, the inflammatory response triggered by viral infection may contribute to olfactory dysfunction through mechanisms such as neuroinflammation and cytokine release (Othman *et al.*, 2022).

Moreover, emerging evidence suggests that the pathophysiology of anosmia in COVID-19 may differ from that of other viral etiologies. Unlike anosmia caused by viruses that directly damage the neural epithelium, such as certain coronaviruses, COVID-19-induced anosmia appears to exhibit a more transient course, with many patients experiencing spontaneous recovery within weeks. This distinction underscores the need for further research to elucidate the mechanisms underlying anosmia in COVID-19 and its implications for disease prognosis and management (Butowt & von Bartheld, 2021).

This study aims to investigate the incidence, prevalence, and outcomes of anosmia among patients diagnosed with COVID-19 in Dubai, UAE. Additionally, the study seeks to establish the time of onset and duration of symptoms related to the loss of smell and taste in COVID-19 patients. By examining these factors, the study aims to contribute to a deeper understanding of the clinical presentation and course of COVID-19 in the context of anosmia, thereby informing diagnostic and management strategies for affected individuals in Dubai and potentially beyond.

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Anosmia, defined as the temporary or permanent loss of smell, has emerged as a distinctive symptom of COVID-19 caused by the novel coronavirus, SARS-CoV-2. This phenomenon has garnered significant attention due to its high prevalence and potential diagnostic value in identifying COVID-19 cases (Ahmed *et al.*, 2022). Understanding the epidemiology, pathophysiology, and clinical implications of anosmia in COVID-19 is crucial for effective disease management and control efforts.

Anosmia has been reported as one of the earliest and most common symptoms of COVID-19, often occurring before the onset of other respiratory symptoms (Aanand *et al.*, 2022). A study by Altundağ *et al.* (2020) has indicated that anosmia may affect up to 80% of COVID-19 patients with varying degrees of severity (Altundag *et al.*, 2021). The prevalence of anosmia appears to run across different populations and geographic regions, highlighting the need for comprehensive epidemiological studies to elucidate its global burden.

Anosmia has been proposed as a potential predictor of COVID-19 infection, prompting individuals to seek testing and medical care. Several studies have suggested that anosmia may precede the onset of other symptoms, such as fever and cough, making it a valuable clinical marker for early detection of COVID-19 cases (Avcı *et al.*, 2020; Talavera *et al.*, 2020). Including anosmia in COVID-19 screening protocols has been advocated to improve case identification and facilitate timely intervention.

The underlying mechanisms of anosmia in COVID-19 are not fully understood but are thought to involve viral-induced damage to the olfactory epithelium. SARS-CoV-2 has been shown to infect cells expressing angiotensin-converting enzyme 2 (ACE2) receptors, which are abundant in the nasal cavity (de Melo *et al.*, 2021). Viral invasion of nasal epithelial cells may lead to inflammation, neuronal injury, and disruption of olfactory signalling pathways, resulting in anosmia. However, the exact pathophysiological mechanisms require further investigation.

In several aspects, Anosmia in COVID-19 appears to differ from anosmia caused by other viral infections. Unlike some viruses that directly damage neural epithelium, such as certain strains of coronaviruses, COVID-19-induced anosmia is characterised by a relatively rapid onset and recovery (Glezer *et al.*, 2021). Additionally, COVID-19 patients frequently report anosmia without accompanying nasal congestion or obstruction, distinguishing it from other causes of olfactory dysfunction.

Anosmia in COVID-19 patients has been associated with distinct clinical features and outcomes. Studies have indicated that COVID-19-induced anosmia tends to resolve spontaneously within a few weeks to months in most cases (Talavera *et al.*, 2020). However, the duration of anosmia can vary widely among individuals, with some patients experiencing persistent or recurrent symptoms. Despite its transient nature, anosmia can significantly impact quality of life and may contribute to long-term sequelae in some cases.

Recognising anosmia as a prominent symptom of COVID-19 has important implications for disease management and control efforts. Anosmia should be considered in the clinical evaluation of suspected COVID-19 cases, particularly in the absence of other respiratory symptoms. Early detection of anosmia can facilitate prompt isolation, testing, and contact tracing, helping to limit the spread of the virus within communities (Shamsundara & Jayalakshmi, 2023). Moreover, including anosmia in COVID-19 screening protocols may improve the accuracy of case identification and enhance the effectiveness of public health interventions.

MATERIALS AND METHODS

Study Setting

This retrospective study was conducted at the Covid-19 Command & Control Center (CCC) under the auspices of the Dubai Health Authority (DHA) in Dubai, United Arab Emirates (UAE). The study period spanned from May to July 2020.

Sample Size and Data Source

The study included 1079 cases, and data were retrieved from patient records stored in the DHA's digital files system, SALAMA: Electronic Files System.

Exclusion Criteria

Patients were excluded from the study if they met any of the following criteria: individuals below 18 years old or above 60 years old, pregnant women, immunocompromised patients receiving immune suppressive medications, patients with physical disabilities, individuals managed by healthcare institutes other than the CCC, patients residing outside the emirate of Dubai, and those with mental or psychological disorders. Patients already admitted to the hospital via the emergency department were also excluded.

Data Collection

A standardised investigation tool was utilised for data collection, encompassing various parameters such as age, smoking status, body mass index (BMI), presence of comorbidities, symptoms, presence of local nasal pathology, presence of loss of taste, onset of loss of smell, and duration of loss of smell.

Study Execution

The study was conducted by DHA staff members stationed at the DHA COVID-19 Command & Control Center in Dubai, UAE. Data collection was facilitated through telephonic encounters with the study participants. The study sample was randomly selected to ensure patient confidentiality, and no personal identifying information was included in the study dataset. Verbal consent was obtained from all participants before data collection, per ethical guidelines.

Statistical Analysis

Data analysis was performed using appropriate statistical methods, including descriptive statistics, to summarise the demographic and clinical characteristics of the study population. If deemed appropriate, inferential statistics may be employed to assess associations between variables.

Ethical Considerations

All procedures were conducted according to ethical principles outlined in the Declaration of Helsinki and other applicable guidelines. Patient confidentiality and privacy were strictly maintained throughout the study. Informed consent was obtained from participants.

RESULTS

All variables, including the percentage, correlation, coefficient of determination, and p-value, were evaluated using SPSS after all data had been analysed using standard descriptive statistics. A total of 1079 patients—878 males (81.3%) and 201 females (18.7%)—were included in the study as positive cases.

The correlation coefficients observed in the analysis exhibit a negligible magnitude, with values approaching zero, indicating an absence of substantial linear relationships between the variables under scrutiny. Concurrently, the determination coefficients, indicative of the proportion of variability in one variable that another can explain, approach insignificance. However, the confidence level exceeds 99%, underscoring a high degree of reliability in the findings. Moreover, the p-values, which signify the probability of obtaining results as extreme as those observed, are consistently greater than 0.05 across all analysed factors. These collective findings suggest that variables such as gender, smoking habits, diabetes, hypertension, lung disease, heart disease, thyroid disorders, malignancy, and pregnancy are associated with the loss of olfactory function, as elucidated in Table 1.

Table 1: Correlation between loss of smell and comorbidities

		Frequency (Percent)	Frequency Loss of Smell (Percent)	Correlation R	Coefficient of Determination R Square	P value.
Gender	Male	878 (81.4)	177 (20.2)	X2 (3, N = 126) = 10.1, p = .017.	.015	.000
	Female	201 (18.6)	67 (33.3)			
Smoking	NO	928 (86.0)	211 (22.7)	.007	.000	.810
	YES	151 (14.0)	33 (21.9)			
Diabetes	NO	1013 (93.9)	228 (22.5)	.010[a]	.000	.744
	YES	66 (6.1)	16 (24.2)			
Hypertension	NO	986 (91.4)	223 (22.6)	.000	.000	.994
	YES	93 (8.6)	21 (22.6)			
Lung Disease	NO	1068 (99.0)	240 (22.5)	.033	.001	.274
	YES	11 (1.0)	4 (36.4)			
Heart Disease	NO	1067 (98.9)	242 (22.7)	.015	.000	.621
	YES	12 (1.1)	2 (16.7)			
Thyroid Disease	NO	1058 (98.1)	240 (22.7)	.012	.000	.694
	YES	21 (1.9)	4 (19.9)			
Malignancy	NO	1075 (99.6)	241 (22.4)	.076	.006	.012
	YES	4 (.4)	3(75)			
Pregnancy	NO	1074 (99.5)	241 (22.4)	.061	.004	.045
	YES	5 (.5)	3 (60)			

The observation regarding loss of taste is noteworthy that a correlation coefficient of 0.584 and a determination coefficient of 0.341 were observed in the context of loss of taste and loss of smell, suggesting a potential association of these symptoms with approximately 34.1% of COVID-19 cases. Despite these coefficients indicating a moderate relationship, they denote a modest explanatory power regarding the variability observed. Furthermore, the confidence level exceeds 99%, indicating a high degree of certainty in the observed results. Importantly, all p-values associated with the analysed variables are below 0.05, underscoring their statistical significance, as shown in Table 2.

Table 2: Correlation between loss of smell and other COVID symptoms

		Frequency (Percent)	Frequency Loss of Smell (Percent)	Correlation R	Coefficient of Determination R Square	P value.
Asymptomatic	NO	598 (55.4)	198 (33.1)	.280	.078	.000
	YES	481 (44.6)	46 (9.6)			
Loss of Taste	NO	831 (77.0)	77 (9.3)	.584	.341	.000
	YES	248 (23.0)	167 (67.3)			
Sore Throat	NO	937 (86.8)	185 (19.7)	.176	.031	.000
	YES	142 (13.2)	59 (41.5)			
Fever	NO	721 (66.8)	100 (13.9)	.297	.088	.000
	YES	358 (33.2)	144 (30.2)			
Cough	NO	790 (73.2)	138 (17.5)	.203	.041	.000
	YES	289 (26.8)	106 (36.7)			
Difficult Breathing	NO	981 (90.9)	208 (21.2)	.107	.011	.000
	YES	98 (9.1)	36 (36.7			
Diarrhea	NO	990 (91.8)	204 (20.6)	.160[a]	.026	.000
	YES	89 (8.2)	40 (45)			

In examining age groups, no discernible discrepancies in percentages were observed. The correlation coefficient, approaching insignificance, and a determination coefficient close to zero suggest a negligible association between age and the incidence of loss of smell, with a confidence level exceeding 99% and a p-value of 0.924, as outlined in Table 3.

Nearly all patients who reported experiencing loss of smell subsequently recovered, constituting approximately 95% of cases. Additionally, it is observed that about 47% of patients identified loss of smell as their initial symptom of COVID-19, as depicted in Table 4.

Table 5 displays the distribution of durations in days associated with loss of smell among the study population. Varied durations are evident, with a majority experiencing symptoms for shorter periods. Notably, the highest frequency occurs within the seven-day range, constituting 3.7% of cases, as depicted in Table 5.

Table 3: Distribution of patients according to age groups

		Frequency (Percent)	Frequency Loss of Smell (Percent)	Correlation R	Coefficient of Determination R squire	P value Sig.
Age	from 1 to 10	4 (.4)	0 (0)	.003	.000	.924
	from 11 to 20	21 (1.9)	5 (23.8)			
	from 21 to 30	337 (31.2)	78 (23.2)			
	from 31 to 40	441 (40.9)	97 (22)			
	from 41 to 50	192 (17.8)	45 (23.4)			
	from 51 to 60	72 (6.7)	17 (23.4)			
	more 60	12 (1.1)	2 (16.7)			

Table 4: loss of smell and other parameters before swab, before other symptoms and outcomes

	Loss of Smell	Frequency (Percent)
Swab Test	Before	133 (54.5)
	After	111 (45.5)
Other Symptoms	NO	34 (14.3)
	Before	114 (47.9)
	After	90 (37.8)
The outcome of Loss of Smell	Cured	233 (95.5)
	Impaired	11 (4.5)

Table 5: Loss of smell and duration

Days	Frequency (Percent)
1.00	3 (.3)
2.00	15 (1.4)
3.00	30 (2.8)
4.00	27 (2.5)
5.00	37 (3.4)
6.00	8 (.7)
7.00	40 (3.7)
8.00	11 (1.0)
9.00	4 (.4)
10.00	21 (1).9
11.00	1 (.1)
12.00	5 (.5)
13.00	1 (.1)
14.00	15 (1.4)
15.00	4 (.4)
16.00	1 (.1)
17.00	1 (.1)
20.00	5 (.5)
21.00	1 (.1)
25.00	1 (.1)
30.00	4 (.4)
49.00	1 (.1)
60.00	2 (.2)

DISCUSSION

The global spread of COVID-19 has presented a spectrum of manifestations ranging from mild flu-like symptoms to severe pneumonia. Notably, alterations in olfactory and gustatory senses have emerged as prominent indicators of infection with the novel coronavirus. This assertion is substantiated by the prevalence of anosmia and ageusia exceeding 22% among COVID-19 patients (Mastrangelo *et al.*, 2021). However, while these sensory changes serve as crucial diagnostic markers, the precise onset and duration of such symptoms remain to be definitively established. Comprehensive quantification of loss of smell and taste and a clear understanding of their temporal relationship with COVID-19 holds significant promise in facilitating early diagnosis, thus mitigating further transmission and potential complications associated with the disease. In our study encompassing 1075 patients, males constituted the majority at 81.4%, with females comprising 18.6% of the cohort. The median age fell within the 31 to 40-year range. Notably, individuals experiencing loss of smell tended to be younger than those without this symptom.

Furthermore, our findings indicate that 33.3% of female and 20% of male cases reported insomnia. Interestingly, nearly half of the patients (47.3%) noted the onset of anosmia preceding other COVID-19 symptoms, while 14.3% experienced it concurrently with different manifestations, and 37.8% reported its occurrence after other symptoms. Additionally, a notable proportion (9.6%) of individuals reported anosmia as their sole symptom associated with COVID-19. These findings collectively underscore the importance of recognising and understanding the temporal dynamics of olfactory and gustatory dysfunctions in COVID-19, thereby aiding in more effective disease management and control efforts.

In our investigation, we examined the correlation coefficients, determination coefficients (R square), and significance levels, alongside percentages, about several variables, including smoking, diabetes, hypertension, heart disease, lung disease, thyroid disease, malignancy, and anosmia among COVID-19 patients. Additionally, we explored the potential associations between other symptoms—sore throat, fever, cough, difficulty breathing, and diarrhoea—and anosmia. Despite the importance of comorbidities in predicting disease severity, our study did not reveal significant correlations between COVID-19 and various factors, including age, gender, smoking, heart disease, diabetes, hypertension, lung disease, thyroid disease, and malignancy. Notably, while some associations were observed, such as between loss of smell and taste, the overall correlations between anosmia and other symptoms were weak. For instance, the correlation and determination coefficients for sore throat, fever, cough, difficulty breathing, and diarrhoea were modest. These findings underscore the need for further research to comprehensively elucidate the relationship between anosmia and COVID-19 symptoms, especially regarding disease prognosis and management.

In our analysis of the asymptomatic group, we observed that 33.1% of patients exhibited anosmia, albeit with a coefficient factor of 0.280 and R square of 0.07, indicating that 7.8% of asymptomatic individuals experienced this symptom, based on a robust sample size of 481 patients, which suggests that anosmia may be overlooked compared to more severe symptoms, such as breathing difficulty and fever, as patients and healthcare workers tend to prioritise these more acute manifestations. Regarding the duration of anosmia, the median range spanned 3 to 10 days, with 95% of patients (233 individuals) reporting recovery by the study's conclusion. However, 5% of patients (11 individuals) had yet to recover, warranting further investigation and follow-up. Importantly, we investigated whether anosmia preceded or followed other symptoms, finding that 47% of cases occurred before other symptoms, 37% after, and 14.3% concurrently. This distinction may aid healthcare workers in predicting diagnoses and curbing infection transmission.

Our study aligns with the study of Hopkins *et al.* (2020), which comprised 2428 male and female adults, predominantly women (73%) and individuals under 40 (64%) (Hopkins *et al.*, 2020). The study, conducted in London, UK, reported varying onset times for anosmia, with 13% occurring before other symptoms, 38.4% simultaneously, and 48.6% after. Symptoms persisted for

1 to 4 weeks, showing significant improvement within the initial 2 weeks. A majority (74.4%) experienced a complete loss of smell, while 17.3% reported severe loss. Notably, 90% noted a reduction in taste, but 61% could still discern basic flavours. Additionally, 17% said no other COVID-19 symptoms, while cough or fever was prevalent in 51% of cases with additional symptoms. In our study of 1075 patients, with a male predominance (81.4%), the median age ranged from 31 to 40 years. Anosmia was more common in younger patients, and insomnia was noted in 33.3% of females and 20% of males. Similarly, anosmia onset varied, with 47.3% preceding other symptoms, 14.3% concurrent, and 37.8% subsequent, with 9.6% reporting no other associated symptoms.

Comparing our study with Spinato *et al.* (2020), which included 202 male and female adults with an average age of 56 years in Italy, notable similarities and differences emerge (Spinato *et al.*, 2020). In both studies, anosmia or loss of taste exhibited varied onset times relative to other symptoms, with comparable proportions reported before, during, and after other manifestations. Specifically, 11.9% experienced symptoms before, 22.8% concurrently, and 26.7% afterwards, with 3.0% presenting with anosmia or loss of taste as the sole symptom. In our study of 1075 patients, predominantly male (81.4%), similar patterns were observed, with 47.3% experiencing anosmia before other symptoms, 14.3% concurrently, and 37.8% afterwards, with 9.6% reporting no other associated symptoms. Notably, our findings diverge in the presence of nasal obstruction, as reported by 34.6% of individuals with altered sense of smell or taste in Spinato *et al.* In contrast, our study did not find a correlation with insomnia. Furthermore, our study encompassed a larger sample size and investigated the impact of comorbidities, which needed to be explored in previous research.

Compared to Lechien *et al.* (2020)a, which involved 1420 individuals aged over 15 years, male and female, our study presents notable similarities and distinctions (Lechien, Chiesa-Estomba, Place, *et al.*, 2020). While our research focused on a specific demographic, encompassing 1075 patients, predominantly males (81.4%), Lechien *et al.* (2020) examined a larger cohort with a more balanced gender distribution (458 men and 962 women) and a slightly older average age of 39.17 years. Furthermore, their multicenter European study, conducted across various regions, including France, Italy, Spain, Belgium, and Switzerland, provided a broader geographical perspective compared to our single-centre investigation. Interestingly, both studies highlighted the prolonged duration of symptoms among COVID-19 patients, with Lechien *et al.* reporting an average duration of 11.5 ± 5.7 days for mild to moderate cases and noting that loss of smell persisted for at least 7 days post-recovery in 37.5% of patients, mirroring findings in our study. These similarities underscore the consistency of observations regarding the persistence of anosmia in COVID-19 patients across different populations and settings (Lechien, Chiesa-Estomba, Place, *et al.*, 2020).

The prevalence of loss of smell appeared higher among women, with younger patients exhibiting a greater propensity for this symptom, as observed in our study of 1075 patients in Dubai compared to a multicenter study in Europe by Lechien *et al.* (2020)b, while our research indicated that 70.2% of individuals experience loss of smell and 54.2% experience loss of taste, the European research reported different percentages. In our cohort, comprising 81.4% males and 18.6% females with a median age of 31 to 40, anosmia was more common among younger patients. Notably, 47.3% of our patients reported anosmia preceding other symptoms, 14.3% occurring concurrently, and 37.8% following, with 9.6% reporting no other associated symptoms. Although similarities were noted in age group findings, discrepancies emerged in the total percentage of individuals experiencing loss of smell, highlighting potential variations across different populations and settings (Lechien, Chiesa-Estomba, De Siati, *et al.*, 2020).

Comparing our study with Kaye *et al.* (2020), which comprised 237 adults with an average age of 39.6 years from various countries, including the United States, Mexico, Italy, and the United Kingdom, notable parallels and differences emerge. While both studies observed the onset of anosmia relative to COVID-19 diagnosis, with 73% experiencing anosmia before diagnosis in Kaye *et al.* and 47.3% reporting pre-diagnosis anosmia in our study, variations are evident in the timing of symptom improvement. Kaye *et al.* (2020) reported an average improvement time of 7.2 ± 3.2 days post-diagnosis, while our study did not provide specific data on symptom resolution. These findings highlight consistent trends in the onset of anosmia about COVID-19 diagnosis across different populations while emphasising potential differences in the duration of symptom resolution (Kaye *et al.*, 2020).

CONCLUSION

This study concludes that 22% of COVID-19 patients experience anosmia, or loss of smell, as the initial symptom. This symptom is transient and is not significantly correlated with comorbidities such as diabetes, hypertension, heart disease, lung disease, and thyroid disease. However, there is no correlation between anosmia and other common COVID-19 symptoms like fever, cough, shortness of breath, and diarrhoea. The study provides valuable insights into the temporal patterns of anosmia onset and resolution among COVID-19 patients and its association with other clinical features. Despite the absence of strong correlations with comorbidities or other symptoms, anosmia remains a significant early indicator of COVID-19 infection, underscoring its importance in the diagnostic process. Healthcare professionals can improve the identification and management of COVID-19 cases by recognising anosmia as a distinct clinical feature. Further research is needed to elucidate the underlying mechanisms of anosmia in COVID-19 and its implications for disease prognosis and management.

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