INPLASY

Exercise Snack Modality and Postprandial Glycaemic Control in Overweight and Obese Adults: A Protocol for a Systematic Review, Network Meta-Analysis, and Dose Response Meta-Analysis

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ADMINISTRATIVE INFORMATION

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Review Stage at time of this submission - The review has not yet started.

Conflicts of interest - None declared.

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Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 10 May 2026 and was last updated on 10 May 2026.

INTRODUCTION

Review question / Objective This review asks: which exercise snack modality produces the greatest acute reduction in postprandial glucose incremental area under the curve in overweight and obese non-diabetic adults, and is there a minimum effective snack duration below which the glycaemic benefit is no longer clinically meaningful?
The objective is to generate a Bayesian network meta-analysis ranking of aerobic, resistance, and combined exercise snack modalities against uninterrupted sitting, and to quantify the dose response relationship between snack duration and postprandial glycaemic response.

Rationale Postprandial hyperglycaemia is well established as an independent cardiovascular risk factor and an early physiological marker of insulin resistance, particularly in individuals with overweight or obesity. The interruption of prolonged sitting with brief, structured exercise bouts has attracted growing research interest as a low-cost, accessible strategy for attenuating postprandial glucose excursions. However, the published literature does not yet provide a clear answer to the comparative effectiveness question: whether aerobic, resistance, or combined snack modalities offer the greatest glycaemic benefit, and whether this benefit is preserved at shorter durations such as two or five minutes.
Existing reviews have addressed aspects of this question but have done so through pairwise comparisons that cannot simultaneously rank multiple modalities, have pooled sedentary and diabetic populations in ways that obscure metabolic differences, and have reported outcomes on heterogeneous scales that are not directly c.

Condition being studied The review concerns postprandial glycaemic dysregulation in adults with overweight (BMI 25 to 29.9 kg per m squared) or

obesity (BMI 30 kg per m squared or above) who have not been diagnosed with type 2 diabetes, prediabetes, or any other metabolic condition requiring pharmacological glycaemic management. Postprandial glucose excursions, measured as incremental area under the glucose curve following a standardised meal or oral glucose challenge, represent the primary physiological target. This population sits at the intersection of modifiable metabolic risk and documented sedentary behaviour, making it an appropriate and clinically important target for exercise snack research.

METHODS

Search strategy Searches will be run in PubMed/MEDLINE, SCOPUS, Web of Science Core Collection, SPORTDiscus via EBSCOhost, and CENTRAL. Search strings will be adapted for each database using controlled vocabulary (MeSH for PubMed; Emtree for SCOPUS) combined with free-text terms and Boolean operators. The example below is written for PubMed.
("exercise snack*" OR "activity break*" OR "exercise break*" OR "brief exercise bout*" OR "interrupted sitting" OR "movement break*") AND ("postprandial glucose" OR "glycaemic response" OR "blood glucose" OR "incremental area under the curve" OR "iAUC" OR "postprandial glycaemia") AND ("overweight" OR "obese" OR "obesity" OR "adipos*" OR "body mass index") AND ("randomized controlled trial" OR "crossover trial" OR "RCT" OR "randomised")
No date restrictions will be applied. The search will be limited to English language publications. Supplementary searching will include Google Scholar (first 200 results sorted by relevance, searched without publication type restriction; search terms and.

Participant or population Eligible participants are adults aged 18 years or older with a BMI of 25 kg per m squared or above, without a clinical diagnosis of type 2 diabetes, prediabetes, impaired fasting glucose, or any metabolic condition managed pharmacologically at baseline. Studies that enrol exclusively normal-weight participants will be excluded. Where a study includes a mixed population of overweight and normal-weight participants, it will be included only if outcomes for the overweight or obese subgroup are reported separately and can be extracted independently. No exclusions will be applied on the basis of sex, ethnicity, menopausal status, or self-reported physical activity level.

Intervention The intervention of interest is an exercise snack, defined as a discrete, structured bout of physical activity lasting 10 minutes or less, performed as an interruption to a period of prolonged sitting of at least 30 minutes within a postprandial measurement session. Three modalities will serve as nodes in the network.
Aerobic snacks: walking at a brisk pace; stepping in place; stationary cycling; or any equivalent activity of light to moderate aerobic intensity.
Resistance snacks: bodyweight squats; chair-based lower limb exercises; calf raises; or resistance band protocols targeting the lower body.
Combined snacks: protocols that incorporate both aerobic and resistance components within a single bout of 10 minutes or less.

Comparator The reference node for all network comparisons is uninterrupted sitting maintained for the full duration of the postprandial assessment period, typically two to three hours, with no prescribed movement. Studies that use a light walking comparator rather than passive sitting will be included only where a passive sitting arm is also present, or where the study can contribute indirect evidence to the network.

Study designs to be included Acute crossover randomised controlled trials in which each participant completes all experimental conditions across separate sessions are the primary design of interest. Parallel group randomised controlled trials that include both an exercise snack arm and an uninterrupted sitting control arm will also be eligible. Studies must include a standardised postprandial assessment protocol with glucose measured at multiple time points sufficient to calculate incremental area under the curve. Non-randomised designs, observational studies, and studies without a sitting control will be excluded.

Eligibility criteria Inclusion criteria are as follows.
Adults aged 18 years or older with BMI of 25 kg per m squared or above at enrolment.
No diagnosis of type 2 diabetes, prediabetes, or metabolic condition requiring glucose-lowering medication.
Exercise snack duration of 10 minutes or less per bout.
At least one eligible snack modality arm and one uninterrupted sitting control arm.
Glucose incremental area under the curve or convertible area under the curve reported following a standardised meal or oral glucose tolerance test.
Crossover or parallel group randomised controlled trial.
Full text available in English.
Exclusion criteria are as follows.

BMI below 25 kg per m squared throughout (normal weight only sample).
Participants with type 2 diabetes, prediabetes, or on glucose-lowering agents.
Exercise bouts exceeding 10 minutes per snack.
No passive sitting control condition present.
Outcome expressed only as fasting glucose, HbA1c, or a non-standardised composite index.
Conference abstracts, letters, editorials, and narrative reviews.

Information sources The five electronic databases to be searched are PubMed/MEDLINE, SCOPUS, Web of Science Core Collection, SPORTDiscus via EBSCOhost, and CENTRAL. These will be supplemented by Google Scholar (first 200 results by relevance) and ClinicalTrials.gov, and systematic hand-searching of reference lists. Embase is not searched directly; CENTRAL systematically indexes RCTs from Embase and Scopus provides substantial bibliographic overlap for clinical trial literature. This will be acknowledged as a residual limitation in the final manuscript.

Main outcome(s) The primary outcome is postprandial glucose incremental area under the curve, expressed in mmol per litre per minute, measured over a two-hour postprandial window following a standardised meal challenge or 75 g oral glucose tolerance test. The standardised mean difference will be used as the effect measure because glucose incremental area under the curve values differ across studies as a function of meal composition, glucose analyser calibration, and postprandial window duration; rescaling to within-study standard deviation units is necessary for valid cross-study synthesis.
Outcome directionality: postprandial glucose iAUC values will be coded so that a positive standardised mean difference consistently indicates a reduction in postprandial glucose (i.e., benefit). For all outcomes where lower values indicate better glycaemic control, values will be multiplied by −1 prior to pooling. This transformation will be documented in the methods section of the final manuscript.
Minimum clinically important difference.

Additional outcome(s) Postprandial insulin incremental area under the curve (pmol per litre per minute); standardised mean difference.
Peak postprandial glucose concentration (mmol per litre); standardised mean difference.
Glucose time in range (percent of assessment period) for studies using continuous glucose monitoring; standardised mean difference.

Data management All references retrieved from database searches will be imported into EppiReviewer, where automated duplicate detection will flag probable duplicates based on title, author, and year similarity. All flagged probable duplicates will be reviewed and confirmed by human review before any record is removed. Near-duplicate entries (the same dataset reported in multiple publications) will be documented with a rationale for deduplication decisions. The total deduplicated record count will serve as the starting figure for the PRISMA 2020 flow diagram. Title and abstract screening will be conducted independently by two reviewers within EppiReviewer. Records passing this stage will proceed to full text assessment, also conducted independently by two reviewers in EppiReviewer. Disagreements at either stage will be resolved by discussion; unresolved disagreements will be referred to a third reviewer. A PRISMA 2020 flow diagram will document the complete selection process.
Data extraction will be performed using a standard.

Quality assessment / Risk of bias analysis Each included study will be assessed for risk of bias using the Cochrane Risk of Bias tool version 2. For crossover trials, the crossover extension of RoB 2 will be applied, with specific attention to carryover effects and adequacy of washout periods. Two reviewers will conduct assessments independently, with disagreements resolved by consensus. The overall certainty of evidence for each network comparison will be rated using the GRADE approach for network meta-analysis, implemented in GRADEpro GDT. GRADE domains assessed will include within-study bias, transitivity, inconsistency, imprecision, indirectness, and publication bias. Summary of findings tables will be prepared in GRADEpro GDT.
Transitivity assessment: prior to analysis, the distribution of key effect modifiers across treatment comparisons will be tabulated and evaluated. Effect modifiers to be assessed include participant training status, sex composition, mean age, exercise intensity, supervision level, health status, outcome measurement instrume.

Strategy of data synthesis A Bayesian random effects network meta-analysis will be conducted using the gemtc package in R with Markov chain Monte Carlo estimation (four chains; 50,000 iterations; 20,000 burn-in; thinning interval of 10). Convergence will be assessed using the Gelman-Rubin statistic (target R-hat < 1.05 for all parameters) and trace plot inspection. Effective sample size will be reported for key parameters. The standardised mean difference with 95%

credible intervals will be the primary effect measure. In the Bayesian framework, the between-study heterogeneity parameter τ will be estimated from its posterior distribution and reported with 95% credible intervals. Prior distributions will be specified as Normal(0, 2.5^2) for treatment effects and half-normal or Uniform(0, 2) for τ, with prior sensitivity analysis conducted under at least two alternative τ priors. Prediction intervals will be calculated for primary outcome comparisons. Network geometry will be visualised using network plots. Posterior rank probabilities and.

Subgroup analysis Sex (male versus female)
BMI category (overweight 25 to 29.9 kg per m squared versus obese 30 kg per m squared or above)
Age (18 to 40 years versus above 40 years)
Snack timing relative to meal (pre-meal versus post-meal commencement)
All pre-specified subgroup analyses will be conducted as separate stratified networks. For each subgroup network, the feasibility thresholds apply: k ≥ 10 for network meta-analysis, or k ≥ 3 for conventional pairwise meta-analysis. If a subgroup network falls below k ≥ 10, pairwise meta-analysis will be substituted; if below k ≥ 3, the subgroup will be reported narratively with the available study count stated. This fallback hierarchy is pre-specified and will be applied consistently. Any subgroup analysis not meeting minimum thresholds will not be conducted and will be noted in the PRISMA flow and limitations.

Sensitivity analysis Restricting the analysis to studies rated as low risk of bias across all RoB 2 domains
Restricting to crossover designs only
Restricting to studies using a standardised 75 g oral glucose tolerance test exclusively
Excluding crossover studies with a washout interval of fewer than seven days
Additional mandatory sensitivity analyses include: (1) re-running the NMA under at least two alternative prior distributions for the heterogeneity parameter τ to assess prior sensitivity; (2) pairwise validation for all direct comparisons with k ≥ 3, comparing conventional pairwise meta-analysis estimates to the corresponding NMA direct estimates; (3) re-running the analysis excluding studies for which standard deviations were imputed, where imputation is required for a substantial proportion of included studies. Material changes in rankings or effect estimates arising from any sensitivity analysis will be reported prominently and discussed as robustness concerns.

Language restriction The search will be restricted to studies published in English. Studies identified in other languages during the search will be noted in the PRISMA flow diagram and listed as excluded.

Country(ies) involved China.

Keywords Exercise snacks; postprandial glucose; network meta-analysis; Bayesian analysis; overweight; obesity; glycaemic control; dose response; aerobic exercise; resistance exercise.

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