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Research Article

The Risk Factors for Exposure to Covid-19 in Diabetes Patients in the Johar Baru Health Centre Work Area

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Abstract

Aims: The study aims to analyse the risk factors for exposure to Covid-19 in Diabetes Mellitus (DM) Patients in the Johar Baru Health Centre work area.

Design: This research was an observational analytic with a *cross-sectional* design. 146 DM patients were selected using the purposive sampling technique as respondents. Four instruments were employed in this study, they were The Perceived Stress Scale, modified Diabetes Self-management Questionnaire, Self-assessment form from the Ministry of Health to measure the risk of exposure to Covid-19, and The Covid-19 Preventive Behaviour Questionnaire, which was compiled based on a literature study and tested for validity and reliability.

Methods: This research is a quantitative descriptive research.

Results : Using Kendal's Tau B statistics, the risk of being exposed to Covid-19 was found to have a significant relationship to the length of suffering from DM, comorbidities, stress levels, self-management, and Covid-19 preventive behaviour with a *p-value* <0.05. The multiple linear regression test found that the risk of being exposed to Covid-19 was influenced by the variable duration of suffering from DM, stress level, and Covid preventive behaviour (*p-value* < 0.05) with the results of *Cox and Snell R* = 0.382 indicating that the independent variable contributes 38.2%.

Conclusions: DM patients were in high risk for exposure Covid 19, thus they need to control stress levels and carry out Covid preventive behaviour by prioritizing optimal health procedures to prevent the risk of being exposed to Covid-19.

Keywords

Covid-19; Diabetes Mellitus; Preventive Behaviour; Risk of Exposure; Stress

INTRODUCTION

Covid-19 is a highly contagious zoonosis produced by SARS-CoV-2 and spread from humans through respiratory secretions. Patients with Diabetes Mellitus (DM) have comorbidities for the occurrence of Covid-19, which according to the incidence of this incident, has afflicted 463 million people (WHO, 2020). DM patients have a higher risk of infection, especially if they have poor glycaemic control due to a weakened immune system as the first line of defence against SARS-CoV-2. DM patients can be in a pro-

inflammatory state characterised by inappropriate and excessive cytokine responses, as illustrated in Covid-19 patients where serum levels of interleukin-6, C-reactive protein and ferritin are significantly higher in patients with DM. Excessive activation of the hemodynamic system causes fatal thrombolytic complications that eventually lead to death (1). In addition, comorbidities in DM patients such as hypertension and heart disorders are also risk factors that cause the sufferer's immune system to weaken, leading to more difficulty to fight infection (2). Older age is a risk factor to being exposed to COVID-19 because it is often associated with groups that are susceptible to various diseases as the physiological function of the immune system being reduced. WHO report that in the pre-elderly age (50-59 years), the mortality rate reaches 2%, age of 60-69 years rises to 4% and continues to rise to 8- 15% within those above 70 years old. Most deaths occurred in Covid-19 sufferers found in those aged 80 years and over, with a percentage reaching 21.9% (3). This incidence is also significant with DM patients whose prevalence will increase with age (4). The challenge for people with diabetes is that social restrictions can inhibit physical activity, which affects glycaemic control, and psychologically leads to depression and anxiety. Unhealthy emotions will affect glycaemic control in people with DM amid the Covid-19 pandemic. Factors that trigger it are the process of increasing secretion and action of counter regulatory hormones, changes in glucose transport function, and increased activation of inflammation (5). The Special Capital Region of Jakarta (DKI Jakarta) is currently implementing an integrated social restriction for outdoor activities, where people can start leaving their homes and hold mass gatherings. This implementation is risky to increase the incidence of Covid-19 because many people ignore the appropriate health protocol. Several international endocrine institutions such as American Diabetes Association (ADA), International Diabetes Federation (IDF) and Centers for Disease Control and Prevention (CDC) encourage people with DM to stay at home and avoid contact with the masses (6–8). Data centre of Jakarta's Covid-19 suggests that DM patients in the Johar Baru sub-district can be infected with Covid-19. It is part of the high-risk zone with 412 active cases, 398 active suspected cases, and 171 active close contact cases. As of July 18, 2021, four new active cases were also found in the Johar Baru area, where the patients were in the age range of 40-52 years with hospitalisation status. Self-management in diabetic patients, if applied extensively, will reap great success. ADA recommends emphasising the importance of self-management for DM patients because good self-management has been shown to correlate with good glycaemic control positively, decreased complications and improved quality of life (9). The research of (10) reinforces this recommendation with their finding revealing DM patients who perform regular self-management will significantly reduce fasting blood sugar levels ($p < 0.05$) (10). Therefore, this study aims to analyse the risk factors for exposure to Covid-19 in Diabetes Mellitus (DM) Patients in the Johar Baru Health Centre work area.

METHODS

This study is an observational analytic with a cross-sectional design. This research was conducted in March-August 2021 in the sub-district of Johar Baru health centre work area. In 2019, the DM patients at Johar Baru Health Centre work area were 200

patients and using the Slovin formula (11) , 146 DM patients were selected by non-random sampling technique, namely purposive sampling, with inclusion criteria, including age 40-70 years, routinely controlled at the health centre, having gadgets to access google forms, while the exclusion criteria was illiterate DM patients.

The four research instruments used were including The Perceived Stress Scale (PSS)-10 Items, Self-management Questionnaire (DSMQ), The Covid-19 prevention behaviour Questionnaire which is compiled based on a literature study and those use Likert's four-point scale and A self-assessment questionnaire-21 Items. The Perceived Stress Scale-10 items showed adequate internal consistency reliability ($\alpha = 0.78$) (12). Self-Management questionnaire was adapted from Diabetes Academy Mergentheim Research Department. Self-Management questionnaire translated into Indonesian language and have been tested by some researchers ($p > 0.05$, $\alpha > 0.80$) (13). The validity and reliability in this present study was tested for the 30 DM patients in the Jabodetabek area (outside Johar Baru Health centre area), a Covid-19 red zone for Self-Management questionnaire and The Covid-19 Preventive Behaviour Questionnaire with Cronbach's alpha of 0.75 and 0.76 respectively. A self-assessment questionnaire-21 Items consisting of the risk of exposure to Covid-19 was adapted from the official website of the Ministry of Health. The respondents were contacted by health cadres under Johar Baru Health Centre and they were asked to fill the G-form.

Data were analysed using IBM SPSS version 20 for Windows. The Shapiro-Wilk was conducted to analyse the distribution of data and the results showed that the data was normally distributed. Descriptive statistics and bivariate statistics used Kendal's Tau B, and multiple linear regression was used to examine the effect of the independent variable on the dependent variable. This research had received ethical clearance from the Sint Carolus STIK's Ethics Commission No.098.A/KEPPKSTIKSC/III/2021.

RESULTS

The results of research conducted on 146 respondents with DM, as depicted in table 1, showed that the majority of respondents were female with a total of 107 (73.3%), a total of 41 were in the early elderly (age range 46-55 years), and a total of 64 (43.8%) had the *underweight* category. 82 respondents had blood sugar above 200 mg/dL (56.2%), with 110(75.3%) having a duration of suffering DM for more than one year. Besides, most respondents took oral anti-hyperglycaemic drugs (67.8%), and almost fifty per cent (43.2%) of the respondents had hypertension. In addition, the majority of respondents' also experienced severe stress (79.5%), with 62 respondents (42.5%) had poor self-management of DM, and the majority (91.1 %), had carried out Covid-19 preventive behaviour well. For the dependent variable in this study, most respondents (89.7%) had a lower risk of being exposed to Covid-19. Kendal's Tau B statistical test found a significant relationship between duration of suffering from DM, comorbidities, stress levels, self-management, and Covid-19 preventive behaviour on the risk of being exposed to Covid-19 (p -value < 0.05).

Table 1.
Frequency Distribution of Respondents and Analysis of the variables' relationship to the Risk of Covid-19 for people with DM in Johar Baru Health Centre work area

| Variables | n | % | p value |
|--|-----|------|--------------|
| Gender | | | |
| Male | 39 | 26,7 | 0.266 |
| Female | 107 | 73,3 | |
| Age | | | |
| Early Adult: 26-35 years old | 28 | 19,2 | 0.272 |
| Late Adults: 36-45 years old | 12 | 8,2 | |
| Early Elderly: 46-55 years old | 41 | 28,1 | |
| Late Elderly: 56-65 years old | 39 | 26,7 | |
| Seniors: > 65 years old | 26 | 17,8 | |
| Educational background | | | |
| Basic education | 130 | 89 | 0.486 |
| Higher education | 16 | 11 | |
| BMI | | | |
| <i>Underweight</i> BMI <18,5 kg/ m ² | 64 | 43,8 | 0.262 |
| Normal BMI 18,5-22,9 kg/m ² | 51 | 34,9 | |
| <i>Overweight</i> BMI 23-24,9 kg/ m ² | 20 | 13,7 | |
| Obese BMI >25 kg/m ² | 11 | 7,5 | |
| Blood sugar | | | |
| Normal: < 200mg/dl | 64 | 43,8 | 0.857 |
| DM: ≥ 200 mg/dl | 82 | 56,2 | |
| Duration of Suffering DM | | | |
| < 1 year | 36 | 24,7 | 0.034 |
| > 1 years | 110 | 75,3 | |
| Types of Drugs Consumed | | | |
| Oral Hyperglycaemia | 99 | 67,8 | 0.063 |
| Insulin injection | 19 | 13 | |
| None | 28 | 19,2 | |
| Comorbidities | | | |
| None | 46 | 31,5 | 0.005 |
| Hypertension | 63 | 43,2 | |
| Heart Diseases | 2 | 1,4 | |
| Others | 35 | 24 | |
| Stres level | | | |
| Severe Stress | 116 | 79,5 | 0.001 |
| Mild Stress | 30 | 20,5 | |
| Diabetes Self-Management | | | |
| Poor | 62 | 42,5 | 0.001 |
| Good | 84 | 57,5 | |
| Covid-19 prevention behaviour | | | |
| Poor | 13 | 8,9 | 0.000 |
| Good | 133 | 91,1 | |

Table 2.
Fitting research model

| Model | -2 Log Likelihood | Chi-Square | df | Sig. |
|----------------|-------------------|------------|----|------|
| Intercept Only | 107.064 | | | |
| Final | 36.822 | 70.241 | 19 | .000 |

Based on table 2, the Fitting research model test on the dependent variable-risk of exposure to covid-19 a -2-log decrease Likelihood and a significant value at a p-value of 0.000 were found. Statistically, the independent variables (age, gender, education level, BMI, blood sugar, length of suffering from DM, type of drug, comorbidities, stress level, self-management, and Covid-19 preventive behaviour) provided good accuracy on the risk of Covid-19 exposure.

Table 3.
Assessment of Pseudo R-Square Coefficient

| | |
|---------------|------|
| Cox and Snell | .382 |
|---------------|------|

Pseudo R-Square test based on Cox and Snell values was carried out to determine the independent variable's contribution. Based on table 3, the R-square value (Cox and Snell) was 0.382. The independent variable contributed 38.2% to the risk of being exposed to Covid-19, and the other 61.8% were from unexamined variables. Other variables that may contribute to the risk of being exposed to COVID-19 include socioeconomic status related to financial conditions (14) type of work, and use of public transportation (15).

Table 4.
Parameters Estimates to Risk of Covid-19

| | | Estimate | df | Sig |
|-----------|-------------------------------|----------|----|--------------|
| Threshold | Risk of Covid-19 | -19.064 | 1 | 0.996 |
| Location | Age | 3.715 | 1 | 0.178 |
| | Gender | -0.116 | 1 | 0.943 |
| | Education level | -0.332 | 1 | 0.913 |
| | BMI | 3.327 | 1 | 0.270 |
| | Blood sugar | 2.393 | 1 | 0.173 |
| | Duration of illness | -6.244 | 1 | 0.021 |
| | Medication | 5.436 | 1 | 0.129 |
| | Other Illness | -20.544 | 1 | 0.995 |
| | Stress Level | 4.254 | 1 | 0.037 |
| | Diabetes Self-Management | 4.465 | 1 | 0.073 |
| | Covid-19 Prevention behaviour | -4.925 | 1 | 0.005 |

Parameter Estimation test revealed three variables that affected the risk of being exposed to Covid-19 with a significant value <0.05 , including the length of suffering from DM, stress, and Covid-19 preventive behaviour. Variable duration of illness and Covid-19 prevention behaviour had negative estimate with significant value <0.05 these due to unequal distributed sample where duration of illness >1 year and good covid-19 Prevention behaviour are dominate the frequency.

DISCUSSION

One who has a medical condition such as DM is more susceptible to experiencing severe illness due to the COVID-19 virus. It is because hyperglycaemia conditions encourage the production of oxidative stress and pro-inflammatory cytokines. They facilitate tissue inflammation and cause a decrease in the function of neutrophils, lymphocytes, and macrophages as the immune system, causing a person with hyperglycaemic conditions to become easily infected with viruses (16). As a result, one who experiences fluctuations in blood glucose levels will be more challenging to treat due to immune disorders when having infections as the body cannot fight the virus. Besides, the virus can thrive in a high blood glucose environment causing the lengthy recovery period of Covid-19 patients (17). Patients diagnosed with prolonged DM experience a chronic inflammatory status compared to patients with newly diagnosed DM who are still in an acute inflammatory state. Homeostatic glucose regulation and peripheral insulin sensitivity become so impaired that the immune response becomes abnormal and ineffective. This chronic inflammatory condition may play a role in increasing the risk of being exposed to the COVID-19 virus (18).

Another factor that can cause the risk of being exposed to the Covid-19 virus is comorbid conditions, such as hypertension. Angiotensin-Converting Enzyme (ACE) in the body plays an essential physiological role in regulating blood pressure. ACE stimulates the work of the renin-angiotensin-aldosterone (RAA) system by converting angiotensin I to angiotensin II, resulting in vasoconstriction of blood vessels with an increase in blood volume and extracellular fluid volume. In turn, it will increase blood volume and pressure (19). However, on the other hand, ACE 2 mediates the entry of SARS-CoV-2 in humans. This idea is supported by laboratory tests conducted in Wuhan, showing that protein molecules in the covid virus are interested in binding to ACE 2 (20). In other words, ACE 2 can be a receptor for the entry of the COVID-19 virus into the human body (21). As a result, it explains why hypertension conditions can increase susceptibility to Covid-19 virus infection (22).

Good self-management is a practical approach to preventing the transmission of the COVID-19 virus (23). Proper glycaemic control is expected to reduce the covid-19 virus infection and disease severity (23). In addition, poor glycaemic control can worsen the patient's condition and cause metabolic complications (24). Self-management of diabetic patients, by the PERKENI Consensus on the Management and Prevention of Type 2 Diabetes Mellitus, focuses on glucose control, including diet, physical exercise, and medication/insulin. However, based on the data analysis results in this study, $>50\%$ of respondents rarely and sometimes do not adhere to the diet and are lazy to do physical activity to maintain optimal sugar levels. Poor eating arrangements will

increase the glycaemic index level, while lack of exercise tends to cause insulin resistance, and both factors will increase the incidence of hyperglycaemia.

A systematic review of meta-analysis shows that 32.9% of Asian residents experience stress due to the Covid-19 pandemic (25). Covid 19, considered a threat, creates tension for the world community. In addition, severe stress will cause various health problems and increase hyperglycaemia in diabetic patients. In Indonesia, the effort of coping Covid-19 resulting in several policies such as the closure of schools and workplaces; Restrictions on activities in public/religious places/facilities, and restrictions on public transportation modes (3). These policies certainly cause an increased level of stress in the community. A person with severe stress may see the case of Covid-19 as a significant threat. Still, surprisingly this big threat can act as a motivational factor to carry out behaviours that facilitate the preventive behaviour of COVID-19, leading to a low risk of infection (26). This finding is supported by research that reports that limiting outdoor activities allows people to spend more time with their families and doing alternatives to the routines exercise such as walking on the terrace (27). In other words, the feelings of stress they experience can be channelled by doing different activities as a coping mechanism.

In addition, in 2021, WHO also states that the spread of the COVID-19 virus can be reduced by taking preventive steps, such as washing hands, maintaining distance, using masks, and avoiding crowds and closed places (28). Based on the Covid-19 preventive behaviour data analysis, >50% of respondents sometimes and rarely consume vitamins/food supplements and neglect to clean/disinfect frequently touched surfaces. As widely known, the Sars-CoV-2 virus is transmitted through droplets and the surfaces of objects touched by the sufferer. This virus can survive for some time, and therefore if someone touches a contaminated surface and then touches the nose or mouth area, the virus may transmit.

In this study, most respondents have underweight BMI, which will undoubtedly affect their health status. The literature suggests that DM patients in developing countries need vitamin supplements to maintain their health and reduce the risk of Covid-19 infection (29). Other research also finds that anti-hyperglycaemic drugs can reduce serum Vit B-12 with type 2 DM in 22 % of patients who take metformin for a long time. Further, research affirms that B-12 can also affect the replication of Sars-Cov-2 and aggravate the disease process and cure Covid-19 disease (30). In addition to Vitamin B-12, Vitamin D also has a significant effect on Covid-19 patients because Vitamin D can affect ACE 2, which affects inflammatory cytokine reactions causing problems in the respiratory system. Moreover, vitamin D also helps to increase the body's sensitivity to insulin, reducing insulin resistance (31). Therefore, taking vitamin supplements is highly recommended for DM.

CONCLUSION

Based on the results, it can be concluded that DM patients need to control their stress levels and carry out covid preventive behaviour by prioritising optimal health procedures to prevent the risk of being exposed to Covid-19. In addition, DM patients need to control their glycaemic index by increasing compliance in consuming healthy foods and doing physical activities at home.

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