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EXERCISE SNACK: A TIME-EFFICIENT STRATEGY TO IMPROVE HEALTH, FITNESS AND LONGEVITY- A NARRATIVE REVIEW

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ABSTRACT

Background: The increasing prevalence of sedentary lifestyles poses major health risks, including cardiovascular disease, type 2 diabetes, and premature mortality. “Exercise snacks” - brief, vigorous bouts of activity performed throughout the day - have emerged as a time-efficient strategy to reduce physical inactivity and improve health.

Aim: This narrative review synthesises current evidence on the physiological effects, clinical outcomes, and public health potential of exercise snacks across diverse populations.

Material and Methods: Evidence from peer-reviewed studies published between 2007 and 2025 was examined, including scoping and systematic reviews, experimental trials, and observational studies involving healthy, sedentary, and clinical cohorts. Key sources included Sports Medicine, Diabetologia, Scandinavian Journal of Medicine & Science in Sports, and WHO reports on physical inactivity.

Results: Findings consistently show that very short bouts of vigorous activity, accumulated throughout the day, can significantly improve glycaemic control, cardiorespiratory fitness, body composition, and cognitive performance. Stair climbing, sprint intervals, or workplace-based micro-exercises elicit beneficial effects on vascular and metabolic health without requiring structured training sessions. Evidence also links intermittent vigorous activity to lower risks of cardiovascular disease and cancer. Qualitative studies highlight high feasibility, adherence, and perceived enjoyment, particularly when exercise snacks are integrated into daily or occupational routines.

Conclusion: Exercise snacking is a practical, accessible, and safe approach to counteract sedentary behaviour. Integrating brief, vigorous activity into daily life can yield meaningful improvements in cardiometabolic and cognitive health, offering a scalable strategy to promote physical activity and prevent chronic disease in modern populations.

KEYWORDS

Exercise Snacks, Physical Activity, Sedentary Lifestyle, Glycaemic Control, Cardiorespiratory Fitness, Vascular Health, Longevity

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Introduction

Modern lifestyles are increasingly characterised by prolonged sitting and low levels of physical activity. Sedentary behaviour- defined as any waking activity with an energy expenditure below 1.5 metabolic equivalents (METs) while sitting or reclining- is now recognised as a distinct health risk factor. In 2022, more than one billion people worldwide were living with obesity, and about 43% of adults were classified as overweight or obese. Sedentary time averages 8.3 hours per day in Korea and 7.7 hours in the United States, while Europeans spend approximately 40% of their leisure time watching television. With one-third of adults globally engaging in insufficient physical activity, sedentary lifestyles contribute to the rising prevalence of metabolic, cardiovascular, and cognitive disorders [1,21,22,23].

Prolonged sitting impairs lipid and glucose metabolism, reduces insulin sensitivity and vascular function, and promotes weight gain and chronic inflammation. Consequently, it is strongly associated with increased risks of diabetes, cardiovascular disease, certain cancers, and all-cause mortality.

Lack of time, access to facilities, or environmental constraints are among the most frequently reported barriers to regular physical activity [2]. This has driven interest in short, efficient, and easily accessible exercise strategies.

In this context, “exercise snacks”- brief, intense bursts of physical activity performed several times per day- have emerged as a novel approach to reduce sedentary time, increase energy expenditure, and improve metabolic and cardiovascular health. This review summarises the current literature on exercise snacks, including their conceptual evolution, physiological mechanisms, clinical benefits, and implications for health promotion.

Methodology of Literature Selection

This narrative review was conducted following best practice guidelines for narrative and scoping reviews in health sciences. The primary objective was to synthesize and critically discuss evidence on the physiological, metabolic, and clinical effects of brief, vigorous bouts of activity—so-called “exercise snacks.”

Search strategy: A comprehensive search was performed in PubMed, Scopus, and Google Scholar databases for peer-reviewed publications between January 2007 and March 2025. The search strategy combined the following keywords and Boolean operators: “exercise snacks” OR “exercise snacking” OR “vigorous intermittent lifestyle physical activity” OR “VILPA” OR “micro-exercise” OR “brief vigorous activity” AND “metabolic health” OR “cardiorespiratory fitness” OR “glycaemic control” OR “vascular function” OR “sedentary behaviour”.

Inclusion and exclusion criteria:

Table 1. The table presents the inclusion and exclusion criteria that were used as the basis for the literature research.

Inclusion Criteria	Exclusion Criteria
Included human participants (healthy, sedentary, or with metabolic or cardiovascular conditions).	Animal studies, case reports, conference abstracts, and non-original commentaries were excluded.
Articles published in English and peer-reviewed journals.	Studies focusing exclusively on traditional exercise programs (e.g., continuous aerobic training or full HIIT protocols) were not included unless they incorporated a “snacking” or intermittent design element.
Investigated the effects of short bouts (<10 min) of moderate-to-vigorous activity performed intermittently during the day.	
Reported outcomes related to metabolic, cardiovascular, musculoskeletal, cognitive, or behavioural health.	

Study selection and synthesis:

Titles and abstracts were screened independently by two authors. Full texts of relevant articles were then assessed for eligibility. Reference lists of key papers were manually searched to identify additional studies. Data were extracted narratively, focusing on study design, population, intervention type, duration, and key outcomes. Given the heterogeneity of study designs, quantitative meta-analysis was not conducted. Instead, findings were synthesised descriptively and grouped thematically into metabolic, cardiovascular, musculoskeletal, cognitive, and behavioural domains.

This approach ensured comprehensive coverage of the most relevant and up-to-date evidence, while allowing flexibility typical of narrative reviews aimed at integrating mechanistic and applied perspectives.

Concept and Definition

The term exercise snacks was first introduced by Hartley, Lee, and Ferrari (2007) as brief periods of vigorous-intensity physical activity lasting no more than two minutes [3]. Early research by Francois et al. (2014) demonstrated that performing several short bouts of walking before meals improved glycaemic control in individuals with insulin resistance [4].

To date, there is no single, standardised form of exercise snacking. Different authors have proposed varied interpretations and protocols. According to Wang [14], the concept evolved to include two general forms adaptable to individuals’ needs, abilities, and lifestyles:

1. Gentle intermittent exercise (10-minute bouts, twice daily)
2. Vigorous exercise snacks (30-60 seconds, 3-8 times daily)

These activities may be structured (planned) or unstructured (incidental), integrated within daily routines- for example, climbing stairs, brisk walking, or performing bodyweight squats. A related concept, Vigorous Intermittent Lifestyle Physical Activity (VILPA), describes spontaneous high-intensity movements embedded in daily life, such as running to catch a bus or carrying heavy groceries [5].

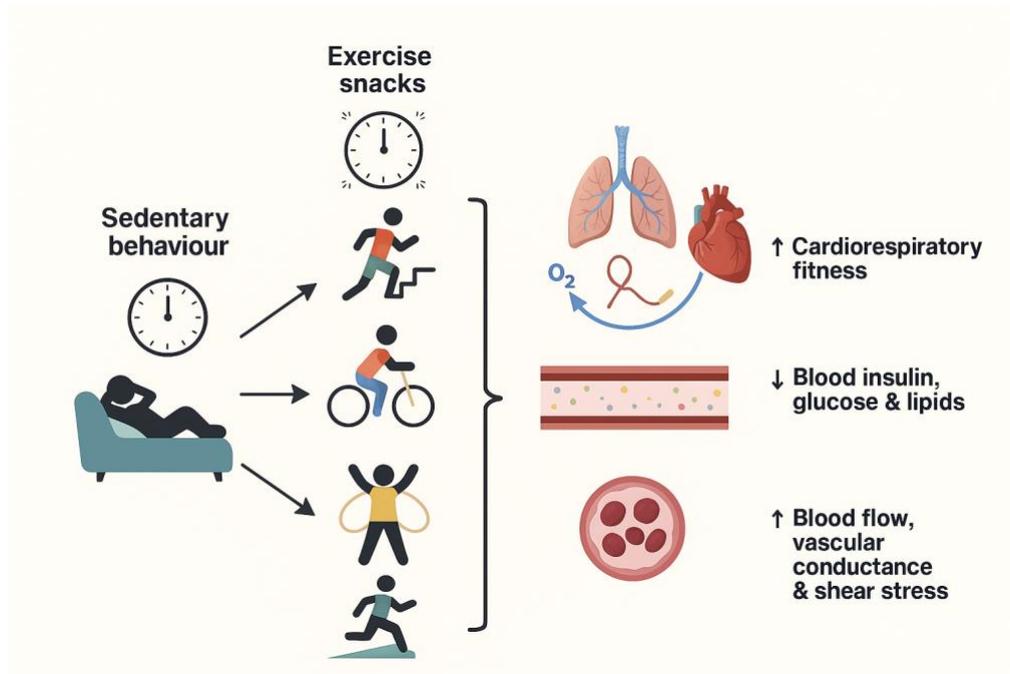


Fig. 1. Conceptual model illustrating the physiological mechanisms and health benefits of exercise snacks across metabolic, cardiovascular, and cognitive domains.

Physiological Mechanisms

Exercise snacks elicit many of the same physiological adaptations as longer workouts, despite their brevity. Their effectiveness is linked to repeated acute stimulation of metabolic, cardiovascular, and neuromuscular pathways. The cumulative effect of these micro-bouts results in meaningful adaptations when performed consistently throughout the day, as they repeatedly disrupt sedentary physiology and enhance metabolic homeostasis [5,6,7,16,18].

Metabolic Mechanisms

Short bouts of vigorous exercise increase glucose uptake by activating GLUT-4 transporters in muscle cells, enhancing insulin sensitivity and stabilising blood glucose levels [4,6,20]. This transient activation of AMP-activated protein kinase (AMPK) and Ca²⁺/calmodulin-dependent protein kinase pathways stimulates glucose transport independently of insulin, which is particularly beneficial for insulin-resistant individuals [4,18].

Repeated activation of skeletal muscle during exercise snacks also enhances mitochondrial biogenesis via the PGC-1 α pathway, improving oxidative capacity and lipid metabolism [6,16]. According to Wan et al. (2025), even when total exercise time is less than 10 minutes per day, measurable improvements in HbA1c and postprandial glucose variability are observed in overweight and obese adults [7].

These mechanisms collectively contribute to better metabolic flexibility- the ability to efficiently switch between fat and carbohydrate oxidation- a key factor in preventing metabolic disorders and maintaining energy balance [15,18,23].

Cardiovascular and Vascular Mechanisms

Brief, frequent muscle contractions stimulate endothelial shear stress, improving vascular conductance and nitric oxide bioavailability [8]. This shear-induced activation of endothelial nitric oxide synthase (eNOS) enhances vasodilation and promotes arterial compliance. Caldwell et al. (2021) demonstrated that hourly 20-second stair sprints increased femoral artery shear rate by approximately 30%, offsetting endothelial dysfunction caused by prolonged sitting [8].

Additionally, repeated transient increases in heart rate and blood pressure during vigorous snacks lead to improvements in stroke volume and cardiac output, similar to those achieved through conventional high-intensity interval training (HIIT) [9,10,16]. Over time, this enhances maximal oxygen uptake (VO_{2peak}), a strong predictor of cardiovascular and overall mortality risk [11,12].

Neuromuscular and Osteogenic Effects

Dynamic, multi-joint lower-body movements (e.g., jumping, squatting) promote osteogenesis, preventing sarcopenia and osteoporosis [2,30]. Brief, high-load or impact activities stimulate mechanotransduction pathways in bone cells, increasing osteoblast activity and bone mineral density [30]. In addition, frequent activation of large muscle groups supports neuromuscular coordination, postural stability, and proprioception.

According to Nuzzo et al. (2024), performing short bouts of resistance-based exercise snacks two to three times daily can improve muscle strength by 5-15% within 4-6 weeks, even in older adults [30]. These adaptations occur through increased motor unit recruitment, elevated myofibrillar protein synthesis, and enhanced neural drive, highlighting the efficiency of micro-dosed resistance training.

Lipid and Hormonal Responses

High-intensity activity activates lipoprotein lipase (LPL), facilitating triglyceride breakdown and promoting LDL-C clearance from the bloodstream [7]. Repeated brief bouts also enhance HDL-C production and improve overall lipid profiles, especially when accumulated across the day [7,16].

Exercise snacks acutely elevate catecholamine levels (epinephrine and norepinephrine), which stimulate lipolysis and thermogenesis, contributing to improved body composition [17,23]. Moreover, intermittent activation of the hypothalamic-pituitary-adrenal (HPA) axis through short, vigorous activity appears to reduce chronic cortisol exposure, potentially mitigating stress-related metabolic disturbances [5,6,26].

Molecular and Systemic Integration

Collectively, these physiological responses underscore the concept that frequency, not duration, is critical in counteracting the detrimental effects of sedentary behaviour. By introducing repeated “metabolic spikes” throughout the day, exercise snacks help maintain endothelial function, insulin sensitivity, and muscular efficiency. Islam, Gibala, and Little (2022) emphasised that the repeated activation of metabolic and vascular pathways across multiple brief sessions can elicit chronic adaptations comparable to those from traditional structured exercise, despite drastically lower total training time [16,18].

Thus, the mechanistic foundation of exercise snacking supports its role as a scientifically sound, time-efficient strategy for improving cardiometabolic, musculoskeletal, and cognitive health.

Evidence From Clinical and Epidemiological Studies*Metabolic and Glycaemic Effects*

The foundational trial by Francois et al. (2014) demonstrated that six one-minute bouts of brisk walking before each meal improved glycaemic control and insulin sensitivity more effectively than a continuous 30-minute walk [4]. Performing brief, high-intensity exercise snacks before main meals represents a time-efficient and effective strategy to improve glycaemic control in individuals with insulin resistance [4,6].

Tremblay et al. (2010), Duvivier et al. (2013), and Reyna et al. (2013) found that short bouts of activity throughout the day enhance glucose transport and insulin sensitivity by activating muscle glucose transporters [20]. Follow-up studies confirmed the approach as safe, feasible, and effective for individuals with obesity and type 2 diabetes [6].

Cardiorespiratory Fitness

Francois et al. (2018) found that sedentary adults performing 3×20-second bouts of vigorous stair climbing, three times daily, increased their VO₂peak by 12% after six weeks. Jenkins et al. (2019) demonstrated comparable improvements between “sprint snacks” performed throughout the day and traditional sprint interval training (SIT) conducted in one session [9,10,16].

These findings indicate that short, vigorous activity distributed across the day can elicit similar cardiorespiratory fitness (CRF) adaptations to more time-consuming exercise regimens. Islam et al. (2022) further emphasised that exercise snacks significantly improve cardiometabolic health even without weight loss [18].

Muscle Strength

Muscle strength- the maximal voluntary force a person can produce- naturally declines with age, making its preservation crucial for independence and longevity. Reduced muscle strength is associated with increased mortality, fall risk, and reduced daily functioning [29].

According to Nuzzo et al. (2024) and related studies [30]:

Short, daily resistance exercise snacks can yield 5-15% increases in muscle strength after 4-6 weeks.

In older adults, brief leg-resistance exercises performed once or twice daily improved lower-limb strength by 10-12% and muscle cross-sectional area by 5-8%.

Among office workers, two-minute resistance snacks twice daily for ten weeks improved shoulder and neck strength by 6-10% and reduced muscle pain by over 30%.

These data confirm that even minimal, frequent resistance activity can produce measurable improvements in muscle function, supporting exercise snacking as a time-efficient and evidence-based strategy for enhancing strength and overall health.

Vascular Function

Caldwell et al. (2020, 2021) demonstrated that sitting for 6-8 hours with hourly “staircase sprint” exercise snacks (14-20 seconds) increased femoral artery blood flow and shear rate by approximately 30%, improving vascular conductance [8]. These findings suggest that brief, vigorous activity serves as a micro-intervention to mitigate vascular dysfunction associated with prolonged sitting.

Longevity and Mortality Risk

Large-scale epidemiological studies show that even small amounts of vigorous physical activity substantially reduce mortality risk.

The European Heart Journal (2022) reported that just 15-20 minutes per week of vigorous activity was associated with a 16-40% lower all-cause mortality, with benefits extending to 50-57% at higher durations [11].

JAMA Oncology (2023) found that engaging in only 3-4 minutes of daily vigorous intermittent activity reduced cancer incidence by 17-32% among previously inactive adults [12].

Practical Implementation

Exercise snacks are highly adaptable and require no specialised equipment or facilities. Typical examples include: Climbing stairs briskly for 20-60 seconds; Performing bodyweight squats or push-ups before meals; Jumping jacks or fast marching in place between tasks; Short cycling sprints of 15-30 seconds.

These activities can be performed three to eight times per day, separated by at least one hour of rest. The optimal intensity corresponds to approximately 76-90% of maximum heart rate. However, because this may not accurately reflect physiological impact during such brief efforts, the Borg Rating of Perceived Exertion (RPE) is often recommended as a more practical measure of intensity. Exercise snacks should feel “hard” to “very hard”, corresponding to 15-17 on the 6-20 Borg scale or 7-8 on the CR10 scale [14,24].

Multi-joint, dynamic, lower-body movements yield the best musculoskeletal and metabolic outcomes [2]. While physical activity is essential for promoting overall health, maintaining a balanced diet— independently and in combination with exercise—remains fundamental for optimising health outcomes [17].

Integration With Lifestyle and NEAT

Exercise snacks complement non-exercise activity thermogenesis (NEAT)- all physical activity outside of formal exercise sessions. Regular movement throughout the day, including household chores and active commuting, can expend up to 2,000 additional kilocalories daily [15]. Populations in so-called Blue Zones, such as Okinawa and Sardinia, naturally incorporate frequent, unstructured movement into their routines. Buettner’s team observed that people in these regions are “nudged” to move every 20 minutes- a key factor contributing to their exceptional longevity [28].

Integrating exercise snacks into modern sedentary lifestyles may therefore replicate some of the benefits of naturally active living, promoting energy balance and metabolic health.

Cognitive Health and Work Benefits

Workplace wellness programmes incorporating short exercise breaks have been shown to enhance employee productivity, reduce perceived stress, and improve both physical and mental health. Such interventions counteract the negative effects of prolonged sitting while promoting energy, focus, and job satisfaction [25].

Recent studies further support this approach: Mues et al. (2025) reported that short, vigorous exercise snacks performed during the workday produced immediate and sustained improvements in cognitive functions such as attention, processing speed, and inhibitory control- effects likely to translate into greater workplace performance [26].

Complementary findings from Andersen et al. (2022) indicate that regular micro-exercise during working hours could prevent up to 12.8% of long-term sickness absence cases in the general working population [27].

Overall, these findings suggest that integrating exercise snacks into occupational settings could improve employee health, performance, and economic productivity.

Comparison With Traditional Exercise

Traditional exercise programmes typically involve longer aerobic or resistance sessions, which can be difficult to sustain for individuals with limited time, motivation, or health constraints- nearly 50% of people drop out within six months. Moreover, only one in five individuals attempting weight loss succeeds in maintaining a 10% reduction for at least a year [31].

While high-intensity interval training (HIIT) offers a shorter, effective alternative for improving cardiovascular fitness, it still requires dedicated time, facilities, and a structured environment, limiting adherence. In contrast, exercise snacks consist of brief, frequent bouts of activity integrated naturally throughout the day, requiring no equipment or dedicated setting. This approach reduces sedentary time while increasing overall energy expenditure.

A 12-week study in older adults (60-89 years) found that performing two to four short bouts of exercise per day improved strength, flexibility, and balance, with participants appreciating the flexibility and ease of incorporation into daily routines [32]. Thus, exercise snacks represent a more practical and sustainable approach to maintaining physical fitness and health compared with conventional training models.

Future Directions

Although current evidence strongly supports the effectiveness of exercise snacks across various populations, further research is needed to explore:

- Long-term adherence and sustainability under free-living conditions

- Dose-response relationships between frequency, intensity, and specific health outcomes

- Applications in clinical populations (e.g., cardiovascular disease, frailty, metabolic syndrome)

- Integration with wearable technology and digital health tools to prompt and monitor micro-bouts of activity.

Advancements in these areas will help refine exercise snack protocols and inform evidence-based public health guidelines.

Conclusions

Exercise snacks represent a paradigm shift in preventive health and exercise science. They offer a time-efficient, accessible, and evidence-based means of reducing sedentary behaviour, improving metabolic and cardiovascular health, and enhancing longevity- even when total exercise time amounts to only a few minutes per day [4,6,7,16,18]. Given their safety, feasibility, and adaptability, exercise snacks could become a cornerstone of future public health recommendations aimed at combating inactivity and promoting lifelong health [1,5,14]. Their integration into daily life addresses key barriers to exercise, including lack of time, motivation, or access to facilities, providing a practical solution for diverse populations, from sedentary office workers to older adults and clinical cohorts [2,7,30]. Mechanistically, repeated brief bouts of vigorous activity elicit meaningful adaptations across metabolic, cardiovascular, neuromuscular, and cognitive systems. Improvements in glycaemic control, insulin sensitivity, lipid metabolism, endothelial function, and muscle strength highlight the multidimensional benefits of micro-dosed exercise interventions [4,6,8,30]. Additionally, exercise snacks support cognitive performance, attention, and mental well-being, making them valuable not only for physical health but also for occupational and social functioning [25,26,27]. From a population health perspective, even small increments in daily vigorous activity can translate into substantial reductions in mortality and disease risk. Epidemiological studies indicate that as little as three to twenty minutes per week of intermittent vigorous activity is associated with 16-57% lower risk of all-cause mortality and reduced incidence of cardiovascular disease and cancer [11,12], underscoring the scalability and public health impact of incorporating exercise snacks into routine lifestyles. Moreover, ongoing advancements in wearable technologies and digital health tools may further enhance adherence, monitoring, and personalization of micro-exercise interventions, creating new opportunities for sustainable behaviour change. The consistent evidence of safety, feasibility, and broad applicability suggests that exercise snacks could be particularly valuable in populations traditionally challenged by conventional exercise regimens, including older adults, individuals with chronic conditions, and those with highly sedentary occupations [16,18,31]. In conclusion, exercise snacking offers a practical, evidence-based, and highly adaptable approach to counteract sedentary lifestyles. By transforming micro-moments of daily activity into potent health interventions, this strategy has the potential to improve cardiometabolic, musculoskeletal, and cognitive outcomes, enhance quality of life, and contribute meaningfully to the prevention of chronic disease on a population level [1,5,7,16,18,30].

Authors' Contributions Statement

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REFERENCES

1. Weston KL, Little JP, Weston M, McCreary S, Kitchin V, Gill A, Niven A, McNarry MA, Mackintosh KA. Application of Exercise Snacks across Youth, Adult and Clinical Populations: A Scoping Review. *Sports Med Open*. 2025 Mar 18;11(1):27. PMID: 40102333; PMCID: PMC11920532. <https://doi.org/10.1186/s40798-025-00829-6>
2. Huang CH, Yen M. [Applying an Exercise Snack-Based Health Promotion Strategy]. *Hu Li Za Zhi*. 2023 Apr;70(2):78-83. Chinese. PMID: 36942545. [https://doi.org/10.6224/jn.202304_70\(2\).10](https://doi.org/10.6224/jn.202304_70(2).10)
3. Hartley H, Lee I-M, Ferrari N. An "Exercise Snack" Plan. *Newsweek*. 2007. <https://pubmed.ncbi.nlm.nih.gov/19130829/>
4. Francois ME, Baldi JC, Manning PJ, Lucas SJ, Hawley JA, Williams MJ, Cotter JD. 'Exercise snacks' before meals: a novel strategy to improve glycaemic control in individuals with insulin resistance. *Diabetologia*. 2014 Jul;57(7):1437-45. Epub 2014 May 10. PMID: 24817675. <https://doi.org/10.1007/s00125-014-3244-6>
5. Jones MD, Clifford BK, Stamatakis E, Gibbs MT. Exercise Snacks and Other Forms of Intermittent Physical Activity for Improving Health in Adults and Older Adults: A Scoping Review of Epidemiological, Experimental and Qualitative Studies. *Sports Med*. 2024 Apr;54(4):813-835. Epub 2024 Jan 8. PMID: 38190022. <https://doi.org/10.1007/s40279-023-01983-1>
6. Praveen Kumar TK, Mohammed Shafeek A, Arif Khan L. Exercise snacking: A convenient and time-efficient strategy for enhancing physical fitness and health. *Int J Physiol Exercise Phys Educ*. 2025;7(1):44-48. DOI: 10.33545/26647249.2025.v7.i1a.150
7. Wan KW, Dai ZH, Wong PS, Huang WY, Lei EF, Little JP, Lin FC, Tam BT. Effects of Exercise Snacks on Cardiometabolic Health and Body Composition in Adults: A Systematic Review and Meta-Analysis. *Scand J Med Sci Sports*. 2025 Aug;35(8):e70114. PMID: 40814152; PMCID: PMC12354995. <https://doi.org/10.1111/sms.70114>
8. Caldwell HG, Coombs GB, Rafiei H, Ainslie PN, Little JP. Hourly staircase sprinting exercise "snacks" improve femoral artery shear patterns but not flow-mediated dilation or cerebrovascular regulation: a pilot study. *Appl Physiol Nutr Metab*. 2021 May;46(5):521-529. Epub 2020 Nov 26. PMID: 33242251. <https://doi.org/10.1139/apnm-2020-0562>
9. Jenkins EM, Nairn LN, Skelly LE, Little JP, Gibala MJ. Do stair climbing exercise "snacks" improve cardiorespiratory fitness? *Appl Physiol Nutr Metab*. 2019 Jun;44(6):681-684. Epub 2019 Jan 16. PMID: 30649897.
10. Little JP, Langley J, Lee M et al. Sprint exercise snacks: a novel approach to increase aerobic fitness. *Eur J Appl Physiol*. 2019;119:1203-1212. <https://doi.org/10.1007/s00421-019-04110-z>

11. Ahmadi MN, Clare PJ, Katzmarzyk PT, del Pozo Cruz B, Lee IM, Stamatakis E. Vigorous physical activity, incident heart disease, and cancer: how little is enough? *Eur Heart J.* 2022;43(46):4801-4814. <https://doi.org/10.1093/eurheartj/ehac572>
12. Stamatakis E, Ahmadi MN, Friedenreich CM, Blodgett JM, Koster A, Holtermann A, Atkin A, Rangul V, Sherar LB, Teixeira-Pinto A, Ekelund U, Lee IM, Hamer M. Vigorous Intermittent Lifestyle Physical Activity and Cancer Incidence Among Nonexercising Adults: The UK Biobank Accelerometry Study. *JAMA Oncol.* 2023 Sep 1;9(9):1255-1259. PMID: 37498576; PMCID: PMC10375384. <https://doi.org/10.1001/jamaoncol.2023.1830>
13. Wu J, Wang Y, Qui P, Li Y. Associations of exercise snacks with cognitive function among older adults in NHANES 2011-2014. *Gen Hosp Psychiatry.* 2025;94:167-173. <https://doi.org/10.1016/j.genhosppsych.2025.03.005>
14. Wang T, Laher I, Li S. Exercise snacks and physical fitness in sedentary populations. *Sports Med Health Sci.* 2024 Feb 27;7(1):1-7. PMID: 39649791; PMCID: PMC11624330. <https://doi.org/10.1016/j.smhs.2024.02.006>
15. von Loeffelholz C, Birkenfeld AL. Non-Exercise Activity Thermogenesis in Human Energy Homeostasis. [Updated 2022 Nov 25]. In: Feingold KR, Ahmed SF, Anawalt B, et al., editors. *Endotext* [Internet]. South Dartmouth (MA): MDText.com, Inc.; 2000-. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK279077/>
16. Islam H, Gibala MJ, Little JP. Exercise Snacks: A Novel Strategy to Improve Cardiometabolic Health. *Exerc Sport Sci Rev.* 2022 Jan 1;50(1):31-37. PMID: 34669625. <https://doi.org/10.1249/jes.0000000000000275>
17. West JS, Guelfi KJ, Dimmock JA, Jackson B. Preliminary Validation of the Exercise-Snacking Licensing Scale: Rewarding Exercise with Unhealthy Snack Foods and Drinks. *Nutrients.* 2018 Dec 2;10(12):1866. PMID: 30513806; PMCID: PMC6316787. <https://doi.org/10.3390/nu10121866>
18. Islam H, Gibala MJ, Little JP. Exercise Snacks: A Novel Strategy to Improve Cardiometabolic Health. *Exerc Sport Sci Rev.* 2022;50(1):31-37. <https://doi.org/10.1249/jes.0000000000000275>
19. World Health Organization. Risk Reduction of Cognitive Decline and Dementia: WHO Guidelines. Geneva: WHO; 2019. ISBN 978-92-4-155054-3. Available from: <https://apps.who.int/iris/bitstream/handle/10665/312180/9789241550543-eng.pdf>
20. Reyna SM, Tantiwong P, Cersosimo E, Defronzo RA, Sriwijitkamol A, Musi N. Short-term exercise training improves insulin sensitivity but does not inhibit inflammatory pathways in immune cells from insulin-resistant subjects. *J Diabetes Res.* 2013;2013:107805. <https://doi.org/10.1155/2013/107805>
21. World Health Organization. Physical inactivity: a global public health problem. Geneva: WHO; 2020. Available from: https://www.who.int/dietphysicalactivity/factsheet_inactivity/en/
22. Sirwan KA, Ribera AM. Obesity: Prevalence, causes, consequences, management, preventive strategies and future research directions. *Metabolism Open.* 2025;27:100375. <https://doi.org/10.1016/j.metop.2025.100375>
23. Park JH, Moon JH, Kim HJ, Kong MH, Oh YH. Sedentary Lifestyle: Overview of Updated Evidence of Potential Health Risks. *Korean J Fam Med.* 2020;41(6):365-373. <https://doi.org/10.4082/kjfm.20.0165>
24. Lea JWD, O'Driscoll JM, Hulbert S et al. Convergent Validity of Ratings of Perceived Exertion During Resistance Exercise in Healthy Participants: A Systematic Review and Meta-Analysis. *Sports Med Open.* 2022;8:2. <https://doi.org/10.1186/s40798-021-00386-8>
25. Barr-Anderson DJ, AuYoung M, Whitt-Glover MC, Glenn BA, Yancey AK. Integration of short bouts of physical activity into organisational routine: a systematic review of the literature. *Am J Prev Med.* 2011;40(1):76-93. <https://doi.org/10.1016/j.amepre.2010.09.033>
26. Mues JP, Flohr S, Kurpiers N. The Influence of Workplace-Integrated Exercise Snacks on Cognitive Performance in Sedentary Middle-Aged Adults- A Randomised Pilot Study. *Sports.* 2025;13(6):186. <https://doi.org/10.3390/sports13060186>
27. Andersen LL, Skovlund SV, Vinstrup J et al. Potential of micro-exercise to prevent long-term sickness absence in the general working population: prospective cohort study with register follow-up. *Sci Rep.* 2022;12:2280. <https://doi.org/10.1038/s41598-022-06283-8>
28. Buettner D, Skemp S. Blue Zones: Lessons from the World's Longest Lived. *Am J Lifestyle Med.* 2016 Jul 7;10(5):318-321. PMID: 30202288; PMCID: PMC6125071. <https://doi.org/10.1177/1559827616637066>
29. Volaklis KA, Halle M, Meisinger C. Muscular strength as a strong predictor of mortality: A narrative review. *Eur J Intern Med.* 2015 Jun;26(5):303-310. Epub 2015 Apr 25. PMID: 25921473. <https://doi.org/10.1016/j.ejim.2015.04.013>
30. Nuzzo JL, Pinto MD, Kirk BJC, Nosaka K. Resistance Exercise Minimal Dose Strategies for Increasing Muscle Strength in the General Population: an Overview. *Sports Med.* 2024 May;54(5):1139-1162. Epub 2024 Mar 20. PMID: 38509414; PMCID: PMC11127831. <https://doi.org/10.1007/s40279-024-02009-0>
31. Wing RR, Phelan S. Long-term weight loss maintenance. *Am J Clin Nutr.* 2005 Jul;82(1 Suppl):222S-225S. PMID: 16002825. <https://doi.org/10.1093/ajcn/82.1.222S>
32. Jansons P, Fyfe JJ, Dalla Via J et al. Barriers and enablers associated with participation in a home-based pragmatic exercise snacking program in older adults delivered and monitored by Amazon Alexa: a qualitative study. *Aging Clin Exp Res.* 2023;35:561-569. <https://doi.org/10.1007/s40520-022-02327-1>
33. Patel P, Abate N. Body Fat Distribution and Insulin Resistance. *Nutrients.* 2013;5:2019-2027. <https://doi.org/10.3390/nu5062019>