Synergistic Impact of High-Fat Diets and Smoking on Cardiovascular Health: A Literature Review

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Abstract: Cardiovascular disease continues to be a global public health challenge with multiple complex risk factors. The combination of high-fat diet and smoking habits has a synergistic effect that increases the risk of cardiovascular disease. This study aimed to determine the relationship between a high-fat diet and smoking habits and cardiovascular disease, and to emphasize the importance of dual interventions targeting dietary changes and smoking cessation as the primary strategy to reduce the burden of coronary heart disease and stroke. This study used a literature review method. The results of this study indicate that smoking and excessive fat consumption are two major risk factors contributing to the increasing incidence of cardiovascular disease (CVD). Smoking has been shown to accelerate the process of atherosclerosis by increasing blood pressure, vascular inflammation, and decreasing HDL cholesterol levels. Consuming saturated fat makes this condition worse by raising levels of easily oxidized LDL cholesterol and lowering levels of HDL cholesterol, which speeds up the accumulation of plaque in blood vessels. Nutritional interventions like lowering saturated fat and raising MUFA intake through a nutritious diet, like the Mediterranean diet, can lower this risk. This all-encompassing approach is anticipated to dramatically lower the incidence of coronary heart disease in at-risk groups when paired with smoking cessation initiatives.

1 INTRODUCTION

Cardiovascular disease is a non-communicable disease that has a reasonably large prevalence rate; this disease is still a global threat (global threat). It is a disease that plays a significant role as the number one cause of death throughout the world. (1).

One of the most common conditions is coronary artery disease, which is a leading cause of death worldwide and contributes significantly to disability rates. (2). According to a report from the American Heart Association, coronary heart disease resulted in 371,506 deaths in 2022. Data from the WHO shows that more than 17 million individuals worldwide died from heart and blood vessel disease. (3)The World Health Organization estimates that as many as 4.2 million people in Europe died from cardiovascular disease in 2019, representing more than 2 in 5 (42.5%) of total deaths. More than 8 in 10 (82%) of cardiovascular disease deaths in Europe in 2019 were due to heart attacks and strokes. (4).

In Indonesia, cardiovascular disease is also a leading cause of death and a significant health concern. According to data from the 2023 Indonesian

Health Survey (SKI), the number of heart disease sufferers in Indonesia shows a worrying upward trend, with the productive age group 25-34 years dominating the cases, reaching over 140,000 people. (5). This figure indicates that heart disease not only attacks the elderly, but also threatens the younger generation due to increasingly unhealthy lifestyle changes such as poor diet, lack of physical activity, and increased cigarette consumption.

According to data from the Indonesian Ministry of Health in 2025, cardiovascular disease is the leading cause of death in the nation, with heart disease and stroke accounting for almost 800,000 deaths annually. Addressing this problem has received serious attention, with various efforts such as reducing salt and trans fat consumption in the public's diet and smoking cessation campaigns supported by the WHO and national health organizations. (6).

Predictions show that the number of hospitalizations due to heart failure has increased sharply in several hospitals in Indonesia in 2021-2024 and is projected to continue to rise until 2028, especially in male patients of productive age. (7)This demonstrates the urgency of increasing prevention efforts through education on healthy lifestyles, controlling risk factors such as obesity, hypertension, and low physical activity, and developing more effective and multidisciplinary health services.

There are two types of causes of coronary heart disease: modifiable and non-modifiable. Age, gender, and genetics—a family history of heart and blood vessel disease—are examples of non-modifiable factors. Lifestyle modifications like quitting smoking, controlling one's diet, and engaging in regular exercise can help prevent potential risk factors. This is due to the fact that coronary heart disease can be brought on by a number of factors, such as dyslipidemia, high blood pressure, high cholesterol, type 2 diabetes, smoking, obesity, and a lack of physical activity. (8).

Cardiovascular disease continues to be a global public health challenge with multiple complex risk factors. One significant risk factor is the consumption of saturated and trans fats. Saturated fat is known to increase LDL cholesterol levels, contributing to atherosclerotic plaque formation in the coronary arteries. A systematic study by Zheng et al. (2023) showed that saturated fat intake was significantly associated with an increased risk of coronary heart disease due to unfavorable changes in blood lipid profiles. (9).

Besides fatty foods, smoking is also a significant risk factor for cardiovascular disease. Toxic substances in cigarette smoke, such as nicotine and carbon monoxide, can damage the endothelium of blood vessels and trigger a chronic inflammatory process that accelerates the development of atherosclerosis. (10). The meta-analysis by Shi et al. (2025)(11)Reports indicate that active smokers have more than double the risk of myocardial infarction compared to nonsmokers, while passive smokers also have a higher risk than individuals never exposed to cigarette smoke. Smoking impacts vascular function and lipid imbalance, which worsens heart and blood vessel conditions.

The combination of high-fat diets and smoking has a synergistic effect that increases the risk of cardiovascular disease. Research by Whitehead et al. (2024)(12)suggested that co-exposure to a high-fat diet and smoking significantly increased oxidative stress and vascular inflammation compared to either

factor alone. These findings highlight the significance of dual interventions aimed at quitting smoking and altering one's diet as the main means of lowering the incidence of coronary heart disease and stroke.

2 METHOD

This research uses a literature review method. This method identifies, evaluates, and interprets research findings relevant to a specific topic or phenomenon that is the focus of the research. This process involves a systematic review of scientific articles.

3 KEYWORDS FOR ARTICLE SEARCH

The Boolean operator AND and particular keywords were used in the article selection process for this study. Using databases including PubMed.gov, Wiley Online Library, Cochrane Library, ProQuest, and ScienceDirect, the search was carried out in August 2025. The Google search
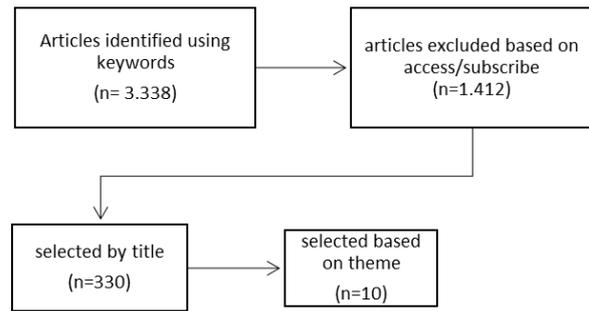
engine was also used to look for articles. The search scope covered publications from 2020 to 2024, with inclusion criteria limited to literature reporting research findings. The literature search process using the keyword combination "high-fat diet" AND "cardiovascular" found 1,023 research articles. "smoking" AND "cardiovascular" found 2,316.

articleResearch. Selected based on downloads (subscribed), found 1,412 journals and selected based on the title 330, journals chosen according to the topic and purpose of writing the literature review, selected 10 journals

4 RESULT AND DISCUSSION

Title	Author, year	Method	Results
Knowledge and Awareness Level of Cardiovascular Diseases and Their Risk Factors among the Saudi Population	Khalid A. Alghamdi, Kumail J. Alburih, Saad S. Alziyadi, Raghad S. Bahamdin, Nawaf S. Almutairi, Saba H. Alkharboush, Abdullah M. Almutayib, Mohammed F. Alotaibi, Mohammed M. Alotaibi, Alwaleed M. Alshamrani and Khames T. Alzahrani. (2025)	This cross-sectional observational study was conducted in Saudi Arabia between July 2024 and February 2025. The study involved distributing an online questionnaire to the public in the Kingdom of Saudi Arabia to assess public knowledge and awareness of cardiovascular disease and its risk factors. Inclusion criteria were males and females in the Kingdom of Saudi Arabia aged 18 years and above. Individuals under 18 and non-residents of Saudi Arabia were excluded from the study. The Raosoft sample size	The study results indicate that a combination of lifestyle, clinical factors, and public awareness influences cardiovascular disease (CVD) in the Saudi Arabian population. Dietary patterns are a key factor in lifestyle. Fifty-seven percent of respondents reported consuming fast food occasionally, 19.9 percent frequently, and only 22.7 percent reported consuming it rarely or never. This pattern reflects the high public exposure to foods high in fat, calories, and salt, which contribute to elevated cholesterol levels, obesity, and other metabolic disorders. Public awareness of this issue is quite good, as 85.2 percent of respondents stated that high cholesterol levels due to excessive fat consumption are a

| | | calculator was used to calculate the sample size. The minimum target sample size was 384, with a percentage indicator 0.50, a margin of error of 5%, and a 95% confidence interval (CI). | significant risk factor for cardiovascular disease. However, the gap between knowledge and actual behavior remains clear, as many continue to consume unhealthy diets despite being aware of the impact. However, a small percentage of respondents also exhibited smoking behavior, with the prevalence of current smokers at 8.3% and former smokers at 3.5%. Given that smoking is known to speed up the development of atherosclerosis, raise blood pressure, and lower the blood's oxygen capacity, the effect of smoking on heart health is still substantial even though this number is relatively low. Respondents' awareness of the dangers of smoking was very high, with 94.2% stating that smoking was a risk factor for cardiovascular disease. Similar to fat consumption, this condition also indicates a gap between high levels of knowledge and its application in daily life. In addition to these two factors, the study also found that 42.6% of respondents had never exercised, 14.4% had been diagnosed with hypertension, 10.9% had diabetes, 16.2% had high cholesterol, and 15.3% were obese. These factors further strengthen the link between an unhealthy lifestyle and an increased risk of cardiovascular disease. Although overall, 74.5% of respondents demonstrated a high level of awareness of CVD risk factors, only 48.8% actually had a high level of knowledge, indicating the need for more in-depth education that can encourage behavior change. |
| Risk factors for cardiovascular disease among Saudi students: Association with BMI, current smoking, level of physical activity, and dietary habits | Mohammed Shaab Alibrahim, Mohamed Ahmed Said, Abdulmalek K. Bursais, Ibrahim I. Atta, Mohamed Abdelmoniem Abdelrahman, Hasnaa Hamdi Mohamed, Ahmad K. Hassan, Abdulrahman I. Alaqil, Norah S. Almudaires, Narjis MA Alamer, Osama Eid Aljuhani, Hind Omer Salem Alshaghdali, Amani | Stratified cluster random sampling was used to select 495 Saudi university students for this cross-sectional study. Anthropometric measurements, an FFQ for dietary intake, and structured questionnaires were used to gather data. Analysis was performed using binary logistic regression to examine lifestyle factors associated with cardiovascular disease risk. | The findings show that a number of dietary and behavioral factors play a major role. The prevalence of smoking among college students was 9.4%; men were more likely to smoke (23.1%) than women (3.7%). Saturated fat consumption was also relatively high, at 69.5% of respondents, with a greater prevalence among women (73%) than men (61.2%). Logistic regression analysis showed that smoking increased the risk of CVD by 6.54-fold, while excessive saturated fat intake increased the risk by 4.79-fold. In addition, other significant risk factors were a high body mass index (BMI), which increased the risk by 11.7-fold, low physical activity, which increased the risk by 7.61-fold, and consumption of foods |

	Hamzah ALjahani, Zuhair A. Al Salim, Atyh Abdullah Hadadi, Najeeb Abbas Aldarushi, Amal Nassir Alkuraieef, Ghareeb O. Alshuwaier, (2025)		with a high glycemic load (GL), which increased the risk by 7-fold. Respondents' dietary patterns also tended to be generally unhealthy, characterized by high sugar consumption, low fiber, and continued consumption of fast food and sugary drinks. Overall, this study shows that smoking, eating a diet high in saturated fat, not exercising, and having a suboptimal nutritional status all significantly raise the risk of cardiovascular disease in young people. For this reason, early nutritional interventions and health promotion are essential.
Association of circulating fatty acids with cardiovascular disease risk: analysis of individual-level data in three large prospective cohorts and updated meta-analysis	Fanchao Shi, Rajiv Chowdhury, Eleni Sofianopoulou, Albert Koulman Luanluan Sun, Marinka Steur, Krasimira Aleksandrova, Christina C. Dahm Claudia Agnoli, Matthias B. Schulze, Yvonne T. van der Schouw, Pilar Amiano, Jolanda MA Boer, Christian S. Bork, Natalia Cabrera-Castro, Fabian Eichelmann, Alexis Elbaz, Marta Farràs, Alicia K. Heath, Rudolf Kaaks Pekka Keski-Rahkonen, Giovanna Masala, Verena K, Conchi Moreno-Iribas, Salvatore Panico, Keren Papier, Dafina Petrova, J. Ramón Quirós, Fulvio Ricceri Tammy YN Tong, Rosario Tumino, Gianluca Severi, Anne Tjønneland, Nicholas J. Wareham, Elisabete Weiderpass, Emanuele Di	The study design used a prospective analysis of 3 cohorts and a systematic meta-analysis. The respondent population was 172,891 participants without a history of CVD, EPIC-CVD (31,606, Europe), UK Biobank (99,762, UK), INTERVAL (41,523, UK)

With fatty acid measurements using EPIC-CVD: 38 FA plasma phospholipids (GC), UKB & INTERVAL: 5 subtypes of total FA plasma/serum + two individual FA (NMR), and focused on: SFA, MUFA, PUFA (n-3, n-6), DHA, LA. Outcome: CHD, stroke, CVD mortality, total CVD (fatal & non-fatal). Statistical analysis: Cox regression, random-effects meta-analysis; adjusted for risk factors (age, sex, smoking, diabetes, hypertension, physical activity, BMI, alcohol, lipids) | With 9,453 CHD cases, 8,182 strokes; median follow-up 9.4–12.6 years.

Results: Total SFA or saturated fatty acids have been shown to increase the risk of coronary heart disease (CHD) and stroke. There is a higher risk of CHD (HR 1.17) and stroke (HR 1.13). DGLA (n-6) is associated with an increased risk, and MUFAs are generally neutral, but some types (e.g., palmitoleic acid/16:1) actually increase the risk of stroke. |

	Angelantonio, Nita G. Forouhi, John Danesh, Adam S. Butterworth, and Stephen Kaptoge (2024)		
Cardiovascular dysfunction induced by combined exposure to nicotine inhalation and a high-fat diet	Anna K. Whitehead, Zhen Li, Eric Lazartigues, and Kyle B. LaPenna, Nour Abbes, Thomas E. Sharp, David J. Lefer, Xinping Yue (2024)	The research subjects were male & female mice aged 6–7 weeks. The research design was divided into four groups: 1) Air + normal diet (RD), 2) Air + high-fat diet (HFD), 3) Nicotine + RD, 4) Nicotine + HFD. Duration 10–12 weeks, Echocardiography (heart function), radiotelemetry (blood pressure & HR), LV hemodynamics, vascular reactivity (ACh & SNP), molecular analysis (Western blot, PCR RAS) measurements.	The results showed that a high-fat diet increased body weight, but nicotine exposure suppressed this increase. However, the combination of nicotine and a high-fat diet still resulted in significant obesity. In cardiac function parameters, the combination of nicotine with HFD causes increased LVEDP and slowed left ventricular relaxation (diastolic dysfunction). Exposure to inhaled nicotine and a high-fat diet together worsens cardiovascular dysfunction through impaired cardiac relaxation and endothelial dysfunction, with mechanisms involving eNOS and the RAS system.
Intervention design and adherence to Mediterranean diet in the Cardiovascular Risk Prevention with a Mediterranean Dietary Pattern Reduced in Saturated Fat (CADIMED) randomized trial	Lourdes Chávez-Alfaro a, Carmen Tenorio Jiménez b, Víctor Silveira-Sanguino a, María José Noguera Gómez c, Concepción Fernández-Morenoc, Ana María Rodríguez Cuesta d, Antonio F. Lebrón Aranac, Óscar Segura Calvoc, Ignacio Merino De Haro d,Concepción M. Aguileraa,e,f, Carolina Gómez-Llorente a,e,f, Óscar Daniel Rangel-Huertag,Nerys Astbury h, Aurora Pérez-Cornagoi, Marta Guasch-	The study design was a Randomized Controlled Trial (RCT), 8 weeks, two parallel groups, with respondents in Granada, Spain; 156 adults (18–75 years) with dyslipidemia (LDL-C 116–190 mg/dL), not taking lipid-lowering medication. Participants were divided 1:1 into intervention and control groups with stratification based on age, sex, obesity status, and fruit/vegetable consumption. There were two groups - Intervention Group: Mediterranean Diet (MD) without red & processed meat, web-based education, recipes, substitution strategies (fish, chicken, nuts) Control: General advice on a healthy diet for CVD	Number of Samples Analyzed: The first set of data came from 81 people (up until December 31, 2024). Characteristics of the Participants: The average age was 51.9 ± 10.6 years, the average BMI was 27.2 ± 4.3 kg/m² (overweight category), and the average LDL-C level was 150.4 ± 18.4 mg/dL. Most of them are men (56.8%) Mediterranean Diet (MD) Adherence Results: Low, with a mean MEDAS score of 7.6 ± 1.9 (scale 0–14). And the results of Red & Processed Meat Consumption: Average 1.04 ± 0.9 servings per day (approximately 43.9 servings per month). Consisting of red meat 8.7 portions/month and processed meat 35.2 portions/month. Key Findings: High red/processed meat consumption and low adherence to the Mediterranean dietary pattern may

	Ferrej, Carmen Piernas (2025)	prevention without specific red/processed meat restrictions. **Main Measurements**: Changes in plasma LDL-C levels (mg/dL) and erythrocyte fatty acid profiles after 8 weeks. **Secondary Measurement**: Total cholesterol, HDL-C, triglycerides, inflammatory biomarkers (CRP, IL-6, TNF-α, etc.), insulin resistance (glucose, HbA1c, insulin), blood pressure, BMI, waist circumference, gut microbiota, and adherence to diet. Statistical analysis with Intention-to-treat with linear regression, comparing baseline & follow-up	contribute to increased cardiovascular risk.
Dietary patterns derived by reduced-rank regression and cardiovascular disease: A cross-sectional study	Sun, Qiaorui Wen, Jun Lyu, Dianjianyi Sun, Yuan Ma, Sailimai Man, Jianchun Yin, Cheng Jin, Mingkun Tong, Bo wang, Canqing, Yi Ning, Liming Li, (2022)	Cross-sectional study design, Beijing MJ Health Center (2008–2018). 75.159 respondents were without CVD (dietary pattern analysis); the association with CVD was 89,633 participants. RRR analysis method to find patterns that influence lipid profiles and adiposity. Dietary patterns formed, high: staple foods, red meat, processed meat, fried foods, offal; low: jam/honey, fruit, milk/dairy products. Association with risk factors through Multivariate logistic regression to assess the association between dietary pattern scores and CVD prevalence, controlled for age, sex, income, education, marital status, family history, smoking, alcohol consumption, physical activity, and daily energy intake.	The first dietary pattern extracted by RRR provided the most significant predictive ability for participants' lipid and adiposity profiles. Association of Lipid Profile and Adiposity: High nutritional pattern scores were associated with increased LDL-cholesterol and triglycerides, greater BMI and waist circumference, and lower HDL-cholesterol levels in high dietary pattern scores. Association with CVD Prevalence: Participants with high dietary pattern scores had a 1%–38% greater chance of having CVD than those with low nutritional scores (OR = 1.18; 95% CI = 1.01–1.38) A diet characterized by high consumption of processed foods, red meat, and fried foods, and low consumption of healthy fruits and dairy products, is directly associated with a worsening lipid profile and obesity. This pattern is linked to cardiovascular disease. A healthy dietary approach—low in saturated fat, high in fruits, vegetables, and healthy animal products—can be an

			essential strategy in CVD prevention in the community.
Genetics of Smoking and Risk of Atherosclerotic Cardiovascular Diseases A Mendelian Randomization Study	MichaelG.Levin, MD; Derek Klarin, MD; Themistocles L. Assimes, MD, PhD; Matthew S. Freiberg, MD; Erik Ingelsson, MD, PhD; Julie Lynch, PhD; Pradeep Natarajan, MD; Christopher O'Donnell, MD; Daniel J. Rader, MD; Philip S.Tsao, PhD; Kyong-MiChang, MD; Benjamin F.Voight, PhD; Scott M.Damrauer, MD (2021)	This study used genetic data-based Mendelian Randomization (MR) to evaluate the association between smoking habits (measured by the lifetime smoking index) and the risk of cardiometabolic diseases, including atherosclerotic cardiovascular disease. It utilized large genetic data sets from various international consortia, including GIANT, GLGC, MAGIC, CKDGen, DIAGRAM, and UK Biobank. Statistical analysis was performed using the inverse-variance weighted MR method.	Through the Mendelian Randomization approach, it was found that genetics and smoking are related to: 1. Increased blood pressure (systolic and diastolic). 2. Increased triglycerides and decreased HDL-cholesterol. 3. Increased risk of type 2 diabetes. These effects explain how smoking directly contributes to the mechanisms of atherosclerosis and cardiometabolic disorders.
The interaction between diet quality and cigarette smoking on the incidence of hypertension, stroke, cardiovascular diseases, and all-cause mortality	Mostafa Norouzzadeh, Farshad Teymoori, Hossein Arhadnejad, Nazanin Moslehi Sendedeh, Tayebeh Rahideh, Parvin Mirmiran, & Fereidoun Azizi (2024)	The research method used is prospective. This research started in 1999 at the Tehran Regional Hospital, where data were taken every three years, but the test data used were from 2018. The initial number of participants was 5532, with an age range of $\geq$ 30 years, with the condition that the individual did not suffer from any cardiovascular disease, a history of cancer, or mothers who were pregnant or breastfeeding, so the final number of participants was 5048. Information on food intake data using the FFQ questionnaire	The study results showed that people with poor diets (including frequent consumption of high-fat foods) and smokers had a higher risk of stroke and all-cause mortality. Compared with people in the higher quartile, nonsmokers with better diets had a higher risk of all cardiovascular diseases and all-cause mortality than smokers in both the lower and higher quartiles of the DQI. The study showed that people aged $\geq$ 30 years who smoked had a greater risk of stroke and death, regardless of whether they had a higher or lower quality diet.

Joint association of the Mediterranean diet and smoking with all-cause mortality in the Seguimiento Universidad de Navarra (SUN) cohort/	Miren Idoia Pardavila-Belio, Victor de la O, María Soledad Hershey, María Barbería-Latasa, Estefanía Toledo, Jose M. Martin-Moreno, Miguel Angel Martínez-Gonz alez, Miguel Ruiz-Canela (2022)	The research method was a prospective cohort study from 1999 to 2017 in Spain. The data collected through a questionnaire was 22.552 respondents who participated in this research; however, after selection criteria, such as missing data, excessive or insufficient intake, and participants who did not follow up, 18,948 respondents were obtained. Information in knowing respondents' consumption patterns using the FFQ method. Meanwhile, regarding smoking measurements, a questionnaire was given regarding the number of cigarettes smoked.	The research results indirectly show that people who smoke and have a high-fat diet are directly related to cardiovascular events. Still, people who smoke have a poor diet (high in fat and rarely eat vegetables). This study does not directly explain the relationship between a high-fat diet and smoking on cardiovascular events; however, people who have a smoking habit and a poor diet (often eating foods high in fat) have a higher death rate than people who don't smoke and have a good diet.
Cigarette smoking and cardiovascular disease incidence and all-cause mortality: the modifying role of diet quality	Mostafa Norouzzadeh, Farshad Teymoori, Hossein Farhadnejad, Nazanin Moslehi, Parvin Mirmiran, Seyedeh Tayebeh Rahideh, and Fereidoun Azizi (2024)	This prospective cohort study, which began in 1999, was conducted in Tehran, Iran, as part of the Tehran Lipid and Glucose Study (TLGS). Initially, 12,523 respondents were included, but after a selection process (removing missing data, reports of abnormal food intake, and participants who did not continue), the final number of respondents was 955. Information on dietary patterns was obtained using a validated, standardized Food Frequency Questionnaire (FFQ). Diet quality scores were calculated using the Diet Quality Index-International (DQI-I), the Diet Quality Index-Revised (DQI-R), and the Mediterranean Diet Quality Index (Med-DQI).	From the research results, people who smoke lightly and have a good quality diet (not consuming high-fat foods too often) have a higher risk of developing cardiovascular disease compared to people who smoke heavily and have a poor quality diet. Compared to people who smoke heavily and have a poor diet, people who smoke lightly but have a good diet have a lower cardiovascular risk. This study shows that people who have a poor quality diet plus heavy smoking have a high risk of cardiovascular disease, and not only that, the prevalence of death is higher than in people who do not smoke.

Cardiovascular disease is a medical condition that affects the heart and blood vessels. Many factors cause it, but the most common is the buildup of fat in the arteries (atherosclerosis) and increased susceptibility to thrombosis. According to the WHO, cardiovascular disease is the leading cause of death globally, responsible for 17.9 million people in 2019, representing 32% of all deaths. Cardiovascular disease is not an acute disease, which appears suddenly in less than 6 months, but a disease that develops over a long period of time, influenced by an unhealthy lifestyle and diet, including the habit of consuming fatty foods and smoking. A cross-sectional study of Saudi students showed that smoking increased the risk of heart disease by 6.54 times, while excessive consumption of saturated fat increased the risk by 4.79 times. (14). This is also supported by research(15), which shows that poor eating habits, frequent consumption of high-fat foods, and smoking habits are the causes of cardiovascular disease in Saudi society, which is a mismatch between knowledge about healthy living and existing reality, and this is in line with research conducted. by Norouzzadeh et al., (2024) The results show that a healthy diet is not enough to significantly reduce the risk of stroke if you still have a smoking habit, the same as people who have a poor diet, often consume foods high in saturated fat and smoke. This study involved respondents aged ≥ 30 years. The four previous studies are strengthened by the study of Sun et al. (2022), which stated that total polyunsaturated fatty acids (PUFA n-6) [0.94 (0.91-0.98)], including linoleic acid (LA) [0.89 (0.83-0.95)], negatively correlated with the risk of stroke.)

(17) A study found that individuals with a genetic predisposition to smoking were closely associated with increased systolic and diastolic blood pressure, triglyceride levels, and decreased HDL cholesterol. These changes in cardiometabolic risk factors collectively explain the contribution of smoking to the development of atherosclerosis and an increased risk of cardiovascular disease. These findings confirm that long-term smoking influences changes in lipid profiles and blood pressure, thereby increasing the risk of heart disease. Furthermore, a trial conducted on mice that administered nicotine and consumed a high-fat diet increased the risk of cardiovascular disease because smoking and a high-fat diet are two modifiable risk factors for cardiovascular events. (18).

Research conducted (19) found that people with a high Mediterranean diet score, a diet that prioritizes plant-based sources of fat, limits consumption of red and processed meat, and prioritizes fish and poultry in moderate to low amounts, tended to have a reduced risk of hypertension. This is because the diet is rich in fiber and healthy fats, and low in saturated fat. However, if patients did not adhere to the Mediterranean diet and instead frequently consumed foods high in saturated fat, red meat, and processed foods with high salt content, this condition could increase or worsen the risk of hypertension. This is because excessive intake of saturated fat and sodium can trigger increased blood pressure, reduce blood vessel elasticity, and disrupt fluid and electrolyte balance in the body. This is supported by research conducted by(20), which states that people who frequently consume saturated fat are linked to an increased risk of congenital heart disease and stroke. People who consume high levels of saturated fat have a 17% increased risk of developing congenital heart disease and a 13% increased risk of stroke.

Furthermore, specific omega-6 fatty acids, such as Dihomo-γ-Linolenic Acid (DGLA), while monounsaturated fats are generally neutral, some monounsaturated fats, such as palmitoleic acid, are closely linked to a higher risk. Even people with a low Mediterranean diet score are associated with higher mortality rates.

Therefore, preventing and controlling cardiovascular disease is a crucial step in reducing high morbidity and mortality rates, especially in Indonesia. Based on national data, promotive and preventive efforts are directed at changing people's lifestyles through the CERDIK program: regular health checks, cigarette smoke elimination, Regular physical activity, Balanced diet, Adequate rest, and Stress management. (21)This intervention is important to control modifiable risk factors such as smoking and consumption of saturated fat foods that can lead to atherosclerosis and hypertension.

Proactive early detection of risk factors is highly recommended, including regular blood pressure screening, lipid profiles, and blood sugar checks, especially in the productive age group, which is starting to see an increase in heart disease cases. Health promotion clinics in healthcare facilities, regular education on healthy lifestyles, and hospital-based cardiac rehabilitation with a multidisciplinary approach are all strategic efforts that can improve patient compliance with healthy eating and smoking cessation.)

Dietary control, emphasizing a Mediterranean diet rich in fruits, vegetables, and healthy fats (such as omega-3s), while limiting consumption of red meat and processed foods, has also been shown to be beneficial in lowering blood pressure and cardiovascular risk. Education and support for patients with hypertension and obesity to adhere to this dietary pattern should be supported by community empowerment programs, nutritional counseling, and healthy cooking training. Furthermore, a comprehensive smoking cessation program involving psychosocial support and nicotine therapy is crucial for reducing the risk of heart disease complications. (19).

Regular physical activity is also a key component of prevention strategies. The WHO recommends at least 150 minutes of moderate-intensity exercise per week to reduce the risk of cardiovascular disease. The government and the public are expected to create environments that support physical activity, such as green open spaces and public sports facilities. Combining a healthy diet, smoking cessation, and increased physical activity can effectively reduce the prevalence of heart disease and stroke, extend life expectancy, and improve the quality of life for Indonesians. (23).

5 CONCLUSIONS

According to the findings of a review of the literature, cardiovascular disease is the world's leading cause of death and is strongly linked to lifestyle choices, especially smoking and consuming excessive amounts of saturated fat. It has been demonstrated that smoking raises the risk of heart disease by accelerating atherosclerosis, altering lipid profiles, raising blood pressure, and damaging endothelium. Excessive saturated fat consumption also exacerbates this condition by increasing oxidized LDL levels, thereby accelerating atherosclerotic plaque formation. The combination of these two factors results in a higher risk of coronary heart

disease and stroke than either factor alone. Conversely, a healthy Mediterranean diet rich in plant-based fats, MUFAs, PUFAs, fish, and fiber has been shown to improve lipid profiles, lower LDL-C, and reduce cardiovascular risk

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