

RECENT APPLICATIONS OF BIOLOGICAL DRUGS IN THE TREATMENT OF CARDIOVASCULAR DISEASES IN SAUDI ARABIA

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Abstract

Globally, cardiovascular diseases (CVDs) are prevalent chronic illnesses that cause morbidity and mortality. In many places, including Saudi Arabia, the risk of CVDs has grown due to a variety of variables, including urbanization, changes in lifestyle, and socioeconomic levels. Cardiovascular diseases (CVDs) in Saudi Arabia are impacted by several important risk factors. This shows a greater prevalence of different risk factors for CVD. These risk factors include smoking, diabetes mellitus, dyslipidemia, ischemic heart disease, hypertension, and a history of stroke. Lack of disease information is another limitation as the reports were not specific to which type of CVD. The importance of this study stems from the importance of the applications of biological drugs in the treatment of cardiovascular diseases, which represents a global issue and an important area of research. This researcher will use the descriptive approach by reviewing the related previous studies that have the same variables and goals as the current research.

Keywords: *(Cardiovascular diseases, Biological drugs, Treatment, Chronic illnesses, Risk factors)*

1. Introduction

Globally, cardiovascular diseases (CVDs) are prevalent chronic illnesses that cause morbidity and mortality. According to earlier data, CVDs were responsible for about 17.7% of the 55 million fatalities that occurred in 2017. Seventy percent of CVDs and deaths were caused by modifiable risk factors, such as metabolic syndrome, where hypertension was the main risk factor. Worldwide, myocardial infarction and stroke are linked to additional CVD risk factors, such as diabetes and dyslipidemia. All nations and areas, including high-, middle-, and low-income countries, are impacted by CVD (Tash & Al-Bawardy, 2023).

According to Abdulkader & Fahad (2023), in many places, including Saudi Arabia, the risk of CVDs has grown due to a variety of variables, including urbanization, changes in lifestyle, and socioeconomic levels. The economy's quick rise and oil finding have accelerated socioeconomic growth. These alterations spread to lifestyle choices like sedentary behavior, poor food, and inactivity, which raise the chance of developing certain diseases. Diabetes, hypertension, cardiovascular diseases, strokes, osteoarthritis, and frailty are among the many chronic disorders that have recently become more common in Saudi Arabia.

According to the World Bank, Saudi Arabia's life expectancy has risen over the past 20 years, from 69.08 years in 1990 to 75.13 years in 2019. However, managing chronic conditions like diabetes, cancer, and cardiovascular diseases (CVDs) becomes more difficult as the population ages. The World Health Organization (WHO) defines cardiovascular disease (CVD) as encompassing deep vein thrombosis, pulmonary embolism, peripheral arterial disease, congenital heart disease, coronary heart disease, and cerebrovascular illness (Fragoulis, Soulaïdopoulos, Sfrikakis, Dimitroulas, & Kitas, 2021).

In addition to increasing the elderly population, CVDs are also concerning on the rise among the younger age. A study conducted in the United States of America revealed that youths with unhealthy body weights had much higher healthcare costs for CVD. With an average increase of 8.6% for overweight individuals, 18.8% for obese individuals, and 76% for severely obese individuals, cumulative healthcare expenses (including costs associated with CVDs) rise progressively with obesity (Abdulkader & Fahad, 2023).

According to prior systematic research, the Gulf Cooperation Council countries had a 5.5% prevalence of CVDs. However, coronary heart disease, stroke, and other related disorders were linked to the prevalence of CVDs as the primary outcomes, along with numerous other conditions and risk factors. The World Health Organization defines cardiovascular diseases (CVDs) as deep vein thrombosis, pulmonary embolism, rheumatic heart disease, congenital heart disease, peripheral arterial disease, coronary heart disease, and cerebrovascular illness. Only certain CVD kinds and geographically restricted populations were used in earlier studies, and the results had limited generalizability. To develop successful preventative measures in Saudi Arabia, it is imperative to conduct a thorough analysis of CVD prevalence (Fragoulis, Soulaïdopoulos, Sfrikakis, Dimitroulas, & Kitas, 2021).

Cardiovascular medicine research is still progressing, with continuous attempts to find new biomarkers, create tailored treatments, and enhance healthcare provision. There is potential for enhancing our comprehension of the pathophysiology of CVDs and creating more potent preventative treatments through the integration of multidisciplinary approaches, such as genetics, genomics, and data science. The ultimate objective is to lessen the burden of CVDs worldwide and enhance impacted people's lives. Cardiovascular medicine could undergo a revolution thanks to

artificial intelligence (AI), which can improve diagnosis accuracy, forecast the course of diseases, and customize treatment regimens (Tash & Al-Bawardy , 2023).

2. Research Problem and Questions

The prevalence of CVDs in all Saudi Arabian regions using a nationally representative sample. In Saudi Arabia, the total prevalence of CVDs was 1.6% in all regions, with 1.9% of men and 1.4 percent of women affected. In Saudi Arabia, the prevalence of CVDs varies significantly by age, sex, and geographic location. The largest frequency of CVD was seen in the Makkah region (1.92%), among men, and among those 65 and older (11.1%) (Abdulkader & Fahad, 2023).

In Saudi Arabia, little research has been done on CVDs. Our study's 1.6% prevalence of CVDs in Saudi Arabia was significantly lower than the 5.5–13.6% prevalence found in other studies. The kinds of CVDs and the samples used in these investigations may be to blame for this. 5.5% of adults between the ages of 30 and 70 have coronary artery disease. 17,232 people from various regions participated in this study. The disparity in prevalence may be explained by the fact that the age inclusion (30 years old) was greater than the age inclusion (15 years old) in our study. Additionally, among surgical patients, the prevalence of deep vein thrombosis was 13.6%. Peripheral artery disease, however, is common among individuals who visit a primary care facility. Among 471 patients, the prevalence of peripheral artery disease was 11.7% (Tash & Al-Bawardy , 2023).

Cardiovascular diseases (CVDs) in Saudi Arabia are impacted by several important risk factors. This shows a greater prevalence of different risk factors for CVD. These risk factors include smoking, diabetes mellitus, dyslipidemia, ischemic heart disease, hypertension, and a history of stroke. Through Saudi Vision 2030, the Saudi government aims to raise the average lifespan from 75 to 80 years. The Saudi government is dedicated to tackling noncommunicable diseases, including cardiovascular disease (CVD). Efforts are focused on lowering biological and behavioral risk factors such as obesity, dyslipidemia, and hypertension because these diseases are preventable. Younger Saudi citizens are encouraged to lead better lifestyles to avoid noncommunicable diseases and benefit in the long run. To serve as a guide, the Saudi Public Health Authority and the World Bank Group have produced an extensive paper (Alqahtani & Alenazi , 2024).

Lack of disease information is another limitation as the reports were not specific to which type of CVD. Other risk factors related to CVD such as obesity, hypertension, and lack of physical activity were not measured. Based on the forgoing, the research attempts to answer the following main question; **"What are the applications of biological drugs in the treatment of cardiovascular diseases in Saudi Arabia?"**

Additionally, the study attempts to answer the following sub-questions:

1. What are the determinants of CVDs in Saudi Arabia?
2. What are the risk factors of CVDs in Saudi Arabia?

3. Research Objectives

The main goal of this research is **"to investigate the applications of biological drugs in the treatment of cardiovascular diseases in Saudi Arabia"**. This is conducted by achieving the following objectives:

- Highlighting the determinants of CVDs in Saudi Arabia.
- Shedding the light on the risk factors of CVDs in Saudi Arabia.

4. Research Significance

The importance of this study stems from the importance of the applications of biological drugs in the treatment of cardiovascular diseases, which represents a global issue and an important area of research. Studies on the applications of biological drugs in the treatment of cardiovascular diseases in Saudi Arabia are scarce. Therefore, it is expected that conducting such research on this topic will have highly positive implications and importance that can be summarized as follows:

- The scientific importance of this research lies in the scarcity of studies that specifically address the applications of biological drugs in the treatment of cardiovascular diseases in Saudi Arabia, which makes this research a new scientific attempt to identify the nature of the relationship between the two variables and develop appropriate scientific recommendations.
- The significance of this research lies in its potential to contribute valuable insights and knowledge to the field of pharmacology. By exploring the applications of biological drugs in the treatment of cardiovascular diseases in Saudi Arabia, this research addresses a timely and important topic.
- The research conclusion can have practical implications for patients, cardiovascular specialists, and pharmacists. Understanding the applications, determinants, and risk factors of biological drugs in the treatment of cardiovascular diseases can help guide decisions about the use and integration of biological drugs into the treatment of cardiovascular diseases, and increase treatment efficiency.
- This research can guide the creation of current and useful medical resources by examining how the integration of biological drugs in the treatment of cardiovascular diseases pedagogy, curricula, and training programs. It can help educators and institutions adapt their curricula to meet the changing needs of biological drugs in the treatment of cardiovascular diseases.
- This study will serve as a good reference for future studies as it will provide future researchers and scholars interested in pharmacology with valuable literature, recommendations, and suggestions for their proposed studies.

5. Research Methodology

This researcher will use the descriptive approach by reviewing the related previous studies that have the same variables and goals as the current research.

6. Literature Review

6.1 Cardiovascular Diseases

According to the World Bank, life expectancy in Saudi Arabia has risen over the past 20 years, from 69.08 years in 1990 to 75.13 years in 2019. However, managing chronic conditions like diabetes, cancer, and cardiovascular diseases (CVDs) becomes more difficult as the population ages. The World Health Organization (WHO) defines cardiovascular disease (CVD) as encompassing deep vein thrombosis, pulmonary embolism, peripheral arterial disease, congenital heart disease, coronary heart disease, and cerebrovascular illness (Joseph, et al., 2024).

According to Taunay, Albelda, Frias, & Lipinski (2018), in addition to the increasing in the elderly population, CVDs are also concerning on the rise among the younger age. A study conducted in the United States of America revealed that youths with unhealthy body weights had much higher healthcare costs for CVD. With an average increase of 8.6% for overweight individuals, 18.8% for obese individuals, and 76% for severely obese individuals, cumulative healthcare expenses (including costs associated with CVDs) rise progressively with obesity. These

results imply that individuals who are overweight or obese throughout their youth have a higher lifetime risk for CVD. Nevertheless, initiatives to lower CV risks at a younger age have not received much attention.

The prevalence of non-communicable diseases, including cardiovascular diseases (CVDs), in the younger generation and the various obstacles a society faces in overcoming them have recently attracted attention. In addition to lowering quality of life, the earlier onset of CVDs is concerning for many reasons: (1) the workforce is younger; (2) early retirement has been linked to chronic diseases like CVDs; and (3) long-term healthcare expenses. Additionally, urbanization is a contributing factor to the rise in CVDs, and it has been closely linked to an increase in obesity, poor diets, sedentary lifestyles, and smoking (Godbole & Solomon, 2024).

Public health and disease prevention will be given top priority in the healthcare sector transformation program. Additionally, access to healthcare services will be improved through optimal coverage, comprehensive and equitable geographic distribution, and improved e-health services and healthcare delivery quality. In Saudi Arabia, the total cost of health care accounts for more than 8%, or over \$56 billion, of the government's overall budget (Abdulkader & Fahad, 2023). According to estimates, the economic cost of CVD in Saudi Arabia was \$3.5 billion in 2016 (\$1.6 billion in indirect expenses from lost productivity and \$1.9 billion in direct hospital costs). By 2035, this amount is predicted to quadruple to \$9.8 billion. It has long been known that promoting healthy behaviors is necessary to stop the spread of vascular illnesses, including CVDs. Individual, dispersed attempts to contain this epidemic, however, fell short of expectations and have thus far produced only minor results. Thus, government-supported initiatives are required to enhance healthcare generally and CVD prevention specifically (Alqahtani & Alenazi, 2024).

Primary prevention is a cost-effective strategy that provides significant returns on investment when it comes to removing CV risk factors. Strict control of modifiable risk factors, such as smoking, diabetes mellitus, and hyperlipidemia, should be enforced by screening and early detection of CVDs. This will stabilize the conditions and prevent disease complications and their social and economic repercussions (Addissouky, Sayed, & Wang, 2024).

Abdulkader & Fahad (2023) asserted that 201,300 Saudi citizens had cardiovascular disease (CVD) in 2016, comprising 51,700 people with cerebrovascular disease and 149,600 adults with ischemic heart disease. Over 45% of all deaths are thought to be caused by CVD. It was predicted that 5.5% of Saudi Arabians had coronary artery disease (CAD) in 2005. Given the increase in CVD risk factors in Saudi Arabia (obesity, diabetes mellitus, dyslipidemia, hypertension, and others), the country's current CVD prevalence is anticipated to be much higher. Furthermore, a 2013 study revealed that 20% of patients treated for acute coronary syndrome also had heart failure, and the 2012 projected prevalence of heart failure in Saudi Arabia was estimated to be 1.2% (for a total population of about 29 million). In 2017, the prevalence of CVD in Saudi Arabia was 10,921 years of disability per 100,000 people with a healthy life (YDL).

Saudi Arabia's way of life has recently allowed non-communicable diseases to spread throughout the developed globe. Despite Saudi Arabia's socioeconomic divide, younger generations have tended to lead sedentary lives. This is probably a complex issue because of the weather, which restricts outdoor activities and walking or bicycling to work, as well as the effects of globalization, which include social media, video games, and a cosmopolitan diet high in fat and sugar. Saudis' well-being suffered as a result of their increasingly sedentary lifestyle. Specifically, since the beginning of the new millennium, rates of hypertension and hyperlipidemia have nearly doubled (Addissouky, Sayed, & Wang, 2024).

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Chapter 2 on health resources in the Health Statistical Year Book states that MOH has 24 cardiology facilities and departments, 600 smoking cessation centers, and 26 specialist diabetes and endocrinology centers spread over Saudi Arabia. The government's 2030 vision places a high priority on equity and access to healthcare services, as well as the distribution of healthcare facilities around the nation. Poorly managed diabetes, hypertension, dyslipidemia, and other CV risk factors may be caused by other variables, such as patient compliance, even if access to treatment may be restricted in some geographic areas. This aspect can be addressed by ensuring that the highest quality of care is implemented and controlled, as well as by launching national campaigns and increasing awareness at the primary care office level (Godbole & Solomon, 2024).

6.1 Biological Drugs in Cardiovascular Diseases

The use of compounds derived from living creatures or their laboratory-produced analogs to treat illness is known as biologic therapy. Through the use of monoclonal antibodies, recombinant proteins, RNA interference (RNAi), stem cell therapy, and growth factors biologics have developed to accomplish therapeutic objectives. Biologic treatments have seen a significant increase in utilization as a treatment option for cardiovascular disease (CVD), despite their widespread use in the treatment of rheumatologic disorders and cancer. Following the discovery of detrimental cardiovascular effects, especially heart failure (HF), prescriber vigilance has also grown (Karpouzas, Ormseth, Hernandez, & Budoff, 2020).

Additionally, biological therapy's beneficial benefits on CVD have drawn attention. Understanding the connection between inflammation and cardiovascular disease sparked interest in inflammatory cytokine blocking as a therapeutic approach. The phagocytosis of circulating oxidized lipids by resident macrophages of the artery intima causes atherosclerosis. After that, these macrophages mature into foam cells, which are an essential part of atheroma (Taylor, 2017). A thin fibrous top, a big lipid core, and a significant inflammatory cell infiltration are characteristics of atherosclerotic plaques that are prone to rupture. When it happens in a coronary artery, rupture of the intimal fibrous cap causes the thrombus to spread and can result in abrupt vascular occlusion, which can cause myocardial infarction (MI). Myocyte death, cardiac remodeling, and varying degrees of regional myocardial dysfunction are the outcomes of the complicated inflammatory process that myocardial ischemia starts. When the level of dysfunction

reaches clinical significance, this process known as ischemic cardiomyopathy leads to heart failure.

According to Ciucci , Colliva, Vuerich, Pompilio, & Zacchigna (2021), human monoclonal antibodies called ustekinumab and canakinumab target the shared p-40 component of IL-12 and IL-23. In addition to stimulating and differentiating T cells, IL-12 also encourages the release of TNF- α . T-cell subtypes that generate inflammatory cytokines are supported in their survival by IL-23. Adverse cardiovascular events have been reported even though ustekinumab and briakinumab have both demonstrated effectiveness in treating several autoimmune disorders. MACE significantly increased in patients with persistent plaque psoriasis on anti-IL-12/23 therapy with ustekinumab and briakinumab, according to a 2012 meta-analysis of randomized controlled studies. Therefore, when using this treatment class in individuals who are at risk for CVD, caution is suggested.

In 15% to 20% of cases of breast cancer, the human epidermal growth factor receptor-2 (HER2) is overexpressed. A common treatment for HER2-positive breast cancer is trastuzumab, a monoclonal anti-HER2 antibody. Trastuzumab has been linked to HF and LV dysfunction induction. Trastuzumab monotherapy carries a 4% risk of cardiotoxicity. Nevertheless, the risk rises to 27% when anthracycline and cyclophosphamide are used together (Addissouky, Sayed, & Wang, 2024).

One well-established process by which cancers proliferate is angiogenesis. In anticancer treatment, vascular endothelial growth factor (VEGF) inhibitors have specifically targeted this process. A humanized monoclonal anti-VEGF antibody is bevacizumab. Despite being a successful anticancer treatment, it has been linked to heart failure. Individuals with glioblastoma, breast cancer, renal cell cancer, or those receiving concurrent taxanes have the highest chance of developing heart failure (Korjian, et al., 2023).

Determinants of CVDs in Saudi Arabia 6.2

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According to the Global Obesity Observatory, the prevalence of obesity increased from 26.4% for men and 44% for women in 2000 to 31.5% for men and 50.4% for women in 2005. While the prevalence of obesity was lower in 2019 (19.2% for men and 21.4% for women), the prevalence of overweight is remarkably high, accounting for 38.2% of the measured population, meaning that over half of the population is either obese or overweight. According to a more recent nationwide cross-sectional study conducted in 2020, the prevalence of obesity in Saudi Arabia was 24.7%, and rates of several obesity-related morbidities were consistently higher (Godbole & Solomon, 2024).

According to a 2016 systematic review, Saudi women are particularly vulnerable to CVD because of their low levels of physical activity, which range from 53% to 98%. This likely contributed to a higher prevalence of CVD risks, including hypertension (22%), diabetes (10% to

28%), overweight (27%), and obesity (40%). The aforementioned data from the Global Obesity Observatory further highlighted the greater incidence of obesity among women (Tash & Al-Bawardy, 2023).

Overweight and obesity are very common in Saudi Arabia, regardless of trends, and are mostly linked to a sedentary lifestyle and poor food. Between 2013 and 2019, the prevalence of tobacco use increased from 12.2% to 21.4% and 20%, respectively. Furthermore, the aging of the population, urbanization, globalization, stress, and socioeconomic shifts can all lead to an increase in CVDs. The prevalence of key risk factors for chronic diseases was examined using data gathered on the government's e-service portal (ABSHER) between April 2019 and February 2021. Changes between 2017 and 2020, a significantly bigger 2020 sample, and possible underestimations because of the nature of self-reported data could all be the cause of discrepancies (Abdulkader & Fahad, 2023).

6.2 Risk Factors of CVDs in Saudi Araba

Overweight and obesity are very common in Saudi Arabia, regardless of trends, and are mostly linked to a sedentary lifestyle and poor food. Between 2013 and 2019, the prevalence of tobacco use increased from 12.2% to 21.4% and 20%, respectively. Furthermore, the aging of the population, urbanization, globalization, stress, and socioeconomic shifts can all lead to an increase in CVDs. The prevalence of key risk factors for chronic diseases was examined using data gathered on the government's e-service portal (ABSHER) between April 2019 and February 2021. Changes between 2017 and 2020, a significantly bigger 2020 sample, and possible underestimations because of the nature of self-reported data could all be the cause of discrepancies (Alyami, Al-Slaim, Alzamanan, Bayan, & Ahmed, 2024).

Numerous dietary and lifestyle therapies have been researched in the past. 151 participants at risk for CVDs were randomly assigned to intervention and control arms in a study conducted in a primary healthcare facility in Northern Sweden. The intervention included food (five group sessions of diet counseling with a dietician) and exercise (supervised endurance and circuit training in groups three times a week for three months). A year later, there has been a substantial decrease in diastolic blood pressure (2.3 mmHg, $P < 0.05$), waist circumference (1.9 cm, $P < 0.001$), and waist-to-hip ratio (0.01, $P < 0.01$) (Tash & Al-Bawardy, 2023).

Another study randomly assigned middle-aged individuals to either a counseling intervention group or a standard of care group to assess the effectiveness of lifestyle interventions (counseling on smoking, exercise, nutrition, and stress) on reducing CV risk. The intervention group's systolic blood pressure (7.49 mmHg, $P < 0.05$) and total cholesterol levels (0.41 mmol/L, $P < 0.05$) were considerably lower than those of the control (standard of care) arm. The effectiveness of primary prevention in reducing CV risk was demonstrated by the lack of significant outcome changes observed in the secondary prevention group (Abdulkader & Fahad, 2023).

Women who had at least one CV risk factor and were either receiving conventional care (control) or a lifestyle intervention were shown to have healthy behavior and CV risks. Compared to the standard of care (control) (33.1%), a considerably greater percentage of women in the intervention group (58.4%) improved their eating habits, and 57.3% versus 42.3%, respectively, improved their physical activity ($P < 0.001$). The intervention group's blood pressure significantly dropped 9.1% from baseline (systolic 5.9 mmHg and diastolic 3.8 mmHg, $P < 0.05$), HDL cholesterol increased by 2.6 mg/dl ($P < 0.05$), and other CV risk factors improved, all of which helped to reduce the 10-year CV risk by 0.9% ($P < 0.05$). Only around 30% of patients meet their

LDL-cholesterol targets, according to studies conducted in the past ten years. In Saudi Arabia, a significant number of people with dyslipidemia go undiagnosed and untreated, highlighting deficiencies in screening, care, and adherence to global standards (Alyami, Al-Slaim, Alzamanan, Bayan, & Ahmed, 2024).

The World Heart Federation reaffirmed in 2022 the significance of lipid management for the success of CV risk management, calling for a variety of strategies, including risk stratification, health literacy, and changes to health policies, in addition to access to screening and lipid-lowering drugs (statins and combinations as needed). The Saudi Guidelines for Dyslipidemia Management were released in 2022 to offer a thorough framework for managing dyslipidemia in the nation and its effects on the cardiovascular system (Alqahtani & Alenazi, 2024).

In terms of smoking, only 49.1% of students were aware of the risk of lung cancer, but that number rose to 84.9% after the intervention ($P < 0.001$), and at baseline, 11.5% of students recognized that smoking promotes CVD versus 46.3% after the intervention, $P < 0.001$. Two times as many students began exercising at least six days a week ($P < 0.001$), and the intention to exercise rose from 87.1% to 96.2% of students ($P < 0.001$). Furthermore, food makers have been encouraged to reformulate healthier products by clear nutrition labels, which rank lowering sodium first, then increasing dietary fiber, and lowering the amount of sugar and saturated fats. According to a projection study, the required added sugar label on food packaging will avoid 354,400 occurrences of CVDs and \$31 billion in net healthcare expenses between 2018 and 2037 (Ghamri, 2024).

Related Previous Studies .3

A study entitled **“Recent Developments in the Diagnosis, treatment, and management of Cardiovascular Diseases Through Artificial Intelligence and other innovative approaches”** conducted by Addissouky et al (2024) aimed to provide an update on recent developments in the field of CVDs, including the use of artificial intelligence (AI) in diagnosis and management, advances in genetic testing and precision medicine, the role of telemedicine and remote monitoring technologies, novel therapies such as gene therapy and cell therapy, and the importance of addressing mental health in the prevention and management of CVDs. Novel therapies such as gene and cell therapy are being explored to treat CVDs, with early studies showing promising results.

Another study conducted by Alyami et al (2024) entitled **“The Prevalence of Risk Factors for Cardiovascular Diseases in Najran Region, Saudi Arabia”** sought to investigate the knowledge, prevalence, and risk factors of cardiovascular diseases among individuals in the Najran region of Saudi Arabia. An online cross-sectional survey was conducted by the researchers. The study’s findings underscore the crucial need for more extensive and efficient educational initiatives that consider the targeted population’s talents, attitudes, and perceptions.

Another study entitled **“Knowledge of cardiovascular diseases and associated risk factors in the general adult population of Jeddah, Saudi Arabia: A cross-sectional study examining gender disparities”** conducted by Ghamri (2024) sought to assess knowledge about cardiovascular diseases (CVD) among the general population, we emphasized gender-related disparities and other lifestyle and health-related factors. An online questionnaire was administered to assess knowledge of CVD types, symptoms, and risk factors. Knowledge was optimal for major CVD risk factors, such as smoking (90.6%) and high low-density lipoprotein cholesterol levels

(85.1%); however, gaps were observed in recognizing diabetes (56.2%) and stress (69.4%) as factors for CVD.

A study entitled **“A national perspective on cardiovascular diseases in Saudi Arabia”** conducted by Alqahtani and Alenazi (2024) aimed to estimate the national and regional prevalence rates of CVDs among the Saudi population. This study used data from an ongoing household health survey conducted by the General Authority for Statistics in 2017. The prevalence of CVDs among the Saudi population aged 15 years and older was 1.6% (n = 236,815). The prevalence is higher in males at 1.9% compared to females at 1.4%. Age is a significant factor, with a gradual increase in CVD prevalence until the age of 50, followed by a sharp rise. The prevalence among the age group (≥ 65 years) was the highest, recording 11% (n = 93,971), followed by the age group (60–64 years) which reached 6.5% (n = 31156.71), and the lowest prevalence was found in the age group (< 40 years) as 1.2% (n = 108,226). When considering regional differences, Makkah has the highest prevalence at 1.9% (n = 85,814), followed by Riyadh at 1.7% (n = 79,191). Conversely, Najran has the lowest prevalence at 0.76% (n = 332), with the Northern Border Region having the second lowest rate at 1.46% (n = 4218).

Another study conducted by Fragoulis et al (2021) entitled **“Effect of Biologics on Cardiovascular Inflammation: Mechanistic Insights and Risk Reduction”** aimed to recognize that atherosclerosis and consequently cardiovascular disease (CVD) are closely linked with inflammatory processes. Most data are derived from observational studies and, therefore, randomized controlled trials are needed to assess the possible favorable effect of bDMARDs on CVD outcomes. The study findings were here is accumulating evidence for a beneficial effect of immunosuppressive treatment in cardiac inflammation and function in several ARDs.

Another study entitled **“Impact of Biologic Therapy on Key Cardiovascular Risk Parameters in a Psoriatic Cohort a Retrospective Review”** conducted by Joseph et al (2024) aimed to assess the change in cardiovascular risk factors in a cohort of patients treated with 1 year of continuous biologic treatment. A retrospective medical record review was conducted of consecutive patients receiving biologic therapy for chronic plaque psoriasis in a single dermatology centre at a major tertiary hospital in Australia. A total of 106 patients were reviewed with a median age of 44 years, and 63% of the patients were male. At baseline, mean BMI was 30 (SD 7), mean SBP was 129 (SD 17), mean DBP was 81 (SD 9) and mean HR was 82 (SD 14). Over 12 months, the PASI was reduced from 17.4 (SD 8.5) to 1.4 (SD 1.7, $p < 0.001$) indicating skin improvement. There was no significant difference from baseline in SBP (difference 2.3 mmHg, 95% CI – 1.4–5.9), DBP (0.6 mmHg, 95% CI – 1.2–2.5), BMI (difference – 0.1 kg/m², 95% CI – 0.9–0.7) or HR (difference 1.3, 95% CI – 3.9–6.4).

Last study is entitled **“Biologics May Prevent Cardiovascular Events in Rheumatoid Arthritis by Inhibiting Coronary Plaque Formation and Stabilizing High-Risk Lesions”** conducted by Karpouzas et al (2020) aimed to evaluate whether biologic disease-modifying antirheumatic drugs (DMARDs) decrease cardiovascular disease (CVD) risk in rheumatoid arthritis (RA) and whether biologic DMARDs might have a beneficial effect on coronary plaque formation or progression. In this single-center observational cohort study, 150 patients underwent computed tomographic angiography for evaluation of coronary atherosclerosis (total, noncalcified, mixed/calcified, and low-attenuation plaque); 101 had repeat assessments within a mean $\pm$ SD of 6.9 ± 0.3 years to evaluate plaque progression. Per-segment plaque progression analyses showed that biologic DMARD exposure was associated with transition of noncalcified to mixed/calcified plaque (OR 4.00 [95% CI 1.05–15.32]). Biologic DMARD exposure predicted a lower likelihood

of new plaque forming in segments without plaque among patients without mixed/calcified plaque in other coronary segments (OR 0.40 [95% CI 0.17–0.93]), but not among those with calcification. Biologic DMARD treatment also predicted low-attenuation plaque loss ($P = 0.042$).

7. Conclusion and Recommendations

Risk classification and early detection have been enhanced by novel biomarkers. Developments in AI, gene therapy, cell therapy, and pharmacogenomics present exciting prospects for creating customized treatments and enhancing patient outcomes. Validating biomarkers, facilitating access to cutting-edge technologies, and incorporating novel strategies into clinical practice still present difficulties. Reducing the worldwide burden of cardiovascular illnesses will need addressing these issues through interdisciplinary cooperation and further study.

Using a representative sample, the national and regional prevalence of CVD among Saudi adults varies significantly by age, sex, and location. Due to an aging population and an increase in CV risk factors, Saudi Arabia, like other developed nations, is facing a significant burden of CVD. The rising prevalence of obesity and poor lifestyles aggravates this trend. To address CV risk factors and lessen the prevalence of CVD in Saudi Arabia, a cooperative strategy is required given the country's present health reform trajectory. The emphasis should now be on prevention on several levels, including community programs, individual education and awareness campaigns, and established primary care clinics that provide high-quality screening and management services and are easily accessible. These initiatives will reduce the morbidity and death linked to CVD while developing a cost-effective strategy.

Improved specificity and innovative disease modification mechanisms have been made possible by biological treatments. The use of biologics in CVD conditions is in progress, albeit still in its early stages. Furthermore, cost containment will be essential, especially considering the size of the population that these innovative treatments could benefit. Based on the information that is now available, there is a very good chance that biologics will improve the field of cardiology. Regarding this, the researcher suggests some recommendations mentioned as follows:

- To evaluate new biomarkers and imaging methods, assess their cost-effectiveness, and encourage their incorporation into clinical guidelines and practice, more research is required.
- The practical effectiveness of cutting-edge treatments like gene therapy, cell therapy, and artificial intelligence should be assessed in more excellent clinical trials. Making cutting-edge technologies more widely available must be the main goal of health policies and initiatives.
- Precision medicine techniques and novel modalities should be taught in medical school. Clarifying the intricate pathophysiology of cardiovascular illnesses and implementing research advancements in patient care requires the cooperation of multidisciplinary teams comprising geneticists, data scientists, and clinicians.
- Cardiovascular disease prevention and management should be guided by a patient-centered approach that takes socioeconomic status, mental health, and quality of life into account.

8. Future Research

In order to develop CVD prevention techniques in Saudi Arabia, future research should employ top-notch design and gold-standard measures.

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