



Review article

Effects of acute psychological stress induced in laboratory on physiological responses in asthma populations: A systematic review



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ABSTRACT

Background: Psychological stress has long been suspected to have a deleterious effect on asthma, with acute psychological stress being associated with physiological responses in asthma patients.

Objectives: The purpose of this systematic review was to provide a narrative synthesis of the impact of acute laboratory psychological stress on physiological responses among asthma patients.

Methods: An extensive search was conducted by two independent authors using Pubmed, PsycINFO, PsyArticles and the Cochrane Library electronic databases (up to September 2016). English and French articles which assessed physiological responses during or post-stress and compare them to baseline or pre-stress values were included.

Results: Thirty-two studies met the inclusion criteria. Studies indicated that exposure to active stressors (e.g., arithmetic tasks) was associated with an increase in sympathetic nervous system (SNS) responses, cortisol, and inflammatory responses, but had little effect on the caliber of the bronchi. Exposure to passive stressors (e.g., watching stressful movies or pictures) was also associated with an increase in SNS responses and with mild bronchoconstriction. However, a paucity of data for passive stressors limited conclusions on other measures.

Conclusions: In patients with asthma, both active and passive stressors seem to be associated with an increased activation of the SNS. Passive stressors seem to have a more immediate, deleterious impact on the airways than active stressors, but the latter may be associated with delayed inflammatory driven an asthma exacerbation. Further studies are needed to understand the impact of acute stressors on the physiological mechanisms associated with asthma, particularly HPA and immune markers.

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Contents

1. Introduction	22
2. Methods	22
2.1. Literature search	22
2.2. Study selection and data extraction	22
3. Results	23
3.1. Study characteristics	23
3.2. Physiological stress responses	23

ABBREVIATIONS: ANS, Autonomic nervous system; FeNO, Fraction of exhaled nitric oxide; FEV₁, Forced expiratory volume in 1 s; % FEV₁, Percent predicted FEV₁; HPA, Hypothalamic-pituitary-adrenocortical; M, Mean; MeSH, Medical subject headings; PNS, Parasympathetic nervous system; RSA, Respiratory sinus arrhythmia; SD, Standard deviation; SES, Socioeconomic status; SNS, Sympathetic nervous system; TSST, Trier Social Stress Test.

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3.2.1.	Respiratory responses	23
3.2.2.	Immune responses	23
3.2.3.	Autonomic responses	23
3.2.4.	Hypothalamic-pituitary-adrenocortical responses	23
3.2.5.	Cardiovascular responses	24
3.3.	Risk of bias assessment	24
4.	Discussion	25
4.1.	Physiological stress responses in asthmatics	25
4.1.1.	Impact of active stressors	25
4.1.2.	Impact of passive stressors	25
4.1.3.	Summary and clinical implications	26
4.2.	Methodological implications and recommendations	26
4.2.1.	Timing of the stress response assessments and the use of comparators	28
4.2.2.	Acute stress tasks and manipulation checks	28
4.2.3.	Asthma assessment	29
4.2.4.	Medication cessation prior to testing	29
4.3.	Limitations and strengths of the present review	30
5.	Conclusion	30
	Acknowledgments	30
	Supplementary data	31
	Competing interests	31
	Funding	31
	References	31

1. Introduction

Asthma is a chronic respiratory disease characterized by airway hyper-responsiveness, inflammation, and airflow obstruction [1], and is one of the world's most common chronic diseases in adults [2]. Despite the availability of effective treatments, over 50% of asthma patients remain poorly controlled [3], accounting for a significant proportion of health care costs [4,5]. Optimal asthma control depends on several behavioral (e.g., managing environmental triggers, and adherence to controller medication) [1] and physiological (e.g., bronchial and immune responses to allergens) [6] factors, both of which may be influenced by psychological stress. Psychological stress occurs when an individual perceives that their environmental demands exceed their abilities to cope with them [7]. The psychological stress - asthma link is not new [8], with asthma being referred to as a “neurotic affection” as far back as the 19th century [9]. Interestingly, some asthma patients report psychological stress as an asthma trigger [1], and both chronic (e.g., presence of psychiatric disorders [10,11]) and acute (e.g., public speaking) psychological stress have been associated with increased asthma exacerbations [12,13].

Several laboratory studies have been conducted to better understand the impact of psychological stress on asthma [14–16]. Physiological responses to stress (e.g., respiratory, immune, autonomic, hypothalamic-pituitary-adrenocortical [HPA], and cardiovascular) seem to vary as a function of stressor type, *i.e.*, passive vs. active stressors [17–19]. Passive psychological stressors are defined as the presentation of stimuli during which participants do not have control over and cannot use active coping efforts to resolve the stressful situation [20], *e.g.*, watching stressful movies or pictures [14,16,21–28]. Active psychological stressors are defined as stimuli that participants feel they have a certain degree of control over and can use psychological or behavioral coping efforts to deal with [29], *e.g.*, public speaking and video games [15,30–38].

Though there have been several narrative reviews [17–19,39], to our knowledge, no systematic reviews have summarized the impact of different laboratory-based acute psychological stress tasks on physiological responses in asthmatics. The purpose of this systematic review was to provide a synthesis of the physiological

responses to different acute laboratory psychological stress tasks, specifically, active and passive.

2. Methods

The present systematic review was conducted in accordance with the Preferred reporting items for systematic reviews and meta-analysis protocols (PRISMA-P) guidelines [40]. The protocol was registered in Prospero (registration number: CRD42015026431).

2.1. Literature search

A comprehensive search was performed using the following electronic bibliographic databases: PubMed, PsycINFO, PsyArticles, and The Cochrane Library (publication dates: up to the 15th of September 2016). Medical subject headings (MeSH) were used as search terms when available, or key words when appropriate, see [Supplement A](#) for details. We complemented this by reviewing the reference sections of eligible articles and review articles.

2.2. Study selection and data extraction

Two reviewers independently screened the titles and abstracts of potentially eligible articles retrieved. Study inclusion criteria were: (1) English or French language peer-reviewed articles; (2) pediatric or adult asthma populations; (3) experimental studies assessing the impact of an acute laboratory psychological stress task on physiological responses; and (4) physiological responses assessed during or post-stress and compared to baseline or pre-stress values.

In this review, an “acute psychological stressor” was defined as a stimulus that triggered immediate/short term mental or psychological stress (*i.e.*, negative emotional responses) in a controlled laboratory setting. Stress induced by physical challenges were not included (*e.g.*, exercise, pain tasks or inhalation of carbon dioxide) considering that they have been found to have a different impact on physiological responses [41,42]. Stress tasks could be active (*e.g.*, mental arithmetic tasks, Trier Social Stress Test [TSST], etc.) or

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