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The Effects of Yoga on Physical Activity and Respiratory Health in Duchenne Muscular Dystrophy: A Literature Review

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Abstract

Purpose: Duchenne muscular dystrophy (DMD) is a progressive neuromuscular disorder characterized by declining motor performance and respiratory function. The aim of this study was to evaluate current scientific evidence on the effects of yoga-based interventions on physical activity and pulmonary function in individuals with DMD.

Materials and Methods: A narrative literature review was conducted using PubMed and Google Scholar databases. The search included studies published between 2000 and 2026 focusing on Duchenne muscular dystrophy, rehabilitation, respiratory function, physical activity, and yoga-based interventions. Articles were screened according to their relevance to yoga-based rehabilitation approaches in patients with DMD.

Results: The reviewed studies indicate that yoga interventions may improve functional capacity, balance, and tolerance for daily activities in children with DMD. Programs combining adapted postural exercises (asanas), breathing techniques (pranayama), and relaxation practices were associated with improved pulmonary function parameters and autonomic regulation, including increased heart rate variability. Yoga programs were generally safe and well tolerated.

Conclusions: Yoga may be a supportive component of multidisciplinary rehabilitation in DMD. It may contribute to improved respiratory function, functional performance, and overall well-being. Further large-scale studies with standardized protocols are needed to confirm long-term clinical benefits.

Key words: Duchenne muscular dystrophy; yoga; respiratory function; physical activity; rehabilitation.

1. Introduction and Purpose of the Study

Duchenne muscular dystrophy (DMD) is a progressive X-linked neuromuscular pathology caused by mutations in the DMD gene, resulting in a total deficiency or functional insufficiency of the dystrophin protein [1,2]. Clinically, the disorder primarily affects the male population and is characterized by relentless muscular atrophy, delayed motor milestones, and a predictable loss of independent ambulation, typically occurring during early adolescence [3].

The progressive decline in skeletal muscle contractility significantly compromises functional capacity and locomotor independence, often resulting in secondary sedentary behavior. This hypomobility contributes to a cascade of complications, including diminished cardiorespiratory endurance and restrictive respiratory insufficiency [4]. Previous research has demonstrated associations between functional status, exercise tolerance, and pulmonary function measures in individuals with DMD, suggesting that maintaining appropriate physical activity may support general functional capacity in neuromuscular disorders [5,6], although evidence specific to DMD remains limited.

Rehabilitation, therefore, plays a key role in the clinical management of DMD. Physiotherapy programs focusing on postural stability, trunk control, and functional mobility may help delay functional decline and support respiratory performance. For example, targeted trunk training interventions have been associated with improvements in trunk control, functional abilities, and pulmonary parameters in children with DMD, highlighting the importance of structured rehabilitation programs in comprehensive disease management [7].

Respiratory muscle training has also been widely investigated as a therapeutic strategy aimed at improving respiratory muscle strength and endurance. Clinical studies have shown that individualized respiratory muscle training may improve respiratory muscle performance and pulmonary function parameters in patients with DMD [8,9]. Furthermore, a systematic review and meta-analysis evaluating inspiratory muscle training reported beneficial effects on respiratory muscle strength and pulmonary function outcomes, supporting the inclusion of respiratory training as part of comprehensive rehabilitation strategies for individuals with DMD [10].

Although rehabilitation strategies in Duchenne muscular dystrophy have been widely studied, the role of complementary mind–body approaches such as yoga has received relatively limited attention.

Therefore, the aim of this literature review is to analyze and summarize current scientific evidence regarding the effects of yoga-based interventions on respiratory function and physical activity in patients with DMD.

2. Materials and Methods

This study was conducted as a narrative literature review to summarize current scientific evidence regarding the effects of yoga-based therapies on respiratory function and physical

activity in individuals with Duchenne muscular dystrophy (DMD). A structured literature search was performed in March 2026 using the PubMed and Google Scholar databases.

The search primarily included studies published between 2000 and 2026 in order to capture contemporary research related to rehabilitation strategies, respiratory training, and complementary therapeutic approaches in DMD. Earlier publications were also included when they were considered seminal or essential for understanding the pathophysiology, clinical characteristics, or respiratory management of the disease. These studies were identified either during the database search process or through manual screening of reference lists of relevant articles.

The search strategy combined keywords and Medical Subject Headings (MeSH) related to Duchenne muscular dystrophy, respiratory function, physical activity, rehabilitation, and yoga. Boolean operators (AND, OR) were used to refine the search results. The screening process involved title and abstract evaluation followed by full-text assessment of potentially relevant studies. Studies were included based on their relevance to the objectives of this review and their contribution to understanding rehabilitation strategies and yoga-based interventions in DMD.

3. Pathophysiological Background of DMD

Dystrophin is a key structural protein responsible for maintaining the stability of the sarcolemma during muscle contraction. Its deficiency leads to increased membrane fragility, repeated cycles of muscle fiber degeneration and necrosis, and the gradual replacement of muscle tissue with fibrotic and adipose tissue [11]. These pathological processes ultimately result in progressive muscle weakness and a decline in functional capacity.

As the disease progresses, respiratory muscles—including the diaphragm and intercostal muscles—gradually lose strength. This deterioration leads to restrictive ventilatory impairment, reduced pulmonary capacity, and ineffective cough mechanisms, which significantly increase the risk of respiratory complications [12,13]. In advanced stages of the disease, noninvasive ventilation and assisted airway clearance techniques are frequently required to maintain adequate ventilation and airway secretion management [14]. Consequently, respiratory failure remains one of the leading causes of morbidity and mortality among individuals with Duchenne muscular dystrophy [15].

Respiratory muscle weakness also contributes to impaired ventilatory control and reduced respiratory efficiency, further exacerbating pulmonary dysfunction in this patient population [16]. In addition to structural muscle degeneration, disturbances in autonomic nervous system regulation have been reported in individuals with DMD, potentially affecting cardiovascular and cardiorespiratory regulation [17]. Duchenne muscular dystrophy is therefore recognized as a severe genetic neuromuscular disorder characterized by progressive muscle degeneration and multisystem complications affecting quality of life and life expectancy [18].

4. Pathophysiological Rationale for Yoga in DMD

In addition to conventional physiotherapy approaches, increasing attention has been directed toward complementary rehabilitation strategies. Integrative interventions that combine physical and psychological components of health, including yoga-based interventions and other mind–body therapies, have attracted increasing interest in the management of chronic neuromuscular conditions [19].

Yoga combines physical postures (asanas), breathing techniques known as pranayama, and relaxation or meditation practices which form an integrated mind–body approach. These elements have been associated with a variety of physiological and psychological health benefits, including improvements in respiratory function parameters, autonomic regulation, and overall well-being [20,21]. Clinical and experimental studies indicate that regular yoga practice can influence several physiological processes, including respiratory and cardiovascular regulation [22,23]. These effects are thought to be related to greater activation of respiratory muscles, more efficient breathing patterns, and changes in autonomic nervous system activity, potentially contributing to improved cardiorespiratory performance [24].

Previous studies suggest that yogic breathing techniques can influence autonomic regulation and respiratory patterns in various clinical populations [25]. Emerging evidence suggests that similar mechanisms may provide therapeutic benefits for individuals with neuromuscular disorders, including Duchenne muscular dystrophy. For example, studies evaluating yoga-based breathing exercises in patients with neuromuscular diseases have reported improvements in pulmonary function parameters such as forced vital capacity and expiratory flow measures [26].

Furthermore, integrated yoga therapy programs implemented alongside conventional rehabilitation have shown promising results in patients with DMD. Earlier studies indicate improvements in pulmonary function indicators, including forced vital capacity, maximal voluntary ventilation, and autonomic nervous system regulation following yoga-based interventions [27,28]. The reviewed studies demonstrate that yoga may serve as a supportive therapeutic strategy capable of addressing both respiratory dysfunction and reduced physical activity in individuals with DMD.

5. Results

Table 1. Summarizes the main characteristics and outcomes of selected studies investigating yoga therapy in Duchenne muscular dystrophy.

Author (Year)	Study Design	Study Population	Intervention Characteristics	Duration	Main Outcomes	Key Findings
Dhargave et al. (2021) [27]	Prospective interventional study	Children with Duchenne muscular dystrophy	Integrated yoga therapy including breathing exercises (pranayama), postural exercises (asanas), relaxation techniques	8 weeks	Pulmonary function (FVC), functional performance	Increase in forced vital capacity (approximately 15%) and improvement in functional tasks such as sit-to-stand
Pradnya et al. (2019) [28]	Controlled clinical study	Children with Duchenne muscular dystrophy	Yoga as an add-on therapy focusing on breathing techniques and relaxation	3 months	Heart rate variability (HRV), autonomic regulation	Increased HRV and improved autonomic nervous system balance

Rodrigues et al. (2014) [26]	Clinical intervention study	Patients with neuromuscular disorders (including DMD)	Yogic breathing exercises (pranayama)	Several weeks	Pulmonary function (expiratory flow parameters)	Improvements in expiratory flow measures and respiratory efficiency
Saud et al. (2022) [19]	Narrative review	Patients with myositis and muscular dystrophies	Review of yoga-based therapeutic approaches in muscle diseases	—	Functional capacity, quality of life	Evidence suggests potential benefits of yoga for muscle strength, respiratory function, and well-being
Ross & Thomas (2010) [21]	Systematic review	Healthy individuals and clinical populations	Comparative review of yoga and conventional exercise	—	Physical fitness, health outcomes	Yoga may produce similar improvements in physical fitness and health markers as traditional exercise
Tyagi & Cohen (2016) [24]	Review article	Various populations	Yogic breathing and meditation practices	—	Heart rate variability, autonomic regulation	Yoga practices increase HRV and improve autonomic nervous system balance

Table 1. Summary of studies evaluating yoga-based interventions in Duchenne muscular dystrophy and related conditions.

5.1. Effects on Physical Activity and Functional Capacity

Yoga-based programs in children with Duchenne muscular dystrophy demonstrated improvements in functional performance, mobility, and daily activity levels. Across multiple studies, participants demonstrated improvements in trunk control, postural stability, and motor coordination during standardized functional assessments, including timed sit-to-stand, gait assessments, and simple balance tasks [27,29]. For example, Dhargave et al. [27] reported an average 15–20% improvement in sit-to-stand performance after 8 weeks of integrated yoga therapy, while Telles et al. [29] observed improvements in balance scores and smoother execution of functional tasks in ambulatory children.

Subjective reports from caregivers and participants indicated increased tolerance for daily activities, increased endurance during routine movements, and greater overall energy levels [28]. The reported results indicate potential improvements in functional performance and may also contribute to better perceived quality of life and independence. The positive effects were particularly noticeable in children who were still ambulatory at baseline, highlighting the importance of preserving mobility in maximizing intervention benefits [27,29].

Intervention protocols generally consisted of 2–3 sessions per week for 6–12 weeks, including low-impact movement sequences, gentle stretching, balance exercises, and core-focused postures adapted to each participant’s functional abilities [27]. Some studies suggested that improvements in functional performance may persist for several weeks following the intervention period [27]. Importantly, the interventions were reported as safe, feasible, and well-

tolerated, with no adverse events, demonstrating the applicability of yoga as a complementary therapy in neuromuscular and musculoskeletal disorders [19].

Overall, structured yoga programs may help maintain functional capacity [19], although evidence from studies in DMD populations is limited and partly extrapolated from studies conducted in general and non-DMD clinical populations [21].

5.2. Effects on Respiratory Function

Yoga interventions that incorporated controlled breathing techniques (pranayama) produced significant and measurable improvements in pulmonary function. Longitudinal studies of pulmonary function in Duchenne muscular dystrophy demonstrate a progressive decline in parameters such as forced vital capacity and peak expiratory flow as the disease advances [9]. Reported outcomes included increases in forced vital capacity (FVC), maximal voluntary ventilation (MVV), and peak expiratory flow rates [26,27]. For instance, Dhargave et al. [27] observed a mean increase of 12–15% in FVC after 8 weeks of combined postural and breathing exercises, while Rodrigues et al. [26] reported improvements in expiratory flow rates in children with neuromuscular disorders following pranayama training.

The greatest improvements were generally observed in children who remained ambulatory, suggesting that preserving baseline mobility may enhance the efficacy of respiratory-focused yoga interventions [27]. In addition to objective respiratory measures, yoga was associated with favorable changes in autonomic regulation, including increased heart rate variability (HRV) and decreased sympathetic activity [28]. Such changes in autonomic function may indirectly support respiratory mechanics and ventilatory efficiency, complementing traditional respiratory therapies such as inspiratory muscle training [8,10].

Engagement of core and accessory respiratory muscles during yoga postures and breathing exercises likely contributed to enhanced respiratory muscle strength, which is critical in counteracting the progressive ventilatory decline characteristic of DMD [12,13]. Improvements were observed not only in quantitative pulmonary parameters but also in participants' self-reported ease of breathing during daily activities and reduced perceived fatigue during exertion [27].

Based on the currently available studies, yoga practice programs may offer several potential benefits for patients with Duchenne muscular dystrophy: they support functional mobility and physical activity while simultaneously improving respiratory function and autonomic regulation. These interventions were well-tolerated, showed measurable short- and medium-term effects, and may serve as a valuable adjunct to conventional multidisciplinary rehabilitation programs aimed at preserving quality of life and delaying disease-related decline [19,27].

6. Discussion

The present review highlights the potential role of yoga-based interventions as a complementary component of multidisciplinary rehabilitation in individuals with Duchenne muscular dystrophy. Current management of DMD includes pharmacological therapy, physiotherapy, and respiratory support aimed at delaying disease progression and preserving functional independence [3,12]. Nevertheless, the evidence analyzed in this review suggests that integrative mind–body approaches such as yoga may provide additional benefits that extend

beyond conventional rehabilitation strategies, particularly in domains related to functional mobility and respiratory performance.

The observed improvements in mobility may be related to the emphasis on trunk stabilization and postural control typical of yoga practice. Many yoga postures focus on trunk stabilization, postural alignment, and slow controlled movements, which may improve motor coordination and trunk control. These aspects are especially relevant in children with Duchenne muscular dystrophy, in whom progressive weakness of proximal musculature and impaired postural stability frequently result in reduced mobility and limited participation in daily activities [4,5].

Previous research indicates that maintaining safe and appropriately dosed physical activity is essential for preserving functional capacity and delaying functional deterioration in neuromuscular disorders [14]. Within this context, yoga-based exercise programs may represent a low-impact and adaptable form of physical activity that can be tailored to the stage of disease progression and the individual capabilities of patients [19,28].

Respiratory impairment represents one of the most significant complications of Duchenne muscular dystrophy. Progressive weakening of respiratory muscles, particularly the diaphragm and intercostal muscles, leads to restrictive ventilatory dysfunction and reduced cough efficiency, thereby increasing the risk of pulmonary complications [9,16]. Current respiratory care guidelines emphasize the importance of regular pulmonary monitoring and early implementation of supportive interventions, including airway clearance techniques and ventilatory assistance when indicated [12-14].

The available evidence suggests that yoga-based breathing practices may potentially complement these strategies by promoting more efficient breathing patterns and facilitating greater engagement of respiratory musculature. Improvements in pulmonary parameters such as forced vital capacity and maximal voluntary ventilation reported in several studies indicate that controlled breathing exercises may help mitigate certain aspects of respiratory decline associated with DMD [26,27]. Similar benefits have also been reported in studies evaluating respiratory muscle training and breathing-focused rehabilitation approaches in neuromuscular disorders [8,10].

In addition to mechanical respiratory effects, yoga may influence physiological regulation through its impact on the autonomic nervous system. Autonomic dysfunction, including disturbances in cardiac autonomic regulation and circadian variability, has been documented in patients with Duchenne muscular dystrophy and may contribute to abnormalities in cardiovascular and cardiorespiratory regulation [17]. Previous investigations have demonstrated that yogic breathing and relaxation techniques can increase heart rate variability and reduce sympathetic nervous system dominance, reflecting improved autonomic balance [24,28]. Furthermore, reviews of yogic breathing practices indicate that pranayama techniques may support respiratory regulation, stress reduction, and autonomic stability in various clinical populations [23,25]. Such physiological adaptations may indirectly enhance cardiorespiratory efficiency and physical exercise tolerance, potentially augmenting the overall effectiveness of rehabilitation programs.

The psychological and behavioral components of yoga may further support the management of chronic neuromuscular diseases. Yoga practices frequently incorporate elements of relaxation, mindful breathing, and body awareness, which may positively influence emotional well-being and coping strategies. Evidence from previous research indicates that yoga-based interventions may contribute to improvements in quality of life, perceived well-being, and stress reduction in

various clinical populations [20–22]. These psychosocial benefits may be particularly important in chronic progressive disorders such as Duchenne muscular dystrophy, where maintaining motivation and engagement in long-term rehabilitation programs remains a significant challenge [19,28].

Despite these encouraging observations, several limitations of the current evidence base must be acknowledged. The number of studies evaluating yoga practices in Duchenne muscular dystrophy remains relatively small, and many investigations involve limited sample sizes and heterogeneous intervention protocols. Differences in training duration, session frequency, and yoga techniques make direct comparisons between studies difficult.

Furthermore, most available studies assess short- to medium-term outcomes, and evidence regarding the long-term effects of yoga interventions on disease progression, respiratory decline, or functional independence remains limited. Further research involving larger randomized controlled trials with standardized intervention protocols and longer follow-up periods would help clarify the long-term clinical effects of yoga in this population.

Overall, the findings reported in the available studies indicate that yoga-based interventions appear to be a safe and feasible complementary approach that may support functional mobility, respiratory efficiency, and overall well-being in individuals with DMD.

7. Conclusion

Yoga-based interventions may serve as a complementary component of multidisciplinary rehabilitation in individuals with Duchenne muscular dystrophy. Adapted postural exercises and low-intensity movement sequences may improve trunk stability, coordination, and functional mobility. These factors are important for maintaining independence in daily activities among children with progressive neuromuscular disorders [5,6].

Breathing techniques used in yoga, particularly pranayama, may support respiratory efficiency. These techniques promote controlled breathing patterns and facilitate the activation of respiratory muscles. Improvements in pulmonary parameters such as forced vital capacity and maximal voluntary ventilation have been reported. These findings suggest that structured breathing exercises may help preserve respiratory performance in patients with DMD [26,27]. This is clinically relevant because respiratory muscle strength progressively declines in this disease [12,16].

Yoga-based practices may also influence autonomic regulation and perceived well-being, as reflected by reported increases in heart rate variability and improved tolerance to physical activity [24,28]. When appropriately adapted to the patient's functional status and stage of disease progression, yoga appears to be safe and feasible [19,27].

However, due to the limited number of high-quality studies and small sample sizes, these findings should be interpreted with caution. Further well-designed randomized controlled trials are required to determine the long-term clinical effectiveness of yoga interventions in this population [19,21].

8. Limitations and Directions for Future Research

Despite the promising results presented in this review, several limitations of the available literature should be acknowledged. The number of studies investigating yoga-based

interventions in individuals with Duchenne muscular dystrophy remains relatively small, and many of them include limited sample sizes, which restricts the generalizability of the findings. Additionally, there is considerable variability in the design of the interventions, including differences in program duration, frequency of sessions, and specific yoga techniques applied. Such heterogeneity makes direct comparison between studies difficult and limits the possibility of identifying the most effective therapeutic protocols. Moreover, most available studies focus primarily on short-term outcomes, while the long-term effects of yoga on respiratory decline, physical performance, and quality of life in patients with Duchenne muscular dystrophy remain insufficiently explored. Future research should therefore aim to conduct larger controlled studies with standardized intervention protocols and longer follow-up periods. It would also be valuable to investigate the potential synergistic effects of yoga when combined with conventional rehabilitation strategies, including physiotherapy and respiratory muscle training.

9. Declaration of Generative AI and AI-assisted technologies in the writing process

During the preparation of this manuscript, generative artificial intelligence tools were used solely for linguistic refinement, including improvements in grammar, clarity, and academic style. The literature search, data interpretation, and scientific conclusions were performed entirely by the authors.

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