

# INPLASY

## Sedentary lifestyle, heart rate variability and its Influence on Spine Posture in adults: A Systematic Review Study

INPLASY202460055

doi: 10.37766/inplasy2024.6.0055

Received: 15 June 2024

Published: 15 June 2024

Fathima, D; Lobo, J; Angioi, M; Blach, W; Rydzik, L; Ambrozy, T; Malliaropoulos, N.

### Corresponding author:

Deena Fathima

deenamolkc@gmail.com

### Author Affiliation:

Queen Mary University of London.

### ADMINISTRATIVE INFORMATION

**Support** - University of Health & Sport Sciences in Wroclaw, Academy of Physical Education in Cracow, Poland.

**Review Stage at time of this submission** - Completed but not published.

**Conflicts of interest** - None declared.

**INPLASY registration number:** INPLASY202460055

**Amendments** - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 15 June 2024 and was last updated on 15 June 2024.

### INTRODUCTION

**Review question / Objective** 1. Synthesise the current known relationship between posture and heart rate variability. 2. Determine whether changes in posture will benefit heart rate variability and autonomic functions and how this might be utilized in future interventions addressing autonomic health.

**Condition being studied** Heart rate variability (HRV) defines the fluctuations in time intervals between consecutive heartbeats. A healthy heart does not beat metronomically but oscillates around a continuously changing rhythm, enabling rapid adaptation to physical and psychological changes. This delicate neurocardiac function reflects the efficacy of heart-brain interactions and autonomic nervous system (ANS) processes. Thus, HRV can be used to measure autonomic balance, blood

pressure, vascular tone, and other physiological parameters. Furthermore, these parameters can predict medical conditions' prognosis, making HRV an essential health index.

Despite HRV's inherent chaotic nature, external pathological influences can alter its variability, leading to abnormal rhythms associated with increased mortality risk. Healthy biological systems exhibit spatial and temporal complexity, whereas disease states can involve either a loss or gain in complexity. Quantifying changes in HRV and examining their relationship with external factors can provide insights into the primary influences on this cardiac marker.

Several physiological, pathological, and environmental factors influence HRV, but lifestyle factors are less well understood. A significant

lifestyle factor impacting autonomic function is posture, particularly through sedentary behavior.

#### Sedentary Behavior and Posture:

Sedentary behavior, characterized by any waking activity expending less than or equal to 1.5 Metabolic Equivalent of Tasks (METs) while in a seated, reclined, or lying position, is strongly associated with poor posture. With more occupations shifting to home-based environments that promote prolonged sitting, sedentary lifestyles have become increasingly prevalent.

Sedentary behavior is linked to posture compensation, leading to lower back pain and other bodily malfunctions. This biomechanical reconfiguration, known as mechanotransduction, explains the connection between sedentary lifestyles and regressing posture. One study examining the relationship between sitting time and low back pain in adults with full-time sedentary desk jobs found that those who worked from home had significantly higher sitting times, predicting poorer posture and reduced physical activity.

#### Impact on Health:

The cumulative effects of daily sedentary activities in developed societies, characterized by extensive use of technology and automation, are eroding individuals' capacity to maintain biomechanical integrity and body functionality. Adaptation to current occupational ergonomics and leisure lifestyles is under heavy discussion. The ideal posture for various daily activities remains inconclusive, necessitating considerations for both physical health and productivity. For those leading sedentary lifestyles, standardized guidelines are needed to prevent the repercussions of prolonged sitting, along with promoting physical activity to combat sedentary behavior's adverse effects. Therefore, the primary aim of this review is to systematically review the literature exploring the relationship between posture and heart rate variability to formulate an idea of how a sedentary lifestyle may impact autonomic health.

## METHODS

**Participant or population** Healthy Adults with a sedentary lifestyle. Participants of any race and demographics are included. Participants with conditions requiring them to remain sedentary are excluded.

**Intervention** Studies that observe the correlation between change of posture and heart rate variability.

**Comparator** Studies can be included regardless of whether a comparison or control group was used.

**Study designs to be included** English language only and Peer-reviewed published studies. All study types (case-reports, cohort studies, RCT, case-series) are included. Studies published in any year.

**Eligibility criteria** Other systematic review, studies not published in English and animal studies where excluded.

**Information sources** A search was conducted on Google Scholar and PROSPERO to identify any previous systematic reviews conducted in the specific research area. However, no relevant studies were found in these searches.

A comprehensive electronic literature search was performed independently by two researchers, DF and JL, across PubMed, Embase, Web of Science, and Cochrane on April 12th, 2023.

**Main outcome(s)** Only Studies that measure the relationship between posture and heart rate variability directly were included in the review. Only 5 papers were eligible from 664 identified papers. The studies were considered heterogeneous to one another due to the variations in interventions, aims and participant populations used. Each of the 5 studies was a prospective case series which did facilitate analysis and comparisons.

**Quality assessment / Risk of bias analysis** The methodological quality of each study included was independently assessed by both researchers of the Systematic Review (JL and DF), using Assessment Criteria for Evaluating Primary Research Papers from a Variety of Fields (QualSyst) which was recommended by The Cochrane Handbook. The QualSyst tool employs 14 criteria to assess quantitative studies. For each criterion, if a study fully and adequately addresses the question, it receives 2 marks. If the question is partially addressed, 1 mark is assigned, and if the question is not addressed, 0 marks are given. Any question that does not apply to a particular study is scored as 'N/A' and is excluded from the calculation. The scores for each study are summed up to obtain a 'Total score'. The results for each study are calculated using the predetermined formula " $\text{Total} / (28 - (\text{Number of 'N/A'} \times 2))$ ". Each study is assigned a numerical value between 0 and 1 (rounded to two decimal places), with 0 indicating the highest risk of bias and 1 indicating the lowest risk.

---

**Strategy of data synthesis** Two reviewers (DF and JL) worked independently and used a standardized form to extract methodological, demographic and outcome data. Data extracted included participant characteristics (age range, gender, number of participants), the location of studies, study aim and methods. Disagreements were resolved by discussing with each other.

**Subgroup analysis** In this systematic review, the five included studies share similarities in design and outcome measures. However, notable differences in variables prevent a concise analysis. One study focused on older adults (60+ years), while three others included participants under 35. Additionally, three studies excluded female participants, while two included both genders. Consequently, no further analyses were conducted.

**Sensitivity analysis** Each of the analyzed studies had specific limitations that were acknowledged and taken into account. There was an imbalance in sample size in terms of sex in one study while the other had a limited sample size making it difficult to generate results. Another limitation was the timing of intervention which varied in each study. Only 5 studies were included limiting the reliability of the synthesised results. The studies showed both heterogeneity and homogeneity in various aspects making it challenging to draw definitive conclusions. Also, one of the papers analyzed did not primarily focus on measuring HRV concerning posture changes but used it as a measurement tool when comparing differences within their study population. This made direct comparisons between the results of the paper difficult.

**Country(ies) involved** This study was conducted at Queen Mary University of London.

**Keywords** Heart rate variability, Posture, Sedentary behaviour, Autonomic function, Sitting position.

#### **Contributions of each author**

Author 1 - Deena Fathima - Main author and drafted the manuscript.

Email: deenamolkc@gmail.com

Author 2 - Joss Lobo - The author participated throughout the review in search strategy, data collection, processing and extraction.

Email: j.p.lobo@smd19.qmul.ac.uk

Author 3 - Manuela Angioi - Overall guidance and support.

Email: m.angioi@qmul.ac.uk

Author 4 - Wieslaw Blach - Funding for publishing.

Author 5 - Lukasz Rydzik - Funding and processing of review for publishing.

Author 6 - Tadeusz Ambrozy - Funding for publishing.

Author 7 - Nikos Malliaropoulos - Correspondence author.