Journal of Endocrinology, Tropical Medicine, and Infectious Disease (JETROMI) Vol. 05, No.3, 2023 / 127-134

JETROMI
Journal of Endocrinology, Tropical Medicine, and Infectious Disease

Cardiometabolic Risk Assessment through Comprehensive Screening for Early Detection

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ABSTRACT

Background: The development of cardiovascular disease (CVD) is influenced by many risk factors, such as tobacco use, an unhealthy diet, and physical inactivity, that could result in obesity, hypertension, dyslipidemia, and diabetes mellitus. Continuing exposure to these risk factors can be prevented by routine screening for populations without any clinical symptoms. This study was conducted to obtain data on cardiometabolic profiles of people who participated in the Community Service Program of the Department of Cardiology and Vascular Disease, University of Sumatera Utara.

Method: This research was a descriptive study with a cross-sectional research design. The study aims to screen for the cardiometabolic profile in the people of Tebing Tinggi City. Cardiovascular risk factors were obtained from interviewing the participants and on-the-spot examination with validated measurement tools. All data were processed and analyzed statistically using SPSS ver.26. Categorical variables are presented with frequency (n) and percentage (%). Numeric variables are presented with mean and standard deviation (SD) values for normally distributed data. As for the normal non-distributed data numerical variables are presented with the middle value (median) and the interquartile range.

Results: All subjects in this study (n= 102) are 39 male and 63 female. Most participants were in the 4th to 5th decade, with normal heart rates and normal sinus rhythm. Most female participants had a low risk for obstructive sleep apnea (OSA) and the male had intermediate risk. Most participants had normal random blood sugar and total cholesterol but mostly had obesity. Near 20-30% of participants were grade I and II systolic hypertensives but normally had diastolic blood pressure.

Conclusion: In this study, most of the cardiometabolic risks of patients in the Community Service program were obesity, followed by hypertension.

Keywords: Cardiometabolic Risk Factors, Indonesia, Obesity, Sumatera Utara

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DOI: https://doi.org/10.32734/jetromi.v5i3.12818
Journal Homepage: https://jetromi.usu.ac.id

ABSTRAK

Latar Belakang: *Berkembangnya penyakit kardiovaskular (PJK) dipengaruhi oleh banyak faktor risiko, seperti: merokok, diet tidak sehat, kurangnya aktifitas fisik, yang dapat berakibat kegemukan, hipertensi, dislipidemia dan diabetes melitus. Paparan yang terus-menerus pada faktor risiko ini dapat dicegah dengan skrining rutin pada populasi tanpa gejala klinis. Penelitian ini dilakukan untuk mendapatkan data profil kardiometabolik peserta yang mengikuti Program Pengabdian Masyarakat yang dilakukan oleh Departemen Penyakit Jnatung dan Pembuluh Darah Fakultas Kedokteran Universitas Sumatera Utara.*

Method: *Penelitian ini merupakan penelitian deskriptif dengan design potong-lintang. Tujuan penelitian ini adalah untuk mendapatkan profil kardiometabolik masyarakat di Kota Tebing Tinggi. Faktor risiko kardiovaskular didapat dari wawancara dan pemeriksaan langsung di tempat dengan menggunakan alat pengukuran yang telah divalidasi. Semua data diproses dan dianalisi menggunakan SPSS versi 26. Variabel kategori ditampilkan dalam frekuensi (n) dan persentase (%). Variabel numerik disajikan dengan rata-rata dan standar deviasi (SD) untuk data yang berdistrinbusi normal. Sedangkan untuk data yang tidak berdistribusi normal disajikan dalam bentuk median dan rentang interkuartil.*

Hasil: *Semua peserta dalam penelitian ini (n= 102) adalah 39 orang laki-laki dan 63 orang perempuan. Kebanyakan peserta berada dalam dekade ke-4 dan ke-5, dengan detak jantung normal dan irama sinus. Kebanyakan peserta perempuan memiliki risiko rendah terhadap obstructive sleep apnea (OSA) dan laki-laki memiliki faktor risiko yang sedang. Kebanyakan peserta memiliki normal gula darah acak dan kolesterol total, namu kebanyak peserta mengalami obesitas. Hampir 20-30% peserta mengalami hipertensi sistolik grade I dan II, namun dengan tekanan darah diastolik yang normal.*

Kesimpulan: *Pada penelitian ini, kebanyakan faktor risiko kardiometabolik pada peserta Program pengabdian masyaarat ini adalah obesitas, diikuti dengan hipertensi.*

Kata kunci: *Faktor risiko kardiometabolik, Indonesia, Obesity, Sumatera Utara*

Received 10 July 2023 | Revised 01 August 2023 | Accepted 01 August 2023

1 Introduction

Cardiovascular disease (CVD) closely matches the trend of epidemiological change and worldwide economic growth over the past century. With almost 80% of CVD-related deaths taking place in low-income countries, CVD began to assume the role of the world's major cause of premature mortality and morbidity toward the end of the 20th century.[1] In 2017, there were reportedly 55 million fatalities worldwide, of which 17.7 million were attributable to CVD. Keeping track of any changes or consistency in the creation of global and context-specific prevention measures will be aided by an understanding of the relationships between risk factors for CVD and mortality worldwide.[2,3]

Multiple heart and metabolic health risk factors, also referred to as cardiometabolic risk factors (CMRFs) greatly increase the risk of developing cardiovascular conditions like ischemic heart disease, myocardial infarction, and future cardiovascular events. The CMR of a person is influenced by several different things. For example, there is a significant link between food and cardiovascular disease (CVD), which can start developing in children. Atherosclerosis and hypertension, two conditions that contribute to CVD, are also influenced by diet. The American Heart Association (AHA) advises eating a balanced diet, striving for normal blood glucose levels,

and maintaining prescribed levels of low-density lipoproteins, high-density lipoproteins, and triglycerides to prevent CVD.[4,5]

The significance of cardiometabolic risk screening lies in its role in the early identification of cardiovascular diseases. By examining the various components of metabolic syndrome, specific criteria were taken into consideration, such as triglyceride levels exceeding 150 mg/dL, HDL cholesterol levels below 40 mg/dL, systolic blood pressure surpassing 130 mm Hg, or diastolic blood pressure exceeding 85 mmHg. Additionally, waist circumference above the 90th percentile for age, sex, and ethnicity was also considered.[6,7] Consequently, CHD screening becomes essential for the identification and management of potential cardiovascular diseases.[8,9]

While the resting electrocardiogram (ECG) has a limited negative predictive value for excluding the possibility of coronary artery disease (CAD), it remains valuable in providing indicative symptoms of CAD due to its high positive predictive value. Therefore, regular ECG screenings, ideally on an annual basis, are cost-effective and crucial for diabetic patients. By incorporating routine ECG checks, the early risk of CAD can be detected in individuals with diabetes, allowing for timely preventive measures to be implemented.[10,11]

Indonesia is the fourth most populated country in the world, and it is no different from the rest of the globe in that cardiovascular diseases (CVDs) pose a considerable health burden. Nearly one-third of all fatalities and the primary cause of disability in Indonesia are attributed to CVDs. Similar difficulties are faced by Tebing Tinggi City in reducing the frequency of CVDs there. Specifically for Tebing Tinggi City, this research attempts to emphasize the significance of early screening as a proactive strategy to identify and address CVDs.[12,13]

2 Method

This research was a descriptive study with a cross-sectional research design of people who participated in the examination at the Community Service Program of the Department of Cardiology and Vascular Disease, University of Sumatera Utara. The study was held on March 8^{th,} 2023 at Balai Kartini, Tebing Tinggi. This study aims to screen for the cardiometabolic profile in the people of Tebing Tinggi City. The sample is an affordable population that meets the inclusion criteria, people with age >18 years old and want to participate in the study. Demographic variables such as age and sex were obtained by interviewing the participants. Variables related to cardiometabolic were obtained by the spot examination by investigators. All participants had been told about the procedures of the examination and that the result of the study will be published. Participants had been signing the informed consent before the examination.

Blood pressure and heart rate examination were measured using a digital sphygmomanometer that had been validated and expressed in mmHg units. The electrocardiograph (ECG) was obtained by using a KardiaMobile machine connected by Bluetooth to a mobile phone. The data obtained

was ECG rhythm, if it was sinus or atrial fibrillation. The measurement of the abdominal and neck circumference was carried out by examining the size of the abdominal and neck circumference obtained using a tape measure (midline) in cm. Body weight and height were measured by the GEA ZT-120 body weight scale that had been validated. Body mass index (BMI) was obtained by dividing the body weight by body height square.

Blood sugar levels are obtained from the results of measuring blood sugar levels during laboratory examination of blood in mg/dl units. Total cholesterol levels are obtained from the results of measuring total cholesterol levels from blood laboratory examinations in mg/dl. Obstructive sleep apnea risk score was obtained by Stop Bang Risk Score for OSA.

Statistical Analysis

All data were processed and analyzed statistically using SPSS ver.26. Categorical variables are presented with frequency (n) and percentage (%). Numeric variables are presented with mean and standard deviation (SD) values for normally distributed data. As for the normal non-distributed data numerical variables are presented with the middle value (median) and the interquartile range.

3 Result

All subjects in this study (n= 102) are 39 male and 63 female. By age group, the number of subjects in the age groups of below 30 years, 31-40 years, 41-50 years, 51-60 years, and more than 60 years. Most participants were in the 4^{th} to 5^{th} decade, with the median age of all participants being 48 years old (Table. 1). All participants had sinus rhythm for ECG with 1 male participant having bradycardia and tachycardia, respectively.

For female participants, only 2 people (3.2%) had tachycardia and no one had bradycardia. The body height median was 159 cm (155-165) for all participants, with 165 cm (161-170) for males and 156 cm (153-160) for females. Male participants had 73 kgs (161-170) body weight and female participants had 62 (56-70). The median abdominal circumference for all participants was 88 cm (80.5-96) and the neck circumference was cm 35 (32-37). Male participants mostly had intermediate risk score for OSA (48.7%) and female participants mostly had low risk for OSA (79.4%).

Table 1 Baselines Data Demography

No	Variables	Total (n=102) (n;%)	Male (n=39) (n;%)	Female (n=63) (n;%)
1	**Age (yr)**	48 (37.75-55)	48 (37-56)	48 (39-54)
	< 30	14 (13.7)	5 (12.8)	9 (14.3)
	31-40	14 (13.7)	6 (15.4)	8 (12.7)
	41-50	29 (28.4)	10 (25.6)	19 (30.2)
	51-60	39 (38.2)	13 (33.3)	26 (41.3)
	> 60	6 (5.9)	5 (12.8)	1 (1.6)
2	**Heart Rate (bpm)**	79.5 (71-86)	77 (71-88)	80 (72-86)
	<60	1 (1)	1 (2.6)	0
	60-100	98 (96.1)	37 (94.9)	61 (96.8)
	>100	3 (2.9)	1 (2.6)	2 (3.2)
3	**ECG (AF)**	0	0	0
4	**Body Measurements**			
	Body Height (cm)	159 (155-165)	165 (161-170)	156 (153-160)
	Body Wieght (kgs)	66 (60-76)	73 (66-80)	62 (56-70)
	Waist Circumference (cm)	88 (80.5-96)	95 (88-102)	84 (77-91)
	Neck Circumference (cm)	36.25 (33.4-40)	40 (37-42)	35 (32-37)
5	**OSA Risk Score**			
	Low risk	61 (59.8)	11 (28.2)	50 (79.4)
	Intermediate Risk	31 (30.4)	19 (48.7)	12 (19)
	High Risk	10 (9.8)	9 (23.1)	1 (1.6)

Based on Hearts Risk-based CVD management, published by WHO in 2020, we can see that most participants had normal random blood sugar, and only 1 female participant had random blood sugar > 200 mg/dl. As for total cholesterol, around 15% of participants (both male and female) had higher than normal levels of total cholesterol. From BMI, near to 50% of male participants were obese with 10.3% being overweight. Of female participants, 15.9% participants were overweight and 38.15 were obese, but most female participants were within normal BMI (Table. 2).

Table 2 Characteristics of WHO Cardiovascular Disease Risk Factors

No	Variables	Total (n=102)	Male (n=39)	Female (n=63)
1	**Laboratory Parameters**			
	RBS (mg/dl)	110 (90-126)	112 (94-130)	103 (90-124)
	≥ 200	1 (1)	0	1 (1.6)
	< 200	101 (99)	39 (100)	62 (98.4)
	Total Cholesterol (mg/dl)	178 (167-196)	177 (158-196)	181 (170-197)
	≥ 200	16 (15.7)	6 (15.4)	10 (15.9)
	< 200	86 (84.3)	33 (84.6)	53 (84.1)
2	**BMI** (kg/m^2)	26.5 (23.3-28.9)	27.7 (24.2-29.3)	26 (23.1-28)
	Underweight	2 (2)	1 (2.6)	1 (1.6)
	Normal	40 (39.2)	12 (30.8)	28 (44.4)
	Overweight	14 (13.7)	4 (10.3)	10 (15.9)
	Obesity	46 (45.1)	22 (56.4)	24 (38.1)
3	**SBP** (mmHg)	130 (120-140)		
	<140	72 (70.6)	24 (61.5)	48 (76.2)
	140-159	15 (14.7)	6 (15.4)	9 (14.3)
	>160	15 (14.7)	9 (23.1)	6 (9.5)
4	**DBP** (mmHg)	83 (78-92)		
	<89	102 (100)	39 (100)	63 (100)
	90-99	0	0	0
	>100	0	0	0

RBS: Random Blood Sugar; BMI: body mass index; SBP: Systolic Blood Pressure**;** DBP**:** Diastolic Blood Pressure

Most participants had normal systolic and diastolic blood pressure (70,6% and 100%, respectively). Fifteen percent of participants had grade I and grade II hypertension, respectively, with 15.4% of male participants having grade I hypertension and 23.1% having grade II hypertension. Meanwhile, 14.3% of female participants had grade I hypertension, and 9.5% had grade II hypertension.

4 Discussion

Based on HEARTS: Risk-based CVD Management published by WHO in 2020, it is said that the development of cardiovascular disease (CVD) is influenced by many risk factors, such as tobacco use, an unhealthy diet, physical inactivity, that could result in obesity, hypertension, dyslipidemia (abnormal blood level and function of circulating cholesterol), and diabetes mellitus, that result to elevated blood sugar in circulation. Continuing exposure to these risk factors can be prevented by routine screening for populations without any clinical symptoms.[14]

Assessment of CVD risk and early management of hypertension and diabetes mellitus also can be routinely undertaken in populations aged > 40 years old, smokers, obese, known to have hypertension or diabetes mellitus, history of premature CVD in first-degree relative, and history of DM or kidney disease in first-degree relative.[14,15]

Based on this study, we found that all the variables except for smoker had been collected, so we can also compare it to the WHO-CVD risk chart to assess the 10-year risk of fatal or non-fatal CVD events, and for participants with more than high-risk (10-year risk of fatal or non-fatal CVD event >20%) should be treated or refer according to risk level. Male participants have more CVD risk factors than female participants. It was appropriate with the previous study that said that sex (male) was a non-modifiable risk factor for CVD. A similar result was also obtained from WHO data for CVD risk factors that said that from all countries with adults aged 40-60 years old, the male is more fragile from CVD events.[1,14]

The optimal screening strategy in primary care is likely stepwise, in apparently healthy people, with the use of risk scores. Increasing public awareness and actively involving GPs might facilitate screening efficiency and uptake.[16] Screening score is a pragmatic way of identifying individuals with CMR without performing biochemical tests. Cost-effective community screening programs may be planned.[17] A center was established for the comprehensive screening of an asymptomatic population with 10 tests designed to detect early vascular and cardiac abnormalities and blood tests to identify potential targets for risk contributor intervention. The first 396 individuals screened in the center have been analyzed. The screening tests utilized are effective in uncovering unsuspected early cardiovascular disease in which targeted treatment could be effective in reducing the incidence of cardiovascular events in susceptible individuals. Documentation of the sensitivity and specificity of this approach requires a longitudinal study.[18]

There is an alarming increase in obesity and diabetes mellitus (DM), with a concomitant increase in diabetes-related complications, including CVD. Researchers have found that the risk of CVD becomes greater with increasing hyperglycemia and insulin resistance that occur in people long before the onset of clinical DM. Extending routine systematic assessment from cardiovascular risk to cardiometabolic risk--that is, the risk for developing CVD and/or DM-- and increasing understanding of the basic mechanisms that regulate energy balance and metabolic risk factors are needed to address this impending epidemic of DM.[19] Waist-to-height ratio (WHtR) shows good and robust performance in identifying CMRs clustering across racial populations, suggesting its promising utility in public health practice globally.[20]

In this study, the data were not normally distributed. And as we see from this study the most common cardiovascular risk factor in the population of Tebing Tinggi City was obesity, followed by systolic hypertension, we suggest that screening must be enlarged to a large population with a larger number of samples. We also suggest that the patient with an unmodified risk factor, such as age and sex must undergo routine blood pressure examination and reduce carbohydrate and lipid consumption to reduce obesity. Cholesterol data from this study are mostly < 200 mg/dl. This was similar to global data that said that total cholesterol concentrations of 2.6–10.3 mmol/L (48-185 mg/dl) and from samples representative of the national population.[2,14]

In this study, we found the cardiometabolic risk profile of patients who participated in the Community Service Program of the Department of Cardiology and Vascular Disease, University of Sumatera Utara in Tebing Tinggi City was obesity, followed by hypertension.

5 Conclusion

The most cardiometabolic risk profile of participants who participated in the Community Service Program of the Department of Cardiology and Vascular Disease, the University of Sumatera Utara held in Tebing Tinggi City was obesity, followed by hypertension.

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