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Risk Factors for Olfactory Dysfunction in Hospital Setting Following Covid-19 Infection Among Hospital Employees Following Treatment of Covid-19 Infected Patients: A Survey Research

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Abstract: *Coronavirus disease 2019 (COVID-19) is an infectious respiratory disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). To reveal the risk factors for olfactory dysfunction in employees with COVID-19 in the workplace of the subject hospital in Indonesia. This study was quantitative and descriptive, using data from questionnaires distributed to subject hospital in Indonesia employees who have experienced COVID-19. This study shows that anosmia (33.2%) is the most common olfactory dysfunction in COVID-19. COVID-19 infection often occurs in resident doctors (58.1%); women (55.6%); those aged 55 years (92.3%); those with comorbidities such as hypertension (4.3%) and obesity (65%); nonsmokers (91.5%) and smokers 10–20 cigarettes per day (5.1%); and nondrinkers (100%). Anosmia is the most common olfactory dysfunction in COVID-19. It is commonly experienced by resident doctors, women aged ≥55 years, employees without comorbidities, obese employees, nonsmokers, and nondrinker*

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INTRODUCTION

Coronavirus disease 2019 (COVID-19) is an infectious respiratory disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2).[1] It is a positive single-stranded RNA virus transmitted between animals and humans (zoonosis). (Samuel.dkk,2021) Due to its rapid global spread, the World Health Organization declared COVID-19 a pandemic on March 11, 2020. By April 14, 2022, Indonesia reported over 6 million COVID-19 cases and 155,866 deaths. In West Sumatra, more than 103,700 cases, 2,300 deaths, and 99,000 recoveries were recorded.(Pemprov,2022).

Hospital employees face a high risk of COVID-19 exposure due to close contact with infected patients. Ulfah et al. found that noncompliance with health protocols contributed

to increased transmission among hospital workers. COVID-19 symptoms include fever, fatigue, cough, dyspnea, myalgia, and sputum production.[8] Additionally, olfactory dysfunctions such as anosmia (loss of smell) and hyposmia (reduced smell sensitivity) are common. Poerbonegoro et al. reported that 85.3% of Indonesian COVID-19 patients experienced olfactory dysfunctions.(Poerbonegoro NL.dkk, 2021).

Klopfensten et al. found anosmia in 47% of COVID-19 patients, while hyposmia incidence ranged from 33.9% to 85.6%. Several studies identify risk factors for olfactory dysfunction, including gender, age, comorbidities, obesity, smoking, and alcohol consumption. Mona et al. found women (85.5%) more likely to develop anosmia than men (66.7%). Najafloo et al. reported an increased risk in COVID-19 patients aged 40–50. Hypertension (27%), diabetes (19%), and cardiovascular disease (6%) are common comorbidities. Hasan et al. noted that smokers face a higher risk of olfactory dysfunction.(Hasan.dkk,2021).

Given the high prevalence of olfactory dysfunction in COVID-19, this study aims to analyze its characteristics and risk factors among hospital employees in Indonesia, who have a heightened risk of exposure. Identifying these risk factors can aid in effective management and improve patient prognosis.

MATERIALS AND METHODS

Experimental Design

This quantitative descriptive study with a cross-sectional design was conducted at All Hospital in Indonesia from December 2021 to February 2023. Due to the ongoing COVID-19 pandemic, data collection was conducted using online questionnaires distributed via WhatsApp.The study included 196 participants, with a minimum required sample size of 49, calculated using the formula for descriptive research(Dahlan,2010)

$$n = \frac{Z\alpha^2 PQ}{d^2}$$

Note:

n	: sample number
$Z\alpha$	: alpha standard deviate = 1.96
P	: Proportion of variable categories studied = 85.3% = 0.853[15]
Q	: 1 − P = 0.147
d	: precision = 10% = 0.1

From the equation, the following equations are formed:

$$n = \frac{1.96^2 x\ 0.853\ x\ 0.147}{0.1^2}$$

$$n = 48.7 \approx 49$$

Inclusion and Exclusion Criteria

Inclusion criteria:

- Employees confirmed COVID-19 positive via PCR test.
- Employees who provided informed consent and completed the questionnaire.

Exclusion criteria:

- Individuals with olfactory dysfunction prior to the pandemic.
- History of nasal/head trauma, chronic rhinosinusitis, or neurodegenerative diseases.

Data Analysis

Univariate analysis was performed to describe respondent characteristics and frequency distribution tables were used to present data on olfactory dysfunction risk factors, including gender, age, comorbidities, obesity, smoking, and alcohol consumption.

Statistical Analysis

- Editing: Checking variables for accuracy.
- Coding: Assigning codes to collected data.
- Processing: Entering data into SPSS for analysis.
- Cleaning: Ensuring data completeness and correctness.

Data Availability

Data is available from the corresponding author upon reasonable request.

RESULT AND DISCUSSION

This study found that among 702 hospital employees diagnosed with COVID-19, only 196 met the inclusion and exclusion criteria. Of these, 117 respondents (59.7%) experienced olfactory dysfunction, while 79 (40.3%) did not. These findings align with those of Poerbonegoro et al., who reported that 56.8% of COVID-19 patients exhibited olfactory dysfunction.(Poerbonegoro.dkk,2021)

Olfactory dysfunction was assessed using the Connecticut Chemosensory Clinical Research Center (CCCRC) test. This test evaluates odor identification using common odorants such as coffee, naphthalene, vanilla, soap, chocolate, oregano, and talcum powder. Additionally, an olfactory threshold test was performed using n-butanol diluted at seven different concentrations (4% to 0.005%). Testing was conducted separately for each nasal cavity with participants' eyes closed.

Participants were scored from 0 to 7 based on their ability to detect odors, with 0 indicating no odor detection at any concentration (anosmia) and 7 indicating the ability to detect the lowest concentration (normosmia). Olfactory dysfunction was classified into mild hyposmia (5–5.75), moderate hyposmia (4–4.75), severe hyposmia (2–3.75), and anosmia (0–1.75). This classification helps determine the severity of olfactory impairment in COVID-19 patients.(Fenolio.dkk, 2022)

Table 1. Distribution of the frequency of olfactory dysfunctions in employees with COVID-19 at Dr. M. Djamil Padangan Central General Hospital employees

Olfactory dysfunctions	Frequency (196)	Percentage (100%)
Present	117	59.7%
• Anosmia	65	33.2%
• Hiposmia	52	26.5%
Absent	79	40.3%

Source: Authors own processed data (2023)

Table 2 showed that 68 resident doctors (58.1%) exhibited olfactory dysfunction, which consist half of the study sample. Other respondents who filled out the questionnaire were 9 specialists (7.7%), 2 general practitioners (1.7%), 24 nurses (20.5%), 1 laboratory officer (0.9%), 2 administrative officers (1.7%), and 11 of others.

Table 2. Frequency distribution of Dr. M. Djamil Padangan Central General Hospital employees with olfactory dysfunction

Employee status	Frequency (117)	Percentage (100%)
Specialists	9	7.7%
Resident doctors	68	58.1%
General practitioners	2	1.7%
Nurses	24	20.5%
Laboratory officer	1	0.9%
Administrative officers	2	1.7%
Others	11	9.4%

Source: Authors own processed data (2023)

Table 3 showed that on the basis of gender, female employees (65 respondents, 55.6%) with COVID-19 infection who have olfactory dysfunctions were found to be more than male employees (52 respondents, 44.4%). The results of this study align with the research of Otoum et al.(Otoum mm.dkk,2022) who found a significant relationship between sex and anosmia (women, 85.5%, and men, 66.7%).

Table 3. Frequency distribution of risk factors for olfactory dysfunction in employees with COVID-19 in Dr. M. Djamil Padangan Central General Hospital employees

Risk factors	Frequency (117)	Percentage (100%)
Gender		
• Male	52	44.4%
• Female	65	55.6%
Age		
• ≤55 years	108	92.3%
• >55 years	9	7.7%
Comorbidity records		
Hypertension		
• Yes	5	4.3%
• No	112	95.7%
Diabetes mellitus		
• Yes	1	0.9%
• No	116	99.1%
Cardiovascular diseases		
• Yes	2	1.7%
• No	115	98.3%
Obesity		
• Yes	76	65%
• No	41	35%
Smoking history		
• Nonsmoker	107	91.5%
• 1–9 cigarettes per day	4	3.4%
• 10–20 cigarettes per day	6	5.1%
• >20 cigarettes per day	0	0%

Alcoholic beverage consumption history		
• Yes	0	0%
• No	117	100%

Source: Authors own processed data (2023)

Discussion

This study confirms the predominance of knee osteoarthritis (OA) in women (77.27%), aligning with epidemiological evidence linking this disparity to hormonal, anatomical, and biomechanical factors.(Friske.dkk,2022) The older age profile in the PRP and HA groups reinforces OA's progressive nature and the need for age- and gender-specific treatments.

A key finding is the significant reduction in miR-132 expression in the PRP group (5.18 to 0.95; $p < 0.001$), suggesting its role in modulating OA-related molecular pathways. While the HA group exhibited a numerically larger decrease (4.92 to 0.52), high variability rendered the reduction statistically insignificant ($p = 0.775$). The lower standard deviation in the PRP group indicates a more consistent effect, aligning with research linking PRP's bioactive proteins to its anti-inflammatory properties.

Variability in PRP outcomes may stem from differences in preparation protocols, patient comorbidities, and platelet concentrations, emphasizing the need for optimization. PRP's efficacy is largely dependent on high platelet counts (>1,500,000/μl) and growth factor concentrations, which promote tissue regeneration and modulate inflammation with minimal immune risk. The findings support PRP's role in knee OA management, showing sustained symptom relief superior to HA.(Fenolio.dkk, 2022)

Regarding inflammatory markers, IL-1β levels significantly decreased in the HA group ($p < 0.001$), suggesting its role in synovial fluid enhancement. PRP did not significantly alter IL-1β, though its WOMAC improvement correlated with IL-1β ($R = -0.429$; $p = 0.046$), indicating broader reparative mechanisms beyond cytokine modulation.(Butowt.dkk,2021) Neither treatment significantly affected IL-6 levels ($p > 0.05$), consistent with findings that systemic inflammation is not the primary therapeutic target in OA. The observed negative correlation between miR-132 and IL-1β suggests PRP influences localized molecular pathways rather than systemic cytokine changes. Given IL-1β's role in cartilage degradation via JAK/STAT and MAPK pathways, its reduction is clinically relevant.(Mendonca.dkk, 2022)

Clinical outcomes reinforce PRP's advantages. Both PRP and HA significantly reduced pain (VAS: PRP, $p = 0.006$; HA, $p < 0.001$), but PRP provided superior functional improvement (WOMAC: $p = 0.035$). PRP's sustained growth factor release likely contributes to its regenerative effects, promoting cellular repair and angiogenesis. In contrast, HA functions primarily as a lubricant, providing symptomatic pain relief without substantial regenerative potential. These findings align with previous research supporting PRP's superiority in joint function improvement over HA's symptomatic relief.(Irfandy D.dkk, 2019)

While PRP is promising, standardization is essential to optimize its efficacy. Factors such as OA severity, patient age, and comorbidities should guide treatment protocols. Combination therapies, integrating PRP's regenerative effects with HA's lubricating properties, warrant further investigation. Despite PRP's potential, its widespread adoption is hindered by a lack of high-quality, long-term studies on structural benefits.However,

increasing clinical use suggests growing acceptance. A meta-analysis indicates PRP-HA combinations may enhance outcomes without increasing adverse effects.(Jha S.dkk,2022) Future research should focus on refining PRP formulations, optimizing patient selection, and evaluating long-term structural improvements to establish PRP as a frontline OA treatment.

CONCLUSION

The subject hospital in Indonesia employees have olfactory dysfunction mostly in the form of anosmia. Resident doctors, women, age group ≤55 years, groups without comorbidities, obesity, and groups who do not smoke and do not consume alcohol consist the majority of respondents who have olfactory dysfunction.

ETHICAL CONSIDERATIONS

Ethical approval was obtained from Dr. M. Djamil Padang Central General Hospital Ethics Committee (No. LB.02.02/5.7/532/2022).…

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CONFLICT OF INTEREST

The author declares no conflict of interest.

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