

REVIEW ARTICLE

Evaluating the Efficacy of Sudarshan Kriya Yoga in Health Care: A Systematic Review of Randomized Controlled Trials

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ABSTRACT

Background: Sudarshan Kriya Yoga (SKY) is an advanced yogic breathing technique developed by the Art of Living Foundation. Given its widespread use in diverse therapeutic settings, a systematic review of randomized controlled trials (RCTs) was conducted to assess its efficacy in health care.

Methods: This review followed the PRISMA guidelines and used the PECO framework. We searched databases such as the Web of Science, Cochrane Library, PubMed, and Scopus from the year 2000 to 2023 using a combination of MeSH phrases and free-text keywords. The inclusion criteria were restricted to RCTs involving any demographic, with SKY as the primary intervention. The risk of bias was assessed using the Cochrane Collaboration's Risk of Bias 2.0 tool.

Results: We included 15 RCTs and synthesized the results using quantitative analysis and qualitative narrative synthesis. The findings demonstrate significant improvements in psychological well-being, especially in stress reduction and emotional regulation across different populations. In addition, SKY also showed potential in managing symptoms of post-traumatic stress disorder and physiological markers such as blood pressure and heart rate variability.

Conclusion: SKY effectively improves mental health and physiological parameters, highlighting its potential utility as a non-invasive therapeutic option. Despite its benefits, the studies varied in methodological rigor, indicating the need for further high-quality research to solidify these findings.

1. INTRODUCTION

Yoga, an ancient practice originating from India, has evolved over thousands of years into a popular holistic discipline that unifies body, mind, and spirit.^[1] Initially focused on spiritual development and tranquillity, yoga is now globally recognized for enhancing physical flexibility, mental clarity, stress reduction, and overall well-being. As yoga has integrated into Western culture, a variety of styles have emerged, each emphasizing different elements such as physical postures (asanas), meditation (dhyana), and breath control (pranayama).

Among these, Sudarshan Kriya Yoga (SKY), developed by the Art of Living Foundation, stands out for its unique use of rhythmic breathing

techniques to positively influence the autonomic nervous system (ANS). SKY includes Ujjayi, known as the "Victorious Breath," Bhastrika, or "Bellows Breath," and cyclical breathing patterns specific to Sudarshan Kriya.^[2] These practices are designed to increase parasympathetic tone and decrease sympathetic arousal, thus aiding in managing stress, anxiety, and depression. The effectiveness of SKY is supported by research showcasing its benefits on heart rate variability, endocrine function, and stress response systems, alongside improvements in emotional regulation and mental focus.^[3,4] According to the official website, the SKY program has been adopted by approximately 10,000 centers across 180 countries, reaching over 500 million individuals worldwide.^[5]

The increasing global incidence of non-communicable diseases and mental health disorders emphasizes the importance of non-invasive interventions like SKY in preventive medicine and mental health care. Research into SKY has spanned various domains, including

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stress, anxiety, depression, and post-traumatic stress disorder (PTSD), examining its effects on physiological and psychological health markers.^[6-8] However, the study rigor and methodology diversity have resulted in a fragmented understanding of SKY's effectiveness, highlighting the need for a more systematic and comprehensive review.^[9,10]

The growing integration of complementary and alternative medicine within the Western medical framework further emphasizes the need for rigorous evaluations of practices like SKY.^[11] With health-care systems increasingly adopting integrative medicine strategies that merge conventional and alternative therapies, high-quality research is crucial to scientifically validate traditional practices.

1.1. Objective

The purpose of this systematic review is to consolidate the existing research on SKY, assessing its application across various medical and psychological conditions through multiple randomized controlled trials (RCTs). Our goal is to comprehensively evaluate SKY's efficacy, address inconsistencies in previous studies, and clarify its role in health and disease management. This review offers a robust synthesis of evidence to inform future research directions and support clinical decisions regarding integrating SKY into therapeutic practices.

2. MATERIALS AND METHODS

We conducted a thorough literature search to identify RCTs that assessed the impact of SKY on various health conditions (Table 1). This was done using a combination of MeSH phrases and free-text keywords. The search encompassed databases such as PubMed, MEDLINE, Web of Science, Scopus, and the Cochrane Library and covered studies published from January 2000 to December 2023.

2.1. Eligibility Criteria

We adhered to PRISMA guidelines to ensure a transparent, rigorous, and reproducible review process.^[12] We employed the PECO framework to specify our criteria:

- Population: Individuals of any age or gender who participated in SKY studies, aiming to encompass a broad demographic.
- Exposure: Studies where SKY was implemented in a structured manner.
- Comparator: Control groups included those receiving no intervention, placebo, or alternative treatments.
- Outcome: Primarily psychological, physiological, and general well-being measures.

2.1.1. Inclusion and Exclusion Criteria

- Inclusion: Only RCTs were considered, with no restrictions on participants' demographic or geographic locations. The intervention needed to be Sudarshan Kriya, administered consistently across subjects.
- Exclusion: Observational studies, case reports, and studies with unclear or incomplete data were excluded, along with those failing to meet minimum quality thresholds as determined by risk of bias assessment tools.

Two independent reviewers (SG and SS) conducted the data extraction process to minimize bias and errors. They extracted data on predefined variables and then cross-checked their findings. In addition to manual data extraction from the included studies, we made use of the advanced

Covidence data extraction tool to streamline the initial screening and data management process. Discrepancies between the reviewers were resolved through discussion or, if necessary, adjudication by a third reviewer (SrS). PROSPERO Registration was not sought for this review as the study was initiated before the systematic registration plan.

2.2. Variables Extracted

The data extraction form included several essential fields. General information captured details such as the author(s), publication year, study title, and country of origin. Study design specifics encompassed the methodology, sample size, randomization method, and study setting. Participant data included demographics, health status, and inclusion/exclusion criteria. The intervention section detailed the sessions' duration, frequency, intensity, and instructor qualifications. Information on comparators included control conditions such as no treatment, placebo, or alternative interventions. Outcomes focused on primary and secondary metrics, including psychological well-being, physiological parameters, and adverse events. Results recorded the outcomes' statistical significance, effect sizes, and confidence intervals. In addition, the quality assessment entailed the evaluation of each study's risk of bias utilizing standardized tools.

2.3. Bias Assessment Protocol

The primary tool used for this assessment was the Risk of Bias 2.0 tool developed by the Cochrane Collaboration.^[13] This tool offered a methodical framework for evaluating bias in multiple areas, including measuring the outcome, selecting the reported result, missing outcome data, variations from intended treatments, and the randomization process. Concurrently, the Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach was used to assess the quality of evidence for each key outcome across studies.^[14] Risks of bias, imprecision, inconsistency, indirectness, and publication bias were considered in this evaluation.

3. RESULTS

During the article selection process's identification stage, 587 items were identified from all assessed databases, as showed in Figure 1. Before screening, 57 duplicate records were eliminated, leaving 530 records to be examined during the preliminary screening process. However, 49 records were excluded, as the complete content could not be located. As a result, 481 reports were obtained. In the next step, many papers were excluded from this evaluation due to pre-established criteria, such as editorials ($n = 79$), off-topic reports ($n = 80$), case reports alone ($n = 86$), scoping reviews ($n = 68$), literature reviews ($n = 69$), and studies that did not meet the PECO framework's standards ($n = 84$). Following this procedure, 15 RCTs that satisfied all inclusion criteria were deemed eligible for the review.^[15-29]

Our systematic review of fifteen RCTs revealed consistent and significant improvements in psychological well-being, particularly in stress reduction and emotional regulation, affirming SKY's efficacy across diverse settings and populations. Notable across multiple studies was SKY's role in managing PTSD symptoms, showcasing substantial benefits in trauma-related care. Given the broad scope of this review, detailed statistical outcomes and specific study characteristics can be referred to in the accompanying comprehensive table, summarizing each study's design, population, outcomes, and key findings [Table 2].

3.1. Bias Assessment Observations

The analysis depicted in Figure 2 reveals that most of the studies examined exhibited a low risk of bias across all domains, indicating robust methodological quality. Specifically, studies conducted by Agte *et al.*,^[15] Goldstein *et al.*,^[18] Janakiramaiah *et al.*,^[20] Mawar *et al.*,^[24] and Seppälä *et al.*^[26] consistently demonstrated low risk across all five domains, implying a high degree of reliability in their findings. Nevertheless, certain studies raised concerns in specific domains. For instance, Bayley *et al.*,^[16] Kjellgren *et al.*,^[21] and Sharma *et al.*^[27] showed some concerns in domain D3, signifying potential issues related to the specific interventions used or deviations from intended interventions. Chaudhari *et al.*^[17] exhibited some concerns in domain D4, possibly reflecting minor issues in measuring the outcome. In addition, Korkmaz *et al.*^[22] and Sureka *et al.*^[28] observed some concerns in domain D1, suggesting biases related to the randomization process. Gupta *et al.*^[19] and Qu *et al.*^[25] noted some concerns in domain D2, indicating potential issues with adherence to the interventions. Swain *et al.*^[29] presented concerns in both D3 and D5 and received an overall rating of some concerns, highlighting potential issues in intervention adherence and outcome measurement that could impact the interpretation of the trial results. While Mathersul *et al.*^[23] showed low risk in individual domains, an overall assessment indicated some concerns, implying that minor issues across domains may impact the study's reliability.

3.2. Population Characteristics Assessed

Agte *et al.*^[15] examined a mixed cohort of hypertensive patients and healthy adults aged 30–60. Bayley *et al.*^[16] focused on veterans with PTSD symptoms. Chaudhari *et al.*^[17] involved adults with no sleep anomalies. Goldstein *et al.*^[18] included undergraduate and graduate students. Gupta *et al.*^[19] studied lowlanders at high altitudes in Leh. Janakiramaiah *et al.*^[20] focused on individuals with melancholic depression. Kjellgren *et al.*^[21] studied adults in a university city in Sweden. Korkmaz *et al.*^[22] included physicians from diverse backgrounds. Mathersul *et al.*^[23] and Seppälä *et al.*^[26] studied U.S. veterans with PTSD symptoms. Mawar *et al.*^[24] targeted adults living with HIV. Qu *et al.*^[25] explored the effects of long-term Sudarshan Kriya and Practices (SK&P). Sharma *et al.*^[27] investigated the efficacy of SK&P in patients with major depressive disorder. Sureka *et al.*^[28] studied male prisoners diagnosed with non-psychotic psychiatric disorders. Swain *et al.*^[29] focused on menopausal women.

3.3. Intervention Details Assessed

The included studies varied in the structure, duration, and setting of SKY interventions. Several studies, such as those by Agte *et al.*^[15] and Kjellgren *et al.*,^[21] provided participants with brief, intensive SKY training followed by periods of continued practice. These setups aimed to embed the techniques effectively and assess their immediate and ongoing effects. Studies such as Bayley *et al.*^[16] and Goldstein *et al.*^[18] implemented SKY programs ranging from 6 weeks to 2 months. These interventions targeted specific populations, including veterans and students, to evaluate the therapeutic effects of SKY on stress, PTSD, and anxiety. Seppälä *et al.*^[26] and Swain *et al.*^[29] conducted year-long studies to examine the long-term impacts of SKY on PTSD and menopausal quality of life, respectively. These extended durations provided insights into the sustainability and prolonged benefits of SKY practice. Unique approaches were also noted in studies like Gupta *et al.*,^[19] which conducted SKY sessions at high altitudes, and Sureka *et al.*,^[28] which implemented SKY in a correctional setting. These studies tested the adaptability and effectiveness of SKY under

varying environmental and social conditions. Janakiramaiah *et al.*^[20] and Mathersul *et al.*^[23] provided comparative analyses of SKY against established treatments such as Electroconvulsive Therapy and Cognitive Processing Therapy, respectively, offering direct evaluations of SKY's efficacy in treating depression and PTSD.

3.4. Outcomes and Findings Assessed

Agte *et al.*^[15] observed significant reductions in diastolic blood pressure and biomarkers of oxidative stress and kidney function, although no changes were seen in lipid profiles. Gupta *et al.*^[19] reported improvements in happiness, weight, and blood pressure, highlighting the holistic benefits of SKY. Bayley *et al.*^[16] found SKY to be non-inferior to cognitive processing therapy in reducing PTSD symptoms, though it showed mixed results for depression and affect over 1 year. Goldstein *et al.*^[18] and Kjellgren *et al.*^[21] demonstrated significant improvements in stress, sleep, social connectedness, anxiety, and depression, enhancing general well-being and psychological resilience. Janakiramaiah *et al.*^[20] presented SKY as an effective non-pharmacological intervention comparable to imipramine and slightly less effective than electroconvulsive therapy for depression.

Korkmaz *et al.*^[22] noted reductions in stress and anxiety and improved professional fulfillment and burnout among physicians, underscoring SKY's applicability in high-stress environments. Mawar *et al.*,^[24] Seppälä *et al.*,^[26] and Swain *et al.*^[29] reported improved quality of life for individuals with HIV, PTSD reduction among veterans, and enhanced menopausal quality of life, respectively. Qu *et al.*^[25] observed molecular changes and more differentially expressed genes in the SKY group, suggesting potential physiological benefits. Chaudhari *et al.*^[17] and Mathersul *et al.*^[23] observed improvements in sleep quality and emotional regulation, with SKY enhancing physiological markers of emotional regulation.

3.5. Certainty Bias Assessed

The GRADE certainty assessment collectively demonstrated that SKY could significantly improve psychological and physiological health parameters in diverse populations and settings [Table 3]. The risk of bias was assessed as low to moderate, suggesting that while studies were generally well-conducted, there may be concerns regarding the completeness of reporting or the potential influence of uncontrolled variables. The low inconsistency among studies implies that findings were generally consistent across different research contexts and populations, enhancing confidence in the robustness of the evidence. The indirectness was low, indicating that the research directly addressed relevant clinically meaningful outcomes, such as improvements in psychological well-being, management of PTSD symptoms, reduction in stress, and physiological health markers such as blood pressure and gene expression changes. The assessment noted low imprecision, which suggests that the results across studies were sufficiently precise to draw reliable conclusions about the effects of SKY without significant wide confidence intervals or sparse data.

4. DISCUSSION

Our systematic review confirms the general efficacy of SKY in enhancing psychological well-being and managing stress-related disorders across a range of populations and settings. The SKY technique employs specific breathing sequences to influence the ANS. Key techniques include:

4.1. *Ujjayi (Victorious Breath)*

This method activates the parasympathetic nervous system (PNS), leading to relaxation and reduced heart rate through slow inhalation and prolonged exhalation, enhancing vagal tone.

4.2. *Bhastrika (Bellows Breath)*

This technique stimulates the sympathetic nervous system (SNS) through rapid, forceful breaths, resulting in a temporary increase in heart rate and blood pressure. This is followed by a state of calm indicative of controlled stress (hormesis).

4.3. *Cyclic Patterns*

These patterns regulate both the SNS and PNS, commencing with rapid cycles to stimulate the SNS, then slowing down to reinforce PNS dominance, ultimately training the body's stress response systems for improved resilience.

The significant improvements in stress reduction, emotional regulation, and psychological health reported in multiple studies align with SKY's purported mechanisms of modulating autonomic functions and enhancing mental focus.^[30-32] The findings suggest that SKY could be effectively integrated into mental health programs, particularly those targeting mood disorders, anxiety, and PTSD. Healthcare providers might consider training in SKY techniques to offer an alternative or complementary treatment option alongside conventional therapies. The variability in health outcomes across studies illustrates SKY's adaptability and broad therapeutic potential. For instance, its benefits in managing PTSD symptoms and improving physiological parameters such as blood pressure and heart rate variability highlight its role in both psychological and physical health domains.

While the existing literature on yoga and mindfulness is robust, it often faces methodological challenges such as small sample sizes and the lack of strong control or comparison groups. Our systematic review addresses this gap by providing a comprehensive evaluation of SKY across a broad spectrum of physiological and psychological health outcomes, making it one of the first studies to assess SKY's effects holistically. Unlike previous studies which tended to focus on specific areas such as sleep, stress, or anxiety, our review encompasses a wider range of health domains, thereby enriching the body of evidence on SKY and identifying areas needing further exploration.

Several specific studies highlight the variable but generally positive impacts of SKY on health. For instance, Castro *et al.* observed that SKY typically enhances sleep quality, although the results varied among individuals.^[33] Kumawat *et al.* noted differing effects of SKY on anxiety and depression across different individuals, suggesting personalized impacts.^[34] Moreover, Zope *et al.* emphasized SKY's benefits in reducing stress and modulating immune function during the COVID-19 pandemic, underscoring its potential utility in crisis situations.^[35]

Despite the robust findings supporting the efficacy of SKY, the variability in methodological rigor among studies and the heterogeneity in populations and outcomes assessed limit the generalizability of the results. Future research should standardize methodologies and employ larger sample sizes, including conducting longitudinal studies, better to understand the long-term impacts, and underlying mechanisms of SKY. In addition, exploring gene expression changes and physiological adaptations in diverse demographic groups could elucidate the molecular underpinnings of SKY's effects. While none of the included studies reported adverse events, this should not be interpreted as definitive evidence of the absence of such events. Many studies in the

broader yoga literature do not systematically assess or report adverse effects, which may affect the availability of data regarding potential negative outcomes associated with SKY. Therefore, while the findings suggest that SKY may be a safe non-invasive therapeutic option, further research with a systematic approach to safety assessment is required to comprehensively evaluate its risk profile.

Given SKY's cost-effectiveness and non-invasiveness, policymakers could consider its integration into public health initiatives, particularly in settings where conventional mental health services are limited. Tailoring SKY interventions to specific populations or health conditions could maximize its therapeutic potential and ensure its benefits are as inclusive as possible.

5. CONCLUSION

The included studies indicated significant improvements in stress reduction, emotional regulation, and overall mental health, particularly in populations dealing with psychological disorders such as PTSD, anxiety, and depression. In addition, some research suggested that SKY influences physiological parameters such as blood pressure and oxidative stress, further hinting at its holistic health benefits. However, the findings were mixed regarding the specific health outcomes, and the populations studied, reflecting the diverse applications and contexts in which SKY was examined. Methodological variations and limitations among the studies, such as differences in study designs, sample sizes, and measurement tools, also posed challenges in drawing uniform conclusions about SKY's efficacy.

6. ACKNOWLEDGMENTS

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7. AUTHORS' CONTRIBUTIONS

All the authors contributed equally in design and execution of the article.

8. FUNDING

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9. ETHICAL APPROVALS

This manuscript not required ethical approval as it is a review study.

10. CONFLICTS OF INTEREST

Nil.

11. DATA AVAILABILITY

This is an original manuscript and all data are available for only review purposes from principal investigators.

12. PUBLISHERS NOTE

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Table 1: Databases and search strings utilized

Database	Search string
PubMed	("Sudarshan Kriya"[MeSH Terms] OR "Sudarshan Kriya"[Title/Abstract]) AND ("randomized controlled trial"[Publication Type] OR "RCT"[Title/Abstract] OR "clinical trial"[MeSH Terms]) AND ("mental health"[MeSH Terms] OR "psychological wellbeing"[Title/Abstract] OR "stress reduction"[Title/Abstract])
Cochrane	TITLE-ABS-KEY ("Sudarshan Kriya" AND "randomized controlled trial") AND (TITLE-ABS-KEY ("anxiety" OR "depression" OR "stress") AND [TITLE-ABS-KEY ("outcome measures" OR "efficacy")])
Scopus	(TITLE-ABS-KEY ("Sudarshan Kriya" AND "breathing technique") AND [ALL ("randomized" OR "clinical trial")]) AND [TITLE-ABS-KEY ("cardiovascular" OR "blood pressure" OR "heart rate variability")]
Web of Science (WoS)	TS=("Sudarshan Kriya" AND "controlled trial") AND TS=("mental health outcomes" OR "physiological effects") AND TS=("long-term effects" OR "follow-up") AND LANGUAGE: (English)

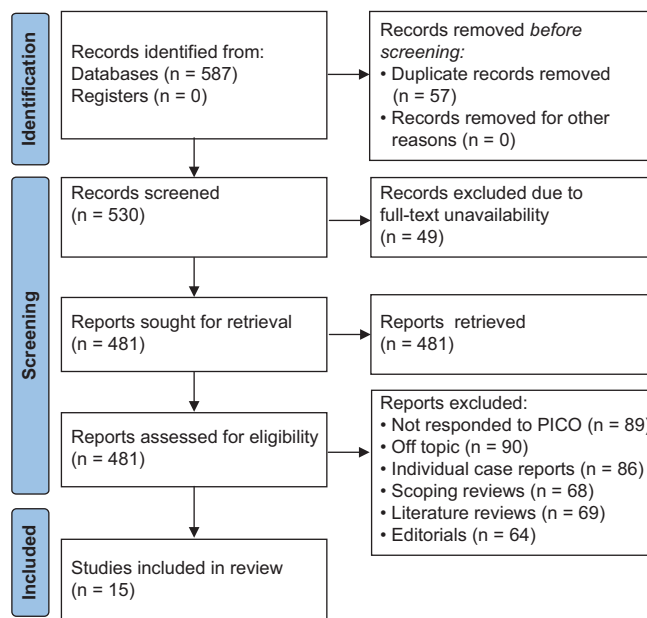


Figure 1: Article selection process representation of the review

Table 2: Studies included in the review and their observed assessments

Study ID	Population details	Intervention details	Duration	Primary outcomes	Statistical findings	Conclusions
Agte <i>et al.</i> ^[15]	55 hypertensive patients, 58 healthy adults, 30–60 y.o.	6-day SKY training followed by 2 months of practice	2 months	Blood pressure, malondialdehyde levels, kidney function, lipid profiles, glucose levels	Significant reduction in DBP in hypertensives; significant decrease in MDA and urea levels; non-significant changes in lipids	SKY normalized extreme physiological values; beneficial for hypertensives
Bayley <i>et al.</i> ^[16]	85 veterans with PTSD symptoms, majority male, mean age 56.9	15-h SKY workshop, followed by weekly sessions	6 weeks	PCL-C, BDI-II, PANAS	SKY non-inferior to CPT in reducing PTSD symptoms at 6 weeks, 1 month, and 1 year; mixed results on depression and affect at 1 year	SKY effective as CPT for PTSD management in veterans
Chaudhari <i>et al.</i> ^[17]	105 adults without sleep anomalies	Daily 30 min SKY sessions for 8 weeks	8 weeks	ESS for daytime sleepiness	Significant improvements in ESS scores for SKY group compared to controls at 4 and 8 weeks; larger effect in obese participants	SKY significantly reduces excessive daytime sleepiness
Goldstein <i>et al.</i> ^[18]	Undergraduate and graduate students (<i>n</i> =69)	Randomized to SKY or WOW workshops, matched for duration and group size	3 months	Perceived stress, sleep, social connectedness, distress, anxiety, depression, conscientiousness, self-esteem, life satisfaction	SKY showed greater improvements in self-report measures than WOW. Heart rate stress reactivity improved in both groups.	SKY may offer unique benefits over cognitive-based stress management in improving various psychological parameters.
Gupta <i>et al.</i> ^[19]	Lowlanders at high altitude in Leh (experimental and control group)	4-day SKY breathing technique protocol at high altitude	Immediate assessment	Happiness (OHQ), weight, BMI, waist and hip circumference, blood pressure	Significant improvements in OHQ, anthropometric and physiological parameters in SKY group ($P \leq 0.001$) versus non-significant in control	SKY can induce positive psychological and physiological changes in challenging environments like high altitudes.
Janakiramaiah <i>et al.</i> ^[20]	Melancholic depressives (<i>n</i> =45, randomized into SKY, ECT, and IMN groups)	SKY, ECT, and IMN treatments assessed weekly over 4 weeks	4 weeks	Depression severity (BDI, HDRS)	No difference in depression reduction among groups; SKY not inferior to IMN, slightly less effective than ECT at week 3	SKY can be a potential first-line alternative to conventional treatments for melancholia without significant side effects.
Kjellgren <i>et al.</i> ^[21]	Adults in a small university city in Sweden (<i>n</i> =103, 55 in SK&P group and 48 controls)	6-day intensive SK&P program followed by 6 weeks of daily practice	6 weeks	Anxiety, depression, stress, optimism (Hospital anxiety depression scale, life orientation test, stress and energy test)	Significant reductions in anxiety, depression, stress, and increased optimism in SK&P group ($P < 0.001$)	SKY significantly enhances wellness, suggesting feasibility for larger trials on yoga and yogic breathing practices.
Korkmaz <i>et al.</i> ^[22]	Physicians from Turkey, Germany, and Dubai, willing to engage in daily relaxation exercises, excluding those with major illnesses or regular mind-body practices.	SKY versus SME; 1.5 h for 3 days via video conference, followed by daily 30-minute practice for SKY and weekly 1-h follow-up for both groups.	2 months	Stress, depression (DASS-42), insomnia (RIS), anxiety, professional fulfillment, work exhaustion, burnout, professional errors	Significant reduction in stress, depression, and anxiety in SKY group, improvement in professional fulfillment and reduction in burnout.	SKY effectively enhances wellness and reduces burnout among physicians, demonstrating its potential in professional health management.
Mathersul <i>et al.</i> ^[23]	US Veterans with clinically significant PTSD symptoms.	Non-inferiority RCT comparing SKY with CPT focusing on PTSD symptoms. Secondary analysis on self-reported and physiological ER.	6 weeks	PTSD symptoms, depression, negative affect, ER (DERS), HRV	Comparable improvements in ER measures between SKY and CPT; SKY uniquely improved physiological ER markers.	SKY is effective for improving both voluntary and automatic ER in PTSD treatment, offering a complementary approach to conventional trauma-focused therapy.

(Contd...)

Table 2: Studies included in the review and their observed assessments

Study ID	Population details	Intervention details	Duration	Primary outcomes	Statistical findings	Conclusions
Mawar <i>et al.</i> ^[24]	Adults living with HIV, CD4 count >400 cells/ μ l, Karnofsky scale >70, excluding those with certain diseases or on specific treatments.	SKY intervention versus standard care; 6-day training followed by daily 30-minute home practice. Evaluated using WHOQOL-HIVBREF.	3 visits over 12 weeks	QOL in physical, psychological, and independence domains	Significant improvements in QOL scores, especially in physical (12%), psychological (11%), and independence (9%) domains in the SKY group (<i>P</i> values noted).	SKY significantly enhances QOL in people living with HIV, advocating for its integration into long-term care strategies for this population.
Qu <i>et al.</i> ^[25]	Male participants, aged 18–50, good psychological health, practiced SK&P for 1.5–5 years, at a yoga retreat in Germany.	Comparison of a comprehensive yoga program (SK&P) against a control involving nature walks and relaxing music. Sessions from 6:30 am to 8:30 am over four consecutive days.	4 days	Gene expression in PBMCs analyzed using microarray techniques.	SK&P showed a threefold higher number of differentially expressed genes compared to the control; 111 versus 38 genes affected.	SK&P induces significant rapid changes in gene expression, suggesting potential molecular benefits.
Seppälä <i>et al.</i> ^[26]	Male U.S. veterans of Iraq or Afghanistan wars with PTSD.	Randomized controlled trial of Sudarshan Kriya yoga versus waitlist control, with assessments of PTSD symptoms, anxiety, and physiological measures before and after the intervention.	1 year	PTSD scores, anxiety symptoms, respiration rate, and eye-blink startle response.	Significant reductions in PTSD scores ($d=1.16$, 95% CI [0.20, 2.04]), anxiety, and respiration rate in the active group.	SKY may have clinical utility for PTSD, showing significant improvements in symptoms and physiological responses.
Sharma <i>et al.</i> ^[27]	Patients with MDD unresponsive to ≥ 8 weeks of antidepressant treatment.	Randomized to SKY or waitlist control for 8 weeks, assessing changes in depression and anxiety scores.	8 weeks	Changes in HDRS-17, BDI, and BAI scores.	Significant improvements in HDRS-17 (-9.77 vs. 0.50 , $P=0.0032$), BDI (-17.23 vs. -1.75 , $P=0.0101$), and BAI scores in the SKY group.	SKY shows promise as an adjunctive treatment for MDD, improving symptoms significantly more than waitlist control.
Sureka <i>et al.</i> ^[28]	230 male prisoners, aged 18–65, diagnosed with non-psychotic psychiatric disorders.	Participants practiced SK&P daily for 6 weeks compared to controls who sat in an armchair focusing on their breath.	6 weeks	GAF, ANX, DEP, PWB, GH, SC, VT, PGWB scores.	Significant improvements in GAF, ANX, DEP, PWB, GH, PGWB scores compared to control. No significant changes in SC and VT.	SKY significantly improves psychological well-being and reduces anxiety and depression among male prisoners. SC and VT improvements were not significant.
Swain <i>et al.</i> ^[29]	80 menopausal women aged 40–50 years.	Participants were divided into SKY and brisk walking groups to study effects on hormonal changes and menopausal quality of life (MENQOL).	1 year	Menopausal quality of life (vasomotor, psychosocial, physical symptoms), antioxidant enzymes, hormonal levels.	Significant improvements in menopausal quality of life and antioxidant enzymes ($P<0.05$); no significant changes in hormone levels.	SKY is an effective non-hormonal intervention for enhancing quality of life in menopausal women, particularly in reducing menopausal symptoms.

SKY: Sudarshan Kriya Yoga, DBP: Diastolic blood pressure, MDA: Malondialdehyde, PCL-C: PTSD checklist-civilian version, BDI-II: Beck depression inventory-II, PANAS: Positive and negative affect schedule, ESS: Epworth sleepiness scale, WOW: Workshop on wellness, OHQ: Oxford happiness questionnaire, BMI: Body mass index, ECT: Electroconvulsive therapy, IMN: Imipramine, SK&P: Sudarshan Kriya and Practices, SME: Stress Management Education, DASS-42: Depression Anxiety Stress Scales - 42 item, RIS: Restless insomnia scale, RCT: Randomized controlled trial, CPT: Cognitive processing therapy, ER: Emotional regulation, DERS: Difficulties in emotion regulation scale, HRV: Heart rate variability, WHOQOL-HIVBREF: World Health organization quality of life - HIV brief, PBMCs: Peripheral blood mononuclear cells, HDRS-17: 17-item Hamilton depression rating Scale, BAI: Beck anxiety inventory, GAF: Global assessment of functioning, ANX: Anxiety, DEP: Depression, PWB: Psychological well-being, GH: General health, SC: Social connectedness, VT: Vitality, PGWB: Psychological general well-being index, MENQOL: Menopausal quality of life, QOL: Quality of life, MDD: Major depressive disorder

Table 3: Representation of GRADE findings

Research Design	Number of Studies	Common Observations	Bias Risk	Variability	Relevance	Accuracy	Additional Factors	Overall Certainty
RCT	15	SKY improves physical and psychological health	Low to moderate	Low	Low	Low	None	Moderate

GRADE: Grading of Recommendations Assessment, Development and Evaluation, RCT: Randomized controlled trial

Study	Risk of bias domains					Overall
	D1	D2	D3	D4	D5	
Agte et al [15]	+	+	+	+	+	+
Bayley et al [16]	+	+	-	+	+	+
Chaudhari et al [17]	+	+	+	-	+	+
Goldstein et al [18]	+	+	+	+	+	+
Gupta et al [19]	+	-	+	+	+	+
Janakiramaiah et al [20]	+	+	+	+	+	+
Kjellgren et al [21]	+	+	-	+	+	+
Korkmaz et al [22]	-	+	+	+	+	+
Mathersul et al [23]	+	+	+	+	+	-
Mawar et al [24]	+	+	+	+	+	+
Qu et al [25]	+	-	+	+	+	+
Seppälä et al [26]	+	+	+	+	+	+
Sharma et al [27]	+	+	-	+	+	+
Sureka et al [28]	-	+	+	+	+	+
Swain et al [29]	+	+	-	+	+	-

Domains:
D1: Bias arising from the randomization process.
D2: Bias due to deviations from intended intervention.
D3: Bias due to missing outcome data.
D4: Bias in measurement of the outcome.
D5: Bias in selection of the reported result.

Judgement
- Some concerns
+ Low

Figure 2: Bias assessment observations using Risk of Bias 2.0 tool