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THE RELATIONSHIP OF PSYCHOLOGICAL DISTRESS AND FRAMINGHAM SCORE IN POPULATION AT RISK OF CORONARY HEART DISEASE IN MALANG, INDONESIA

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Contribution
MDP and NALA conceived the idea and designed the study. Data collection and manuscript writing was done by NALA, TAW, YWU, and KK. All the authors contributed equally to the submitted manuscript.

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ABSTRACT

Objective: The purpose of this study was to analyze the relationship between psychological distress and CHD risk in the next ten years.

Methodology: This research was a cross-sectional study carried out on 73 participants in Malang City, Indonesia, from December 2019 to January 2020. The psychological distress assessment was carried out using the DASS 42 instrument. Meanwhile, the assessment of CHD risk was carried out using the Framingham score instrument. Data analysis used the Spearmen Rank Analysis in the SPSS version 16.0 software with a level of significance at p ≤0.05.

Results: Most participants had normal psychological distress (56.2%) and a low Framingham score (75.3%). Spearmen correlation between psychological distress and Framingham scores showed a coefficient value of 0.177 with a p-value of 0.134 (p>0.05). This study showed that there was a positive but not significant relationship between psychological distress and Framingham scores.

Conclusion: This study shows that psychological distress influences the risk of developing CHD 10 years later. Psychological conditions that are not good can affect physical conditions as well as cardiovascular health. This can provide new insights into the importance of paying attention to a psychological condition.

Keywords: cardiovascular disease, coronary heart disease, Framingham risk score, psychological distress, the risk factor

INTRODUCTION

Coronary Heart Disease (CHD) is a cardiovascular disease that continues to develop throughout the world. It is one of the leading causes of death among patients with cardiovascular disease in the United States, with a total percentage of 43.8%.[1] In Indonesia, the 2016 Survey Registration System (SRS) survey results show that CHD is the second leading cause of death at all ages after cerebrovascular disease at 13.3%.[2] Mortality due to CHD is expected to continue to increase, especially in developing countries. This indicates that effective prevention of CHD is needed worldwide.

One of the preventions of CHD that can be done is by early detection of the risk of CHD events. The Framingham Risk Score is a rating system that is often used to predict the incidence of cardiovascular disease in the next ten years.3 This tool is recommended by the National Cholesterol Education Program (Adult Treatment Panel III) and has been validated by several studies.4 Framingham risk scores were assessed based on CHD risk factors, namely age, sex, total cholesterol and HDL levels, systolic blood pressure, smoking status, and treatment of hypertension.[3]

Psychological distress is one of the psychosocial risk factors that is thought to increase CHD events. Psychological distress is an emotional state of an individual that can be caused by stressors in everyday life.[5] This situation can cause adverse effects on physical health and can increase the prevalence of chronic disease events.[6] Several studies have shown that psychological distress conditions such as stress, anxiety, and depression can cause adverse effects on heart health.[7] High levels of psychological distress, such as depression and anxiety, are associated with poor health behavior patterns. Poor health behaviors such as smoking, consuming alcohol, lack of physical activity, and lack of fruit and vegetable intake can increase the risk of cardiovascular disease 2 to 3 times.[8] Besides, stress conditions can also cause excessive activation of the hypothalamic-pituitary and adrenal gland (HPA axis) system as well as sympathetic nerves, which increase cortisol release, plasma catecholamines, and endothelial damage.[7] All of these biological activities can cause atherosclerosis, coronary artery disease, and acute coronary events later in life. However, the exact mechanism related to psychological distress as a risk factor for CHD still needs to be investigated.

Several studies have discussed the relationship between psychological distress with CHD, but some of this research is still contradictory. Besides, the mechanism of the relationship associated with psychological distress with CHD risk in the next ten years still needs to be investigated. This study aimed to analyze the relationship between psychological distress and CHD risk in the next ten years in Malang, Indonesia.

METHODOLOGY

This cross-sectional design was conducted in the area of the Kedungkandang Community Health Center, Malang City, from December 2019 to January 2020. This study was approved by the Medical Research Ethics Commission of the Faculty of Medicine, Universitas Brawijaya, based on the Ethical Clearance Certificate No. 242 / EC / KEPK / 09/2019.

Sampling was conducted at the community who took a health examination at the Kedungkandang Community Health Center, Malang City. The sample size was calculated according to one correlation test with power: 80% at alpha 0.05. The estimated lowest minimum sample size is between 46 (based on R0 = 0.0 and R1 = 0.4) and the highest minimum sample size was 80 (R0 = 0.5 and R1 = 0.7). Determination of the sample or research subjects were determined based on inclusion criteria, namely people who have five or more risk factors for CHD include: age, smoking, history of hypertension, history of high cholesterol, history of diabetes mellitus, excess body weight (obesity), have a history of heart disease in family, lack of exercise, less consumption of fruit and vegetables, and consumption of fatty foods. Meanwhile, the people who have a previous history of CHD were excluded.

After giving informed consent to the community who were willing to become participants, they were given a questionnaire sheet with the instructions to fill out the questionnaire. There were two instruments used, namely a questionnaire to assess psychological distress and an instrument to assess the risk of CHD in the next ten years.

Psychological distress assessment was carried out using the Depression Anxiety Stress Scale (DASS-42) instrument, which includes measurements for items of anxiety, stress, and depression. The latest version of DASS has advantages, including fewer items and a shorter time to load. However, DASS 42 also has the main advantages, including having higher internal consistency, more reliable scores, and additional clinical information that is more specific than DASS-2.9 This standardized questionnaire contains 42 questions with 14 points each for each item. In completing this instrument, participants were asked to use a scale or severity with 4 points, namely score 3 shows always, score 2 shows often, score 1 indicates sometimes, and never given a score of 0. Then, the three points are added up and categorized. There were five categories of psychological distress, namely normal psychological distress when scores 0 to 25, mild psychological distress when scores 26 to 50, moderate psychological distress when scores 51 to 75, high psychological distress when scores 76 to 100, and psychological distress very high when scores 101 to 126.

The validity test was measured using Pearson Product Moment with a significance of 0.05 (5%). Based on the results of the validity test, it was known that the calculated r-value was higher than the r-table (0.381) for all question items. So, the instrument for measuring psychological distress variables was declared valid. In addition, based on the reliability test results, it was known that the Cronbach's Alpha value was higher than 0.6. So, the instruments for measuring psychological distress variables were declared reliable.

The assessment of CHD risk in the next ten years was carried out using the Framingham score. The assessment was done by entering data related to CHD risk factors into the Framingham score calculator application. Risk factors taken into account are age, sex, smoking, total cholesterol, HDL cholesterol, systolic blood pressure, and hypertension treatment. Risk factors were calculated according to the Framingham score, which showed that the higher the Framingham score, the higher the risk of an individual suffering from Coronary Heart Disease in the next ten years,

and vice versa. The results of the calculation of the Framingham score were divided into three categories, namely the low-risk category if the Framingham risk score is less than 10%, the moderate risk category if the Framingham risk score is between 10% to less than 20% and the high-risk category if the Framingham risk score is equal to or higher of 20%.

Data analysis in this study used the Spearmen Rank Analysis to see the relationship between psychological distress variables with CHD risk in the next ten years. Data analysis in this study used the Statistical Package for Social Sciences (SPSS version 16.0) software with a level of significance at $p \leq 0.05$.

RESULTS

The demographics and clinical characteristics of the study population are presented in Table 1. The number of participants in this study were 73, with an average age of

Table 1: Characteristics of the Study Population (n = 73)

Characteristics	N	Frequency (%)
1. Education		
- None / Primary	30	41.1
- Secondary school	37	50.7
- Diploma / bachelor	6	8.2
2. Income		
- Less than Rp 2.800.000	42	57.5
- More than Rp 2.800.000	31	42.5
3. Sex		
- Male	35	47.9
- Female	38	52.1
4. Smoking Status		
- Smoker	15	20.5
- Non-smoker	58	79.5
5. Treatment of Hypertension		
- Treated Hypertension	15	20.5
- Untreated hypertension	58	79.5
6. Family History of CVD	20	27.4
7. Physical Activity		
- Mild	44	60.3
- Moderate	18	24.7
- Vigorous	11	15.1
	Mean ± SD	**Min-Max**
8. Age	57.58 ± 10.157	31 - 79
9. Systolic Blood Pressure (mmHg)	136.68 ± 24.011	100 - 200
10. Total Cholesterol (mg/dL)	192.38 ± 41.342	117 - 304
11. HDL (mg/dL)	53.01 ± 15.725	24 - 102
12. Body Mass Index (BMI)	27.248 ± 6.317	14.31 - 40.77
13. Blood Glucose Level	87.40 ± 54.567	38 - 294
14. Fruit & Vegetable Consumption	5.25 ± 2.040	0 - 7
15. Fatty Food Consumption	5.99 ± 4.357	0 - 21

57.58± 10.157 years. As many as 47.9% of respondents were male, and 52.1% of respondents were female. Most respondents had an education level that was secondary school (37%) and income less than Rp 2,800,000 (42%). Respondents in this study have several risk factors for CHD, including obesity, having a history of smoking and hypertension, hyperlipidemia, diabetes mellitus, having a family history of CVD, mild physical activity, and poor diet.

The characteristics of the participants based on the level of psychological distress experienced can be seen in Table 2. Most of them have psychological distress in the normal category, with a total of 41 respondents (56.2%), and none of the respondents have psychological distress in the high and very high categories. Research results related to these three indicators can be seen in table 3.

In the anxiety indicator, it was known that the majority of participants had anxiety in the normal category, with a total of 30 respondents (41.1%). In the stress indicator, it was known that the majority of participants had stress in the normal category, with a total of 57 respondents (78.1%), and none of the participants had very high-stress levels. In addition, the depression indicator, it was known that the majority of participants had depression in the normal category of 61 respondents (83.6%), and none of the participants had very high levels of depression.

Table 2: Characteristics of Respondents Based on Psychological Distress Level and Framingham Score

Psychological Distress Level	Frequency	Percentage (%)
Normal	41	56.2
Mild	24	32.9
Moderate	8	11.0
High	0	0
Very high	0	0
Total	73	100.0
Framingham Score	**Frequency**	**Percentage (%)**
High	1	1.4
Moderate	17	23.3
Low	55	75.3
Total	73	100.0

Table 3: Characteristics of Respondents Based on Anxiety, Stress, and Depression

Psychological Distress Indicator	Interval	Frequency	Percentage (%)
1. Anxiety			
- Normal	0-7	30	41.1
- Mild	8-9	12	16.4
- Moderate	10-14	16	21.9
- High	15-19	8	11.0
- Very high	>20	7	9.6
Total		73	100.0
2. Stress			
- Normal	0-14	57	78.1
- Mild	15-18	8	11.0
- Moderate	19-25	7	9.6
- High	26-33	1	1.4
- Very high	>34	0	0
Total		73	100.0
3. Depression			
- Normal	0-9	61	83.6
- Mild	10-13	5	6.8
- Moderate	14-20	5	6.8
- High	21-27	2	2.7
- Very high	>28	0	0
Total		73	100.0

The characteristics of the participants based on the Framingham score can be seen in table 2. Most respondents had low Framingham scores, with a total of 55 respondents (75.3%), and there was only one respondent (1.4%) who had a high Framingham score. The determination of the Framingham score was obtained from the sum of seven indicators, namely: age, sex, smoking, total cholesterol, HDL cholesterol, systolic blood pressure, and hypertension treatment. Research results related to the seven indicators can be seen in Table 1.

In the gender indicator, most participants were female, as many as 38 respondents (52.1%). Most respondents had the habit of not smoking, as many as 58 respondents (79.5%). Most respondents did not take hypertension treatment, which was 58 respondents (79.5%). In the age indicator, the average age of participants was 57.58 years. On the systolic blood pressure indicator, the average systolic blood pressure of study participants was 136.68 mmHg. Besides, the total cholesterol indicator was known that the total cholesterol of the study respondents was the lowest at 117mg / dL, and the highest had total cholesterol levels of 304 mg / dL. Whereas the lowest respondent's HDL cholesterol was 24 mg / dL, and the highest had 102 mg / dL HDL cholesterol.

Table 4 shows the results of the statistical analysis between psychological distress and Framingham scores. Based on the test results using the Spearmen correlation, the coefficient value was 0.177, with a p-value of 0.134. The test results indicate that the value of the p-value > level of significance (alpha = 5%). This means that there was a positive but not significant effect between psychological distress on the Framingham score. This value indicates that the higher the psychological distress, it tends to increase the Framingham score. And vice versa, the lower the psychological distress, it tends to reduce the Framingham score.

distress and CHD risk in the next ten years. The results show that there was a positive but not significant effect between psychological distress on the Framingham score, where the higher the psychological distress, it tends to increase the Framingham score and vice versa. A low Framingham score indicates a low CHD risk, while a high Framingham score indicates a high CHD risk.

The results of this study are consistent with other studies that showed that psychological distress was associated with cardiovascular disease. Mental health disorders can be associated with increased heart disease morbidity and mortality. Although there has been no research related to a clear relationship between the severity of heart disease with psychological distress levels, individuals with hyperlipidemia and diabetes were reported to experience greater psychological distress.[10] Several studies had shown that individuals with high psychological distress tended to have a higher risk of coronary heart disease. Someone with psychological distress has a 1.7-fold higher risk of experiencing cardiovascular disease.[11]

Psychological distress can cause CHD through the mechanism of the behavioral pathway and biological pathway. Someone who experiences psychological distress tended to exhibit unhealthy behavior, such as lack of physical activity, smoking, and drinking alcohol.[12] Besides, one of the biological mechanisms that can affect cardiovascular disease is dysregulation of the Hypothalamic-Pituitary-Adrenal (HPA) axis.[7] Individuals who experience psychological distress generally experience an increase in the inflammatory response. The process of inflammation and thickening of the arterial wall is caused by atherosclerosis. Atherosclerosis increases the retention of cholesterol carried by Low-Density Lipoproteins (LDLs) in arterial walls.[13] Endothelial dysfunction can occur due to decreased Endothelial Progenitor Cell (EPC) levels and increased Endothelial Microparticle (EMP) levels. The occurrence of imbalances between molecules can cause

Table 4: Statistics Analysis Results

	Framingham Risk Score			
	High	Moderate	Low	Total
Psychological Distress				
Moderate	0% (0)	2.7% (2)	8.2% (6)	11% (8)
Mild	1.4% (1)	11% (8)	20.5% (15)	32.9% (24)
Normal	0% (0)	9.6% (7)	46.6% (34)	56.2% (41)
Total	1.4% (1)	23.3% (17)	75.3 (55)	100% (73)
Correlation Coefficient = 0.177*, p-value = 0.134				

*$p < 0.05$; resulting from Spearmen Rank Analysis.

DISCUSSION

This study analyzed the relationship between psychological

vasoconstriction and vasodilation.[14] Meanwhile, individuals with low psychological distress tend to show high HDL levels and low triglyceride levels.[15] The description of

psychological distress can be seen based on anxiety, stress, and depression.

Research conducted by Emdin et al. (2016) showed that individuals with anxiety disorders were associated with an increased risk of various cardiovascular diseases such as CHD and heart failure. The relationship between anxiety and cardiovascular disease has the same strength as traditional risk factors, such as smoking and diabetes mellitus.[17] There are three dimensions of anxiety that focus on heart disease, namely fear, avoidance, and attention. These three dimensions will show differences in health behavior and health service utilization. If anxiety is represented as avoidance, anxiety will be significantly related to a higher chance of smoking behavior and a lack of physical activity. However, if anxiety is represented as a concern for cardiovascular health, then anxiety will be significantly related to lower smoking behavior and higher physical activity.[18] Anxiety can also lead to a risk of cardiovascular disease through diet and poor sleep patterns. Anxiety can be associated with an increased inflammatory response such as white blood cell count and C-reactive protein.[19] The existence of these mechanisms makes individuals with high anxiety susceptible to CHD.

Previous study showed that stress was associated with a higher risk of CHD. Significant stress can be associated with higher risk behaviors, such as low fruit and vegetable intake, daily smoking, and inactive physical activity.[12] Individuals with high stress are prone to endothelial dysfunction and atherosclerotic plaque formation.[14] Stressful conditions are also associated with an increase in Body Mass Index (BMI), inflammatory responses such as C-reactive protein and IL-6, cortisol levels, and central fat. The existence of these mechanisms makes individuals with high stress-prone to hypertension and diabetes mellitus, which are risk factors for CHD.[20]

Depression is a mental disorder that can cause problems in the form of a large health and economic burden on society. Symptoms of depression have been considered a risk factor for cardiovascular disease that appears in the general population.[21] Research conducted by Song, Kim, Kim, Lee, & Kim (2018) showed that depression was associated with a higher risk of CHD. Symptoms of depression are even associated with an increased risk of morbidity and mortality due to cardiovascular disease.[20] The American Heart Association (AHA) recommends depression to be recognized as a major risk factor for CHD, such as hyperlipidemia, diabetes, hypertension, and smoking. That is because depression can increase poor lifestyle and worsen adherence to the treatment of cardiovascular disease. Symptoms of severe depression can be associated with lower regular physical activity.[18] Prolonged depression can also cause a high Body Mass Index (BMI) and poor sleep quality.[23] Several biological mechanisms may occur,

namely the autonomic nervous system, platelet aggregation and endothelial dysfunction, inflammatory conditions, and neuroendocrine alterations.[21] In addition, biologically, depression is also associated with an increase in the hormone cortisol.[7] This mechanism makes individuals with depression vulnerable to CHD.

The results of this study indicate that there was a positive relationship between psychological distress with the Framingham score, but it is not significant. This might be caused by several things that can affect the state of psychological distress such as age, sex, history of illness, and history of events in the past.[24] On the other hand, the DASS instrument is used to measure the psychological distress that is currently being experienced. Meanwhile, other research showed that long-term psychological distress was more associated with a greater risk of coronary artery calcification (OR per SD increase = 1.49. 95% CI=1.03-2.16). Long-term mental health disorders and an increase in cortisol indicate a risk of severe coronary artery calcification. This risk is increasing in older individuals. Thus, it is important to pay attention to any factors that influence psychological distress and the duration of psychological distress because they may give different health outcomes.

The results of this study provide very important input related to psychological distress that can increase the risk of CHD. By knowing the risk factors that influence CHD risk, it can be considered in the provision of health interventions. Psychological distress such as stress and anxiety can be targets of prevention in primary care to minimize the risk of CHD. Individuals, especially with psychological distress such as stress, anxiety, and depression, will need and benefit from psychiatric treatment in the form of managing CHD risk. There are various efforts to prevent CHD that health workers can do. Promotive and preventive efforts that can be done are therapy to reduce negative behavior, therapy of behavioral health care, Cognitive Behavior Therapy (CBT), health education and screening or CHD risk assessment in healthy communities who have CHD risk factors.[22] In addition, the results of this study can be considered in conducting health interventions, especially for patients who experience psychological distress to reduce the risk of patients experiencing CHD.

There are several limitations of research that may need to be considered. First, this is a cross-sectional study, so data cannot be used to investigate the causal relationship between psychological distress and CHD risk. Second, this study has a relatively small sample and social study, making it difficult to control the homogeneity of the participants' characteristics. Further research is needed with a larger sample, mechanisms in the relationship that must be identified, and interventions to deal with psychological distress that occurs. In addition, further research is needed

to be able to compare cross-sectional data with prospective data on psychological distress with CHD risk. It is also important to consider the factors that can influence psychological distress and the duration of psychological distress that is experienced because it may have a more significant effect on CHD risk.

CONCLUSION

A positive relationship between psychological distress with the Framingham score is found, but it is not significant. This study shows that psychological distress influences the risk of developing CHD 10 years later. Psychological conditions that are not good can affect physical conditions as well as cardiovascular health. This can provide new insights into the importance of paying attention to a psychological condition.

Acknowledgments

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