REVISTA CEFAC
SPEECH, LANGUAGE, HEARING SCIENCES AND EDUCATION JOURNAL
Rev. CEFAC. 2022;24(2):e9322 https://doi.org/10.1590/1982-0216/20222429322

Original articles

Anosmia and ageusia in people after COVID-19: an analysis between the type and length of hospital stay

Glória de Moraes Marchiori[1]
https://orcid.org/0000-0002-2987-1665
Braulio Henrique Magnani Branco[2]
https://orcid.org/0000-0002-4625-9128
Daiane de Almeida Ciquinato[3]
https://orcid.org/0000-0002-3280-7218
Aline Diniz Gehren[4]
https://orcid.org/0000-0002-1374-3490
Gabriel Henrique Carvalho[4]
https://orcid.org/0000-0002-3174-2491
Jayson Júnior Mesti[1]
https://orcid.org/0000-0003-4283-0590
Luciana Lozza de Moraes Marchiori[5]
https://orcid.org/0000-0002-9026-0468

[1] UniCesumar, Curso de Medicina, Maringá, Paraná, Brasil.
[2] UniCesumar, Programa de Doutorado em Promoção da Saúde, Grupo de Estudos GEFFEND, Laboratório Interdisciplinar de Intervenção em Promoção da Saúde - LIIPS/UNICESUMAR, Maringá, Paraná, Brasil.
[3] UniCesumar, Grupo de Estudos GEFFEND, Maringá, Paraná, Brasil.
[4] UniCesumar, Curso de Fonoaudiologia, Maringá, Paraná, Brasil.
[5] UniCesumar, Laboratório Interdisciplinar de Intervenção em Promoção da Saúde - LIIPS/UNICESUMAR, Grupo de estudos GEFFEND, Maringá, Paraná, Brasil.

Research support source: Fundação Araucária.

Conflict of interests: Nonexistent

Received on: June 22, 2022
Accepted on: November 9, 2022

Corresponding address:
Luciana Lozza de Moraes Marchiori
Laboratório Interdisciplinar de Intervenção em Promoção da Saúde (LIIPS/UNICESUMAR)
Avenida Guedner, 1610 - parte externa do bloco 7, ao lado da extensão do juizado - Jardim Aclimação
CEP: 87050-900 - Maringá, Paraná, Brasil
E-mail: lucianamarchiori@sercomtel.com.br

ABSTRACT

Purpose: to analyze the type and length of hospital stay in people who reported anosmia and ageusia after COVID-19.

Methods: a cross-sectional study with patients who were referred by the hospital after medical discharge. They answered a standardized in-person questionnaire on age, sex, anthropometry, need for hospitalization, anosmia, and ageusia. Nonparametric statistics were calculated to analyze the data. The Mann-Whitney and Kruskal-Wallis tests were used to compare the groups. Significance was set at $p<0.05$.

Results: the responses of 201 participants with a mean age of 44.7 ± 12.7 years were analyzed, 52.2% (n = 105) were males, 67.7% had been hospitalized (n = 136), 60.2% (n = 121) reported ageusia, and 55.7% (n = 112) reported anosmia. There was a difference in days spent in the Intensive Care Unit (ICU) for the Ageusia group ($p = 0.004$), which had a shorter length of stay. As for those who reported anosmia, there was a difference and shorter length of stay for both the ward ($p = 0.001$) and ICU ($p = 0.004$). Categorical data showed that anosmia was associated with hospitalization (yes or no) ($p = 0.018$; phi = -0.167). Among those who were not hospitalized, 67% (n = 44) reported anosmia.

Conclusion: those who reported anosmia and ageusia had shorter hospital stays, when necessary.

Keywords: Hospitalization; Anosmia; Ageusia; COVID-19

INTRODUCTION

Since 2019, the entire world has been experiencing the SARS-CoV-2 pandemic, which causes COVID-19 and quickly spread across all continents. It contaminated many people and had a huge epidemiological impact on mortality and morbidity, including secondary changes to acute viral conditions[1]. Auditory and olfactory-gustatory disorders, such as anosmia (or complete loss of smell) and ageusia (or complete loss of taste), have been reported in some studies and associated with some viruses. However, there are still several gaps in the understanding and consensus on the clinical management of these cases[1-6].

Ageusia requires differentiation from other taste disorders such as hypogeusia (decreased sensitivity to all flavors), hypergeusia (increased taste sensitivity), dysgeusia (unpleasant perception of a tastant), and phantogeusia (taste perception that occurs in the absence of a tastant). Anosmia can be characterized by the absence of a range of normal (normosmic) or decreased (hyposmic) ability to correctly detect and label odors, or even by dysosmia (altered olfactory perception) and phantosmia (olfactory hallucinations)[6,7]. Although ageusia and anosmia are not life-threatening conditions, they can cause discomfort[7].

Considering that smell and taste are essential sensory functions regarding the quality of life, there is a need to investigate SARS-CoV-2 in these symptoms and verify its maintenance during and after acute viral conditions. Viral upper airway infections can lead to olfactory and gustatory disorders of varying degrees and durations; in 70% of cases, they are caused by rhinovirus, influenza and parainfluenza viruses, respiratory syncytial virus, adenovirus, and SARS-CoV-2 virus[1-3]. Increasingly frequent international reports on COVID-19 indicate that 5% to 85% of affected patients have temporarily lost their sense of smell[2], acutely and/or chronically, and there are reports in the literature indicating the loss of the sense of smell several months after recovery from the disease[2,3].

There are still gaps in elucidating the pathways involved in the loss of smell caused by SARS-CoV-2; however, the great affinity of the virus with the ACE-2 receptors, which are present in large quantities in the nasal cavity and the olfactory bulb has been considered[4,5]. A recent systematic review carried out to identify evidence in the scientific literature on olfactory disorders listed six articles out of the 1,788 selected records[1]. Studies have shown that olfactory-gustatory disorders were present even without nasal obstruction/rhinorrhea and with their onset even before clinical signs/symptoms of COVID-19 appeared. The smell/taste is recovered, when so, usually within the first 2 weeks after the acute solution of the disease[4,5].

Considering the aforementioned aspects, studies indicate that SARS-CoV-2 involves human sensory systems. However, it is due to the involvement of the vestibulo-auditory system in COVID-19 disease, with data based only on cases/medical records. Such data already indicate that COVID-19 can lead to the persistence of anosmia and hyposmia for some time after recovery from the acute phase, which is estimated in 3-20% of this population[4,5]. In addition to COVID-19, the risk of olfactory dysfunction is known to increase with advancing age and may result from chronic sinonasal diseases, severe head trauma, upper respiratory infections, or neurodegenerative diseases[4-6]. These disorders impair the ability to sense alert odors in food and the environment, in addition to impairing the quality of life related to social interactions, food, and the sense of well-being[6].

Given the above, it is believed that population studies on the prevalence and associated factors, involving the different symptoms caused by COVID-19, can contribute to the construction of knowledge about symptoms secondary to the disease and their permanence in patients recovered from the acute phase of the disease in its mildest and most severe forms. Considering that COVID-19 is a disease whose knowledge is still under construction, with high transmissibility and without consensual treatment available to everyone, the identification of patients and their symptoms at greater risk of evolving to the critical form of the disease is fundamental[8]. Therefore, the central objective of the present research was to analyze the type and duration of hospital stay in people who reported anosmia and ageusia, after COVID-19.

METHODS

This cross-sectional study is part of the Public Notice of the Research Program for the Unified Health System (PPSUS) of the Araucaria Foundation of the State of Paraná. The Human Research Ethics Committee of the *Universidade Cesumar*, Brazil, approved the project under number: 4,546,726. All research participants were informed about the objectives and procedures to be carried out and voluntarily signed an informed consent form.

Patients were recruited via referral from the hospital institution after medical discharge. Data for this broad

research project[9] were collected between August and December 2021, performing clinical assessments (blood pressure measurement, blood glucose, oxygen saturation, physical assessment with anthropometry, body composition with electrical bioimpedance, and cardiorespiratory stress test) and applying a standardized questionnaire with 90 open-ended and closed-ended questions, including data on medical history, pre-existing diseases, need for hospitalization, time and type of hospital stay, anosmia, and ageusia (with questions about the presence of symptoms during and/or after COVID-19 and duration of symptoms after hospital discharge).

The severity of COVID-19 was classified according to the "Clinical management of COVID-19: Living guidance" (World Health Organization, 2021)[10] by a physician who was part of the team. For this study, the inclusion criteria were as follows: being 19 to 65 years old; having been diagnosed with COVID-19 via qualitative molecular testing (RT-PCR); having contracted COVID-19 between January 3rd, 2021, and July 1st, 2021; and having received the 1st dose of the COVID-19 vaccine. As exclusion criteria, the following were not accepted: patients with debilitating neurological diseases; and people with limited mobility (using a cane or wheelchair).

SPSS software version 20 for Windows was used to analyze the data. Nonparametric statistics were applied. The Mann-Whitney test was used to compare the groups with and without ageusia, with and without anosmia, and the length of stay. The effect size was calculated with the equation: $r = Z / \sqrt{n}$, where "r" is the correlation coefficient, "Z" is the standardized U-value, and "n" is the number of observations[11]. The Kruskal-Wallis test was used to compare three groups, namely: N/A (not applicable – that is, that did not present either ageusia or anosmia symptoms), ageusia or anosmia (that presented one symptom or the other), and both (presented both ageusia and anosmia symptoms) and length of hospital stay. For the effect size, the estimated square epsilon (Er2) was calculated with the equation: $Er2 = H/(n2 - 1)/(n + 1)$; where "Er2" is the coefficient ranging from 0 (indicating no relationship) to 1 (indicating perfect relationship); "H" is the value obtained with Kruskal-Wallis, and "n" is the number of observations[12]. Effect sizes and correlation classifications followed the Cohen classification[13]. The chi-square test was used to verify the association between the categorical variables; the phi value and Cramer's V were also calculated. For all analyses, the significance level was set at $p<0.05$. In addition, multiple linear regression analysis (backward or backward method) was used to control for the influence of anosmia, ageusia, sex, and age on the length of stay (in days) in the ward and intensive care unit (ICU).

RESULTS

The responses of 201 participants with a mean age of 44.7 ± 12.7 years were analyzed, 52.2% (n = 105) were males; 67.7% were hospitalized (n = 136); 60.2% (n = 121) reported ageusia and 55.7% (n = 112) reported anosmia. There were no cases of non-recovery of smell or taste. The minimum and maximum length of ward stay for those reporting ageusia (n = 121) were 0 and 30 days, respectively, and 0 to 82 days in the ICU. For those who reported anosmia (n = 112), it was 0 to 18 days in the ward, and 0 to 82 days in the ICU. The data can be seen in Table 1.

Table 1. Absolute and relative frequency of the categorical and continuous variables (n = 201)

CATEGORICAL VARIABLES	n	%
SEX		
Males	105	52.2
Females	96	47.8
HOSPITALIZATION		
No	65	32.3
Yes	136	67.7
TYPE OF HOSPITAL STAY		
No hospitalization needed	65	32.3
Ward	75	37.3
ICU	17	8.5
Both	44	21.9
OXYGEN THERAPY		
No	84	41.8
Yes	117	58.2
AGEUSIA		
No	80	39.8
Yes	121	60.2
TASTE RECOVERY		
Taste was not lost	80	39.8
Yes, totally	81	40.3
Yes, partially	40	19.9
TIME OF AGEUSIA		
N/A	80	39.8
< 2 months	93	46.3
2 – 4 months	11	5.5
4 – 6 months	5	2.5
> 6 months	12	5.9
Could not inform precisely	12	6.0
ANOSMIA		
No	89	44.3
Yes	112	55.7
SMELL RECOVERY		
Smell was not lost	89	44.3
Yes, totally	73	36.3
Yes, partially	39	19.4
TIME OF ANOSMIA		
N/A	89	44.4
< 2 months	79	39.3
2 – 4 months	16	7.9
4 – 6 months	3	1.5
> 6 months	14	6.9
Could not inform precisely	14	7.0
CONTINUOUS VARIABLES	**Mean**	**standard deviation**
Age (years)	47.7	12.7
Height (cm)	165. 7	16.2
Weight (kg)	86.8	20.0
BMI	31.1	6.5
Length of ward stay (days)	6.2	7.1
Length of ICU stay (days)	5.8	12.8
Ageusia (n = 121)	**Minimum**	**Maximum**
Length of ward stay (days)	0	30
Length of ICU stay (days)	0	82
Anosmia (n = 112)		
Length of ward stay (days)	0	18
Length of ICU stay (days)	0	82

Captions: N/A = not applicable; BMI = body mass index; ICU = intensive care unit; n = number; % = percentage

Table 2 indicates that a difference was found in the number of days spent in the ICU for the ageusia group (p = 0.004); those who reported ageusia had a shorter length of stay. As for those who reported anosmia, there was a difference both for admission to the ward (p = 0.001) and to the ICU (p = 0.004); and those who reported anosmia had a shorter hospital stay.

Table 2. Comparison between two groups of patients with ageusia or anosmia and type and length of stay

	No ageusia (n = 78)	Ageusia (n = 121)	p-value Mann Whitney
Length of ward stay (days)	7 [0-11] [a]	5 [0-9] [a]	p = 0.052 r = 0.13
Length of ICU stay (days)	0 [0-12] [a]	0 [0-1] [a]	p = 0.004* r = 0.20
	No anosmia (n = 86)	**Anosmia (n = 112)**	**p-value Mann Whitney**
Length of ward stay (days)	8 [0-13] [a]	4 [0-7] [a]	p = 0.001* r = 0.26
Length of ICU stay (days)	0 [0-12] [a]	0 [0-1] [a]	p = 0.004* r = 0.20

Captions: a = median and interquartile range [25%-75%]; p = statistical significance value; r = effect size for the Mann-Whitney test; * = statistically significant difference; ICU = intensive care unit

When considering also those who did not present symptoms of ageusia or anosmia (N/A group), there was a difference in the length of stay, both in the ward (p = 0.007) and in the ICU (p = 0.011), and the paired comparison showed a difference between the Both group (with anosmia and ageusia) and N/A group (Table 3) – those who had both conditions spent fewer days in the hospital. The effect size was small.

Table 3. Comparison between three groups of patients with ageusia and/or anosmia and the type and length of hospital stay

	N/A (n = 69)	Ageusia or anosmia (n = 25)	Both (n = 104)	p-value Kruskal Wallis
Length of ward stay (days)	8 [0-12][a]	4 [0-13] [a]	4 [0-7] [a]	p = 0.007* E_r^2 = 0.01
Length of ICU stay (days)	0 [0-13] [a]	0 [0-3] [a]	0 [0-0] [a]	p = 0.011* E_r^2 = 0.01

Captions: a = median and interquartile range [25%-75%]; p = statistical significance value; Er2 = effect size for the Kruskal-Wallis test; * = statistically significant difference; N/A = not applicable – did not report either ageusia or anosmia; ICU = intensive care unit

For categorical variables, there was an association between anosmia and the need for hospitalization (yes or no) (p = 0.018; phi = -0.167). Among those who were not hospitalized, 67% (n = 44) reported anosmia. Other non-significant variables (p > 0.05) can be seen in Table 4.

Table 4. Association between anosmia and ageusia and hospitalization

Variables	Was not hospitalized	Was hospitalized	p-value chi-square
Ageusia			
No	20 (30.8)	60 (44.4)	p = 0.064
Yes	45 (69.2)	75 (55.6)	phi = 0.131
Taste recovery			
N/A	20 (30.8)	60 (44.4)	p = 0.166
Yes, totally	29 (44.6)	51 (37.8)	phi = 0.134
Yes, partially	16 (24.6)	24 (17.8)	
Time to recover taste			
N/A	20 (30.8)	57 (46.3)	p = 0.057
< 2 months	30 (46.2)	53 (43.1)	V = 0.223
2 – 4 months	6 (9.2)	5 (4.1)	
4 – 6 months	4 (6.2)	1 (0.8)	
> 6 months	5 (7.7)	7 (5.7)	
Anosmia			
No	21 (32.3)	67 (50)	p = 0.018*
Yes	44 (67.7)	67 (50)	phi = -0.167
Smell recovery			
N/A	21 (32.3)	67 (50)	p = 0.061
Yes, totally	28 (43.1)	44 (32.8)	phi = -0.168
Yes, partially	16 (24.6)	23 (17.2)	
Time to recover smell			
N/A	22 (34.4)	61 (50)	p = 0.211
< 2 months	27 (42.2)	45 (36.9)	V = 0.179
2 – 4 months	6 (9.4)	8 (6.6)	
4 – 6 months	2 (3.1)	1 (0.8)	
> 6 months	7 (10.9)	7 (5.7)	

Captions: N/A – not applicable; * statistically significant.

Finally, multiple linear regression analysis showed that for the length of stay in the ward, only anosmia data were significant ($p < 0.001$; adjusted R2: -0.085; $\beta = -0.299$), that is, anosmia contributed with 8.5% of the findings. The value of β in Table 5 indicates that, for each person who reported anosmia, there was a 0.085 standard deviation decrease in the length of hospital stay (in days). For ICU length of stay, there were no significant predictors. These data can be viewed in Table 5.

Table 5. Analysis of significant predictors with multiple linear regression for length of stay

Dependent variable	Predictors	Adjusted R2	β	F	t	p-value
Length of ward stay	Anosmia	0.085	-0.299	19.205	-4.382	0.001*
Length of ICU stay	-	-	-	-	-	-

Captions: Adjusted R2 (when multiplied by 100, this value represents a percentage of the variability explained by the model); β (beta – standardized coefficient); F (ANOVA F statistics); t (t-statistics); *(statistically significant).

DISCUSSION

This study aimed to analyze the type and length of hospital stay in people who reported anosmia and ageusia after COVID-19. Those who reported anosmia and ageusia had a shorter length of stay, both in the ward and in the ICU, when necessary. Most of those who reported anosmia were not hospitalized.

According to the data presented, many participants who recovered from COVID-19 reported ageusia (60.2%) and anosmia (55.7%). Such findings are similar to a study carried out in the United Arab Emirates in 500 patients with mild to severe COVID-19, which found that a total of 26.4% were asymptomatic and 21.4% were classified as having less severe symptoms[14]. Nearly equal proportions of the study population experienced extreme reductions in taste (43%) and loss of smell (44%). Statistically significant decreases in the senses of smell and taste were observed among younger subjects. The magnitude of the reduction in both sense changes increased sharply from the asymptomatic group to the paucisymptomatic and symptomatic groups[14]. Thus, the authors conclude that anosmia or sudden ageusia need to be recognized for the early detection of COVID-19 infection and to identify hidden carriers, favoring an early isolation strategy to restrict the spread of the disease[14].

One hypothesis about the pathophysiology of post-infectious olfactory loss is that viruses could trigger an inflammatory response of the nasal mucosa or directly damage the olfactory neuroepithelium. However, in patients with COVID-19, loss of smell can occur without other rhinological symptoms or suggestive nasal inflammation. According to evidence, anosmia-related SARS-CoV-2 may be a novel viral syndrome unique to COVID-19[15]. Furthermore, through experimental intranasal inoculation in mice, SARS-CoV-2 can be inoculated into the olfactory neural circuit[15]. That is, the neuronal cells present in the olfactory epithelium have the host receptors ACE2 and TMPRSS2, which increases the possibilities of subsequent brain infection, starting from the olfactory neurons[16,17].

Another interesting finding was the relationship between anosmia and ageusia with less need for hospitalization and/or stay, especially in the ward. In this sense, a study carried out in Brazil[18] in 261 participants who had mild to severe COVID-19 showed that there was a significantly higher proportion of individuals with olfactory dysfunction in the mild flu syndrome group than in the severe ones (mild × severe - $p < 0.001$; odds ratio = 4.63); this relationship was also maintained between mild and critical patients (mild × critical - $p < 0.001$; odds ratio = 9.28); thus, changes in smell may be a predictor of a good prognosis of the infection[18]. Another MRI study showed that transient olfactory bulb edema co-occurred with olfactory dysfunction, suggesting that an inflammatory response to this viral invasion by SARS-CoV-2 may also contribute to the symptomatology[19]. Therefore, an efficient and rapid inflammatory response could contribute to a better prognosis of COVID-19 in patients with anosmia. The hyperinflammatory involvement of SARS-CoV-2 may be correlated with each patient's pathophysiological and immunological aspects, directly influencing inflammation with ACE2 and the cluster of differentiation 6 (CD6) as possible mediators, although this is currently debated[4,5,20].

In contrast, the consequences of these acute and complex immunological phenomena related to SARS-CoV-2, increased by anosmia, ageusia, and altered microbiota, can lead to decreased food intake and exacerbated catabolism. The hyperinflammatory involvement of SARS-CoV-2 accentuates the immunosenescence process, increasing endothelial damage and, due to mitochondrial dysfunction and autophagy, induces myofibrillar breakdown and muscle degradation. Thus, it influences the degree of muscle mass and functional loss, with consequent acute sarcopenia, which can widely affect the in-hospital prognosis of patients, as well as the vulnerability to post-COVID-19 functional and physical deterioration[20]. In addition, imposed physical inactivity, confinement, quarantine, or acute hospitalization with bed rest would intensify the process of acute sarcopenia[20].

Studies relating anosmia and ageusia to pro- and anti-inflammatory factors are essential and urgent to identify protective and risk factors in people with COVID-19. Moreover, they can point to promising areas of research on biological changes related to the appearance and permanence of anosmia and ageusia in this population, understanding the individual variability of inflammation that results in these symptoms. In other words, when determining individual susceptibility, new strategies to prevent olfactory-gustatory symptoms related to COVID-19 can be provided. Therefore, science must advance concerning all types of olfactory-gustatory disorders, each patient's pathophysiological aspects and immunity, and those related to the evolution of the clinical condition, both during the acute illness of COVID-19 and in the long form of the disease. In this sense, understanding

anosmia and ageusia and their etiological factors and consequences can guide preventive attitudes and effective therapies to combat the effects of SARS-CoV-2 on the human body, including nutritional support, early physical and cardiopulmonary rehabilitation, psychological support, and cognitive training[20].

Based on the results of the present study and the aforementioned research, further studies should be encouraged with healthy adults without hospitalization and with people with different sensory conditions regarding anosmia, ageusia, and other senses such as sight and hearing to deepen the knowledge about anosmia and ageusia and their actual differential in the prognosis of COVID-19. Given this, health promotion programs and health interventions are needed to support people with anosmia and/or ageusia after COVID-19, including rehabilitation for subsequent recovery.

This study brings interesting results but has some limitations that must be considered. A possible limitation is self-reported complaints of ageusia and anosmia, in addition to the cross-sectional study design, which does not allow for a cause-and-effect relationship.

CONCLUSION

Anosmia and ageusia were important symptoms in the study, being reported by more than 50% of the analyzed sample. Those who reported anosmia and ageusia had a shorter length of stay, both in the ward and in the ICU, when necessary. There was also an association between not needing hospitalization and anosmia. Among those who were not hospitalized, 67% reported anosmia.

REFERENCES

1. Costa Klinger VT, Carnaúba ATL, Rocha KW, Andrade KCL, Ferreira SMS, Menezes PL. Olfactory and taste disorders in COVID-19: a systematic review. Braz J Otorhinolaryngol. 2020;86(6):781-92. DOI: 10.1016/j.bjorl.2020.05.008.
2. Suzuki M, Saito K, Min WP, Vladau C, Toida K, Itoh H. Identification of viruses in patients with postviral olfactory dysfunction. Laryngoscope. 2007;117(2):272-7. DOI: 10.1097/01.mlg.0000249922.37381.1e.
3. Allis TJ, Leopold DA. Smell and taste disorders. Facial Plast Surg Clin North Am. 2012;20(1):93-111. DOI: 10.1016/j.fsc.2011.10.011
4. Izquierdo-Dominguez A, Rojas-Lechuga MJ, Mullol J, Alobid I. Olfactory dysfunction in the COVID-19 outbreak. J Investig Allergol Clin Immunol. 2020;30(5):317-26. doi: 10.18176/jiaci.0567.
5. da Silva Júnior PR, Gomes ALOR, Coelho LEA, Morais MA, de Almeida PVFC, Neri WJR et al. Anosmia and COVID-19: perspectives on its association and the pathophysiological mechanisms involved. Egypt J Neurol Psychiatr Neurosurg. 2021;57(1):8. DOI: 10.1186/s41983-020-00266-0.
6. Boesveldt S, Postma EM, Boak D, Welge-Luessen A, Schöpf V, Mainland JD et al. Anosmia: a clinical review. Chem Senses. 2017;42(7):513-23. doi: 10.1093/chemse/bjx025.
7. Rathee M, Jain P. Ageusia. [Updated 2022 aug 8]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2022. Available at: https://www.ncbi.nlm.nih.gov/books/NBK549775/
8. Santos VB, Stein AT, Barilli SLS, Garbini AF, Almeida RC, Carazai DR et al. Adult patients admitted to a tertiary hospital COVID-19 and risk factors associated with severity: a retrospective cohort study. Rev Inst Med Trop Sao Paulo. 2022;64:e20. doi.org/10.1590/S1678-9946202264020>.
9. Lemos MM, Cavalini GR, Pugliese Henrique CR, Perli VAS, de Moraes Marchiori G, Marchiori LLM et al. Body composition and cardiorespiratory fitness in overweight or obese people post COVID-19: a comparative study. Front Physiol. 2022;13:949351. DOI: 10.3389/fphys.2022.949351.
10. World Health Organization (2021). COVID-19 clinical management: Living guidance, 25 January 2021. World Health Organization. Available at: https://apps.who.int/iris/handle/10665/338882
11. Fritz CO, Morris PE, Richler JJ. Effect size estimates: current use, calculations, and interpretation. J Exp Psychol Gen. 2012;141(01):2-18. DOI: 10.1037/a002433.
12. Tomczak A, Tomczak E. The need to report effect size estimates revisited. An overview of some recommended measures of effect size. Trends Sport Sci. 2014;1(21):19-25.
13. Cohen J. Statistical power analysis for the behavioral sciences. 2nd ed. New York: Routledge, 1988.

14. Al-Rawi NH, Sammouda AR, AlRahin EA, Ali FAA, Arayedh GSA, Daryanavard HA et al. Prevalence of anosmia or ageusia in patients with covid-19 among United Arab Emirates population. Int Dent J. 2022;72(2):249-56. doi: 10.1016/j.identj.2021.05.006.
15. Othman BA, Maulud SQ, Jalal PJ, Abdulkareem SM, Ahmed JQ, Dhawan M et al. Olfactory dysfunction as a post-infectious symptom of SARS-CoV-2 infection. Ann Med Surg (Lond). 2022;75:103352. doi: 10.1016/j.amsu.2022.103352.
16. Butowt R, Bilińska K. SARS-CoV-2: olfaction, brain infection, and the urgent need for clinical samples allowing earlier virus detection. ACS Chem Neurosci. 2020;11(9):1200-3. DOI: 10.1021/acschemneuro.0c00172.
17. von Bartheld CS, Hagen MM, Butowt R. The D614G virus mutation enhances anosmia in COVID-19 patients: evidence from a systematic review and meta-analysis of studies from south Asia. ACS Chem Neurosci. 2021;12(19):3535-49. DOI: 10.1021/acschemneuro.1c00542.
18. Mendonça CV, Mendes Neto JA, Suzuki FA, Orth MS, Neto HM, Nacif SR. Olfactory dysfunction in COVID-19: a marker of good prognosis? Braz J Otorhinolaryngol. 2022;88(3):439-44. doi.org/10.1016/j.bjorlp.2020.12.004.
19. Laurendon T, Radulesco T, Mugnier J, Gérault M, Chagnaud C, El Ahmadi AA et al. Bilateral transient olfactory bulb edema during COVID-19-related anosmia. Neurology. 2020;95(5):224-5. DOI: 10.1212/WNL.0000000000009850.
20. Piotrowicz K, Gąsowski J, Michel JP, Veronese N. Post-COVID-19 acute sarcopenia: physiopathology and management. Aging Clin Exp Res. 2021;33(10):2887-98. DOI: 10.1007/s40520-021-01942-8.