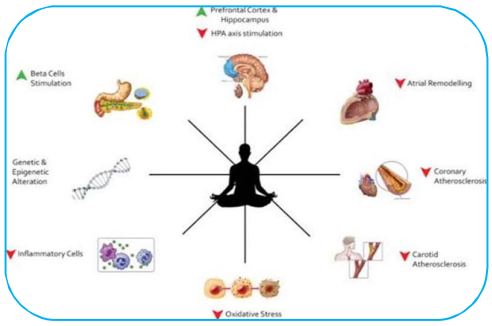
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YOGA PRACTICE AND AGE-RELATED CARDIOVASCULAR AND METABOLIC DECLINE: A NARRATIVE REVIEW

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ABSTRACT :



With age there are progressive changes in cardiovascular and metabolic function including elevated blood pressure, decreased vascular compliance, poor glucose control, insulin resistance and changes in autonomic nervous system activity. These developments have led to a higher incidence of cardiovascular disease, type 2 diabetes mellitus and hypertension in middle-aged and older persons. Practicing yoga frequently has been found to be a possible helpful supplemental lifestyle intervention that includes physical postures, breathing techniques, relaxation and meditation. This article reviews the available data on cardiovascular and metabolic benefits of yoga with a focus on blood pressure regulation, autonomic balance, glycemic control, insulin sensitivity and lipid metabolism. Research has indicated that the regular practice of yoga, in conjunction with appropriate medical treatment, may result in modest improvements in blood pressure and glucose control. This could be due to less sympathetic activation in response to stress, more physical activity, and better behavioral self-regulation. However, the confidence and generalizability of current findings are limited by methodological constraints, differences in yoga protocols, and differences in study populations. Yoga is best seen then as a complementary approach to healthy aging, not a treatment that arrests biological aging or substitutes for conventional medical care.

KEYWORDS: *healthy aging, insulin resistance, hypertension, metabolic health, cardiovascular health, yoga.*

SUMMARY

Aging is a natural biological process that gradually alters the structure and function of many physiological systems. Chronological aging cannot be stopped, but the rate of functional decline is affected by lifestyle factors such as physical activity, diet, psychological stress, sleep, etc. Maintaining cardiovascular and metabolic health is particularly important because these systems are critical to sustaining physical independence and overall well-being in later life.

Cardiovascular aging may involve increased arterial stiffness, reduced vascular reactivity, altered heart rate control along with increased risk of hypertension . Metabolic aging is associated with decreased insulin sensitivity, changes in body composition, reduced glucose tolerance and disorders of lipid metabolism. These processes interact: metabolic disorders and high blood pressure increase the risk for cardiovascular disease, and physical inactivity and excessive obesity can worsen insulin resistance.

Yoga is a classic mind-body practice that includes meditation, relaxation, controlled breathing (pranayama) and physical postures (asanas). Compared to training programs that develop only cardiovascular conditioning or muscular strength, yoga may affect physical, autonomic and

psychological processes simultaneously. This is a versatile tool and might be appropriate for people with different levels of mobility and fitness.

Loewenthal and colleagues (2024) examined yoga and the physiology of aging, looking at yoga's capacity to promote multiple physiological systems, and its possible relevance to frailty prevention. Recently, yoga in people with type 2 diabetes, obesity and hypertension has been studied too.

The objectives of this article are to review the evidences for the beneficial effects of regular yoga practice on some of the metabolic and cardiovascular changes associated with aging, analyze the available data and determine the implications for healthy aging.

The Role of Yoga in Age-Related Cardiovascular Decline

Vascular function and blood pressure

High blood pressure is one of the major cardiovascular risk factors that tend to increase with age. This increase may be related to lifestyle changes, autonomic modulation, vascular resistance and arterial compliance. Persistent hypertension increases the workload of the heart and is associated with an increased risk of stroke, coronary artery disease and other cardiovascular complications.

Yoga, which involves relaxation, stress reduction, controlled breathing and mild exercise, may help regulate blood pressure. Daily exercise may increase overall physical fitness but slow breathing and relaxation techniques may influence autonomic activity.

Geiger et al. (2025) conducted a comprehensive review and meta-analysis of 30 randomized controlled studies involving a total of 2,283 individuals with prehypertension or hypertension. They reported that yoga practitioners had lower blood pressure than inactive control groups. The pooled systolic and diastolic blood pressure differences were about 8 mmHg and 5 mmHg, respectively. However, the authors noted substantial heterogeneity between the studies and gave a very low certainty rating to the evidence. Benefits were less apparent compared to active therapies.

These findings suggest that yoga may be used as an adjunct therapy in hypertension. But the declines reported do not prove that yoga reduces cardiovascular events or that it will for all who practice.

Autonomic nervous system regulation

The autonomic nervous system controls heart rate, blood pressure and other vital functions of the stability of the cardiovascular system. Aging and chronic psychological stress may be related to changes in autonomic modulation, including heart rate variability (HRV).

HRV represents the variations in the time interval between consecutive heartbeats. It is often used as an indirect index of autonomic control and is affected by a number of physiological parameters. But it should not be used as a sole sign for diagnosing cardiovascular health.

Yoga includes slow breathing, body awareness, and relaxation, all of which might influence autonomic responses. Pal et al. (2014) studied the practice of yoga in healthy males of different age. After the 3 months of yoga, the participants showed improvements in several measured cardiovascular and autonomic variables such as heart rate, blood pressure and some HRV parameters.

This study provides relevant physiological information, but the results cannot demonstrate that yoga reverses age-related cardiovascular decline as the study participants were younger than many considered older adults. Longer follow-up periods and larger trials involving older populations are needed.

Lowering stress and protecting the heart

Psychological stress may involve repeated activation of stress-response systems that could contribute to the risk of cardiovascular disease. Stress can also affect sleep, eating, physical activity and compliance with treatment.

Most yoga programs include breathing techniques, meditation and relaxation. Such activities may help individuals better regulate their perceived stress, and increase their awareness of emotional and physiological reactions.

Stress reduction may indirectly improve cardiovascular health by encouraging healthy daily habits and by lessening some stress-related physiological responses. But there's still much to be learned about how yoga-related stress reduction can affect long-term cardiovascular outcomes.

METABOLIC BENEFITS OF REGULAR YOGA PRACTICE

Insulin Sensitivity and Blood Sugar Control

One of the major metabolic problems of aging is reduced insulin sensitivity. Insulin resistance is when the body's tissues don't respond as well to insulin, making it more difficult to maintain normal blood glucose levels. This can eventually lead to the development of type 2 diabetes.

Yoga can influence the regulation of blood sugar by several complementary mechanisms. Glucose may be used up by muscle contraction and movement in physical postures. Regular physical activity may promote insulin sensitivity, while stress reduction and relaxation may have an impact on the behaviors and physiological responses associated with metabolic health.

Vijay et al. (2025) performed a systematic review and meta-analysis of 14 randomized controlled trials with 1,876 individuals with type 2 diabetes who participated in three-months yoga programs. The combined results showed reductions in postprandial blood glucose, fasting blood glucose and glycated hemoglobin (HbA1c). Furthermore, the authors noted that the included trials were at high risk of bias and had substantial heterogeneity.

Kaur et al. (2023) performed a separate systematic review comparing walking, yoga, and control conditions in type 2 diabetes research. Yoga therapies have been associated with improvements in fasting glucose, postprandial glucose, HbA1c, and several insulin resistance parameters.

All of these findings suggest yoga may help those with type 2 diabetes control their blood sugar levels. However, we cannot assume that findings from clinical research apply to all yoga programs or to healthy older persons.

Body Composition and Metabolic Risk of Obesity

Excess body fat, especially abdominal adiposity, has been associated with insulin resistance, hypertension, and increased risk of cardiovascular disease. Age-related changes in body composition and physical activity may exacerbate these disorders.

For those who find vigorous activity difficult, yoga offers a type of movement that is less demanding. Depending on the type and intensity, yoga may improve levels of physical activity, mobility and muscle endurance. It may also promote more consistent participation in healthy behaviours, improved stress management and mindful eating.

A systematic review and meta-analysis of randomized controlled trials among adults with overweight or obesity in 2026 found some lipid measurements improved and blood pressure decreased after yoga therapies. However, effects on individual lipid outcomes were inconsistent and the authors noted significant between-study heterogeneity.

Yoga is not a replacement for proven weight-management strategies. The degree of help one gets from losing weight depends on how often and how much one practices, eating habits, other types of physical activity and personal characteristics.

Cardiovascular risk and lipid metabolism

Metabolic dysfunction and aging may coexist with adverse lipid profiles, including high triglycerides and low-density lipoprotein cholesterol. These abnormalities are associated with atherosclerotic cardiovascular disease.

Yoga can indirectly influence the metabolism of lipid through promoting physical activity, weight management, reduction of stress and adhering to the healthy lifestyle choices. While the results are mixed for total cholesterol and LDL cholesterol, some intervention trials have noted improvements in triglycerides and other lipid markers.

Therefore, it is premature to conclude that yoga alone can prevent atherosclerosis or restore normal lipid profiles. Individuals with dyslipidemia should continue to receive appropriate evaluation and evidence-based care.

Potential Mechanisms related to Healthy Aging and Yoga

The cardiovascular and metabolic effects of yoga may be due to interacting systems, rather than a single physiological pathway.

First, prolonged muscle exercise and mild movement may help with glucose utilization and physical fitness. Second, controlled breathing and relaxation may influence autonomic activity and physiological responses to stress. Third, meditation and mindfulness may aid practitioners in acknowledging stress, managing emotions and sustaining more advantageous behavioural patterns.

Further, yoga may improve willingness to participate in other health-promoting activities, perceived well-being and sleep. These changes in behavior over time can lead to improvements in metabolic and cardiovascular health.

It is important to distinguish between established causal effects and likely mechanisms. Although improvements in blood pressure, glucose measurements and some autonomic variables have been reported in studies, it remains unclear as to what proportion of each benefit can be attributed to yoga itself, increased physical activity, relaxation, social support or changes in other lifestyle factors.

Implications for Research and Practice

Yoga can be included in a comprehensive healthy aging program for middle aged and older persons that involves frequent medical evaluations, appropriate physical activity, a well-rounded diet, and adequate sleep.

A useful program may include relaxation, meditation, easy breathing techniques and light asanas. Practice should be modified based on the individual's mobility, balance, cardiovascular health and experience. Chair-supported or supervised yoga can be beneficial for older beginners.

Individuals with hypertension, diabetes, cardiovascular disease or significant restrictions to their mobility should consult a qualified healthcare professional before starting or making significant changes to their practice. Some people may not be able to perform strenuous postures, long breath holds and forceful breathing. Yoga should be used with clinical monitoring and prescribed drugs, not instead of them.

Future research needs to include standardized yoga protocols, appropriate active control groups, longer follow-up periods, and adequately powered randomized controlled trials in middle-aged and older adults. Studies should evaluate clinically meaningful outcomes, including ambulatory blood pressure, HbA1c, insulin sensitivity, lipid profiles, physical function and adverse events. In addition, researchers should investigate whether the effects vary by age, baseline health, yoga experience and frequency of practice.

To conclude

Regular practice of yoga is a promising adjunct strategy to promote cardiovascular and metabolic health with aging. Other studies have suggested potential benefits for autonomic function, blood pressure, glucose control and some metabolic risk factors. These results may be produced by the interaction of physical activity, breathing, relaxation, and improved health-related behaviors.

But there are still important limitations in the research available today and the strength of the evidence varies across outcomes. Yoga is not a proven means of stopping biological aging or preventing diabetes and cardiovascular disease. Its most defensible role is as a flexible element of a more comprehensive, evidence-based approach to good aging.

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