Volume 01 Issue 01, January 2024, p. 31-39

Journal of Nursing Periodic
http://journal.uds.ac.id/index.php/JNP

ORIGINAL ARTICLE **Open Access**

The Relationship Of Oxygen Saturation With Malaise In Diabetes Mellitus Patients In Jember

Nikmatul Jannah[1], Andi Eka Pranata[1]*, Umi Sukowati[1]

[1]Faculty of Health Sciences, Universitas dr. Soebandi, Jember, Indonesia

*Correspondence:
Andi Eka Pranata
Email: andiekapranata@uds.ac.id

Received: 2023-09-12 **Accepted: 2024-01-10** **Published:2024-01-15**

Abstract

Introduction: Diabetes mellitus causes sugar in the blood to not be brought into cells and causes hyperglycemia. Excessive levels of sugar in the blood can disrupt the work of blood cells which will release oxygen so that oxygen in the blood becomes reduced which causes hypoxia in peripheral tissues. Glucosuria causes the body to lose calories, causing a decrease in metabolic energy and malaise. This study aimed to analyze the relationship of oxygen saturation with malaise in diabetes mellitus patients. **Methods:** The design used in this research is a cross-sectional approach. The population of DM patients at hospital on average in the last 3 months was 160 patients. The sample in this study was 50 respondents. This study used a sampling technique of no-probability sampling with the Quota sampling method. Data collection in this study used oximetry and the DSS questionnaire. The data analysis technique used is the Spearman test. **Results:** This study showed that most of the oxygen saturation experienced moderate hypoxemia as many as 20 people and the category of acute malaise was 1 person (2%), subacute malaise was 16 people (32%), and chronic malaise was 33 people (66%). Based on the results of the Rank Spearman statistical test, it is known that there is a relationship between oxygen saturation and malaise in diabetes mellitus patients (p-value 0.000 $\alpha < 0.05$). **Conclusion:** There is a relationship between oxygen saturation and malaise in Diabetes Mellitus patients. The health care system can implement the comprehensive strategy to solve problem related to diabetes mellitus patient.

Keywords: Diabetes Mellitus, Malaise, Oxygen Saturation

Introduction

Diabetes mellitus (DM) is a chronic or chronic disease metabolic disorder characterized by an increase in blood glucose levels above normal values. Diabetes mellitus is a complex chronic disease that requires ongoing medical care with multifactorial risk reduction strategies beyond glycemic control. People with diabetes mellitus will experience disturbances in the peripheral neurosystem which is characterized by the presence of dead tissue, tingling, and malaise. Symptoms of malaise can include anorexia or lack of appetite,

weight loss, headaches, chills, and night sweats. The longer the symptoms of malaise get worse the occurrence of intermittent (Christa Simarmata et al., 2021).

International Diabetes Federation states that 463 million people suffer from diabetes and the global prevalence rate reaches 9.3% (International Diabetes Federation, 2019). This makes Indonesia's status alert for diabetes because it still haunts the world. According to (the Indonesian Ministry of Health, 2020), Indonesia is seventh out of 10 countries with the most sufferers, namely 10.7 million people. Indonesia is the only country in Southeast Asia on the list. Results (Basic Health Research, 2018) 10.9% of people who have had blood glucose checks are aged 15 years and over. The prevalence of diabetes patients in East Java Province is in the top 10 in Indonesia with a prevalence of 6.8%. The total number of DM sufferers in the Jember Regency is 12,000 people with DM, the number is increasing from the previous year (Jember Health Office, 2019). At the time of the preliminary study at Balung Hospital Jember, there were 1,440 diabetes mellitus patients in 2022, and the average in the last three months in the Melati inpatient room was 160 people.

Malaise is a condition of being unfit which describes a feeling of tiredness and can be caused by several factors, one of which is glucose levels in the blood, lack of nutrition, and insufficient oxygen supply to the tissues in the body. Malaise can be related to depression and feelings of weakness. Weak describes the feeling of being tired and having no energy. Feeling depressed and weak is normal, but if it continues for a long time it can cause serious emotional and psychological problems such as stress. The failure of the pancreas to produce insulin on time causes a series of metabolic diseases such as diabetes mellitus. A state of malaise will appear if there is a lack of energy sources for the body due to metabolic instability depression and weakness (Irfan & Wibowo, 2019).

Patients with uncontrolled diabetes mellitus need to pay attention to the level of oxygenation in the body because cells use glucose for metabolic processes and convert it into energy. Measurement of oxygen saturation is a way to assess the effectiveness of oxygenation or tissue perfusion in patients. Maintaining oxygenation is an effort to ensure an adequate supply of oxygen entering the tissues or cells so that it does not affect the vascular and cellular activities of the tissues. High blood viscosity also carries a risk of various kinds of infections where it can cause sepsis and multiple failures and hinder the healing process of wounds in patients with diabetic ulcers that take place normally as well as obstacles in preventing infection.(Fadlilah et al., 2020). This study aimed to analyze the relationship of oxygen saturation with malaise in diabetes mellitus patients.

Methods

The design used in this study is a *cross-sectional approach.* The study population was DM patients at Jember Hospital. The sample in this study was 50 respondents. This study uses a *non-probability sampling technique* with the *Quota sampling method.* Data collection in this study used *oximetry* and the DSS questionnaire. The data analysis technique used is the *Spearman rank test.*

Results

The characteristics of the respondents in this study were based on age, gender, education, and work.

Table 1 Characteristics of respondents

Variable	Frequency	Percentage %
Age		
40-55 years	19	38
56-75 years	27	54
76-85 years	4	8
Gender		
Man	23	46
Woman	27	54
Education		
Elementary School	42	84
Junior High School	6	12
Senior High School	2	4
Work		
Housewife	21	42
Laborer	16	32
Self-employed	7	14
Doesn't work	6	12
SaO2		
Normal: 95-100	11	22
Mild hypoxemia: 90-94	19	38
Moderate hypoxemia: 75-89	20	40
Malaise		
Acute	1	2
Subacute	16	32
Chronic	33	66
Total	50	100

Table 1 showed that the majority of DM patients are aged 56-75 years as many as 27 people (54%). The majority of DM patients are women, 27 people (54%), elementary school, 42 people (84%), housewives as many as 21 people (42%), moderate hypoxemia are 20 people (40%), and chronic malaise are 33 people (66%).

Table 2 Data on the Relationship between Oxygen Saturation (SaO2) and Malaise in Diabetes Mellitus Patients

		Malaise							
		I		Subacute		Chronic		Total	Mark P
		N	%	N	%	N	%		
Oxygen Saturation	Normal	1	2.0%	9	18.0%	1	2.0%	11	0,000
	Mild hypoxia	0	0	7	14.0%	12	24.0%	19	
	Moderate hypoxia	0	0	0	0	20	40.0%	20	
Total		1	2.0%	16	32.0%	33	66.0%	50	

Based on Table 7, shows that oxygen saturation is mostly in the moderate hypoxemia category, and malaise is mostly in the chronic category. Based on *Spearman's* results, *a P-value* of 0.000 < (0.05) was obtained. It can be said that there is a relationship between oxygen saturation and malaise in DM patients.

Discussion

Oxygen Saturation in Diabetes Mellitus

The results of this study showed that 11 respondents experienced normal, and 19 respondents experienced mild hypoxemia, and 20 experienced moderate hypoxemia.

Diabetes Mellitus is a chronic disease that can be caused by the pancreas due to not producing enough insulin so that the body cannot use insulin properly and effectively. A DM sufferers, especially those who have high blood sugar levels in the long term, eating will cause high cholesterol to occur, resulting in the narrowing of blood vessels. If a sufferer has atherosclerosis, the person's blood flow will not flow smoothly and they will experience a lack of oxygen(Angelica & Peni, 2017).

Decreased oxygen saturation can be caused by a macroangiopathy process in the blood vessels so that tissue circulation decreases. Impaired blood circulation, especially in the lower extremities, can result in decreased oxygen saturation delivery to peripheral tissues. Diabetes Mellitus patients have a risk of decreased blood circulation to the periphery which is characterized by a decrease in peripheral oxygen saturation. If circulation decreases to that part of the foot for a long and continuous period, it will have an impact on cell metabolism. A continuous decrease in metabolism results in lactic acid so sufferers will complain of pain, aches, malaise, weakness, and progress to diabetic foot.

Most Diabetes Mellitus Patients experience moderate hypoxemia. This is in line with the explanation that (Yuniarsih & Budiharto, 2018), high blood sugar levels can cause diabetic ketosis. This condition can cause the release of free fatty acids from adipose fat tissue, Free

fatty acids will undergo a beta oxidation process in the liver which will be converted into ketone bodies with a low pH, the accumulated ketone bodies will cause metabolic acidosis. The condition of uncompensated metabolic acidosis will cause hyperventilation and the oxygen saturation picture of the patient experiencing mild to severe hypoxemia and also result in the blood vessel endothelium being flooded with glucose so that the blood vessel membrane becomes swollen and thickened, and the blood vessels become stiff, this disrupts the blood supply. to related organs, for example, the femoral artery which causes peripheral organ disorders which results in reduced oxygen levels in peripheral organs which will be visible when measuring oxygen saturation.

From the research results, the majority of Diabetes Mellitus patients experience moderate hypoxemia. Patients who experience moderate hypoxemia can be caused by several factors, namely development and behavior. Lifestyle is a behavioral factor in the form of physical activity and stress that occurs in an individual so that it can influence a person's oxygen needs directly or indirectly (Sartika et al., 2021).

The results of this study can be seen in that the majority of Diabetes Mellitus patients are aged 56-75 years. Diabetes patients are mostly elderly so they have low physical activity and experience a decrease in oxygen saturation. Physical activity is a person's activities during work, sleep, and free time. Several conditions that influence a decrease in oxygen saturation are age, respiratory function as assessed by oximetry, and also the time when oxygen saturation data is collected. Older age, less activity, decreased respiratory function, and taking oxygen saturation data in patients hospitalized can result in oxygen saturation values below normal.

Malaise in Diabetes Mellitus

The results of this study showed that as many as 1 Diabetes Mellitus patient experienced malaise in the acute category, 16 people experienced sub-acute, and 33 people experienced chronic malaise.

Malaise can occur due to several factors, including disease, infection, inadequate nutrition, and side effects from certain medications. Diabetes Mellitus is one of the factors of malaise, namely a metabolic disease that has many problems for individual health because diabetes mellitus is a chronic disease caused by the mechanism of endogenous and ineffective insulin use. This disease requires good attention from patients, families, and staff. Health care reduces various complications, both acute, sub-acute, and chronic, which can ultimately affect the patient's life both mentally, in quality of life, and socially. (Sayekti & Yulistari, 2022).

Energy management produced by diabetes mellitus patients is in the poor category because Diabetes Mellitus patients experience an increase in blood glucose which results in energy loss, fatigue, and malaise (Astri Yulianti et al., 2021). Fatigue and feeling malaise are the body's protective mechanisms to avoid further damage. Fatigue and malaise are subjective conditions that are different for everyone, but all are necessary for recovery. There are two types of weakness: general fatigue and muscle fatigue. Muscle fatigue is a decrease in muscle ability due to physical activity. Meanwhile, general fatigue, namely loss of will to work, can be caused by the state of the central nervous system and psychological psychological conditions. Several things that can influence energy management include fatigue management, nutrition, both biological and psychological comfort, rest and sleep time, and social support management Fatigue experienced by diabetes mellitus patients can cause sleep disorders, thus affecting the patient's quality of life (Sutawardana et al., 2022).

This research is in line with what was carried out (Yazid et al., 2020), where the greatest malaise or feeling of fatigue felt by diabetes mellitus patients will experience continuous fatigue and malaise, this is due to the presence of organic phosphate and potassium. Apart from that, neuropathy complications, especially in Diabetes Mellitus patients, will also result in fatigue and malaise because pain will affect the respondent's rest time which will affect the patient's quality of life. Patients who experience complications tend not to carry out activities because this occurs due to physical and mental limitations. Even though they often rest, they complain that their body feels weak, and they have no appetite and malaise.

The results of the research showed that the highest description of malaise felt by respondents was in the chronic category, the majority of the gender was female, and the occupation was housewife. This is because women are more likely to experience stress, anxiety, and depression than men. Stress experienced will increase the hormone cortisol so that it will interfere with glucose regulation. Respondents who do not work or are housewives with diabetes are included in the light physical activity category. These activities can affect the use of insulin. Patients who experience complications are more likely to not carry out activities, this occurs because of physical limitations, even though they often rest they complain that their bodies feel tired, unwell, weak, and malaise.

Relationship between Oxygen Saturation and Malaise in Diabetes Mellitus

Based on Table 5.7, the results of this study show that there is a significant relationship between oxygen saturation and malaise in Diabetes Mellitus patients with a *p-value* of 0.000 <

α 0.05. If the p-value is smaller than α 0.05, it means that there is a relationship between oxygen saturation and malaise in diabetes mellitus patients.

In this study, it was found that the majority of diabetes mellitus patients experienced hypoxemia, so the malaise they felt was in the chronic category. According to (Sholehah et al., 2022). Oxygen saturation is the percentage of Hb or hemoglobin that binds oxygen or oxygenated Hb saturation. Oxygen saturation can be influenced by three factors, namely lung function, circulatory system, and lung function. Normal oxygen saturation indicates adequate blood circulation to carry oxygen and nutrients to cells and tissues. Insufficient oxygen and nutrition can affect the patient's condition such as weakness, fatigue, and malaise. Hyperglycemia can cause areas to thicken so that blood circulation becomes obstructed. It can also delay diabetic wound healing and repair of new cells that cannot be fulfilled.

In the case of *Diabetes Mellitus* (DM), the decrease in peripheral oxygen saturation is caused by a macroangiopathic process in the blood vessels so that tissue circulation decreases. (Rismawati et al., 2018). Accumulation of sorbitol in the vascular intima and hyperlipoproteinemia caused by hyperglycemia result in vascular blockage which occurs due to the thickening of the intima (arterial basement membrane hyperplasia) in large blood vessels and capillaries and can even cause leakage of albumin out of the capillaries, disrupting the distribution of blood to the tissues so that blood circulation is disrupted. If this occurs in the peripheral arteries it can result in peripheral vascular insufficiency accompanied by intermittent claudication. Impaired blood circulation in the lower extremities can reduce oxygen delivery to tissues, causing a decrease in peripheral oxygen saturation.

According to previous research the process that occurs, and the researchers' initial findings indicate that changes in blood oxygen saturation can occur in people due to advancing age and reduced physical activity (Nurul Islami & Marisa, 2022). In this study, most of the respondents who experienced low oxygen saturation and chronic malaise were aged 56-75 years. Physical activity is needed to stabilize blood glucose levels. Physical activity facilitates glucose transport into cells and increases insulin sensitivity. If people with diabetes mellitus do not carry out active movements or physical activity, the process of transporting glucose into the cells decreases and even fails to occur. The condition of blood sugar levels will increase and trigger hypoxemia as a result of the macroangiopathy process in the blood vessels.

According to researchers, clients experience moderate hypoxia with levels of 86-90% of clients feeling shortness of breath which means that clients experience continuous fatigue, weakness, and malaise because the supply of oxygen in the body is insufficient, the lungs, heart, and diaphragm will work harder when breathing. Every cell in the human body needs oxygen

to work in any type of metabolic function. Therefore oxygen is the most important substance of life. Oxygenation is maintained to ensure adequate oxygen supply to tissues or cells. Insufficient oxygen supply in the body can damage human body tissue.

Conclusion

Based on the results of the research and discussion on the relationship between oxygen saturation and malaise in diabetes mellitus patients showed most of the diabetes mellitus patients experienced moderate hypoxemia. Most experience malaise in the chronic category. There was a relationship between oxygen saturation and malaise in diabetes mellitus patients.

References

Angelica, I., & Peni, VW (ND). *Effectiveness of Hyperbaric Oxygen Therapy on Blood Sugar Levels in Diabetes Mellitus Patients*.

Astri Yulianti, D., Ladesvita Nursing Study Program, F., & Health Sciences, F. (2021). Comparison of Fatigue Levels in Diabetic Kidney Disease and Hypertensive Kidney Disease Patients Undergoing Hemodialysis. In *Widya Gantari Indonesian Nursing Journal* (Vol. 5, Issue 1).

Christa Simarmata, P., Desi Esta Ulina Sitepu, S., Lestari Sitepu, A., Murni Karokaro, T., Nursing Studies, PS, Health Medistra Lubuk Pakam, I., Nursing Studies, PD, Health Deli Husada Deli Tua Jln Sudirman No, I., Pakam, L., & Deli Serdang, K. (2021). Counseling on Nutrition Regulation on Blood Sugar Levels in Diabetes Mellitus Patients. *Journal of Community Service*, *1* (2), 2775–2437. https://Doi.Org/10.35451/Jpk.V1i2.924

Jember Health Office. (ND). Rahmat Tulloh Amin, Ina Martiana, Jenie Palupi, Jamhariyah. *Https://Stikes-Nhm.E-Journal.Id/Nu/Index Attribution-Noncommercial 4.0 International. Some Rights Reserved The Relationship between Self Empowerment and Blood Glucose Levels in Patients with Type 2 Diabetes Mellitus*.

Fadlilah, S., Rahil, H., & Lanni, F. (2020). Analysis of factors influencing blood pressure and peripheral oxygen saturation (Spo2). In *Kusuma Husada Health Journal-January* .

International Diabetes Federation. (2019). Muhamad Idris Devi Apta Sari. *Self Management is Associated with Blood Sugar Levels in Diabetes Mellitus Sufferers*, *10no 2 Page 447-458* (E-Issn 2655-8106, P-Issn2338-2090), 2.

Irfan, M., & Wibowo, H. (ND). *The Relationship Between Stress Levels and Blood Sugar Levels in People With Diabetes Mellitus (DM) at the Peterongan Community Health Center, Jombang Regency (The Relationship Between Stress Levels and Blood Sugar Levels in People With Diabetes Mellitus (DM) in Peterongan Clinic Jombang Regency)*.

Ri Ministry of Health. (2020). Muhamad Idri Devi Apta Sari. *Self Management is Associated with Blood Sugar Levels in Diabetes Mellitus Sufferers*, *10no 2 Page 447-458* (E-Issn 2655-8106, P-Issn2338-2090), 2.

Nurul Islami, V., & Marisa, D. (ND). *Literature Review: Oxygen Saturation Values in Individuals with an Overweight Body Mass Index*.

Basic Health Research. (2018). Rahmat Tulloh Amin1, Ina Martiana2, Jenie Palupi3, Jamhariyah. *Relationship between Self Empowerment and Blood Glucose Levels in Diabetes Mellitus Patients*, 2.

Rismawati, E., Rosyidah, I., & Ardianti, LP (ND). *Nursing Care for Clients Suffering from Diabetes Mellitus with Problems of Ineffective Peripheral Tissue Perfusion in the Melati Room at Bangil Hospital*.

Sartika, M., Undergraduate Study Program in Nursing and the Nursing Profession at Medika University Suherman, P., Raya Industri Pasir Gombong Jababeka North Cikarang Bekasi, J., & Barat, J. (ND). *Analysis of the Relationship between Hyperglycemia and Oxygen Saturation Levels in Type II Diabetes Mellitus Patients in the Icu Room at Rs.Mitra Keluarga Cikarang in 2021* .

Sayekti, S., & Yulistari, N. (2022). The Relationship Of Stress Level With Blood Glucose Levels During Semester 6 (Six) Students Study Program Di Medical Laboratory Technology Faculty of Vocational Institute of Science and Health Technology Scholars Medika Jombang The Relationship Of Stress Level With Glucose Level In Sixth Semester Student Of Diploma Iii Medical Laboratory Program At Institute Technology And Health Of Human Scholars Medika Jombang. In *Insan Scholar Journal* (Vol. 9, Issue 2).

Sholehah, B., Junaidi Gunawan, A., Siswanto, H., Fatkhur Rahman Nurul Jadid University, H., Nurul Jadid, JP, Tj Lor, D., Paiton, K., Probolinggo, K., & Timur, J .(ND). *The Relationship Between Oxygen Saturation Levels and the Recovery Rate of Corona Virus Disease-19 Clients in Isolation Rooms*. Http://Jurnal.Globalhealthsciencegroup.Com/Index.Php/Jppp

Sutawardana, JH, Na'ilah Rahmatica, N., & Hakam, ; Glorious. (2022). The Relationship between Energy Management and Fatigue in Type 2 Diabetes Mellitus Patients. *Priority Nursing Journal, 5* (1).

Yazid, SA, Sutawardana, JH, & Siswoyo, S. (2020). The Relation Between Fatigue And Self-Management In Patients With Diabetes Mellitus Type 2 In Dr Soebandi Hospital Jember. *Journal of Nursing, 11* (1), 82–90. Https://Doi.Org/10.22219/Jk.V11i1.8348

Yuniarsih, L., & Budiharto, I. (ND). *The Analysis of Healing Inhibitors Factors Of Diabetic Foot Ulcer At The Kitamura Clinic Pontianak*.