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RISK FACTOR ACUTE CORONARY SYNDROME (ACS): A SYSTEMATIC REVIEW

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ABSTRACT

Acute Coronary Syndrome (ACS) remains the leading cause of morbidity and mortality globally, requiring a deeper understanding of its modifiable risk factors to inform prevention strategies. Objective: This study aims to identify the dominant risk factors contributing to ACS. Method: This systematic review synthesizes evidence from 11 peer-reviewed articles published between 2020 and 2025, sourced from PubMed and Google Scholar. Results: Among the studies evaluated, five major risk factors consistently emerged as significantly associated with ACS incidence: hypertension, smoking, diabetes mellitus, dyslipidemia, and obesity. Hypertension is the most commonly reported factor, demonstrating its important role in endothelial dysfunction and the development of atherosclerotic plaques. Smoking emerges as a strong and modifiable behavior-related risk, exacerbating oxidative stress and inflammation. Diabetes mellitus is associated with accelerated microvascular damage and atherogenesis, while dyslipidemia contributes through an imbalance of LDL and HDL cholesterol levels, promoting plaque formation. Obesity acts as an overarching metabolic disruptor, affecting four other risk factors through pathways involving insulin resistance and systemic inflammation. Conclusions: These findings reinforce the multifactorial etiology of ACS and highlight the urgent need for integrated public health interventions targeting these modifiable risks. Early identification and management of these conditions are critical to reducing the burden of ACS globally.

Keywords: acute coronary syndrome; diabetes mellitus; dyslipidemia; obese hypertension; smoking

INTRODUCTION

Acute Coronary Syndrome (ACS) represents a continuum of clinical conditions characterized by the emergence of new symptoms or clinical manifestations, which may or may not correspond with alterations in the 12-lead electrocardiogram (ECG), and which may or may not coincide with an acute elevation in cardiac troponin (cTn) levels. (PERKI, 2024). The World Health Organization noted in 2021 that roughly 20-25% of the world's individuals, or 2 million, together with another 6 million, are at an elevated risk for an ACS diagnosis. According to data derived from the 2023 Indonesian Health Survey (SKI), the national prevalence of heart disease, as diagnosed by medical professionals across all age demographics, reached 0.85%, corresponding to approximately 877,531 individuals throughout Indonesia. This statistic underscores the notion that heart disease, inclusive of ACS, constitutes a significant public health concern on a national scale.

Acute Coronary Syndrome continues to signify one of the critical public health issues that require comprehensive examination owing to its associated high rates of morbidity and mortality. In addition to its significant impact on mortality rates, this condition also has noteworthy social and economic implications, as evidenced by the burden of excessive medical costs, the requirement for comprehensive diagnostic assessments, and prolonged treatment periods.. Evidence from both global and Indonesian contexts suggests that instances of ACS frequently culminate in mortality as a consequence of delays in medical intervention. This further accentuates the critical importance of preventive strategies, particularly those focusing on early detection and efficient disease management (Johanis et al., 2020).
In response to these conditions, a systematic study is needed to summarize and critically evaluate various scientific findings related to the risk factors that play a role in the occurrence of ACS. This research initiative aims to clarify a more comprehensive understanding of the key factors contributing to ACS,

thus establishing a foundational basis for the formulation of more effective and evidence-based preventive measures. Thus, the results of this study are expected to contribute to efforts to reduce the incidence and mortality rate due to ACS through increased preventive interventions and early detection in at-risk populations.

METHOD

This study implements a structured review approach consistent with the standards defined by PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses). The search strategy was carried out systematically through two online databases, namely Google Scholar and PubMed, using the keyword: "Risk Factors for Acute Coronary Syndrome". The articles searched were limited to publications published within the last five years, namely between 2020 and 2025. Selection is made for articles that are available in Indonesian or English, have full text, and include the identity of a valid publication.Inclusion criteria include articles that explicitly discuss risk factors in patients with ACS. Meanwhile, the exclusion criteria consist of articles that do not provide access to the full text, are written in languages other than English or Indonesian, were published before 2020, and do not include the identity of an official publication (ISSN/ISBN). The article selection process includes four stages according to the PRISMA flow, namely identification, screening, feasibility, and inclusion. In the final stage, eligible articles are analyzed qualitatively.

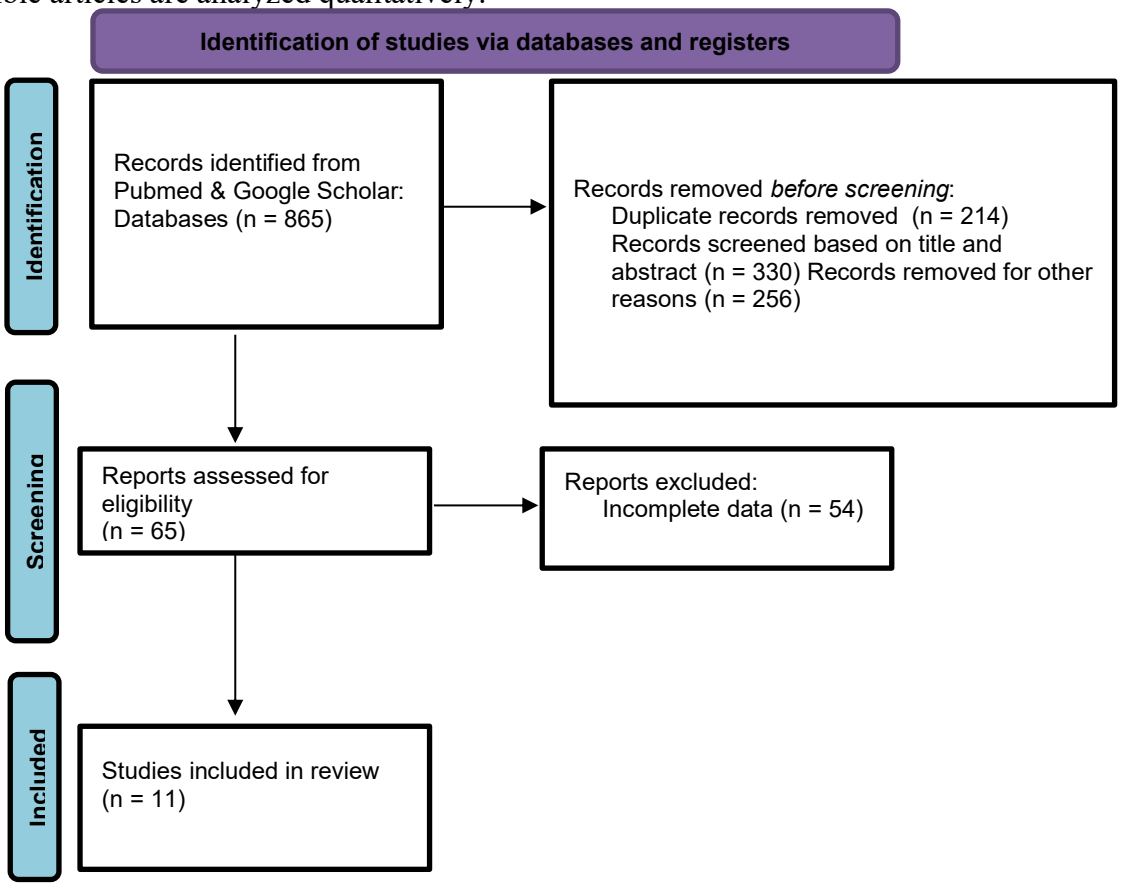

Figure 1. PRISMA

Each ACS risk factor found in each publication was recorded and analyzed narratively. The analysis process was carried out by grouping findings based on the emergence of risk factors and conformity with the existing literature. Conclusions are drawn based on the pattern and frequency of risk factor findings from the articles that have been systematically reviewed.

RESULT AND DISCUSSION

Table 1.
Summary of primary studies (N=4,600)

No	Researcher (Year)	Article	Sample	Risk factors of ACS
1	Radyaputri et al. (2025)	Risk Factors of Acute Coronary Syndrome in Adam Malik General Hospital	190	Smoking, hypertension, diabetes mellitus, obesity, and dyslipidemia.
2	Pandey et al. (2024)	A study on the spectrum of conventional risk factors in acute coronary syndrome in Nepal	100	Hypertension, smoking, diabetes mellitus, and dyslipidemia
3	Agung & Anindya (2024)	Prevalence and Impact of Modifiable Risk Factors on Acute Coronary Syndrome: A Case Control Study	100	smoking, dyslipidemia, hypertension, diabetes mellitus, obesity, and hyperuricemia.
4	Hubacek et al. (2024)	Cholesterol-associated genetic risk score and acute coronary syndrome in Czech males	929	Smoking, hypertension, and diabetes mellitus
5	Roy et al. (2023)	Associated Risk Factors and Clinical Outcomes of Acute Coronary Syndrome Patients in A Tertiary Care Hospital	100	Smoking, hypertension, diabetes mellitus, hypercholesterolemia, family history of cardiovascular disease, and alcohol consumption
6	Raesi et al. (2023)	Risk Factors of Acute Coronary Syndrome: The Experience from Iran	228	Hypertension, high blood sugar upon arrival, high BMI, and drug abuse
7	Nuviastuti et al. (2023)	Patients with Acute Coronary Syndrome Characteristics	75	Hypertension, Smoking
8	Rao et al. (2022)	Metabolic risk factors in the first acute coronary syndrome (MERIFACS) Study	2153	Hypertension, diabetes mellitus, and smoking
9	Salem et al. (2020)	Risk Factors Associated With Acute Coronary Syndrome among Patients Admitted to the Coronary Care Unit in the Military Cardiac Center - Sana'a-Yemen	124	Hypertension, Khat chewing, and dyslipidemia.
10	Liu et al. (2020)	The characteristics of risk factors in Chinese young women with acute coronary syndrome	415	Hyperlipidemia, hypertension, hypercholesterolemia, diabetes mellitus, and a family history of early-onset CHD
11	El-Gamal et al. (2020)	Risk factors of clinical types of Acute Coronary Syndrome	186	Smoking

Based on a series of primary studies involving a total of 4,600 respondents, several major risk factors are consistently associated with the incidence of ACS. The most dominant risk factors are hypertension, smoking, diabetes mellitus (DM), and dyslipidemia. Hypertension was found in almost all studies to be a significant major risk factor, followed by smoking, which is also widely reported to play a role in the incidence of ACS. Diabetes mellitus and abnormalities in blood lipid levels (dyslipidemia) are also risk factors that often appear in various populations. In addition, some studies identified additional risk factors such as obesity, a family history of cardiovascular disease, alcohol consumption, as well as drug abuse. Genetic factors were also found to contribute to the risk of ACS, especially in a study conducted by Hubacek et al. (2024). In some specific populations, such as patients in Yemen, the habit of chewing Khat is also associated with a risk of ACS. Studies with large samples confirm that hypertension, diabetes, and smoking are major risk factors that play a broad role. Overall, these results suggest that the control of modified risk factors such as hypertension, smoking, diabetes, and dyslipidemia is essential in the prevention of ACS in a wide range of populations. (table 1 and figure 1).

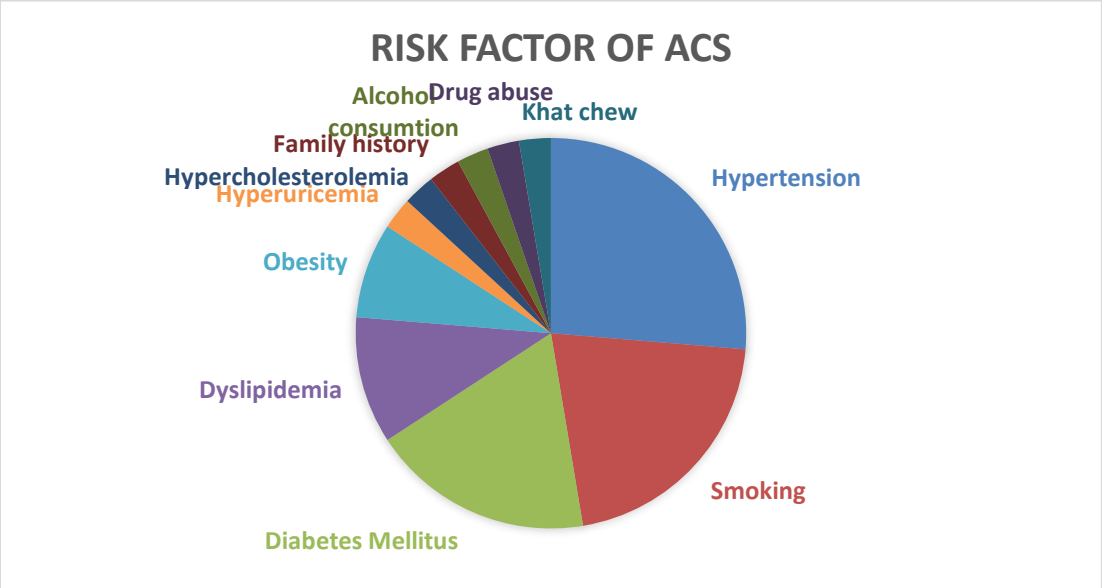

Figure 2. Pie Chart Risk Factor of ACS

This systematic review shows that ACS is a clinical manifestation of a complex and multifactorial atherosclerotic process. Most of the literature states that the accumulation of LDL cholesterol in the arterial intima tunica, accompanied by endothelial dysfunction and chronic inflammatory processes, is a major trigger for the formation of unstable atherosclerotic plaques. (El-gamal et al., 2020; Liu et al., 2020). The instability of such plaques can lead to rupture and activation of the coagulation cascade, leading to the formation of a thrombus and eventually leading to acute myocardial ischemia (Hygriv Rao et al., 2022; Liu et al., 2020). Several risk factors that contribute to the development of ACS have been identified consistently in many studies, including hypertension, diabetes, smoking, obesity, and dyslipidemia (Pandey et al., 2024; Raesi et al., 2023; Roy et al., 2023; Santoso et al., 2023). Hypertension is a major risk factor that plays a role in the pathogenesis and progression of ACS. A significant increase in blood pressure, especially when it occurs suddenly, can trigger myocardial ischemia by increasing systemic vascular resistance and cardiac workload. In individuals with coronary atherosclerotic lesions, the hypertensive response can interfere with subepicardial perfusion, increase myocardial oxygen needs, and increase the stress of the ventricular wall, ultimately leading to hypoxia, apoptosis, and myocardial cell necrosis. Hypertension can also trigger pathological cycles that worsen systolic and diastolic dysfunction of the left ventricle. In the context of emergency hypertension that accompanies ACS, a gradual and controlled decrease in blood pressure should be carried out. Too rapid a drop in blood pressure can lead to hypoperfusion of vital organs, worsen coronary ischemia, and increase the risk of cardiovascular morbidity and mortality (Tocci et al., 2018)

Moreover, tobacco consumption has the potential to elevate morbidity and mortality rates through the interplay of metabolic and physiological pathways, encompassing endothelial dysfunction, oxidative stress, platelet aggregation, and inflammatory processes (Liu et al., 2020) Prolonged exposure to tobacco smoke leads to the constriction of the lumen within coronary arteries, arterioles, and microvascular structures, and is correlated with adverse effects on serum lipid profiles and the development of insulin resistance (El-gamal et al., 2020). The reduction in oxygen transport capacity detrimentally impacts various organ systems and aggravates pre-existing chronic conditions, including metabolic syndrome (Hygriv Rao et al., 2022). Individuals admitted to healthcare facilities following acute coronary syndrome frequently exhibit comorbid conditions, such as chronic renal failure, gastrointestinal disorders, pulmonary diseases, hematological disorders, and malignancies (Santoso et al., 2023). Consequently, cessation of smoking may attenuate morbidity and mortality associated with chronic non-cardiovascular diseases, in addition to providing cardiovascular advantages (Franck et al., 2018). Having

diabetes mellitus is a considerable risk that promotes the quick onset of ACS through different pathophysiological mechanisms. Long-standing high blood sugar levels related to diabetes trigger oxidative stress, overall inflammation, and issues with endothelial function, resulting in decreased production of nitric oxide (NO) and heightened expression of vascular adhesion molecules, thus promoting the advancement of atherosclerosis. Moreover, insulin resistance intensifies atherogenic dyslipidemia, identified by heightened triglyceride and low-density lipoprotein (LDL) concentrations, coupled with lowered high-density lipoprotein (HDL) levels, consequently aiding the emergence of atherosclerotic plaques in coronary arteries. Individuals suffering from diabetes mellitus often experience plaques that are likely to become unstable and rupture, which sets off platelet activation and coagulation processes, ultimately leading to a critical blockage of coronary blood flow caused by thrombus creation. In contrast, heightened levels of fibrinogen and impaired fibrinolysis augment the risk of thrombosis. Additionally, diabetic autonomic neuropathy may elicit atypical ischemic manifestations, such as dyspnea or rapid fatigue, which often leads to a delayed diagnosis of ACS.

The elevation of low-density lipoprotein (LDL) is a major element in the cause of ACS. The presence of oxidized LDL (oxLDL) incites a chronic inflammatory response and facilitates the formation of foam cells, which subsequently aggregate to form atherosclerotic plaques. The occurrence of unstable plaques makes rupture more likely, causing platelet activation and eventually forming a thrombus that hinders the coronary arteries. The aggressive reduction of LDL levels constitutes a pivotal strategy in the secondary prevention of ACS. High-dose statins, ezetimibe, PCSK9 inhibitors, and bempedoic acid as therapeutic interventions have revealed success in mitigating the incidence of repeated ischemic events. Nonetheless, suboptimal treatment rates attributable to financial constraints, adverse effects, and patient non-compliance persist as significant obstacles in clinical practice (Yadav & Sawhney, 2024).Obesity, specifically central obesity, constitutes a significant determinant in the etiology of ACS. The deposition of visceral adipose tissue results in the secretion of adipokines and pro-inflammatory cytokines, including tumor necrosis factor-alpha (TNF-α) and interleukin-6 (IL-6), which contribute to endothelial impairment, heightened oxidative stress, and the acceleration of atherogenic processes. The condition is exacerbated by the comorbidities that often accompany obesity, such as dyslipidemia, hypertension, and insulin resistance, which increase susceptibility to atherosclerotic plaque rupture. This process leads to the formation of a coronary thrombus, which is the basis for ACS. The distribution of fat, especially intraabdominal fat, has a significant pathophysiological role even though body mass index appears normal (Wan et al., 2019)

Curiously, several recent investigations have shown that overall cholesterol and low-density lipoprotein (LDL) concentrations might not represent the key determinants of ACS risk. Instead, some researchers suggest that measurements of apolipoprotein B (ApoB) levels can provide more accurate risk predictions. A decrease in cholesterol levels after an ACS attack can also be a confusing factor in assessing the role of cholesterol as a primary cause (Hubacek et al., 2024). Furthermore, lifestyle modifications and enhanced management of cardiovascular risk determinants in recent decades seem to have played a significant role in the reduction of overall lipid levels within the population; however, the incidence and clinical ramifications of ACS continue to be elevated. (Hubacek et al., 2024; Kusuma & I Gede Bagus Gita Pranata Putra, 2024). Therefore, a multifactorial approach that includes genetic, environmental, and lifestyle factors is important in assessing and preventing ACS risks (Mirza et al., 2018).

CONCLUTION

Hypertension, smoking, diabetes mellitus, dyslipidemia, and obesity are the main risk factors most commonly associated with the occurrence of ACS. Therefore, strict action is needed from the government to control these risk factors in the primary and secondary prevention ceremonies of ACS. Population-based preventive approaches and clinical interventions focused on modifying these risk factors.

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