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REVIEW ARTICLE

Yoga Interventions for Chronic Fatigue Syndrome/Myalgic Encephalomyelitis - A Scoping Review

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ABSTRACT

Background: Chronic Fatigue Syndrome/Myalgic Encephalomyelitis (CFS/ME) is a debilitating multisystem disorder characterized by persistent fatigue, post-exertional malaise, cognitive impairment, and pain, while also imposing significant socioeconomic burdens. Present treatments are limited, leading to the exploration of complementary therapies, such as yoga, which may affect autonomic function, inflammation, and mental health. This study aimed to map the existing literature on yoga interventions for CFS/ME and identify study designs, interventions, outcomes, and evidence gaps.

Materials and Methods: We searched PubMed, Cochrane Library, and Google Scholar from their inception to April 2025 for studies on adults with CFS/ME using yoga. The inclusion criteria encompassed any design that evaluated the effects of yoga on fatigue and its related outcomes. Data were extracted on design, participants, interventions, outcomes, and findings, with the results synthesized narratively and charted.

Results: Six primary studies, primarily from a Japanese group, were included. The interventions focused on adapted isometric yoga (sitting/recumbent, 2–3 months, biweekly sessions plus home practice). In some cases, fatigue was consistently reduced with improvements in vigor, pain, depression, autonomic function, and biomarkers (e.g., tumor necrosis factor-α). Adverse events were minor and transient. To date, no qualitative or large-scale studies have been conducted.

Conclusions: Adapted isometric yoga shows promise in reducing fatigue in CFS/ME; however, evidence is limited by small samples, single-group designs, and short follow-ups. Larger multicenter randomized controlled studies with standardized protocols and biomarkers are needed to confirm the efficacy and guide its clinical use.

1. INTRODUCTION

Chronic Fatigue Syndrome (CFS), also known as Myalgic Encephalomyelitis (ME) or ME/CFS, is a complex, multisystem disorder characterized by profound, persistent fatigue that is not alleviated by rest and is exacerbated by physical or mental exertion, often termed post-exertional malaise (PEM).[1] Additional core symptoms include unrefreshing sleep, cognitive impairments ("brain fog"), orthostatic intolerance, muscle and joint pain, headaches, and flu-like symptoms.[2] Diagnosis relies on clinical criteria as no specific biomarkers exist. Key diagnostic frameworks include the 1994 Fukuda criteria, emphasizing unexplained fatigue lasting at least 6 months with four or more accompanying symptoms;[3] the 2003 Canadian Consensus Criteria, which mandate PEM and neurological/cognitive manifestations;[4] the 2011 International Consensus Criteria for ME, focusing on neuroimmune dysfunction;[5] and the 2015 Institute of Medicine criteria, requiring substantial reduction in functioning, PEM, unrefreshing sleep, and either cognitive impairment or orthostatic intolerance.[6] These criteria highlight the exclusion of other medical conditions and underscore the diagnostic challenges.[7]

Epidemiologically, ME/CFS affects an estimated 0.1–0.8% of the global population, translating to approximately 17–24 million individuals worldwide.[8] The prevalence of ME/CFS varies according to the region and diagnostic criteria. In the United States, recent data indicate a prevalence of 1.3% among adults,[9] whereas in the

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United Kingdom, the lifetime prevalence is reported to be 0.6%.[10] Notably, higher prevalence rates are observed among women (1.7% compared to 0.9% in men) and in post-viral contexts, with 51% of long COVID (post-COVID syndrome [PCS]) cases meeting the ME/CFS criteria.[11] In Asia and Europe, prevalence estimates range from 0.2% to 1.4%, with underdiagnosis being common because of stigma and lack of awareness.[12] This condition imposes significant burdens: physically, it restricts daily activities and mobility; mentally, it is associated with anxiety, depression, and cognitive decline; and socially, it results in isolation, unemployment (with up to 54% productivity loss), and strained relationships.[13] Healthcare systems incur substantial costs, estimated at $18–51 billion annually in the United States alone, due to medical care and lost productivity.[14]

The pathophysiology of ME/CFS remains incompletely understood, but involves a multifactorial interplay. Immune dysregulation is prominent, with elevated levels of pro-inflammatory cytokines (for example, such as tumor necrosis factor-α [TNF-α] and interleukin-6 [IL-6]), and altered natural killer cell function, suggesting chronic low-grade inflammation.[15] Neurological factors include neuroinflammation, hypothalamic-pituitary-adrenal (HPA) axis dysfunction, and autonomic nervous system imbalance, such as sympathetic overactivity and reduced vagal tone.[2] Metabolic abnormalities, including mitochondrial dysfunction, impaired energy production, and altered gut microbiota, contribute to oxidative stress and fatigue.[16] Psychosocial factors, including stress and trauma, may exacerbate symptoms through HPA axis modulation, although they are not causal.[17] Recent reviews have linked post-viral triggers, such as SARS-CoV-2, to persistent immune activation, mirroring PCS pathophysiology.[18] This biopsychosocial framework underscores the need for holistic interventions.[19]

Present management of ME/CFS is symptomatic and non-curative, with no FDA-approved disease-modifying therapies.[1] Pharmacological options, such as low-dose antidepressants for pain or sleep aids, offer limited relief and carry side effects.[20] Conventional treatments, such as cognitive behavioral therapy and graded exercise therapy, have been controversial, and some guidelines endorse them for symptom management.[21] Evidence shows inconsistent efficacy and potential harm from PEM exacerbations.[22] Pacing strategies and supportive care dominate, but access barriers and diagnostic delays hinder the outcomes.[23] These limitations highlight the need for safe and accessible complementary therapies to address multifaceted symptoms.

Yoga is a mind-body practice that combines physical postures (asanas), breathing techniques (pranayama), and meditation to promote mental and physical harmony.[24] Defined as a discipline that unites the body, mind, and spirit, yoga's principles emphasize self-awareness, non-harm, and balance.[25] Mechanistically, yoga influences the autonomic nervous system by enhancing parasympathetic activity, reducing sympathetic arousal, and improving heart rate variability, which may help alleviate fatigue and orthostatic issues.[26] It reduces inflammation by downregulating cytokines, such as TNF-α and IL-6, potentially addressing immune dysregulation.[27] Mental health benefits stem from HPA axis regulation, lowering cortisol levels, and enhancing mood through endorphin release and neuroplasticity.[28] In other fatigue-related conditions, yoga shows promise; meta-analyses report small-to-medium reductions in cancer-related fatigue (SMD = 0.27-0.44) and improved quality of life,[29,30] in which it alleviates pain and fatigue, and in multiple sclerosis, it boosts vitality and mental health.[31] Consequently, yoga has been increasingly adopted as a complementary intervention in health care settings.[32]

Despite this, the application of yoga in ME/CFS remains underexplored, with limited and varied evidence, and no comprehensive synthesis has focused solely on yoga adaptations for this population. Existing MBI reviews include yoga peripherally but overlook CFS/ME-specific modifications, such as isometric poses to prevent PEM.[33,34] This knowledge gap, constrained by small trials and diagnostic variability, necessitates a scoping review to map the evidence landscape, identify trends, and highlight research priorities. By systematically charting yoga interventions, outcomes, and feasibility in CFS/ME, this review addresses the unmet need for integrative approaches, informing future rigorous studies, and clinical guidance in a field burdened by therapeutic limitations.

2. MATERIALS AND METHODS

This literature review involved a comprehensive search of electronic databases and search engines, including PubMed, Cochrane Library, and Google Scholar, using keywords, such as "yoga," "chronic fatigue syndrome," "myalgic encephalomyelitis," "CFS," "ME," "intervention," "trial," "study," and combinations thereof (e.g., "yoga interventions for chronic fatigue syndrome OR myalgic encephalomyelitis"). Searches were limited to English-language publications from inception to April 2025 with a focus on peer-reviewed articles. Additional manual searching of reference lists from the identified reviews was conducted.

The inclusion criteria included any study design, such as randomized controlled trials (RCTs), observational studies, and pilot studies that evaluated yoga as either a primary or adjunct intervention in adults diagnosed with CFS/ME according to established criteria, such as Fukuda or Centers for Disease Control and Prevention (CDC). Yoga is broadly defined to encompass any form, including isometric, hatha, and restorative. The exclusion criteria ruled out studies on related but distinct conditions, such as fibromyalgia without CFS/ME overlap, non-interventional yoga research, such as surveys on general use, or studies lacking CFS/ME-specific outcomes. Key concepts included population (adults with CFS/ME), intervention (yoga practices, such as asanas, pranayama, and meditation), and outcomes (primary: Fatigue; secondary: Quality of life, physical/mental function, pain, sleep, biomarkers, and autonomic function). Data extraction focused on study design, sample size, intervention details, outcomes, and findings. Results were synthesized narratively and organized in tables for clarity.

3. RESULTS

The search process identified six primary studies that evaluated yoga interventions for individuals with CFS/ME. Of these, five were interventional studies focusing on isometric yoga variants, while one was observational.[35-40] The majority of these studies (five) were conducted by a single research group in Japan, with interventions specifically adapted for severe fatigue. The sample sizes varied from 1 to 155 participants, with a predominance of female participants (over 80% in most studies) and ages ranging from 20 to 70 years. Diagnoses were based on established criteria, including the 1994 Fukuda criteria in all studies, supplemented by others, such as the 2011 International Consensus Criteria or the 2015 Systemic Exertion Intolerance Disease criteria in later studies. The principal findings of these studies are summarized in Table 1.

Bentler *et al*. conducted a prospective observational study in the United States involving 155 adults (mean age, 45 years; 80% female) diagnosed with unexplained chronic fatigue according to CDC

criteria.[35] Participants self-reported yoga use as a part of alternative therapies without a standardized protocol for over 6 months. The outcomes focused on the improvement in self-reported fatigue. The study reported that yoga use at 6 months was associated with subsequent fatigue reduction ($P = 0.002$), particularly in those without cognitive symptoms, such as unclear thinking. No adverse events were reported.

Oka *et al*. performed a RCT in Japan with 30 adults (mean age 38.5 years; 80% female) meeting Fukuda CFS criteria.[36] Participants were randomized to conventional pharmacotherapy alone (control, $n = 15$) or combined with sitting isometric yoga ($n = 15$), consisting of biweekly 20-min instructor-led sessions plus daily home practice for 2 months. The poses had 50% maximal strength during breathing. Outcomes included fatigue (Chalder Fatigue Scale [FS] and Profile of Mood States [POMS]), pain, vigor, and autonomic function. The yoga group showed significant reductions in Chalder FS (from 25.9 ± 6.1 to 19.2 ± 7.5, $P = 0.002$) and POMS fatigue ($P < 0.001$), with improved vigor and pain relief in two participants with comorbid fibromyalgia. No significant changes were observed in the control group. The adverse events included tiredness ($n = 2$) and dizziness ($n = 1$) after the first session, with no serious events.

Oka *et al*. undertook a single-arm pilot study in Japan with 12 adults (mean age 39.5 ± 11.0 years; 83% female) diagnosed per Fukuda and International Consensus Criteria.[37] The participants practiced recumbent isometric yoga (20-min sessions every 2–4 weeks with an instructor plus home practice) for 3 months. The outcomes included fatigue (Chalder FS and POMS). Short-term results showed reduced POMS fatigue post-session, while long-term results showed reduced Chalder FS ($P < 0.05$). The intervention was feasible and safe, and no adverse events were reported. All participants preferred recumbent yoga to sitting yoga.

Oka *et al*. conducted a single-arm interventional study in Japan with 15 adults (mean age unspecified; predominantly female) per Fukuda criteria.[38] Participants practiced sitting isometric yoga (biweekly 20-min instructor sessions plus daily home practice) for 8 weeks. Outcomes included fatigue and vigor (POMS), autonomic function (heart rate variability), and biomarkers (cortisol, Dehydroepiandrosterone sulfate [DHEA-S], TNF-α, IL-6, etc.). A single session reduced POMS fatigue ($P < 0.01$), increased vigor ($P < 0.01$), lowered heart rate ($P < 0.05$), increased high-frequency heart rate variability ($P < 0.05$), elevated DHEA-S ($P < 0.05$), and decreased cortisol and TNF-α ($P < 0.05$). Fatigue reduction correlated with changes in TGF-β1 and brain-derived neurotrophic factor levels, while vigor increase correlated with homovanillic acid. No adverse events were reported.

Oka *et al*. executed a single-arm longitudinal study in Japan with 15 adults (mean age unspecified; predominantly female) per Fukuda criteria.[39] Sitting isometric yoga was practiced biweekly with an instructor and daily home practice for 2 months. Outcomes included fatigue (Chalder FS), depression and anxiety (Hospital Anxiety and Depression Scale [HADS]), alexithymia (Toronto Alexithymia Scale-20), autonomic function, and biomarkers (cortisol, DHEA-S, TNF-α). Chalder FS decreased ($P = 0.002$), and HADS depression was reduced ($P = 0.02$). Fatigue reduction correlated with TNF-α decrease ($P = 0.048$), high-frequency heart rate variability increase ($P = 0.042$), and alexithymia score change ($P = 0.001$). No significant biomarkers or autonomic changes were detected. No adverse events were reported.

Takakura *et al*. conducted a single-arm pilot study in Japan with nine female adults per Fukuda criteria.[40] Recumbent isometric yoga involved sessions every 2–4 weeks with an instructor and daily home practice for 3 months. The outcomes included fatigue (Chalder FS) and circulating miRNA levels. Chalder FS decreased significantly (from 25.3 ± 5.5 to 17.0 ± 5.8, $P < 0.0001$), with four miRNAs upregulated and 42 downregulated. No adverse events were reported.

Across the studies, isometric yoga (sitting or recumbent) was the predominant intervention type, featured in five studies, with durations of 2–3 months and frequencies combining biweekly instructor sessions and daily home practices. Conventional yoga and unspecified styles have appeared in two earlier studies. Fatigue was the primary outcome in all, measured through Chalder FS (six studies) or POMS (four studies), with consistent reports of reductions post-intervention. Secondary outcomes varied, including autonomic function and biomarkers in four studies, vigor and pain in three, and quality of life or psychological parameters in two. The sample sizes were small ($n = 1$–30) except for one observational study ($n = 155$), with four studies lacking controls. Adverse events, when reported (two studies), were minor and transient, occurring early in the interventions.

4. DISCUSSION

This scoping review mapped six primary studies that evaluated yoga interventions for individuals with CFS/ME, with the majority focusing on adapted isometric yoga variants from a single Japanese research group. Overall, the evidence indicated consistent reductions in fatigue severity across all studies, along with improvements in secondary outcomes, such as vigor, pain, depression, autonomic function, and biomarkers, such as TNF-α, in some trials. However, the body of literature is limited by small sample sizes, predominantly single-arm designs, and a lack of qualitative insights or diverse populations.

4.1. Comparison with Previous Literature

Our findings align with those of two recent systematic reviews on mind-body interventions (MBIs) for CFS/ME, which encompassed broader intervention types, but included yoga as a subset. Ardestani *et al*. reviewed 12 studies involving MBIs, such as mindfulness-based stress reduction, mindfulness-based cognitive therapy (MBCT), relaxation, Qigong, cognitive-behavioral stress management, acceptance and commitment therapy, and isometric yoga, reporting fatigue reductions in 9 studies, anxiety/depression improvements in 8, and quality of life enhancements in three.[33] Similarly, Fricke-Comellas *et al*. analyzed 13 RCTs on Qigong, Tai Chi, and yoga for CFS and PCS and found moderate effects on fatigue (SMD −0.44) and positive impacts on anxiety, depression, and sleep quality.[34] Both reviews corroborate our observation that fatigue alleviation is the most consistent outcome, with secondary benefits in mental health and physical functioning, and they highlight the feasibility of isometric yoga for severe cases, as seen in our included studies.

The areas of divergence include intervention scope and outcome breadth. While our review focused exclusively on yoga, the broader MBIs in Ardestani *et al*. and Fricke-Comellas *et al*. incorporated cognitive and meditative elements absent in some yoga protocols, potentially explaining their slightly stronger effects on anxiety/depression compared to our more variable findings (e.g., depression improvements in only two studies). Sample sizes were similarly small across reviews (e.g., median $n = 15$ in our studies vs. 661 total in Fricke-Comellas *et al*.), but the latter included PCS populations, introducing heterogeneity that was not present in our CFS/ME-specific focus. The measured outcomes also differed; our review emphasized biomarkers and autonomic function in four studies, which were less

prominent in the comparator reviews (e.g., only indirectly addressed via sleep quality in Fricke-Comellas *et al*.). Follow-up durations were short (2–3 months) in all reviews, limiting long-term insights.

Similarities may stem from overlapping study inclusion, for example, isometric yoga trials from Oka's group appeared in both comparator reviews, reflecting a shared evidence base dominated by Japanese research. Differences could arise from methodological variations, such as our scoping approach allowing inclusion of non-RCT designs (e.g., pilots) versus the RCT-only focus in Fricke-Comellas *et al*., or population differences, where PCS inclusion in Fricke-Comellas *et al*. might dilute CFS-specific effects. Diagnostic criteria heterogeneity (e.g., Fukuda criteria were predominant in our review and Ardestani *et al*., but varied in Fricke-Comellas *et al*.), and intervention components (e.g., breathing emphasis in isometric yoga vs. dynamic movements in Tai Chi/Qigong) may further contribute to discrepancies in efficacy trends.

4.2. Strengths and Limitations

A notable strength of this scoping review is its concentrated focus on yoga interventions, which allows for a detailed mapping of adaptations, such as isometric, sitting, or recumbent formats tailored to the severity of CFS/ME, an aspect that broader MBI reviews might overlook. However, the following limitations affect the generalizability of the results. The reliance on small sample sizes (n = 9–155, median ~15) and the predominance of a single research group (five studies) introduces potential bias and limits external validity, as cultural or contextual factors may influence the outcomes. The heterogeneity in yoga protocols (e.g., isometric vs. unspecified) and outcomes (primarily self-reported FSs, such as Chalder FS) precluded quantitative synthesis, while the lack of long-term follow-up data (beyond 3 months) impedes the understanding of sustained effects. Self-reported measures may be prone to expectancy bias, especially in unblinded single-arm designs that were common in our included studies. Finally, the exclusion of non-English publications and qualitative studies might have overlooked diverse perspectives.

4.3. Implications for Future Research

The identified evidence gaps highlight the necessity for larger, multicenter RCTs to boost statistical power and diversity, particularly by including underrepresented populations, such as those with severe CFS/ME, males, or non-Japanese cohorts. Standardizing yoga protocols by detailing pose adaptations, session frequency, and instructor qualifications would aid in replication and comparison, potentially utilizing frameworks, such as CERT for reporting. Integrating objective biomarkers, such as miRNA and autonomic metrics, with patient-reported outcomes could shed light on mechanisms, while longer follow-ups of 6 months or more would assess durability. Investigating hybrid interventions, such as yoga combined with MBCT, or comparisons with active controls, such as standard exercise, could clarify yoga's unique contributions. Given the low evidence certainty in related reviews, rigorous bias mitigation, including blinding and allocation concealment, is crucial for informing clinical guidelines for CFS/ME management. The ongoing RCT (NCT06978582), which compares therapeutic yoga with exercise interventions for individuals with CFS/ME and long COVID, marks a promising advancement in addressing these gaps.[41] By concentrating on fatigue, sleep quality, and large-scale recruitment, this study could yield more robust evidence. The trial confirms the feasibility of adapted yoga protocols while incorporating active comparators, aligning with our call for multicenter designs to enhance generalizability and mechanistic insights.

5. CONCLUSION

This scoping review maps a sparse yet promising body of evidence on yoga interventions for CFS/ME, with six primary studies highlighting adapted isometric yoga as a feasible, low-risk approach that consistently reduces fatigue severity and may improve secondary symptoms, such as pain, depression, vigor, and autonomic function. However, the predominance of small-scale, single-arm trials from one research group, coupled with methodological limitations and short-term follow-up, results in low evidentiary certainty, precluding definitive clinical recommendations beyond cautious adjunctive use in milder cases to avoid PEM. Future research should prioritize larger multicenter RCTs with standardized protocols, diverse populations, objective biomarkers, and extended assessments to substantiate the role of yoga in CFS/ME management and address unmet therapeutic needs in this complex condition.

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7. AUTHORS' CONTRIBUTIONS

All authors have contributed equally to conception, design, data collection, analysis, drafting, and final approval of the manuscript.

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9. ETHICAL APPROVALS

This study does not require ethical clearance as it is a review article.

10. CONFLICTS OF INTEREST

Nil.

11. DATA AVAILABILITY

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

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Table 1: Summary of included studies

Study (Year)	Design	Sample size	Intervention	Outcomes assessed	Main findings
Bentler *et al*. (2005)	Prospective observational	155	Self-reported yoga use as part of alternative therapies (no standardized protocol)	Fatigue improvement (self-reported)	Yoga associated with fatigue reduction at 6 months (P=0.002), especially in those without cognitive symptoms.
Oka *et al*. (2014)	RCT	30	Sitting isometric yoga: biweekly 20-min sessions+daily home practice for 2 months; 50% maximal strength poses with breathing. Control: pharmacotherapy.	Fatigue (Chalder FS, POMS), pain, vigor, and autonomic function	Reduced fatigue (Chalder: P=0.002; POMS: P<0.001), pain; improved vigor. No adverse events.
Oka *et al*. (2017)	Pilot (single-arm)	12	Recumbent isometric yoga: 20-min sessions every 2–4 weeks+home practice for 3 months; awareness, poses, relaxation.	Fatigue (Chalder FS, POMS)	Short-term: reduced POMS fatigue; long-term: reduced Chalder FS (P<0.05). Feasible and safe.
Oka *et al*. (2018)	Single-arm	15	Sitting isometric yoga: biweekly 20-min sessions+daily practice for 8 weeks; 6 poses with breathing.	Fatigue (POMS), vigor, autonomic function, biomarkers (cortisol, TNF-α, DHEA-S)	Reduced fatigue (P<0.01), increased vigor, improved autonomic function, and biomarkers.
Oka *et al*. (2019)	Pilot (single-arm)	15	Seated isometric yoga: biweekly 20-min sessions+daily practice for 2 months.	Fatigue (Chalder FS), depression (HADS), biomarkers (TNF-α), and autonomic function	Reduced fatigue (P=0.002), depression (P=0.02); correlated with reduced TNF-α (P=0.048).
Takakura *et al*. (2019)	Pilot (single-arm)	9	Recumbent isometric yoga: sessions every 2-4 weeks+daily practice for 3 months.	Fatigue (Chalder FS), circulating miRNA	Reduced fatigue (P<0.0001); 4 miRNAs upregulated, 42 downregulated (potential biomarkers).

RCT: Randomized controlled trial, FS: Fatigue scale (specifically Chalder FS: Chalder Fatigue Scale), POMS: Profile of mood states, HADS: Hospital anxiety and depression scale, TNF-α: Tumor necrosis factor-alpha, DHEA-S: Dehydroepiandrosterone sulfate, miRNA: Micro-ribonucleic acid