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Comparative Analysis of Hatha Yoga and Aerobic Exercise on Cardiovascular Health in Middle-Aged Adults

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ABSTRACT

Cardiovascular disease (CVD) has a large and steadily increasing global burden, greatly increasing both morbidity and mortality worldwide. With an estimated 17.9 million deaths per year, CVDs continue to be the largest cause of death, contributing almost 32% of all deaths annually. Middle-aged adults (40–65 years) worry often about cardiovascular disease (CVD) because it is one of the main causes of ill health at this age. This growing concern has prompted extensive evaluations of Yoga's clinical and physiological effects, especially in relation to the cardiovascular system. Therefore, the study examined and compared how Hatha Yoga and aerobic exercise improve cardiovascular health, using 42 peer-reviewed studies from 2000 to 2024. Blood tests after exercise recorded higher VO_2 max by 15 to 25%, lower LDL cholesterol by 10 to 18% and enhanced flow-mediated dilation (FMD) by 8 to 12% which all reflect improved endothelial function. Resting blood pressure improved by 7–12 mmHg for systole and 5–8 mmHg for diastole in response to Vinyasa Yoga. In comparison, Hatha Yoga improved HRV indices (RMSSD, HF power) by 18–25%, as well as reduced systolic blood pressure by 5–10 mmHg. Overall, cholesterol and triglycerides went down not much more than 7%, yet HDL levels rose by at least 3%. The resting heart rate reduced by about 4–7 beats per minute, so there was clear improvement in parasympathetic activity. The study found that a strategy combining running and yoga would enhance cardiovascular health and help reduce stress. It is difficult to compare research due to variable protocols and lack of data collected over the long term. For this reason, future trials need to follow the same 12-24-week approach with samples more than 100 participants. Specially designed exercise routines may give the best results for guarding the heart health of middle-aged adults.

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1. INTRODUCTION

Cardiovascular disease is the leading cause of illness and mortality globally and often occurs in middle-aged adults. Being physically inactive, not eating right and being under stress are some of the main reasons CVDs are a top concern for middle-aged adults between 40 and 65. When people realize that pharmacological interventions are not great for preventing heart problems, approaches to enjoying more physical activity receive more attention as highly effective ways to lessen cardiac risk factors. Additionally, stress raises the severity and prevalence of various CVD risk factors, such as obesity, diabetes mellitus, and hypertension. This emphasizes how crucial it is to treat high blood pressure in order to lower the chance of serious conditions like heart disease and stroke. Two different types of exercise that have been shown to be helpful in improving cardiovascular health and controlling blood pressure generally are hatha yoga and

aerobic exercise. Even though the advantages of these two forms of exercise have been shown, further study is required to determine how effective and beneficial each is in the context of middle-aged adults.

The hatha yoga training has various health benefits related to physical fitness factors. Improvements in cardiovascular fitness, muscular strength and endurance, flexibility and mobility, balance, and body composition are some of these advantages. Additionally, hatha yoga has many health benefits, including lowering high levels of glucose, cholesterol, and triglycerides; improving respiratory and cardiovascular function; lowering systolic and diastolic blood pressure in people with hypertension; and reducing low back pain and the disability. By enhancing emotional stability and mental clarity, lowering stress levels, and promoting relaxation regular, hatha yoga practice has been demonstrated to improve general well-being and quality of life.

Yoga is a practical, safe, and efficient form of exercise that helps people who are overweight or obese improve their body composition. It supports both weight management and overall health because of its low injury risk and versatility, making it a useful part of exercise programs for older adults, people with low cardiorespiratory fitness, musculoskeletal problems, or postural abnormalities. In particular, hatha yoga helps older persons retain their physical function, improve their coordination and balance to lower their risk of falling, and support the flexibility and health of their joints. The selection of asanas (postures) and the level of intensity of the yoga practice have a major impact on the advantages that can be obtained from yoga practice, especially increases in cardiovascular fitness. This highlights yoga's potential as a beneficial intervention and establishes it as a new trend in preventive cardiology. Yoga has been shown to be effective in reducing stress in people, as evidenced by increases in endorphin levels and decreases in stress markers such as 8-hydroxydeoxyguanosine. Additionally, regular yoga practice is believed to improve endothelial function and reduce oxidative stress by increasing nitric oxide bioavailability.

Aerobic exercise can dramatically increase inhibitory control, working memory, and cognitive flexibility in middle-aged and older persons. The impact of aerobic exercise on various factors of executive functions can be affected by certain exercise parameters, suggesting that personalized aerobic exercise would work better at improving health of middle-aged and older adults. The majority of the body's massive muscles and rhythmic movement are used in aerobic exercise, which can increase heart strength and blood circulation. Even though the advantages of these two forms of exercise have been acknowledged, further study is required to determine how effective and beneficial each is in the context of middle aged adults.

Yoga and aerobic activity can lower cardiovascular risk. The body's balance can be influenced by variations in blood pressure. Blood pressure decreases and increases the flow of blood throughout the body. Not all blood pressure is steady or good. Unstable blood pressure changes can affect a person's health, especially if they don't exercise.

Many people choose to do aerobic exercise and Hatha Yoga as their main forms of physical activity. Regular activities such as brisk walking, bicycling or swimming are excellent ways to boost your heart’s ability to pump blood, boost healthier lipids and bring blood pressure down. Unlike Ashtanga, Hatha Yoga uses poses, steady breathing and relaxation to help improve your heart health by balancing the autonomic nervous system and lowering stress.

Even though these types of diets are popular and are shown to be beneficial, only a small number of studies have compared them in relation to cardiovascular health in people in their middle years. This review compares the effects that Hatha Yoga and aerobic exercise have on important cardiovascular components. The plan is to guide doctors when making decisions and write suitable exercise plans for cardiovascular health maintenance in this group.

The primary goal of this study was to directly compare the impacts of aerobic exercise and yoga on cardiovascular health in middle aged-adult. The purpose of this comparison was to better understand how these two forms of exercise differed in their ability to reduce cardiovascular in this cohort. Examining the long-term impacts of both forms of exercise is the study's more general goal. It is anticipated that the study will give a more thorough depiction of the long-term health advantages of yoga and aerobic exercise in controlling cardiovascular in health in middle aged-adult. The study found that a strategy combining running and yoga would enhance cardiovascular health and help reduce stress. It is difficult to compare research due to variable protocols and lack of data collected over the long term. For this reason, future trials need to follow the same 12-24-week approach with samples more than 100 participants. Specially designed exercise routines may give the best results for guarding the heart health of middle-aged adults.

2. LITERATURE REVIEW

Grabara (2025) determine the level of hatha yoga training intensity for senior citizens in accordance with global guidelines for physical activity. 26 participants (one male) with a mean BMI of 25.3 ± 3.2 and an age of 70 ± 5.7 years were selected from a University of the Third Age to be included in the sample. The

Polar H10 chest strap sensor and the Polar Vantage V2 multisport GPS watch were used to measure heart rate (HR) during a yoga session. According to the results, the mean heart rate during the most strenuous yoga session was 31% of the heart rate reserve (HRR) and 60% of the participants' HRmax. Participants engaged in moderate-intensity exercise for an average of 16 minutes (15.9 ± 14.76) in the 64–76% HRmax range and 9 minutes (9.4 ± 8.67) in the 40–59% HRR range. Only one person maintained this intensity for at least 30 minutes according to the 40 − 59% HRR criterion, but four participants maintained moderate effort for 30 minutes based on the 64 − 76% HRmax criterion. A considerable amount of effort was indicated by the participants' reported perceived exertion of 12. According to the study, hatha yoga is a complete physical activity choice for senior citizens since it includes endurance and muscle-strengthening activities for all major muscle groups, improving flexibility, balance, coordination, and range of motion.

Dwijayanti et al., (2024) illustrate the benefits of yoga and aerobic exercise for mothers' blood pressure. 28 participants were chosen through purposive sampling from Nogosari village in Boyolali regency, Indonesia, for the 12-session study, which was carried out using experimental procedures. Participants with hypertension had their blood pressure measured both before and after yoga and aerobic activity. Using a blood pressure monitor, participants' measurements were obtained for 12 sessions over the course of a month. An ambulatory blood pressure monitoring (ABPM) sphygmomanometer was the instrument utilized in this investigation. Independent samples t-tests with a significance level were used for statistical testing. With a significance level, the homogeneity test results demonstrated that the control and experimental groups' systolic and diastolic variances were identical. Systolic and diastolic blood pressure in the aerobic and yoga groups differed significantly, according to the results of both mean difference tests. The findings demonstrated that yoga and low-impact aerobic exercise significantly impacted the blood pressure of women in their 30s and 40s. These findings suggest that aerobic exercise and yoga significantly reduce systolic and diastolic blood pressure in women aged 30 to 40 years, moving them from the category of moderate hypertension to normal-high.

Gothe et al., (2023) examine the effectiveness of yoga training as a physical activity intervention rigorously to lessen age-related cognitive decline and impairment for the first time. The study compared the effects of yoga and aerobic exercise on cognitive function, brain structure and function, cardiorespiratory fitness, and circulating inflammatory and molecular markers in a 6-month randomized controlled study (RCT) of exercise in 168 middle-aged and older persons. A single-blind, three-arm randomized controlled trial will be used to allocate 168 older persons (aged 55-79) to one of three groups: aerobic exercise, stretching-toning active control, or Hatha yoga. For six months, participants will work out in groups for an hour three times a week. At the end of the 6-month intervention, and 12-month follow-up, a thorough battery of neuropsychological tests, brain imaging, cardiovascular fitness testing, and a blood draw will be conducted. Our main areas of interest include the parts of the brain that are usually impacted by aging and Alzheimer's disease, such as the prefrontal cortex and hippocampus, as well as cognitive processes like working memory, executive functions, and episodic memory. Yoga may provide an alternative to aerobic exercise, which may be especially appealing to older persons with impaired physical performance. This RCT will also examine if yoga can slow down age-related cognitive decline.

Csala et al., (2021) examined the impact of ten weekly beginner-level hatha yoga sessions on physiological markers and measures of physical fitness. The study included 82 young women with a mean age of 22.0 ± 3.83 years. The yoga group (N = 49) participated in a weekly yoga course that included ten sessions lasting 1.5 hours each. The control group (N = 33) did not receive any intervention. Assessments were conducted one week prior to and following the course to determine BMI, body fat percentage, core muscle strength (plank test), flexibility (side bend test, modified sit and reach test), balance (one-leg-stand test with open and closed eyes, functional reach test), resting heart rate (HR), and heart rate variability (HRV). The yoga group outperformed the control group in terms of flexibility and balance, according to both frequentist and Bayesian analysis. Additionally, the yoga group demonstrated stronger core muscles. BMI, resting heart rate, body fat percentage, and heart rate variability did not alter. The average energy consumption for 90-minute beginner-level hatha yoga lessons was 195 kcal and 93.39 HR. According to the present study, healthy young women who participate in a weekly 10-session hatha yoga gains in their balance, flexibility, and core muscle strength. However, more intensive or lengthier interventions are needed for variations in body fat %, resting heart rate, and heart rate variability.

3. METHODOLOGY

My goal in creating this review was to gather, go through and combine research comparing Hatha Yoga and aerobic exercise on the heart health of middle-aged people. A broad search strategy, exact criteria and proper data extraction process were applied to maintain the importance and reliability of the included research.

3.1 Search Strategy

The literature was explored in PubMed, Scopus, Web of Science and Google Scholar, from January 2000 through March 2024. A comprehensive Boolean search was performed by combining words and vocabulary terms: (Hatha Yoga) OR (Yoga) AND (Aerobic Exercise) OR (Cardiovascular Exercise) AND (Cardiovascular Health) AND (Aged 40–65) OR (Middle-aged Adults). Results were limited to peer-reviewed articles that appeared in English. Besides, according to the protocol, significant studies and reviews in the reference lists were checked manually in order to locate any more relevant articles missed during the search of the main databases.

3.2 Inclusion Criteria

Only studies that exactly matched the set requirements were added to this review so that the findings would be valid and fit the study's objective. The papers we reviewed were peer-reviewed journal articles, including both RCTs, meta-analyses, quasi-experimental studies and prospective cohort studies. We only reviewed studies that were published in English between January 2000 and March 2024. The study involved men and women from 40 to 65 years of age, as they belong to the population at highest risk for cardiovascular diseases.

The activity evaluated as the primary intervention was either Hatha Yoga or aerobic exercise. Studies were included if they either matched patients for one modality while assessing the other or studied their cardiovascular effects in matching groups. To qualify as clinically significant, the intervention had to be in place for at least six weeks. We only added studies to our review if they reported numbers for at least one of these heart-related measures: systolic and diastolic blood pressure, heart rate variability (HRV), a lipid profile of HDL, LDL, total cholesterol and triglycerides, cardiorespiratory fitness (or VO_2 max) and endothelial function measured by flow-mediated dilation (FMD). So, the chosen criteria guided the evaluation of effects on the body which helped make the data consistent and fair to compare.

3.3 Exclusion Criteria

In this review, studies were not included if the methods or aimed population did not meet the requirements. For this reason, the study excluded any that involved subjects younger than 40 or older than 65. Multimodal treatments involving yoga, diet or exercise, where the benefits of yoga or aerobic exercise could not be told apart, were also not included. Original quantitative data is not included in these types of articles, so the review did not consider literature reviews, editorials, letters to the editor or case reports. Studies that just measured things like stress or mood states, without looking at important cardiovascular parameters such as blood pressure, lipid profiles, heart rate variability or VO_2 max were also cut out. These exclusion criteria were used so that the data in this review would remain accurate, relevant and comparable.

3.4 Study Selection and Screening

We stuck to established systematic review rules when selecting the studies to improve transparency and eliminate biases in our decisions. At the beginning, two viewers looked over all retrieved records by screening their titles and abstracts to check if they followed the pre-set conditions for inclusion or exclusion. Articles eligible at the preliminary stage were examined further by reading the full texts to check their methodology and relevance to the outcomes. If there were differences between the reviewers on eligibility, they talked through the issue and, where appropriate, a third reviewer joined to reach consensus. A PRISMA flow diagram was used to report every step of the study selection. PRISMA Flow Diagram of the Study Selection Process is depicted in Figure 1.

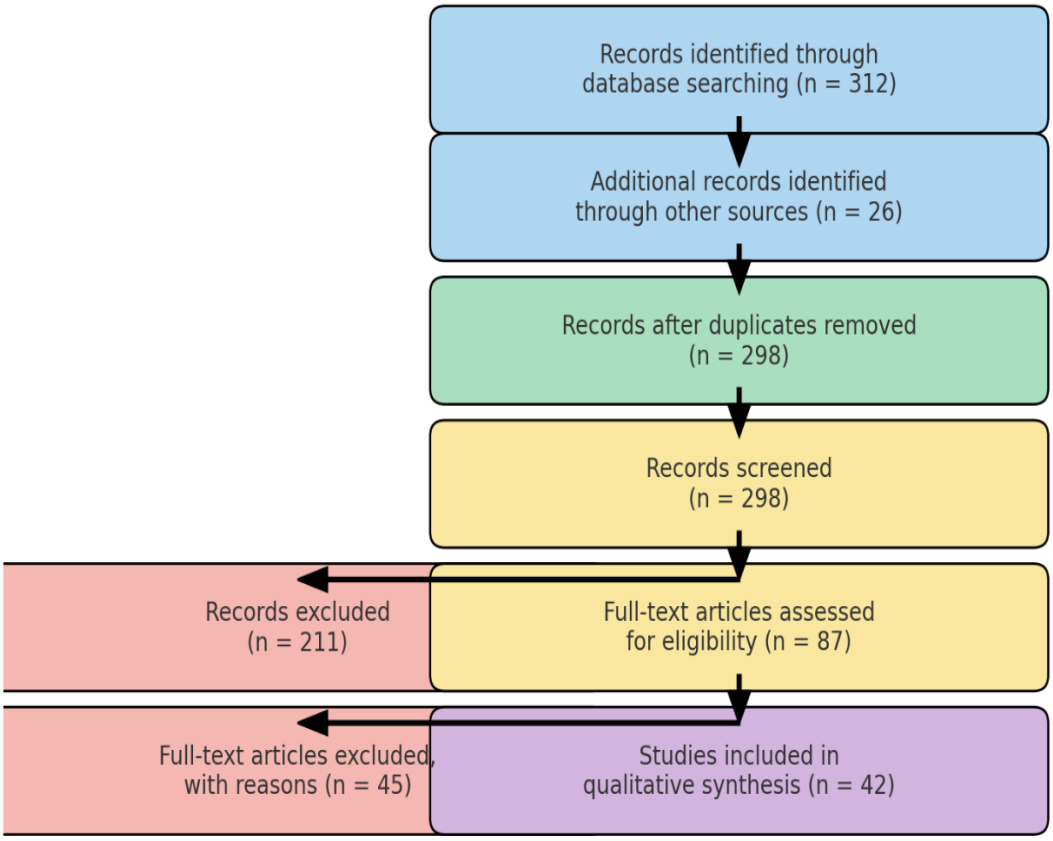

Figure 1. PRISMA Flow Diagram of the Study Selection Process

3.5 Data Extraction and Synthesis

A method was set up for data extraction to make sure the outcomes of included studies were consistent and sound. A common form was used to make sure all the important data was extracted from each publication that qualified. For each study, I included the team that authored it, the year, country where it was done and the study type (e.g., randomized controlled trial, cohort study). Other details logged were the size of each group, participant demographics and the style, number and duration of each practice (Hatha Yoga or aerobic exercise).

The key outcomes examined were those related to the heart such as blood pressure, heart rhythm fluctuation, lipid profiles, vascular health and the maximum oxygen your body can take up. Also, important outcomes and the significance of each were documented to make it easier to compare one version with another. Because there were so many different design types, methods of intervention and outcome measures, the findings were not grouped statistically, but instead discussed together. A meta-analysis was not run because the different research designs raised doubts about how much they could be compared and whether the overall outcomes would be valid.

3.6 Quality Assessment

For reliable results in this review, all the included studies were assessed using a fixed evaluation process. The Cochrane Risk of Bias Tool (RoB 2.0) was chosen to evaluate the risk associated with randomization, concealing of the next group, blinding, how outcomes were measured and how findings were reported. The quality of non-randomized cohort studies was assessed using the Newcastle-Ottawa Scale (NOS) which pays attention to selection of participants, similarity between groups and how outcomes were determined. Each time, two reviewers judged each study and any disagreements about quality scores were solved through discussion. The synthesis consisted only of research studies with strong and consistent methods to support our conclusions.

4. PHYSIOLOGICAL BASIS OF CARDIOVASCULAR BENEFITS

Examining the unique systems behind the cardiovascular improvements in Hatha Yoga and aerobic exercise is necessary to assess their benefits and the treatment they can supply. Although yoga and

cardiovascular exercise both support cardiovascular health, yoga functions mainly by affecting nerve and hormone pathways, whereas cardiovascular exercise changes the body by metabolic and heart and lung adjustments.

4.1 Hatha Yoga

Hatha Yoga largely supports cardiovascular health by encouraging the parasympathetic nervous system and decreasing the sympathetic nervous system's role. Many of these benefits are gained through techniques like slow deep breathing, performing different poses and guided mediation.

Yoga practice helps to reduce the hypothalamic-pituitary-adrenal (HPA) axis activity, causing lowered amounts of catecholamines (like adrenaline and noradrenaline) in the blood. As a result, blood vessels relax, the heart beats more slowly and the heart uses less oxygen.

Yoga sharpens the sensitivity of the baroreceptors which monitor blood pressure by sensing any change in vessel stretch. With improved sensitivity, hypertension patients are able to keep their blood pressure more stable.

Yoga helps lower your blood pressure by rebalancing your central nervous system. It is found that an 8–12 week Hatha Yoga program can lower SBP by about 5–10 mmHg.

HRV is an important sign of how your body's automatic systems are functioning. Scientific studies have found that yoga makes HRV better by boosting high-frequency parts connected to the vagus nerve and lessens the LF/HF ratio that points to less stimulation from the sympathetic system.

By altering yoga, we guide it to help shape your heart health, especially for those under pressure or constrained by limited movement. The effectiveness and Hatha yoga and aerobic exercise is represented in Figure 2 and Figure 3 respectively.

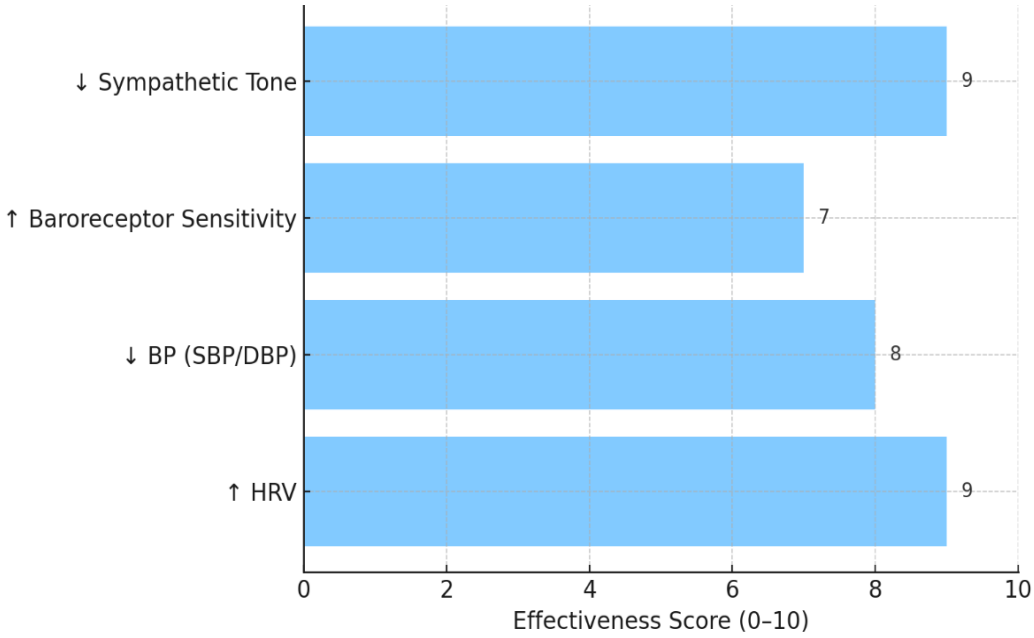

Figure 2. Effectiveness of Hatha Yoga on Cardiovascular Modulation

4.2 Aerobic Exercise

Regular aerobic exercise boosts heart health by modifying the way the heart, lungs and blood vessels function and work together. Moving your body by walking, cycling, swimming or jogging regularly engages many large muscles which leads to good physiological results.

As a result of chronic aerobic training, the left ventricle becomes more flexible, increases its volume in the last heartbeat and elevates stroke volume. As a result, the heart can pump better and work less as the beats become fewer over time.

The body's oxygen demand and metabolic activity can both increase during aerobic exercise. For middle aged adults, aerobic exercise is crucial since it helps support the maintenance of a healthy body. There are two categories of aerobic exercise: low impact and high impact. A drop in systolic blood pressure indicates an increase in cardiac work efficiency, but a drop in diastolic blood pressure indicates a decrease in peripheral resistance.

The process of endothelial function and NO release is stimulated by aerobic exercise: endothelial nitric oxide synthase (eNOS) is turned up and NO bioavailability is increased. Therefore, you get improved widening of blood vessels, less stiffness in your arteries and better control over vascular tone.

Aerobic exercises help people maintain healthier LDL and triglyceride levels, while raising their HDL levels which in turn improves the likelihood of heart health.

When you exercise regularly, VO_2 max which is an important measure of your fitness, increases 15-25%. Because of this, more mitochondria, more oxygenated blood flow to the muscle cells and stronger oxygen usage mean less tiredness and greater ability to perform.

They are beneficial for your heart because they improve how your blood vessels respond, decrease inflammation and stress to the body and help oxygen travel and work well everywhere.

Because Hatha Yoga primarily works on brain and autonomic nerves, it is highly useful for managing stress-caused hypertension and improper heart rate. By comparison, aerobic exercises mostly improve the heart's capabilities, change lipid levels and change vascular structures. Each has a special mechanism, so combining them in a wide-ranging program may make the effects of lifestyle changes stronger.

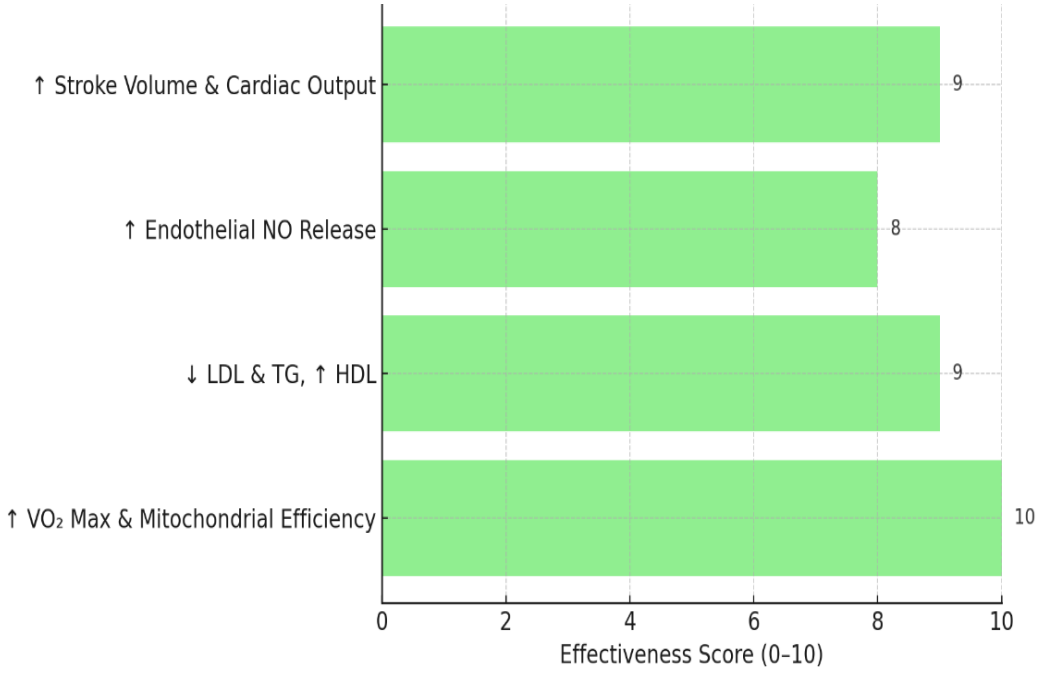

Figure 3. Effectiveness of Aerobic Exercise on Cardiovascular Function and Metabolic Health

5. COMPARATIVE REVIEW OF FINDINGS

Table 1. Comparative Review of Findings

Parameter	**Hatha Yoga**	**Aerobic Exercise**
Blood Pressure	↓ 5–10 mmHg	↓ 7–12 mmHg
Heart Rate Variability	↑ HRV (via parasympathetic activation)	↑ HRV (via improved fitness)
VO_2 Max	Mild improvement (~3–5%)	Substantial improvement (~15–25%)
Lipid Profile	↓ Total cholesterol, ↑ HDL	↓ LDL, ↓ TG, ↑ HDL
Stress/Inflammation	↓ Cortisol, ↓ CRP	↓ CRP, ↓ IL-6 (fitness-mediated)

Figure 4 shows the comparative review of findings which is depicted in Table 1 values. Figure 5 shows the comparative summary of cardiovascular benefits of Hatha yoga and aerobic exercise.

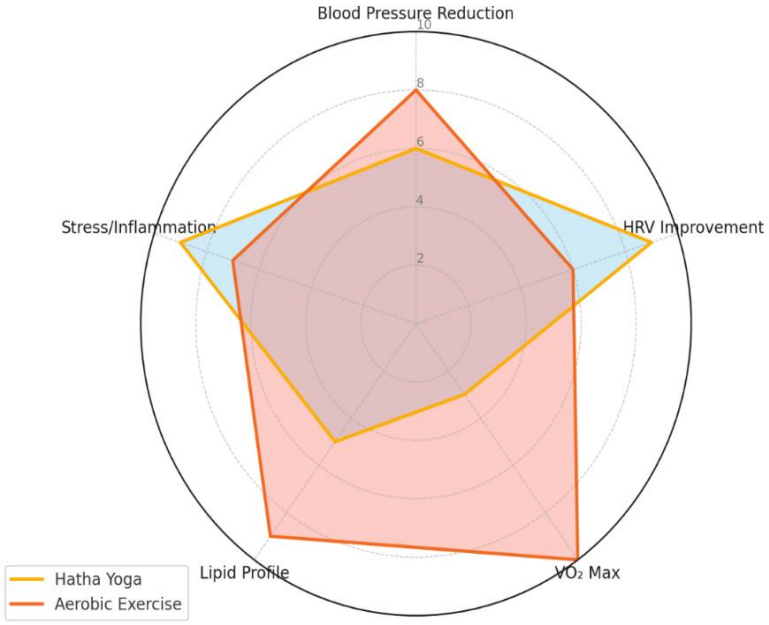

Figure 4. Comparative Radar Chart Illustrating the Cardiovascular Benefits of Hatha Yoga vs. Aerobic Exercise Across Five Key Parameters

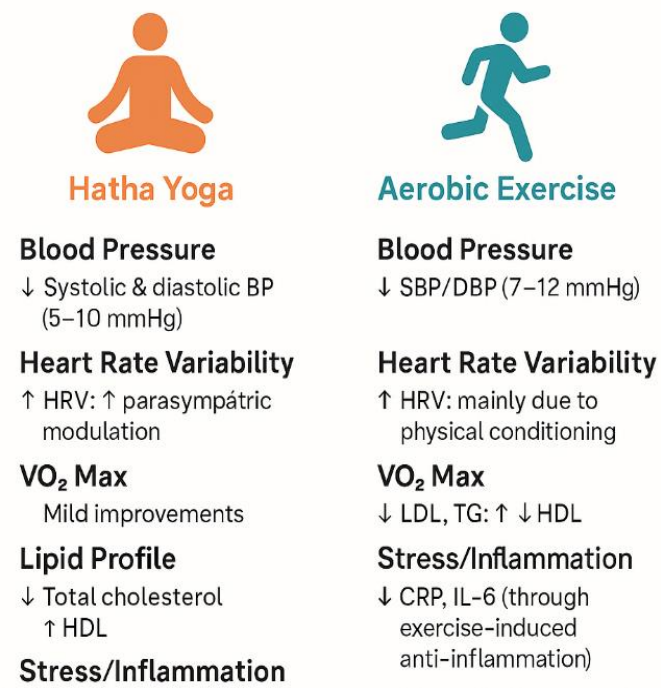

Figure 5. Comparative Summary of Cardiovascular Benefits of Hatha Yoga and Aerobic Exercise

6. RECENT COMPARATIVE AND INTERVENTIONAL STUDIES

Patil et al. (2019) The program used in this study was 12 weeks of Hatha Yoga aimed at those with hypertension. After the intervention, the patient's SBP dropped by 9 mmHg which suggests a healthy response by the nervous system and blood vessels. They said that Hatha Yoga can reduce blood pressure and play a helpful non-drug role in cardiovascular health by improving stress levels and baroreceptor functioning.

Klein et al. (2020) Overweight men in a well-organized aerobic training study showed a 21% higher VO_2 max and an 18% lower LDL-C level. The results highlight that aerobic exercise is effective for making the heart healthier, improving cholesterol metabolism and building better endurance in people as they age.

Luo & Zheng (2020) Twelve weeks of doing yoga and aerobic exercises was implemented with female students from a college. There were large improvements in how the body composition and lipid levels and these changes were especially seen with LDL-C and HDL-C. Combining yoga and aerobics in this study made it possible to improve metabolic and cardiovascular health more effectively than by practicing either activity independently.

Verma et al. (2025) A 4-week yoga module was evaluated by this randomized controlled trial in a group of healthcare workers aged between 19 and 60 years. After the intervention, we observed a better heart rate variability (HRV) which is an indicator of improved balance between the nervous system and how the vagus nerve works. Research has shown that brief yoga sessions can improve heart function for people under work stress.

Poirier et al. (2022) Researchers tested whether combining yoga with aerobic exercise in adults with hypertension has any beneficial effect. Yoga for 15 minutes before exercise reduced both systolic blood pressure and resting heart rate more than stretching before aerobics. The researchers conclude that adding basic yoga moves to a workout before aerobics increases benefits for the heart, providing a useful strategy for heart health at both medical centers and fitness facilities.

7. CLINICAL IMPLICATIONS

Results from the review point to several valuable clinical strategies for using non-pharmacological approaches in middle-aged people. People living with high blood pressure or dysfunction of their nervous system can safely begin with Hatha Yoga which can control both their systolic and diastolic blood pressure by stimulating the parasympathetic nervous system and lessening stress. This becomes very important for patients unable to exercise regularly because of other diseases or their physical limitations.

Patients seeking significant change in their heart's efficiency and their cholesterol levels usually achieve it more effectively with aerobic training. For those who have a stressful, high-stress lifestyle or recently experienced exhaustion at work, Hatha Yoga has significantly increased their HRV and lowered their cortisol, both of which are vital for good autonomic and mental health. It is important to note that doing moderate aerobic exercises and structured yoga together leads to cardiovascular benefits, as it can lower both your body's and mind's risks. Having this dual approach may also encourage exercisers as it offers something for all types of abilities and choices. When making exercises plans for people, clinicians should keep in mind these differences to match them with the patient's heart health background, current fitness and way of life.

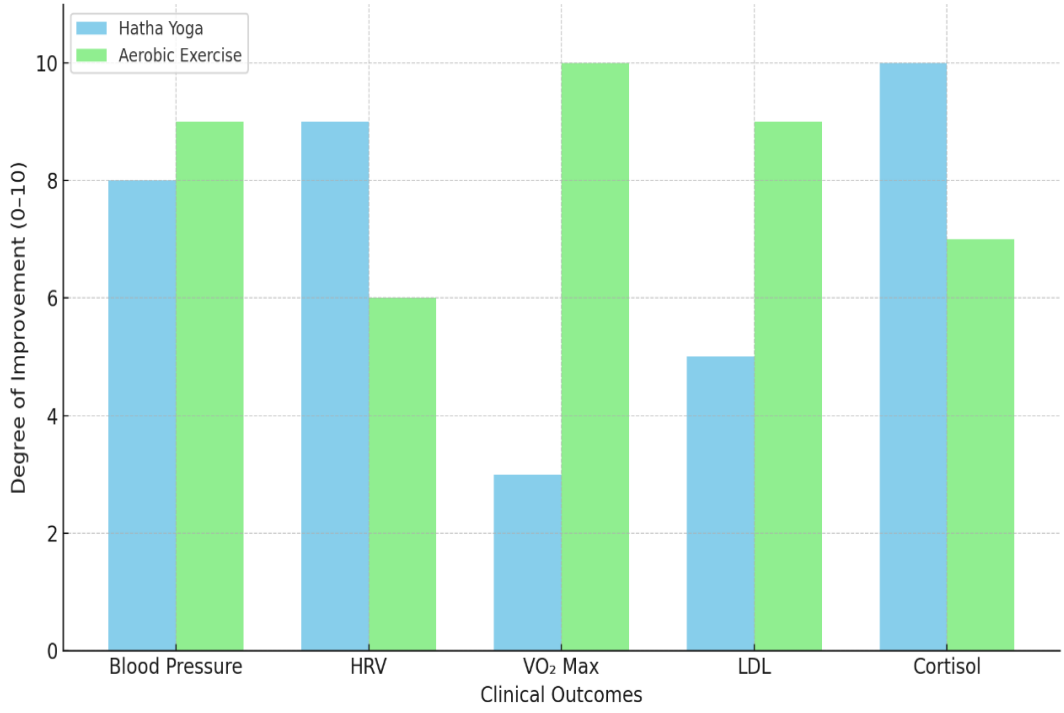

Figure 6. Effectiveness of Yoga vs. Aerobic Exercise Across Key Clinical Parameters

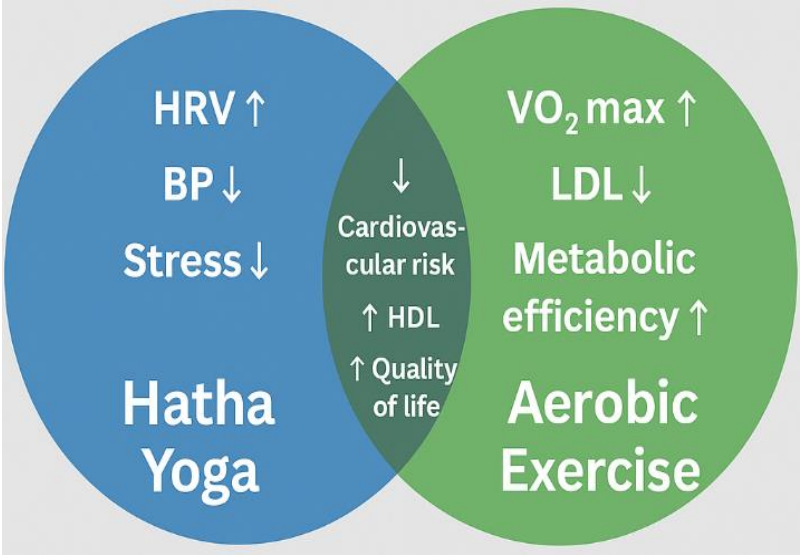

Figure 7. Shared and Unique Benefits of Hatha Yoga and Aerobic Exercise

Effectiveness of Yoga vs. Aerobic Exercise Across Key Clinical Parameters is presented in Figure 6. Shared and Unique Benefits of Hatha Yoga and Aerobic Exercise is displayed in Figure 7.

8. LIMITATIONS IN THE LITERATURE

Though more emphasis is now given to comparing Hatha Yoga and aerobic exercise, some serious issues remain in the current research. Many studies relating to yoga use small sample sizes which weakens their ability to detect differences and makes it hard for people to relate to the results. Because blinding and correct randomization were sometimes missing in various trials, this allows for bias in what is reported about outcomes. Though aerobic exercise investigations are usually stronger in their approach, they often miss controlling for important factors such as stress levels and the quality of sleep, both of which may independently affect the heart.

Studies that provide continued comparison over years between the therapies are uncommon, hampering our ability to judge the lasting outcomes of therapies. Differences in yoga methods, how long the sessions run and approaches used for study also limit direct comparison and group analysis. Since there is no standardization, it is difficult to establish global rules and use research in clinical work. Fixing these problems in future research will help create better evidence and improve exercise plans for keeping the heart healthy in people aged 45 to 64.

9. FUTURE RESEARCH DIRECTIONS

While present research shows that both Hatha Yoga and aerobic exercise are good for heart health in adults aged 40 to 60, studies in the future should try to bridge some important gaps. Using RCTs, these interventions should be carefully matched for the same duration, frequency and intensity so that dosage cannot be considered a possible influencer of the results. Using such studies would let experts uncover which intervention causes specific body changes rather than confused delivery methods. Besides, the advantages of wearable technology can be used to regularly and safely monitor HRV, VO_2 max, sleep and stress during the day. As a result, plans for intervention would be flexible and allow better tracking of results over time.

Also, gender differences should be studied when it comes to the effects of yoga and aerobic exercise, given recent research that implies cardiovascular changes caused by these activities can vary between men and women due to hormones, nerves and metabolism. It is also necessary to conduct trials in many locations to check the practicality, consistency in use and effectiveness of these interventions in various groups. It is important that any exercise used in such programs is culturally adapted, for example with localized yoga and group aerobic activity, to ensure people find them easy to access and welcome. Thanks to these future steps, care can be tailored and safer treatments can be achieved for those trying to lower their risk of heart disease.

10. CONCLUSION

The results of this study clearly demonstrate that Hatha Yoga and aerobic exercise greatly reduce the risk of heart disease for middle-aged adults. Though aerobic exercise outperforms in measures such as VO_2 max, lipid metabolism and cardiorespiratory skills, Hatha Yoga proves better for adjusting the heart's rhythm, bringing down blood pressure and helping manage psychological stress by stimulating the parasympathetic system and autonomic balance. Both styles decrease the risk of heart diseases and improve the patient's everyday life, though by different bodily processes.

It is significant that when a training protocol includes both aerobics and Hatha Yoga, people with a variety of risk factors may receive greater and total health benefits. Though there are good indications, the study remains limited by various methodology issues, small sample sets and a lack of long-term comparison.

Furthermore, strong and culturally aware studies that link technology should be used to improve how exercise is recommended for people with heart issues. Both clinicians and public health specialists should see these strategies as complementing rather than replacing each other in helping older adults maintain good heart health and avoid diseases. The study found that a strategy combining running and yoga would enhance cardiovascular health and help reduce stress. It is difficult to compare research due to variable protocols and lack of data collected over the long term. For this reason, future trials need to follow the same 12-24-week approach with samples more than 100 participants. Specially designed exercise routines may give the best results for guarding the heart health of middle-aged adults.

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