Systematic review

Effectiveness of exercise therapy on motor functions among individuals with facioscapulohumeral muscular dystrophy: a systematic review

Eficácia da terapia de exercícios nas funções motoras entre indivíduos com distrofia muscular facioescapuloumeral: uma revisão sistemática

Angel Gupta[1]
Deeksha Sharma[2]
Sarita Khadayat[3]
Arushi Mishra[4]
Ankit Kumar[5]

[1, 3-5]Maharishi Markandeshwar University (Kumarhatti). Himachal Pradesh, India.
[2]Corresponding contact. Maharishi Markandeshwar University (Kumarhatti). Himachal Pradesh, India.deeksha0075sharma@gmail.com

ABSTRACT | INTRODUCTION: Facioscapulohumeral muscular dystrophy (FSHD) is prevalent innate autosomal dominant form of muscular dystrophy (MD) involving asymmetrical progression of muscle weakness. However, there is a dearth of literature that exists regarding effective exercise therapy interventions. Therefore, this review aims to identify and synthesize the existing evidence on effective exercise therapy interventions for improving motor functions. **OBJECTIVE:** To evaluate the current evidence of the effectiveness of exercise therapy programs in improving motor function among individuals with FSHD. **MATERIALS AND METHODS:** We gathered data as per Preferred Reporting Items for Systematic Review and Meta- Analysis (PRISMA) guidelines. Multiple databases were searched for Randomized Controlled trials that investigate the effectiveness of physiotherapy intervention for FSHD published from 2004 to 2024. PEDro scale and Cochrane risk of bias tool was used to evaluate the studies' quality and risk of bias. **RESULT:** Out of 974 studies, only 7 studies fulfilled the predesigned selection criteria of the review. Out of 7 studies, five studies show good quality and low risk of bias while two studies show fair quality and high risk of bias. In included studies strength training (ST), endurance training (ET), aerobic training (AET), and high-intensity interval training (HIT), were commonly used treatment interventions. **CONCLUSION:** This review concludes that the various interventions utilized in the studies that were included in our analysis were both safe and effective in enhancing motor function for individuals diagnosed with FSHD.

KEYWORDS: Muscular Dystrophy. Muscular Dystrophy Facioscapulohumeral. Exercise Therapy. Muscle Weakness.

RESUMO | INTRODUÇÃO: A distrofia muscular facioescapuloumeral (FSHD) é uma forma prevalente e inata de distrofia muscular (DM) autossômica dominante que envolve a progressão assimétrica da fraqueza muscular. No entanto, existe uma escassez de literatura sobre intervenções eficazes de terapia de exercícios. Portanto, essa revisão tem como objetivo identificar e sintetizar as evidências existentes sobre intervenções eficazes de terapia de exercícios para melhorar as funções motoras. **OBJETIVO:** Para avaliar as evidências atuais da eficácia dos programas de terapia de exercícios na melhoria da função motora entre indivíduos com FSHD. **MATERIAIS E MÉTODOS:** Coletamos dados de acordo com as Diretrizes de Itens Preferenciais para Revisão Sistemática e Meta-Análise (PRISMA). Múltiplos bancos de dados foram pesquisados para ensaios clínicos randomizados que investigam a eficácia da intervenção fisioterapêutica para FSHD publicados de 2004 a 2024. A escala PEDro e a ferramenta Cochrane de risco de viés foram utilizadas para avaliar a qualidade dos estudos e o risco de viés. **RESULTADO:** Dos 974 estudos, apenas 7 estudos atenderam aos critérios de seleção pré-desenhados da revisão. Dos 7 estudos, cinco estudos mostram boa qualidade e baixo risco de viés, enquanto dois estudos mostram qualidade justa e alto risco de viés. Nos estudos incluídos, o treinamento de força (ST), o treinamento de resistência (ET), o treinamento aeróbico (AET) e o treinamento intervalado de alta intensidade (HIT) foram comumente utilizados como intervenções de tratamento. **CONCLUSÃO:** Esta revisão conclui que as várias intervenções utilizadas nos estudos incluídos em nossa análise foram tanto seguras quanto eficazes em melhorar a função motora de indivíduos diagnosticados com FSHD.

PALAVRAS-CHAVE: Distrofia Muscular. Distrofia Muscular Facioescapuloumeral. Terapia por Exercício. Fraqueza Muscular.

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List of abbreviations and acronyms

AET – Aerobic training
ET – Endurance training
FSHD – Facioscapulohumeral muscular dystrophy
HIT – High-intensity interval training
MD – Muscular dystrophy
PEDro – Physiotherapy Evidence Database
PRISMA – Preferred Reporting Items for Systematic Review and Meta-Analysis
ST – Strength training

1. Introduction and background

Muscular dystrophy (MD) is a hereditary neuromuscular disorder that results in progressive muscle weakness and atrophy[1]. Among all types of MD, facioscapulohumeral muscular dystrophy (FSHD) is the second most widespread inherited autosomal dominant metabolic skeletal muscle disorder described by Louis Landouzy and Joseph Dejerine in late 1800s[1-4]. Globally, the prevalence of FSHD range between 4-12 in 100,000 individuals with an average of 52 new diagnosis every year[5,6]. The condition typically begins during the second or third phase of life with higher incidence in males whereas females are asymptomatic carrier[7-9]. Many people experience symptoms before 20 years of age[10]. FSHD is classified on the basis of pathological predisposition to genetic events. The pathology of FSHD is associated to the deletion of chromosome 4q35 within D4Z4 repeat array, which is associated with DNA hypomethylation[11]. FSHD type 1 accounts for 95% occurrence rate which results due to loss of microsatellite repeat arrays on chromosome 4 in the D4Z4 area whereas FSHD type 2 accounts for 5% in which mutation in SMCHD1 gene causes defect in DUX4 protein[9].

The clinical characteristics vary according to the type of FSHD with asymmetrical progression, gradual onset of muscle weakness accompanied by joint pains, chronic fatigue, and frequent falls[12]. These symptoms initially start with the facial muscles, scapular stabilizer muscles and humeral muscles but deltoid is preserved. Abdomen and lower extremities get affected in the progressive stage of the disease[13,14]. Ankle flexor weakness is observed in 56% of the FSHD cases, frequently results in foot drop, thereby affecting gait[15].

As the diseases progress it affects individuals' lives to a greater extent, leads to decreased quality of life (QOL). Thus, a thorough assessment is essential to evaluate and to make effective treatment strategy for FSHD; diagnosis can be done with imaging, electrodiagnostic biomarkers and molecular tests which identify altered muscles, degree of lipomatosis, detect inflammation in muscle tissue and evaluate of severity of disease[16]. Management of FSHD includes pharmacological intervention and non-pharmacological interventions[1,13]. Pharmacological interventions have not proven effective in preserving muscle strength or slow down muscle loss; however, studies have shown that some medicines are effective in addressing physical limitations and fatigue symptoms in patients with FSHD[13]. Non-pharmacological interventions encompass surgical treatments, including scapular stabilization procedures to enhance scapular stability; supportive devices such as knee-ankle-foot orthoses (KAFOs), ankle-foot orthoses (AFOs), and braces; and rehabilitation, which is a critical component for optimizing performance in individuals with FSHD[16,17].

Currently, the existing literature related to physical therapy in FSHD is relatively sparse, and thus, a more in-depth investigation is necessary to uncover insights that go beyond what has already been documented to enhance the effectiveness of physiotherapy in managing FSHD. This systematic review aims to examine the various physical therapy interventions and provide a comprehensive analysis of available treatment programs and the effectiveness of exercise therapy in improving motor function in individuals with FSHD.

2. Materials and methods

Researchers used Preferred Reporting Items for Systematic Review and Meta- Analysis (PRISMA) to conduct the present review. The study protocol was registered in the international database of systematic reviews registration (PROSPERO) with the registration number: CRD42024553079.

A PICO search method was employed to systematically gather relevant data, to ensure clarity and consistency in the evaluation process. This review specifically focused on individuals who have been diagnosed with FSHD (P) and who were undergoing physiotherapy along with structured exercise regimens (I). In contrast, it also examined the effects of pharmacological treatment (C). The primary method for assessing improvement in motor function was the 6-minute walk test (6MWT), maximal voluntary isometric contraction (MVIC), VO_{2max}. (O), MAP: Maximum aerobic power, $VO_{2\ peak}$: Peak oxygen consumption.

2.1 Search strategy

Data was systematically collected from databases using PubMed, Physiotherapy Evidence Database (PEDro), Cochrane Library, and ScienceDirect to identify trials published from year 2004 to 2024. The search strategy employed by using medical subject headings (MeSH) with specific search terms and combining them using the Boolean operators "AND" and "OR." The specific search terms are (facioscapulohumeral muscular dystrophy) AND (Physical therapy OR Physiotherapy OR Exercise therapy OR Rehabilitation) as shown in Table 1.

Table 1. Search methods with keywords

Keywords	Boolean terms	PubMed	PEDro	Cochrane Library	Science Direct	Total
#1 Facioscapulohumeral muscular dystrophy	#1	05	07	103	445	**560**
#2 Physical therapy #1 Facioscapulohumeral muscular dystrophy	#2 AND #1	03	01	25	135	**164**
#3 Exercise therapy #1 Facioscapulohumeral muscular dystrophy	#3 AND #1	03	01	20	89	**113**
#4 Physiotherapy #1 Facioscapulohumeral muscular dystrophy	#4 AND #1	02	0	03	26	**31**
#5 Rehabilitation #1 Facioscapulohumeral muscular dystrophy	#5 AND #1	02	0	06	98	**106**

Source: the authors (2025).

2.2 Eligibility criteria

This review specifically focused on randomized controlled trials (RCT) which primarily focused on physiotherapy intervention specifically exercise therapy for individuals with FSHD. Full text studies available in English language, published between 2004 to 2024. Studies other than randomized controlled trials, not directly related to FSHD, medical management, surgical treatment, not measuring motor function were excluded from the review.

2.3 Methodological quality assessment

The studies found were systematically analyzed through a specific methodological quality assessment instrument, the PEDro scale, consisting of 11 criteria. The final score is given by the sum of the number of these criteria, excluding the first item and ranging from 0 to 10 points. The higher score is better quality of the study.

2.4 Risk of bias assessment

Risk of bias assessment of the studies were done by the commonly used tool "Cochrane risk of bias tool".

2.5 Data extraction and analysis

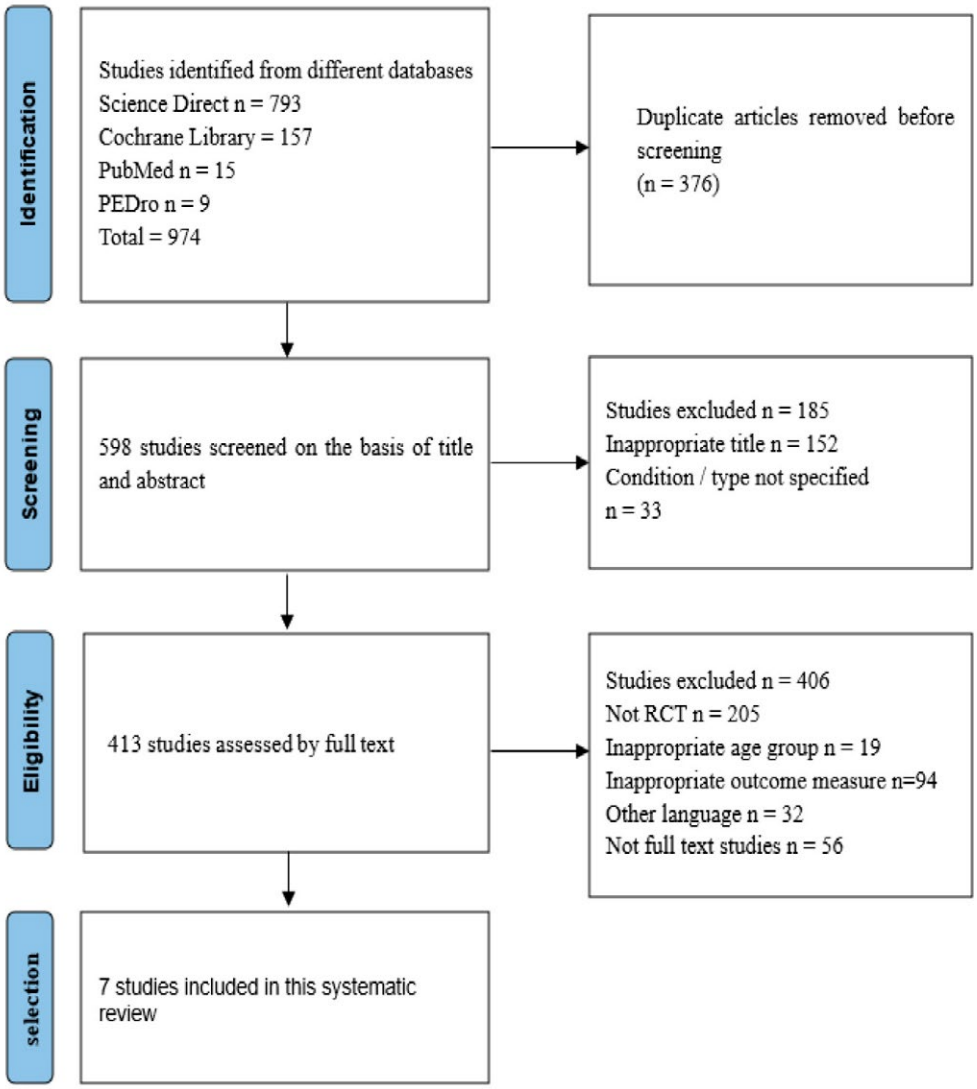
Three reviewers independently assessed all the titles and abstracts to determine the eligibility of the studies while fourth reviewer was consulted for the final approval. Data extraction process consisted of author name and year of publication, total number of subjects, characteristics of population, intervention, outcome measure, and conclusion.

3. Results

3.1 Search results

The search strategy yielded 974 articles, with 376 duplicates removed, leaving 598 articles which were screened for abstract and title review. This screening procedure led to exclusion of 184 studies that did not meet inclusion criteria, 152 studies had inappropriate titles while 33 studies were different muscular dystrophy types. 413 studies were then evaluated for full text. Out of which 205 were not RCTs, 19 studies were excluded for inappropriate age group while 94 had unsuitable outcomes, 32 were non-English, and 56 had different interventions. Ultimately, 7 studies were included[3,12,18-22], as shown in Figure 1.

Figure 1. PRISMA flow chart of study



Source: the authors (2025).

3.2 Study characteristics

A total of 331 participants of both genders underwent physical therapy in included studies, out of which 197 subjects were in 'experimental group' and 134 participants were in 'control group'. All articles presented in this review reveal homogeneity concerning both characteristics of the studies and the participants involved[3,12,18-22]. All studies that have been included are RCTs. Among these trials, four[18-21] were carried out in the Netherland, while two[12,22] were conducted in Denmark, and one study took place in France[3].

Each study that was included in this systematic review had at least one group that received physical therapy as an intervention. Total number of participants in each intervention group varied significantly as follows: group engaged in high intensity training (HIT) alone consisted of 13 participants[22], while group that underwent strength training (ST) combined with albuterol included 68 participants[18,19]. In contrast, a group focused solely on aerobic exercise training (AET) had 20 participants[21]. Additionally, another group that combined AET with usual care had 25 individuals involved in their sessions[20]. Furthermore, group that engaged in AET coupled with post-exercise protein supplementation, comprised of 18 participants[12] and a group that included combination of interventions such as ST, HIT, and low-intensity AET comprised of 8 participants[3]. Although all the groups received physical therapy interventions, but still the frequency and duration of these treatments varied significantly among the studies.

The treatment frequency duration across these studies displayed considerable heterogeneity. A study conducted in 2017[22] recommended that participants would engage in 3 sessions per week, each lasting 10 minutes, of HIT over a period of 8 weeks. In another study from 2016[3], a RCT proposed a regimen combining of ST, HIT, and low-intensity AET, for 3 sessions of 35 minutes each week for a total duration of 24 weeks. Moreover, a RCT in 2015 put forth a recommendation for AET, supplemented with post-exercise protein, recommended a structure of 3 sessions lasting 30 minutes each week over a 12-week period[12]. Meanwhile, in 2014, it was advised that participants complete 2 sessions of 30 minutes of AET each week over 3 weeks[21]. In another study published in 2010, it was suggested that participants perform AET alongside usual care for 3 sessions each week for an extensive duration of 16 weeks[20]. Additionally, in year 2007 a RCT prioritized ST combined with albuterol treatment for a period of 24 weeks[19], while a 2004 study also recommended ST with albuterol but for an extended duration of 26 weeks[18] as shown in Table 2.

Table 2. Study and Population Characteristics (to be continued)

S. no.	Author & Year	Age (years)	Participants	Interventions	Outcome Measure	Conclusion
1.	Andersen G et al 2017[22]	EG 1= 53 ± 15 EG 2= 52 ± 14 CG= 46 ± 9	EG1= 6 patients (2F and 3M) EG2= 6 healthy participants (2F and 4M) CG= 6 patients (1F and 5M)	EG1= Patients underwent 8 weeks of supervised HIT for 3×10 min cycle-ergometer HIT/week EG2= Healthy participants underwent 8 weeks of supervised HIT/week CG= patient underwent 8 weeks of unsupervised HIT	6MWT, 5STS, VO_{2max}	HIT is safe, well-tolerated, and applicable in patients with FSHD1, with no reported muscle pain or injuries.
2.	Bankole LC et al 2016[3]	EG= 40 CG1= 41 CG2= 42	EG= 8 patients (3F and 5M) CG1= 8 patients (1F and 7M) CG2= 8 patients (1F and 7M)	EG= training consisted of combination of ST, HIT and low-intensity AET at home for 24 weeks (3×35min/week) CG2= GC1 patient performed identical training program after 24 weeks.	MVIC and MAP, VO_2 peak	A regimen integrating both ST and HIT improve overall health leads to functional benefits of patients affected with FSHD without causing any adverse effects on muscle integrity

Table 2. Study and Population Characteristics (conclusion)

S. no.	Author & Year	Age (years)	Participants	Interventions	Outcome Measure	Conclusion
3.	Andersen G et al 2015[12]	EG1= 42.6 EG2= 45.7 CG= 51.3	EG= 13 patients (5F and 8M) EG2= 13 patients (6F and 7M) CG= 9 patients (4F and 5M)	EG= participants performed upright stationary bike (3 times/ week) and were instructed to add 0.4L water with PC supplement after 15 minutes of each exercise session. EG2= participants performed upright stationary bike (3 times/ week) and were instructed to add 0.4L water with sukrin supplement after 15 minutes of each exercise session. CG= no intervention was given	6MWT, VO_2max, 5-STS, 12-Step-Stair-Test, Standing Balance Test, 14-step-stair-test	Endurance training enhances fitness, walking speed, and self-assessed health in FSHD patients without inducing injury to muscle tissue. Post-exercise PC supplementation does not yield additional benefits to training.
4.	Voet N et al 2014[21]	EG1= ≥18 years EG2= ≥18 years CG= ≥18 years	EG1= 20 patients EG2= 13 patients CG= 24 patients	EG1= Patients performed AET (cycle ergometer) for 30 minutes, 2 sessions/day for 3 weeks EG2= patient underwent CBT for 50 minutes CG= patients were given usual care	CIS-Fatigue, VO_2 Peak, VAS, SIP, NHP-Sleep	AET and CBT can help to relieve long term fatigue in FSHD individuals.
5.	Voet N et al 2010[20]	EG= ≥18 years CG= ≥18 years	EG1= 25 participants EG2= 25 participants CG= 25 participants	EG1= received AET and usual care 3 times/week for 16 weeks EG2= received CBT and usual care once a week for 16 weeks CG= received usual care 16 weeks	CIS-fatigue	This RCT explores the effectiveness of AET and CBT in reducing fatigue and improve activity in FSHD patients.
6.	Van der K et al 2007[19]	EG= 25 F (40 ± 11) and 40M (37 ± 10) CG= = 25 F (40 ± 11) and 40M (37 ± 10)	EG= 34 participants CG= 31 participants	EG= participants underwent the ST of elbow flexors and ankle dorsiflexors. After 24 weeks albuterol was added CG= no treatment was given	MVIC, VAS, CIS-fatigue, SIP	ST and albuterol did not any impact on pain, fatigue, functional status and mental distress
7.	Van der K et al 2004[18]	EG1= 36 ± 11 years EG2= 36 ± 9 years CG1= 41 ± 12 years CG2= 36 ± 9 years	EG1= 15 participants (4F and 11M) EG2= 19 participants (8F and 11M) CG1= 15 participants (6F and 9M) CG2= 16 participants (7F and 9M)	EG1= ST and albuterol after 26 weeks EG2= ST and placebo after 26 weeks CG1= non-training and albuterol CG2= non-training and placebo	MVIC, PFT, Dynamic Muscle Strength	ST and albuterol seem to be safe therapies and have beneficial effect on muscle volume and strength in FSHD patients

Source: the authors (2025).

EG: Experimental group, CG: Control group, M: male, F: female, FSHD: Facioscapulohumeral muscular dystrophy, HIT: High Intensity-Interval Training, AET: Aerobic Exercise Training, CBT: Cognitive Behavioural Therapy, ST: Strength Training, 6MWT: 6-minute walk test, 5STS: 5-sit to stand, VO_{2max}: Maximum oxygen consumption, MAP: Maximum aerobic power, $VO_{2\ peak}$: Peak oxygen consumption, SIP: Sickness impact profile, NHP-sleep: Nottingham health profile-sleep, MVIC: Maximum voluntary isometric contraction, VAS: Visual analogue scale, PFT: Pulmonary function test.

3.3 Quality assessment

The PEDro scale was used to assess the quality of the studies that were included in this review[3,12,18-22]. To ensure accuracy and consistency, three independent investigators manually calculated the PEDro scores for each of the studies reviewed. Assessment revealed that out of seven articles included in this review, five studies shows good quality[12,18-21]. While, two studies scored[5], which classifies it as fair quality[3,22] as shown in Table 3.

Table 3. Quality assessment - The Physiotherapy Evidence Database (PEDro) scale

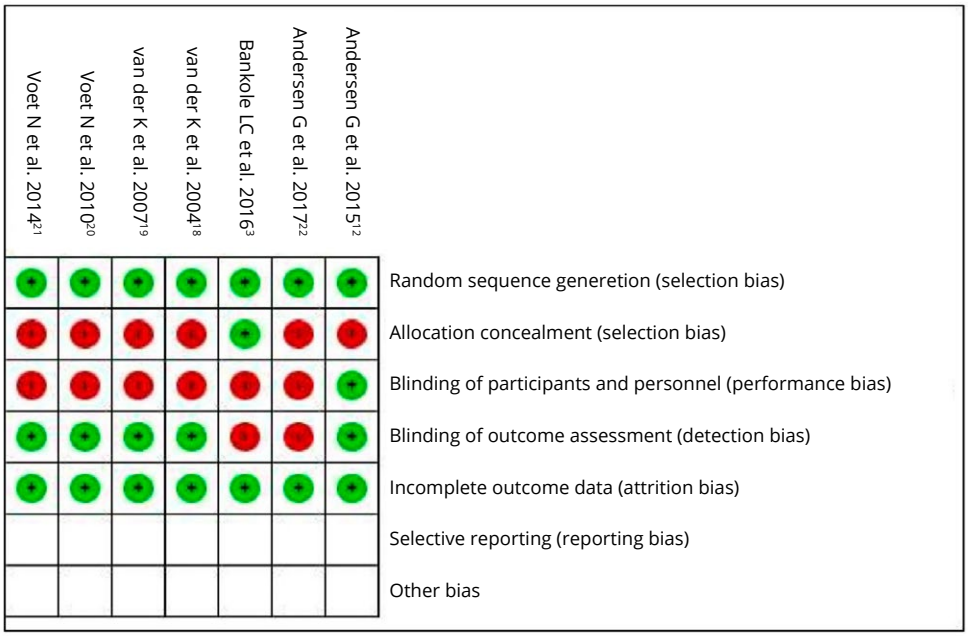
Athor/Year	1	2	3	4	5	6	7	8	9	10	11	Total
Andersen G, et al. 2017[22]	1	1	0	1	0	0	0	1	0	1	1	5
Bankole LC, et al. 2016[3]	1	1	1	1	0	0	0	0	0	1	1	5
Andersen G, et al. 2015[12]	0	1	0	1	1	0	1	1	1	1	1	8
Voet N, et al. 2014[21]	1	1	0	1	0	0	1	1	1	1	1	7
Voet N, et al. 2010[20]	1	1	0	1	0	0	1	1	1	1	1	7
Van der K, et at. 2007[19]	0	1	0	1	0	0	1	1	1	1	1	7
Van der K, et at. 2004[18]	1	1	0	1	0	0	1	1	1	1	1	7

Source: the authors (2025).
1 – Eligibility criteria; 2 – Randomly allocated; 3 – Concealed allocation; 4 – Baseline similarity; 5 – Blinding of subjects; 6 – Blinding of therapist; 7 – Blinding of assessors; 8 – Measure of at-least one key outcome; 9 – Control group received treatment; 10 – Inter-group statistical; 11 – The study provides both point variability.

3.4 Assessed domains of bias

The risk of bias assessment of the articles was carried out by using “Cochrane Risk of Bias tool” as illustrated in Figure 2. Out of the total of 7 studies that were included in our analysis, it was found that 5 studies[12,18-21] were classified as having a low risk of bias, while remaining 2 studies fell into the high risk of bias[3,22]. All the studies included demonstrated a low bias in terms of random sequence generation and reporting bias. Furthermore, one included study shows low risk in terms of allocation concealment[3]. Also, only single study showed low risk in blinding of participants and personnel[12]. Moreover, five studies showed a low bias in the blinding of outcome assessment[12,18-21] and nearly all the studies assessed displayed low risk of bias in terms of incomplete outcome data[3,12,18-21]. Lastly all the included RCTs conveyed unclear risk of bias in terms of selective reporting[3,12,18-22] as shown in Figure 2.

Figure 2. Risk of bias summary



Source: the authors (2025).

4. Discussion

This systematic review was aimed at investigating the role of physiotherapy in management of individuals with FSHD. This is the first review to underline the crucial role of implementing specific physical therapy interventions to improve motor functions in individuals with facioscapulohumeral muscular dystrophy (FSHD). The quality assessment of included studies was determined by using PEDro scale and Cochrane risk of bias tool. In this review, we found out that number of males were greater than that of females thus this indicate that males are more commonly affected with FSHD than females. Our study findings was supported by a previous literature which also concluded that male were more affected with FSHD than female[9,13].

Grete A et al. in their study used VO_{2max}, 5-STS, MVIC and 6-MWT as outcome measure[12,22], another study conducted by Eichinger K et al. conclude that 6-MWT is reliable and valid test to evaluate FSHD[23]. Out of 7 included studies, Voet N et al. used CIS-fatigue and VAS as outcome measure in two separate studies[20,21] and Kooi EL et al. use MVIC and CIS-fatigue in their study to assess fatigue and muscle strength in patient with FSHD[18,19].

Interventions that commonly use in treatment of FSHD include ST, AET, ET and HIT. Out of seven included studies, one article[22] used HIT as intervention, another three articles[12,20-21] provide AET as intervention to FSHD patients. Other two, studies used ST as an intervention[18,19] whereas, a study conducted by Bankole LC et al. use a combination of all above mention intervention in their study and conclude that combination therapy helps in the reduction in fatigue symptoms and improve VO_{2max} without any damage to muscle tissue[3]. Another study by Voet N et al. suggests that combination of different training methods improve muscle strength, pain, fatigue and enhance QOL in FSHD patients[24].

Treatment frequency, duration and sessions were highly different among all, including seven studies[3,12,18-22]. One study suggested HIT for 10 minutes and 3 sessions per week for 8 weeks[22]. Another study conducted by Bankole LC et al. proposed a regimen combining of ET, ST, HIT and low-intensity AET for 3 sessions of 35 minutes weekly over 24 weeks[3]. In a study Voet N et al. found that integrating a variety of training approaches strengthens muscles, alleviating discomfort by reducing pain and fatigue, leading to an overall improvement in QOL for people with this condition[24]. Whereas another study, conducted by Grete A et al., suggested 3 sessions of 30 minutes of AET with post-exercise protein for 12 weeks[12], another study conducted by Voet N et al. suggested 2-3 sessions of 30 minutes of AET weekly for 3 weeks or AET along with usual care for 16 weeks[20,21]. While Van der Kooi et al. focused on ST with albuterol for 24 weeks to 26 weeks in two related studies[18,19].

Out of 7 included studies, 6 studies suggest that engaging in low-intensity exercises or moderate-intensity exercises can provide significant benefits to patients with FSHD[3,12,18-21]. One included study concludes that HIT is helpful in improving 6-MWT, VO_{2max} and significantly effective in improving muscle strength, overall physical fitness, aerobic capacity, and the QOL in FSHD patients without causing any muscle damage[22]. Similar results were obtained by Soren A et al. in their study that HIT increased the maximal oxygen uptake, thus improving cardiorespiratory status in patients with FSHD and conclude that HIT was well tolerated in FSHD patients. Supervised HIT or a combination of ET, ST, HIT and AET provide significant improvement in motor function[25].

In this systematic review, we found high variability in the outcome measure, exercise protocol as well as the treatment duration of the exercises. However, all the studies included in this review suggested that exercise interventions used in different studies show improvement in motor function among individuals with FSHD.

5. Strength of the study

A notable strength of this study lies in its comprehensive evaluation of a variety of research articles. It employed well-regarded quality assessment tools to reduce study risk of bias.

6. Limitations of the study

• The scope of the study is restricted to the effects and applications of exercise therapy in FSHD. Consequently, physiotherapy interventions applicable to other forms of MD were not explored.

• The heterogeneity of exercise frequency and exercise protocol across different studies, which makes it difficult to determine a standardized timing schedule and optimal exercise-based approach that would benefit individuals with FSHD.

• Additionally, it is notable that no study adequately addressed strategies specifically tailored for the acute stages of FSHD. This absence of information constitutes a significant gap in our understanding of how to best manage the initial and potentially most debilitating stages of the condition via targeted rehabilitation interventions.

• We have limited our database research to PubMed, Science Direct, PEDro, Cochrane Library.

7. Final considerations

This review highlights the importance of physiotherapy in managing motor dysfunction among individuals with FSHD. This review concludes that interventions used in included studies were safe and effective for improving motor function among individuals with FSHD.

8. Future scope

In order to advance the field, it is essential that further research can be conducted to develop the standardized physiotherapy treatment protocol that is not only more streamlined but also more integrated. This is important because extensive studies are required to thoroughly explore treatment of FSHD. Future research should concentrate on highly relevant RCT studies that involve exercise therapy along with electrotherapy, utilization of advanced techniques and development of home exercise programs. Additionally, there should be an emphasis aimed at early prevention and awareness among people. By focusing on these aspects, a generalized protocol according to different age groups, and severity of disease can be established.

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Authors contributions

The authors declared that they have made substantial contributions to the work in terms of the conception or design of the research; the acquisition, analysis or interpretation of data for the work; and the writing or critical review for relevant intellectual content. All authors approved the final version to be published and agreed to take public responsibility for all aspects of the study.

Competing interests

No financial, legal, or political conflicts involving third parties (government, private companies, and foundations, etc.) were declared for any aspect of the submitted work (including but not limited to grants and funding, advisory board participation, study design, manuscript preparation, statistical analysis, etc.).

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