

# Effectiveness of McKenzie-Based Exercises for Forward Head Posture and Their Implications for Gastroesophageal Reflux Disease: A Systematic Review

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## ABSTRACT

**Background:** Forward head posture (FHP) is a common postural abnormality associated with neck pain, functional impairment, and altered biomechanics. Emerging evidence indicates that FHP may also influence respiratory mechanics and gastroesophageal reflux disease (GERD).

**Objective:** To evaluate the effectiveness of McKenzie-based and related exercise interventions in improving FHP and to examine their potential physiological relevance to reflux-related mechanisms.

**Methods:** This systematic review adhered to the PRISMA 2020 guidelines and was registered with PROSPERO (CRD420261334277). Searches were performed in PubMed, Scopus, and Google Scholar for studies published between 2010 and 2025. The review focused on adults with forward head posture (FHP) who underwent exercise-based interventions. The primary outcomes measured were the craniovertebral angle, neck pain, and disability. Secondary outcomes assessed included respiratory measures and diaphragmatic function. The risk of bias was evaluated using the RoB 2 and ROBINS-I tools, while the certainty of evidence was determined using GRADE.

**Results:** A total of 27 studies were included. Exercise interventions significantly improved craniovertebral angle, reduced neck pain, and decreased functional disability with moderate certainty. Improvements were also noted in pulmonary function, respiratory muscle strength, and chest expansion, though no studies specifically assessed GERD severity.

**Conclusion:** McKenzie-based and similar exercise interventions effectively enhance FHP and musculoskeletal outcomes. While there may be indirect benefits for reflux mechanisms, direct evidence linking these methods to GERD is insufficient. Future trials should include reflux-related outcomes.

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**Keywords:** Forward head posture; McKenzie-based exercises; Mechanical diagnosis and therapy; Craniovertebral angle; Exercise therapy; Neck pain; Gastroesophageal reflux disease.

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### Background

Forward head posture (FHP) is a prevalent postural abnormality characterized by the anterior positioning of the head in relation to the cervical spine.<sup>1</sup> It is increasingly prevalent due to prolonged sedentary behavior and extensive use of digital devices.<sup>2</sup> FHP is associated with altered cervical biomechanics, muscular imbalance, and reduced functional capacity, often leading to neck pain and disability.<sup>1</sup> Individuals with FHP show reduced deep cervical flexor endurance, increased superficial muscle activity, and altered scapular positioning.<sup>3</sup>

FHP is commonly assessed using the craniovertebral angle (CVA), a validated measure of anterior head translation.<sup>1</sup> A reduced CVA is associated with greater postural deviation, increased pain intensity, and functional impairment.<sup>2</sup> As a result, physiotherapy interventions targeting postural correction are widely used in managing musculoskeletal disorders. Postural alignment may also influence respiratory mechanics, diaphragmatic function, and thoracoabdominal pressure.<sup>4,5</sup> These physiological interactions suggest that Spinal alignment may influence pressure dynamics in the thoracic and abdominal cavities.

Gastroesophageal reflux disease (GERD) is a chronic gastrointestinal disorder marked by the backward flow of gastric contents into the esophagus, due to lower esophageal sphincter dysfunction and altered pressure gradients.<sup>6</sup> Body posture and spinal alignment can influence reflux episodes by modifying thoracoabdominal pressure relations and diaphragmatic function.<sup>7,8</sup>

FHP, often associated with thoracic hyperkyphosis, may impair respiratory mechanics and diaphragmatic function, affecting intra-abdominal pressure.<sup>9</sup> Spinal deformities, including kyphosis, are associated with increased reflux symptoms, suggesting a mechanical link between posture and gastrointestinal function.<sup>7</sup> Although the direct relationship between FHP and GERD has not been extensively investigated, these biomechanical interactions suggest that postural abnormalities may play a role in reflux physiology.

Exercise-based rehabilitation is widely used for managing cervical dysfunction. The Mckenzie-based

approach (Mechanical Diagnosis and Therapy, MDT) emphasizes repeated spinal movements, posture correction, and self-management strategies to restore spinal mechanics and reduce pain.<sup>10</sup> Central to the McKenzie-based interventions is the identification of directional preferences in spinal movement, accompanied by the prescription of exercises that both centralize symptoms and enhance spinal alignment and functional mobility. Empirical studies have established that rehabilitation programs based on the McKenzie approach are effective in reducing neck pain and significantly enhancing functional outcomes among individuals with cervical spine disorders.<sup>11</sup> Additionally, interventions tailored to improve the function of cervical and scapular muscles have been found to positively affect the craniovertebral angle and mitigate the severity of forward head posture.<sup>12</sup>

Recent studies in physiotherapy have further suggested that corrective exercise programs targeting forward head posture can lead to improvements in cervical muscle endurance, postural alignment, and respiratory function.<sup>2,4</sup> FHP-related thoracic changes may allow alignment-focused rehabilitation to improve respiratory function and mobility, suggesting broader effects. Most studies focus on pain relief and posture correction.<sup>12</sup> Most existing research has primarily focused on physiotherapy interventions related to cervical musculoskeletal disorders.<sup>2,12</sup> However, there is limited research on the wider physiological impacts, especially concerning gastrointestinal issues like GERD.<sup>6</sup> Biomechanical research indicates that spinal alignment might affect thoracic function, diaphragmatic movement, and the regulation of intra-abdominal pressure.<sup>4,5</sup> There has been limited clinical investigation into how physiotherapy-based adjustments in posture might relieve reflux symptoms. This gap warrants additional research to assess whether FHP-targeted physiotherapy improves reflux symptoms.

The review aimed to evaluate the effectiveness of McKenzie-based and related physiotherapy interventions in improving FHP, postural alignment, neck pain, and functional outcomes. It also explored their potential implications for GERD by examining

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the links between spinal alignment, respiratory function, and abdominal pressure.

### Methods

#### Study design and protocol registration

The review was conducted and reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) guidelines to ensure methodological transparency, completeness of reporting, and reproducibility of the review process.<sup>13</sup> A protocol outlining the objectives, eligibility criteria, and methodological framework for this review was registered in advance with the International Prospective Register of Systematic Reviews (PROSPERO) [Registration number: CRD420261334277]. Prospective registration of systematic review protocols is recommended to enhance methodological transparency and reduce the risk of reporting bias.<sup>14,15</sup>

#### Protocol Amendment

During screening, the eligibility criteria were revised due to the lack of studies involving both FHP and confirmed GERD. The review was expanded to include studies on FHP irrespective of GERD status. Accordingly, the analysis focused on McKenzie-based interventions for FHP, while GERD implications were explored conceptually. This amendment was made to maintain clinical relevance and is consistent with accepted practices.<sup>13</sup>

#### Literature Search Strategy

A systematic electronic literature search was conducted using MEDLINE (PubMed), Scopus, and Google Scholar to find studies assessing exercise-based physiotherapy interventions for forward head posture (FHP) and associated cervical musculoskeletal dysfunction. PubMed was chosen due to its comprehensive coverage of biomedical literature.<sup>16</sup> Studies published between 2010 and 2025 were identified through searches in PubMed, Scopus, and Google Scholar using relevant keywords combined with Boolean operators. The search was limited to human studies in English. Reference lists of relevant articles were also manually screened to identify additional studies.<sup>17</sup> The complete search strategy and key search terms used in the literature search are presented in **Table 1**.

**Table: 1. Search Strategy and Key Search Terms used in the Literature Search**

Search criteria	Keywords / Search Terms Used
Intervention terms	“McKenzie”, “Mechanical Diagnosis and Therapy”, “MDT”, “exercise therapy”, “Physiotherapy”, “Physical therapy”, “corrective exercise”, “postural correction”, “cervical stabilization exercise”, “deep cervical flexor training”, “scapular stabilization exercise”, “global postural reeducation”.
Postural condition terms	“forward head posture”, “craniovertebral angle”, “upper crossed syndrome”, “cervical posture”, “head posture”, “postural dysfunction”, “rounded shoulder posture”, “text neck”.
Reflux-related terms (exploratory)	“gastroesophageal reflux disease”, “GERD”, “acid reflux”, “reflux symptoms”
Outcome terms	“neck pain”, “Neck Disability Index”, “postural alignment”, “cranio-vertebral angle”, “muscle activation”, “respiratory function”, “thoracic mobility”, “chest expansion”, “functional disability”.
Database searched	MEDLINE (PubMed), Scopus, Google Scholar (grey literature)
Publication period	2010–2025
Language restriction	English
PubMed Search String used	(McKenzie OR "Mechanical Diagnosis and Therapy" OR MDT OR "exercise therapy"[MeSH]) AND ("forward head posture" OR "craniovertebral angle" OR "upper crossed syndrome" OR "cervical posture" OR "head posture") AND ("2010"[Date - Publication] : "2025"[Date - Publication])
Scopus search strategy (posture focused)	TITLE-ABS-KEY (“McKenzie Method” OR “Mechanical Diagnosis and Therapy” OR MDT OR “exercise therapy” OR

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	physiotherapy OR “physical therapy”) AND TITLE-ABS-KEY (“forward head posture” OR “craniovertebral angle” OR “upper crossed syndrome” OR “cervical posture” OR “head posture”) AND PUBYEAR > 2009 AND PUBYEAR < 2026 AND (LIMIT-TO (LANGUAGE, “English”))
Scopus search strategy (GERD exploratory)	TITLE-ABS-KEY (“gastroesophageal reflux disease” OR GERD OR “acid reflux” OR “reflux symptoms”) AND PUBYEAR > 2009 AND PUBYEAR < 2026 AND (LIMIT-TO (LANGUAGE, “English”))
Google scholar strategy	Broad keyword combinations of intervention and posture terms were searched; the first several hundred results were screened by relevance and duplicates were removed.
Additional search method	Manual screening of reference lists and similar articles

### Study Selection

The study selection process occurred in two phases. Initially, all collected records were evaluated based on their titles and abstracts to pinpoint studies that might be relevant. At this stage, articles were excluded if they clearly did not pertain to exercise-based physiotherapy interventions, did not evaluate forward head posture or cervical postural dysfunction, or addressed unrelated medical issues.

In the second phase, full texts of the potentially eligible studies were obtained and assessed according to established eligibility criteria. Studies that failed to fulfill the requirements related to population, intervention, or study design were excluded from consideration. This selection process was meticulously documented using a PRISMA flow diagram, which visually represents the number of records identified, screened, evaluated for eligibility, and ultimately included in the review.<sup>13</sup>

### Eligibility Criteria

The eligibility criteria for the studies were established based on the Population–Intervention–Comparator–Outcome–Study design (PICOS) framework, which is widely recommended for structuring systematic review inclusion criteria.<sup>18</sup>

#### PICOS Framework

Studies involving adults with FHP or related cervical postural disorders were included. FHP was assessed using validated methods such as CVA or standardized postural assessments. Eligible interventions were exercise-based physiotherapy programs, including Mechanical Diagnosis and Therapy (MDT), cervical and scapular stabilization, and corrective exercise approaches. Comparators included standard care, no treatment, or alternative rehabilitation programs. Studies reporting outcomes related to postural alignment or cervical function were included. Primary outcomes included pain, functional measures, and respiratory parameters; GERD-related outcomes were recorded when available but were not mandatory.

#### Study Design

Both randomized and non-randomized interventional studies were eligible for inclusion. This category included randomized controlled trials, controlled clinical trials, quasi-experimental studies, and prospective pre–post intervention studies that evaluated exercise-based physiotherapy interventions. Studies employing cross-sectional, case-control, or observational designs without an intervention component were excluded. Case reports, case series, narrative reviews and conference abstracts lacking sufficient methodological detail were also excluded.

#### Data Synthesis

Due to the diversity in study populations, intervention methods, comparators, outcome measures, and follow-up periods, a quantitative meta-analysis was deemed unsuitable. As a result, the findings were integrated using a qualitative narrative approach. Due to variability in populations and interventions, a meta-analysis was unsuitable. Findings were summarized narratively, with studies grouped by intervention type and outcome areas like postural alignment, pain, and reflux measures.<sup>19</sup> Studies were categorized by intervention type and outcomes, including McKenzie-based techniques, stabilization, and multimodal physiotherapy. Outcomes included postural alignment, pain, disability, respiratory measures, and GERD-related physiology, with findings summarized narratively.

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## Risk of Bias Assessment

The methodological quality of the studies included in this review was evaluated using risk of bias tools. Randomized controlled trials were evaluated with the Cochrane Risk of Bias 2 (RoB 2) tool, which examines biases in randomization, intervention deviations, missing outcomes, measurement accuracy, and result selection.<sup>18</sup> For nonrandomized interventional studies, the ROBINS-I tool was used to assess biases related to confounding, participant selection, intervention classification, deviations, missing data, outcome measurement, and reporting practices.<sup>20</sup> Two reviewers (LE and SSP) independently assessed the risk of bias. Discrepancies were resolved through discussion, with a third reviewer (PS) as needed, all supervised by a senior reviewer (SSS) to ensure methodological rigor.

## Certainty of Evidence Assessment

The overall certainty of evidence for the primary outcomes was evaluated using the Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach. This framework assesses the quality of evidence across several areas, including risk of bias, consistency of results, indirectness of evidence, imprecision, and potential publication bias.<sup>21</sup> Based on these criteria, the certainty of evidence for each important outcome was classified as high, moderate, low, or very low. The GRADE assessment was utilized to help interpret the findings and to highlight areas where further research may be necessary.

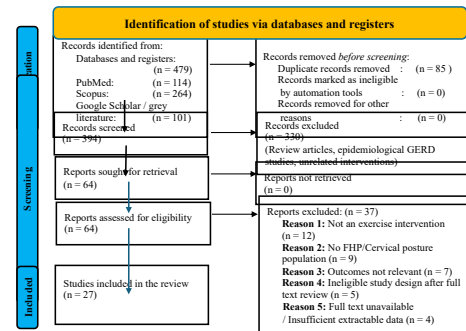
## Results

### Study Selection

The database search yielded 479 records from various electronic sources, which included PubMed (114 records), Scopus (264 records), and Google Scholar/grey literature (101 records). After eliminating 85 duplicate entries, a total of 394 articles were evaluated based on their titles and abstracts. At initial screening, 330 records were excluded due to irrelevant interventions, absence of FHP assessment, unrelated populations, or non-interventional designs. The full texts of 64 potentially relevant studies were then obtained and evaluated for eligibility. After applying the established PICOS criteria, 37 studies were excluded due to non-exercise interventions, absence of FHP outcomes, ineligible designs, or insufficient data. Ultimately, 27 studies met the inclusion criteria and were incorporated into the final

qualitative synthesis. The study selection process followed the PRISMA 2020 guidelines,<sup>13</sup> and illustrated in **Figure 1**.

**Figure 1: PRISMA 2020 flow diagram illustrating the study selection process**



Source: Page MJ, et al. BMJ 2021;372:n71. doi: 10.1136/bmj.n71.

### Characteristics of Included Studies

The 27 studies considered, published from 2016 to 2025, assessed physiotherapy interventions focused on exercise for forward head posture (FHP), upper crossed syndrome, or chronic neck pain. The majority of these were randomized controlled trials, with participant numbers varying between about 20 and 120. The interventions assessed across these studies included McKenzie exercises, cervical stabilization routines, scapular strengthening programs, thoracic mobilization paired with exercise, corrective exercise regimens, breathing retraining, diaphragm-focused methods, and multimodal physiotherapy approaches. The durations of these interventions ranged from 4 to 8 weeks, with most studies featuring supervised sessions occurring two to three times weekly. Commonly measured outcomes incorporated craniovertebral angle (CVA), Neck Disability Index (NDI), intensity of neck pain, respiratory function, muscle activation patterns, chest expansion, and performance-related indicators. While no studies directly evaluated gastroesophageal reflux disease (GERD) symptoms, several looked at physiological variables that might relate to reflux mechanisms, such as respiratory muscle strength, pulmonary function, thoracic mobility, and diaphragmatic functionality.

Detailed characteristics of the included studies are presented in **Table 2**.

**Table 2. Characteristics of included studies examining McKenzie and related physiotherapy**

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interventions for FHP and potential relevance to GERD physiology.

Study	Study Design	Population	Intervention	Comparator	Duration	Primary Outcomes	GERD-related physiological outcomes
Chaiyawijit & Kanlayanaphotporn, 2024	Randomized clinical trial	Adults with chronic neck pain and FHP	McKenzie neck exercises	Cranio-cervical flexion exercise	6 weeks	Craniovertebral angle, neck pain, disability	None reported
Kim et al., 2018	Interventional study	Adults with forward head posture	McKenzie exercise combined with myofascial release and kinesio taping	Exercise only	4–6 weeks	Craniovertebral angle	None reported
Cho et al., 2017	Randomized clinical trial	Individuals with forward head posture	Thoracic mobilization and mobility exercise	Cervical stabilization exercise	6 weeks	Craniovertebral angle, Neck Disability Index	Thoracic mobility
Batool et al., 2024	Randomized clinical trial	Individuals with nonspecific neck pain and forward head posture	Neck stabilization exercises	Dynamic neck exercises	8 weeks	Pain intensity, disability	None reported
Fathollahnejad et al., 2019	Controlled intervention study	Adults with forward head posture and rounded shoulders	Manual therapy combined with stabilization exercises	Exercise alone	6 weeks	Postural alignment	None reported
Seidi et al., 2020	Randomized controlled trial	Men with upper crossed syndrome	Comprehensive corrective exercise program	No-exercise control	8 weeks	Postural alignment, muscle activation	None reported
Yaghoubitajani et al., 2022	Randomized controlled trial	Office workers with upper crossed syndrome	Workplace-based corrective exercise	Online corrective exercise	8 weeks	Neck pain, posture	None reported

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Abd El-Azeim et al., 2022	Randomized controlled trial	Adults with symptomatic FHP	Postural correction exercises with scapular stabilization	Postural correction exercise only	6 weeks	Craniovertebral angle, pain	None reported
Park et al., 2024	Interventional study	Individuals with chronic neck pain	Cervical stabilization exercise	Conventional physiotherapy	6 weeks	Pain, posture	None reported
Nitayarak et al., 2021	Randomized controlled trial	Individuals with upper crossed syndrome	Scapular stabilization exercises	Control group	6 weeks	Postural alignment	None reported
Dareh-Deh et al., 2022	Randomized controlled trial	Individuals with neck pain and postural dysfunction	Therapeutic exercise program including respiratory training	Conventional exercise	6 weeks	Respiratory function, posture	Respiratory muscle strength
Abadiyan et al., 2021	Randomized controlled trial	Individuals with neck pain and postural abnormalities	Global postural re-education	Conventional physiotherapy	8 weeks	Postural alignment	None reported
Shih et al., 2017	Interventional study	Individuals with FHP	Kinesio taping combined with exercise	Exercise alone	4 weeks	Craniovertebral angle	None reported
Lee et al., 2017	Interventional study	Asymptomatic individuals with FHP	Corrective exercise program	Alternative exercise method	6 weeks	Postural alignment	None reported
Ahmed et al., 2024	Interventional study	Asymptomatic individuals with FHP	McKenzie exercises	Posture correction band	6 weeks	Pulmonary function, chest expansion	Pulmonary function
Arif et al., 2022	Interventional study	Adults with FHP	Cervical stabilization exercises	Conventional therapy	6 weeks	Respiratory muscle strength	Respiratory function
Aneis et al., 2022	Randomized controlled trial	Individuals with upper crossed syndrome	Multimodal physiotherapy program	Standard care	8 weeks	Pain, posture	None reported
Buttagat et al., 2023	Randomized	Individuals with FHP	Thai massage	Exercise only	6 weeks	Postural alignment	Thoracic mechanics

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	controlled trial		with stabilization exercises				
Elgendy et al., 2024	Randomized controlled trial	Adults with FHP	Head postural correction program	Conventional physiotherapy	6 weeks	Craniovertebral angle, grip strength	None reported
Alghadir et al., 2021	Interventional study	Teachers with neck pain and FHP	Deep cervical flexor training with pressure biofeedback	Conventional physiotherapy	8 weeks	Craniovertebral angle, Neck Disability Index	Respiratory muscle activation
Tatsios et al., 2025	Randomized controlled trial	Adults with non-specific chronic neck pain and FHP	Cervical spine manual therapy + diaphragm manual therapy + breathing reeducation	Conventional physiotherapy	6 weeks	Cervical ROM, craniocervical angle, pain	Diaphragmatic function, breathing mechanics
Haghighat et al., 2025	Randomized controlled trial	Women with symptomatic FHP	Diaphragm myofascial release + neck exercise program	Neck exercise alone	4 weeks	FHP correction, chest expansion, disability	Chest expansion, diaphragmatic mechanics
Han et al., 2016	Interventional study	Adults with FHP	Corrective postural exercise program	Control group	6 weeks	Pulmonary function, respiratory muscle activity, craniocervical angle	Pulmonary function and respiratory mechanics
Anwar et al., 2022	Double-blind randomized controlled trial	Adults with chronic non-specific neck pain	Breathing re-education program	Standard physiotherapy	6 weeks	Pain, disability, pulmonary outcomes	Pulmonary function
Kang et al., 2016	Interventional study	Adults with forward head posture	Feedback respiratory exercise	Baseline / conventional exercise	4-6 weeks	Craniovertebral angle, Neck Disability Index	Respiratory muscle activity

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Mosallaiezadeh et al., 2022	Controlled clinical trial	Adults with chronic neck pain and FHP	Diaphragmatic exercise + conventional rehabilitation	Conventional rehabilitation	6 weeks	Pain, disability, proprioception, posture	Diaphragmatic breathing
Parida et al., 2024	Randomized controlled trial	Adults with forward head posture	Breathing exercise + posture correction exercise	Posture correction exercise alone	6 weeks	Peak expiratory flow rate, cervicovertebral angle	Pulmonary function

**FHP – Forward head posture; GERD – Gastroesophageal reflux disease;**

**Effects of interventions on postural alignment**

Most studies included in this review found significant enhancements in postural alignment after implementing exercise-based interventions. Programs emphasizing cervical stabilization, postural correction, scapular strengthening, and multimodal rehabilitation resulted in notable increases in cervicovertebral angle (CVA), suggesting a decrease in the severity of forward head posture. Additionally, McKenzie-based interventions yielded positive outcomes for cervical posture and related symptoms. For instance, research by Chaiyawijit and Kanlayanaphotporn,<sup>22</sup> reported that both McKenzie neck exercises and cranio-cervical flexion exercises significantly improved the cervicovertebral angle and decreased disability among individuals suffering from chronic neck pain. In addition, comprehensive corrective exercise regimes aimed at addressing upper crossed syndrome yielded positive results in terms of postural alignment and muscle activation patterns.<sup>23</sup> Thoracic mobilization, when coupled with exercise interventions, also produced advantageous effects on cervical posture and disability outcomes.<sup>24</sup>

**Effects on Pain and Functional Outcomes**

Multiple studies indicated a reduction in neck pain intensity and an improvement in functional disability resulting from exercise-based physiotherapy interventions. Programs centered on stabilization exercises were especially effective in enhancing both postural alignment and clinical results. Batool et al. (2024) reported that neck stabilization exercises led to significant decreases in pain intensity and enhancements in disability scores among individuals

with nonspecific neck pain coupled with forward head posture. Furthermore, multimodal physiotherapy strategies that integrated exercise therapy with manual therapy interventions were linked to improvements in both pain management and functional outcomes.<sup>25</sup>

**Physiological Outcomes Relevant to Gastroesophageal Reflux Disease**

While the studies included did not directly assess gastroesophageal reflux disease (GERD) symptoms, several investigations examined physiological outcomes that may impact reflux physiology. Improvements in respiratory muscle strength and pulmonary function were noted in studies that explored cervical stabilization exercises and postural correction programs. For example, Ahmed et al. (2024) reported enhancements in pulmonary function and chest expansion as a result of McKenzie exercises and posture correction interventions.<sup>26</sup> Similarly, Arif et al. (2022) found improvements in respiratory muscle strength following cervical stabilization training.<sup>27</sup> Additional studies by Tatsios et al. (2025), Haghghat et al. (2025), Anwar et al. (2022), Han et al. (2016), Mosallaiezadeh et al. (2022), and Parida et al. (2024) further supported benefits in breathing mechanics, diaphragmatic function, and respiratory efficiency.<sup>4,28-32</sup>

These findings hold significance, as forward head posture can disrupt thoracic alignment and respiratory mechanics. Prior research has established that postural irregularities can negatively affect respiratory efficiency and diaphragmatic function, potentially influencing thoraco-abdominal pressure relationships that are factors in gastroesophageal reflux.<sup>4,5</sup>

**Risk of Bias Assessment**

The methodological quality of included studies was assessed using RoB2 for randomized trials and

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ROBINS-I for non-randomized studies. Two reviewers independently evaluated the risk of bias. Most randomized studies showed low risk or some concerns, mainly due to lack of blinding, while non-randomized studies had greater concerns related to


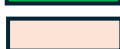
confounding and reporting. A detailed assessment of the risk of bias across the studies is summarized in **Table 3.**

**Table 3. Risk of Bias Assessment of Included Studies**

Study	Randomization	Allocation concealment	Blinding	Incomplete outcome data	Selective reporting	Overall risk
Chaiyawijit 2024	Low	Some concern	Some concern	Low	Low	Some concern
Kim 2018	Some concern	Some concern	Some concern	Low	Low	Some concern
Cho 2017	Low	Some concern	Some concern	Low	Low	Some concern
Batool 2024	Low	Low	Some concern	Low	Low	Low
Fathollahnejad 2019	Some concern	Some concern	Some concern	Low	Low	Some concern
Seidi 2020	Low	Low	Some concern	Low	Low	Low
Yaghoubitajani 2022	Low	Some concern	Some concern	Low	Low	Some concern
Abd El-Azeim 2022	Low	Some concern	Some concern	Low	Low	Some concern
Park 2024	Some concern	Some concern	Some concern	Low	Low	Some concern
Nitayarak 2021	Low	Low	Some concern	Low	Low	Low
Dareh-Deh 2022	Low	Low	Some concern	Low	Low	Low
Abadiyan 2021	Low	Low	Some concern	Low	Low	Low
Shih 2017	Some concern	Some concern	Some concern	Low	Low	Some concern
Lee 2017	Some concern	Some concern	Some concern	Low	Low	Some concern
Ahmed 2024	Some concern	Some concern	Some concern	Low	Low	Some concern
Arif 2022	Some concern	Some concern	Some concern	Low	Low	Some concern
Aneis 2022	Low	Low	Some concern	Low	Low	Low
Buttagat 2023	Low	Low	Some concern	Low	Low	Low
Elgendy 2024	Low	Low	Some concern	Low	Low	Low
Alghadir 2021	Some concern	Some concern	Some concern	Low	Low	Some concern

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Tatsios 2025	Low	Low	Some concern	Low	Low	Low
Haghighat 2025	Low	Low	Some concern	Low	Low	Low
Han 2016	Some concern	Some Concern	Some concern	Low	Low	Some concern
Anwar 2022	Low	Low	Low	Low	Low	Low
Kang 2016	Some concern	Some concern	Some concern	Low	Low	Some concern
Mozallaiezhadeh 2022	Low	Some concern	Some concern	Low	Low	Some concern
Parida 2024	Low	Low	Some concern	Low	Low	Low

 Low risk of bias  
 Some concerns/moderate risk of bias

**Note:** The risk of bias was assessed using the Cochrane Risk of Bias 2 (RoB2) tool for randomized studies and ROBINS-I for non-randomized studies. “Low” indicates low risk of bias, while “some concerns” indicates moderate risk of bias.

### Certainty of Evidence Assessment

The level of evidence for key outcomes was assessed using the Grading of Recommendations Assessment, Development and Evaluation (GRADE) framework, which took into account factors like risk of bias, inconsistency, indirectness, imprecision, and publication bias.

The evidence supporting improvements in postural alignment (measured by craniocervical angle), neck pain, and functional disability was deemed moderate, indicating generally consistent results despite some limitations in the study sizes and methodologies. In contrast, the evidence related to respiratory outcomes and chest expansion/diaphragmatic mechanics was classified as low due to the limited number of studies and variability in the outcome measures used. It's noteworthy that none of the studies included directly assessed symptoms of gastroesophageal reflux disease (GERD), reflux severity, or esophageal outcomes. Consequently, the level of evidence concerning the connection between physiotherapy-based postural rehabilitation and the management of GERD was rated

as very low. The overall certainty ratings are presented in **Table 4**.

**Table 4: GRADE Certainty of Evidence for Major Outcomes**

Outcome	Number of studies (outcomes)	Certainty of evidence	Reason for downgrading
Craniovertebral angle (postural alignment)	23	Moderate	Risk of bias in several studies
Neck pain intensity	9	Moderate	Heterogeneity in intervention protocols
Neck disability index	8	Moderate	Small sample sizes
Respiratory outcomes	8	Low	Heterogeneity in respiratory outcome measures (PEFR, pulmonary function, respiratory strength)

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Chest expansion/diaphragmatic mechanics	3	Low	Limited number of studies and indirectness of outcomes
GERD symptoms / reflux outcomes	0	Very low	No direct clinical interventional studies assessing GERD symptoms, reflux severity or oesophageal outcomes

**Note: Certainty of evidence was assessed using the GRADE (Grading of Recommendations Assessment, Development and Evaluation) approach. Evidence was downgraded based on risk of bias, inconsistency, and imprecision where applicable.**

**Discussion**

This systematic review synthesized evidence from 27 intervention studies assessing the effectiveness of McKenzie-based and related physiotherapy exercise programs aimed at addressing forward head posture, while also exploring their potential effects on the physiological mechanisms related to gastroesophageal reflux disease (GERD). The results demonstrate that exercise-based physiotherapy interventions can effectively improve cervical posture, alleviate neck pain, and enhance functional outcomes for individuals suffering from forward head posture or upper crossed syndrome.<sup>22,23,25,33</sup>

The studies included consistently reported enhancements in craniocervical angle, a critical measure of the severity of forward head posture, following structured exercise interventions.<sup>22,24,25</sup> Physiotherapy programs focused on cervical stabilization, scapular strengthening, and thoracic mobility showed beneficial effects on postural

alignment.<sup>23-25</sup> These findings align with earlier research indicating that enhancing the strength of deep cervical flexor muscles and rectifying muscular imbalances linked to upper crossed syndrome can promote normal cervical biomechanics and lessen mechanical stress on cervical structures.<sup>2,12</sup>

In addition to musculoskeletal benefits, several studies noted improvements in respiratory function and thoracic mechanics post-intervention.<sup>26,27</sup> Tatsios et al. (2025) found that combining cervical manual therapy with diaphragmatic manual therapy and breathing retraining enhanced cervical flexibility, alignment, and respiratory functions.<sup>28</sup> Haghghat et al. (2025) indicated that diaphragm myofascial release paired with neck exercises led to better chest expansion and posture improvement.<sup>34</sup> Anwar et al. (2022) revealed that breathing retraining positively affected pain levels, disability, and pulmonary outcomes in individuals with chronic neck pain.<sup>30</sup> Research by Han et al. (2016) and Kang et al. (2016) supported the link between correcting forward head posture (FHP) and enhanced respiratory muscle performance and lung function.<sup>3,4</sup> Mosallaiezhadeh et al. (2022) showed that integrating diaphragmatic exercises with rehabilitation yielded benefits in pain management, posture, and proprioception,<sup>31</sup> while Parida et al. (2024) reported enhancements in peak expiratory flow rate and craniocervical angle following breathing exercises combined with posture correction.<sup>35</sup>

These outcomes are clinically significant because forward head posture can negatively affect thoracic spine curvature and rib cage movement, which may compromise diaphragmatic function and breathing efficiency. Prior research has shown that individuals with forward head posture often experience diminished respiratory muscle performance and altered breathing patterns.<sup>4</sup> Similarly, modifications in thoracic configuration have been found to impact respiratory function and thoraco-abdominal mechanics.<sup>5</sup>

These biomechanical relationships might extend beyond musculoskeletal health. GERD is impacted by various physiological factors, including lower esophageal sphincter function, diaphragmatic pressure, and intra-abdominal pressure differentials.<sup>6</sup> Changes in thoracic posture and diaphragmatic activity could thus affect reflux mechanisms. For instance, spinal deformities like thoracic kyphosis have been linked to a higher frequency of reflux

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symptoms due to mechanical influences on abdominal pressure and esophageal position.<sup>7</sup> Additionally, body posture can alter reflux episodes by affecting the pressure dynamics between the thoracic and abdominal cavities.<sup>8</sup>

Despite plausible physiological links, no studies directly assessed GERD outcomes following postural interventions. Thus, the therapeutic role remains speculative, although improvements in respiratory function and thoracic mobility suggest potential relevance.<sup>4,26-28,30,31,34,35</sup>

Future research should examine the relationship between postural rehabilitation and gastrointestinal outcomes. Randomized trials should include GERD-specific measures to determine whether improvements in posture and respiratory function translate in to clinical benefits.

### Strengths and Limitations

Notable advantage of this review is its thorough compilation of evidence regarding exercise-based interventions for forward head posture, following PRISMA 2020 guidelines and utilizing eligibility criteria grounded in the PICOS framework. It drew from various electronic databases, such as PubMed and Scopus, enhancing the literature scope and minimizing the risk of overlooking relevant studies. The inclusion of recent research contributed to the evidence pool, particularly concerning respiratory outcomes and physiological metrics related to reflux mechanisms. Methodological quality was assessed using recognized tools (RoB 2, ROBINS-I), and the strength of evidence was evaluated using the GRADE framework.

However, there are several limitations. Variability in participant characteristics, intervention protocols, and outcome measures hindered formal meta-analysis and direct comparisons. Some studies had methodological weaknesses, including the absence of blinding and small sample sizes. Most interventions lasted only 4–8 weeks, limiting conclusions about long-term effectiveness. Additionally, only English-language studies were included, which could introduce language bias. Finally, none of the studies directly assessed gastroesophageal reflux disease (GERD) symptoms, limiting conclusions about the clinical relevance of postural rehabilitation for GERD management.

### Conclusion

Exercise-based physiotherapy interventions, such as McKenzie exercises, cervical stabilization programs,

and various corrective exercise techniques, have demonstrated effectiveness in addressing forward head posture. These approaches not only alleviate neck pain but also improve overall functional outcomes. Recent research indicates that these interventions may yield positive effects on respiratory function, thoracic mobility, and the mechanics of diaphragm movement. This suggests that rehabilitating posture can provide physiological benefits that extend beyond just the musculoskeletal system.

These findings suggest a potential link between posture correction and gastroesophageal reflux disease (GERD). Improving thoraco-abdominal pressure and breathing efficiency may help manage GERD symptoms. However, there is limited clinical evidence connecting physiotherapy for forward head posture with reduced GERD symptoms. More research is needed to explore the relationships between spinal posture, respiratory function, and gastrointestinal health, and future trials should evaluate reflux-related outcomes in postural rehabilitation.

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