

ORIGINAL RESEARCH

Risk factors of coronary heart disease in patients with type 2 diabetes mellitus

Elisabeth Sekaringtyas Medistya Putri¹, Soebagijo Adi S^{2*}, Mohammad Budiarto³¹Medical Program, Faculty of Medicine, Universitas Airlangga, Surabaya, Indonesia.²Department of Internal Medicine, Dr. Soetomo General Academic Hospital, Surabaya, Indonesia.³Department of Cardiology and Vascular Medicine, Dr. Soetomo General Academic Hospital, Surabaya, Indonesia.

Article Info**Article history:**

Received Aug 18, 2021

Revised Nov 17, 2021

Accepted Des 9, 2021

Published Jan 5, 2022

Keywords:

Coronary heart disease

Dyslipidemia

Healthy lifestyle

Risk-factors

Type 2 diabetes mellitus

***Corresponding author**

Soebagijo Adi S

soebagijo.adi.s@fk.unair.

ac.id

ABSTRACT

Background: Diabetes mellitus is a metabolic syndrome that becomes a concern in almost all countries in the world, particularly developing countries. Changes in lifestyle and genetic factors are causing the incidence of this disease to continue to increase every year. Nowadays, type 2 diabetes mellitus (T2DM) caused by insulin resistance is the most common kind. One of its complications known as a major cause of morbidity and mortality in patients with diabetes is coronary heart disease (CHD). Insulin resistance can lead to the atherosclerosis process that is the basis of coronary heart disease. It is said that conditions of hyperglycemia, hypercoagulable state, and high cholesterol can induce the process of atherosclerosis. Besides diabetes mellitus, the other risk factors that increase the incidence of CHD are sex, age, family history, dyslipidemia, smoking, hypertension, and obesity. **Objective:** The purpose of this study was to describe the risk factors for coronary heart disease in patients with type 2 diabetes mellitus in Dr. Soetomo General Academic Hospital, Surabaya, Indonesia. **Materials and Methods:** A cross-sectional study of diabetes mellitus patients with coronary heart disease was conducted in Dr. Soetomo General Academic Hospital from 1 January 2014 to 31 December 2014. Data were taken from medical records at the Department of Internal Medicine. Incomplete medical records were not included in this study. Risk factors analyzed were age, sex, history of hypertension and dyslipidemia. Results of this study were presented in a frequency distribution table. **Results:** Based on the data of 70 samples, risk factors of CHD in T2DM patients are found as follows: 44 (62.9%) samples were male, 56 (80%) high-risk aged group, 48 (68.6%) with dyslipidemia, and 50 (71.4%) with hypertension, while 24 (34.3%) samples had three risk factors at once. **Conclusion:** High-risk aged, male sex, hypertension, and dyslipidemia are more commonly found in T2DM patients with CHD. The more risk factors that one may have will increase the occurrence of cardiovascular disease within 10 years forward.

How to cite:Putri, E.S.M., Adi S, S., Budiarto, M. 2022. Risk factors of coronary heart disease in patients with type 2 diabetes mellitus. *Majalah Biomorfologi*, 32(1): 13-17*Majalah Biomorfologi (Biomorphology Journal)* p.ISSN:0215-8833, e.ISSN: 2716-0920doi: [10.20473/mbiom.v32i1.2022.13-17](https://doi.org/10.20473/mbiom.v32i1.2022.13-17)

Copyright: © 2022 by the authors. Open access publication under the terms and condition of the Creative Commons Attribution 4.0 International license (CC.BY 4.0).

BACKGROUND

Diabetes mellitus is a metabolic disorder characterized by chronic hyperglycemia due to disruption of the function of insulin hormone or their secretions. According to the [American Diabetes Association \(2015\)](#), there are several types of diabetes mellitus, such as type 1, type 2, gestational type, and others. Changes in lifestyle and genetic factors are causing the incidence of this disease to continue to increase every year. Based on data from the [International Diabetes Federation \(2013\)](#), there were 4,572 million people in the world, 381.3 million of them suffering from diabetes mellitus and its prevalence will increase by 55% in 2035.

Nowadays type 2 diabetes mellitus (T2DM) caused by insulin resistance is the most common kind. One of its complications known as a major cause of morbidity and mortality in patients with diabetes is coronary heart disease (CHD). CHD is a disease that is based on a process of atherosclerosis which leads to the development of plaque in the blood vessel lumen of the coronary arteries. This process can be induced by insulin resistance. Insulin resistance triggers oxidative stress and endothelial dysfunction of the blood vessels generates atheroma plaques formation. Previous research also includes the conditions of hyperglycemia, hypercoagulable state, and high cholesterol in the process of atherosclerosis ([Chiha, et al., 2012](#)). Besides diabetes mellitus, the other risk factors that increase the incidence of CHD such as sex, age, family history, dyslipidemia, smoking, hypertension, and obesity. Research conducted by [Sadeghi, et al., \(2013\)](#) found that among the risk factors, dyslipidemia is the most dominant risk factor for CHD in patients under the age of 50 years (77.6%).

OBJECTIVE

The purpose of this study was to describe the risk factors for coronary heart disease in patients with type 2 diabetes mellitus in Dr. Soetomo General Academic Hospital, Surabaya, Indonesia.

MATERIALS AND METHODS

This study was a cross-sectional study to describe the risk factors of coronary heart disease in diabetic patients. Data were collected from medical records of T2DM patients at the Department of Internal Medicine, Dr. Soetomo General Academic Hospital in Surabaya, Indonesia. The inclusion criteria were diabetic patients with CHD who were treated at the outpatient clinic of Dr. Soetomo General Academic Hospital from 1 January 2014 to 31 December 2014. Patients with incomplete medical records were excluded from this study. Risk factors analyzed were age, sex, history of hypertension and dyslipidemia. Age categories were divided into high risk and low-risk age. Male patients were at high risk if they were ≥ 45 years old, while women were at high risk if they were ≥ 55 years old. Furthermore, we classified the samples according to the number of risk factors they have. Results were presented in a frequency distribution table.

RESULTS

The results of this study found that from the total population of patients with diabetes mellitus at the Internal Medicine Department of Dr. Soetomo General Academic Hospital, Surabaya in 2014, the prevalence of patients with coronary heart disease was 15.7%.

Table 1. Distribution of risk factors in T2DM patients with CHD (n=70)

Risk factors	Frequency (%)
Sex	
Male	44 (62.9)
Female	26 (37.1)
Age Group	
High risk	56 (80)
Low risk	14 (20)
Hypertension	
Positive	50 (71.4)
Negative	20 (28.6)
Dyslipidemia	
Positive	48 (68.6)
Negative	22 (31.4)

Table 1 shows the distribution of risk factors in 70 patients with CHD. Gender was dominated by males, majority of patients were in the high-risk age group, hypertension, and dyslipidemia.

Table 2. Distribution of total risk factors of CHD in patients with T2DM

	Frequency (%)
1 risk factor	8 (11.4)
2 risk factors	17(24.3)
3 risk factors	24 (34.3)
4 risk factors	21 (30)

Table 2 revealed that majority of patients have three risk factors, followed by 4 risk factors, 2 risk factors, and 1 risk factor respectively.

DISCUSSION

Coronary heart disease is the most leading cardiovascular disease with traditional risk factors including sex, age, hypertension, dyslipidemia, diabetes mellitus, smoking and obesity. Its morbidity and mortality could be prevented by early intervention of modifiable risk factors. Therefore, this study was conducted to describe the risk factors for CHD, especially in diabetic patients.

Results showed that male patients were more likely to have CHD than female patients. This was supported by research conducted by [Tanna, et al., \(2013\)](#) that from 208 people who had coronary heart disease were 59.13% males and 40.87% females. The different results were obtained in [Riset Kesehatan Dasar \(Riskesdas\) \(2013\)](#) where the prevalence of CHD was suffered more by women. In this case, the hormone estrogen was believed to play an important role. The hormone estrogen was said to be capable of maintaining vascular endothelium, therefore minimizing the possibility of damage to the endothelium and preventing the formation of the atheroma plaques. This mechanism occurs because of an increase in endothelial nitric oxide synthase (eNOS), which causes vasorelaxation and revascularization ([Elizabeth & Daniel, 2011](#)). Patients at high-risk age were more likely to have CHD. A research conducted by [Tanna, et al., \(2013\)](#) showed that patients with coronary heart disease were dominated by the 60-69 age group. [Riskesdas \(2013\)](#) also found that the prevalence of CHD increased with age. Its results showed that CHD was suffered mostly by the age group of 65-74 years, followed by 55-64 years and above 75 years respectively. Based on the Adult Treatment Panel III in 2012, age can be classified as low-risk and high-risk age groups according to gender. It was stated that males with high-risk aged of CHD are those over or equal to 45 years old, while females of over 55 years old ([Eckel & Cornier., 2014](#)). Postmenopausal women are at greater risk than pre-menopausal women. It is associated with declining estrogen levels after menopause. Moreover, increased age may also decrease the elasticity of blood vessels and endothelial function to prevent damage.

This study also found that diabetic patients with CHD were suffered more from dyslipidemia. These results were in line with the established theory that dyslipidemia increases the risk of cardiovascular disease. [Sadeghi, et al., \(2013\)](#) conducted a study on 125 patients with premature coronary heart disease who were under the age of 50 years and found as many as 77.6% of patients suffering from dyslipidemia. In addition, a research by [Mahalle, et al., \(2014\)](#) found that patients with dyslipidemia found much low insulin sensitivity and with the increased inflammatory markers such as IL-6, TNF- α and hs-CRP. However, different results were obtained in research conducted at Dr. M Djamil Hospital in Padang, Indonesia. Of 88 patients with diabetes mellitus with CHD complications, as many as 74 people (84%) did not suffer from dyslipidemia ([Yuliani, et al., 2014](#)). The different outcomes can be influenced by many factors, such as the glycemic status of the subjects that are not observed. A study by [Thambiah, et al., \(2016\)](#) found a significant association between glycemic status with dyslipidemia in diabetic patients. These results showed that HbA1c can be used as a biomarker for dyslipidemia conditions other than as a control of blood sugar in diabetic patients. HbA1c below 6.5% is believed to reduce the occurrence of complications in diabetes.

Then, results showed that diabetic patients with complications of CHD are more accompanied by a history of hypertension. Similar results have been obtained from a study by [Yuliani, et al., \(2014\)](#) where there were 54 of 88 (61.4%) diabetic patients with complications of CHD accompanied with

hypertension. Hypertension is said to increase the incidence of cardiovascular disease due to endothelial dysfunction. Vulnerable vascular endothelium may facilitate the occurrence of atherosclerosis (Shimbo, et al., (2010). Hypertensive state also issued mediators such as angiotensin II, which triggers the production of plasminogen activator inhibitor 1 (PAI-1). Thrombus in vessels will be easily formed with the presence of this hormone so that the risk for the occurrence of thromboembolism is higher (Ambrose & Singh, 2015).

The result showed that most of the diabetic patients with CHD were accompanied by four comorbid factors, which may include gender, age, dyslipidemia, or hypertension. Unexpectedly, patients with these four risk factors were at the second-highest. It might be explained by other factors that were not examined in this study, for instance, family history, obesity, and smoking. The Third Report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III) has created a score to determine how much risk someone has for developing cardiovascular disease within 10 years forward. These risks were divided into three groups: <10%, 10-20% and >20%. The more risk factors that one may have will increase the occurrence of heart disease. This score was based on the Framingham study that establishes CHD risk factors such as age, total cholesterol, HDL cholesterol, hypertension and smoking habits (Eckel & Cornier, 2014).

CONCLUSION

High-risk age, male sex, hypertension, and dyslipidemia were more commonly found in T2DM patients with CHD in Dr. Soetomo General Academic Hospital, Surabaya, Indonesia. The more risk factors that one may have will increase the occurrence of cardiovascular disease within 10 years forward. Further research is needed with a larger number of samples and includes more other risk factors, such as obesity, smoking, and family history.

REFERENCES

- Ambrose, J. & Singh, M., 2015. Pathophysiology of coronary artery disease leading to acute coronary syndromes. *F1000prime reports*, 7(8). doi:10.12703/P7-08.
- American Diabetes Association., 2015. Standards of Medical Care in Diabetes. *Diabetes Care*, 38. doi: 10.2337/dc15-S001.
- Chiha, M., Njeim, M., Chedrawy, E., 2012. Diabetes and coronary heart disease: A risk factor for the global epidemic. *International Journal of Hypertension*: 1–7. doi: 10.1155/2012/697240.
- Eckel, R. & Cornier, M., 2014. Update on the NCEP ATP-III emerging cardiometabolic risk factors. *BMC Med*, 12. doi: 10.1186/1741-7015-12-115.
- Elizabeth, M. & Daniel, K., 2011. Estrogen Signaling and Cardiovascular Disease. *Circulation Research*: 691–692. doi: 10.1161/CIRCRESAHA.110.236687.
- International Diabetes Federation. 2013. *IDF Diabetes Atlas: sixth edition*.
- Kementerian Kesehatan Republik Indonesia. 2013. *Riset kesehatan dasar 2013*. Jakarta: Kementerian Kesehatan RI.
- Mahalle, N., Garg, M., Naik, SS., Kulkarni, MV., 2014., Study of pattern of dyslipidemia and its correlation with cardiovascular risk factors in patients with proven coronary artery disease. *Indian Journal of Endocrinology and Metabolism*, 18(1): 48–55. doi 10.4103/2230-8210.126532.
- Sadeghi, R., Nadia, a., Erfanifar, A., Gachkar, L., Magshoomi, Z., 2013. Premature coronary heart disease and traditional risk factors-can we do better?. *International Cardiovascular Research Journal*, 7(2): 46–50.
- Shimbo, D., Muntner, P., Mann, D., Viera, AJ., Homma, S., Polak, JF., Barr, RG., Herrington, D., Shea, S., 2010. Endothelial dysfunction and the risk of hypertension: The multi-ethnic study of atherosclerosis. *Hypertension*, 55(5): 1210–1216. doi: 10.1161/HYPERTENSIONAHA.109.143123.
- Tanna, N., Srivastava, R., Tanna, V., 2013. Age wise distribution of coronary artery disease risk factors. *International Journal of Medical Science and Public Health*, 2. doi: 10.5455/ijmsph.2013.190720131.
- Thambiah, S., Samsudin, I.N., George, E., Zahari, S.S.Y., Lee, H.M., Muhamad, M.A., Hussein, Z., Mohd, N.N., 2016. Relationship between dyslipidemia and glycaemic status in patients with type 2

diabetes mellitus. *Malaysian Journal of Pathology*, 38(2): 123–130.

Yuliani, F., Oenzil, F., & Iryani, D., 2014. Hubungan Berbagai Faktor Risiko Terhadap Kejadian Penyakit Jantung Koroner Pada Penderita Diabetes Melitus Tipe 2. *Jurnal Kesehatan Andalas*, 3(1): 37–40. doi: 10.25077/jka.v3i1.22.