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Relationship of comorbid factors diabetes mellitus with oxygen saturation (SaO_2) among people with Covid-19 in the Quarantine House

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ABSTRAK

Latar Belakang: *Covid-19 telah menjangkiti seratus orang negara, di Indonesia sebesar 8,9%, angka ini merupakan yang tertinggi di Asia Tenggara. Fenomena tersebut menunjukkan bahwa relawan perawat yang bekerja di tempat karantina pasien Covid-19 tidak melakukan pengawasan terhadap nilai SaO_2 pasien Covid-19, padahal dampak happy hypoxia terhadap mortalitas akan tinggi jika nilai saturasi oksigen di bawah nilai saturasi oksigen. nilai normal. Faktor komorbid, Diabetes Mellitus dapat memperburuk kondisi fisik dan penilaian klinis sehingga meningkatkan angka kematian.*

Tujuan: *Tujuan penelitian untuk mengetahui hubungan usia, jenis kelamin, dan faktor penyerta dengan nilai saturasi oksigen (SaO_2) pada pasien Covid-19 di Tempat Karantina Baturaden.*

Metode: *Penelitian ini merupakan penelitian kuantitatif dengan menggunakan metode observasional analitik dengan pendekatan crossectional. Sampel dalam penelitian ini menggunakan random sampling sebanyak 93 responden dengan uji Fisher Exact.*

Hasil: *Dari hasil penelitian ini didapatkan fisher exact test dengan p-value = 0,007, ada hubungan antara faktor komorbiditas responden dengan SaO_2 pada pasien terkonfirmasi COVID-19. Responden dengan SaO_2 95-100% yang memiliki faktor penyerta sebanyak 20 responden (21,5%) lebih sedikit dibandingkan responden yang tidak memiliki faktor penyerta sebanyak 29 responden (30,5%). Kadar glukosa darah dapat meningkatkan replikasi virus dan menekan respon imun antivirus. Hal tersebut yang menyebabkan pasien diabetes mellitus lebih cenderung mengalami malnutrisidan rentan terhadap terjadinya badai sitokin yang menyebabkan perburukan kondisi klinis dengan cepat dibandingkan pasien non diabetes mellitus.*

Kesimpulan: *Faktor komorbiditas akan meningkatkan mortalitas pasien COVID-19 karena faktor risiko, faktor komorbiditas diabetes mellitus, dengan COVID-19 yang terkait dengan usia lanjut, obesitas, peradangan sistemik kronis, peningkatan koagulasi, yang secara signifikan dapat meningkatkan tekanan darah, secara tidak langsung menyebabkan komplikasi yang lebih parah akibat COVID-19.*

KATA KUNCI*: faktor komorbiditas; SaO_2; happy hipoksia; covid-19*

ABSTRACT

Background: *The Covid-19 has infected a hundred people countries, in Indonesia at 8.9%, this figure is the highest in Southeast Asia. The phenomenon, shows that nursing volunteers who work in quarantine place for Covid-19 patients not maintenance to screen of SaO_2 value of Covid-19 patients, even though the impact of happy hypoxia on mortality will be high if the oxygen saturation value is below the normal value. Comorbid factors, Diabetes Mellitus can worsen the physical condition and clinical assessment thereby increasing mortality.*

Objectives: *The purpose of research to determine the relationship between age, gender, and comorbid factors with the value of oxygen saturation (SaO_2) in Covid-19 patients at the Baturaden Quarantine Place.*
Methods: *This study is a quantitative study using an analytical observational method with a crossectional approach. The sample in this study used random sampling of 93 respondents with the Fisher Exact test.*
Results: *The results of this study, fisher exact test obtained with a p-value = 0.007, there is a relationship between the respondent's comorbidity factor and SaO_2 in patients with confirmed COVID-19. Respondents with 95-100% SaO_2 who have comorbid factors as many as 20 respondents (21.5%) are fewer than respondents who do not have comorbid factors as many as 29 respondents (30.5%). Blood glucose levels can increase viral replication and suppress the antiviral immune response. This causes DM patients to be more likely to be malnourished and susceptible to cytokine storms that cause a rapid deterioration of clinical conditions compared to non-diabetic patients.*
Conclusions: *The comorbid factors will increase mortality of COVID-19 patients due to risk factors, comorbid of diabetes mellitus factors, with COVID-19 associated with advanced age, obesity, chronic systemic inflammation, increased coagulation, which can significantly increase blood pressure, indirectly lead to more severe complications due to COVID-19.*

KEYWORD ***:*** *comorbidity; $SaO_{2;}$ happy hypoxia; covid-19*

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INTRODUCTION

At the end of 2019 to the beginning of 2020, the world was shocked by the presence of disease originating from the city of Wuhan, China. The disease is caused by a virus that attacks human respiration. The virus comes from a type of coronavirus and has a type of SARS-CoV-2 (previously referred to as 2019-nCoV). The virus causes a disease called COVID-19 or Coronavirus Disease 2019. This virus can cause pneumonia, caused the cytopathic effect of the virus and its capabilities in defeating the immune response is viral infection severity. Immune system inadequate in response to infection as well determine the severity, on the other hand Excessive immune response also contributes in tissue damage. Patient Covid-19 experiencing Acute Distress Respiratory Syndrome (ADRS) was also found CD4 and CD8 T cells were decreased, CD4 and CD8 lymphocytes undergo hyperactivation. ARDS is one of the cause of death in Covid-19 cases caused by an increase in mediators proinflammatory (cytokine storm) that does not controlled. That will result in Lung damage, fibrotic tissue formation so that a malfunction can occur (1). COVID-19 caused infections in large numbers and in a short time in the People's Republic of China and in several countries in Asia and Europe, until it eventually became a pandemic due to its global scale, with the current number of cases reaching more than 300,000 cases and causing more than 13,000 deaths (2).

Currently the highest position is in the United States, which is 8,342,665 cases, but cases of recovery in the United States are also high, namely 5,432,192 cases (3). The first COVID-19 reported in Indonesia on March 2, 2020 was two cases. As of October 18, 2020, Indonesia was ranked 19th with a total of 357,762 cases. Data on March 31, 2020 showed that there were 1,528 confirmed cases and 136 deaths. Three weeks later to 790 cases. There are 24 provinces that have confirmed that there are positive 2019 corona virus, namely Bali, Banten, Yogyakarta, Jakarta, Jambi, West Java, Central Java, East Java, West Kalimantan, East Kalimantan, Central Kalimantan, South Kalimantan, Kep. Riau, West Nusa Tenggara, South Sumatra, North Sumatra, North Sulawesi, Southeast Sulawesi, South Sulawesi, Lampung, Riau, North Maluku, Maluku and Papua (4).

Recently, there has been a phenomenon of patients with coronavirus disease (Covid-19) being described as having oxygen levels that are not in accordance with the body's physiology without dyspnea in the patient. This is termed happy hypoxia or more accurately called silent hypoxemia, very confusing to doctors and considered contrary to basic physiology (5). This combination attracted widespread media coverage but has not yet been discussed in medical journals. This can happen because the corona virus has a special action on receptors in chemosensitivity to oxygen (6).

On the other hand, patients with Covid-19 condition can be aggravated by various factors such as age, gender, and comorbid diseases. By looking at the phenomenon of happy hypoxia, it could be influenced by these factors. By knowing the relationship between these factors and the occurrence of happy hypoxia, health workers and volunteers can immediately screen COVID-19 patients who experience the happy hypoxia phenomenon or not. If patients with happy hypoxia are not given further treatment, then the patient's condition can fall into a state of respiratory failure, eventually causing death (7). Clinical symptoms may vary in each individual due to the influence of factors comorbid. Most of the COVID-19 patients have a comorbid disease such as diabetes mellitus, hypertension, cardiovascular disease, and chronic liver disease. Patients who have these comorbidities more often experience deterioration and death (8).

Chronic diseases such as DM is a risk factor that cause COVID-19 patients experience high rates of morbidity and high mortality. The result meta-analysis shows that Covid-19 sufferers who have DM comorbidity is 42 people per 1000 cases with numbers mortality is up to 10%. Based on the results of the study, patients who have diabetes mellitus have 1.7 times more risk than people who do not have diabetes (9).The phenomenon in the field shows that volunteers who work in quarantine homes for Covid-19 patients do not screen or check the oxygen saturation (SaO_2) value of Covid-19 patients. A good oxygen saturation is >95%. If the SaO_2 value shows <94% and even drops drastically, then it requires more serious medical treatment to prevent worsening of the patient's condition and even death. However, not all confirmed COVID-19 patients are not necessarily treated in hospitals, they can only be quarantined and not all who treat confirmed patients are nurses or medical personnel. So, nurses need to give their caring function to patients, even though they are in quarantine.

MATERIALS AND METHODS

This research is a quantitative research using analytical observational method with a cross sectional approach. This study aims to determine the relationship between Age, Gender, and comorbid factors with SaO_2 values in Covid-19 patients. The population in this study were patients with confirmed Covid-19 in quarantine house Baturaden, Banyumas. It is known that the number of confirmed patients at the Education and Training Center is 120 people. The sample in this study used random sampling of 93 respondents. The test analysis used in this study is with the Fisher Exact test.

The inclusion criteria in this study included: adult patients over 18 years, conscious and cooperative patients, confirmed COVID-19 patients, patients undergoing quarantine at the Education and Training Center. The exclusion criteria in this study were: patients who were declared cured but were re-quarantined, patients who received the Covid-19 vaccine injection, and patients who were referred to the hospital. The exclusion criteria for this study included patients who were declared cured but were re-quarantined, patients who received the Covid-19 vaccine injection, and patients who were referred to the hospital. The location of this research was carried out at the Baturaden Education and Training Center Building which became a quarantine place for Covid-19 patients during February-April 2021. Data collection was carried out once and at the same time. Before the respondent is measured the value of SaO_2, the respondent will first be interviewed regarding characteristics including age, gender, and comorbid diseases. After obtaining valid data, the respondent will measure the value of SaO_2. Volunteers will write down the results on the observation sheet.

RESULTS AND DISSCUSSION

RESULT

Based on the results of research conducted by researchers in Banyumas on April 2021, 93 responden, the results of the univariate analysis were as follows:

Based on **Table 1**, the characteristics of the respondents are based on gender. Respondents in this study were 93 respondents. The description of the characteristics of respondents based on age shows that the respondents are dominated by female respondents as many as 51 people (54.8%) while male respondents as many as 42 people (45.2%). Based on age, respondents were dominated in the Early Adult category as many as 29 respondents (31.2 %), the Late Adolescent category as many as 18 respondents (19.4%), the Late Adult category as many as 22 respondents (23.7%), the Early Elderly category as many as 20 respondents (21.5%), while respondents in the Late Elderly category were 4 respondents (4.3%). The description of the characteristics of respondents based on comorbid factors shows that respondents who have comorbid factors are 50 people (53.8%) while respondents who do not have comorbid factors are 43 people (46.2%).

Tablel 1. Frequency distribution of respondents' characteristics

Characteristics	F	%
Gender		
Male	42	45,2%
Female	51	54,8%
Age		
Late Teen	18	19,4%
Early Adult	29	31,2%
Late Adult	22	23,7%
Early seniors	20	21,5%
Late Elderly	4	4,3%
Comorbidity Factor		
Exist	50	53,8%
Not exist	43	46,2%
SaO_2 Score		
95 – 100%	49	52,7 %
<95%	44	47,3 %

Based on **Table 2**, result Fisher's Exact test, it was found that respondents who had oxygen saturation of 95-100% who had comorbid factors were 20 respondents (21.5%) less than respondents who did not have comorbid factors as many as 29 respondents (30.5%), but far less more respondents with oxygen saturation <95% and have comorbidities as many as 30 respondents (32.2%). Based on Fisher's Exact test, it was obtained with a p value = 0.007 less than = 0.05, which means that there is a relationship between the respondent's comorbidity factor and the oxygen saturation value in confirmed COVID-19 patients.

Table 2. Result of Exact Fisher

Comorbidity Factor	SaO_2 Score		Total	*P* (sig)
	95-100%	<95%		
Exist	20	30	50	0,007
Not exist	29	14	43	
Total	49	44	93	

DISSCUSSION

According to research by Arif, et al, in COVID-19, target cells are mostly found in the lower respiratory tract. The lungs are the organs of the body that are very influential on COVID-19. In the lungs there are type I and type II alveolar cells, whereas in type II alveolar cells there are a lot of ACE2 enzymes (10). This virus can activate host cells using the enzyme ACE2. In order to combine with ACE2 and enter the host cell, the virus has a special surface glycoprotein or spike. Increased ACE2 in the tissue is related to the severity of the disease, resulting in damage to alveolar cells, damage to alveolar cells can trigger various systemic reactions and death may even occur (2).

Several studies have stated that the severity and mortality of COVID-19 is influenced by several comorbid diseases, one of which is hypertension, where existing hypertension can aggravate COVID-19 2.5 times. The severity of COVID-19 is also associated with the use of ACEI drugs and ARBs, because the use of these drugs may regulate ACE2 receptors (11). In addition to hypertension, diabetes also causes patient morbidity and mortality rates.

A study conducted by Kulcsar et al in 2019 showed that diabetes causes the general health condition of Covid-19 patients to be worse. This result is supported by 2 different studies conducted by Hussain, Bhowmik, & Cristina on 2020 (3) and Erener (12). The results of both show that diabetes is one of the important factors that influence the severity and mortality of Covid-19 patients. Research shows that people with diabetes who experience COVID-19 will be more at risk for experiencing severe/severe COVID-19, ARDS, and even death. Different results were shown in a study with a meta-analysis conducted by Tadic et al, who found that the severity and prognosis of COVID-19 patients with comorbid diabetes was unclear due to bias in various studies.

The process of the COVID-19 disease course generally involves the release of inflammatory cytokines and the formation of antigen-antibody complexes that will affect cell membrane permeability. However, in patients with chronic kidney failure, the glomerular filtration process has worsened, so that systemic inflammation due to COVID-19 can worsen kidney function. In addition, due to the presence of ACE2 receptors in the urogenital system, the COVID-19 virus can also easily stimulate the inflammatory process in the kidneys which will worsen the patient's condition (13).

The mechanism by which diabetes causes increased morbidity and mortality in COVID-19 patients has been reported in the four studies used in this study. Krueger, Ma, Drosten (2019) reported that the association between diabetes and COVID-19 is based on mechanisms of chronic systemic inflammation, increased coagulation activity, impaired immune response, and the potential for direct pancreatic damage by SARSCoV-2. Diabetes found in elderly individuals and/or individuals with other comorbidities, such as hypertension, also increases the morbidity and mortality of these patients. A study conducted by Hussain found that old age, diabetes, and other comorbidities were significant predictors of morbidity and mortality in COVID-19 patients.

Possible mechanisms of COVID-19 causing abnormal glucose metabolism include pancreatic beta cell damage and insulin resistance. Previous studies have reported that some viruses can directly cause pancreatic beta cell damage (14) and that angiotensin converting enzyme-2 (ACE2) as a SARSCoV-2 receptor has higher expression in pancreatic endocrine tissue than in exocrine tissue (15). Autopsy showed that although a small number of pancreatic beta cells were degenerated in pancreatic tissue, while immunohistochemical analysis and polymerase chain reaction assays did not detect the presence of SARS-CoV-2 in pancreatic beta cells (8), indicating that it was not there is sufficient evidence of direct damage caused by SARS-CoV-2. Levels of plasminogen activator inhibitor-1, CRP, serum amyloid A, TNF-, IL-1β, and IL-6 have been shown to be elevated in obese patients and type 2 diabetes mellitus. This can be reduced by lifestyle modification and weight loss, which suggests that inflammatory markers may be involved in pancreatic beta cell damage and insulin resistance (16). Inflammatory factors released in response to SARS-CoV-2 may also be involved in pancreatic beta cell destruction and insulin resistance resulting in more severe disturbances of glucose metabolism at the time of infection.

High blood glucose levels can increase viral replication and suppress the antiviral immune response (17). In addition, DM patients are more likely to be malnourished and prone to developing cytokine storms, which can eventually lead to rapid deterioration, than non-DM patients. In addition, pulmonary dysfunction affecting lung volume, lung diffusion capacity, respiration, bronchomotor tone, and neuroadrenergic bronchial innervation in non-COVID-19 patients with DM has been previously reported (18). All of these factors may explain the tendency for more serious lung damage in diabetic COVID-19 patients with uncontrolled blood glucose. The clinical severity and supporting parameters are in line with the increase in ICU room use and the COVID-19 mortality rate (11). This indicates the importance of screening for diabetes or hyperglycemia in COVID-19 patients to avoid underdiagnosis, considering that the history of diabetes is usually only based on the history.

These symptoms arise as a form of the body's response to COVID-19 infection. Cell destruction that occurs due to the viral replication process will stimulate the body's defense system to start an inflammatory process that will cause various symptoms experienced by the patient. These symptoms are a sign, where the infection process has taken place and the virus has begun to replicate and spread to other cells (19). The study by Du et al found that if a patient had respiratory symptoms such as shortness of breath or coughing up phlegm, his risk of dying could be up to 7.35 (2.08 - 25.97) times higher. If there are symptoms outside the respiratory tract, the risk can increase to 3.80 (1.19 - 12.18) times higher to die (20).

CONCLUSION AND RECOMMENDATION

COVID-19 has risk factors including low immunity, age, smoking, and comorbid diseases such as hypertension and diabetes mellitus. Type 2 diabetes mellitus will increase the severity and mortality of COVID-19 patients due to risk factors, namely due to the mechanism of the relationship between diabetes mellitus and COVID-19 related to advanced age, obesity, chronic systemic inflammation, increased coagulation activity, potential direct damage. Pancreas, changes in ACE2 receptor expression, dysregulation of the number and activity of immune cells, alveolar dysfunction, and endothelial dysfunction that can indirectly lead to more severe complications due to COVID-19.

REFERENCES

1. Levani Y, Prastya AD, Mawaddatunnadila S, Wuhan K, Huebei P. Coronavirus Disease 2019 (COVID-19): Patogenesis , Manifestasi Klinis dan Pilihan Terapi. 2019;2019.
2. Sun P, Lu X, Xu C, Sun W, Pan B. Understanding of COVID-19 based on current evidence. 2020;(February):548–51.
3. Hussain A, Bhowmik B, Cristina N. Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company' s public news and information website. Elsevier

hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre-including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active. COVID-19 and diabetes: Knowledge in progress. 2020;(January).

4. Lu R, Zhao X, Li J, Niu P, Yang B, Wu H, et al. Articles Genomic characterisation and epidemiology of 2019 novel coronavirus : implications for virus origins and receptor binding. Lancet [Internet]. 2020;395(10224):565–74. Available from: http://dx.doi.org/10.1016/S0140-6736(20)30251-8
5. Dhont S, Derom E, Braeckel E Van, Depuydt P, Lambrecht BN. The pathophysiology of 'happy' hypoxemia in COVID-19. Respiratory Research, vol. 21, no. 1, 2020, p. 198
6. Jiao Y, Gao S, Wu L, Song A. Continuity of care for quality of life and clinical outcomes in patients with peritoneal dialysis. International Journal of Clinical and Experimental Medicine, 2017;10(12):16586–94.
7. Shianata CM, Engka JNA, Pangemanan DHC. Happy Hypoxia Pada Coronavirus Disease. Jurnal Biomedik, 2021;13(28):58–66. Available from: https://doi.org/10.35790/jbm.13.1.2021.31743
8. William E, Hamonangan B. Pandemi COVID-19 dalam Perspektif Demografi Sosial (Komorbiditas) Dinamika Mortalitas Dalam Kejadian Luar Biasa : Studi Kasus Pandemi Coronavirus Disease 2019 (Covid-19). Research Gate: Covid dan Sosiologi. 2020;(March). Available from: https://doi.org/10.13140/RG.2.2.36248.83200
9. Acharya D, Lee K, Lee DS, Lee YS, Moon S. Mortality Rate and Predictors of Mortality in Hospitalized COVID-19 Patients with Diabetes. Healthcare (Basel). 2020 Sep 13;8(3):338. doi: 10.3390/healthcare8030338.
10. Letko M, Marzi A, Munster V. Functional assessment of cell entry and receptor usage for SARS-CoV-2 and other lineage B betacoronaviruses. Nature Public Health Emergency Collection. 2020 Apr;5(4):562-569. doi: 10.1038/s41564-020-0688-y.
11. Tignanelli CJ, Ingraham NE, Sparks MA, Reilkoff R, Bezdicek T, Benson B, et al. Correspondence Antihypertensive drugs. Lancet Respir [Internet]. 2020;2600(20):2019–20. Available from: http://dx.doi.org/10.1016/S2213-2600(20)30153-3
12. Erener S. Diabetes, Infection Risk And Covid-19. Mol Metab [Internet]. 2020;101044. Available from: https://doi.org/10.1016/j.molmet.2020.101044
13. Wulandari A, Rahman F, Pujianti N, Sari AR, Laily N, et al. Hubungan Karakteristik Individu dengan Pengetahuan tentang Pencegahan Coronavirus Disease 2019 pada Masyarakat di Kalimantan Selatan Jurnal Kesehatan Masyarakat Indonesia 15(1):42 Available from: https://doi.org/10.26714/jkmi.15.1.2020.42-46.
14. Kulcsar KA, Beck SE, Frieman MB, Kulcsar KA, Coleman CM, Beck SE, et al. Comorbid diabetes results in immune dysregulation and enhanced disease severity following MERS-CoV infection Comorbid diabetes results in immune dysregulation and enhanced disease severity following MERS-CoV infection. 2019;4(20).
15. Chen C, Xiao H, Shi Y, Bian X. 三例遗体 多部位穿刺组织病理学研究. Chinese Journal

of Pathology. 2020 (April),49 (05): 411-417. Available from: https://doi.org/10.3760/cma.j.cn112151-20200312-00193
16. Fanshan M, Lin Z, Wenqing L, Chunlei L, Yongqiang L, Naiyi L. Functions of standard CPR training on performance qualities of medical volunteers for Mt . Taishan International Mounting Festival. 2013;13(Suppl 1):1–5.
17. Gasparini M, Khan S, Patel JM, Parekh D, Bangash MN, Shah A, et al. Renal impairment and its impact on clinical outcomes in patients who are critically ill with COVID-19 : a multicentre observational study. Anaesthesia. 2021 Mar;76(3):320-326. doi: 10.1111/anae.15293..
18. Fuso L, Pitocco D. Diabetic lung , an underrated complication from restrictive functional pattern to pulmonary hypertension. Diabetes Metab Res Rev. 2019 Sep;35(6):e3159. doi: 10.1002/dmrr.3159
19. Du RH, Liang LR, Yang CQ, Wang W, Cao TZ, Li M, Guo GY, Du J, Zheng CL, Zhu Q, Hu M, Li XY, Peng P, Shi HZ. Predictors of mortality for patients with COVID-19 pneumonia caused by SARS-CoV-2: a prospective cohort study. Europe Respiratory Journal. 2020 May 7;55(5):2000524. doi: 10.1183/13993003.00524-2020
20. Mpotos N, Monsieurs KG, Idrissi SH. Effect of rescuer’s sex on the quality of chest compression during cardiopulmonary resuscitation on manikins. European Journal of Emergency Medicine 22(1):69. Available from: https://doi.org/10.1097/MEJ.0000000000000219