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AIM AND MEANING OF BREATHING EXERCISES: INTERDISCIPLINARY LITERATURE REVIEW

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Abstract. *Respiration is an indispensable aspect of life that significantly influences both the physical and mental well-being of individuals, depending on such factors as depth and rhythm. Exploring the distinctions between chest and abdominal breathing is crucial for understanding their profound impacts, and embracing appropriate breathing exercises has proven to be advantageous for short-term relief and long-term holistic health. While acknowledged for diverse therapeutic applications, such as mitigating vocal cord fatigue, a comprehensive exploration of breathing exercises remains essential. Sport scientists and coaches are encouraged to acquire a set of breathing exercises for future implementation in the training routines. This study strives to conduct an interdisciplinary literature review to shed light on the aims, meaning, and classification of breathing exercises. Employing a literature review methodology, were analysed peer-reviewed articles from PubMed and ScienceDirect published during the years from 2000 to 2023, focusing on such keywords as breathing exercises, deep breathing, nasal breathing, abdominal breathing, thoracic breathing, pursed-lip breathing, breathing control, and respiratory muscle training. The research findings illustrate the multifaceted definitions, components, aims, and classifications of breathing exercises. This study establishes a foundation for identifying distinct subtypes, contributing to a more nuanced understanding of the significance and purpose of breathing exercises in enhancing overall well-being.*
Keywords: *breathing exercises, meaning of breathing exercises, classification of breathing exercises.*

Introduction

In recent years, a growing number of studies have proved that breathing exercises can significantly improve the quality of life (Yiting, Zile, Wang, Xuanlin, & Yang, 2022). Research suggests that breathing exercises can be safely used and may have positive effects on the posture, flexibility, and strength of healthy adults (Csepregi et al., 2022).

It is known that breathing exercises cover a multitude of therapeutic approaches; however, in general, the meaning of breathing exercises is not defined (Bruton, Garrod & Thomas, 2011). There are many different views, but there is a lack of definitions for known breathing exercises. Trials involving breathing techniques have historically been published by simply describing the intervention

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as involving a course of breathing exercises. Although most authors now provide more detailed explanations, it is still generally insufficient to allow an accurate replication.

The aim of this research is to conduct an interdisciplinary (medicine, physiology) literature review on the meaning of breathing exercises and their classification. The aim will be reached by researching scientific articles on the "PubMed" and "ScienceDirect" databases on the concept of breathing exercises, as well as by defining terminology and analysing the scientific literature and previous scientific studies that can contribute to defining and classifying the meaning of breathing exercises.

"Breathing exercises" is a phrase which is used by scientists and therapists to describe an aim and functions, but not the meaning of the exercises. Interventions used in clinical practice and research need to be described in sufficient detail to permit an accurate replication.

The current study is connected to previously conducted studies by the approach on breathing exercise application for the improvement of quality of life. Previous studies produced eight breathing exercise components that serve as the basis for the current study.

Several conducted studies show that breathing exercises can display different results depending on the approach to exercise application. Since words and phrases can change their meaning over time, it is important that authors choose their words carefully and define everything that might be considered too ambiguous. Unfortunately, currently no clear classification of breathing exercises is available.

The Research Methods

In order to determine the definition and meaning of breathing exercises, the following methods were selected: a systematic search and review of scientific articles, comparative analysis, and generalization methods. The search for information sources published in English within the years 2000-2023 was carried out in the PubMed and Science Direct databases. Considering the topic, aim, and objectives of a scientific article, the following limitations were applied to the search results of the definition of breathing exercises: systematic reviews, review articles, books, target group - adult population, article language - English language. Keywords used for the search – breathing exercises, breathing exercise, deep breathing, nasal breathing, abdominal breathing, thoracic breathing, pursed-lip breathing, breathing control, respiratory muscle training. The search process was repeated 9 times, using each keyword. As a result, 19 sources were analysed in depth.

Results and Discussion

The results of the research provided a clearer definition and use cases for studying breathing exercises. Research shows that information on breathing exercises and their definitions is very limited. As shown in Figure 1, the search for main keywords resulted in a broad range of articles that mention breathing exercises; however, only a limited number of articles correspond to the purpose of the study.

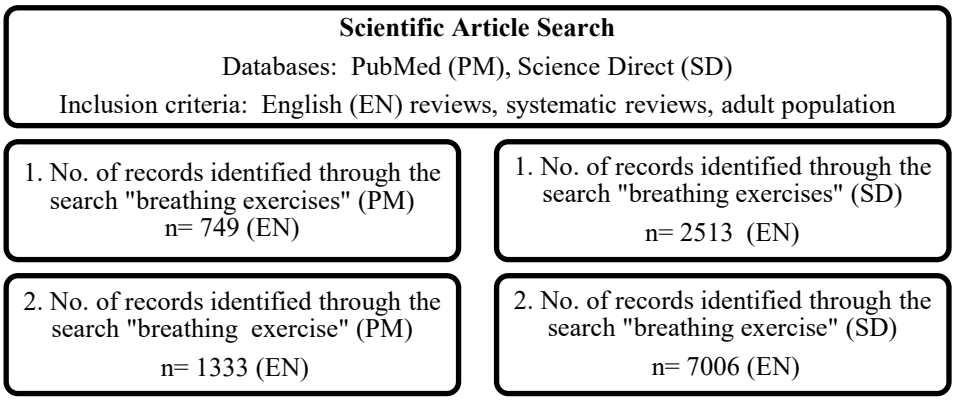

Figure 1 ***The Process of Systematic Search*** *(by the Authors)*

The search within the PubMed (PM) and Science Direct (SD) databases for the terms "Breathing exercises" and "Breathing exercise" with set limitations (publishing years 2000-2023; study type: review, systematic review, full-text; language: English) produced the following definitions (see Table 1):

Table 1 ***Characteristics of Breathing Exercises***

Term/Studies Included in the Review	**Definition**	**Author/s, Year**
Breathing exercises PubMed - 2 articles	"Breathing exercises" is a phrase which covers a multitude of therapeutic approaches. The simple phrase "breathing exercises" has legitimately been used to encompass all the activities: breathing control, pursed-lip breathing, respiratory muscle training, thoracic expansion exercises, diaphragmatic breathing, abdominal breathing, deep breathing, nasal breathing.	(Bruton, Garrod & Thomas, 2011)
	"Breathing exercises" are a form of exercise which can improve the overall efficiency at which the lungs function. They can be helpful both in individuals with healthy lungs and in those with impaired lung function.	(Laís, Celso, Alex, & Mandy, 2019)

The search within the Science Direct database did not yield a result for a useful definition of the keyword "Breathing exercises". In turn, the PubMed database produced 2 meaningful definitions that were included in Table 1.
Taking into account that breathing exercises cover a multitude of therapeutic approaches, the research was continued with the purpose to produce definitions for the subtypes of breathing exercises. The overall result for the term "Breathing exercises" produced 1029 articles on the Science Direct database and 49 articles on the PubMed database; however, searching for the definitions of breathing exercise components allowed for the search to be narrowed down and more clearer definitions to be obtained.

The search within the PubMed and Science Direct databases for the term "Breathing control" with set limitations (publishing years 2000-2023; article type: review, systematic review, full-text; language: English) produced 94 articles, of which 5 were included in the review and produced the following definitions (see Table 2):

Table 2 ***Meaning of the Breathing Exercise Component "Breathing Control"***

Breathing Exercise Component/Included in the Review	**Definition**	**Author/s, Year**
Breathing control PubMed - 1 article	"Breathing control" is normal tidal breathing, using the lower chest with relaxation of the upper chest and shoulders. This used to be known as diaphragmatic breathing.	(Pryor & Prasad 2009)
Breathing control Science Direct – 1 article	"Breathing control" is a complex process that depends on different highly integrated pathways underpinning both automatic and voluntary commands. Breathing control involves brain's motor, sensory and limbic areas, as well as midbrain structures, underlying the multidimensional aspects of such a system.	(Betka, Adler, Similowski & Blanke, 2022)

The definition obtained within the PM database gives clear instructions which describe the actions that should be taken for "breathing control". On the other hand, the definition within the SD database provides a more detailed description of the processes that are involved during "breathing control".
The search within the PubMed and Science Direct databases for the term "Pursed-lip breathing" with set limitations (publishing years 2000-2023; study type: review, systematic review; language: English) produced 34 articles, of which 3 were included in the review and produced the following definitions (see Table 3):

Table 3 ***Meaning of the Breathing Exercise Component "Pursed-Lip Breathing"***

Breathing Exercise Component/Included in the Review	**Definition**	**Author/s, Year**
Pursed-lip breathing PubMed - 1 article	"Pursed-lip breathing" is a technique that allows people to control their oxygenation and ventilation. The technique requires a person to inspire through the nose and exhale through the mouth at a slow controlled flow.	(Nguyen & Duong, 2023)
Pursed-lip breathing Science Direct – 1 article	"Pursed-lip breathing" is another method, often associated with relaxation activities, suggested for improving ventilation and oxygenation and relieving respiratory symptoms in individuals with airway clearance dysfunction.	(Tecklin, 2007)

The definition found within the PM database describes the technique mechanics, but it does not provide any details of the effect of "pursed-lip breathing". In turn, the definition found within the SD database suggests that the exercises in question have a positive effect on people with airway clearance dysfunction, but it completely lacks the description of exercises themselves.

The search within the PubMed and Science Direct databases for the term "Respiratory muscle training" with set limitations (publishing years 2000-2023; study type: review, systematic review; language: English) produced 100 articles, of which 5 were included in the review and produced the following definitions (see Table 4):

Table 4 ***Meaning of Breathing Exercise Component "Respiratory Muscle Training"***

Breathing Exercise Component/Included in the Review	**Definition**	**Author/s, Year**
Respiratory muscle training PubMed - 1 article	The application of skeletal muscle training principles to the respiratory muscles is a relatively new field. Strength and endurance training of the respiratory muscles can be achieved in normal humans and in patients with neuromuscular and chronic obstructive pulmonary diseases. This is a promising area, although further research is necessary to determine the indications for respiratory muscle training. Furthermore, it is still necessary to determine the optimal mode of training.	(Pardy, Reid & Belman, 1988)
Respiratory muscle training Science Direct – 1 article	Respiratory Muscle Training (RMT) can be defined as a technique that aims to improve the function of the respiratory muscles through specific exercises. Inspiratory Muscle Training (IMT) in particular has been shown to increase inspiratory muscle strength, respiratory muscle function, and might help to reduce dyspnoea on exertion.	(Pereira, Dacha, Testelmans, Gosselink & Langer, 2019)

The definition found within the PM database suggests that the Respiratory muscle training is a relatively new field; however, while it is a promising thought, the definition lacks any description of the possible exercises. Similarly, the

definition found within the SD database provides a use case of the technique, but no examples or descriptions of the exercise itself are found in the definition.

The search within the **PubMed** and **Science Direct** databases for the term "**Thoracic expansion exercises**" with set limitations (publishing years 2000-2023; study type: review, systematic review; language: English) produced 28 articles, of which 3 were included in the review and produced the following definitions (see Table 5):

Table 5 ***Meaning of Breathing Exercise Component "Thoracic Expansion Exercises"***

Breathing Exercise Component/Included in the Review	**Definition**	**Author/s, Year**
Thoracic expansion exercises PubMed - 2 article	Thoracic expansion exercises are simply active inspirations with larger than normal breaths, followed by relaxed expiration. This larger lung volume increases airflow through peripheral airways and collateral ventilation channels, which increases the gas volume available to mobilize secretions during expiration.	(Fink, 2007)
Thoracic expansion exercises Science Direct – 1 article	Thoracic expansion exercises are deep breathing exercises that emphasize inspiration and breathing control is normal tidal breathing using the lower chest.	(Cecins, Jenkins, Pengelley, & Ryan, 1999)

The definition found within the PM database gives a clear description of the breathing exercise in question, as well as describes the effect of the exercise. However, no information is provided on what are the advantages of using the exercises included in the definition. In a similar manner, the SD database gives a brief description of the technique, but it does not provide any details of the effect of the exercises.

The search within the **PubMed** and **Science Direct** databases for the term "**Diaphragmatic breathing**" with set limitations (publishing years 2000-2023; study type: review, systematic review; language: English) produced 131 articles, of which 5 were included in the review and produced the following definitions (see Table 6):

The definition found within the PM database gives a brief description of the exercise and describes the effects of the exercise. However, it also emphasizes that the effects on human health should be further researched. In turn, the definition obtained on the SD database provides a brief description of the processes that are activated by performing the exercise, but the effect on the human body is not described.

Table 6 ***Meaning of Breathing Exercise Component "Diaphragmatic Breathing"***

Breathing Exercise Component/Included in the Review	**Definition**	**Author/s, Year**
Diaphragmatic breathing PubMed - 1 article	Diaphragmatic breathing (DB) is slow and deep breathing that affects the brain and the cardiovascular, respiratory, and gastrointestinal systems through the modulation of autonomic nervous functions. However, the effects of DB on human health need to be further investigated.	(Hamasaki, 2020)
Diaphragmatic breathing Science Direct – 1 article	Abdominal breathing is also known as diaphragmatic breathing. The diaphragm is the biggest and most important muscle of respiration. When the diaphragm contracts, it is forced downward, causing the abdomen to expand. This produces a negative pressure within the thoracic cage, forcing air into the lungs.	(Maker-Clark, 2012)

The search within the **PubMed** and **Science Direct** databases for the term "**Abdominal breathing**" with set limitations (publishing years 2000-2023; study type: review, systematic review; language: English) produced 119 articles, of which 3 were included in the review and produced the following definitions (see Table 7):

Table 7 ***Meaning of Breathing Exercise Component "Abdominal Breathing"***

Breathing Exercise Component/Included in the Review	**Definition**	**Author/s, Year**
Abdominal breathing PubMed - 1 article	Abdominal breathing is breathing that is dominated by the movement of the diaphragm that expands the abdominal wall if chest movement is controlled, while thoracic breathing is dominated by accessory inspiratory muscles (e.g., external intercostal muscles, scalenus, pectoralis, and sternocleidomastoid) that increase the diameter of the thoracic cavity.	(Anderson & Bliven, 2017)
Abdominal breathing Science Direct – 1 article	Abdominal breathing is also known as diaphragmatic breathing. The diaphragm is the biggest and most important muscle of respiration. When the diaphragm contracts, it is forced downward, causing the abdomen to expand. This produces a negative pressure within the thoracic cage, forcing air into the lungs. The negative pressure also pulls blood into the chest, increasing venous return to the heart. This leads to improved cardiac output, which results in improved stamina in both disease and athletic activity.	(Maker-Clark, 2012)

The definition found within the PM database provides a brief description of the exercise, but the information is not sufficient to correctly replicate the exercise. Similarly, the SD definition describes the effect of the exercise; however, it does not give full details on how to perform the exercise correctly.

The search within the **PubMed** and **Science Direct** databases for the term "**Deep breathing**" with set limitations (publishing years 2000-2023; study type: review, systematic review; language: English) produced 263 articles, of which 3 were included in the review and produced the following definitions (see Table 8):

Table 8 ***Meaning of Breathing Exercise Component "Deep Breathing"***

Breathing Exercise Component/Included in the Review	**Definition**	**Author/s, Year**
Deep breathing PubMed – 1 article	As diaphragmatic (abdominal) breathing (DB) is a slow and deep breathing method, it should not be considered as just a breathing control.	(Bruton, Garrod, & Thomas, 2011)
Deep breathing Science Direct – 1 article	Deep breathing, also known as diaphragmatic breathing, is one of the least time-consuming techniques to employ and easiest for adults and children to learn. When a person becomes anxious and/or experiences pain, breathing becomes shallow and irregular due to the increased muscle tension in the chest.	(Waldman, 2011)

The definition found within the PM database provided a brief description of the exercise, but it did not contain any information on the effect of the exercise on the human body. In a similar manner, the definition found within the SD database gives brief information on the technique, but the effects on the human body are not described, nor is the exercise method.

The search within the **PubMed** and **Science Direct** databases for the term "**Nasal breathing**" with set limitations (publishing years 2000-2023; study type: review, systematic review; language: English) produced 76 articles, of which 4 were included in the review and produced the following definitions (see Table 9):

Table 9 ***Meaning of Breathing Exercise Component "Nasal Breathing"***

Breathing exercise component/included in review	**Definition**	**Author/s, Year**
Nasal breathing PubMed - 1 article	Nasal breathing is defined as inspiration through the nose and expiration through the mouth, whilst mouth breathing is the converse of this: inspiration through the mouth and expiration through the nose.	(Settergren et al., 1998)
Nasal breathing Science Direct – 1 article	Nasal breathing is involuntary. Mouth, or voluntary, breathing occurs when there is difficulty breathing through the nose, such as in exertion, under stress, and – in particular – when cardiac, pulmonary, or other illness hampers the supply of oxygen to the tissues.	(Gilbert, Chaitow, & Bradley, 2014)

The definition found within the PM database contains a brief description of the exercise itself, but it does not contain any information on the effect of the exercise. In contrast, the definition found within the SD database covers the

overall information on Nasal breathing, but it does not provide any description of the exercise.

Classification

The search within the particular databases did not produce multiple definitions for the same exercise subtype. Only one clear definition per exercise was discovered within a particular database. The results show that 3 out of 8 subtypes of exercises have different names, but they still have the same meaning and are used as synonyms (Fig.2).

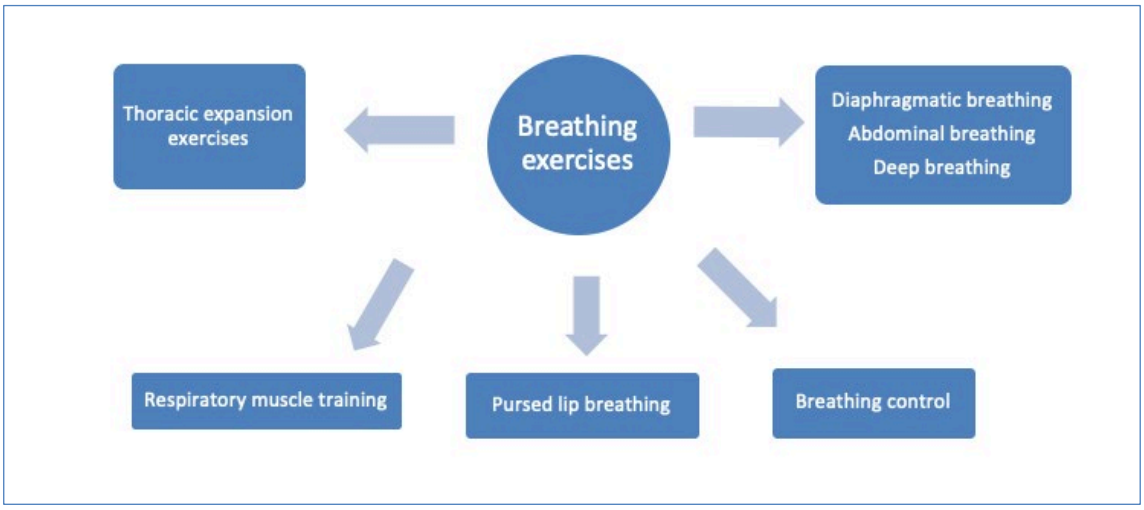

Figure 2 ***Classification of Breathing Exercises*** *(by the Authors)*

Conclusions

The findings of this research underscore the importance of continued exploration and refinement of breathing exercises in the context of physiology, specifically addressing the critical objective of mitigating vocal cord fatigue. The primary focus of this study has been the identification and selection of exercises that may be effective in reducing voice chord fatigue, contributing to the broader understanding of the physiological impact of conscious breathing control.
In the realm of respiratory physiology, the study has provided valuable insights into the definition, aim, and classifications of breathing exercises. The significance of these exercises extends beyond general well-being, particularly showcasing their potential in targeted application, such as the reduction of vocal cord fatigue. This not only enhances our comprehension of the physiological mechanisms involved, but also lays the groundwork for tailored interventions in various health-related contexts.

It is imperative to emphasize the need for future research endeavours to expand the scope of databases and delve deeper into the definitions and meanings

associated with breathing exercises. This will further enrich our understanding and refine the selection criteria for exercises aimed at reducing vocal cord fatigue, contributing to the ongoing evolution of respiratory health practices.

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