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Breathing Retraining Adjuncts - A Systematic Review

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ABSTRACT

Background: The COVID-19 pandemic highlighted the importance of breath and the impact of deficiency of oxygen supply and desaturation on modern medicine. In such situations, positioning, breathing exercises, and counseling are critical to patient survival. Additionally, breathing exercises have been found effective in minimizing pulmonary complications and promoting early recovery in pre and post-surgical conditions. Therefore, this study aimed to identify the existing devices used as adjuncts in breathing retraining and assess their effectiveness in routine chest physiotherapy practice.

Method: Randomized controlled trials (RCTs) conducted until July 2022 were included in the review. The electronic databases MEDLINE, PEDro, CINHAL, PUBMED, and Google Patents were searched based on the PRISMA guideline's criteria, and research articles studied devices as adjuncts to physiotherapy in respiratory disorders. Devices that can aid in inspiratory or expiratory exercises with or without resistance are available and can be used during physiotherapy as adjuncts to management. However, not all devices are found to be multifunctional.

Conclusion: The study found that devices with functionality involving inspiratory or expiratory exercises with or without resistance can be used during physiotherapy as adjuncts to management. However, not all devices are multifunctional, and further research is needed to identify the most effective devices for use in respiratory disorders.

Keywords: Breathing exercises device, breathing, physiotherapy

INTRODUCTION

The pulmonary muscles are distinct from the other body muscles because they must function continuously throughout life. These muscles may be impacted by ailments like respiratory illnesses, “neurological lesions, electrolyte disturbances, blood gas abnormalities, extreme weight loss, and cardiac decompensation”. Reduced muscular contractility characterizes respiratory muscle weakness, which prevents the muscles from producing enough pressure and air flow during inspiration and exhalation. If the air flow does not occur it causes a pulmonary disorder [1]. For many kinds of pulmonary disorder, particularly “chronic lung disease, such as cystic fibrosis, bronchiectasis, bronchitis, bronchial asthma, and primary ciliary dyskinesia syndrome, chest physiotherapy (CPT)” with bronchial drainage is the usual treatment. In individuals with chronic respiratory disorders, CPT has been found to be beneficial in preserving pulmonary function and preventing or reducing respiratory consequences [2]. Standard CPT, however, is exceedingly labor- and time-intensive for both inpatient and outpatient patients with poor airway clearance. Due to this, many patients discontinue their regular physiotherapy sessions with negative outcomes. In recent years, equipment for respiratory physiotherapy has been available, providing patients with chronic lung diseases with less time-consuming alternatives to regular CPT and more mobility [3]. Figure 1 depicts the general representation of RMT.

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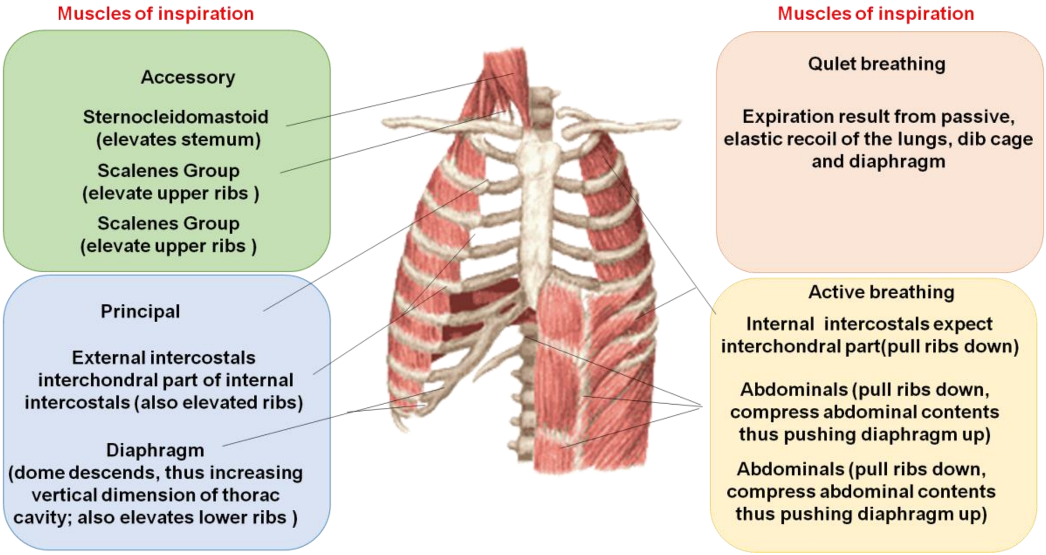

Figure 1: General representation of RMT

In the most recent research, respiratory physiotherapy devices are proposed as alternative therapeutic methods to assist and enhance the mobilisation of mucus from airways, which may then be accomplished to improve lung ventilation and pulmonary function. These apparatus are secure and provide comparable airway clearance to standard CPT. Pulmonary muscle training is one strategy that might improve the respiratory muscles' performance. Repetitive breathing exercises are used in this intervention to counteract an external load [4, 5]. The duration, intensity, and/or frequency of the training may all be adjusted. To get a training response, muscle fibers must be stressed by working for longer, at greater intensities, and/or more often. Most training programmes combine two or three of these components to overload. The changes generated by training depend on the muscle's stimulation. A strong muscle improves strength and endurance improves endurance [6].
There are already various devices on the market that may be utilised for training in pulmonary muscle. The pulmonary apparatus are classified into 2 types: those that provide training for resistance and for training endurance. The three primary types of "resistance-training apparatus are passive flow-resistance (PFR), dynamically controlled flow-resistance (DCFR), and pressure valve (PV), threshold valve (TV)" [7]. These devices expose the muscles to an external stress similar to lifting a weight. The pulmonary muscles are exercised at significant contracting velocity for prolonged periods of time, and the primary load on the muscle is the intrinsic flow-resistance and mobility of the pulmonary system. Due to its advantages, such as independent usage and lower treatment costs, patients with chronic respiratory disorders choose to utilise respiratory physiotherapy devices [8].

METHODOLOGY

Eligibility criteria:

Studies were included if they met the following criteria:
The study investigated the use of technologies for pulmonary physiotherapy
The study had a PEDro score of 6 or higher
The study had a clinical investigation and outcome
The study was published in a peer-reviewed journal
The study was available in full-text English language articles
Studies were excluded if they met the following criteria:

The study contained personal communications, case reports, retrospective studies, narrative reviews, non-controlled research, personal blogs, and less than 6 in PEDro Score. The study did not meet the eligibility criteria listed above. Search strategy: A comprehensive search of the electronic databases MEDLINE, PEDro, CINHAL, PUBMED, and Google Patents was conducted up through July 2022. The following keywords were used in the search:

Respiratory training
Breathing exercises
Inspiratory muscle training
Expiratory muscle training
Pulmonary function
Breathing re-training devices
Incentive Spirometer

Study selection: Two reviewers independently screened the titles and abstracts of the identified articles for eligibility. Full-text articles were then assessed for eligibility using the inclusion and exclusion criteria listed above. Any discrepancies were resolved through discussion and consensus. Data were extracted from the eligible studies using a standardized form. The following information was extracted:

Study design

Participants
Intervention
Comparator (if applicable)
Outcome measures
Results
Risk of bias assessment:

The Cochrane Risk of Bias tool was used to assess the risk of bias in the included studies. Two reviewers independently assessed the risk of bias in each study, and any discrepancies were resolved through discussion and consensus.

Data synthesis: A narrative synthesis of the included studies was conducted, and the results were summarized. If possible, a meta-analysis was conducted to pool the results of the included studies. Publication bias was assessed using a funnel plot and the Egger's regression test. The quality of evidence was assessed using the GRADE approach. The PRISMA guidelines were followed for the reporting of the systematic review. The study selection process was presented using a flow diagram (Figure 2).

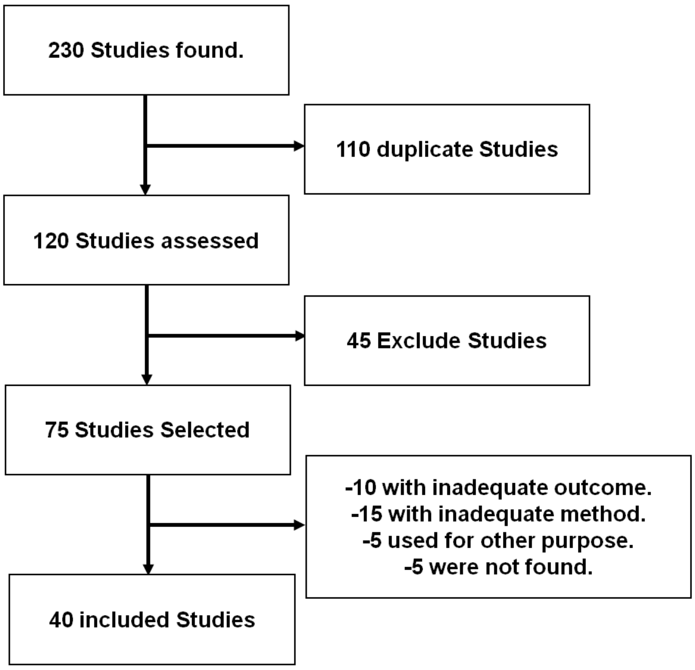

Figure 2: Flowchart of criteria

Studies pertaining to the use of technologies for pulmonary physiotherapy, PEDro score ≥6, studies pertaining to a clinical investigation and outcome, journal publication under peer review, full text English language articles, were included for the review. However, total of 45 studies containing personal communications, case reports, retrospective studies, narrative reviews, non-controlled research, Personal blogs, and less than 6 in PEDro Score were excluded. Table 1 depicts the list of keywords used during search

1. Respiratory training
2. Breathing exercises
3. Inspiratory muscle training
4. Expiratory muscle training
5. Pulmonary function
6. Breathing re-training devices
7. Incentive Spirometer

Table 1: List of Keywords

According to the PRISMA guideline's criteria, Randomized Controlled and/or Clinical Trials (RCT) up through July 2022 were searched using the electronic databases MEDLINE, PEDro, CINHAL, PUBMED, and Google Patents, were included in the review. Total of 230 research articles were included among which 110 studies found duplicated, 45 studies were of low quality whereas, 35 studies were excluded due to inadequate research outcome, improper methodology and purpose of the study was not suitable for present review. Research publications also looked at devices used as physiotherapy adjuncts in respiratory illnesses. As an addition to management during physiotherapy, devices with functionality including inspiratory or expiratory with or without resistance are available. Figure 2 depicts the flowchart of studies.

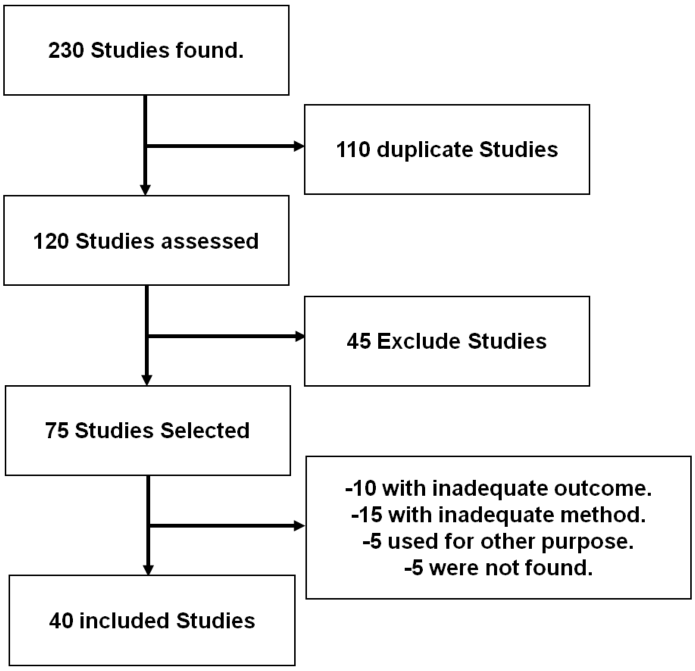

Figure 2: Flowchart of criteria

Result:

Quality Assessment of the Studies included was done using PEDro score which was set as benchmark to review good quality studies. Among the 40 included studies, 12 studies evaluating the effect of PV, 11 studies undergoing for TV, 10 studies evaluating PFR, and 7 studies undergoing DCFR. The current review included 10 widely viable devices with documented research. In general, the majority of these devices are portable (91%), simple to use or suitable for use at home (88%), versatile (77%), fast to adjust (83%), and low-priced (66%). In contrast, just 3 of the current devices support both exhalation and inspiration exercises.

1. Resistance-training apparatus

According to the method used to create the load, the resistance-training devices may be divided into three basic categories: pressure threshold valve, dynamically controlled flow resistance, and passive flow resistance [9].

a. Pressure apparatus

Individuals utilising these devices need to produce adequate pulmonary pressure to start breathing after overcoming a pressure load [10]. Figure 3 depicts the pressure apparatus.

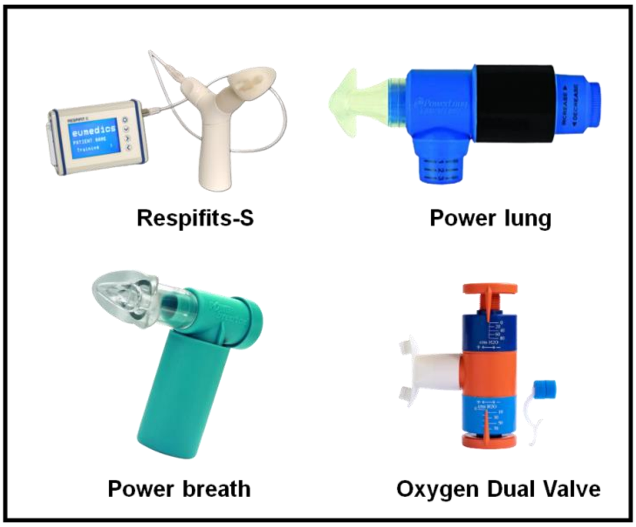

Figure 3: pressure apparatus

- **Oxygen Dual Valve® (ODV)**

A portable and low-cost respiratory trainer, the ODV enables patients to exercise both their inspiratory and expiratory muscles at the same time. Additionally, the ODV offers workloads up to seventy centimeter H_2O, with periodic intervals for both instances of ten centimeter H_2O [11]. Despite only being recently developed, research on individual with chronic heart failure and stroke have shown its effectiveness. In patients with moderate-to-severe COPD, high-intensity “inspiratory muscle (IM)” exercise improved IM function, resulting in substantial decreases in dyspnea and fatigue [12]. The ODV increases the effectiveness of the rehabilitation programme compared to standard training since it uses less time and personnel and enables patients to develop skills for additional training [13].

Beneficial features:

Its device includes two opposing chambers, an inhalation and an exhalation, and these connected mechanisms in a single device enable both concurrent and random dual training. This valve's name comes from this dual training capability.

Drawbacks:

Once designed by Spanish experts, the ODV is exclusively accessible online in Spain

- **Powerbreathe(PB)**

The PB® is a low-cost IM trainer, and studies have shown that it is effective [14]. Three different types of this device are available (PB classic, PB plus), with “load setting spans of 17-98 cm H_2O, 23-186 cm H_2O, and 29-274 cm H_2O” [15]. Additionally, it includes a flexible “mouthpiece (MP)” that adapts to the patient's mouth for improved comfort and air tightness. Similar to the PB® K-Series, it may be used in any situation provided the patient has weak pulmonary muscles, even though published research mostly highlighted its usage with patients with chronic obstructive pulmonary disease [16].

Beneficial features:
The PB® is reasonably priced, readily adjusted, and has a good MP sealing. Additionally, it isolates the flow channels for the inspiratory and expiratory gases so that the inspiratory valve is shielded from expiration.

Drawback:
Just inhalation training is permitted.

- **PowerLung**

An innovative hand-held respiratory muscle device called the PowerLung was recently created for healthy individuals [17]. Using a "spring-loaded valve mechanism" with independent controls for inhalation and exhalation, this device can regulate both airflow. The four versions of the PowerLung that provide different amounts of resistance are as follows: AireStream is recommended for those who have healthy lifestyles, are reasonably active, and do not participate in organised sports or exercise regimens; Breathe Air: Recommended for moderately active persons who exercise two to three days a week with low-intensity activities; Sport: recommended for those who want to enhance their performance in games or other strenuous exercise; and Trainer: made especially for professional athletes and demanding athletic competition training [18, 19,20].

Beneficial features:
The PowerLung TM is simple to adjust and has a good MP sealing. Additionally, this device's hand-adjustable knobs allow for varying resistance on inhalation and exhalation.

Drawbacks:
Due to the high cost of this gadget, specialised clinics are the only places where this procedure is used.

- **Respifits-S**

The Respifit-S is a specialized for training device in pulmonary muscle used to develop the inspiratory muscles of a variety of groups, including those with "Parkinson's disease, chronic obstructive pulmonary disease, and stroke" [21]. This device consists programme card is inserted, a handle MP for adjusting inhalation and exhalation volumes and modules, a programme card that is adjusted according to each patient's breathing capacity, and a tube in transparent that joins the main body to the MP [22].

Beneficial features:
The graphical display informs the patient of "workloads up to 200 cm H_2O". The "Respifit-S" is also a endurance training (ET).

Drawbacks:
This approach is only used in specialised clinics since the device is relatively expensive

b. Threshold apparatus

The thresholds offer changeable, measurable loading by providing almost flow-independent respiration resistance [23]. Figure 4 depicts the threshold apparatus.

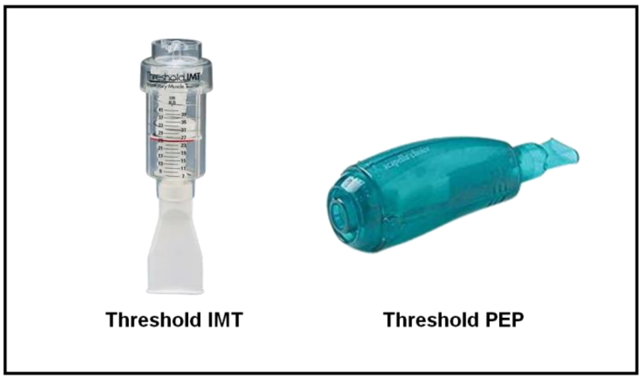

Figure 4: Threshold apparatus

- **IMT Threshold (IM training)**

An affordable IM trainer called the Threshold® IMT has been utilised extensively with a variety of medical issues [24]. This device has a valve at its end that is closed by a spring's positive pressure and has a range of 9 to 41 cm H_2O. It permits resistance modifications in increments of two cm of water. The “Threshold IMT” includes a one-way spring-loaded valve that shuts and needs strong inhalation to open [25]. This device delivers continuous pressure for IM training, no matter how quickly or slow individuals breathe, and the appropriate loading pressure may be modified according on participant characteristics [26].

Beneficial features:

The Threshold® IMT may be adjusted quickly, is reasonably priced, and provides increments of resistance of 2 cm H_2O. Additionally, the most thorough and best published research has validated its usage.

Drawbacks

Only a hard-plastic tube MP is provided with this device, making it difficult for some users to maintain an airtight seal. Additionally, it is challenging to reach optimal training levels due to its low maximum load.

- **PEP Threshold**

The Threshold PEP (positive expiratory pressure), which has been utilised in prior research to treat a variety of medical issues, has the same mechanism and price as the IMT threshold but was created for training the muscles for expiratory and has a range of 5 to 20 cm H_2O [27]. Expiratory flow spring resistance. Flutter®, Acapella®, AerobikA®, and RC-Cornet® are well-known by their brand names [28].

Beneficial features:

The Threshold PEP is affordable, simple to operate, and permits resistance adjustments in 1 cm H_2O increments.

Drawbacks

This device only has a hard-plastic tube MP, similar to the Threshold® IMT, which might make it difficult for certain users to maintain the airtight seal. It is challenging to generate acceptable amounts of expiratory muscle training with this device due to its low maximum load. One solution to get around this restriction is to utilise the Threshold IMT device in reverse, which has a twice as high a load limit. For this, an additional plastic MP must be added to the end of the inspiratory trainer, allowing it to be used with the same device for both expiratory and inspiratory training.

c. PFR apparatus

The resistive load for a given flow is determined by a “variable diameter orifice”, where the narrower the orifice is, the greater the resistive load. The fact that the load is passively created by the air flow produced by respiration and presents an essential constraint for these devices. As a result, loading is inaccurate because they are very susceptible to the effects of respiratory flow rate [29]. Figure 5 depicts the PFR apparatus.

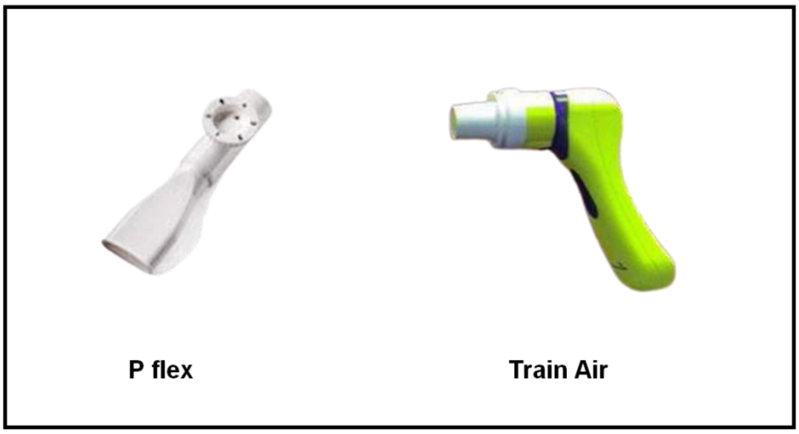

Figure 5: PFR apparatus

- **TrainAir**

The IM trainer used for strength training is the TrainAir®. With the addition of pressure monitoring to the device's PFR mechanism, load setting is now dependable and measurable. Patients who suffer neurological or cardiac issues as well as respiratory muscle weakness from illnesses like chronic obstructive pulmonary disease may benefit from using this device [30].

Beneficial features:

The MP sealing of the TrainAir® is sufficient. Additionally, this device offers the benefit of "continuous biofeedback of training intensity" and integrated evaluation of IM performance.

Drawbacks:

The training is also quite time consuming and demanding, and the necessary laptop and other parts enhance its cost and weight, making it the domain of specialised clinics.

- **Pflex**

Low-priced IM trainers like the Pflex® are often utilized for strength training [31]. This 5.7 cm long, cylindrically shaped plastic device includes a hole at one end where a detachable plastic MP may be inserted, and a one-way valve seals the other end. An "adjustable dial-like system with six fixed orifices" adjusts breathing resistance. This device can be used in a variety of other conditions, including those affecting the elderly, people with neurological or cardiac conditions, and patients with chronic obstructive pulmonary disease [32].

Beneficial features:

The Pflex® is simply adjustable, has a good MP seal, and costs less.

Drawbacks:

Since training load changes with flow, not simply orifice size, it's difficult to evaluate training load and progression without data on respiratory flow rate. 'Targeted flow-resistive training' may be used to regulate flow and make loading dependable. However, this modification significantly increases the device's size and cost.

1.1 Survey on Apparatus for training endurance

ET, also known as "voluntary isocapnic hyperpnea training", is complex and physically demanding, requiring a high level of user attention to attain and sustain training intensity. A high level of motivation is required for this sort of training since individuals must sustain high goal levels of ventilation for up to 30 minutes [33]. Typically, three to five sessions per week are held at a maximum voluntary ventilation level of 60 to 90 percent. Figure 6 depicts the ET apparatus.

Figure 6: ET apparatus

- **SpiroTiger**

An electronic endurance trainer called the SpiroTiger® has received research supporting its effectiveness and may be used to a number of medical issues. This device comprises of a base station and a hand-held unit with a respiratory bag. . The individuals are instructed to hold the MP close to their mouths while sitting and observing the monitor. The therapist presses the start button and controls the base station. The individuals begin inhaling and exhaling while they are monitoring the display [34].

Beneficial features:

For the patients' breathing to be limited within the isocapnic threshold value, the device's display and aural feedback are crucial. The only commercially available item that offers this kind of training is the SpiroTiger.

Drawbacks

This approach is only used in specialised clinics since the device is relatively expensive

- **Spirometer**

The amount of air sucked into the lungs during inspiration is measured using an incentive spirometer. A piston within an incentive spirometer rises as the user inhales, measuring the amount of air that is inspired. The incentive spirometry device is used in physical, speech, and respiratory therapy to induce slow, deep inspiration. In order to replicate the deep breathing observed while yawning or sighing, it is vital to use a spirometer gently. This will enable the lungs to expand and will also help open the airways. The prevention and treatment of postoperative pulmonary problems both benefit greatly from pulmonary rehabilitation [35]. This involves "percussion, mobilisation, postural drainage, deep breathing exercises, and muscular training for the inspiratory system". Mechanical breathing aids like the incentive spirometer aid in lung expansion. Table 2 covers their technical features.

Table 2: Technical features of training device

Serial No.	Device	Portability	Adequate Load range	Adequate Mouthpiece Sealing	Usability	Easy/fast Adjustment	Possibility of Home-based Training	Cost Effectiveness (inexpensive)	Allows inspiratory and expiratory training
ET apparatus									
1	Spiro Tiger®	✓	✓	✓	X	X	X	X	✓
2	Spirometer	✓	✓	✓	X	✓	✓	✓	✓
Resistance training device									
3	Pflex®	✓	X	X	✓	✓	✓	✓	X
4	Train Air®	X	✓	✓	X	X	X	X	X
5	Power Lung®	✓	*	✓	✓	✓	✓	✓	✓
6	PB®	✓	✓	✓	✓	✓	X	✓	X
7	ODV	✓	✓	✓	✓	✓	✓	✓	✓
8	Respifit-S	✓	✓	✓	X	✓	X	X	X
9	Threshold™ PEP	✓	X	X	✓	✓	✓	✓	X
10	Threshold® IMT	✓	X	X	✓	✓	✓	X	X
* Not reported									

DISCUSSION

The current systematic review aimed to evaluate the effectiveness of various breathing training devices. The review included 40 studies, which were assessed using the PEDro score as a benchmark for good quality studies. The review included 10 widely available devices, among which 3 devices support both inhalation and exhalation exercises. The majority of the devices were found to be portable, simple to use, versatile, fast to adjust, and low-priced.

The review identified three basic categories of resistance-training apparatus for breathing retraining, namely pressure threshold valve, dynamically controlled flow resistance, and passive flow resistance. The pressure threshold valve devices require individuals to produce sufficient pulmonary pressure to initiate breathing after overcoming a pressure load. The Oxygen Dual Valve (ODV) and Powerbreathe (PB) are two devices that were identified in this category.

The ODV is a portable and low-cost respiratory trainer that enables patients to exercise both their inspiratory and expiratory muscles at the same time. It offers workloads of up to 70 cm H2O, with periodic intervals for both inhalation and exhalation. Research on patients with chronic heart failure and stroke has demonstrated its effectiveness. Additionally, high-intensity inspiratory muscle exercise with the ODV has been shown to improve inspiratory muscle function, leading to significant reductions in dyspnea and fatigue in patients with moderate-to-severe COPD.

The PB is a low-cost inspiratory muscle trainer that has been found to be effective in several studies. It comes in three different types, each with a different load setting range. The device includes a flexible mouthpiece that adapts to the patient's mouth for improved comfort and air tightness. It is mostly used with patients with chronic obstructive pulmonary disease (COPD), but can be used in any situation where the patient has weak pulmonary muscles.

Both the ODV and PB have several beneficial features, such as being reasonably priced, readily adjustable, and having good sealing properties. However, the ODV has a limitation in that it is exclusively available online in Spain, while the PB only supports inhalation training.

One of the devices evaluated in the review was the Oxygen Dual Valve® (ODV), which is a portable and low-cost respiratory trainer that enables patients to exercise both their inspiratory and expiratory muscles simultaneously. The ODV was found to be effective in patients with chronic heart failure, stroke, and moderate-to-severe COPD. Another device evaluated in the review was the PowerLung, which is a hand-held respiratory muscle device that can regulate both inhalation and exhalation airflow. However, due to its high cost, the PowerLung is only used in specialised clinics.

The Respifit-S is another device evaluated in the review, which is a specialised training device for developing the inspiratory muscles of various groups, including those with Parkinson's disease, chronic obstructive pulmonary disease, and stroke. The Respifit-S has a graphical display that informs patients of workloads up to 200 cm H2O, and it is also an endurance training device. However, the device is relatively expensive, and it is only used in specialised clinics.

The review highlights the importance of breathing retraining in managing respiratory conditions and improving overall respiratory health. The majority of the devices evaluated in the review were found to be portable, simple to use, versatile, fast to adjust, and low-priced, which makes them suitable for use at home. However, only a few devices support both inhalation and exhalation exercises, which limits their effectiveness in improving overall respiratory function.

The use of threshold apparatus and PFR apparatus for inspiratory muscle training and expiratory muscle training has been well-documented in literature. The Threshold IMT and Threshold PEP devices are two affordable and widely used IM trainers for inspiratory and expiratory muscle training, respectively. The Pflex is another low-cost IM trainer that can be used for strength training in various medical conditions. Although these devices have their benefits, they also have some limitations, such as a low maximum load limit and inaccurate loading due to respiratory flow rate.

The TrainAir is a more advanced PFR apparatus that offers the benefit of continuous biofeedback of training intensity and integrated evaluation of IM performance. However, the training is time-consuming and demanding, and the cost and weight of the necessary equipment make it suitable for specialised clinics only.

The literature review highlights the use of two devices for endurance training, the SpiroTiger and Spirometer, which have been found to be effective in improving respiratory function. The SpiroTiger is an electronic endurance trainer that has been shown to be effective in improving respiratory function and can be used to treat a number of medical issues. It comprises of a base station and a hand-held unit with a respiratory bag, and the individuals are instructed to hold the mouthpiece close to their mouths while sitting and observing the monitor. However, the device is relatively expensive, which limits its use to specialised clinics.

The Spirometer, on the other hand, is a simpler device that measures the amount of air sucked into the lungs during inspiration. It is commonly used in physical, speech, and respiratory therapy to induce slow, deep inspiration. The incentive spirometry device aids in lung expansion and is used in the prevention and treatment of postoperative pulmonary problems. Table 2 covers its technical features. Although it is less expensive than the SpiroTiger, it lacks the display and aural feedback provided by the SpiroTiger.

Endurance training, also known as “voluntary isocapnic hyperpnea training” (ET), is complex and physically demanding, requiring a high level of user attention to attain and sustain training intensity. A high level of motivation is required for this type of training since individuals must sustain high goal levels of ventilation for up to 30 minutes. Typically, three to five sessions per week are held at a maximum voluntary ventilation level of 60 to 90 percent. The review did not highlight any disadvantages or drawbacks of endurance training itself.

This study sought to describe the workings and features of all presently accessible pulmonary muscle training device, as well as to evaluate their advantages and disadvantages. Consequently, this review discussed ten devices that have been frequently used in research contexts while taking into account eight characteristics: cost, an adequate load range, portability, usability, an adequate MP seal, the ability to conduct training at home, an easy/fast adjustment process, and the availability of training for both exhalation and inhalation processes [36]. It is commonly recognized that the PB and IMT/PEP Thresholds are the two devices most strongly supported by vast. The PB, however, only permits inspiratory exercise. Some users find it difficult to maintain an airtight seal with the IMT and PEP Thresholds because to their limited training load range and hard-plastic tube MP. Additionally, acquiring both variants of the Threshold devices or adapting the Threshold IMT will increase the cost of the equipment in order to train both the inspiratory and expiratory muscles. The recently created ODV, which has all the benefits of the previous devices while also having an adequate training load range and a flexible flanged MP, was created to address these issues. It can concurrently train both the inspiratory and expiratory muscles [37, 38]. More research is need to demonstrate its effectiveness in various health situations, however, since it has just recently been created. In addition, mechanical threshold loading is the basis for the ODV and the majority of other known pulmonary trainers. It is vital to note that all of the devices described may be utilized in a variety of healthy circumstances. However, a patient with “chronic obstructive pulmonary disease” may have fundamentally different causes behind their respiratory muscle weakness than a patient with a stroke [39,40]. Lastly, even though these devices were created to improve strength they have also shown improved respiratory muscle strength and endurance. It is efficient in enhancing several medical outcomes, such pulmonary function. This review highlights the value of respiratory muscle training for a range of clinical outcomes and health issues. Consequently, respiratory muscle training may have an impact on strength and endurance measures.

CONCLUSION

The systematic review aimed to evaluate the effectiveness of different breathing retraining devices and identify the need for developing new devices. The review found that breathing retraining devices can be broadly categorized into three categories, with pressure threshold valve devices such as the ODV and PB being effective, portable, and low-cost options. The SpiroTiger and Spirometer were also found to be effective in improving respiratory function, but the SpiroTiger's cost limits its use to specialized clinics. Endurance training is a complex and physically demanding type of training that requires high user attention and motivation.

The review concludes that while breathing retraining devices have become popular due to their portability, affordability, and effectiveness, there is a need for developing more advanced devices that are affordable, easy to use, and provide accurate loading and biofeedback. Further research is necessary to determine optimal training protocols and intensity for various medical conditions and the long-term benefits and sustainability of respiratory muscle training. Future scope: The systematic review evaluates the effectiveness of different breathing retraining devices, including pressure threshold valve devices, SpiroTiger, and Spirometer, and identifies the need for developing new devices. The review highlights the importance of breathing retraining in managing respiratory conditions and improving overall respiratory health.

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