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Effects of physical activity in patients with systemic lupus erythematosus: a narrative review

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Abstract

Systemic lupus erythematosus (SLE) is a chronic autoimmune disease characterised by heterogeneous clinical involvement and persistent symptom burden despite advances in pharmacological therapy. Fatigue, mood disturbances, reduced physical functioning and heightened cardiometabolic risk remain prevalent and only partially amenable to medication alone. Growing interest has therefore focused on the role of physical activity as a complementary strategy in SLE management. This narrative review synthesises evidence from interventional and observational studies exploring associations between physical activity, structured exercise and key clinical outcomes in adults with SLE. Individuals with SLE consistently demonstrate reduced habitual activity, lower fitness and increased sedentary time compared with the general population. Across multiple trials, aerobic, resistance and combined exercise programmes were safe in clinically stable disease and did not increase activity or flare rates. Exercise interventions improved functional capacity, fatigue and selected psychological outcomes, whereas observational studies additionally link higher activity levels to better mood, sleep and cognitive functioning. Physical activity and fitness also correlate with more favourable cardiometabolic profiles, including lower arterial stiffness and reduced markers of subclinical atherosclerosis. Mechanistic data suggest that exercise may attenuate inflammatory signalling and modulate immune pathways relevant to SLE. Overall, physical activity represents a safe and valuable adjunct to standard therapy, offering benefits across functional,

symptomatic and cardiometabolic domains. Further high-quality trials are required to optimise exercise prescriptions and evaluate long-term effects in diverse SLE populations.
Keywords: systemic lupus erythematosus; physical activity; exercise training; fatigue; cardiovascular risk, quality of life

INTRODUCTION

Systemic lupus erythematosus (SLE) is a chronic autoimmune disease characterised by the production of autoantibodies, immune complex formation and complement activation, leading to inflammation and damage across multiple organ systems. Clinical manifestations may involve the skin, joints, kidneys, cardiovascular and respiratory systems, haematological compartments and both central and peripheral nervous structures, resulting in a highly heterogeneous clinical picture [26,28]. Despite advances in therapy, SLE continues to be associated with substantial morbidity and an increased risk of premature mortality, largely related to cumulative organ damage and cardiovascular complications [25,28].

The epidemiology of SLE varies considerably worldwide. Estimates of incidence range between 1 and 10 cases per 100,000 person-years, while prevalence spans from 4.3 to 150 per 100,000 individuals depending on geographic region, sex and ethnicity [27]. The disease predominantly affects women of reproductive age, with female-to-male ratios approaching 10:1 [27]. Cardiovascular disease remains a leading contributor to long-term mortality and reduced life expectancy in SLE [25,28].

The pathophysiology of SLE is complex and multifactorial, involving genetic susceptibility, hormonal influences and environmental triggers such as ultraviolet radiation, infections and smoking [26,28]. A loss of immunological tolerance results in the production of autoantibodies and circulating immune complexes that deposit in tissues and promote inflammation. Central mechanisms include dysregulated B-cell activation, abnormal T-cell responses and amplified type I interferon signalling [25,28]. Additional abnormalities in cytokine networks—including IL-6, TNF-α and IL-12 family members—as well as perturbations in oxidative stress, NETosis and innate immune pathways contribute to chronic inflammation and vascular dysfunction [25,26].

SLE typically follows a relapsing–remitting course characterised by intermittent flares and periods of relative quiescence [26,28]. Flares may introduce new organ manifestations or exacerbate existing symptoms, and their frequency and severity vary widely between patients. Early symptoms may be non-specific—such as fatigue or arthralgia—while organ-threatening manifestations including renal or neuropsychiatric involvement often develop later in the disease trajectory [25]. Environmental factors such as ultraviolet radiation, infections and psychological stress can precipitate disease flares and contribute to fluctuations in disease activity [26].

The clinical expression of SLE spans constitutional symptoms, musculoskeletal involvement, diverse cutaneous manifestations, serositis, renal disease and haematological abnormalities [26]. Fatigue is one of the most prevalent and burdensome symptoms, affecting up to 80–90% of patients and markedly impairing daily functioning and quality of life [21,22]. Neuropsychiatric manifestations—including depression, anxiety, cognitive dysfunction and sleep disturbances—are also common and may occur independently of other organ involvement, contributing significantly to disability and increased healthcare utilisation [19]. Cardiovascular

complications, including arterial stiffness and subclinical atherosclerosis, are well recognised in SLE and may emerge early in the disease course, even in the absence of traditional cardiovascular risk factors [16,25].

Growing attention has been directed toward the role of lifestyle factors, particularly physical activity, in the management of systemic lupus erythematosus. Individuals with SLE frequently experience reduced exercise tolerance, lower habitual physical activity levels and greater sedentary time compared with the general population, contributing to symptoms such as fatigue, mood disturbances and diminished physical functioning [8,16,18]. Although standard treatment—guided by contemporary EULAR and ACR recommendations—primarily relies on immunomodulatory and anti-inflammatory therapies aimed at controlling disease activity and preventing organ damage [26,28], many symptoms remain only partially alleviated. This has intensified interest in complementary, non-pharmacological strategies that may support overall disease management. In this context, a growing body of interventional and observational research has explored whether physical activity and related lifestyle behaviours influence symptom severity, functional capacity, cardiovascular risk markers and broader aspects of well-being in SLE. However, findings remain dispersed across heterogeneous study designs and differ in scope, methodology and primary outcomes. A narrative review is therefore warranted to integrate existing evidence, clarify emerging patterns and provide a coherent understanding of how physical activity and lifestyle behaviours may relate to key clinical and patient-reported outcomes in SLE.

METHODS

This narrative review was conducted to synthesise and contextualise current evidence examining the relationship between physical activity, structured exercise interventions and lifestyle-related behaviours in adults with systemic lupus erythematosus (SLE). The methodological approach followed established principles of narrative synthesis, allowing integration of findings from diverse study designs without the restrictions typically associated with systematic reviews.

A broad, iterative literature search was carried out in major scientific databases, including PubMed, Scopus and Web of Science. Search terms combined MeSH headings and free-text keywords related to SLE (“systemic lupus erythematosus”, “lupus”), physical activity (“physical activity”, “exercise”, “training”), lifestyle (“sedentary behaviour”, “fitness”, “non-pharmacological interventions”) and outcomes relevant to patient well-being (“fatigue”, “quality of life”, “depression”, “cognition”, “cardiovascular risk”). No limits were placed on study design, allowing the inclusion of randomised controlled trials, interventional studies, observational cohorts, cross-sectional studies and clinical guidelines.

Studies were included if they:

1) involved adult participants diagnosed with SLE,
2) examined any form of physical activity, structured exercise or lifestyle behaviour, and
3) assessed clinical, functional or patient-reported outcomes.

Exclusion criteria were intentionally minimal to reflect the exploratory scope of narrative synthesis and included only non-original publications (e.g., editorials), studies not involving human participants, and articles not available in English.

Evidence was analysed thematically, with findings grouped according to commonly reported domains such as fatigue, neuropsychiatric symptoms, physical functioning, cardiovascular risk markers, disease activity and health-related quality of life. This narrative approach enabled the

integration of results across heterogeneous methodologies, highlighting areas of consistency, divergence and emerging trends that may hold clinical relevance.
Given the conceptual rather than quantitative aim of this review, no meta-analysis or formal risk-of-bias assessment was performed. Emphasis was placed on contextual interpretation and evaluation of the strength and coherence of available evidence within each thematic category.

RESULTS

1. Overview of Included Studies

The evidence reviewed comprises a heterogeneous body of research, including randomised controlled trials, supervised and home-based exercise interventions, longitudinal cohort studies and cross-sectional analyses. The studies vary in sample size, intervention type, duration and outcome measures. While interventional research predominantly focuses on structured aerobic, resistance or combined exercise training, observational studies explore habitual physical activity levels, sedentary behaviour, fitness, lifestyle factors and their associations with clinical and patient-reported outcomes in systemic lupus erythematosus (SLE). Collectively, this literature provides a broad view of how physical activity and related behaviours may relate to the symptom burden and health status of individuals with SLE.

2. Physical Activity Levels in SLE

Across multiple observational cohorts, individuals with SLE consistently demonstrate lower levels of habitual physical activity and increased sedentary time compared with the general population [8,13,18]. Objective assessments using accelerometry or step count monitoring reveal reduced daily movement, decreased moderate-to-vigorous physical activity and overall diminished fitness levels [8,14,17]. These patterns often coexist with elevated fatigue, impaired physical functioning and poorer health-related quality of life. Reduced exercise tolerance is commonly reported and has been attributed to a combination of disease-related factors, decreased cardiorespiratory fitness and behavioural adaptations associated with chronic symptoms [16,18].

3. Effects of Structured Exercise Interventions

3.1 Aerobic Training

Aerobic exercise programmes—typically involving walking, cycling or treadmill-based sessions—have been examined in several interventional studies. These programmes frequently demonstrate improvements in functional aerobic capacity, walking distance and perceived physical functioning [1,6]. Positive effects are most consistently reported in studies lasting 8 to 16 weeks, with regular supervised sessions and gradual intensity progression.

3.2 Resistance Training

Resistance training interventions, although less frequently studied than aerobic programmes, have shown favourable effects on muscular strength, functional mobility and physical performance. These interventions appear to be well tolerated and do not exacerbate disease activity in clinically stable SLE populations [5,10].

3.3 Combined or Multimodal Exercise

Multimodal exercise interventions integrating aerobic and resistance components—sometimes supplemented with flexibility or educational modules—demonstrate improvements across multiple domains, including fatigue, physical capacity and aspects of quality of life [7,11]. These combined programmes may offer broader benefits by targeting different physiological systems simultaneously.

3.4 Safety of Exercise in SLE

Across interventional studies, structured exercise appears safe for individuals with stable SLE. No significant increases in disease activity, flares or clinically relevant adverse events have been reported [1,6,10]. This aligns with contemporary EULAR recommendations, which recognise physical activity as a suitable non-pharmacological component of SLE management [26].

4. Effects of Physical Activity on Core Symptoms

4.1 Fatigue

Fatigue is among the most extensively studied symptoms in relation to physical activity. Observational evidence suggests that higher levels of habitual physical activity are associated with lower fatigue severity and better energy regulation [21,22]. Interventional studies report that structured aerobic or combined exercise programmes lead to modest but meaningful reductions in fatigue, although the magnitude of improvement varies across studies [1,7,12]. Broader reviews of non-pharmacological interventions, including those informing EULAR recommendations, similarly highlight physical activity as one of the most consistently supported behavioural strategies for addressing fatigue in SLE, despite variability in study designs and outcome measures [15].

4.2 Mood, Depression and Anxiety

Several observational cohorts have examined relationships between physical activity and mood in SLE. Lower activity levels and higher sedentary time have been associated with increased depressive symptoms and psychological distress [19]. Interventional studies provide preliminary evidence that structured exercise may contribute to improvements in mood, although findings remain inconsistent and further research is needed [1,12].

4.3 Sleep and Cognitive Symptoms

Limited but emerging evidence suggests that greater physical activity may be related to improved sleep quality and aspects of cognitive functioning. Observational data indicate associations between inactivity, obesity and cognitive complaints, particularly in women with SLE [18]. Interventional findings remain sparse but support the potential for exercise-related improvements in sleep regulation and mental clarity.

5. Effects on Physical Function and Fitness

Numerous studies report improvements in physical functioning following structured exercise training, particularly in measures of aerobic capacity (e.g., VO_2max, 6-minute walk distance), muscular strength and overall physical performance [1,6,10]. These benefits are often accompanied by enhanced mobility, reduced functional limitations and improved patient-perceived physical capability. Observational research similarly shows that greater habitual activity and higher fitness levels are associated with better functional outcomes [14,17].

6. Effects on Cardiometabolic and Cardiovascular Risk

Cardiovascular risk is heightened in SLE, and several studies explore how physical activity may relate to cardiometabolic health. Observational data indicate that higher physical activity and fitness levels are associated with more favourable cardiovascular profiles, including lower arterial stiffness, reduced markers of subclinical atherosclerosis and improved metabolic indicators [14,16]. Longitudinal research demonstrates that baseline physical activity and fitness may predict cardiometabolic outcomes over multi-year follow-up [16]. Exercise interventions have also been linked to improvements in lipid profiles, endothelial function and inflammatory markers, although findings are variable and often based on small samples [2,10].

7. Summary of Key Observed Patterns

Across diverse study designs, several consistent patterns emerge. Individuals with SLE demonstrate lower levels of habitual physical activity and fitness compared with the general population. Structured exercise interventions are safe in clinically stable SLE and commonly yield improvements in physical functioning, aerobic capacity and selected patient-reported outcomes such as fatigue. Associations between physical activity and mood, sleep or cognitive symptoms are supported primarily by observational research, with interventional findings remaining less conclusive. Physical activity appears to relate favourably to cardiometabolic and cardiovascular risk markers, although the strength of evidence varies.

Together, these findings highlight distinct domains of potential benefit: (1) symptom-related and functional outcomes, and (2) cardiometabolic health indicators. This distinction reflects the structure of the available literature and underscores the multifaceted role that physical activity may play in the broader health context of individuals with SLE.

DISCUSSION

This narrative review synthesised evidence examining the relationship between physical activity, structured exercise interventions and key clinical outcomes in systemic lupus erythematosus (SLE). Across observational and interventional research, several consistent patterns emerged. Individuals with SLE engage in lower levels of habitual physical activity, demonstrate reduced fitness and spend more time sedentary than the general population [8,13,18]. Structured exercise programmes—whether aerobic, resistance-based or multimodal—were generally safe for clinically stable patients and did not increase disease activity [1,6,10]. Improvements in functional capacity, physical performance and selected patient-reported outcomes such as fatigue were observed across multiple studies [1,6,7]. Associations between physical activity and mood, sleep or cognitive function also appeared in observational literature, although interventional evidence remains more limited [12,18,19]. Furthermore, physical activity and higher fitness levels were related to more favourable cardiometabolic and cardiovascular risk profiles, suggesting an important role for exercise in addressing long-term morbidity [14,16].

The present findings align with earlier systematic reviews and consensus statements that highlight the safety and potential benefits of physical activity in SLE. Meta-analytic evidence demonstrates significant improvements in aerobic capacity following structured exercise, with no indication of disease exacerbation [1,6]. Cochrane analyses support the role of exercise as an adjunctive therapy but emphasise the heterogeneity of available trials and the need for greater methodological consistency [7]. Broader lifestyle reviews similarly report favourable trends

across both symptom-related and cardiometabolic domains, albeit with variable effect sizes and inconsistent outcome reporting [12,24]. The evidence reviewed here is also consistent with the most recent EULAR recommendations for non-pharmacological management in SLE, which recognise physical activity as a valuable component of multidisciplinary care [26]. While pharmacological therapies remain the cornerstone of disease control, guidelines increasingly emphasise the importance of addressing fatigue, mood disturbance, deconditioning and cardiovascular risk—domains in which physical activity may exert meaningful influence. This synthesis therefore reinforces the role of exercise as a safe and potentially impactful adjunct to standard therapy, while also underscoring the need for more robust, targeted research.

Several mechanisms may explain the beneficial patterns observed across symptom-related and cardiometabolic outcomes. Regular physical activity has well-established anti-inflammatory effects, including modulation of cytokine production, reduced expression of pro-inflammatory mediators and enhanced release of myokines with immunoregulatory properties [3]. These pathways may contribute to reductions in fatigue and improvements in general well-being. Additionally, inactivity itself may exacerbate pathological immune signalling in SLE; recent single-cell analyses demonstrate that reduced physical activity is associated with heightened inflammatory transcriptional activity, suggesting a biological basis through which exercise may modulate disease-related pathways [20]. Potential neuropsychological mechanisms include exercise-induced upregulation of neurotrophic factors, improvements in sleep regulation and enhanced stress resilience, which may collectively contribute to observed improvements in mood or cognitive symptoms [18,19]. Cardiometabolic changes—including enhanced endothelial function, increased nitric oxide availability, reduced arterial stiffness and favourable shifts in lipid metabolism—may underlie the associations between habitual physical activity and reduced cardiovascular risk [14,16,25]. Although these mechanisms remain incompletely understood in SLE, converging evidence suggests that physical activity influences multiple physiological systems relevant to the disease.

The findings of this review support the consideration of physical activity as an important adjunct to the clinical management of SLE. Exercise interventions appear to be safe for patients with stable disease and may help address several symptoms that remain insufficiently controlled by pharmacological therapy, including fatigue, low mood, reduced functional capacity and cardiometabolic risk. Aerobic and combined training programmes show the most consistent benefits across functional domains, although resistance-based interventions also contribute to improvements in muscular strength and mobility. Given the heterogeneity of SLE, personalised exercise prescriptions may be particularly beneficial. Patients with high fatigue, low fitness or increased cardiovascular risk may derive specific advantages from targeted aerobic or combined training protocols. Multidisciplinary approaches involving rheumatologists, physiotherapists, exercise specialists and psychologists may further enhance adherence and optimise clinical outcomes. Incorporating physical activity into standardised care pathways aligns with evolving recommendations from professional societies and reflects a growing emphasis on holistic, patient-centred management strategies [26,28].

Strengths of this review include its integration of diverse study designs, incorporation of both observational and interventional evidence and a synthesis framework that accounts for multiple domains of health relevant to SLE. The narrative approach allowed for contextual interpretation and recognition of emerging trends that may not be apparent in more restrictive methodological designs. However, several limitations must be acknowledged. The heterogeneity of exercise interventions, variability in outcome measures and small sample sizes limit the comparability of findings across studies. Many interventional trials included relatively short follow-up periods,

making it difficult to determine the durability of observed benefits. Patient-reported outcomes such as fatigue, mood and sleep were measured using different instruments, contributing to variability in effect estimates. As a narrative rather than systematic review, the synthesis is also more vulnerable to selection bias, and the absence of formal risk-of-bias assessment precludes definitive conclusions regarding study quality.

Future research should prioritise well-designed, adequately powered randomised controlled trials that evaluate specific exercise modalities, intensities and progression protocols. Standardised outcome measures—particularly for fatigue, mood and cognitive function—would enhance comparability across studies. Longitudinal studies evaluating the sustained effects of physical activity on cardiovascular outcomes, inflammatory pathways and organ-specific involvement are also needed. Mechanistic research integrating biomarker, imaging and functional assessments could help clarify the biological pathways through which exercise influences disease processes in SLE. Additionally, investigations into personalised or precision-based exercise interventions may offer new avenues for improving symptom management and long-term health outcomes.

CONCLUSIONS

Physical activity appears to be a safe and valuable adjunct to pharmacological treatment in systemic lupus erythematosus. Across diverse study designs, exercise interventions consistently demonstrate benefits in functional capacity, fatigue and selected psychological and cardiometabolic outcomes. While pharmacotherapy remains essential for controlling inflammatory activity, structured exercise provides complementary effects that target symptoms and health domains insufficiently addressed by medication alone. Further high-quality research is warranted to refine exercise prescriptions, identify the most effective training modalities for different patient profiles and integrate personalised activity-based strategies into routine SLE management.

Disclosure

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Investigation; WK, KW, KK, AM, AH, MSz, MS, MM, MJ, MP
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