Abstract. Cardiovascular diseases is a group of disorders of the heart and blood vessels, including coronary heart disease, cerebrovascular disease, rheumatic heart disease, peripheral artery disease, congenital heart disease, deep vein thrombosis, and pulmonary embolism. The most important behavioral risk factors for heart disease and stroke are poor diet, physical inactivity, smoking, and harmful alcohol use. The impact of behavioral risk factors may manifest in each individual as high blood pressure, hyperglycemia, hyperlipidemia, overweight, and obesity. The purpose of this study was to give a thorough scientific analysis of yoga’s contribution to the management and prevention of cardiovascular diseases and related risk factors. The records are collected from several databases. We performed an extensive search of the PubMed/Medline electronic database. However, it is believed that the risk of cardiovascular disease can be reduced by adjusting for several risk factors, such as increasing physical activity and using relaxation to reduce stress, both of which are elements of yoga. As yoga has become an increasingly popular form of exercise, it could be an important intervention for primary and secondary cardiovascular disease prevention. Evidence suggests that regular exercise can reduce the risk of death from cardiovascular disease, and it is beneficial when included in primary and secondary prevention strategies. This review assessed the effectiveness of yoga in reducing various cardiovascular risk factors (blood pressure, weight, body mass index, lipid profile, blood sugar). There is promising evidence that the practice of yoga improves cardiovascular health. Yoga practice length has a beneficial relationship with reducing the risk of cardiovascular diseases. Numerous studies used limited sample numbers, varied the forms and lengths of their yoga treatments, and omitted information on the processes behind change. The prevention and management of cardiovascular illnesses and associated risk factors, however, might be greatly aided by yoga. To even further understand the numerous possible mechanisms behind yoga’s effects, more research is necessary.

Keywords: cardiovascular disease; cardiovascular disease risk factors; diabetes mellitus; yoga

Introduction
Cardiovascular diseases (CVD) have become India’s major cause of death. In India, cardiovascular disease claimed between 62.5 and 12.7 million early life years in 2016 [1]. Approximately 12.0 % to 20.0 % and 6.0 % to 9.0 % of all fatalities in these areas, were attributed to ischemic heart disease and stroke, respectively [2]. Common issues like smoking may contribute differently in different Indian states, according to a review of the cardiovascular disease burden connected to modifiable risk factors. The burden of cardiovascular disease is influenced by several variables, including high blood pressure, high cholesterol, dietary exposure, cigarette smoking, and obesity. Among the major lifestyle risk variables that contributed to CVD DALYs in 2016, diet (low intake of fruits, vegetable, cereals and nuts and higher intake of salt, trans-fat, and red meat) was followed by smoking and a lack of exercise. However, among metabolic abnormalities; hypertension, dyslipidaemia and raised fasting plasma glucose levels were the ones that contributed most to the CVD DALYs in India [2]. Much of the success in reducing preventable cardiovascular disease mortality has benefited the elderly, but much remains to be done in the area of primary cardiovascular disease prevention, in particular, are people under the age of 65 [3]. To prevent the first CVD event from happening, primary CVD prevention compromises screening for cardiovascular risk in asymptomatic individuals and implementing risk reduction treatments in...
those at high risk [4, 5]. Interventions aimed at improving nutrition, physical exercise, smoking cessation, and stress management have been associated to significant decreases in absolute cardiovascular disease risk scores in high-risk persons [6]. Physical inactivity is listed in numerous guidelines as a significant modifiable risk factor for developing cardiovascular disease. It is the fourth most common cause of death worldwide [7]. They claim that people who exercise regularly and appropriately reduce their risk of high blood pressure, cardiac disease, strokes, and high plasma glucose level, thus aid them in keeping a healthy weight. Yoga is an age-old Indian discipline that combines physical, mental, and spiritual components, maybe a beneficial form of activity.

**Methodology**

Records were gathered from several databases. Using the keywords “Yoga and Cardiovascular Disease, Yoga and Cardiac rehabilitation, Risk factors for Cardiovascular Disease and Yoga, Yoga and Coronary Heart Disease, Yoga and Hypertension” we conducted a thorough search of the Medline, PubMed electronic database to locate pertinent articles in English. Only included studies with at least one randomized controlled trial of yoga treatment. There were no constraints on the types of yoga done, their frequency, or length. The purpose of this study was to give a thorough scientific analysis of yoga’s contribution to the management and prevention of cardiovascular diseases and their related risk factors.

**Cardiovascular disease in India: a growing problem**

CVD, different malignancies, chronic respiratory disorders, diabetes, and other noncommunicable illnesses are among the main cause of mortality. This epidemiological change is mostly brought on by the rise in cardiovascular disease prevalence and cardiovascular disease risk factors in India. The estimated prevalence of cardiovascular disease in India in 2016 was 54.5 million [8]. In India, cardiovascular illnesses are presently the leading cause of death, with ischemic heart disease and stroke contributing more than 80.0 % of the load [8]. Cardiovascular disorder, such as ischemic heart disease and cerebrovascular diseases like strokes, are the major cause of deaths, accounting for 177 lakh fatalities [9]. In India, the burden of non-communicable diseases kept growing, with cardiovascular disease-bearing a disproportionate share of the burden [10]. Cardiovascular disease-related illnesses now account for more than two third of non-communicable disease mortality in India [11]. Despite large disparities in risk factor incidence across different locations, in India, cardiovascular disorders continues to be leading cause of mortality, particularly in poorer regions and rural areas [12]. In India, the disease transition has mirrored the rapid epidemiological shift paradigm, with a swift change in the last two decades to the era of delayed chronic illnesses. The PURE Study conducted by Yosuf et al., had three key conclusions. First, regardless of the fact that those nations seemed to have the lowest risk-component load, the incidence of significant cardiovascular events increases in the low-income countries. In contrary, the incidence of non-major cardiovascular disease increases in high-income nations. Second, the number of fatalities following major cardiovascular events and the rate of death from all the causes were highest in low-income countries, intermediate in middle income countries, and least in high-income countries. Third, in middle income countries and low income countries, the rate of major cardiovascular events and the rates of death from all the causes were lower in rural than in urban areas, whereas the risk thing load was higher in urban than in rural areas in both the nations [13]. Compared to those of European descent, cardiovascular illness strikes Indians at least 10 years sooner and during their peak profile midlife years [14, 15]. In India, CVDs caused 28.1 % of all the fatalities and 14.1 % of DALYs in 2016 compared to 15.2 % and 6.9 %, respectively, during the year 1990 [16]. The two most prevalent cardiovascular disorders, ischemic heart disease and stroke, accounted for 24.9 % of all DALYs caused by CVDs. In India, the prevalence of CVDs increased from 2.57 crores during 1990 to 5.45 crores during the year 2016. Despite advances in technical and pharmaceutical over the past many years and even slight drops in the overall mortality rate from the CVDs, it continues to be the leading reason for death and a significant economic burden [17].

**Cardiovascular disease risk factors and burden**

The GBD 2016 (Global Burden of Disease) study’s comparative risk factor evaluation for India and the United States revealed that cardiovascular risk variables are historically important predictors of cardiovascular disease in both the US and India [2]. Similar percentages of burden of cardiovascular disease may be related to obesity, smoking, high blood pressure, high blood cholesterol, and dietary exposures.

By 2025, there will be 213.5 million people with hyper tension than there were in 2000 (118 million) [18]. In contrast to most Western countries, India has seen an increase in average blood pressure over the previous 2 decades [19].

Prevalence of DM has quadrupled in rural regions from 2.0 % to 9.0 % during the previous 20 years while nearly doubling in urban areas from 9.0 % to 17.0 % [20]. By 2030, it is predicted that there will be a startling 101 million people worldwide who have DM [21]. According to a calculation based only on the ICMR-INDIAB research, 77 million Indians have prediabetes, also known as impaired glucose tolerance (IGT) or impaired fasting glucose (IFG) [22].

Sequential studies conducted in India suggested that the average levels of triglycerides, low-density lipoprotein cholesterol, and non-high-density lipoprotein cholesterol increasing rapidly [23]. Only 20.0 % of participants in the ICMR-INDIAB research had each of their lipid levels inside the normal limits, and a significant number of them had minimum one lipid anomaly [24]. Low HDL-cholesterol, which was seen more frequently in people with lower educational levels remained the most frequently seen lipid anomaly [24]. Low concentrations of HDL cholesterol in the blood and high triglyceride concentrations are the indicators of dyslipidaemia. The crude prevalence of high total cholesterol in 2016 was 23.0 % [8].
Obesity, especially abdominally obesity, increases the chances of developing or increases the risk of metabolic and cardiovascular disease risk factors such as increased blood pressure, deranged lipid profile, insulin resistance, and type 2 DM. Such risk factors also contribute to growing health care expenditure by raising the chance of CVD morbidity and death [25, 26]. In accordance with WHO criteria for the Asia-Pacific region, obesity is classified as either overweight (BMI > 23 kg/m²) or obese (BMI > 25 kg/m²) [27, 28]. Irrespective of age and Body Mass Index (BMI), abdominal obesity, as determined by waist size, is also substantially linked to the risk for cardiovascular disease as well as a predictor of higher mortality in both men and women [29, 30]. Waist measurement above 88 cm for females and over 102 cm for males is considered central obesity. It is more advantageous to lose 5.0 % to 10.0 % of body weight and maintaining it for prolonged periods of time since it lowers the risk of CVDs and other health issues [31]. Prevalence rates of central obesity and obesity overall range from 16.9 % to 36.3 % and 11.8 % to 31.3 %, respectively, according to ICMR-INDIAB research. Thus, abdominal obesity is significant risk factor for CVDs in India [32].

**Cardiovascular disease prevention**

Focusing on the primary cardiovascular disease prevention and managing the modifiable risk factors for the illness, such as cigarette smoking, elevated blood pressure, deranged lipid profile, elevated blood glucose levels, and most crucially, obesity, have been encouraged. The recommendations advise that prompt lifestyle changes are crucial for the control and prevention of CVDs in both at-risk population and those who already have it [33]. Numerous risk factors are connected to lifestyle decisions including lack of exercise, smoking, drinking, and eating unhealthy [34]. Different approaches incorporating a healthier diet and managing stress have been found to be useful, even though scientific treatments are effective in preventing and managing CVDs [34]. Yoga is such a method that combines stress reduction with physical activity. Given that high levels of physical activity are a crucial factor in reducing obesity and cardiovascular illnesses, yoga may be a significant intervention for both primary and secondary prevention of CVDs since it is becoming more and more popular as a type of physical activity [34]. Yoga really does help with high blood pressure, deranged lipid profile, and atherosclerosis, based on various research. Systemic study showed that yoga reduced metabolic risk factors including high blood pressure and deranged lipid profile [34]. The evidence suggests that behavioural treatment or lifestyles modification may help with preventive care and sustainable management of CVDs, as well as reducing the chance of developing the condition, albeit effectiveness depends mainly on compliance [35]. Statistics shows that those who don’t ever had any cardiovascular disease risk factors by midlife live much longer and are healthy [36]. The American Heart Association has recommended a programme called Life’s Simple 7 TM that focuses on 4 healthier lifestyles elements and 3 ideal characteristics [37]. First, the committee developed a concept of optimum cardiovascular health, which would be defined as (1) the simultaneous practice of four healthy activities (no smoking since 1 year, within normal limit BMI, daily minimum required physical exercise, healthy intake of diet so as to encourage cardiovascular health), (2) the presence of four good health indicators (no DM, no cigarettes use over the last year, total cholesterol level not higher than 200 mg/dl without any treatment, blood pressure not more than 120/80 mmHg without medications); and (3) not having any significant cardiovascular disease (like stroke, heart failure, coronary heart disease, etc). Smoking is a habit that appears on that both list of health indicators and health related behaviours owing to the importance of quitting smoking and smoking termination for health education. In order to achieve all the requirements listed above which define perfect cardiovascular fitness, the committee identified a total of seven health behaviours and aspects. Blood pressure, cholesterol, blood glucose, physical inactivity, food, weight, and smoking are the seven major risk factors which individuals may reduce via healthy lifestyle choices to assist them in achieving optimum cardiovascular health.

**Yoga**

Yoga is described as “an ancient Indian discipline comprising of posture movements, controlled breathing, meditation” as in Oxford Handbook of Complementary Medicine [34]. It is claimed to lead the understudy to a unification of both mind and body and soul and was established in India more than five thousand years ago. It is built on the integration of three fundamental elements: Asana (body position), Pranayama (breath), Dhyana (concentration and devotion). The six primary sub-disciplines of yoga are bhakti, hatha, jnana, karma, mantra, and raja [34].

Hath yoga is one of the varieties of yoga that is regarded as a practice that can help avoid cardiovascular disease. A modern-day stressor is a key contributory factor in a variety of ailments, including cardiovascular disease. Several research indicates that yoga may reduce risk factors for CVDs including type 2 DM, smoking, hypertension, deranged lipid profiles, overweight, and psychological stress [38–41]. There is data that a yoga-based regimen could slow or even stop the advancements of cardiovascular illnesses [42]. Exercising regularly appears to reduce the chance of succumbing through CVDs, according to the evidence, and it is advantageous when included within primary and secondary preventive methods [34]. This is due to the positive impact that regular activity had upon CVD symptoms, a person’s functional ability, metabolism, and the life quality, in addition to CVD risk factors. Yoga is also a reasonably safe, mild option for improving overall health and mental well-being, particularly for individuals who live sedentary lifestyles [34].

**Yoga and high blood pressure**

By 2020, hypertension, which is a significant risk factor for many cardiovascular illnesses, would be the leading cause of mortality and disability in India [43]. Various researches have revealed that practising yoga significantly lowers systolic and diastolic blood pressure [44–46], pulse pressure [47–49], and mean arterial blood pressure and all of these measurements in people with high blood pressure [49, 50]. Certain asanas and pranayama are suggested for the goal of
lowering blood pressure (BP). Advantages might include a decrease in stress and a modification of baroreceptors sensitivity and parasympathetic tone. Yoga is a non-toxic supplement to diets and exercises that lowers blood pressure and is also reasonably priced. However, it is still unclear which component, asanas, pranayama, or meditation, has the most effect on decreasing blood pressure, or whether it is a blend of all three [36].

Yoga and dyslipidaemia

The practice of yogic techniques to decrease lipid levels is a secure alternative that's being evaluated. Owing to the calming effects of meditating, this impact is likely influenced by a decrease in adrenergic activity as well as a change in serum cholesterol [51].

Yoga and diabetes

A defining characteristic of effective diabetes care is the decrease in cardiovascular risk factors in DM [52–54]. It appears like yoga can help with it though. There are 2 potential avenues for the yoga’s mode of action: vagal stimulation is the first step, followed by parasympathetic activation and hypothalamic-pituitary-adrenal axis alteration [55].

The first hypothesised mechanism explains how yoga’s effect on stimulation of vagus enhances baroreflex sensitivity, decreases inflammatory cytokines, and thus lowers BP as well as resting heart rate [52, 55–58]. In those with type 2 DM, practicing yoga decreases the likelihood of cardiovascular illnesses and enhances endothelial function [52]. The usefulness of a yoga-based fitness programme in enhancing glucose control in patients suffering from type 2 DM was examined in a research by U. Gupta et al. Comparing the yoga-based fitness programme subjects with subjects given standard care, there was a positive decrease (0.21 % 95% confidence interval [–0.34, 075], p = 0.454) in HbA1c. In comparison to 37.5 % of individuals in the standard arm, a decrease in HbA1c of less than 0.5 % was seen in 44.7 % of individuals in the yoga-based exercise programme. The HbA1c reduction was 0.3 % for those who attended more than 75.0 % of the sessions as opposed to 0.1 % for those having attended less than 75.0 % of the sessions, which was a superior result [59]. According to a preliminary study by Saboo et al. yoga programmes would be a risk reduction strategy for type 2 DM and its sequelae. Yoga interventions have a significant impact on autonomic nervous system in prediabetes [60]. Short-term yoga interventions are beneficial in the management of glycaemic indices such as blood glucose, HbA1c, and lipid profile in prediabetic individuals, according to research by S. Kacker et al. According to this preliminary study, yoga classes for prediabetic individuals, according to research by S. Kacker et al. and calculating the 10-year cardiovascular risk score. Following a brief yoga-based intervention, estimations of FRS and cardiovascular risk were significantly lower than they had at the beginning [64].

Yoga and metabolic factors

In year 2015 research by P.M. Siu et al., participants with metabolic syndrome who were middle aged and older Chinese adults were examined to see how one year of yoga practise affected their cardiovascular risk factors, such as abdominal obesity, high blood pressure, deranged lipid profile, and high blood glucose levels. The yoga programme was shown to be linked with a decline in the number of cardiovascular metabolic diagnostic components. A year of yoga practise resulted in a substantially reduced waist circumference. A shift toward lower systolic blood pressure was observed after the yoga intervention. These results suggest yoga’s positive supplementary function in the treatment of metabolic syndrome [63]. Another study conducted by D.Y. Seo et al., examines the impact of an eight-week yoga-asana programme upon obese teenage male’s body mass, lipid panel, and insulin sensitivity. The study’s main conclusions have been that obese teenage males with elevated levels of body weight, fat mass, body fat percentage, body mass index, basal metabolic rate, fat-free mass, and total cholesterol responded better to an 8-week yoga-asana training regimen than they had at the beginning [64].

Yoga and cardiovascular disease risk score

The effect of the Bikram yoga-intervention on risk factors for heart disease in stressed-out and inactive individuals was studied by Z.L. Hewett et al. in 2017. According to regression analysis, greater participation in the intervention class was linked to a substantial decline in body mass index, body fat percentage, and diastolic blood pressure [65].

Yoga and metabolic factors

The effectiveness of short-term yoga-based short-term intervention programme was assessed by R. Yadav et al. in 2017, in lowering the Framingham Risk Score (FRS) and calculating the 10-year cardiovascular risk score. Following a brief yoga-based intervention, estimations of FRS and cardiovascular risk were significantly lower at 10 years. Low-density lipoprotein cholesterol and the decline in FRS have a substantial positive association; triglycerides, serum very low-density lipoprotein cholesterol, and systolic blood pressure have a positive but weaker correlation [42].

Yoga’s second suggested mode of action involves the stimulation of the parasympathetic nervous system and related anti-stress processes. It lessens the perception of stress as well as the arousal of the hypothalamic-pituitary-adrenal axis, enhancing the metabolic and psychological profiles altogether, enhancing insulin sensitivity, and enhancing glycemic control and lipid metabolism [55].
Based on this concept, a yoga-based lifestyle intervention might help deter the onset of cardiovascular and metabolic problems altogether [66]. Modifying one’s lifestyle lowers the likelihood of developing cardiovascular diseases, making it effective for both the primary prevention and improved management of these conditions [67].

Conclusion
In accordance with this study, yoga may assist in minimizing several risk factors of CVDs (weight, heart rate, body mass index, blood pressure, stress, inflammation, oxidative stress, and blood glucose levels). Yoga practise length has a beneficial relationship with reducing the risk of CVDs. Numerous studies used limited sample numbers, varied the forms and lengths of their yoga treatments, and omitted information on the processes behind change. The prevention and management of cardiovascular illnesses and associated risk factors, however, might be greatly aided by yoga. To even further understand the numerous possible mechanisms behind yoga’s effects, more research is necessary.

Limitations. Since this is a review article, we are unable to go into detail about our research methodology.

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Вплив йоги на серцево-судинні фактори ризику

Резюме. Серцево-судинні захворювання — це група захворювань серця й кровоносних судин, включно з ішемічною хворобою серця, серцево-судинною хворобою, тромбозом глибоких вен і емболією легеневої артерії. Найважливішими поведінковими факторами ризику серцево-судинних захворювань та інсулют є незбалансоване харчування, відсутність фізичної активності, куріння й зловживання алкоголем. Вплив поведінкових факторів ризику може проявлятися в кожній людині у вигляді підвищеного артеріального тиску, гіперглікемії, гіперліпідемії, надмірної маси тіла й ожиріння. Метою цього дослідження було провести науковий аналіз внеску йоги в лікування й профілактику серцево-судинних захворювань і пов’язаних з ними факторів ризику. Нами проведено широкий пошук в електронній базі даних PubMed/Medline. Встановлено, що ризик серцево-судинних захворювань можна зменшити, враховуючи декілька факторів ризику, наприклад посилення фізичної активності й використання релаксації для зменшення стресу, обидва з яких є елементами йоги. Оскільки йога стає все більш популярною формою фізичних вправ, вона може стати важливим заходом первинної і вторинної профілактики серцево-судинних захворювань. Результати свідчать, що регулярні фізичні вправи можуть знизити ризик смерті від серцево-судинних захворювань, і вони корисні, якщо їх включити до стратегій первинної і вторинної профілактики. У цьому огляді оцінювалася ефективність йоги в зниженні різних серцево-судинних факторів ризику (arterіальний тиск, маса тіла, індекс маси тіла, ліпідний профіль, рівень цукру в крові). Її використання є багатообіцяючою в.Reverse translation:Kлючові слова: серцево-судинні захворювання; фактори ризику серцево-судинних захворювань; йога.