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JUNK FOOD CONSUMPTION AND CVDS (CARDIOVASCULAR DISEASES): AN EXPLORATION OF DYSLIPIDEMIA'S CAUSAL LINK IN GLOBAL PERSPECTIVE

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ABSTRACT

The increase in cardiovascular diseases (CVDs) globally has been linked to alterations in eating habits especially the consumption of energy-rich and nutrient-poor junk food. This review evaluates the causational relationship between junk food consumption and the occurrence of CVDs via secondary mechanism of dyslipidemia. Massive consumption of junk foods, which are usually high in saturated fats, trans fats, man-made sugars, and sodium, have been found to have a negative impact on endorsing lipids by increasing the level of low-density lipoprotein (LDL) cholesterol, triglyceride, and total cholesterol, along with a decrease in high-density lipoprotein (HDL) levels. All these lipid abnormalities have a major role to play in atherosclerosis, hypertension and other cardiovascular risks. Based on the epidemiological evidence provided by studies around the world, in conjunction with nutritional data, the review summarizes the decaying rates of dyslipidemia that have been linked to junk foods in both developed and developing countries. The results indicate the necessity of public health measures, nutritional policies, and educational programs to curtail the cardiovascular burden occasioned by poor dietary behaviors. This association is important to understand in order to come up with effective prevention strategies against the increasing epidemic of CVD globally

Keywords: *Junk food, cardiovascular diseases (CVDs), Dyslipidemia, Saturated fats, Trans fats, Atherosclerosis, Lipid profile, Global health, Dietary patterns, public health nutrition*

INTRODUCTION

Cardiovascular diseases (CVDs) are an extensive range of disorders that target the heart and vascular system, changes in the heart muscle, and stroke, hypertension-related cardiopathies, peripheral vascular diseases, and health conditions that interfere with the circulatory processes of the body in general and cardiac functioning in particular (Amini et al., 2021). CVDs also cause high mortality and morbidity, which places them among the essential public health issues. On a global scale, they remain as the top-leading causes of death (Gaidai et al., 2023). CVDs (cardiovascular diseases) are the leading cause of morbidity and mortality in the world, and an estimated 17.9 million people die annually due to CVDs, representing 32 percent of deaths in the world (World Health Organization [WHO], 2021). Out of these deaths, more than 85 percent are because of heart attack and stroke. Dyslipidemia, which is the presence of high total cholesterol, low-density lipoprotein cholesterol (LDL-C), triglycerides, and low high-density lipoprotein cholesterol (HDL-C) levels is one of the most severe and avoidable risk

factors associated with CVD. The rising global intake of high energy, low nutrients junk food has been raised as a key dietary factor causing dyslipidemia, particularly in urban and developing countries.

Junk food, generally described as highly processed, palatable food products enriched with sugar, salt, unhealthy fats, and refined carbohydrates, has achieved a permanent place in contemporary diets. Its massive usage and sales, followed by extensive marketing efforts, low pricing, and convenient access has resulted in a worldwide dietary change, whereby conventional, nutrient-dense foods are now substituted by unhealthy foods. This transition has attendantly magnified the burden of non-communicable diseases (NCDs), especially of the CVDs (cardiovascular diseases), due to their adverse consequences on lipid levels and metabolic health (Mozaffarian et al., 2016; Popkin et al., 2020).

According to a national survey, conducted by the Pakistan Health Research Council (PHRC), about 96 percent of adults in the urban regions consume fast food at least once per week, and it is strongly associated with elevated concentrations of LDL cholesterol and triglycerides (PHRC, 2018). Likewise, Punjab and Sindh provinces documented that more than 40 percent of adults in their state had abnormal cholesterol or triglyceride levels that could go undiagnosed because of ineffective screening procedures (Jafar et al., 2021). The egregious thing is that there is an increasingly rising number of adolescents and young adults in Pakistan who also exhibit symptoms of metabolic syndrome such as dyslipidemia, central obesity, and insulin dysregulation and they have it mostly to do with the consumption of junk food, sugar-sweetened drinks, and sedentary behaviors (Mushtaq et al., 2015).

The poor circulation that occurs under the influence of age is a contributor to the disproportionate influence of CVDs (cardiovascular diseases) on older adults especially those that are aged 65 years and above. The prevalence of cardiovascular diseases grows with age, and elderly persons are the most susceptible to this disease (Ciumărnean et al., 2021). CVD is the number one killer and cause of premature death in women, both in the United States and worldwide. Even with tremendous progress in prevention and management in the last 50 years, CVD (cardiovascular diseases) still kills a woman in every three (Rajendran et al., 2023). According to (Roeters van Lennep et al., 2023) study, women in the age range of 45-65 years, especially in the U.S. and Europe, have a higher mortality risk associated with atherosclerotic cardiovascular disease (ASCVD).

2-Atherosclerosis and other causes of circulatory diseases:

The leading causative aspect of cardiovascular diseases is atherosclerosis, which is a complicated pathophysiological disorder (Frąk et al., 2022). As a disease manifested by stiffening and hardening of arteries, atherosclerosis is strongly associated with the aging process and it plays a significant role both in the structural dysfunction issue and the pathogenesis of several other related conditions (Mitchell & Powell, 2020). Among all, the major risk factors of atherosclerosis are increasing age and eating diets rich in fats, which expose people to metabolic ailments like dyslipidemia (Singh, 2022). Lifestyle factors play a role in the development of CVD through effects on body weight, blood pressure, dyslipidemia, cigarette smoking, and hyperglycemia. However, the prevalence of CVD differs depending on demographics and study methods (Consortium, 2023).

3-Lipids and its classifications:

Such motley of biomolecules presents in many food sources, lipids are crucial to maintaining intracellular structure, energy storage, production of metabolic wastes, and epigenetic regulation processes. They also play key roles in human nutrition. Nevertheless, the high consumption of specific fats, especially cholesterol and saturated fatty acids, has also been associated with the development and evolution of numerous health-related problems, including cardiovascular diseases (Domínguez et al., 2022). The classification of blood lipoproteins is separated into seven subclasses regarding their size, fatty acid profile, and apolipoprotein content, and is used to transport lipids in the blood. Such categories are chylomicrons, chylomicron remnants, very-low-density lipoproteins (VLDL), VLDL remnants, low-density lipoproteins (LDL), high-density lipoproteins (HDL), and lipoprotein (a) [Lp (a)] as shown in (**Figure 1**) . All other classes of lipoproteins are pro-atherogenic except HDL, or so-called good cholesterol. Conversely, HDL has been identified as

protective and against atherosclerosis, and thus an essential variable in cardiovascular health (Feingold, 2024).

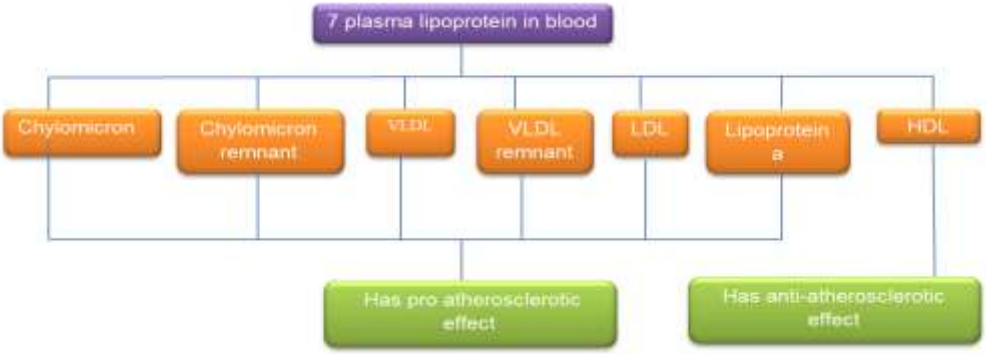

Figure 1: Types of plasma lipoprotein found in blood serum

Fatty acids are an essential part of human nutritional physiology. They make up a large proportion of body energy needs and are necessary in the transport of fat-soluble vitamins, minerals, and essential fatty acids. There is a critical need of having proper amounts of lipids in the body as it ensures a normal functioning of the body. Nonetheless, consumption of harmful fats in an excessive amount may result in an accumulation of postprandial TG excursions, which favor the atherogenesis process. The level of triglycerides in the blood of an atherosclerotic patient is also problematic: in this condition, it contributes significantly to the development of vascular diseases. These disorders are linked to abnormal lipid levels, including the presence of fatty plaque in the walls of arteries (Bravo-Núñez et al., 2024). The increase in lipid levels can be caused by a variety of underlying conditions, such as chronic stress, alcoholism, liver conditions, kidney disorders, hypothyroidism, and hyperglycemia (Natesan & Kim, 2021).

4-Effect of junk food on cardiac health:

With the changes in dietary habits, there has been an increasing rate of hypercholesterolemia (high cholesterol), a condition characterized by a serum cholesterol level that is more than 200 mg/dl. Young people who consume fast foods and sugary drinks in larger quantities and become insufficient in fibers are prone to elevated cases of hypercholesterolemia (Sari et al., 2024). A large amount of the caloric content in the U.S population is represented by ultra-processed food that is industrially produced and pre-prepared with limited whole food. These foods comprise not just classic junk foods but also seemingly healthy breakfast cereals, low-calorie options, sweetened yogurts, and fortified products (Juul et al., 2021).

The healthy diet is one of the primary prevention strategies against atherosclerotic cardiovascular disease (ASCVD). It has been shown that diets rich in sodium but poor in the whole foods, unrefined grains, and beneficial fats are also leading factors of the death of about 10 million people and 207 million cases of cardiovascular diseases worldwide (Cecchini et al., 2022). Junk foods are rich in saturated fats that have been known to reduce high-density lipoprotein cholesterol (HDL-C or good cholesterol) and increase low-density lipoprotein cholesterol (LDL-C or bad cholesterol) and the levels of triglycerides. Such disproportion in lipid levels can add to atherogenesis causing exceeded incidences of cardiac arrest and other arteriosclerotic related disorders (GÖKÜSTÜN, 2024).

When (Permatasari & Syauqy, 2024) carried out a study in Indonesia among mature adults, they found that they had abnormal cholesterol levels. These poor dietary habits were highly related to dyslipidemia. (Yoon et al., 2020) also stated that various studies have now classified junk food consumption as a key risk factor in the occurrence of obesity and chronic diseases like heart disease and type II diabetes. (Kumboyono et al., 2020) drew a high association between cholesterol levels and dumpling intake, and as a consequence, the eating habits, notably in early adulthood, are critical in determining the levels of cholesterol in the body.

Moreover, men were more dominantly positioned above women in terms of lipid reference levels during the initial phase of growth.

Even with the increased evidence that highly processed food leads to poor health outcomes, adolescents still indulge in unhealthy diets. These habits cause people to be abnormally predisposed to heart diseases, high blood pressure, and hyperglycemia, and obesity. These foods are typically high in unhealthy fats, processed grains, and added sugars as opposed to delivering crucial nutrients (Bohara et al., 2021). According to a study conducted by (Khani Jeihooni et al., 2021), the world mortality rate due to arteriosclerotic diseases is expected to increase to about 23 million in the year 2030, which is a third of global deaths. Furthermore, improper intake of junk food that has a lot of energy content, high levels of saturated fats intake and the absence of healthy food altogether greatly affects modifiable risk factors of circulatory diseases.

High consumption of ultra-processed food is strongly linked to the metabolic complication, high blood sugar level, visceral fat accumulation, higher fat index body, metabolic imbalances, high-blood pressure, and cardiovascular complications (Donat-Vargas et al., 2021). Organic preservatives in junk foods like that of phosphate-based preservatives have been reported to increase the chances of atherosclerosis which leads to stiffening of blood vessels under both experimental and real-life situations. Moreover, junk food can replace healthier, whole foods in the diet, thus indirectly undermining overall health (Montero-Salazar et al., 2020).

5-Dyslipidemia as a Link Between Diet and Cardiovascular Disease:

Atherogenic dyslipidemia is an unnatural derangement of the circulating blood lipid quality, an aspect that negatively impacts cardiovascular vascular well-being. It is a major cardiovascular disease risk factor that is lifestyle-related. Dyslipidemia affects approximately 40 percent of the world population overall, leading to approximately one-third of all deaths connected to atherosclerotic heart disease and stroke (Georgoulis et al., 2022). In a dyslipidemic person, the major carrier of cholesterol towards arterial walls is low-density lipoprotein (LDL), commonly known as bad cholesterol. Due to its status as the most dominant apolipoprotein B (apoB)-containing lipoprotein in the blood, LDL-elevations are both a hallmark of the dyslipidaemia state as well as an important risk factor in the development of cardiovascular diseases, with special emphasis on ischemic heart disease (Du & Qin, 2023).

6- Pathophysiology of cardiovascular diseases due to atherosclerosis:

The endothelial stimulation process is the first case and it is followed by a sequence of events that entail vasoconstriction and the development of inflammatory processes. The end result of these processes is the development of atherosclerotic plaques (atheromas), which can be visualized in (**Figure 2**) (Jebari-Benslaiman et al., 2022). Atheroma is the clumping and reformation of lipids, immune cells, vascular smooth muscle cells, and cellular garbage in the endothelial cells that line the inner surface of the arterial wall. The resulting effect of this plaque formation is that the blood vessels narrow compelling the reduced blood flow, up to 50 per cent in certain instances, thus causing symptoms including chest pain (angina), primarily when physical exertion or stressful occasions occur. The lesions containing inflammatory cells and lipid-laden materials are more likely to rupture. This interference may block the blood flow causing serious effects like myocardial infarction (heart attack) or cardiac failure. When the clot is transported to the brain and blocks it, it may lead to a stroke when it reaches it (Björkegren & Lusis, 2022).

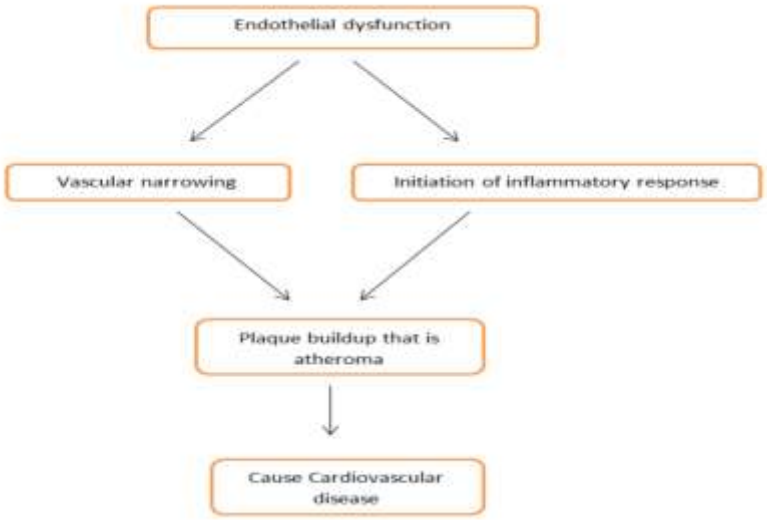

Figure 2: Flow chart of pathophysiology of cardiovascular diseases due to atherosclerosis

7-Epidemiology of cardiovascular diseases:

Dyslipidemia patients are more prone to experience atherosclerotic cardiovascular disease (ASCVD) twice as much as patients with normal cholesterol patterns. The estimated composite prevalence of hyperlipidemia among adults in Africa is 25.5% among adults. In particular, the high concentrations of LDL cholesterol (also referred to as the "bad" cholesterol), HDL cholesterol (the "good" cholesterol), and serum triglycerides have a close connection with the higher morbidity rates (Gebreegziabiher et al., 2021), The Global Burden of Disease study from 2019 found that the morbidity rate of CVD doubled between 1990 and 2019 (271 to 523 million cases). Additionally, the mortality rate gradually increased from 12.1 million fatalities in 1990 to 18.6 million deaths in 2019 (Brunham et al., 2024).

CVD caused about 17.8 million deaths in 2017 globally, a loss of 330 million years of life through early mortality, and 36.5 million disability-adjusted life years (DALYs) according to findings by (Vaduganathan et al., 2022). In Europe, any death related to CVD occurring before age 70 is thought to be premature and this leads to more than 60 million life years being lost each year. Women die more than men overall due to CVD, albeit at lower age-adjusted rates of morbidity and mortality, especially below age 70 where the gender gap is greatest (Townsend et al., 2022).

The levels of dyslipidemia were observed to be rising globally, with a certain fraction of ill-defined lipid levels in individuals less than 20 years as recorded at the National Health and Nutrition Examination Survey (NHANES). It is found that 15 percent of children between 6 and 11 years old and 25 percent of adolescents have at least one abnormal lipid value, and these trends are well linked to age and obesity. Noteworthy, the prevalence of dyslipidemia is not considerably different between adolescent males and females (Mainieri et al., 2023). In South Korea, in 2013, the epidemiological burden of dyslipidemia was 16.58%, although 24.14 percent knew about it, and yet insufficiently used (Han & Kim, 2021).

8-Impact of saturated fatty acid and trans-fat consumption in CVD (cardiovascular diseases):

The content of saturated fatty acids, especially 1-16 carbon chains content, has been demonstrated to increase the circulating amounts of low-density lipoprotein cholesterol (LDL-C) as compared to carbohydrates and unsaturated fatty acids. This identification has resulted in the persistently held belief that saturated fatty acid consumption raises the risk of atherosclerotic cardiovascular disease (ASCVD) TFAs may occur due to natural and synthetic preparation thus they are known to contribute to systemic inflammatory responses. Higher consumption of TFAs is also strongly

associated with rising C-reactive protein (CRP) levels, which causes endothelial dysfunction (Magriplis et al., 2022).

9-Protective effect of unsaturated fatty acid:

Essential fatty acids (omega-3 and omega-6) significantly affect the homeostasis in cardiovascular preparation, control inflammatory processes, and improve fatty acid oxidation. Omega-3-polyunsaturated fatty acids, namely eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) have demonstrated anti-inflammatory properties, reduce triglycerides, enhance the performance of the endothelial cell, and reduce the likelihood of developing blood clotting. These compound effects make them protective to atherosclerosis (Pirillo & Catapano, 2025). Demonstrating the cardiovascular advantages of omega-3 polyunsaturated fatty acids (n-3 PUFAs), (Oppedisano et al., 2021)also point out the antioxidant properties of this compound and its role in heart-protective processes.

10-Role of plant-based diet in CVD (cardiovascular diseases) management:

Diets based on plants are gaining interest concerning their possible use in the secondary prevention and treatment of chronic conditions like cardiovascular disease, diabetes mellitus, and other types of cancer. (Goldman et al., 2025). These bean rich, pulse rich, fruit and vegetable rich diets have immense health benefits because of their nutritional value and bioactive phytochemicals (Mullins & Arjmandi, 2021). A vegetarian diet has been demonstrated to reduce the risk of heart disease and death, as well as decreasing the risk of dependency on medication through blood pressure, blood sugar and cholesterol regulation (Salehin et al., 2023).

11-Role of Mediterranean diet in CVD (cardiovascular diseases) management:

In its composition of more plant-based food with an increase of olive oil, fruits, vegetables, whole grains, nuts, lentils, and beans, among others, the Mediterranean diet is renowned to possess a great variety of health advantages (AlAufi et al., 2022). This diet has shown to be especially effective in preventing atherosclerotic cardiovascular disease. Researchers found that diets high in olive oil improved the rate of the progression of atherosclerosis better than normal low-fat diets (Jimenez-Torres et al., 2021). (Itsiopoulos et al., 2022) also investigated that the stronger adherence to the classic Mediterranean diet has been persistently associated to lower rates of all-cause mortality, diabetes, cardiovascular disease, and several types of cancer.

12-Clinical implication and public health policies:

Therapeutic lifestyle changes including regular physical activity, healthy diet, healthy body mass index (BMI), and cessation of smoking are recommended to people with hyperlipidemia. Besides these lifestyle adjustments, there is also a tendency to administer hypolipidemic drugs to those individuals who have a moderate to high level of atherogenic risks established by the use of certain risk assessment tools. Statins may remain the first-line treatment of hyperlipidemia because of the demonstrated clinical effect and the low intensity of side effects observed. That said, new treatments also give medical workers more opportunities to control dyslipidaemia more efficiently (Arvanitis & Lowenstein, 2023).

There is constantly a lot of research demonstrating that those who consume more plant-derived products, whole grains, fruits, vegetables, legumes, seeds and kernels, and less salt and products of animal origin, are less likely to develop atherosclerotic cardiovascular disease. Exchange of animal fats like butter with healthy ones like olive oil also helps (Riccardi et al., 2022). What is more, eating fiber, especially the water-soluble one, can effectively reduce the cholesterol level. Research indicates that diets rich in soluble fiber, such as those in plant-based foods, legumes, and oatmeal, may lead to cardiovascular improvements by the improvement of inflammation, blood pressure, cholesterol, and glycemic effects (Ghavami et al., 2023).

Conclusion:

In conclusion, junk food intake and cardiovascular diseases have presented a coherent relationship, with dyslipidemia as the primary mediating factor. With diets becoming increasingly processed and unhealthy all across the world, and particularly in developing countries, it is likely that the number of individuals with lipid abnormalities and related cardiovascular

outcomes will increase. Effective, evidence-based public health measures should be urgently implemented to roll back this trend. This incorporates not only regulatory options like taxes and labeling but also neighborhood involvement, training, and supporting frameworks of healthy eating. Identifying and targeting the junk food-mediated dyslipidemic propensity is critical in lessening the global misery of CVD and enhancing population health status in the coming decades.

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