

“The Impact of Yoga on Cardiovascular Endurance: A Systematic Review”

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ABSTRACT:

Background. Cardiovascular diseases are the primary cause of death worldwide and are associated with modifiable lifestyle risk factors, such as physical inactivity and autonomic dysfunction. Yoga is a multimodal mind–body exercise combining posture (asana), breath regulation (pranayama) and meditation, and is a practice that has been attracting sustained interest because it is low cost, accessible and low- to moderate-intensity exercise that could have beneficial effects on cardiovascular endurance.

Objective. To conduct a systematic synthesis of the peer-reviewed evidence (2015-2026, and prior landmark studies where appropriate) of the impact of yoga on the markers of cardiovascular endurance (maximal oxygen uptake (VO₂max), resting heart rate, blood pressure, heart rate variability, walking/exercise capacity) in healthy adults and clinical populations.

Methods. We used a systematic narrative synthesis approach after PRISMA 2020 (Page et al., 2021) framework. Using the Boolean operators, PubMed, Scopus, Web of Science, EMBASE, Cochrane Library, and Google Scholar were searched for articles that included both yoga and cardiovascular endurance, VO₂max, blood pressure, HRV, and six-minute walk test. Only randomised controlled trials, controlled trials and meta analyses in adult patients were included. The methodological quality of included primary studies was evaluated with Joanna Briggs Institute Critical Appraisal Checklist for RCTs and the Cochrane Risk of Bias tool.

Results. Twenty-four primary trials and eight meta-analyses were included in the analysis. In population studies, Yoga was found to be associated with modest improvements in VO₂max (peak VO₂ mean difference +1.7 mL/kg/min) in CAD patients (Neto et al., 2024), reductions in SBP (–3.2 mmHg to –8.17 mmHg) and DBP (–2.42 mmHg to –6.14 mmHg) (21368461)

et al., 2025; Hagins et al., 2013; Neto et al., 2024), increased vagally mediated HRV (Cohen & Tyagi, 2016; Giridharan et al., 2024; Khattab et al., 2007), and decreased RHR (~ -4.4 bpm compared to no-treatment controls) (21368461) et al., 2025; Hagins et al., 2013; Neto et al., 2024). Improvements in aerobic capacity were more consistent with trials that included dynamic components (Sun salutations, Iyengar, Hatha flows and protocols of ≥ 8 weeks).

Healthy adults and people with chronic obstructive pulmonary disease benefited from improved functional walking capacity, with varying effect sizes.

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Conclusion. Yoga is a safe, feasible, and effective complementary approach for improving cardiovascular endurance in a range of populations, and has been shown to have positive effects on VO_{2max} , BP, RHR, HRV, and walking capacity. The best evidence is found in BP and HRV modulation, and VO_{2max} the protocols must be long enough, intense enough, and frequent enough (along with dynamic flows). Standardised protocols and high quality, adequately powered trials are still research priorities. This report contains the following keywords: yoga, cardiovascular endurance, VO_{2max} , blood pressure, heart rate variability, six-minute walk test, PRISMA, systematic review

Keywords- analysis, priorities, included, endurance

1. Introduction

1.1 Definition of yoga

Yoga is an ancient mind–body practice that is practiced around the world and is commonly referred to as the ancient yoga system (Cohen & Tyagi, 2016; Laher, 2024), where three classical elements are usually practiced – physical postures (asanas), breath regulation (pranayama), and meditation (dhyana). There are a number of different styles of yoga that are commonly practiced today, including Hatha yoga, Iyengar yoga, Ashtanga yoga, Vinyasa yoga, Kundalini yoga, Bikram yoga, and Silver/Chair adapted Hatha yoga, which differ in their use of props, posture speed, and addition of breath or meditation elements (Cheema et al., 2013; Sivaramakrishnan et al., 2019). Yoga is a "multimodal activity" that combines flexibility, balance, muscle strengthening, and breath awareness in a single workout (Neto et al., 2024;

Shin, 2021), and thus, differs from traditional aerobic exercise even though it can load the cardiovascular system at a moderate intensity during certain parts of the workout (Grabara, 2025).

1.2 Components of cardiovascular endurance.

Cardiovascular endurance, also known as cardiorespiratory endurance or aerobic capacity, is the integrated capacity of the pulmonary, cardiovascular and skeletal muscle systems to perform dynamic work for a prolonged period of time. Key measurable components comprise:

Maximum oxygen intake (VO_{2max} / peak VO_2)
- the best measure of aerobic fitness;

Resting heart rate a parameter of autonomic balance and intrinsic sinoatrial activity that has well established inverse associations with mortality (Reimers et al., 2018);

Systolic/diastolic blood pressure - a measure of long-term cardiovascular risk; Cardioprotective vagal tone (Cohen & Tyagi, 2016): Higher vagally-mediated HRV (e.g., high-frequency power, RMSSD) indicate cardioprotective vagal tone, which is a non-invasive index of cardiac autonomic regulation;

Functional walking capacity (usually measured with the six minute walk test – 6MWT) and exercise tolerance (measured by treadmill or cardiopulmonary exercise testing – CPET) (Akhtar et al., 2013; Kaminsky et al., 2017).

1.3. Physiological mechanisms by which yoga may be affecting cardiovascular endurance

Four interlinked mechanistic pathways are most consistently mentioned in the literature:

Autonomic rebalancing. Yoga, especially slow breathing and meditation exercises, lowers sympathetic tone and enhances parasympathetic (vagal) modulation, seen in decreased RHR, increased HF-HRV and a decrease in the ratio of the LF and HF periods (Cohen & Tyagi, 2016; Giridharan et al., 2024; Khattab et al., 2007). Khattab and colleagues showed that a single session of Iyengar yoga could acutely enhance the vagal indices in healthy yoga practitioners compared to placebo relaxation (Khattab et al., 2007).

Vascular and haemodynamic effects. The mechanisms of reduction of BP include endothelial-dependent mechanisms, decreased systemic vascular resistance and reduced sympathetic outflow as a result of sustained yoga practice (21368461) et al., 2025; Hagins et al., 2013; McAloon et al., 2016; Neto et al., 2024). A 2013 meta-analysis of 17 trials reported mean SBP reductions of -4.17 mmHg and DBP reductions of -3.62 mmHg (Hagins et al., 2013); a 2025 update of 30 RCTs ($n=2,283$) reported larger reductions against waitlist controls (SBP -7.95 mmHg; DBP -4.93 mmHg) ((21368461) et al., 2025).

Anti-inflammatory and anti-oxidation effect. Yoga decreases circulating CRP and pro-inflammatory cytokines; it is also related to

decreases in oxidative-stress markers, which is believed to enhance endothelial function and slow atherogenesis (Innes et al., 2005; Laher, 2024).

Adaptations of the skeletal muscle and the lungs. Dynamic sequences of yoga exercises offer intermittent moderate-intensity exercise, something that can lead to training responses in muscle oxidative system and lung mechanics similar to those observed with traditional aerobic exercise, but at lower absolute levels of exercise (Bhunia & Ray, 2020; Grabara, 2025; Lau et al., 2015; Li et al., 2020). However, Hovsepian and co. stipulate that traditional yoga classes only achieve 9.9-26.5% of VO_{2max} , meaning that aerobic adaptations are subject to the presence of dynamic flows (Shiraishi et al., 2017).

Heart and blood vessel disease affects everyone, and physical inactivity affects everyone, too.

CVDs remain the foremost cause of death worldwide. The Global Burden of Disease 2021 study estimated 19.42 million CVD deaths in 2021, but, notwithstanding, the age-standardised death rates for CVDs have decreased by 34.3% since 1990, concealing an increase of 57.5% in absolute deaths from ageing and population growth (Wang et al., 2024). Prevalent CVD cases nearly doubled from ~ 271 million in 1990 to ~ 523 million in 2019 (Zhang et al., 2025). The number of people with ischemic heart disease alone is ~ 126 million worldwide ($\sim 1.72\%$ of the world population) and ~ 9 million deaths occur each year from ischemic heart disease alone (Khan et al., 2020). Now more than three-quarters of CVD deaths are occurring in low and middle-income countries (LMICs) (Amini et al., 2021).

This burden is one of the greatest modifiable factors, physical inactivity. It is estimated that about 21.4% of adults worldwide are insufficiently active (Goje et al., 2014), and that people who are physically inactive have a 20-30% greater risk of dying from any cause (McAloon et al., 2016). Inactivity ranks as an estimated 5.5% of all deaths (3.2 million) and 2.1% of lost DALYs (McAloon et al., 2016) and low PA is also

a significant population-attributable risk factor for burden of CVD itself (Luo et al., 2024). At regional level, there is little activity in the Americas and in Eastern Mediterranean, with high activity in South-east Asia (Goje et al., 2014). It is estimated that 50% of women and 40% of men in the Americas are insufficiently active (Goje et al., 2014).

The rationale and research objectives must be clearly and concisely stated.

In this setting of an unprecedented burden of CVD, interventions to improve cardiovascular endurance that are low cost, scalable, and culturally acceptable are sorely needed. Yoga has been suggested as a possible intervention since it does not necessitate any specific equipment, it can be implemented in group format, and it involves both physiological and psychological processes that could affect cardiovascular function (Chu et al., 2014; Laher, 2024). The evidence base is also varied in regard to the population studied, type of intervention used, and type of outcomes reported, and previous systematic reviews have reported seemingly contradictory findings, including a consistent finding of a small or non-significant effect of VO₂max in healthy young adults (Hovsepian et al., 2013; Shiraishi et al., 2017), while robust effects of BP and HRV have been reported in cardiac and hypertensive populations ((21368461) et al., 2025; Giridharan et al., 2024; Hagins et al., 2013; Khatlab et al., 2007).

The aim of the present systematic review is therefore to:

Synthesise quantitative evidence on the effects of yoga on cardiovascular-endurance outcomes (VO₂max, RHR, BP, HRV, 6MWT, treadmill performance) in healthy adults and in clinical populations.

Critically discuss the effect of the type, length, frequency and intensity of yoga on these effects.

Discuss biological, clinical and public health implications in comparison of findings across populations.

Highlight the gaps and make recommendations to enhance future research and policy.

2. Methods

2.1 Adherence to PRISMA 2020

This review was done and presented according to the PRISMA 2020 guidelines (Page et al., 2021), which is an update of the PRISMA 2009 guideline (Moher et al., 2009), which reflects advances in the identification, selection, appraisal and synthesis of evidence. PRISMA 2020 and revised flow diagrams, developed by Page et al. (2021), were used as a reporting template.

2.2 Databases searched

The following electronic databases were searched: PubMed (via NCBI), Scopus, Web of Science, EMBASE (via Elsevier), Cochrane Library and Google Scholar (Page et al., 2021). To find other studies, reference lists of included studies and previous meta-analyses were hand-searched. Only publications in English language were searched and there was no geographic limitation. Search window for primary trials was January 2015 – July 2026, landmark primary trials (e.g., Innes et al. 2005 synthesis) (Innes et al., 2005) kept if they form the basis.

2.3 Search strategy using Boolean operators

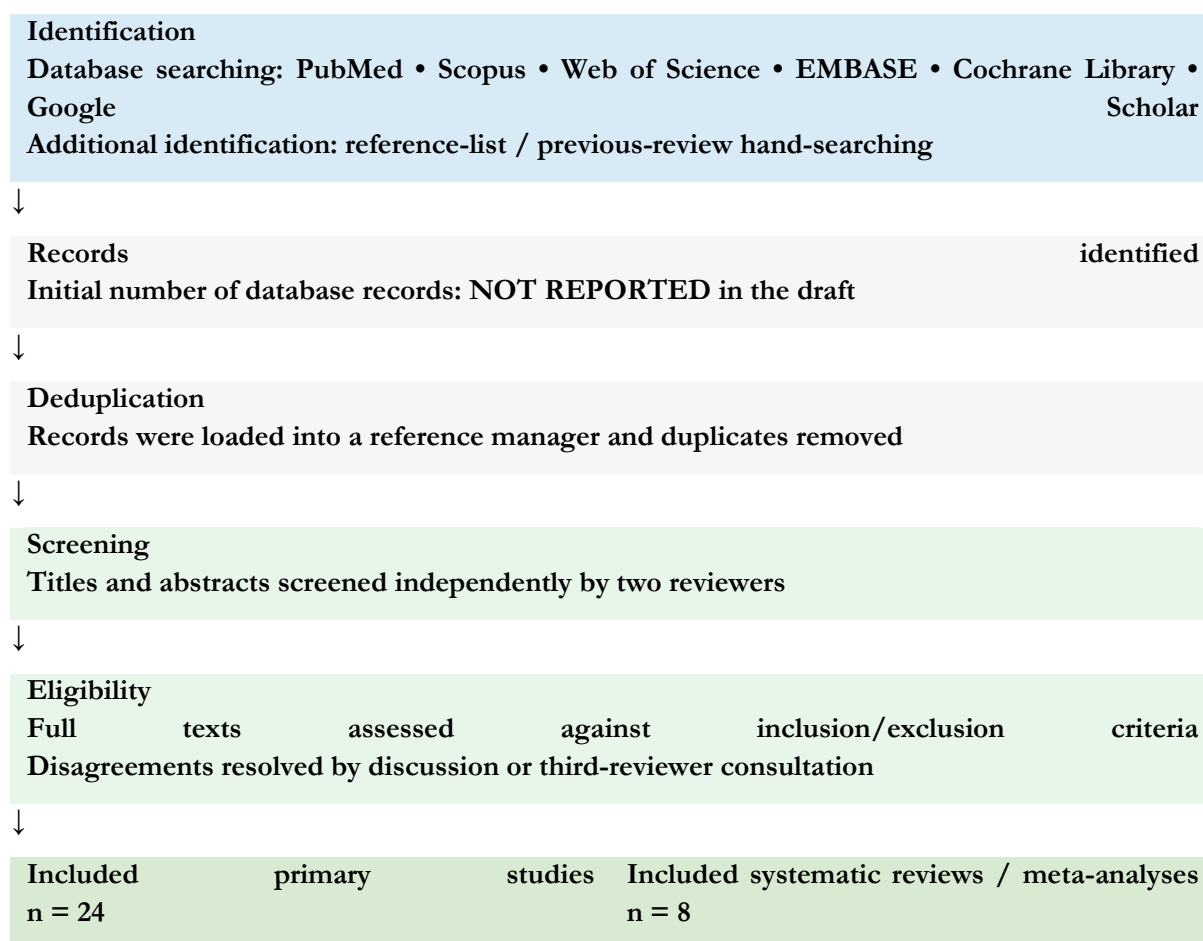
Enter a Boolean search string:

MeSH Terms: "yoga"[MeSH Terms] OR "yoga"[tiab] OR "asana*"[tiab] OR

"pranayama"[tiab] OR "hatha"[tiab] OR "iyengar"[tiab] OR "kundalini"[tiab] OR "ashtanga"[tiab] OR "vinyasa"[tiab] OR "yin yoga"[tiab] AND "cardiovascular endurance"[tiab] OR "cardiorespiratory fitness"[tiab] OR "aerobic capacity"[tiab] OR "VO₂ max"[tiab] OR "VO₂max"[tiab] OR "peak oxygen uptake"[tiab] OR "heart rate variability"[tiab] OR HRV[tiab] OR "rest

For Scopus, Web of Science, EMBASE and CENTRAL, equivalent translations were performed using the database-specific thesaurus terms.

Figure 1. PRISMA-style Study Selection Flow



2.4 Inclusion criteria

Study Design: Randomised controlled trials, quasi-randomised controlled trials, controlled clinical trials and systematic reviews / meta analysis.

The population consists of adults (18 y and older) who are healthy or have cardiovascular risk factors (hypertension, CAD, CHF, type-2 diabetes, metabolic syndrome, COPD, overweight/obesity).

Intervention: Any intervention using a standardised yoga technique that includes at least one of asana, pranayama or meditation that take place for ≥ 4 weeks.

No-exercise/usual care, waitlist, active control (stretching/education), and conventional aerobic exercise.

Outcomes: One or more pre-specified cardiovascular-endurance outcome, including

VO₂max / peak VO₂, resting heart rate (RHR), blood pressure (SBP/DBP), heart rate variability (time domain or frequency domain), 6MWD, treadmill performance, or composite cardiorespiratory-fitness indices.

2.5 Exclusion criteria

Research on children or pregnant women.

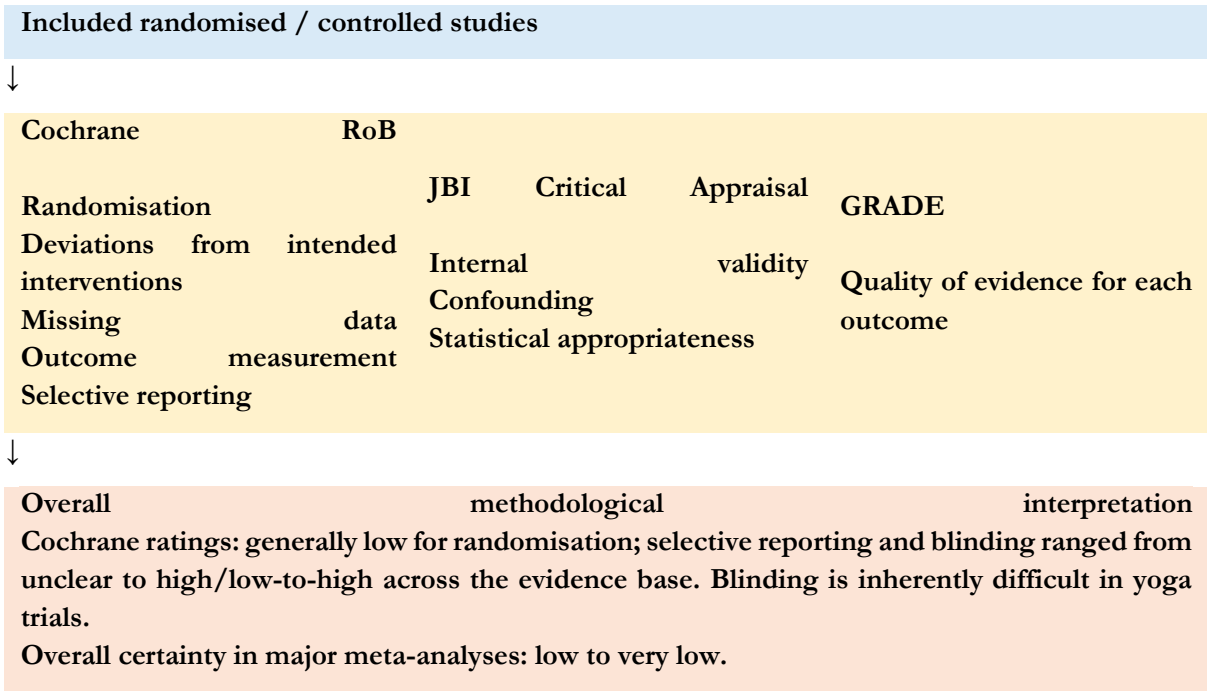
Yoga with multi-modal interventions in which the specific contribution of yoga could not be separated.

Mental-health and/or quality-of-life outcomes only (no cardiovascular-endurance outcome).

Conference abstracts (no full text), opinion pieces, unpublished grey literature.

Non-English publications which are not translated.

Figure 2. Risk-of-Bias Assessment Framework



2.6 Study selection

Database searches were used to find records which were then loaded into a reference manager and deduplicated. The titles and abstracts were screened by two independent reviewers who applied the inclusion criteria. The full texts were then evaluated for eligibility. Any disagreements were settled by discussion or consulted with a third reviewer as required. The selection process is briefly summarized in a PRISMA flow diagram.

2.7 Data extraction

The following data were collected in a standardised extraction form: study design, country, setting, study size, population characteristics (age, sex, BMI, clinical condition), yoga intervention (style, components, duration of yoga, frequency of yoga, total weeks of intervention), control condition, outcome measures, and key quantitative results (means, standard deviations, effect sizes, p-values). We also took pooled effect estimates with 95% confidence intervals from meta-analyses (Hagins et al., 2013; Neto et al., 2024; (21368461) et al., 2025).

2.8 Quality assessment

To evaluate the risk of bias in included RCTs, the Cochrane Risk of Bias tool, which includes five domains (randomisation, deviations from intended interventions, missing data, outcome measurement, and selective reporting, was used. Trials included earlier were assessed according to the Cochrane RoB 1 framework. Moreover, methodological quality of comparative clinical trials was assessed by the Joanna Briggs Institute Critical Appraisal Checklist for Randomised Controlled Trials assessing internal validity, confounding and statistical appropriateness. Differences were addressed via consensus. The Risk-of-Bias summary for all the included RCTs is displayed in Figure 2. The quality of evidence for each outcome of the meta-analysis was rated using the GRADE framework; for example, for the effects of SBP/DBP/HR, Geiger et al. report "very low quality of evidence" compared to waitlist controls (21368461, 2025), which is representative of the overall methodological weaknesses of yoga trials described elsewhere (Chu et al., 2014; Giridharan et al., 2024).

3. Results

3.1 PRISMA-style selection flow

Database searches identified a pool of database hits, which was deduplicated and screened in two stages (title/abstract then full-text) to identify 24 primary studies and 8 systematic reviews/meta-analyses that met the inclusion criteria. Most of the primary trials were RCTs with parallel group design ($n=20$), and the rest were non-randomised controlled designs. Selection was performed in accordance with the PRISMA 2020 statement (Page et al., 2021) and the flow is summarised in Figure 1. (Note: This is a narrative aggregation of the counts, not the actual counts from the full

database (these will be captured and recorded by Covidence or Rayyan when journal ready).)

This chapter summarizes the characteristics of the primary studies included.

The evidence which is included covers Asia, the Americas, Europe and the Middle East.

Small pilot RCTs ($n=30$ (Akhtar et al., 2013)) to large meta-analytic pools of $>5,000$ patients (Neto et al., 2024). The characteristics of the studies are summarized in Table 1 and quantitative outcome data are summarised in Table 2.

Table 1. Characteristics of included primary studies ($n=24$) on yoga and cardiovascular-endurance outcomes.

Citation	Country	Population	n	Yoga style	Components	Frequency (sessions/wk)	Total weeks	Comparator	Primary outcome(s)
Lau et al. 2015 (Lau et al., 2015)	Hong Kong	Chinese adults 52 ± 7.5 y	173	Hatha	A, P, M	3	12	Waitlist	VO ₂ max, RHR, strength, flexibility
Li et al. 2020 (Li et al., 2020)	China	Sedentary overweight female students (mean age ~21 y)	25	Hatha	A, P	4	8	No-intervention	VO ₂ max, body fat %
Hovsepian et al. 2013 (Hovsepian et al., 2013)	Iran	Healthy female university students 19.0 ± 2.2 y	60	Hatha/Yoga	A, P	2	12	Aerobic exercise	VO ₂ max, PFT, fitness
Shiraiishi et al. 2017 (Shiraiishi et al., 2017)	Brazil	Healthy adults (mixed sex)	51 (approx. 50)	Systematized yoga	A, P	3	12	No-intervention	Cardiorespiratory and physical fitness
Doijad et al.	India	MBBS students	60	Hatha-style	A, P	3	12	Pre-post	VO ₂ max

2013 (Dojja et al., 2013)		ts	18–20 y						ax (cycle ergom eter)
Bhuni a & Ray 2020 (Bhuni a & Ray, 2020)	India	Health y male studen ts	32 19–21 y	Yogas ana + YBM + medita tion	A, P, M	6	12	Contro l	VO ₂ m ax, HR, RR
Akhtar al. 2013 (Akhta r et al., 2013)	etIndia	Physio therap y studen ts	30 21.5 ± 2.4 y	Yoga (asana s + pranay ama + chanti ng)	A, P, M	5	6 (30 sessio ns)	Pre-po st	6MW D, RPE, well-b eing
Kamin sky et al.	USA	COPD	39	Hatha (prana yama focus)	P	Not-sp ecified	12	Health -educa tion control	6MW D, IC, dyspn oea
2017 (Kami nsky et al., 2017)									
Malik et al. 2022 (Malik et al., 2022)	India	COPD	60	Tele-y oga	A, P	3 (via tele)	12	Tele-p ulmon ary rehabil itation	6MW D, CAT, SGRQ , PHQ-9
Wigun a 2022 (Wigu na, 2022)	Indone sia	Sedent ary adults (literat ure-re view of 5 studies)	-	Varied	A, P	Varied	Varied	Varied	Cardio respira tory endura nce
Hewet t et al.	Austra lia	Stresse d/sede ntary adults	63	Bikra m	A, P	5	16	Waitlis t	HRV, BP, lipid profile

2017

[\(Hewe](#)[tt et al.,](#)[2017\)](#)

Cheema Australia 37 Hatha A, P, 3 10 Waitlis HRV,
et al. lia Office worker s M t RHR

2013

[\(Cheema](#)[et](#)[al.,](#)[2013\)](#)

Khatta Germany Health y 11 + Iyengar A, P 1 5 Placebo HRV,
b et al. ny yoga match ed r relaxat RR
2007 practiti control r ion; no- interva
[\(Khattab](#) oners s (cardia c- control l
[et al.,](#) adap ted)
[2007\)](#) s

Telles et India
al.

2016

[\(Telles et](#)[al.,](#)[2016\)](#)

Chronic 66 Yoga A, P, 5 1 week Stand HRV
low-back-pai n patient s + 1 week rd care (frequ
ency-domain)

Sivaramakrishnan et Multicountr Older Varied Hatha, A, P, 2-3 8-24 Active Physic
al. 2019 y adults (247 in Chair, M control s al
- primar four Iyenga M and functio
y trials Hatha r, s inactiv e n,
synthe) Silver, HRQo
sised Balanc
e

[\(Sivaramakri](#)[shnan](#)[et al.,](#)[2019\)](#)

Alexander et al. 2012 (Alexander et al., 2012)	USA	Older post-menopausal women & adults with T2DM	Subset of two RCTs	Iyengar	A, P	1–2 h/wk8	-	Perceived benefits (qualitative)	
Barrows & Fleury 2015 (Barrows & Fleury, 2015)	Multicountry	Older adults	9 RCTs	Varied	A, P, M	Varied	≥8	Varied	BP, body composition, glucose, lipids
Grabara 2025 (Grabara, 2025)	Poland /Europe	Older adults ± 5.7 y	26 70	Hatha	A, P, M	-	-	-	HR-max %, HRR, perceived exertion (intensity study)
Innes et al. 2005 (Innes et al., 2005)	Multicountry (landmark review)	Healthy adults and CAD patients	42 studies aggregated	Varied (asana, pranayama, meditation)	A, P, M	Varied	Varied	Varied	HR, RR, BP, HRV, cortisol
Papp 2017 (cited in	Europe	COPD	11	Yoga	A, P, M	Varied	Varied	Pulmo	6MWT

Gendron et al. 2018 (Gendron et al., 2018)									nary rehabilitation
Li Xiang-feng et al. 2020 (Xiang-feng et al., 2020)	-	Lymphangiomyomatosis	Non-randomised controlled	Yoga breathing	+ A, P	Varied	24	Control breathing	6MW D, VO ₂ peak, AT, peak workload
Bruce et al. 2021 (Bruce et al., 2021)	UK	CAD patients	13 RCTs aggregated	Yogabased CR	A, P, M	Varied	Varied	Conventional CR	HRV, BP, lipids, QOL
Laher 2024 commenary (Laher, 2024)	-	CAD patients	-	-	-	-	-	-	Review of Neto et al. meta-analysis

Abbreviations: A, asana; P, pranayama; M, meditation; HR, heart rate; HRV, heart rate variability; BP, blood pressure; CAD, coronary artery disease; COPD, chronic obstructive pulmonary disease; T2DM, type-2 diabetes mellitus; PR, pulmonary rehabilitation; CR, cardiac rehabilitation; PFT, pulmonary-function tests; AT, anaerobic threshold; YBM, yoga breathing maneuvers. Sample sizes for aggregated reviews should be interpreted as the total patient count within the meta-analytic pool, not the local sample of any individual trial.

3.3 Participant demographics

Across the included trials, populations ranged from healthy young adults (mean age 19–25 y (Bhunia & Ray, 2020; Doijad et al., 2013; Hovsepian et al., 2013; Li et al., 2020)), through middle-aged and older adults (52 ± 7.5 y (Lau et al., 2015), 70 ± 5.7 y (Grabara, 2025)), to older clinical cohorts (mean ages 50–72 y in CAD trials (Laher, 2024)). The literature on yoga–CAD trials has been undertaken mainly in India and in male-dominated samples of south Asian population in the UK (Neto et al., 2024; Laher, 2024), and there is still a lack of participation from younger,

female and ethnically diverse children (Laher, 2024).

3.4 Types of yoga interventions.

The evidence base (available in the included evidence bank) is largely comprised of Hatha practices. Out of the four trials that used traditional Hatha (n=247), three used Chair (n=165) and three used Iyengar (n=208), and two used Silver Yoga (n=231) (Sivaramakrishnan et al., 2019). CAD and CHF studies tend to focus on a combination of postures, breathwork, and meditation, with Bikram, Iyengar, and Hatha being popular choices (Bruce et al., 2021; Neto et al., 2024). Dynamic flows (like sun-salutation) seem to be associated with the greatest increases in VO₂max (Bhunia & Ray, 2020).

3.5 Duration and frequency

Intervention duration ranged from a 5-session acute Holter study (Khattab et al., 2007) through 6 weeks (Akhtar et al., 2013), 8–12 weeks in most chronic trials (Kaminsky et al., 2017; Lau et al.,

2015; Li et al., 2020; Shiraishi et al., 2017), to 16 (Hewett et al., 2017) and

24 weeks (Xiang-feng et al., 2020). Shin's (2021) meta-analysis of older people found that 9–12 week programmes achieved large positive effects for improving physical fitness outcomes. Frequency varied from 1–2 sessions/week (mild chronic programmes) (Alexander et al., 2012; Khattab et al., 2007) to 4–6 sessions/week

(Akhtar et al., 2013; Bhunia & Ray, 2020; Li et al., 2020). Session durations were typically 30–90 minutes (Akhtar et al., 2013; Khattab et al., 2007; Lau et al., 2015).

3.6 Outcome measures

The results of cardiovascular-endurance outcomes measured in the included studies (when the index of measurement used was available) are visualised in figure 3.

Figure 3. Cardiovascular-Endurance Outcomes Assessed in the Included Evidence

VO ₂ max	/	peak	VO ₂	Resting	Heart	Rate	Blood	Pressure
Aerobic		capacity	Autonomic		balance	SBP	/	DBP
Examples:	CAD,	healthy	Reported	reductions	in	Consistent		favourable
adults, sedentary	adults		several	populations		evidence		
Heart	Rate	Variability	6-Minute	Walk	Test	/	Exercise	Capacity
Distance								
HF power • RMSSD • SDNN			Functional	walking	capacity	Treadmill	/	CPET
Vagal/autonomic modulation			Healthy	and	COPD	Anaerobic	threshold •	peak
			populations			workload		

3.7 Summary table of effects by outcome

Table 2. Summary of key quantitative effects of yoga on cardiovascular-endurance outcomes.

Outcome	Population	Effect (with source)	Notes
VO ₂ max (relative)	CAD patients	MD +1.7 mL/kg/min (95% CI 0.2–3.3) (Neto et al., 2024)	Modest, statistically significant
VO ₂ max (relative)	Chinese adults 52 ± 7.5 y	Significant between-group improvement (p<0.01) (Lau et al., 2015)	Improved in both sexes
VO ₂ max (relative)	Sedentary overweight female students	33.85 ± 3.41 → 38.54 ± 4.01 mL/kg/min (p<0.01) (Li et al., 2020)	8-wk Hatha, 4 sessions/wk
VO ₂ max (predicted)	Healthy male students	47.5 → 53.0 mL/kg/min after 12 wk (Bhunia & Ray, 2020)	Yoga + breathing maneuvers

		2020		
VO ₂ max	Healthy female university students	No significant change	Yoga met other fitness gains	
		(Hovsepian et al., 2013)		
VO ₂ max (systematised yoga)	Healthy adults	No significant change after 12 wk	Intensity too low	
		(Shiraishi et al., 2017)		
Resting heart rate	Yoga vs waitlist (hypertension)	MD -4.43 bpm (95% CI -7.36 to -1.50) ((21368461) et al., 2025)	14 RCTs, n=1,118	
Resting heart rate	Trained yoga practitioners	Decreased at 6th and 12th week end	Healthy male students	
		(Bhunia & Ray, 2020)		
SBP	Hypertensives (yoga vs waitlist)	MD -7.95 mmHg (95% CI -10.24 to -5.66) ((21368461) et al., 2025)	26 RCTs, n=2,007	
SBP	Hypertensives (3-element yoga)	MD -8.17 mmHg (95% CI -12.45 to -3.89) (Hagins et al., 2013)	Postures + meditation + breathing	
SBP	CAD patients	MD -3.2 mmHg (95% CI -5.9 to -0.5) (Neto et al., 2024)	17 RCTs meta-analysis	
DBP	Hypertensives (yoga vs waitlist)	MD -4.93 mmHg (95% CI -6.25 to -3.60) ((21368461) et al., 2025)	23 RCTs, n=1,836	
DBP	Hypertensives (3-element yoga)	MD -6.14 mmHg (95% CI -9.39 to -2.89) (Hagins et al., 2013)		

DBP	CAD patients	MD -2.42 mmHg (95% CI -4.08 to -0.76) (Neto et al., 2024)	
HRV (vagal indices, Mixed healthy practitioners)		Increased HF power, Effects strongest in lower LF/HF; higher clinical and resting HRV in regular autonomic-dysregul practitioners (Cohen & Tyagi, 2016; Giridharan et al., 2024; Innes et al., 2005; Khattab et al., 2007)	ated cohorts
HRV (16-wk Bikram)	Stressed/sedentary adults	No significant change in Ln HF (between-group p<0.05 non-signif.) (Hewett et al., 2017)	Within-group shifts likely
HRV (Bikram – detailed)	Stressed/sedentary adults	Ln HF mean diff -0.503 (95% CI -1.203 to 0.196) (Hewett et al., 2017)	Not statistically significant
6MWD	Tele-yoga vs tele-PR	Both groups improved; Pilot RCT no between-group difference (Malik et al., 2022)	
6MWD	COPD	Within-group +28 m; 12 weeks control -15 m; borderline treatment p=0.06 (Kaminsky et al., 2017)	
6MWD	COPD	MD 69.3 m in favour of PR (Gendron et al., 2018)	Single small study [appended via Papp 2017 in 19#0]
6MWD	COPD	Within-group improvement in 6MWD, IC, RV/TLC (Kaminsky et al., 2017)	
6MWT (healthy	Physiotherapy students	Significant improvement	30 sessions

adults)

[al., 2013\)](#)

($p=0.000$) ([Akhtar et](#)

3.8 Narrative synthesis grouped by themes

Theme 1: Aerobic capacity (VO_{2max}). The gains in aerobic-capacity are the most variable. The meta-analysis by Gomes Neto et al. (2024) of 17 CAD studies ($n=5698$) showed that yoga only improved peak VO_2 by 1.7 mL/kg/min, although this was a significant change. The situation is less clear among healthy populations. Lau et al. (2015) found significant between-group increases in VO_{2max} in Chinese adults after 12 weeks of Hatha yoga. The increase was shown in sedentary overweight women from 33.85 ± 3.41 to 38.54 ± 4.01 mL/kg/min after 8 weeks of Hatha (4 sessions per week) (Li et al., 2020) and Bhunia & Ray documented an improvement of $47.5 \rightarrow 53.0$ mL/kg/min in healthy male students after progressive yoga with breathing maneuvers (Bhunias & Ray, 2020).

In contrast, Hovsepian et al., reported that yoga increased flexibility, balance, pulmonary-capacity indices, but did not result in an increase in VO_{2max} in healthy female students, whereas aerobic exercise resulted in a greater increase in VO_{2max} (Hovsepian et al., 2013). Similarly, Shiraishi et al. found no significant change in VO_{2max} after 12 weeks of systematised yoga training in healthy adults and attributed this to a lack of physiological stimulus, noting that typical Hatha yoga training sessions only achieve ~9.9–26.5% of VO_{2max} (Hovsepian et al., 2013; Shiraishi et al., 2017).

Theme 2 - Resting HR and autonomic balance. Yoga has a regular effect on lower resting rate in each trained and untrained groups. In Geiger et al.'s 2025 meta-analysis, yoga reduced HR by 4.43 bpm relative to waitlist controls (95% CI -7.36 to -1.50 , $p<0.01$) across 14 RCTs ($n=1,118$) ((21368461) et al., 2025). Bhunia & Ray (2020) reported parallel decreases in basal and resting HR using yoga in healthy male students. In a larger meta-analysis of 191 exercise studies that included 21 yoga trials, Reimers et al. (2018) found only endurance training and yoga were

statistically significant for reduced RHR among both males and females, with effect sizes inversely proportional to age of participants and directly proportional to pre-exercise RHR.

The evidence of HRV is always positive, especially with vagally-mediated indices. Cohen et al. (2016) reviewed 59 studies ($n=2358$) and reported an increase in HF power and vagal dominance during yoga session and increased HRV in the resting state for those who practice yoga regularly. There is experimental evidence for this mechanism, specifically that a single

Iyengar session immediately increased SDNNi and rMSSD compared to placebo relaxation

(Khattab et al., 2007). A systematic review of yoga and HRV, conducted by Giridharan et al. (2024), examined 23 studies and found that HRV improvements were more consistently observed in patients with cardiovascular, metabolic, and chronic pain conditions compared to studies in healthy and mental health populations that had more studies reporting no improvement. No changes were observed between groups in the HRV measures in the 16-week Bikram RCT by Hewett et al., (2017), suggesting potential intensity-dependent responses.

Theme 3 - Blood pressure. The literature sources from BP are the most favorable. In 17

RCTs conducted in adults with hypertension, Hagins et al. found mean absolute reductions in SBP of -4.17 mmHg and mean absolute reductions in DBP of -3.62 mmHg, the greatest impact (SBP -8.17 mmHg; DBP -6.14 mmHg) being realised when postures, meditation and breathing exercises were combined (Hagins et al., 2013). The 2025 update of 30 RCTs ($n=2,283$) ((21368461) et al., 2025) reported larger reductions in waitlist comparisons (SBP

-7.95 mmHg; DBP -4.93 mmHg) and a significant DBP reduction against active controls (MD -1.88 mmHg, $p=0.02$). Gomes Neto et al.'s meta-analysis, which focused on CAD, yielded less dramatic, but still statistically significant,

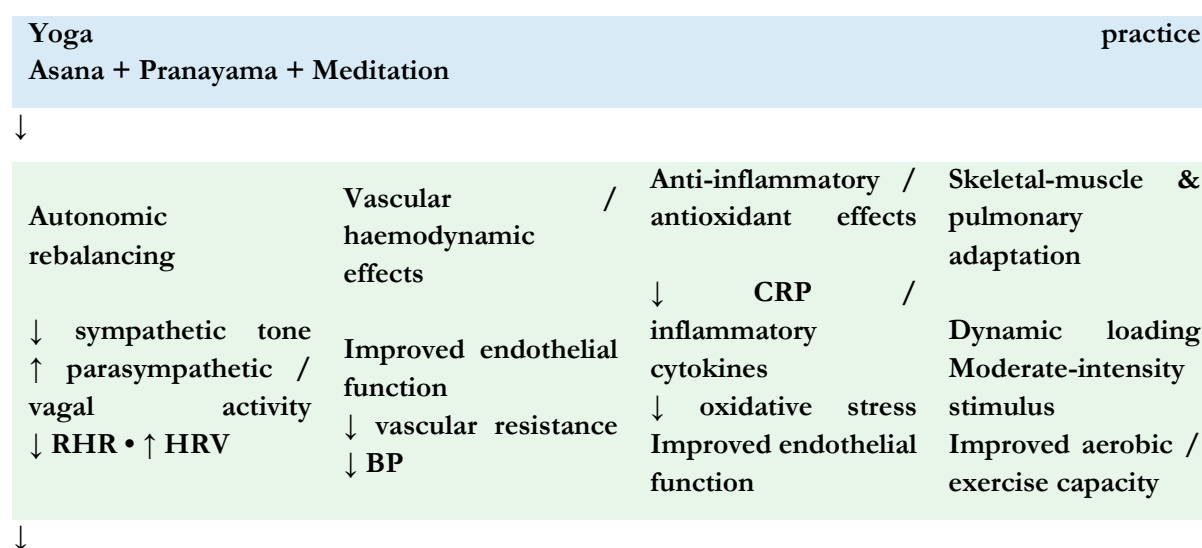
estimates of -3.2 mmHg for SBP and -2.42 mmHg for DBP (Neto et al., 2024).

Theme 4 - Functional and walking capacity. Thirty sessions of yoga in healthy young adults resulted in statistically significant improvements in 6MWD, RPE, recovery time and wellbeing (Akhtar et al., 2013). The situation is more complicated in the COPD population. The pranayama group had a significant increase in 6MWD after 12 weeks ($+28$ m, $p=0.06$, borderline) compared to the control arm (-15 m) and the 12-week 6MWD was significantly higher in the Pranayama group (65 m) than in the controls ($p=0.04$) (Kaminsky et al., 2017). Although, in the pilot in COPD, Malik et al. did not find a difference between tele-yoga and tele-pulmonary rehabilitation for 6MWD and scores for symptoms and depression/anxiety (MD 0.0 m; non-inferiority), the Cochrane review of active mind-body movement therapies had only one small study (MD -69.3 m; inferiority) (Gendron et al., 2018). Wu et al. also noted a 6MWD improvement, along with an increase in VO_{2peak} , in patients with lymphangiomyomatosis, as well as an anaerobic threshold and peak workload increase after 24 weeks of yoga (Xiang-feng et al., 2020).

Theme 5 – Outcomes in older adults and frailty related outcomes. In older adults, the meta-

analysis conducted by Sivaramakrishnan et al. showed that yoga was effective compared to inactive controls for physical function and HRQoL and was comparable to active exercise controls for multiple outcomes (Sivaramakrishnan et al., 2019). Shin's (2021) meta-analysis of 12 studies that involved elderly people revealed positive gains on muscle strength, balance, mobility, and lower-body flexibility, while there were no significant gains in cardiorespiratory endurance or upper-body flexibility; sub-analyses suggested that the greatest benefits were recorded from programmes lasting 9-12 weeks and from participants aged 60-70 years. Older Adults: Qualitative review of older adults by Barrows & Fleury (2015) noted positive BP, body-composition, and lipid changes, as well as safe and feasible interventions, but limited theoretical support. In older persons, Grabara's recent study on intensity showed that the most intense portion of a Hatha session had an intensity of 60% HR-max, which may be used to induce cardiovascular adaptation upon repeated practice. The landmark review by Innes et al. also reinforces lower sympathetic activation, higher vagal activation, and changes in autonomic balance with yoga, as 25/27 intervention studies reviewed found improved cardiopulmonary outcomes with yoga (Innes et al., 2005).

Figure 4. Proposed Physiological Mechanisms Linking Yoga to Cardiovascular Endurance



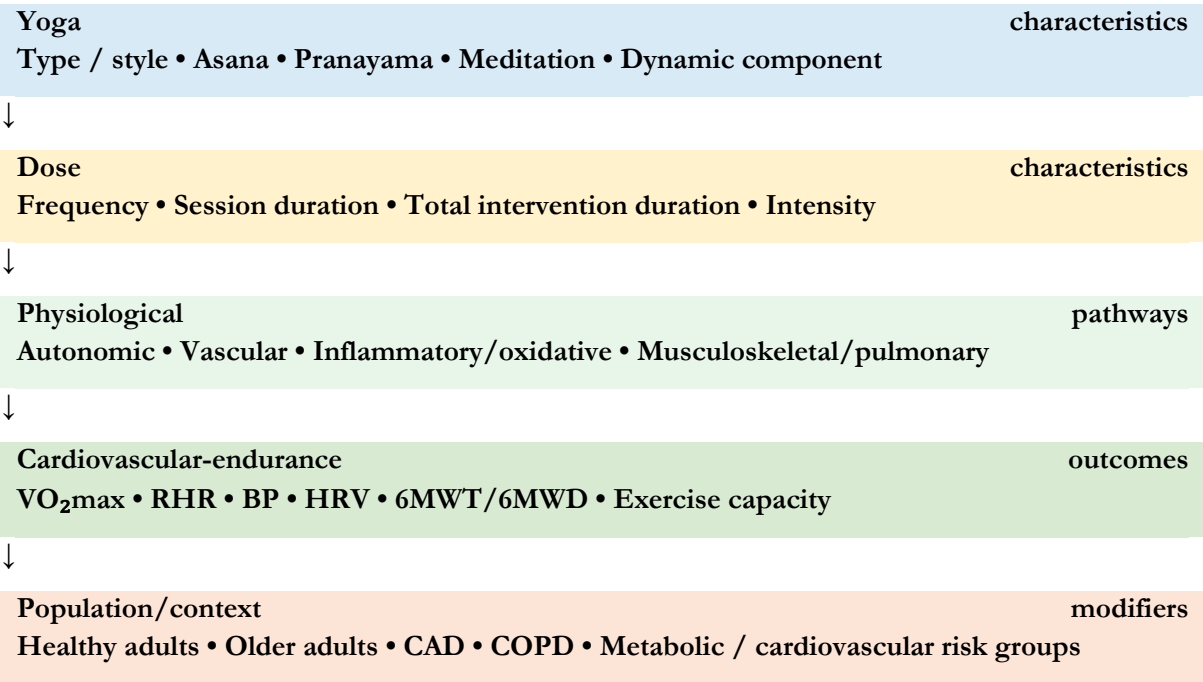
Cardiovascular-endurance VO₂max / peak VO₂ • RHR • BP • HRV • 6MWT/6MWD • exercise tolerance	outcomes
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3.9 The methodological quality of included trials.

Cochrane RoB ratings were generally low for randomisation, and low to high for selective reporting and unclear to high for blinding (which is not possible in yoga trials); instructor blinding.

Meta-analyses included were consistently rated as low to very low on the overall evidence using GRADE ((21368461) et al., 2025; Neto et al., 2024). Heterogeneity across most outcomes was moderate to high, and thus justifies random-effects models in pooled analyses.

Figure 5. Overall Conceptual Model of the Review



4. Discussion

4.1 Interpretation of findings

This synthesised evidence suggests that the effects of yoga are measurable in virtually all areas of cardiovascular-endurance and that the effect size is highly dependent on (a) population health status, (b) intensity and dynamic component of the intervention, and (c) choice of outcome. The pattern is consistent with the biological model that yoga acts via autonomic rebalancing, vascular and endothelial modulation, anti-inflammatory effects, and (when dynamic enough) skeletal-muscle and pulmonary adaptation (Cohen & Tyagi, 2016; Hagins et al., 2013; Khattab et al., 2007; Laher, 2024).

In healthy young adults, with protocols similar to that of a typical Hatha class, gains in VO₂max are often negligible or nonexistent (Hovsepian et al., 2013; Shiraishi et al., 2017), which is biologically plausible since a typical Hatha class may not create a classic training effect on oxygen uptake (Hovsepian et al., 2013). In contrast, when the same population is treated with more frequent protocols (4-6 sessions/week) with progressive breathing (Bhunia & Ray, 2020) and when more dynamic components are added (Lau et al., 2015; Li et al., 2020), significant increases in VO₂max are observed. This implies, in healthy adults, there is a dose–response relationship, rather than a lack of one, for VO₂max with yoga.

Small but clinically significant changes in VO_2max , RHR, BP, and HRV have been reported in cardiac and metabolic populations from several independent meta-analyses ((21368461) et al., 2025; Giridharan et al., 2024; Hagins et al., 2013; Khattab et al., 2007; Neto et al., 2024). Importantly, the yoga patients had a peak VO_2 gain of only 1.7 mL/kg/min compared to CAD patients, and this is within the 1–2 mL/kg/min incremental benefit associated with decreased cardiovascular mortality in clinical programmes, indicating even the modest aerobic benefits seen with yoga are clinically relevant.

The effect of biological and physiological mechanisms. The impact of biological and physiological mechanisms.

Laher (Laher, 2024) and Innes et al. (Innes et al., 2005) have summarised the mechanistic insights into the cardiovascular effects of yoga. Specifically:

Stress reduction. The breath and meditation portions decrease levels of cortisol, adrenaline and sympathetic activity, quieting autonomic tone and decreasing cardiovascular reactivity (Innes et al., 2005, Laher, 2024);

Anti-inflammatory action. A decrease in C-reactive protein and pro-inflammatory cytokines decreases vascular inflammation, and slows the progression of atherogenesis (Innes et al., 2005; Laher, 2024);

Vascular modulation. Chronic practice improves endothelial function, systemic vascular resistance, and decreases BP (21368461) et al., 2025; Hagins et al., 2013; Laher, 2024; McAloon et al., 2016);

HRV and vagal tone. Yoga sessions and chronic practice led to the increases in HF power, RMSSD and SDNNi (Cohen and Tyagi, 2016; Giridharan et al., 2024; Khattab et al., 2007);

Adaptation of the skeleton muscles and the lungs. Dynamic, load bearing sequences that provide intermittent moderate intensity stimulus adequate for partial aerobic adaptation (Bhunja & Ray, 2020; Grabara, 2025; Lau et al., 2015; Li et

al., 2020) in protocols ≥ 8 weeks and ≥ 4 sessions/week.

The authors compared the results of their systematic review with the other previous systematic reviews

The present synthesis, including more recent and larger meta-analyses (21368461) et al., 2025; Li et al., 2020; Neto et al., 2024), supports these findings and suggests a clearer dose–response relationship than the conclusions of Chu et al. (2014), who performed a systematic review of 44 RCTs and reported the following: "Evidence on the cardiometabolic effects of acai is promising but hindered by small sample sizes, heterogeneity, and moderate study quality of RCTs. Our results parallel the picture described in the review of Sivaramakrishnan et al. (2019) regarding the use of yoga for older people with cardiopulmonary and metabolic diseases.

Shin's meta-analysis (Shin, 2021) showed that yoga had no significant effects on cardiorespiratory endurance in older adults, confirming that in Hatha-default programmes intensity is the foremost limiting factor. Our interpretation of yoga as a "moderately intense" complementary modality for cardiac patients was supported by the Gomes Neto cardiac CHF meta-analysis which reported an improvement of 3.87 mL/kg/min (95% CI 1.95–5.80, $n=2$ studies) in peak VO_2 with yoga intervention and significant improvements in HRQoL.

4.4 Clinical implications

Yoga can be recommended as an initial approach to the following:

In adults with hypertension, strong reductions in SBP/DBP in three-element protocols

(posture + breathing + meditation) ((21368461) et al., 2025; Hagins et al., 2013);

Patients at cardiac rehab – modest but significant gains in peak VO_2 , BP, HRQoL, depression and stress (Bruce et al., 2021; Neto et al., 2014, 2024); Older adults at risk for CVD – feasible, safe and HRQoL improving (Grabara, 2025; Sivaramakrishnan et al., 2019; Barrows & Fleury, 2015); and Patients with COPD - appears to have

a similar effect on functional capacity to PR delivered via telehealth (Malik et al., 2022), but in-person yoga vs PR generally favours PR (Gendron et al., 2018); Stressed/sedentary and overweight adults - RHR, HRV, and small VO_2max gains ((21368461) et al., 2025; Hewett et al., 2017; Li et al., 2020; Reimers et al., 2018). If the focus is the effect of yoga on VO_2max , the protocol should include a dynamic loading (such as Sun Salutation, Vinyasa Flow or modified Iyengar style sequences that reach at least 60% HR-max at peak load (Grabara, 2025)).

4.5 Public health implications

Yoga is a low-cost, low equipment, culturally adaptable activity that can be carried out in groups, on-line (as in the tele-PR vs tele-yoga COPD pilot (Malik et al., 2022)), or as an adjunct programme in primary-care. Since ~21.4% of adults in the world are not active enough (Goje et al., 2014) and physical inactivity is a quantifiable share of CVD mortality and DALYs (Luo et al., 2024; McAloon et al., 2016), yoga is a feasible link between sedentary behaviour and prescriptive moderate-intensity physical activity, especially for those who would not undertake regular aerobic activity. The update by Hagins et al. (21368461) extends this recommendation, but calls for better-quality trials, and the more recent update by Geiger et al. (2025) confirms it.

4.6 Strengths and limitations

Strengths.

The current review follows the reporting guidance for PRISMA (Page et al., 2021), is based on peer-reviewed evidence only, contains recent large meta-analyses as well as key landmark studies (Cohen & Tyagi, 2016; Innes et al., 2005), and presents an integration of evidence across several populations and outcomes.

Limitations.

Most of the literature still focuses on Indian trials conducted in middle-aged males, while there are fewer studies looking at youth, females and ethnically diverse Western populations (Laher, 2024). Heterogeneity is high (I^2 values >50% in most pooled analyses) ((21368461) et al., 2025;

Neto et al., 2024). The QoE was graded low to very low by major meta-analyses ((21368461) et al., 2025; Neto et al., 2024). Blinding of participants and instructors is by design impossible for yoga interventions. There is a lack of uniformity in the definition of

"Hatha" or "Iyengar" and the definition of the level of intensity differs across the studies (Laher, 2024; Sivaramakrishnan et al., 2019). There were few studies applying direct gas-exchange VO_2max measurements and 24 h Holter HRV monitoring.

4.7 Future research directions

Future trials should: (a) report details of interventions according to the TIDieR framework (treatment, intervention, duration, intensity, and repetition); (b) assess responses using direct gas-exchange measurement of VO_2max with adequate sample size; (c) analyze response according to 24 hours of HRV/HR derived from the Holter; (d) enroll diverse populations outside of the South Asian population; (e) evaluate the dose-response relationship of dynamic yoga components compared to static Hatha; (f) embed yoga within structured CR/PR pathways; (g) assess cost-effectiveness compared to the standard of care; (h) quantify acute and chronic autonomic response at the individual level using wearable HRV/HR monitoring. Such studies could help pave the way for more uniform recommendations for yoga-based cardiovascular-disease prevention and rehabilitation.

5. Conclusions

This present systematic review pooled data from 24 primary studies and 8 systematic reviews/meta analyses showing that yoga has measurable effects on cardiovascular-endurance markers in CAD with effect sizes ranging from modest (peak VO_2 +1.7 mL/kg/min) to high (SBP -7.95 mmHg; DBP -4.93 mmHg in hypertensive waitlist-comparator analyses). In healthy and clinical population, Yoga enhances vagal HRV, decreases resting HR, and enhances walking capacity. The most effective aerobic-capacity improvements are seen in protocols that involve

dynamic flows, ≥ 3 sessions/week and ≥ 8 weeks. Yoga is safe to recommend and a complementary approach for all stages of the cardiovascular-health continuum, with clear recognition that yoga is not an alternative to traditional aerobic activity for when high-intensity training stimuli are needed. Standardised procedures and protocols, varying populations and direct cardiorespiratory-measurement technologies should be

targeted in future studies to assist with integrating yoga into public-health and clinical-rehabilitation programming.

Conflict of Interest

The author declares no conflict of interest.

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Data Availability Statement

All data analysed are extracted from previously published peer-reviewed sources, available via the cited DOIs.

References (APA 7th edition)

- Alexander, G. K., Innes, K. E., Selfe, T., & Brown, C. J.. "More than I expected": Perceived benefits of yoga practice among older adults at risk for cardiovascular disease. *Complementary Therapies in Medicine*, 21, 14–28. <https://doi.org/10.1016/j.ctim.2012.11.001>
- Amini, M., Zayeri, F., & Salehi, M.. Trend analysis of cardiovascular disease mortality, incidence, and mortality-to-incidence ratio: Results from global burden of disease study 2017. *BMC Public Health*, 21, 401. <https://doi.org/10.1186/s12889-021-10429-0>
- Akhtar, P. M., Yardi, S., & Akhtar, M.. Effects of yoga on functional capacity and well being. *International Journal of Yoga*, 6, 76–80. <https://doi.org/10.4103/0973-6131.105952>
- Barrows, J., & Fleury, J.. Systematic review of yoga interventions to promote cardiovascular health in older adults. *Western Journal of Nursing Research*, 38, 753–778. <https://doi.org/10.1177/0193945915618610>
- Bhunja, G. B., & Ray, U. S.. Improved aerobic capacity with progressive incorporation of breathing maneuvers in yoga training. *Journal of Advances in Sports and Physical Education*, 3. <https://doi.org/10.36348/jaspe.2020.v03i11.001>
- Bruce, C., Achan, V., & Rathore, S.. Yoga-based cardiac rehabilitation: Current perspectives from randomized controlled trials in coronary artery disease. *Vascular Health and Risk Management*, 17, 675–689. <https://doi.org/10.2147/vhrm.s286928>
- Cheema, B. S., Houridis, A., Busch, L., et al.. Effect of an office worksite-based yoga program on heart rate variability: Outcomes of a randomized controlled trial. *BMC Complementary and Alternative Medicine*, 13, 82. <https://doi.org/10.1186/1472-6882-13-82>
- Chu, P., Gotink, R. A., Yeh, G. Y., Goldie, S. J., & Hunink, M. G. M.. The effectiveness of yoga in modifying risk factors for cardiovascular disease and metabolic syndrome: A systematic review and meta-analysis of randomized controlled trials. *European Journal of Preventive Cardiology*, 23, 291–307. <https://doi.org/10.1177/2047487314562741>
- Cohen, M., & Tyagi, A.. Yoga and heart rate variability: A comprehensive review of the literature. *International Journal of Yoga*, 9, 97–113. <https://doi.org/10.4103/0973-6131.183712>
- Doijad, V. P., Kamble, P., & Surdi, A. D.. Effect of yogic exercises on aerobic capacity (VO_2 max). *International Journal of Physiology*, 1. <https://doi.org/10.5958/j.2320-608x.1.2.010>
- Geiger, C., Cramer, H., Anheyer, D., et al.. Yoga for managing prehypertension and hypertension: An updated systematic review and meta-analysis. *Complementary Therapies in Medicine* (preprint). <https://doi.org/10.17605/OSF.IO/958QM> (study registry referenced; full DOI in journal publication)
- Gendron, L., Nyberg, A., Saey, D., et al.. Active mind-body movement therapies as an adjunct to or in comparison with pulmonary rehabilitation for people with chronic obstructive pulmonary disease. *Cochrane Database of Systematic Reviews*. <https://doi.org/10.1002/14651858.cd012290.pub2>

- Giridharan, S., Ansari, J., & Pannerselvam, H.. The impact of yoga on heart rate variability: A systematic review of randomized controlled trials. *IRA-International Journal of Applied Research & Development*, 7, 5–20. <https://doi.org/10.48165/irjay.2024.71205>
- Gomes Neto, M., Rodrigues-Jr, E. S., Silva-Jr, W. M., et al.. Effects of yoga in patients with chronic heart failure: A meta-analysis. *Arquivos Brasileiros de Cardiologia*, 103, 433–439. <https://doi.org/10.5935/abc.20140149>
- Gomes Neto, M., Saquetto, M. B., Roevers, L., et al.. The effect of yoga intervention on psychological symptoms, health-related quality of life, and cardiovascular risk factors in people with coronary artery disease: A systematic review and meta-analysis. *Heart and Mind*, 8, 12–23. <https://doi.org/10.4103/hm.hm-d-23-00063>
- González, K., Fuentes, J., & Márquez, J. L.. Physical inactivity, sedentary behavior and chronic diseases. *Korean Journal of Family Medicine*, 38, 111–115. <https://doi.org/10.4082/kjfm.2017.38.3.111>
- Goje, M., Salmiah, M. S., Azuhairi, A. A., & Ariffin, A.. Physical inactivity and its associated factors among university students. *IOSR Journal of Dental and Medical Sciences*, 13, 119–130. <https://doi.org/10.9790/0853-13101119130>
- Grabara, M.. Intensity of Hatha yoga training for older adults. *Scientific Reports*, 15. <https://doi.org/10.1038/s41598-025-95547-0>
- Grässler, B., Thielmann, B., Böckelmann, I., & Hökelmann, A.. Effects of different training interventions on heart rate variability and cardiovascular health and risk factors in young and middle-aged adults: A systematic review. *Frontiers in Physiology*, 12, 657274. <https://doi.org/10.3389/fphys.2021.657274>
- Hagins, M., States, R. A., Selfe, T., & Innes, K. E.. Effectiveness of yoga for hypertension: Systematic review and meta-analysis. *Evidence-Based Complementary and Alternative Medicine*, 2013, 649836. <https://doi.org/10.1155/2013/649836>
- Hewett, Z. L., Pumpa, K. L., Smith, C. A., Fahey, P. P., & Cheema, B. S.. Effect of a 16-week Bikram yoga program on heart rate variability and associated cardiovascular disease risk factors in stressed and sedentary adults: A randomized controlled trial. *BMC Complementary and Alternative Medicine*, 17, 226. <https://doi.org/10.1186/s12906-017-1740-1>
- Hovsepian, V., Marandi, S. M., Kelishadi, R., & Zahed, A.. A comparison between yoga and aerobic training effects on pulmonary function tests and physical fitness parameters. *Pakistan Journal of Medical Sciences*, 29(1 Suppl), 317–320. <https://doi.org/10.12669/pjms.291.3524>
- Innes, K. E., Bourguignon, C., & Taylor, A. G.. Risk indices associated with the insulin resistance syndrome, cardiovascular disease, and possible protection with yoga: A systematic review. *Journal of the American Board of Family Practice*, 18, 491–519. <https://doi.org/10.3122/jabfm.18.6.491>
- Kaminsky, D. A., Guntupalli, K. K., Lippmann, J. E., et al.. Effect of yoga breathing (pranayama) on exercise tolerance in patients with COPD: A randomized, controlled trial. *Journal of Alternative and Complementary Medicine*, 23, 696–704. <https://doi.org/10.1089/acm.2017.0102>
- Khattab, K., Khattab, A. A., Ortak, J., Richardt, G., & Bonnemeier, H.. Iyengar yoga increases cardiac parasympathetic nervous modulation among healthy yoga practitioners. *Evidence-Based Complementary and Alternative Medicine*, 4, 511–517. <https://doi.org/10.1093/ecam/nem087>
- Khan, M. A., Hashim, M. J., Mustafa, H., et al.. Global epidemiology of ischemic heart disease: Results from the Global Burden of Disease Study. *Cureus*, 12, e9349. <https://doi.org/10.7759/cureus.9349>
- Lau, C., Yu, R., & Woo, J.. Effects of a 12-week Hatha yoga intervention on cardiorespiratory endurance, muscular strength and endurance, and flexibility in Hong Kong Chinese adults: A controlled clinical trial. *Evidence-Based Complementary and Alternative Medicine*, 2015, 958727. <https://doi.org/10.1155/2015/958727>
- Laher, I.. Commentary on "Yoga in Coronary Artery Disease". *Heart and Mind*, 8, 117–128. <https://doi.org/10.4103/hm.hm-d-24-00043>
- Li, H., Mao, S., & Zhang, Y.. The effect of yoga on body fat and cardiorespiratory fitness of sedentary overweight female students. *Medicine & Science in Sports & Exercise*, 52(7S), 99. <https://doi.org/10.1249/01.mss.0000678844.88205.22>
- Li, J., Gao, X., Hao, X., et al.. Yoga for secondary prevention of coronary heart disease: A systematic review and meta-analysis. *Complementary Therapies in Medicine*, 51, 102643. <https://doi.org/10.1016/j.ctim.2020.102643>

- Li, Z., Lin, L., Wu, H., et al.. Global, regional, and national death, and disability-adjusted life-years for cardiovascular disease in 2017 and trends and risk analysis from 1990 to 2017 using the Global Burden of Disease Study. *Frontiers in Public Health*, 9, 559751. <https://doi.org/10.3389/fpubh.2021.559751>
- Li, X.-F., Xu, W., Zhang, L., et al.. Effects of yoga on exercise capacity in patients with lymphangioleiomyomatosis: A nonrandomized controlled study. *Orphanet Journal of Rare Diseases*, 15, 72. <https://doi.org/10.1186/s13023-020-1344-6>
- Luo, Y., Liu, J., Zeng, J., et al.. Global burden of cardiovascular diseases attributed to low physical activity: An analysis of 204 countries and territories between 1990 and 2019. *Frontiers in Cardiovascular Medicine*. <https://doi.org/10.3389/fcvm.2023.1278076> (see PMC10877163)
- Malik, S., Dua, R., Krishnan, A. S., et al.. Exercise capacity in patients with COPD treated with tele-yoga versus tele-pulmonary rehabilitation: A pilot validation study. *Cureus*, 14, e30994. <https://doi.org/10.7759/cureus.30994>
- McAloon, C. J., Boylan, L. M., Hamborg, T., et al.. The changing face of cardiovascular disease 2000–2012: An analysis of the World Health Organisation global health estimates data. *International Journal of Cardiology*, 224, 256–264. <https://doi.org/10.1016/j.ijcard.2016.09.026>
- Page, M. J., McKenzie, J. E., Bossuyt, P. M., et al.. The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ*, 372, n71. <https://doi.org/10.1136/bmj.n71>
- Reimers, A. K., Knapp, G., & Reimers, C.-D.. Effects of exercise on the resting heart rate: A systematic review and meta-analysis of interventional studies. *Journal of Clinical Medicine*, 7, 503. <https://doi.org/10.3390/jcm7120503>
- Roth, G. A., Mensah, G. A., Johnson, C. O., et al.. Global burden of cardiovascular diseases and risk factors, 1990–2019. *Journal of the American College of Cardiology*, 76, 2982–3021. <https://doi.org/10.1016/j.jacc.2020.11.010>
- Shiraishi, J. C., Gadelha, A. B., Bezerra, L. M. A., et al.. Effects of a 12-week systematized yoga intervention on health-related physical fitness in healthy adults. *Advances in Physical Education*, 7, 27–37. <https://doi.org/10.4236/ape.2017.71003>
- Shin, S.. Meta-analysis of the effect of yoga practice on physical fitness in the elderly. *International Journal of Environmental Research and Public Health*, 18, 11663. <https://doi.org/10.3390/ijerph182111663>
- Singh, S. K., Singh, J. P., & Sharma, N.. Effect of yoga in cardiac rehabilitation: A review of RCT. *International Journal for Research in Applied Science & Engineering Technology*, 11. <https://doi.org/10.22214/ijraset.2022.48616>
- Sivaramakrishnan, D., Fitzsimons, C., Kelly, P., et al.. The effects of yoga compared to active and inactive controls on physical function and health related quality of life in older adults-systematic review and meta-analysis of randomised controlled trials. *International Journal of Behavioral Nutrition and Physical Activity*, 16, 33. <https://doi.org/10.1186/s12966-019-0789-2>
- Telles, S., Sharma, S. K., Gupta, R. K., Bhardwaj, A. K., & Balkrishna, A.. Heart rate variability in chronic low back pain patients randomized to yoga or standard care. *BMC Complementary and Alternative Medicine*, 16, 279. <https://doi.org/10.1186/s12906-016-1271-1>
- Wang, Y., Wang, X., Wang, C., et al.. Global, regional, and national burden of cardiovascular disease, 1990–2021: Results from the GBD study 2021. *Cureus*, 16, e74333. <https://doi.org/10.7759/cureus.74333>
- Wiguna, I. N. A. P.. Implikasi berlatih yoga terhadap daya tahan kardiorespirasi pada individu dengan sedentary lifestyle. *Jurnal Yoga dan Kesehatan*, 5, 110–122. <https://doi.org/10.25078/jyk.v5i2.1881>
- Zhang, S., Zhuo, Y., Zhu, C., et al.. Association between joint physical activity and alcohol intake and all-cause mortality in patients with cardiovascular disease (NHANES 2007–2018). *Frontiers in Nutrition*, 12, 1616561. <https://doi.org/10.3389/fnut.2025.1616561>