

Recommended Physical Exercises for Children with Duchenne Muscular Dystrophy in the Home Environment

Exercícios Físicos Recomendados para Crianças com Distrofia Muscular de Duchenne no Ambiente Domiciliar
Ejercicios Físicos Recomendados para Niños con Distrofia Muscular de Duchenne en el Ambiente Doméstico

RESUMO

Objetivo: Os exercícios no ambiente doméstico emergem como uma alternativa promissora para as pessoas com Distrofia Muscular de Duchenne, pois promovem acessibilidade, redução de despesas e maior adesão ao protocolo terapêutico. **Método:** Trata-se de uma revisão da literatura, realizada na *Scopus*, *PubMed*, *Pedro*, *Scielo*, *Science Direct*, Biblioteca Virtual de Saúde (BVS) e Google Acadêmico, no período de fevereiro a março de 2024. **Resultado:** Foram incluídos 14 neste estudo por suas contribuições originais e relevantes. **Conclusão:** Os achados apontam a realização de exercícios aeróbicos de baixa intensidade, alongamentos, exercícios respiratórios, exercícios de resistência e hidroterapia. Embora citada, a hidroterapia mostra-se não adequada para implementação em ambiente domiciliar.

DESCRIPTORIOS: Distrofia Muscular de Duchenne; Exercício Físico; Ambiente Domiciliar; Doenças Raras.

ABSTRACT

Objective: Exercises in the home environment emerge as a promising alternative for people with Duchenne Muscular Dystrophy, as they promote accessibility, reduced expenses and greater adherence to the therapeutic protocol. **Method:** This is a literature review, carried out in *Scopus*, *PubMed*, *Pedro*, *Scielo*, *Science Direct*, *Virtual Health Library (VHL)* and *Google Scholar*, from February to March 2024. **Result:** 14 were included in this study for their original and relevant contributions. **Conclusion:** The findings point to low-intensity aerobic exercises, stretching, breathing exercises, resistance exercises and hydrotherapy. Although mentioned, hydrotherapy is not suitable for implementation in a home environment.

DESCRIPTORS: Muscular Dystrophy, Duchenne; Exercise; Home Environment; Rare Diseases.

RESUMEN

Objetivo: Los ejercicios en el ambiente doméstico emergem como una alternativa prometedora para las personas con Distrofia Muscular de Duchenne, ya que promueven la accesibilidad, la reducción de gastos y una mayor adherencia al protocolo terapéutico. **Método:** Se trata de una revisión de la literatura, realizada en *Scopus*, *PubMed*, *Pedro*, *Scielo*, *Science Direct*, Biblioteca Virtual en Salud (BVS) y *Google Scholar*, de febrero a marzo de 2024. **Resultado:** 14 fueron incluidos en este estudio por sus contribuciones originales y relevantes. **Conclusión:** Los hallazgos apuntan a ejercicios aeróbicos de baja intensidad, estiramientos, ejercicios de respiración, ejercicios de resistencia e hidroterapia. Aunque se menciona, la hidroterapia no es adecuada para su implementación en el hogar.

DESCRIPTORIOS: Distrofia Muscular de Duchenne; Ejercicio Físico; Ambiente en el Hogar; Enfermedades Raras.

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INTRODUCTION

Duchenne Muscular Dystrophy (DMD) is a rare, progressive, degenerative and disabling genetic disease that affects the muscular system, characterized by recurrent myopathies. It predominantly affects males and is the most common dystrophy in children. It affects approximately 250,000 individuals globally, with an estimated incidence of 1 in every 3,500 live births.⁽¹⁾ It therefore represents a challenge for public health.

It is caused by mutations, deletions and/or duplications in the DMD gene, located on the X chromosome, responsible for the production of the dystrophin protein, crucial for the structural and functional integrity of muscle fibers. Mutations in this gene result in the absence or reduction of the production of functional dystrophin, causing deterioration of muscle fibers and consequently compromising muscle function and the quality of life of affected individuals.⁽²⁾

In this sense, the progressive condition of DMD has repercussions on the manifestation of signs and symptoms in the first months of life, being noticed between 3 and 5 years of age by caregivers, especially when those

affected have difficulty walking.⁽³⁾ In addition, complications such as loss of mobility, impaired cardiac and respiratory function, muscle contractures, scoliosis and swallowing difficulties may occur. Thus, the course of the disease has a significant impact on the autonomy and well-being of those affected, requiring a multidisciplinary therapeutic approach and continuous interventions.⁽⁴⁾

Although DMD is a genetic disease with no cure, the focus of treatment is to slow the progression of symptoms and improve the quality of life of those affected. In this context, auxiliary therapeutic approaches, such as regular physical exercise, play a crucial role in promoting the health and well-being of affected individuals. Thus, physical exercise consists of planned and structured movements with the aim of maintaining and/or improving physical capacities such as strength, flexibility and endurance.⁽⁵⁾

From this perspective, physiotherapy is considered an integral part of DMD treatment, with a view to preserving muscle strength, joint range of movement and respiratory capacity.⁽⁶⁾ However, it is essential that treatment is carried out in a way that does not overload those affected, as excessively

intense interventions can be tiring and accelerate the muscular degenerative process.⁽⁵⁾

In this context, online exercise instructional videos emerge as a promising alternative for people with DMD, who often face obstacles in accessing health services. This approach allows patients to perform exercises at home, under the supervision of a caregiver, enabling greater accessibility, reduced costs, and greater adherence to the therapeutic protocol. However, patients and caregivers face challenges in performing exercises correctly at home, and it is important to offer clear, educational, and accessible guidelines. Practicing exercises at home for people with DMD provides greater convenience and autonomy, and allows them to adapt their routine to their daily needs.

It should be noted that this study is part of a project entitled "Educational video with physical exercises for patients with Duchenne Muscular Dystrophy: construction, validation and evaluation by the target audience", whose objective is to create an educational video. As a first step, the objective was to identify physical exercises recommended for people with DMD through the scientific literature.

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METHOD

This is a literature review, carried out from February to March 2024. The difficulties faced by people with DMD regarding the implementation of promising therapies, such as physical exercise, led to the following question: What physical exercises are recommended for people with Duchenne Muscular Dystrophy?

The bibliographic search was carried out in libraries and databases: Scopus, PubMed, Pedro, Scielo, Science Direct, Virtual Health Library (BVS) and Google Scholar, using the Health Sciences Descriptors (DeCS) and uncontrolled terms to survey the studies: “Duchenne Muscular Dystrophy” and “physical exercise”. The logical operator “AND” was used to relate the keywords, thus providing the following search combination “Muscular Dystrophy Duchenne” AND “exercise”.

The inclusion criteria were studies in Portuguese and/or English that addressed the benefits of physical exercise, as well as those that evaluated its effectiveness and safety for people with DMD. Studies that were not available in full, duplicates/repeated studies, and studies with animals were eliminated.

The Rayyan software, which is in the public domain and free of charge, was used to select the studies. Access is via the link: <https://www.rayyan.ai/>. The PRISMA model was also used to demonstrate the organization of the research stages.⁽⁷⁾

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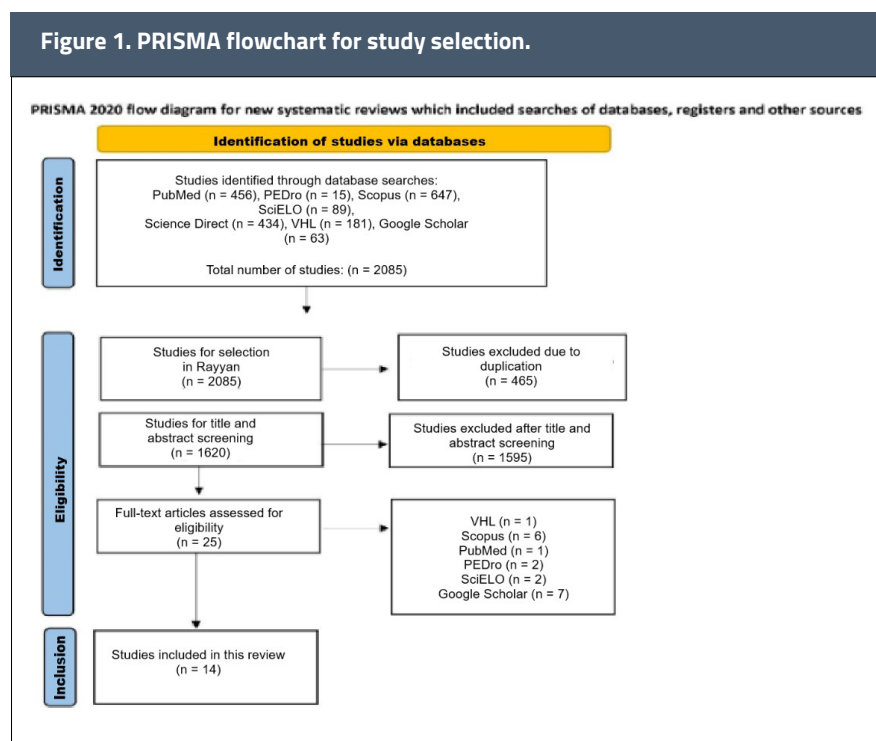
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RESULTS

A total of 2,085 studies were four-

nd in the initial search, of which 465 were duplicates. After reading the titles and abstracts, 25 studies were kept for full reading, with 14 studies being included, as per the guide presented in Figure 1.



Source: Prepared by the authors (2025), adapted from PRISMA.

from the full versions of the studies by identification (ID), title, authors/year, study methodology and main results.

Table 1 presents the data extracted

ID	Title	Authors/year	Methodology	Main results
A1	Effects of physical exercise in a swimming pool on lung function in patients with Duchenne muscular dystrophy: A case report	Sales <i>et al.</i> , (2004)	Case report of the effect of respiratory exercises performed in a swimming pool between July and December 2001, with a DMD patient from the city of Maringá, PR.	The physical exercises performed in the swimming pool contributed to maintaining the patient's vital capacity and improving his respiratory rate. There was also an improvement in the mobility of the rib cage, promoting better functioning of the respiratory system.

A2	Update on physiotherapy treatment for Duchenne and Becker muscular dystrophies	Silva <i>et al.</i> , (2005)	Literature review on Duchenne and Becker muscular dystrophies and their cardiorespiratory complications.	Emphasizes the need for a comprehensive approach that includes stretching exercises, respiratory muscle training and the use of assistive devices to improve mobility and quality of life in individuals with DMD.
A3	Effect of resistance exercise on functionality in Duchenne Muscular Dystrophy	Ramacciott e Nascimento (2010)	Case study of a 6-year-old male child with DMD. The intervention was carried out in a physiotherapy clinic, totaling 10 sessions with each session lasting 60 minutes.	There was an improvement in muscle strength, endurance and functional mobility.
A4	Effects of yoga breathing exercises on lung function in patients with Duchenne muscular dystrophy: an exploratory analysis	Rodrigues <i>et al.</i> , (2014)	Prospective open-label study involving patients with confirmed diagnosis of DMD recruited from the neurology outpatient clinic of a university hospital in São Paulo. Participants were taught hatha yoga breathing exercises and instructed to practice them three times a day for 10 months.	The safety and efficacy of yoga breathing exercises in children with DMD were evaluated and confirmed. The results showed improvement in lung function in relation to predicted values for each patient.
A5	The importance of home treatment in patients with Duchenne muscular dystrophy	Orlandini, (2015)	Literature review to observe the levels of dependence and functional independence of Duchenne patients.	Physiotherapy is essential in the treatment of DMD. The importance of providing continuous assistance to patients and their families is emphasized, due to the progression of the disease and the gradual loss of independence.
A6	Therapeutic effects of aquatic exercises on a boy with Duchenne muscular dystrophy	Atamturk, H e Atamturk, A (2018)	Case report, adopting the qualitative research method, conducted with a boy with DMD in a swimming pool located on the campus of a private university in Northern Cyprus.	The aquatic exercises provided the participant with benefits such as improved socialization, relaxation, quality of life and self-perception, in addition to psychological improvements.
A7	Estabelecimento de um programa de tele-reabilitação para pacientes com Distrofia Muscular de Duchenne na pandemia de COVID-19	Agnieszka Sobierajska-Rek <i>et al.</i> , (2021)	O projeto envolveu 69 meninos com DMD. O programa de reabilitação foi apresentado durante workshops online para pacientes e cuidadores. O mesmo programa foi gravado em vídeo e publicado na internet.	Instruções em vídeo on-line são mais preferidas por pais e cuidadores de pacientes com DMD em comparação com workshops presenciais. Atrasar a perda de habilidades funcionais é essencial para todas as atividades diárias, ajudando a otimizar a independência de meninos com DMD.
A8	Respiratory Telerehabilitation of Boys and Young Men with Duchenne Muscular Dystrophy in the COVID-19 Pandemic.	Agnieszka Sobierajska-Rek <i>et al.</i> , (2021)	A multicenter study evaluated the possibility of implementing breathing exercises through online video program instructions in home rehabilitation routines for patients with DMD.	The effectiveness of home breathing exercises depends directly on the frequency of their practice, and they should be performed at least two or three times a day. These exercises should be personalized according to the patient's respiratory capacity and age.
A9	The role of physical therapy in children with Duchenne Muscular Dystrophy: a literature review	Avargues (2021)	Bibliographic research using the PEDro, Pubmed, Web of Science, CINAHL and Scielo databases, including randomized controlled trials in humans, articles in English and samples under the age of 18..	Physiotherapy improves the general health of people with DMD and slows the progression of the disease.

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A10	Comparison between telerehabilitation and home video exercises in patients with Duchenne Muscular Dystrophy: a single-blind randomized study	Ozge Kenis-Coskun <i>et al.</i> , (2022)	Male outpatients with DMD were randomized into telerehabilitation and video-based exercise groups. Nineteen patients were included in the final analyses.	The exercise program consisted of low- to moderate-intensity aerobic exercise. The study demonstrated that a telerehabilitation approach was superior in improving muscle strength when compared to a video-based exercise program.
A11	Motor rehabilitation for children and young people with muscular dystrophy: a scoping review	Cândido (2022)	Scoping review conducted to identify and examine research on motor interventions in children and young people with muscular dystrophy.	Clinical evidence on the types of exercises in muscular dystrophies is still limited and heterogeneous and does not allow for a consensus on the effects of physical exercise in this clinical condition.
A12	Exercise training in Duchenne muscular dystrophy: a systematic review and meta-analysis	Hammer <i>et al.</i> , (2022)	Systematic literature review conducted in Medline, EMBASE, CINAHL, Cochrane Central, PEDro and Scopus. Twelve studies with 282 participants were included.	Exercise training may be beneficial for DMD, but the evidence is still uncertain. More research is needed to clarify its impact on functioning and health-related quality of life in patients.
A13	Refining a home-based exercise program for children and adolescents with muscular dystrophy in the current COVID-19 pandemic scenario: a scoping review.	Harjpal <i>et al.</i> , (2022)	Scoping review of data collected from electronic databases including PubMed, ProQuest, Cochrane and Web of Science. Included studies that described the positive impacts of home-based exercise programs and the prevention of complications with physical therapy.	Highlighted the importance of personalized and adapted exercise programs for children and adolescents with DMD, taking into account their individual needs and limitations.
A14	Caring for people with Duchenne muscular dystrophy: reviewing recommendations	Fortes; Koller; Campos (2018)	Literature review with systematic search in the Pubmed and BIREME databases, between 2009 and 2016.	Low-impact aerobic exercise promotes the strengthening and development of skeletal muscles, promoting greater strength, endurance and flexibility.

Source: Prepared by the authors (2025).

DISCUSSION

Based on the reading and synthesis of the results, the types of exercises indicated for people with DMD were described, as well as their frequency, duration, effectiveness, safety and benefits. The results were divided into five categories: low-intensity aerobic exercises; stretching exercises; breathing exercises; resistance exercises; and hydrotherapy.

Low intensity aerobic

The randomized study⁽⁸⁾ conducted with DMD patients, demonstrated that telerehabilitation was more effective in improving muscle strength compared to a video-based exercise program. In the telerehabilitation group, patients participated in live sessions with a physical therapist, receiving real-time feedback and encouragement, while the home-based exercise group watched recorded videos, without direct interaction with the professional. After 8 weeks, 3

times a week, telerehabilitation resulted in significant improvements in muscle strength, but both groups showed no differences in functional outcomes related to daily activities.

As the authors point out, low-impact aerobic exercise promotes the strengthening and development of skeletal muscles, promoting greater strength, endurance and flexibility. Furthermore, regular practice of this activity increases respiratory capacity and helps reduce cardiac decline.^(4,8)

The study⁽⁹⁾ highlights the importance of personalized care for people with muscular dystrophies, emphasizing the need to adapt treatment to the specific needs of each patient. By considering factors such as posture, quality of life, motor function and participation in activities of daily living, in addition to starting treatment early, it is possible to improve therapeutic results. Therefore, lower intensity exercises can preserve and improve the functional status of people with dystrophies.

Stretching Exercises

The research carried out within the scope of the Multidisciplinary Care Program for Patients with DMD highlighted that one of the most important elements of home rehabilitation is stretching. In this sense, the authors include stretching exercises for the following muscle groups: Hip flexors and ankle dorsiflexors; shoulder girdle, elbow flexors, extensors, forearm rotators, as well as wrist and finger flexors.⁽¹⁰⁾

Supporting the approach, it includes a series of stretches targeting different muscle groups. For the pectoral muscles, the individual lies on their back with their knees bent and their feet on the floor, holding a towel behind their back and gently pulling their elbows toward the floor. The lateral flexors of the trunk are stretched by raising the arm above the head and leaning the trunk to the opposite side, in a seated position. To stretch the iliotibial band, the person stands, crosses one leg in front of the other and leans the trunk to the side of the crossed leg. The hamstrings are

stretched by leaning the trunk forward with the legs straight. The gastrosoleus muscle is stretched by pulling the toes toward the body with a towel. Finally, to stretch the hips, the person leans the trunk to the side, keeping the back straight and supporting themselves, if necessary, on a chair or wall.⁽⁸⁾

Furthermore, it was found that physiotherapy alone promoted improvements in several aspects of the functional abilities of individuals with muscular dystrophy, such as mobility and daily activities. In contrast, the combination of physiotherapy with yoga resulted in gains restricted to mobility, allowing physiotherapy alone to offer broader benefits in the functionality of patients.⁽¹¹⁾

Breathing exercises

Respiratory telerehabilitation emerges as an effective tool to improve the quality of life of patients with DMD, as it offers advantages such as accessibility to a wider audience, flexible schedules for performing exercises and reduced travel costs, in addition to the active participation of the family.⁽¹²⁾

A study⁽¹⁰⁾ showed that during the Covid-19 pandemic, telerehabilitation was highly accepted by DMD patients and their caregivers, and that it can be implemented using video instructions. The respiratory training techniques proposed in the study, such as positive inspiratory pressure (Breath stacking), glossopharyngeal breathing, and positive expiratory pressure, aim to increase lung volume and improve respiratory muscle strength, which are crucial aspects for respiratory function in DMD patients.

Patients were instructed to take maximum breaths followed by 1 to 3 additional breaths, holding the air for 5 seconds. This exercise was repeated using balloons, where patients inhaled the air from the balloon and tried to hold it as much as possible for 5 seconds, repeating 5 times (positive inspiratory pressure). They also practiced glossopharyngeal breathing, pushing small

volumes of air into their lungs while saying “cat” in Polish. In addition, they were instructed to inflate the balloon by inhaling through the nose and exhaling through the mouth (positive expiratory pressure).⁽¹⁰⁾

In DMD patients who use wheelchairs, it is essential to implement respiratory muscle training. This is due to the progressive loss of lung capacity and volume, with an increase in residual volume. Over time, the effectiveness of coughing also decreases, favoring the retention of secretions, which leads to the risk of pneumonia and contributes to the development of respiratory failure.⁽¹³⁾

It is worth noting that the literature presents controversial results on the effectiveness of home breathing exercises, given that effectiveness is closely related to the frequency with which they are performed. Agnieszka⁽¹⁰⁾ observed that 40% of participants considered some or all of the exercises very difficult to perform, which reinforces the need for individualized adaptations, considering the characteristics and age of each patient. Difficulties in performing home breathing exercises may be related to low adherence, lack of motivation and the need for professional monitoring.

Corroborating, a study⁽¹⁴⁾ revealed the safety and efficacy of yoga breathing exercises in children with DMD. The intervention involved rapid learning of breathing techniques, allowing autonomous practice without the need for equipment or constant supervision. The sequence of exercises was gradually intensified, introducing more complex techniques over time, allowing progressive adaptation. Preliminary results indicated significant improvement in lung function compared to expected values for age. However, randomized controlled trials are needed to confirm these findings and validate their long-term effectiveness.

The exercises followed the following breathing techniques: kapalabhati, which consists of nasal expirations produ-

ced by rapid and vigorous contraction of the abdominal and pelvic muscles, followed by passive inspirations produced by relaxation of the recruited muscles; uddiyana, which consists of apnea after forced expiration, followed by thoracic expansion (achieved without inspiration) and voluntary glottic closure; agnisara, which consists of maximum contraction followed by abdominal projection during apnea after forced expiration.⁽¹⁴⁾

Resistance exercises

In the studies carried out, although the objective was not to identify a specific type of physical training that was most appropriate, they pointed out that physical training can offer benefits, especially in terms of strength and muscular endurance.⁽¹⁵⁾

According to another study⁽⁶⁾, Resistance exercises are essential tools in child development, providing benefits that go beyond increased muscle strength. Through planned and supervised activities, children can improve motor control, balance, and coordination. This approach helps delay the onset of muscle weakness, correct inadequate posture, and prevent premature muscle shortening, in addition to strengthening the cardiorespiratory system.

In this sense, the approach also demonstrated that strength training with aerobic exercises is the most effective intervention for increasing muscle strength and cardiorespiratory function, preventing muscle atrophy due to disuse.⁽⁶⁾ To select the resistance exercises, guidelines were established that related the activities to the therapeutic objectives, using play as motivation. As a therapeutic measure, functional tasks such as walking, turning, climbing up and down four steps were used, timed and supervised by parents. An example of an exercise included performing concentric contractions of the knee extensors and flexions with resistance from an elastic band with 10 repetitions for each leg, three times a week.

The approach proposes a protocol of resistance exercises to strengthen various muscle groups through controlled movements of the joints, such as flexion and extension of the elbows, shoulders, hips, knees and ankles. Strengthening of the neck flexors is performed with the person sitting, lowering the chin towards the chest and resisting the movement with the hands. The quadriceps and pelvic muscles are strengthened in the sitting position, raising the legs, and also lying on the back, contracting the abdomen and raising the hips. Isometric strengthening of the gluteus maximus is done lying on the stomach, with contraction of the glutes, and the hip adductors are worked lying on the side, raising the upper leg and resisting the movement with the hand.⁽⁸⁾

Hydrotherapy

In the study, vital capacity, respiratory rate and thoracic nipple perimeters were measured during normal and deep inspiration for six months, with assessments at the beginning and end of the period.⁽¹⁶⁾ Participants completed 45-minute swimming sessions, 3 times a week. The results showed that vital capacity remained stable, suggesting that pool exercises helped maintain this function, as well as improving respiratory rate and rib cage mobility, which favored the functioning of the respiratory system, indicating that aquatic exercises were beneficial.

In this context, the impact of aquatic exercises on a 6-year-old boy with DMD was investigated. The child participated in swimming sessions over 8 weeks, with two sessions per week, lasting 45 minutes each. The exercises were aimed at strengthening the muscles of the back, arms, legs and chest. Each session began with approximately ten minutes of warm-up activities, such as adaptation, breathing exercises and stretching, followed by 20 minutes of large body movements to develop motor coordination, and concluded with 10 minutes of cool-down exercises. Between exercises,

the patient took 2-minute breaks depending on fatigue.⁽¹⁷⁾

Aquatic therapy plays a crucial role in delaying the progression of DMD, improving children's quality of life in terms of socialization, relaxation, quality of life and self-esteem.⁽¹⁹⁾ Furthermore, it contributes to psychological and emotional well-being, increasing confidence in the water, offering a safe environment against falls and injuries.⁽¹⁷⁾

Exercises for the home environment

After reading and summarizing the results, the types of exercises recommended for people with DMD were described. However, when analyzing the possibility of practicing them at home, stretching exercises, breathing exercises, and resistance exercises were selected.

Stretching exercises are one of the simplest and most practical options to be performed at home, since they do not require complex equipment, which makes implementation more accessible. For people with DMD, stretching is essential to avoid muscle injuries and improve flexibility, which can be compromised by the progression of the disease. These exercises can be done daily, with the support of family members or caregivers who help with guidance and correct execution of the movements.

The positive point of breathing exercises is that they can be easily performed at home, with the help of instructional videos, such as those used in telerehabilitation. This provides flexibility for the patient to do exercises at convenient times, without having to leave the house and using specific techniques, such as the use of balloons for positive inspiratory pressure training.

Resistance exercises can also be effective for patients with DMD, as long as they are adapted to the conditions of each individual. The ease of performing them at home, with simple materials or one's own body weight, makes this approach an option for promoting the maintenance of muscle strength and

functionality, in addition to improving the quality of life of those affected.

It is important to note that hydrotherapy exercises cannot be considered a practical option for performing at home due to the need for an adequate pool and professional supervision, which limits their implementation in the home environment.

CONCLUSION

Performing exercises at home is an alternative for people with DMD. This approach, using educational technology, offers greater accessibility, reduces costs, and increases adherence to therapeutic protocols.

By integrating this therapeutic approach into DMD, significant therapeutic results are expected to be obtained, which promote the quality of life and autonomy of affected individuals. Therefore, it is essential to create clear and accessible educational materials, such as instructional videos and detailed guides, to assist patients and caregivers in correctly performing exercises at home.

The need for ongoing research and the development of new digital technologies is highlighted, in order to offer effective and accessible therapeutic alternatives for this population. Collaboration between the scientific community, health professionals, and health institutions is essential to overcome gaps and ensure the well-being of people with DMD.

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