



# Respiratory Muscle Training in Gastroesophageal Reflux Disease with COPD Subjects: Literature Review

## Treinamento Muscular Respiratório na Doença do Refluxo Gastroesofágico de Sujeitos com DPOC: Revisão de Literatura

## Entrenamiento Muscular Respiratorio En El Enfermedad Del Reflujo Gastroesofágico En Sujetos Con EPOC: Revisión de Literatura

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### **Abstract**

The purpose was to perform a systematic review about the effects of respiratory muscle training in Gastroesophageal Reflux Disease (GERD) of subjects with Chronic Obstructive Pulmonary Disease (COPD). For the selection of studies, the following descriptors were used: “Gastroesophageal Reflux”, “Respiratory aspiration” and “COPD” in the databases PubMed, LILACS, SciELO and TripDataBase, from January to February 2015. As selection criteria were used: articles published in Portuguese, English, and Spanish, regardless of the year of publication. The titles and abstracts were read and if there were doubts as to the purpose of the study of each article, the same was read in its entirety. After reading the titles, abstracts and, if necessary, in full, were listed items that were more closely related to the research purpose. The research with the proposed descriptors generated a total of 324 articles. After the first analysis were selected 68, of these 32 were excluded by repetition. The remaining 36 articles were evaluated according to the purpose of the study, ending in 12. However, none aimed to determine the effects of respiratory muscle training in COPD subjects with GERD. Thus, the authors conducted a literature review to provide theoretical basis for future research about the theme. It was concluded from this study that there aren't studies that evaluated the effects of respiratory muscle training on COPD subjects with GERD, which suggests the

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necessity to conduct research addressing the theme.

**Keywords:** deglutition disorders; gastroesophageal reflux; respiratory aspiration; COPD; respiratory muscle training; rehabilitation

## Resumo

*O objetivo foi realizar uma revisão de literatura sobre os efeitos do treinamento muscular respiratório na Doença do Refluxo Gastroesofágico (DRGE) de sujeitos com Doença Pulmonar Obstrutiva Crônica (DPOC). Para a seleção dos estudos foram utilizados os descritores: “GastroesophagealReflux”, “Respiratoryaspiration” e “COPD” nas bases de dados PubMed, LILACS, ScIELO e TripDataBase, entre os meses de janeiro e fevereiro de 2015. Como critérios de seleção foram adotados: artigos publicados em Português, Inglês ou Espanhol, sem limitação de ano. Os títulos e resumos foram lidos, e, caso houvesse dúvidas quanto ao objetivo da pesquisa de cada artigo, o mesmo era lido na íntegra. Após a leitura dos títulos, resumos e, se necessário, a íntegra do texto para melhor compreensão do trabalho, foram elencados os artigos que tivessem maior relação com o objetivo da pesquisa. A pesquisa realizada com os descritores propostos gerou um total de 324 artigos. Após a primeira análise foram selecionados 68, destes 32 foram excluídos por repetição. Os 36 artigos restantes foram avaliados conforme o objetivo do estudo, finalizando em 12. No entanto, nenhum teve como objetivo verificar os efeitos do treinamento muscular respiratório na DRGE de sujeitos com DPOC. Dessa forma, os autores realizaram uma revisão de literatura a fim de fornecer bases teóricas para futuras pesquisas sobre a temática. Conclui-se com este estudo que, até o momento, não há pesquisas que avaliaram os efeitos do treinamento muscular respiratório sobre a DRGE de sujeitos com DPOC, o que sugere a necessidade de realizar pesquisas abordando a temática.*

**Palavras-chave:** transtorno de deglutição; refluxo gastroesofágico; aspiração respiratória; DPOC; treinamento muscular respiratório; reabilitação.

## Resumen

*El objetivo fue hacer una revisión de la literatura sobre los efectos del entrenamiento de los músculos respiratorios en la enfermedad por reflujo gastroesofágico (ERGE) en sujetos con EPOC. Para selección de los estudios se utilizaron losdescriptores: “GastroesophagealReflux”, “Respiratoryaspiration” y “EPOC” en las bases de datos PubMed, LILACS, SciELOy TripBataBase, entre los meses de enero y febrero 2015. Como criterios de selección fueron adaptados: artículos publicados en Portugués, Inglés o Español, sin limitación año. Los títulos y resúmenes se leyeron y si había dudas sobre la finalidad del estudio de cada artículo, el mismo fue leído en su totalidad. Después de leer los títulos, los resúmenes y, si necesario, el texto completo para una mejor comprensión del artículo, fueron listadas los artículos que tuvieron mayor relación con objetivo de la investigación. La investigación realizada con los descriptores propuestos generó un total 324 artículos. Después del primer análisis fueron seleccionados 68, de estos 32 fueron excluidos por repetición. Los 36 artículos restantes fueron evaluados de acuerdo con propósito del estudio, terminando en 12. Sin embargo, ninguno tuvo como objetivo determinar los efectos del entrenamiento muscular respiratorio en la ERGE en sujetos con EPOC. Por lo tanto, los autores realizaron una revisión bibliográfica con fin de proporcionar base teórica para futuras investigaciones sobre el tema. Se concluye de este estudio que hasta la fecha no hay estudios que evaluaron los efectos del entrenamiento muscular respiratorio sobre la ERGE en sujetoscon EPOC, lo que sugiere la necesidad de realizar investigaciones que abordan el tema..*

**Palabras clave:** trastornos de deglución; reflujo gastroesofágico; aspiración respiratoria; EPOC; entrenamiento muscular respiratorio; rehabilitación.

## Introduction

The Gastroesophageal Reflux Disease (GERD) is defined as a chronic condition resulting from the retrograde flow of gastroduodenal contents into the esophagus and / or regions which underlie it. This reflux causes a wide and varied range of signs and symptoms, esophageal and / or extraesophageal, with or without tissue injuries<sup>1</sup>. These symptoms attributed to reflux are the most frequent complaints related to today's clinical practice gastroenterology<sup>2</sup>.

Epidemiological studies have shown that in the US, 58.7% of the population presented a complaint of "burning" in the last year, and 19.8% reported the symptom in the last week and 7% every days<sup>3</sup>. In Brazil, a national assessment data raised 13.959 patients of 22 cities, where it was estimated prevalence of 11.9% of the complaints of "burning" in the urban population<sup>4</sup>.

Recently, there has been observed a possible relationship between GERD with exacerbations of lung diseases, among them Chronic Obstructive Pulmonary Disease (COPD). This fact proves itself through a recent study<sup>5</sup>, which found that 29% of very severe COPD subjects (GOLD IV) had GERD on their lists of comorbidities.

Another study found the incidence of GERD in subjects with COPD and its relation to disease exacerbations, which found that of the 386 individuals evaluated, 19.7% had exacerbations of lung disease in the last year and 34.2% were identified as having GERD<sup>6</sup>. This indicates that COPD patients are at a higher risk group for exacerbations of underlying disease, when present the GERD<sup>7</sup>.

In addition, GERD is a determining factor of micro-aspiration. There are reports that GERD is accompanied by neutrophilic inflammation. The same type of inflammation which occurs in the way areas of subjects with COPD, which in turn may be increased by this combination. Moreover, the micro-aspiration of gastric contents and bronchospasm induced by the vagus nerve due to irritation of the esophagus caused by stomach acid, may contribute to the association between GERD and signs and / or symptoms of lung diseases<sup>8</sup>.

The lower esophageal sphincter (LES), in association with the diaphragmatic esophageal hiatus, respectively constitute the extrinsic and intrinsic sphincter of the esophagus-stomach<sup>9</sup> transition, and the failure of the same is one of the factors triggering signs and symptoms of

GERD. Studies show that the contractility of the diaphragm exerts an external sphincter action on the esophagus-stomach junction, contributing to a 25% increase in LES pressure, and thus acting as a barrier antireflux<sup>9-11</sup>.

In this context, due to the weakness of the muscle diaphragm and other associated factors<sup>12</sup>, COPD subjects are more likely to develop GERD, and the respiratory muscle training is a possibility of treatment for this disorder.

Given the above, the objective of this study was to systematically review the literature about the influence of respiratory muscle training on GERD in subjects with COPD.

## Materials and Methods

The initial purpose of this study was to conduct a systematic literature review, taking into the guidelines contained in the Cochrane Handbook and guidance provided by Sampaio and Mancini<sup>13</sup>.

The research question that guided the search for work in the databases was: What are the effects of respiratory muscle training in the treatment of GERD in individuals with COPD?

The study was conducted by three researchers, two of them made the search for articles and evaluated independently and blinded the methodological quality of studies for inclusion. And the other was called the reviewer, who assisted in the inclusion of the work analysis in cases of doubt.

The search was conducted in the databases PubMed, LILACS, Scielo and TripDataBase. The descriptors in English "Gastroesophageal Reflux", "Respiratory aspiration", "Respiratory muscle training" and "COPD" were used, with the combination of boolean AND term. The search period was between January and February, 2015.

The papers should be in Portuguese, English or Spanish languages. There was no limitation year of publication. All articles were assessed for the titles and abstracts, when there was doubt about the theme of an article, the reading of the work was done in its entirety. No search filters have been applied.

The exclusion criteria were adopted: repeated articles, those which had only the title without summary or full text, literature review articles, articles involving children, papers discussing other lung diseases in addition to COPD, those that did

not respect directly with the descriptors researched, dissertations, theses and monographs.

After applying the search strategy, 324 articles were found in the databases consulted. After analysis from the inclusion criteria remained 68 articles that were compared for their recurrence in the databases. Finally, 36 articles were evaluated according to the purpose of the study, ending in 12 articles. Of these, none had as objective to verify the effects of respiratory muscle training in the treatment of GERD in individuals with COPD.

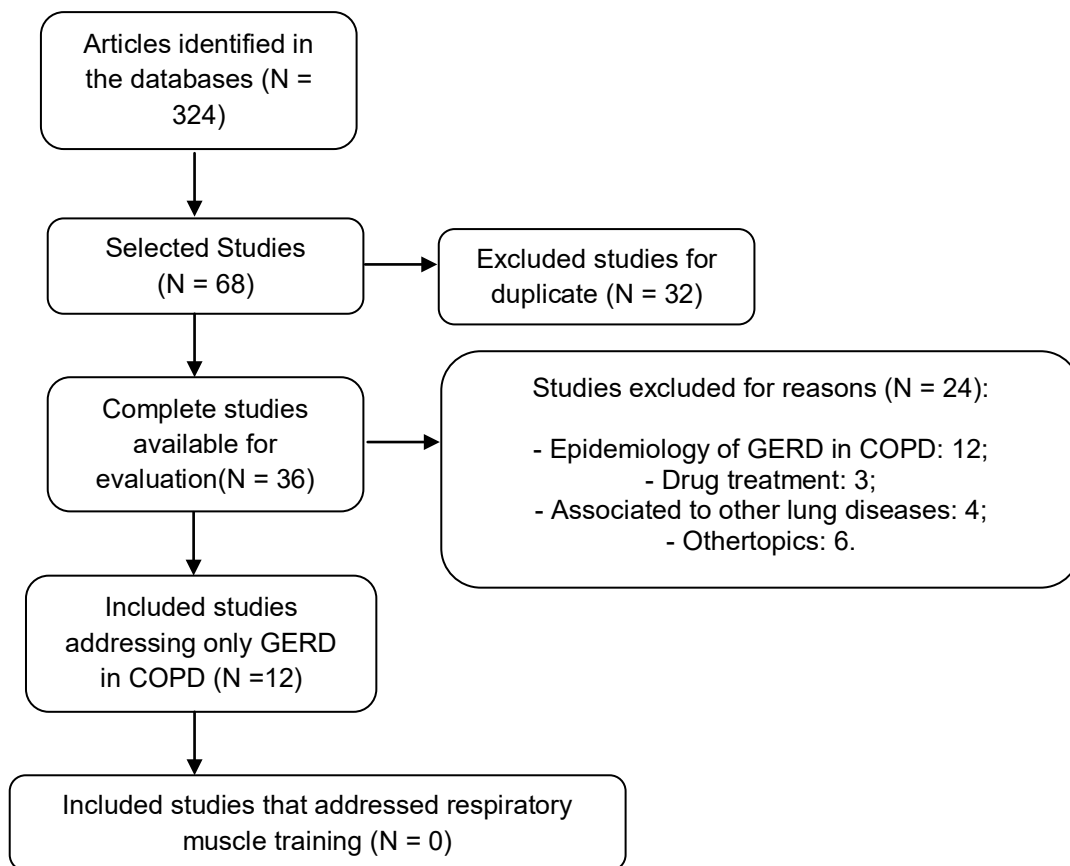
In this sense, it was decided to conduct a literature narrative review in order to provide theoretical

basis for future research that relate respiratory muscle training as a possible strategy for treating GERD in subjects with COPD.

## Results

Through the searches conducted, there were no studies which found to answer the question of initial research (Figure 1).

The review was systematized in two categories: "Gastroesophageal reflux disease in COPD" and "Considerations about the respiratory muscle training in the treatment of GERD in individuals with COPD."



**Figure 1** – Search flow chart of the articles consulted in PubMed, LILACS, SciELO and TripDataBase.

## Gastroesophageal Reflux Disease In Copd

GERD is associated with factors such as lack of ERA, ineffective esophageal clearance and delayed emptying of stomach<sup>9</sup>. In patients with GERD there are functional abnormalities of the ERA, the main ones being: increased spontaneous relaxation of the LES, sphincter hypotonia by pressure reduction from baseline tone and absence or shortening of intra-abdominal sphincter<sup>14</sup> segment.

The symptoms associated with GERD are extremely common, since approximately 20% of adults have heartburn and / or regurgitation at least once weekly and 40% monthly. Approximately half of the adult population of the industrialized countries has personal experience reflux symptoms, and 20% to 30% suffer from DRGE<sup>9</sup>.

Presumably, GERD is the most common disease of digestive tract<sup>8</sup>. The atypical symptoms designation serves as a synonym for the extra esophageal symptoms related to the disease. Therefore, this comorbidity has been linked to various respiratory diseases such as asthma, chronic cough, bronchitis, aspiration pneumonia and idiopathic pulmonary fibrosis; ENT signs and symptoms, including hoarseness, laryngitis, subglottic stenosis, vocal fold granuloma and laryngeal carcinoma; and other extra-esophageal manifestations, such as noncardiac chest pain, dental erosion, sinusitis, pharyngitis and sleep apnea<sup>9,10</sup>.

In COPD exacerbations of the disease are directly related to poor quality of life in the subjects, decreased pulmonary function, hospitalizations and increased health-related costs. Although exacerbations negative impacts on the natural course of the disease, its causes are still undefined in literature<sup>8,15,16</sup>. Thus, recently we have been given an attention to GERD as a risk factor for exacerbations disease<sup>8</sup>.

Authors<sup>17</sup> investigated the prevalence of swallowing alterations and exacerbations of COPD in association with GERD and found that 22 of the 67 patients evaluated presented alteration of the swallowing reflex. These patients had pulmonary exacerbations disorder associated with symptoms of GERD and the presence of colonization in the respiratory tract by bacteria in the gastric contents of these individuals.

In the same context, Kim et al.<sup>18</sup> observed that 28% of 39.987 patients with exacerbation of COPD

in 2009, in South Korea and North Korea, were associated with signs and symptoms of GERD. Kim et al.<sup>19</sup> investigated the prevalence and risk factors for GERD in 253 patients with COPD in South Korea, where 30% had reflux, and the age, number of cigarettes smoked packs and inhalation of anticholinergics the variables independent risk for the development of GERD.

Study<sup>20</sup> assessed the esophageal motility in 40 subjects with COPD. Of these, 55% had signs and symptoms of GERD and, yet, 65% had hypotension upper esophageal sphincter and 52.5% of ERA. Among the risk factors, more severe stages of the disease, age, high body mass index, smoking and high load index were related to the presence of esophageal motility dysfunction. However they found a negative relationship with lung hyperinflation index.

Over time, COPD exacerbations become more frequent and more serious, leading to an increasingly functional decline<sup>21</sup>. Pulmonary risk factors for repeated exacerbations include the forced expiratory volume in one second (FEV1) low before treatment, increased use of bronchodilators or corticosteroids, previous exacerbations (more than two in the last two years), previous use of antibiotics and presence of comorbidities<sup>16</sup>.

Patients with frequent exacerbations have <sup>4.3</sup> times more likely to go to death, compared to those who did not need hospital treatment<sup>22</sup>. Thus, the exacerbation may be a significant factor associated with increased mortality in patients with COPD<sup>8</sup>; GERD can be connected directly with disease exacerbation.

## Considerations In Respiratory Muscle Training Of Gerd Treatment Of individuals With COPD

The air trapping in the lungs, the main characteristic of COPD, causes decrease in lung elastic recoil, leading to hyperinflation of the lungs and impaired respiratory function, modifying the action of the muscles of the rib cage, especially the diaphragm, since their mobility is limited due to the reduction of its curvature and affixing zone. As a result of the shortening of the diaphragm fibers, there is an inability to generate force properly<sup>23</sup>.

Associated with biomechanical disadvantage of the thoracic box, the lung hyperinflation can be related to the development of GERD in these individuals, due to the lowering of diaphragmatic



domes. Moreover, chronic cough, and the increasing use of the abdominal muscles for ventilation in an attempt to active deflation also relates to the development of reflux. Other factors include the use of medications such as bronchodilators, to act on gastrointestinal smooth muscle, leading to a LES relaxation; facilitating reflux beyond Theophylline increases the production of gastric acid, favoring acid reflux<sup>12</sup>.

The underlying mechanism through which the reflux happens in these patients is due to ERA relaxation, allowing stomach content pass into the esophagus, and often goes to the larynx and mouth. This particularly occurs when intra-abdominal pressure is high, a common condition in these patients<sup>24</sup>.

Once the liquid reflux is within the esophagus, the extrinsic increased of intrathoracic pressure, which is evident in COPD, can enhance the movement of the fluid against gravity, leading it toward the larynx. Due to the anatomical arrangement and innervation of the larynx, it is possible that small quantities of liquid flow back to this portion and thus penetrate into the airway due to swallowing disorders<sup>25</sup>. The components of the aspirated material, on contact with the respiratory epithelium, can cause an inflammatory response and potentially increase susceptibility to infection, and lead to bronchospasm response by vagal stimulation<sup>6</sup>.

As the contractility of the diaphragm is able to exercise antireflux action of extrinsic form and individuals with COPD present weakness of these muscles, you can theorize that the application of respiratory muscle training to be able to act as a therapeutic alternative in the treatment of GERD when present in these individuals.

The respiratory muscle training aims to enable specific muscles to perform its function more easily, targeting both muscle strength and endurance<sup>26</sup>. Another goal is to improve respiratory mechanics, coupled with the strength of these muscles, which leads to decreased dyspnea, increased breathing capacity and prevention of infections and fatigue of respiratory muscles<sup>27</sup>. Therefore, measurement of Maximum Inspiratory Pressure (MIP) is directly related to the diaphragm's ability to perform inspiratory force and hence this factor is linked to the diaphragmatic muscle thickness, where a muscle with thicker muscle fibers are able to generate higher contraction force and has greater tone<sup>14,28</sup>.

Due to lack of studies in the literature that have addressed this theme, we chose to present the studies with subjects who had only GERD and the effects of respiratory muscle training in the analyzed variables in each work.

Studies have hypothesized that patients with low pressure in ERA (five to 10 mmHg) could benefit from a respiratory muscle training that aims at increasing the diaphragmatic contraction force and, consequently, increase strength / tone, refractory and extrinsic way the ERA. Thus was increased the pressure barrier anatomically and physiologically offered by this sphincter, the reflux of gastric contents. The study used then an inspiratory muscle training performed by a machine named ThresholdIMT<sup>®</sup>, which has the ability to stipulate a linear load pressure applied to quantify the resistance to movement performed in each device. This affects inspiratory strengthening the major muscle with this function, which is the diaphragm. In this study, equivalent progressive load of 30% of the MIP value of the study group patients and a fixed and constant pressure in control group was used. The results were obtained an average increase of MIP approximately 46% in the values measured in the study group, and this happened in 75% of patients in this group. But there was no significant improvement in the variable pressure ERA in comparison between groups. But intra-group study comparison, there was an increase in this variable. Thus, the study concluded that there should be a deepening of the study, with the search for greater population sample (in this study included 29 patients)<sup>14</sup>.

Already Noble and Souza et al.<sup>11</sup> found different results when applying inspiratory muscle training (ThresholdIMT<sup>®</sup>) in 12 subjects diagnosed GERD were evaluated parameters: esophageal pH, manometry and heart rate variability. The training, held five times a week for two consecutive months, consisted of an initial resistance of 30% of MIP of each individual, followed by the 5% increase every five days. Each session consisted of 10 sets of 15 breaths a maximum of 30 minutes. After the training period, there was a significant increase in the pressure of the gastroesophageal junction (ERA) ( $19.7 \pm 2.4$  vs  $29.5 \pm 2.1$  mmHg,  $p < 0.001$ ), but not significant reduction in progression of proximal reflux and the symptoms of GERD.

It stands out the importance and uniqueness of the therapeutic hypothesis, since it seems that the

respiratory muscle training can be an alternative to the carrier COPD population showing associated GERD.

## Conclusion

GERD is directly linked to the worsening of COPD, being mentioned in the literature as comorbidity, possibly associated with the exacerbations of the disease. The change of swallowing is a common finding in patients with GERD and is possibly the mechanism that chronic lung disease patients may experience exacerbations of its staff, because the risk of aspiration of gastric contents.

In relation to respiratory muscle training as a means of treatment for GERD in subjects with COPD, there are no studies to date. However, through this review, we found that training appears to be a non-drug and viable treatment alternative to decrease symptoms of GERD in chronic lung disease.

However, the authors emphasize the need for multidisciplinary character clinical research involving medical professionals, speech therapy and physiotherapy in order to verify the effects of respiratory muscle training on the symptoms of GERD and its relationship with exacerbations in subjects with COPD.

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