

Cardiovascular Risk Factors and Detection of Atrial Fibrillation in the General Population, Makassar, Indonesia: A cross-sectional analysis from a Car-free day

Sumarni Sumarni^{*1,2}, Soekarno Hatta¹, Iskam Syawal³

¹Department of Cardiology and Vascular Medicine, Faculty of Medicine, Universitas Hasanuddin, Makassar 90245, Indonesia

²Makassar Cardiac Center (Pusat Jantung Terpadu), Dr. Wahidin Sudirohusodo General Teaching Hospital, Makassar 90245, Indonesia

³Medical Doctor Study Program, Faculty of Medicine, Universitas Hasanuddin, Makassar 90245, Indonesia

*e-mail: sumayudi@gmail.com, soekarnohatta09@gmail.com, syawali24c@student.unhas.ac.id

Received: 10 August 2025, Revised: 11 September 2025, Accepted: 10 October 2025

Abstract

Cardiovascular disease (CVD) remains the leading cause of death worldwide, with an increasing prevalence in Indonesia. Understanding cardiovascular risk factors associated with arrhythmias in the general population is crucial for effective prevention. This study aims to analyse the relationship between cardiovascular risk factors and the occurrence of atrial fibrillation among participants of Car-Free Day in Makassar, Indonesia. Methods: This cross-sectional study involved 113 respondents during the Car-Free Day event at Hasanuddin University on December 8, 2024. Data on demographics, cardiovascular risk factors, and clinical profiles, including blood pressure, heart rhythm (measured using mobile ECG_5.33.1.apk), and lipid profile, were collected. Results: Of 113 respondents, 46 met the inclusion criteria. Hypertension had the highest prevalence (23.9%), predominantly in individuals over 40 years old. Tachycardia was more common among younger participants (<40 years) and those with obesity. Conclusions: Age is a significant risk factor for hypertension and other cardiovascular disorders. The high prevalence of hypertension among older adults and tachycardia among younger individuals highlights the need for lifestyle modification and early detection strategies in Makassar.

Keywords: cardiovascular disease, arrhythmia, hypertension, risk factors

INTRODUCTION

Cardiovascular disease (CVD) remains the leading cause of death worldwide, accounting for an estimated 20.5 million deaths in 2021 [1]. In Indonesia, the prevalence of CVD increased by 120% between 1990 and 2019 [2]. This rising trend is largely attributed to the high prevalence of modifiable risk factors such as physical inactivity, dyslipidemia, hyperglycemia, obesity, hypertension, smoking, unhealthy dietary patterns, and gender-related differences [3]. Arrhythmia, a form of CVD characterized by an irregular heart rhythm, encompasses a wide spectrum of rhythm disturbances. Bradycardia is defined as a heart rate of <60 beats per minute, whereas tachycardia refers to a rate exceeding 100 beats per minute [4]. Among various

arrhythmias, atrial fibrillation (AF) is the most prevalent and clinically significant type worldwide [5].

Makassar, a major city in Indonesia, continues to face challenges in reducing the burden of cardiovascular diseases and arrhythmias. The city's Car-Free Day program, held regularly, aims to promote physical activity and healthier lifestyles among its residents. However, the extent to which cardiovascular risk factors contribute to the occurrence of arrhythmias in the general population—particularly among individuals participating in such community-based physical activities—remains unclear. The findings of this study are expected to provide valuable insights for public health strategies on cardiovascular disease prevention and the promotion of heart-healthy lifestyles. This study aimed to examine the relationship between cardiovascular risk factors and the occurrence of atrial fibrillation in the general population of Makassar, Indonesia.

METHODS

Heart rhythm was assessed for atrial fibrillation using the mobile ECG_5.33.1.apk application and evaluated by a local primary care physician. Data collection was conducted on December 8, 2024, between 7:00 AM and 12:00 PM, during the Car-Free Day event at Hasanuddin University, Makassar, using a cross-sectional design. A total of 113 respondents participated in the study.

The collected data included information on sex, age, body mass index (BMI), blood glucose, uric acid, smoking habits, heart failure, hypertension, stroke, diabetes mellitus, coronary artery disease, peripheral artery disease, history and diagnosis of atrial fibrillation, and heart rhythm. Data were obtained through structured interviews and direct clinical examinations.

Respondents with complete interview and examination data were included in the analysis, while individuals with secondary cardiovascular diseases or those unwilling to participate were excluded. Descriptive analyses were performed using IBM SPSS Statistics version 29.0.2.0.

RESULTS

Of the 113 respondents interviewed, 46 completed all required examinations. Participants who did not undergo heart rhythm assessment ($n = 25$), BMI measurement ($n = 28$), or uric acid testing ($n = 14$) were excluded from the analysis. Among the 46 respondents included, 11 (23.9%) had hypertension, 1 (2.2%) had heart failure, and 1 (2.2%) had a history of stroke. No participants reported a prior history of atrial fibrillation, and none were found to have atrial fibrillation during screening.

Table1. Distribution of cardiovascular risk factors among heart failure and hypertension groups

Profil	Frequency		Heart Failure				Hypertension			
	n	%	No	Yes	Unknown	P Value	No	Yes	Unknown	P Value
Gender										
Female	25	54.3	23 (50%)	0 (0%)	2 (4.3%)	0.53	21 (45.7%)	3 (6.5%)	1 (2.2%)	0.11
Male	21	45.7	18 (39.1%)	1 (2.2%)	2 (4.3%)		12 (26.1%)	8 (17.4%)	1 (2.2%)	
Age										
< 40 Years Old	24	52.2	21 (45.7%)	0 (0%)	3 (6.5%)	0.214	21 (45.7%)	2 (4.3%)	1 (2.2%)	0.009
40 - 60 Years Old	19	41.3	18 (39.1%)	1 (2.2%)	0 (0%)		12 (26.1%)	6 (13.0%)	1 (2.3%)	
> 60 Years Old	3	6.5	2 (4.3%)	0 (0%)	1 (2.2%)		0 (0%)	3 (6.5%)	0 (0%)	
IMT										
Underweight	3	6.5	3 (6.5%)	0 (0%)	0 (0%)	0.634	2 (4.3%)	1 (2.2%)	0 (0%)	0.206
Normal	12	26.1	10 (21.7%)	0 (0%)	2 (4.3%)		11 (23.9%)	1 (2.2%)	0 (0%)	
Overweight	10	21.7	9 (19.6%)	1 (2.2%)	0 (0%)		9 (19.6%)	0 (0%)	1 (2.2%)	
Obese 1	18	39.1	16 (34.8%)	0 (0%)	2 (4.3%)		9 (19.6%)	8 (17.4%)	1 (5.6%)	
Obese 2	3	6.5	3 (6.5%)	0 (0%)	0 (0%)		2 (4.3%)	1 (2.2%)	0 (0%)	
Blood Glucose										
Normal	26	56.5	24 (52.2%)	0 (0%)	2 (4.3%)	0.499	21 (45.7%)	3 (6.5%)	2 (4.3%)	0.051
Prediabetes	16	34.8	14 (30.4%)	1 (2.2%)	1 (2.2%)		11 (23.9%)	5 (10.9%)	0 (0%)	
Diabetes	4	8.7	3 (6.5%)	0 (0%)	1 (2.2%)		1 (2.2%)	3 (6.5%)	0 (0%)	
Uric Acid										
Normal	25	54.3	22 (47.8%)	0 (0%)	3 (6.5%)	0.389	17 (37.0%)	8 (17.4%)	0 (0%)	0.136
Increased	21	45.7	19 (41.3%)	1 (2.2%)	1 (2.2%)		16 (34.8%)	3 (6.5%)	2 (4.3%)	
Smoking										
No	41	89.1	36 (78.3%)	1 (2.2%)	4 (8.7%)	0.953	29 (63.0%)	11 (23.9%)	1 (2.2%)	0.217
Passive	1	2.2	1 (2.2%)	0 (0%)	0 (0%)		1 (2.2%)	0 (0%)	0 (0%)	
Active	4	8.7	4 (8.7%)	0 (0%)	0 (0%)		3 (6.5%)	0 (0%)	1 (2.2%)	

Table 2. Distribution of cardiovascular risk factors among diabetes mellitus and stroke groups

Profil	Frequency		Diabetes Mellitus				Stroke			
	n	%	No	Yes	Unknown	P Value	No	Yes	Unknown	P Value
Gender										
Female	25	54.3	24 (52.2%)	1 (2.2%)	0 (0%)	0.362	24 (52.2%)	0 (0%)	1 (2.2%)	0.45
Male	21	45.7	20 (43.4%)	0 (0%)	1 (2.2%)		19 (41.3%)	0 (0%)	2 (4.3%)	
Age										
< 40 Years Old	24	52.2	23 (50.0%)	1 (2.2%)	0 (0%)	0.673	23 (50.0%)	0 (0%)	1 (2.2%)	0.629
40 - 60 Years Old	19	41.3	18 (39.1%)	0 (0%)	1 (2.2%)		17 (37.0%)	0 (0%)	2 (4.3%)	
> 60 Years Old	3	6.5	3 (6.5%)	0 (0%)	0 (0%)		3 (6.5%)	0 (0%)	0 (0%)	
IMT										
Underweight	3	6.5	3 (6.5%)	0 (0%)	0 (0%)	0.04	3 (6.5%)	0 (0%)	0 (0%)	0.53
Normal	12	26.1	12 (26.1%)	0 (0%)	0 (0%)		10 (21.7%)	0 (0%)	2 (4.3%)	
Overweight	10	21.7	10 (21.7%)	0 (0%)	0 (0%)		10 (21.7%)	0 (0%)	0 (0%)	
Obese 1	18	39.1	17 (37.0%)	1 (2.2%)	0 (0%)		17 (37.0%)	0 (0%)	1 (2.2%)	
Obese 2	3	6.5	2 (4.3%)	0 (0%)	1 (2.2%)		3 (6.5%)	0 (0%)	0 (0%)	
Blood Glucose										
Normal	26	56.5	26 (56.5%)	0 (0%)	0 (0%)	0.013	23 (50.0%)	0 (0%)	3 (6.5%)	0.291
Prediabetes	16	34.8	15 (32.6%)	1 (2.2%)	0 (0%)		16 (34.8%)	0 (0%)	0 (0%)	
Diabetes	4	8.7	3 (6.5%)	0 (0%)	1 (2.2%)		4 (8.7%)	0 (0%)	0 (0%)	
Uric Acid										
Normal	25	54.3	23 (50.0%)	1 (2.2%)	1 (2.2%)	0.416	25 (54.3%)	0 (0%)	0 (0%)	0.45
Increased	21	45.7	21 (45.7%)	0 (0%)	0 (0%)		19 (41.3%)	0 (0%)	2 (4.3%)	
Smoking										
No	41	89.1	39 (84.8%)	1 (2.2%)	1 (2.2%)	0.993	38 (82.6%)	0 (0%)	3 (6.5%)	0.822
Passive	1	2.2	1 (2.2%)	0 (0%)	0 (0%)		1 (2.2%)	0 (0%)	0 (0%)	
Active	4	8.7	4 (8.7%)	0 (0%)	0 (0%)		4 (8.7%)	0 (0%)	0 (0%)	

Table 3. Distribution of cardiovascular risk factors among coronary artery disease and peripheral artery disease

Profil	Frequency		Coronary Artery Disease				Peripheral Artery Disease			
	n	%	No	Yes	Unknown	P Value	No	Yes	Unknown	P Value
Gender										
Female	25	54.3	17 (37.0%)	0 (0%)	8 (17.4%)	0.923	17 (37.0%)	0 (0%)	8 (17.4%)	0.665
Male	21	45.7	14 (30.4%)	0 (0%)	7 (15.2%)		13 (28.3%)	0 (0%)	8 (17.4%)	
Age										
< 40 Years Old	24	52.2	16 (34.8%)	0 (0%)	8 (17.4%)	0.381	15 (32.6%)	0 (0%)	9 (19.6%)	0.364
40 - 60 Years Old	19	41.3	14 (30.4%)	0 (0%)	5 (10.9%)		14 (30.4%)	0 (0%)	5 (10.9%)	
> 60 Years Old	3	6.5	1 (2.2%)	0 (0%)	2 (4.3%)		1 (2.2%)	0 (0%)	2 (4.3%)	
IMT										
Underweight	3	6.5	2 (4.3%)	0 (0%)	1 (2.2%)	0.882	2 (4.3%)	0 (0%)	1 (2.2%)	0.72
Normal	12	26.1	7 (15.2%)	0 (0%)	5 (10.9%)		7 (15.2%)	0 (0%)	5 (10.9%)	
Overweight	10	21.7	8 (17.4%)	0 (0%)	2 (4.3%)		7 (15.2%)	0 (0%)	3 (6.5%)	
Obese 1	18	39.1	12 (26.1%)	0 (0%)	6 (13.0%)		11 (23.9%)	0 (0%)	7 (15.2%)	
Obese 2	3	6.5	2 (4.3%)	0 (0%)	1 (2.2%)		3 (6.5%)	0 (0%)	0 (0%)	
Blood Glucose										
Normal	26	56.5	19 (41.3%)	0 (0%)	7 (15.2%)	0.575	19 (41.3%)	0 (0%)	7 (15.2%)	0.285
Prediabetes	16	34.8	10 (21.7%)	0 (0%)	6 (13.0%)		8 (17.4%)	0 (0%)	8 (17.4%)	
Diabetes	4	8.7	2 (4.3%)	0 (0%)	2 (4.3%)		3 (6.5%)	0 (0%)	1 (2.2%)	
Uric Acid										
Normal	25	54.3	20 (43.5%)	0 (0%)	5 (10.9%)	0.047	20 (43.5%)	0 (0%)	5 (10.9%)	0.022
Increased	21	45.7	11 (23.9%)	0 (0%)	10 (21.7%)		10 (21.7%)	0 (0%)	11 (23.9%)	
Smoking										
No	41	89.1	27 (58.7%)	0 (0%)	14 (30.4%)	0.729	26 (55.3%)	0 (0%)	15 (31.9%)	0.684
Passive	1	2.2	1 (2.2%)	0 (0%)	0 (0%)		1 (2.2%)	0 (0%)	1 (2.2%)	
Active	4	8.7	3 (6.5%)	0 (0%)	1 (2.2%)		3 (6.5%)	0 (0%)	1 (2.2%)	

Table 4. Distribution of cardiovascular risk factors in relation with history of prior AF, detection of AF, and ECG results

Profil	Frequency		History of AF				Detection of AF				ECG Result		
	n	%	No	Yes	Unknown	P Value	No	Yes	Unknown	P Value	Sinus Rhythm	Tachycardia	P Value
Gender													
Female	25	54.3	12 (26.1%)	0 (0%)	13 (28.3%)	0.979	16 (34.8%)	0 (0%)	9 (19.6%)	0.85	17 (37.0%)	8 (17.4%)	0.539
Male	21	45.7	10 (21.7%)	0 (0%)	11 (23.9%)		14 (30.4%)	0 (0%)	7 (15.2%)		16 (34.8%)	5 (10.9%)	
Age													
< 40 Years Old	24	52.2	11 (23.9%)	0 (0%)	13 (28.3%)	0.792	14 (30.4%)	0 (0%)	10 (21.7%)	0.18	14 (30.4%)	10 (21.7%)	0.092
40 - 60 Years Old	19	41.3	10 (21.7%)	0 (0%)	9 (19.6%)		15 (32.6%)	0 (0%)	4 (8.7%)		16 (34.8%)	3 (6.5%)	
> 60 Years Old	3	6.5	1 (2.2%)	0 (0%)	2 (4.3%)		1 (2.2%)	0 (0%)	2 (4.3%)		3 (6.5%)	0 (0%)	
IMT													
Underweight	3	6.5	1 (2.2%)	0 (0%)	2 (4.3%)	0.232	1 (2.2%)	0 (0%)	2 (4.3%)	0.368	2 (4.3%)	1 (2.2%)	0.053
Normal	12	26.1	7 (15.2%)	0 (0%)	5 (10.9%)		7 (15.2%)	0 (0%)	5 (10.9%)		9 (19.6%)	3 (6.5%)	
Overweight	10	21.7	5 (10.9%)	0 (0%)	5 (10.9%)		8 (17.4%)	0 (0%)	2 (4.3%)		9 (19.6%)	1 (2.2%)	
Obese 1	18	39.1	6 (13.0%)	0 (0%)	12 (26.1%)		11 (23.9%)	0 (0%)	7 (15.2%)		13 (28.3%)	5 (10.9%)	
Obese 2	3	6.5	3 (6.5%)	0 (0%)	0 (0%)		3 (6.5%)	0 (0%)	0 (0%)		0 (0%)	3 (6.5%)	
Blood Glucose													
Normal	26	56.5	12 (26.1%)	0 (0%)	14 (30.4%)	0.967	17 (37.0%)	0 (0%)	9 (19.6%)	0.895	17 (37.0%)	9 (19.6%)	0.535
Prediabetes	16	34.8	8 (17.4%)	0 (0%)	8 (17.4%)		10 (21.7%)	0 (0%)	6 (13.0%)		13 (28.3%)	3 (6.5%)	
Diabetes	4	8.7	2 (4.3%)	0 (0%)	2 (4.3%)		3 (6.5%)	0 (0%)	1 (2.2%)		3 (6.5%)	1 (2.2%)	
Uric Acid													
Normal	25	54.3	15 (32.6%)	0 (0%)	10 (21.7%)	0.071	19 (41.3%)	0 (0%)	6 (13.0%)	0.094	16 (34.8%)	9 (19.6%)	0.203
Increased	21	45.7	7 (15.2%)	0 (0%)	14 (30.4%)		11 (23.9%)	0 (0%)	10 (21.7%)		17 (37.0%)	4 (8.7%)	
Smoking													
No	41	89.1	20 (43.5%)	0 (0%)	21 (45.7%)	0.379	27 (58.7%)	0 (0%)	14 (30.4%)	0.359	28 (60.9%)	13 (28.3%)	0.331
Passive	1	2.2	1 (2.2%)	0 (0%)	0 (0%)		0 (0%)	0 (0%)	1 (2.2%)		1 (2.2%)	0 (0%)	
Active	4	8.7	1 (2.2%)	0 (0%)	3 (6.5%)		3 (6.5%)	0 (0%)	1 (2.2%)		4 (8.7%)	0 (0%)	

DISCUSSION

In the present study, conducted among 46 respondents who met the inclusion criteria, hypertension was the most prevalent cardiovascular risk factor, affecting 11 participants (23.9%). These findings are consistent with previous evidence demonstrating a strong association between advancing age and the increasing prevalence of hypertension.

A study conducted in Indonesia by Khasanah et al. reported that individuals aged ≥ 40 years had a significantly higher likelihood of developing hypertension ($p = 0.000$; OR = 2.897; 95% CI = 2.367–3.545), indicating that age increases the risk of hypertension by nearly threefold. Similarly, Alinaitwe et al. found that individuals aged >42 years had a 2.5-fold higher risk of hypertension ($p = 0.019$; OR = 2.525; 95% CI = 1.116–5.463) [6].

An increase in blood pressure and the development of degenerative diseases are common in older age [7]. Between the ages of 30 and 65 years, systolic blood pressure typically rises by approximately 20 mmHg and continues to increase beyond the age of 70. Advancing age is therefore a well-established risk factor for hypertension.

CONCLUSIONS

This study demonstrates that age is a significant risk factor for hypertension and other cardiovascular disorders among participants of the Car-Free Day event at Hasanuddin University, Makassar. Hypertension showed the highest prevalence, particularly among respondents aged over 40 years. Conversely, tachycardia was more frequently observed in younger individuals (<40 years) and in those with obesity.

ACKNOWLEDGEMENT

The author expresses gratitude to Hasanuddin University for providing financial support for this study.

REFERENCES:

- [1] Di Cesare, M. et al. (2024) 'The Heart of the World', *Global Heart*, 19(1). Available at: <https://doi.org/10.5334/gh.1288>.
- [2] Muharram, F.R. et al. (2024) 'The 30 Years of Shifting in The Indonesian Cardiovascular Burden—Analysis of The Global Burden of Disease Study', *Journal of Epidemiology and Global Health*, 14(1), pp. 193–212. Available at: <https://doi.org/10.1007/s44197-024-00187-8>.
- [3] Bays, H.E. et al. (2021) 'Ten things to know about ten cardiovascular disease risk factors', *American Journal of Preventive Cardiology*, 5(November 2020), p. 100149. Available at: <https://doi.org/10.1016/j.ajpc.2021.100149>.
- [4] Srinivas, S. et al. (2024) 'Neurological Consequences of Cardiac Arrhythmias: Relationship Between Stroke, Cognitive Decline, and Heart Rhythm Disorders', *Cureus*, 16(3). Available at: <https://doi.org/10.7759/cureus.57159>.
- [5] Ray, L., Geier, C. and Dewitt, K.M. (2023) 'Pathophysiology and treatment of adults with arrhythmias in the emergency department, part 2: Ventricular and bradyarrhythmias', *American Journal of Health-System Pharmacy*, 80(17), pp. 1123–1136. Available at: <https://doi.org/10.1093/ajhp/zxad115>.
- [6] Alinaitwe, B. et al. (2024) 'Prevalence of Risk Factors for Hypertension Among Faculty at an Urban University in Uganda', *Integrated Blood Pressure Control*, 17(December 2023), pp. 1–11. Available at: <https://doi.org/10.2147/IBPC.S440972>.
- [7] Khasanah, D.N. (2022) 'the Risk Factors of Hypertension in Indonesia (Data Study of Indonesian Family Life Survey 5)', *Journal of Public Health Research and Community Health Development*, 5(2), p. 80. Available at: <https://doi.org/10.20473/jphrecode.v5i2.27923>.