BMJ Open

Association between sedentary behaviour and chronic pelvic pain in women: a protocol for systematic review and meta-analysis

Lei Tang ,[1] Yangyan Guo,[1] Guohua Wang[2]

To cite: Tang L, Guo Y, Wang G. Association between sedentary behaviour and chronic pelvic pain in women: a protocol for systematic review and meta-analysis. *BMJ Open* 2025;**15**:e091992. doi:10.1136/bmjopen-2024-091992

► Prepublication history and additional supplemental material for this paper are available online. To view these files, please visit the journal online (https://doi.org/10.1136/bmjopen-2024-091992).

Received 03 August 2024
Accepted 12 April 2025

[1]Beijing University of Chinese Medicine, Beijing, China
[2]Beijing University of Chinese Medicine Third Affiliated Hospital, Beijing, Beijing, China

Correspondence to
Professor Guohua Wang;
wgh1188@163.com

ABSTRACT

Introduction In light of the rising prevalence of sedentary behaviour worldwide, its impact on health has become a subject of growing interest. To clarify whether there is a significant correlation between sedentary behaviour and chronic pelvic pain in women and to explore its potential clinical implications, this study aims to provide a systematic review and meta-analysis of the association between the two. The findings of this study will inform the development of effective prevention and intervention strategies.

Methods and analysis This study will conduct an exhaustive search across electronic databases, encompassing PubMed, Embase, Web of Science, the Cochrane Central Register of Controlled Trials and Scopus, for records published up until 26 June 2024. Two independent researchers will conduct the study selection, data extraction and assessment of bias risks, with any discrepancies resolved through the collaboration of a third reviewer. To accurately discern the underlying sources of heterogeneity, sensitivity, subgroup analyses and meta-regression will be conducted in parallel. Additionally, to ensure the rigour and integrity of our research, Begg's and Egger's tests will serve as the primary means of evaluating the potential for publication bias within the studies under consideration.

Ethics and dissemination Ethical approval will not be required for this study, as it will use publicly accessible, non-identifiable data from the published literature. The research team will ensure data privacy and participant confidentiality through anonymised data processing and strict compliance with relevant regulations. The results of this study will be disseminated through publication in a peer-reviewed journal.

Prospero registration number CRD42024562443.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ This study will adhere to stringent inclusion criteria and follow the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines to ensure the quality and relevance of the included studies.
⇒ The variability in the design, definition and measurement of sedentary behaviour across included studies may introduce heterogeneity, affecting the synthesis of results.
⇒ The reliance on published data may lead to publication bias, potentially limiting the generalisability of our findings.

INTRODUCTION

As the pace of modern society's life accelerates and work patterns evolve, sedentary behaviour has emerged as a prevalent phenomenon. Recent studies highlight a marked increase in the prevalence rates of sedentary behaviour, with data from the US population showing a significant rise over the past decade.[1] The average daily sedentary time has reached 8.2 hours per day. This trend is not limited to the US. Similar increases have been observed globally, underscoring the widespread nature of this issue.[2 3] Defined as any waking activity performed in a seated or reclined position with an energy expenditure ≤1.5 metabolic equivalents,[4] sedentary behaviour is widely recognised as a potential risk factor for various chronic health issues.[5] These encompass, but are not limited to, musculoskeletal disorders, cardiovascular diseases and metabolic disorders,[6–9] underscoring its profound implications.

Specifically, the potential link between sedentary behaviour and chronic pelvic pain (CPP) among women has garnered increasing scientific attention.[10–13] CPP, a complex and elusive condition, is characterised by non-cyclic pelvic pain lasting for more than 6 months, often unresponsive to non-opioid treatments and significantly impacting patients' daily functioning and quality of life.[14] The complexity and elusiveness of CPP stem from the intricate interplay of multiple systems within the female pelvis, including the reproductive organs, urinary system, gastrointestinal tract and musculoskeletal structures.[15–18] Dysfunction in any of these systems can contribute to CPP. Given the multifaceted nature of CPP, delving into

the role of sedentary behaviour becomes paramount, as it may exacerbate or trigger symptoms through mechanisms such as impaired circulation and increased muscle tension in the pelvic region.

Although research on CPP is accumulating, the evidence base is marked by heterogeneity in study designs, definitions and methodologies, leading to inconsistent findings across studies.[10 19 20] This variability complicates the drawing of definitive conclusions regarding the link between sedentary behaviour and CPP. Therefore, a systematic review and meta-analysis are essential to synthesise the current evidence, assess the overall effect size and pinpoint areas for future investigation.

A systematic review and meta-analysis that will consolidate the fragmented evidence on sedentary behaviour and CPP are urgently needed, which will clarify the nature and extent of their association. This synthesis will integrate evidence from various studies, strengthen statistical power and identify potential confounding factors, enabling a more nuanced understanding of this relationship. It will guide clinical sedentary behaviour interventions for CPP patients and inform public health policy. Furthermore, by examining subpopulation differences in this association, our study aims to uncover influencing factors, address gaps in existing research and set a course for future investigative efforts, thereby fostering the field's comprehensive development.

METHOD

The research protocol has been formally registered in the International Prospective Register of Systematic Reviews, with the registration number CRD42024562443. It will follow the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) Protocols guidelines for reporting standards.[21] Guided by the rigorous recommendations in the Cochrane Handbook for Systematic Reviews of Interventions,[22] our systematic review and meta-analysis will ensure clarity and thoroughness at every step.

Search

A meticulous search will be undertaken across multiple electronic databases, specifically PubMed, Embase, Web of Science, the Cochrane Central Register of Controlled Trials and Scopus, to retrieve records published up until 26 June 2024. The search terms will include variations related to sedentary behaviour, such as 'sedentary behavior', 'sitting for long hours', 'lack of physical activity' and 'prolonged sitting', combined with terms associated with CPP, including 'chronic pelvic pain' and 'pelvic pain'. These terms will be combined using the Boolean operators AND and OR to optimise the search strategy. The detailed search strategy for each database is described in the (online supplemental table S1). In addition, following the automated search, a streamlined filtering process will be implemented to expedite the selection of articles, prioritising human-centric studies with full-text availability, thereby facilitating a focused and efficient review process.

Inclusion criteria

The inclusion criteria for this systematic review and meta-analysis will carefully select studies that explore the relationship between sedentary behaviour and CPP, considering those that meet the following criteria:

Participants

Participants will encompass adult, adolescent and child females with CPP. To address potential heterogeneity, we will conduct sensitivity analyses to separately assess the impact of including children. If necessary, studies involving children will be excluded from the primary analysis to ensure homogeneity.

The diagnosis of CPP must adhere to internationally recognised clinical guidelines or consensus statements, including but not limited to those published by the American College of Obstetricians and Gynecologists, the European Association of Urology and the Royal College of Obstetricians and Gynaecologists.

Exposure

The exposure will be sedentary behaviour, defined as any waking activity performed in a seated or reclined position for single bouts exceeding 30 min, recognising the need for further research to refine these thresholds.[23–25] This definition will be applied objectively through measures such as pedometers, accelerometers or culturally validated self-report questionnaires, acknowledging the variability in thresholds used across studies.

Comparator

The comparator group will consist of female individuals or groups with non-sedentary behaviours.

Study designs

Published analytical observational studies (including cross-sectional, case-control or longitudinal designs).

Outcomes

The primary aim of this study is to systematically assess the relationship between sedentary behaviour and the onset or recurrence of CPP in women.

Exclusion criteria

From the perspectives of imposing restrictions on participants' health status, specifying requirements for research design and content and clearly defining research objectives, researchers will adhere to the following exclusion criteria:

1. Participants with lower limb paralysis, motor disorders, severe arthritis or joint diseases and severe cardiovascular diseases will be excluded.
2. Studies lacking a clear definition of sedentary behaviour, an explanation of its link to CPP or a quantitative assessment of their association will be excluded from our analysis.

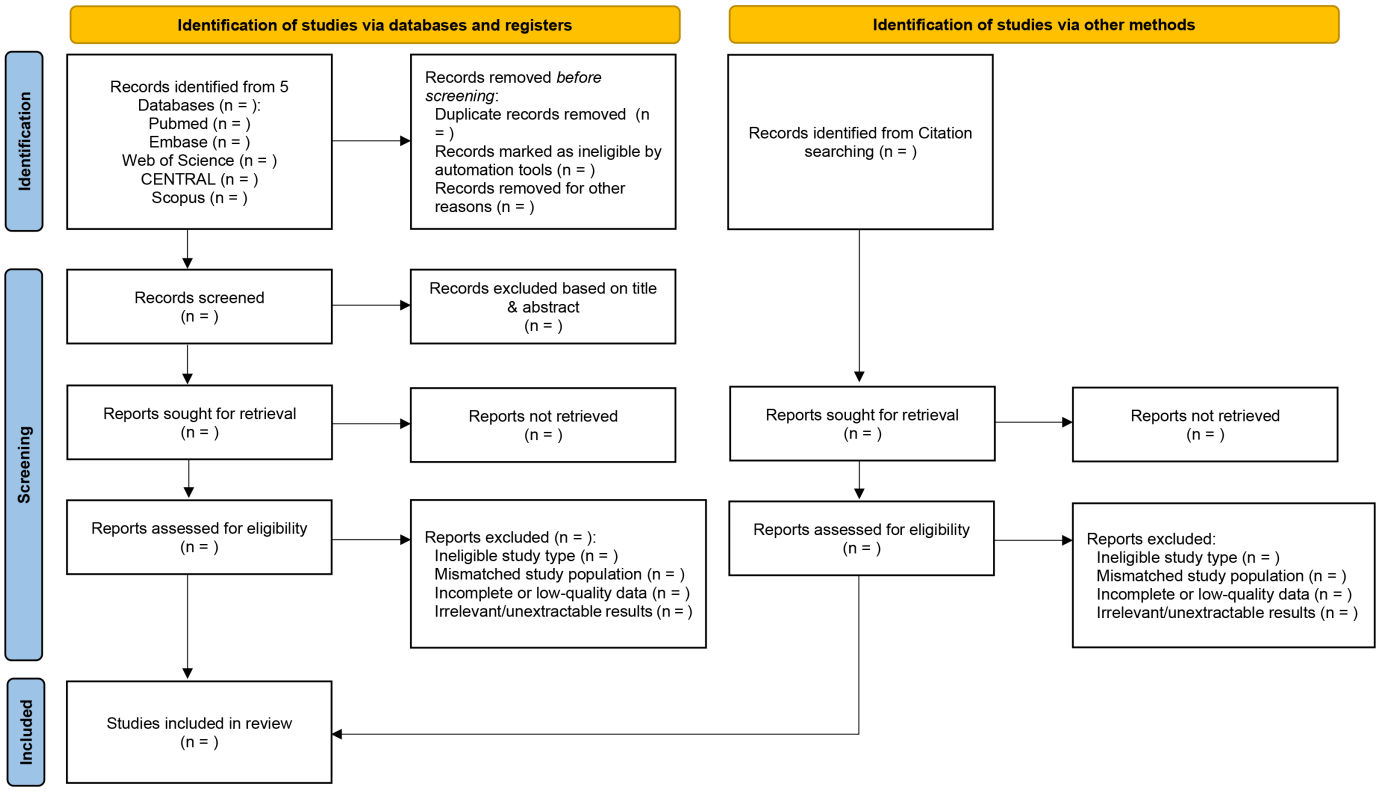

Figure 1 Preferred Reporting Items for Systematic Reviews and Meta-Analyses 2020 flow diagram.

3. Non-research articles, such as editorials, letters to the editor, commentaries or conference abstracts without full text.
4. Duplicate publications or studies that have been superseded by later publications reporting on the same population and outcomes.

Study selection

The study selection process will proceed in two distinct stages, with each stage being evaluated by two independent assessors. Initially, titles and abstracts undergo scrutiny, with eligible studies progressing to a full-text review for confirmation. In the event of any discrepancies or uncertainties arising during the evaluation process, a neutral third-party reviewer will be involved to make the final decision regarding inclusion, who will be blinded to the initial decisions to avoid bias. Throughout, Zotero software will streamline reference management and eliminate duplicates. This review process maintains a strict separation between reviewers, fostering transparency and impartiality in decision-making. The selection process will be recorded in a PRISMA flowchart (figure 1).

Data extraction

Two independent researchers will extract data using standardised spreadsheets, following predefined guidelines to ensure consistency and minimise biases. In cases of insufficient or missing data, we will contact the authors for supplementary information. If no response is received within a reasonable timeframe, we will use sensitivity analyses or impute missing data to maintain robustness. To further reduce variability, we will uniformly define critical variables such as smoking status (categorised as current, former or never smoker) and daily coffee consumption (quantified as cups per day). Inter-rater reliability will be assessed using Cohen's kappa for a subset of studies to ensure consistency and reliability. Discrepancies will be resolved through negotiation or, if necessary, involving a third-party reviewer.

Extracted data will include study details (title, author, publication year, design), subject characteristics (sample size, occupational background, health status, smoking habits, coffee consumption, body mass index), sedentary behaviour metrics (time, screen time, measurement methods, activity types), CPP occurrence/reoccurrence and exposure-outcome associations (correlation coefficients, regression coefficients, risk ratios), as detailed in Supplemental Material (online supplemental table S2).

Risk of bias assessment

To ensure the rigour and transparency of our study, we will use the Newcastle-Ottawa Scale (NOS) to assess the risk of bias in included studies. The NOS evaluates studies based on three main aspects: selection, comparability and outcome. For case-control and cohort studies, we will focus on selection criteria, group comparability and the rigour of methodology. For cross-sectional studies, the modified NOS will identify biases related to sample representativeness, measurement errors and confounding factor control.[26]

Studies will be categorised as having high, moderate or low risk of bias using the NOS. Specifically, studies scoring <4 points will be classified as high risk, those scoring 4–6 points as moderate risk and studies achieving ≥7 points as low risk. To ensure methodological rigour, discrepancies in risk assessments will be resolved through iterative consensus discussions between reviewers or, when necessary, by consultation with a third-party adjudicator with expertise in systematic review methodologies.

Data synthesis and statistical analysis

Our research team will perform a meticulous statistical analysis, leveraging comprehensive evidence. We will begin by synthesising the characteristics of the included studies through descriptive summaries and organised tables. To measure heterogeneity, we will use the inconsistency index (I^2). The effect size will be presented as the OR with a 95% CI, and forest plots will graphically display the outcomes. We will select a random-effects model for I^2 values above 50% and a fixed-effects model for I^2 values at or below 50%, with statistical significance determined by a p value threshold of less than 0.05. In cases where quantitative synthesis is infeasible due to high heterogeneity (I^2 >75%) or limited data, we will pivot to a qualitative synthesis and narrative summary. This method will allow us to delve into the relationship between sedentary behaviour and CPP, identifying patterns, evaluating current evidence and suggesting avenues for future research.

Publication bias

When the final count of included studies surpasses 10, we will rigorously assess and detect potential publication bias using funnel plots, Begg's rank correlation test and Egger's linear regression test. In the event of significant publication bias ($p<0.05$), we plan to conduct a sensitivity analysis to evaluate the robustness of our results. This will involve excluding studies that may drive the bias and reassessing the overall effect. We will also explore the characteristics of these studies to understand the reasons behind the bias, such as smaller sample sizes or lower methodological quality. Additionally, we may perform a trim-and-fill analysis, a method that adjusts for potential publication bias by estimating and adding missing studies to the funnel plot to achieve symmetry, thereby providing a more accurate effect size estimate.

Additional analysis

If sufficient studies are available, we plan to conduct subgroup analyses and metaregression to explore the sources of heterogeneity. Subgroup analyses will evaluate the impact of categorical variables including sedentary time, body mass index, participant age, smoking habits, coffee consumption and physical activity levels, as well as methodological factors like study design and risk of bias scores. For continuous variables such as sedentary time, we will use predefined cut-offs (eg, <4 hours/day, 4–8 hours/day, >8 hours/day) to stratify the data. Metaregression will focus on the influence of continuous covariates such as study quality and participant health status on the relationship between sedentary behaviour and CPP.

To ensure robustness, we will perform sensitivity analyses by sequentially omitting studies to identify outliers or influential studies. We will also report heterogeneity using the I^2 statistic, which quantifies the percentage of variation across studies due to heterogeneity rather than chance. A higher I^2 value indicates greater heterogeneity, and we will interpret this to assess the consistency of our results.

Summary of evidence

The GRADE (Grading of Recommendations Assessment, Development and Evaluation) methodology will be employed to systematically evaluate and summarise the quality of evidence. Using GRADEpro software or the online GRADEpro Guideline Development Tool (http://www.GRADEpro.org), we will generate a comprehensive 'Evidence Profile' that presents the quality assessment outcomes for individual studies and the overall evidence chain. Two independent researchers will assess the evidence quality, considering factors such as bias risk, imprecision of findings, inconsistency among studies, indirectness of evidence and potential publication bias. Any discrepancies in assessments will be resolved through group discussions. If consensus cannot be reached through discussion, third-party arbitration will be invoked. The third assessor will be selected based on their expertise in the relevant field and will provide an independent assessment to ensure the accuracy and reliability of the evidence evaluation. The final publication of our systematic review and meta-analysis will include detailed GRADE tables to transparently present the evidence quality and support the conclusions drawn from our study.

Patient and public involvement

Given the absence of a completed systematic review and meta-analysis on this topic, we will conduct a comprehensive analysis strictly based on published research outcomes. Our direct data sources will be limited to the publicly available literature and reliable sources explicitly mentioned above. Consequently, there will be no direct involvement of patients and the public at any stage of this analysis.

Current study status

Piloting of the study selection process.

DISCUSSION

The escalating prevalence of sedentary behaviour in contemporary society underscores its potentially profound health consequences, particularly in the context of chronic diseases.[27–30] Among these, CPP, a complex and understudied gynecological condition, stands out as an area where the role of sedentary behaviour remains largely unexplored. The female pelvic

region is anatomically complex, characterised by dense vascular networks, intricate neuromuscular structures and dynamic interactions between pelvic organs. Sedentary behaviour may lead to impaired blood flow, sustained muscle tension and the activation of inflammatory mechanisms by compressing pelvic structures,[12 31 32] which in turn can contribute to the development of CPP.

Current research, while acknowledging the general benefits of exercise in mitigating various health conditions, has begun to highlight the specific association between sedentary behaviour and CPP-related symptoms.[33–35] However, a direct and comprehensive exploration of the correlation between sedentary behaviour and CPP is still lacking, despite its potential significance for understanding and managing this debilitating condition.

The complex female pelvic environment makes CPP likely associated with various factors, leading to varied outcomes. To address potential confounders like age, body mass index and occupation, we will use statistical methods to assess and adjust their influence on the relationship between sedentary behaviour and CPP. Subgroup analyses, meta-regression and sensitivity analyses will evaluate these factors' effects on effect sizes, heterogeneity and the robustness of our findings. In interpreting these results, we will consider not only statistical significance but also practical significance in a clinical context, ensuring that our findings are meaningful.

By employing these rigorous methodological approaches, our systematic review and meta-analysis examined the relationship between sedentary behaviour and CPP. By addressing potential biases and ensuring independent evaluations, we strive to clarify the nature of this relationship. If our findings confirm a significant association, they will have importance to bridge the current gap in knowledge regarding the correlation implications for public health strategies, clinical interventions and ultimately, the promotion of healthy behaviours among women. Such insights have the potential to alleviate CPP symptoms, enhance women's quality of life and contribute meaningfully to the advancement of women's health research and practice.

ETHICS AND DISSEMINATION

This study will use publicly accessible, non-identifiable data from the published literature for a systematic review and meta-analysis, thereby eliminating the need for ethical approval. To ensure data privacy and participant confidentiality, we will anonymise all data and comply with relevant data protection regulations. The results of this study will be disseminated through publication in a peer-reviewed journal.

Acknowledgements The authors are grateful to express their sincere gratitude to the Beijing University of Chinese Medicine, who have provided invaluable support throughout the development of this research protocol.

Contributors LT and YG contributed equally to the conception and design of the study, the acquisition of data and the drafting of the manuscript. GW provided critical revisions to the manuscript and supervised the overall research process. All authors have read and approved the final manuscript. GW is the guarantor of this work and, as such, had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

Funding This work was supported by Beijing University of Chinese Medicine Third Affiliated Hospital, grant number: BZYSY-2022-PYMS-13.

Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, conduct, reporting or dissemination plans of this research.

Patient consent for publication Not applicable.

Provenance and peer review Not commissioned; externally peer reviewed.

ORCID iD

Lei Tang http://orcid.org/0000-0002-9270-7868

REFERENCES

1 Yang L, Cao C, Kantor ED, *et al*. Trends in Sedentary Behavior Among the US Population, 2001-2016. *JAMA* 2019;321:1587–97.
2 Ng SW, Popkin BM. Time use and physical activity: a shift away from movement across the globe. *Obes Rev* 2012;13:659–80.
3 Prince SA, Melvin A, Roberts KC, *et al*. Sedentary behaviour surveillance in Canada: trends, challenges and lessons learned. *Int J Behav Nutr Phys Act* 2020;17:34.
4 Sackner MA, Lopez JR, Banderas V, *et al*. Can Physical Activity While Sedentary Produce Health Benefits? A Single-Arm Randomized Trial. *Sports Med - Open* 2020;6:47.
5 Stamatakis E, Ekelund U, Ding D, *et al*. Is the time right for quantitative public health guidelines on sitting? A narrative review of sedentary behaviour research paradigms and findings. *Br J Sports Med* 2019;53:377–82.
6 Gao W, Sanna M, Chen Y-H, *et al*. Occupational Sitting Time, Leisure Physical Activity, and All-Cause and Cardiovascular Disease Mortality. *JAMA Netw Open* 2024;7:e2350680.
7 Pulsford RM, Stamatakis E, Britton AR, *et al*. Associations of sitting behaviours with all-cause mortality over a 16-year follow-up: the Whitehall II study. *Int J Epidemiol* 2015;44:1909–16.
8 Wilmot EG, Edwardson CL, Achana FA, *et al*. Sedentary time in adults and the association with diabetes, cardiovascular disease and death: systematic review and meta-analysis. *Diabetologia* 2012;55:2895–905.
9 Dzakpasu FQS, Carver A, Brakenridge CJ, *et al*. Musculoskeletal pain and sedentary behaviour in occupational and non-occupational settings: a systematic review with meta-analysis. *Int J Behav Nutr Phys Act* 2021;18:159.
10 Lamvu G, Carrillo J, Ouyang C, *et al*. Chronic Pelvic Pain in Women: A Review. *JAMA* 2021;325:2381–91.
11 Lamvu G, Carrillo J, Witzeman K, *et al*. Musculoskeletal Considerations in Female Patients with Chronic Pelvic Pain. *Semin Reprod Med* 2018;36:107–15.
12 Gyang A, Hartman M, Lamvu G. Musculoskeletal causes of chronic pelvic pain: what a gynecologist should know. *Obstet Gynecol* 2013;121:645–50.
13 Haanpää M, Attal N, Backonja M, *et al*. NeuPSIG guidelines on neuropathic pain assessment. *Pain* 2011;152:14–27.
14 Chronic Pelvic Pain. *Obstetrics & Gynecology* 2020;135:e98–109.
15 Tirlapur SA, Kuhrt K, Chaliha C, *et al*. The 'evil twin syndrome' in chronic pelvic pain: A systematic review of prevalence studies of bladder pain syndrome and endometriosis. *Int J Surg* 2013;11:233–7.

16 Sutcliffe S, Jemielita T, Lai HH, *et al*. A Case-Crossover Study of Urological Chronic Pelvic Pain Syndrome Flare Triggers in the MAPP Research Network. *J Urol* 2018;199:1245–51.
17 Gao X, Tian S, Huang N, *et al*. Associations of daily sedentary behavior, physical activity, and sleep with irritable bowel syndrome: A prospective analysis of 362,193 participants. *J Sport Health Sci* 2024;13:72–80.
18 Gavilán-Carrera B, Delgado-Fernández M, Álvarez-Gallardo IC, *et al*. Longitudinal association of sedentary time and physical activity with pain and quality of life in fibromyalgia. *Scand J Med Sci Sports* 2023;33:292–306.
19 Siqueira-Campos VM, de Deus MSC, Poli-Neto OB, *et al*. Current Challenges in the Management of Chronic Pelvic Pain in Women: From Bench to Bedside. *Int J Womens Health* 2022;14:225–44.
20 Fuentes-Márquez P, Cabrera-Martos I, Valenza MC. Physiotherapy interventions for patients with chronic pelvic pain: A systematic review of the literature. *Physiother Theory Pract* 2019;35:1131–8.
21 Moher D, Shamseer L, Clarke M, *et al*. Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015 statement. *Syst Rev* 2015;4:1.
22 Higgins J, Thomas J. *Cochrane handbook for systematic reviews of interventions*.Available: https://training.cochrane.org/handbook/current [accessed 22 Aug 2023].
23 Wu J, Fu Y, Chen D, *et al*. Sedentary behavior patterns and the risk of non-communicable diseases and all-cause mortality: A systematic review and meta-analysis. *Int J Nurs Stud* 2023;146:104563.
24 Tremblay MS, Aubert S, Barnes JD, *et al*. Sedentary Behavior Research Network (SBRN) - Terminology Consensus Project process and outcome. *Int J Behav Nutr Phys Act* 2017;14:75.
25 Kerrigan SG, Call C, Schaumberg K, *et al*. Associations between change in sedentary behavior and outcome in standard behavioral weight loss treatment. *Transl Behav Med* 2018;8:299–304.
26 Herzog R, Álvarez-Pasquin MJ, Díaz C, *et al*. Are healthcare workers' intentions to vaccinate related to their knowledge, beliefs and attitudes? a systematic review. *BMC Public Health* 2013;13:154.
27 Friedenreich CM, Ryder-Burbidge C, McNeil J. Physical activity, obesity and sedentary behavior in cancer etiology: epidemiologic evidence and biologic mechanisms. *Mol Oncol* 2021;15:790–800.
28 Lavie CJ, Ozemek C, Carbone S, *et al*. Sedentary Behavior, Exercise, and Cardiovascular Health. *Circ Res* 2019;124:799–815.
29 Kerr NR, Booth FW. Contributions of physical inactivity and sedentary behavior to metabolic and endocrine diseases. *Trends Endocrinol Metab* 2022;33:817–27.
30 Dohrn I-M, Welmer A-K, Hagströmer M. Accelerometry-assessed physical activity and sedentary time and associations with chronic disease and hospital visits - a prospective cohort study with 15 years follow-up. *Int J Behav Nutr Phys Act* 2019;16:125.
31 Kashef E, Evans E, Patel N, *et al*. Pelvic venous congestion syndrome: female venous congestive syndromes and endovascular treatment options. *CVIR Endovasc* 2023;6:25.
32 Wang H, Zhou Z, Liu X, *et al*. Anti-inflammatory diets might mitigate the association between sedentary behaviors and the risk of all-cause deaths. *Nutr Metab (Lond)* 2025;22:11.
33 Tellum T-O, Jurkovic D-O. Understanding and addressing female pelvic pain - a multifaceted challenge. *Acta Obstet Gynecol Scand* 2023;102:1248–9.
34 Moreno-Ligero M, Moral-Munoz JA, Salazar A, *et al*. mHealth Intervention for Improving Pain, Quality of Life, and Functional Disability in Patients With Chronic Pain: Systematic Review. *JMIR Mhealth Uhealth* 2023;11:e40844.
35 Aota E, Kitagaki K, Tanaka K, *et al*. The Impact of Sedentary Behavior After Childbirth on Postpartum Lumbopelvic Pain Prolongation: A Follow-Up Cohort Study. *J Womens Health (Larchmt)* 2021;30:1804–11.