Effectiveness of diaphragmatic breathing on physiological and psychological stress in adults: a quantitative systematic review protocol

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Review question: What is the effectiveness of diaphragmatic breathing on physiological and psychological stress in adults?

Keywords Diaphragmatic breathing; physiological; psychological; stress

Introduction

Stress is a global epidemic. In 2011, the World Health Organization (WHO) developed guidelines to support primary care providers in the care of their patients who experience stress. 1,2 A 2016 global assessment by WHO recognized that sources of stress varied internationally and identified that 330 million people were affected by stress worldwide. 2 Stress is the process through which environmental demands result in detrimental outcomes to a person’s physical and/or mental health. 3,4 When a person experiences stress they have both physiological and psychological responses. The physiological responses to stress arise from activation of the sympathetic nervous system through the secretion of cortisol. 5 Therefore, increases in the respiratory rate, heart rate and systolic blood pressure result from stress. The stress response can be immediate or delayed, acute or long term. 4 Sympathetic nervous system activity increases in response to psychological stress and is pro-inflammatory leading to the development of mental and physical disease states. 4,5 Stress is a major risk factor for the development of many chronic diseases, both physiological (e.g. cancer and cardiovascular disease) and psychological (e.g. anxiety and depression). 6

From a global perspective, stress may be triggered in a variety of ways. 5,6 Global sources of stress include catastrophic events such as floods and earthquakes, inadequate food and water sources, and poor living conditions. 2 Additional triggers of stress include work, school, finances, family and social interactions and expectations. 7,8 In a study of over 115 million people conducted in the United States (US) by the Robert Wood Johnson Foundation in conjunction with National Public Radio and the Harvard School of Public Health, over half of the adults surveyed acknowledged that they had a major stressful event in the past year. 9 Seventy-two percent of those surveyed regularly experience financial stress and 60% reported job-related stress. 10

In work and college environments, stress can lead to the development of cardiovascular disease, hypertension, depression, anxiety, social dysfunction, drug and alcohol abuse, and in extreme cases can result in death. 11-14 The International Labour Organization’s 2016 report on workplace stress identified that global workplace stress is only beginning to be quantified. 15 The study reported EUR272 billion in lost productivity from work-related stress and EUR242 billion in healthcare costs in Europe. 15 In addition, Australian estimates in 2008/09 for lost productivity related to stress were AUD5.3 billion annually. 15 In the US, the cost of stress to employers has been reported to be over USD300 billion (EUR273 billion). 10 The overall financial burden of stress reported globally is staggering. 2 The high costs of stress is well documented. 6,16 In a study investigating anxiety and depression by the WHO, increasing future worldwide treatment from 2016 to 2030 using
psychosocial counselling and medication is estimated to cost USD141 billion (EUR119.67 billion).\textsuperscript{17} Identifying evidence-based stress reduction interventions that are low cost, easy to use and can be self-administered is essential to the overall treatment and management of this global health issue. The intervention of interest in this review that could meet these criteria is diaphragmatic breathing.

Diaphragmatic breathing involves breathing deeply and expanding the lungs into the diaphragm rather than using the abdomen or ribcage alone.\textsuperscript{18,19} Diaphragmatic breathing techniques focus on slowing the respiratory rate by using a process such as counting the breaths while expanding the abdomen and inhaling deeply through the nose, pausing, then contracting the abdomen and exhaling slowly and completely though the mouth.\textsuperscript{18-20} This type of deep breathing technique includes developing a pattern of inhalation and exhalation to decrease respiratory rate.\textsuperscript{19-22} Deep breathing assists in blood flow, it lowers the pulse rate and blood pressure by improving vagal activity and reducing the sympathetic reaction.\textsuperscript{18} Diaphragmatic breathing needs no equipment or specific setting and it can be easily taught and learned, making it cost effective. Furthermore, diaphragmatic breathing can be self-administered as soon as a person identifies a stress trigger, making it a readily available treatment for the management of stress. Diaphragmatic breathing has been identified as beneficial to both physical and mental health.\textsuperscript{22}

Researchers have found diaphragmatic breathing interventions with varying doses, duration and samples to be effective in managing physiological and psychological stress.\textsuperscript{7,13,19,22,23} In studies identified from a limited search of the literature, diaphragmatic breathing sessions occurred in a dose ranging from one to 20 sessions with the intervention ranging from once to nine months.\textsuperscript{7,13,19,22,23} The Perceived Stress Scale and the Depression Anxiety Stress Scale (DASS-21), specifically the stress sub-scale, are some of the psychometric tools used to measure changes in stress.\textsuperscript{19,23} Physiological parameters to measure stress included heart rate, respiratory rate, blood pressure and salivary cortisol levels.\textsuperscript{7,13,19,22,23} The interventions were delivered either by the researchers themselves or a designee, either in person or by an audio CD. In these studies, diaphragmatic breathing interventions showed significant decreases in stress.\textsuperscript{7,13,19,22,23}

The intervention of diaphragmatic breathing is being considered in this review independent of other complementary or mindfulness-based therapies in order to provide supporting evidence of its efficacy to reduce physiological and psychological stress in the absence of any interventions that are framed by spiritual or religious beliefs. If diaphragmatic breathing can be shown to provide physiological and psychological stress reduction, it may be a cost effective means for improved health outcomes. Therefore, this review seeks to determine the effectiveness of diaphragmatic breathing as an evidence-based intervention on physiological and psychological stress management. A search of PubMed, Cumulative Index to Nursing and Allied Health Literature (CINAHL), JBI Database of Systematic Reviews and Implementation Reports, Cochrane Database of Systematic Reviews, and Virginia Henderson Global Nursing e-Repository was performed and no existing or ongoing systematic review on this topic was identified.

**Inclusion criteria**

**Participants**

This review will consider studies that include adults 18 years and over. There will be no exclusion based on mental or physical diagnosis, and acute or chronic disease states.

**Intervention**

This review will consider studies that will include diaphragmatic breathing of any regimen or duration. Diaphragmatic breathing involves breathing deeply and expanding the lungs into the diaphragm rather than using the abdomen or ribcage alone.\textsuperscript{18,19} The intervention of interest may be administered by any method. Studies will be considered if the intervention is delivered by either researchers themselves or a designee. Studies will be excluded if diaphragmatic breathing is paired with any intervention that may have religious or spiritual implications, such as yoga, meditation, or mindfulness.

**Comparator**

This review will consider studies that compare the intervention of diaphragmatic breathing to no intervention. This review will also consider other stress reduction interventions such as progressive muscle relaxation and mindfulness techniques if measured...
Outcomes
This review will consider studies that include the following outcomes: effectiveness of diaphragmatic breathing on physiological and psychological stress. This review will consider studies that use physiological measurements such as respiratory rate, heart rate, blood pressure and cortisol levels; and self-report instruments that measure participants’ perceived stress such as the Perceived Stress Scale and stress as measured by the Depression Anxiety Stress Scales (DASS-21) stress subscale. Outcome measures will be considered from any time period after the delivery of the intervention.

Types of studies
This review will consider both experimental and quasi-experimental study designs including randomized controlled trials, non-randomized controlled trials, before and after studies and interrupted time-series studies. In the absence of experimental designs, analytical observational studies including prospective and retrospective cohort studies, case-control studies and analytical cross-sectional studies will be considered for inclusion.

Methods

Search strategy
The search strategy will aim to find both published and unpublished studies. An initial limited search of PubMed and CINAHL will be undertaken followed by an analysis of the text of words contained in the title and abstract, and of the index terms used to describe the article. This informed the development of a search strategy which will be tailored for each information source. A full search strategy for PubMed is detailed in Appendix I. The reference list of all studies selected for critical appraisal will be screened for additional studies.

Studies published in English will be included. Studies published from the inception of each data-base through the current date of the review will be considered for inclusion.

Information sources
The databases to be searched include: PubMed, CINAHL via EBSCOhost, Cochrane Central Register of Controlled Trials (CENTRAL), Embase via Elsevier, PsycINFO via EBSCOhost, ProQuest Nursing and Allied Health Data Base, and Health Source: Nursing/Academic Edition via EBSCOhost.

The search for unpublished studies/gray literature will include: ProQuest Dissertations and Theses A&I, New York Academy of Medicine Library, Virginia Henderson Global Nursing e-Repository, and Google Scholar.

In addition, subject matter experts will be contacted to identify other potentially relevant studies.

Study selection
Following the search, all identified citations will be collated and uploaded into EndNote and duplicates removed. Titles and abstracts will then be screened by two independent reviewers for assessment against the inclusion criteria for the review. Studies that meet or could potentially meet the inclusion criteria will be retrieved in full and their details imported into the Joanna Briggs Institute System for the Unified Management, Assessment and Review of Information (JBI SUMARI). The full text of selected studies will be retrieved and assessed in detail against the inclusion criteria. Full text studies that do not meet the inclusion criteria will be excluded, and reasons for exclusion will be provided in an appendix in the final systematic review report. Included studies will undergo a process of critical appraisal. The results of the search will be reported in full in the final report and presented in a PRISMA flow diagram. Any disagreements that arise between the reviewers will be resolved through discussion or with a third reviewer.

Assessment of methodological quality
Selected studies for retrieval will be assessed by two independent reviewers for methodological validity prior to inclusion in the review using standardized critical appraisal instruments from the Joanna Briggs Institute.24 Any disagreements that arise between the reviewers will be resolved through discussion or with a third reviewer. All selected studies, regardless of their methodological quality, will undergo data extraction and synthesis where possible.

Data extraction
Data will be extracted from papers included in the review using the standardized data extraction tool in JBI SUMARI. The data extracted will include specific details about the interventions, populations,
study methods and outcomes of significance to the review question and specific objectives. Any disagreements that arise between the reviewers will be resolved through discussion or with a third reviewer. Authors of papers will be contacted to request missing or additional data where required.

Data synthesis
Quantitative data will, where possible, be pooled in statistical meta-analysis using JBI SUMARI. Effect sizes expressed as weighted mean differences (for continuous data) and their 95% confidence intervals will be calculated for analysis. Heterogeneity will be assessed statistically using the standard Chi-square and I squared tests. The choice of model (random or fixed effects) and method for meta-analysis will be based on the guidance by Tufanaru et al. Where statistical pooling is not possible, the findings will be presented in narrative form including tables and figures to aid in data presentation where appropriate.

Assessing certainty in the findings
A Summary of Findings will be created using GRADEPro GDT software. The Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach for grading the quality of evidence will be followed. The Summary of Findings will present the following information where appropriate: absolute risks for treatment and control, estimates of relative risk and a ranking of the quality of the evidence based on study limitations (risk of bias), indirectness, inconsistency, imprecision, and publication.

The following outcomes will be included in the Summary of Findings: physiological measurements of stress such as respiratory rate, heart rate, blood pressure, and cortisol levels; and psychological measurements of stress as measure by tools such as the Perceived Stress Scale and the Depression Anxiety Stress Scales (DASS-21) stress subscale.

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References


Appendix I: Search strategy

**PubMed**