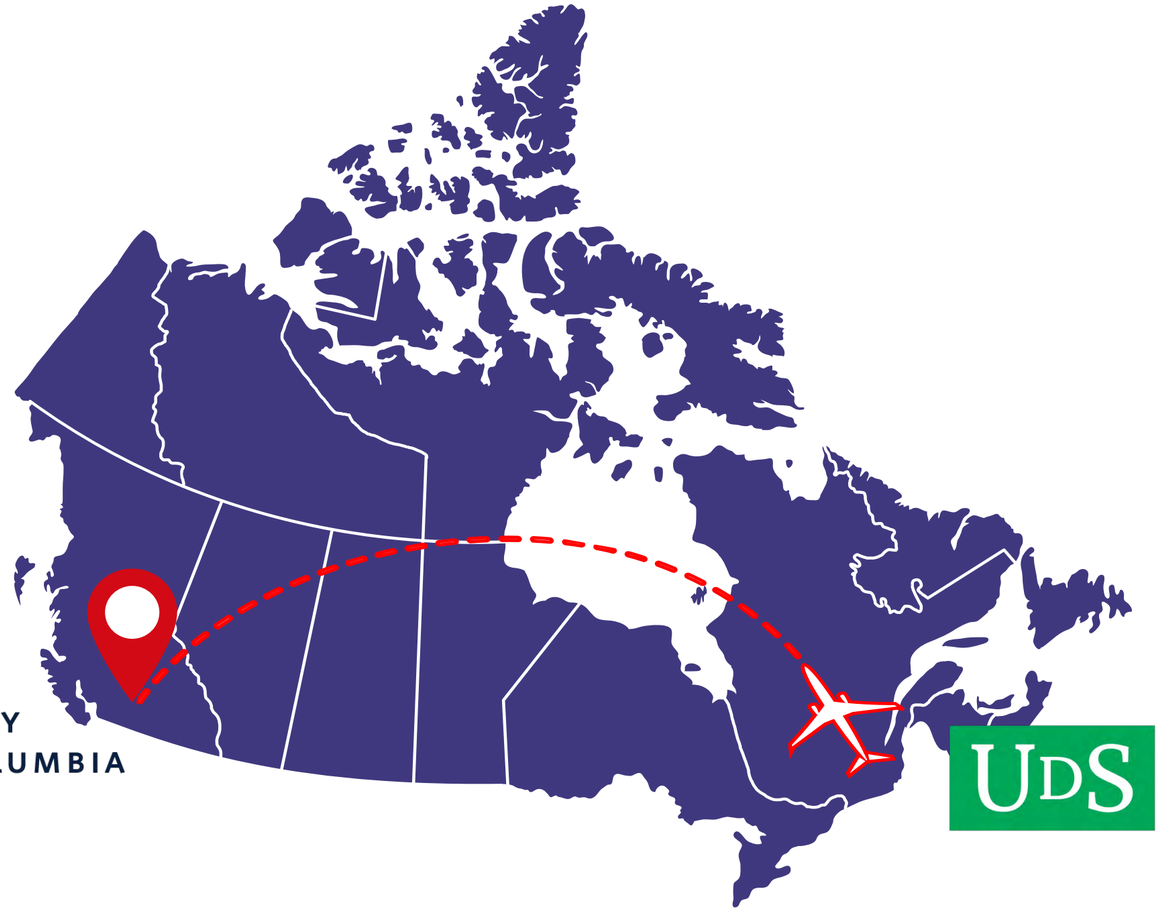
Les “snacks d'exercice” une stratégie innovante pour améliorer la santé cardiométabolique?

Midi-Savoirs – Santé Québec

Pr. Alexis Marcotte-Chénard
Université de Sherbrooke — Novembre 2026





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Plan

1. Pourquoi exercise est-il bénéfique?
2. Impact du diabète de type 2
3. Snacks d’exercice
4. Astuces et conseils

Mention légale



1. **L’information présentée a pour seul objectif d’éduquer et ne doit en aucun cas être interprétée comme un avis médical.**

2. **Elle s’appuie sur la littérature scientifique ainsi que sur l’expertise de nombreux professionnels à travers le monde.**

3. **Les réponses à l’exercice varient d’une personne à l’autre; ce qui fonctionne pour quelqu’un peut ne pas convenir à une autre.**

4. **Consultez un professionnel de la santé avant de commencer tout nouveau programme d’exercice, surtout si vous avez des problèmes de santé préexistants.**

Pourquoi l’exercice est-il bénéfique?



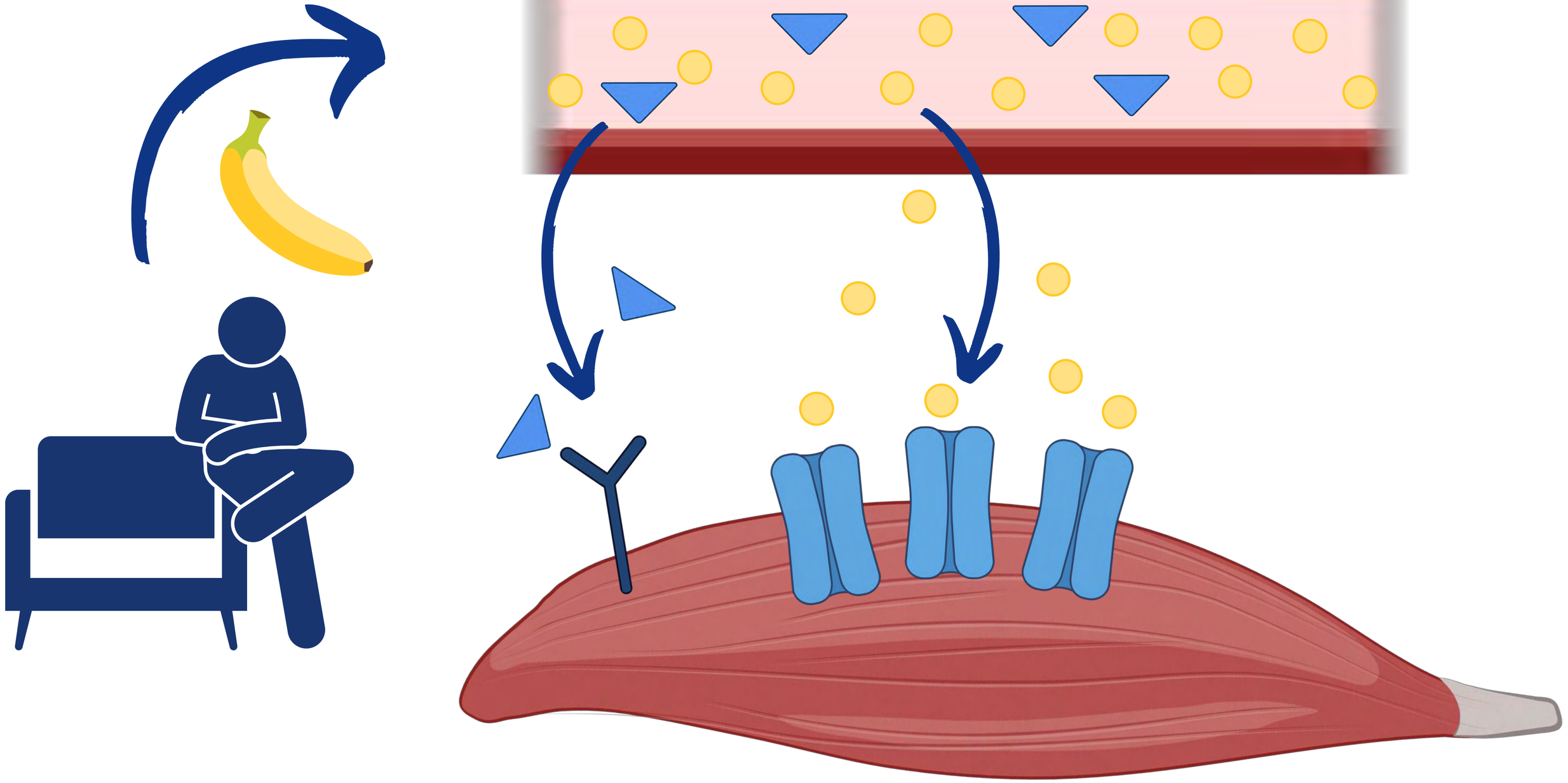
Pourquoi l’exercice est-il bénéfique?

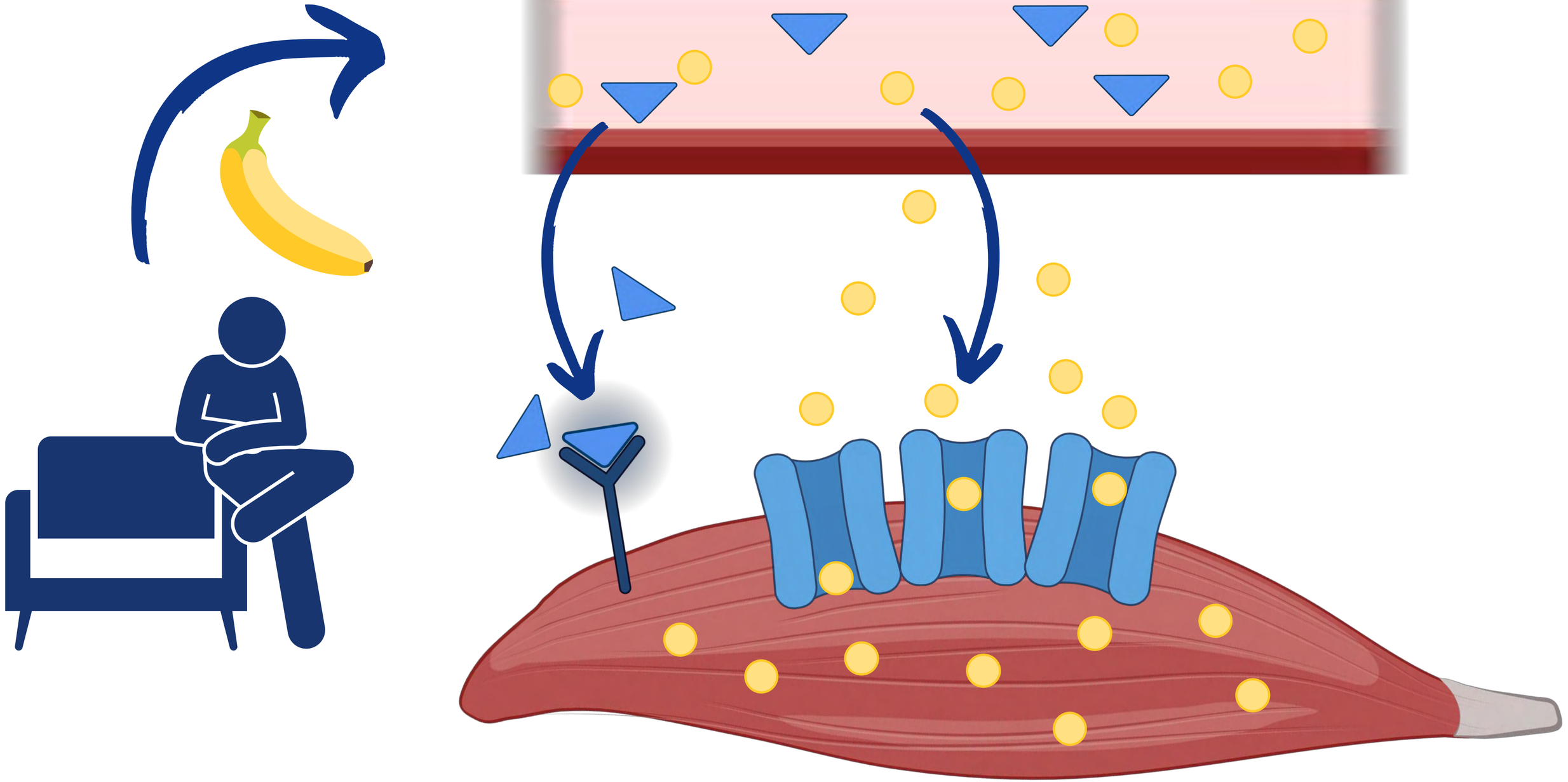


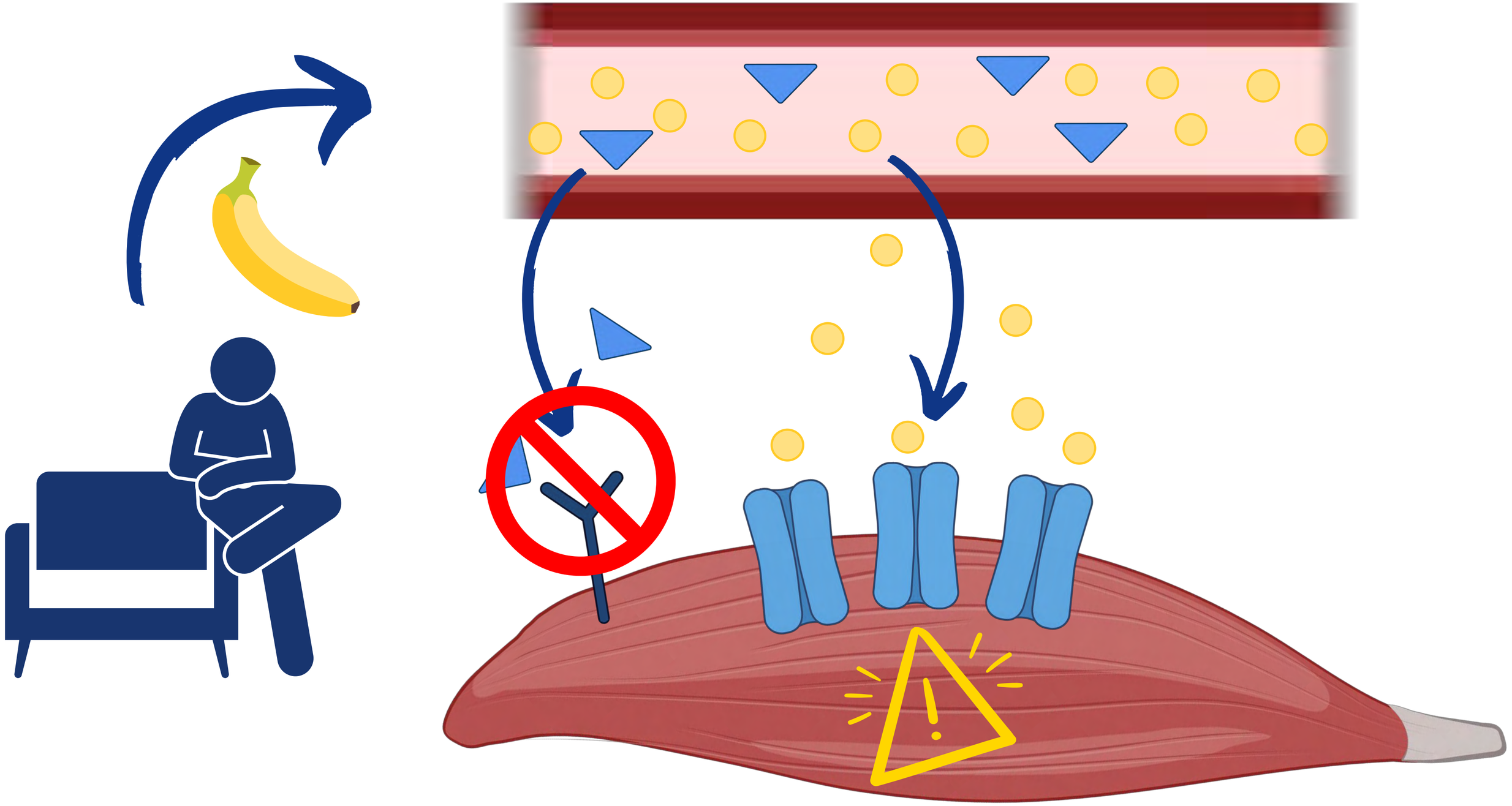
Aigue

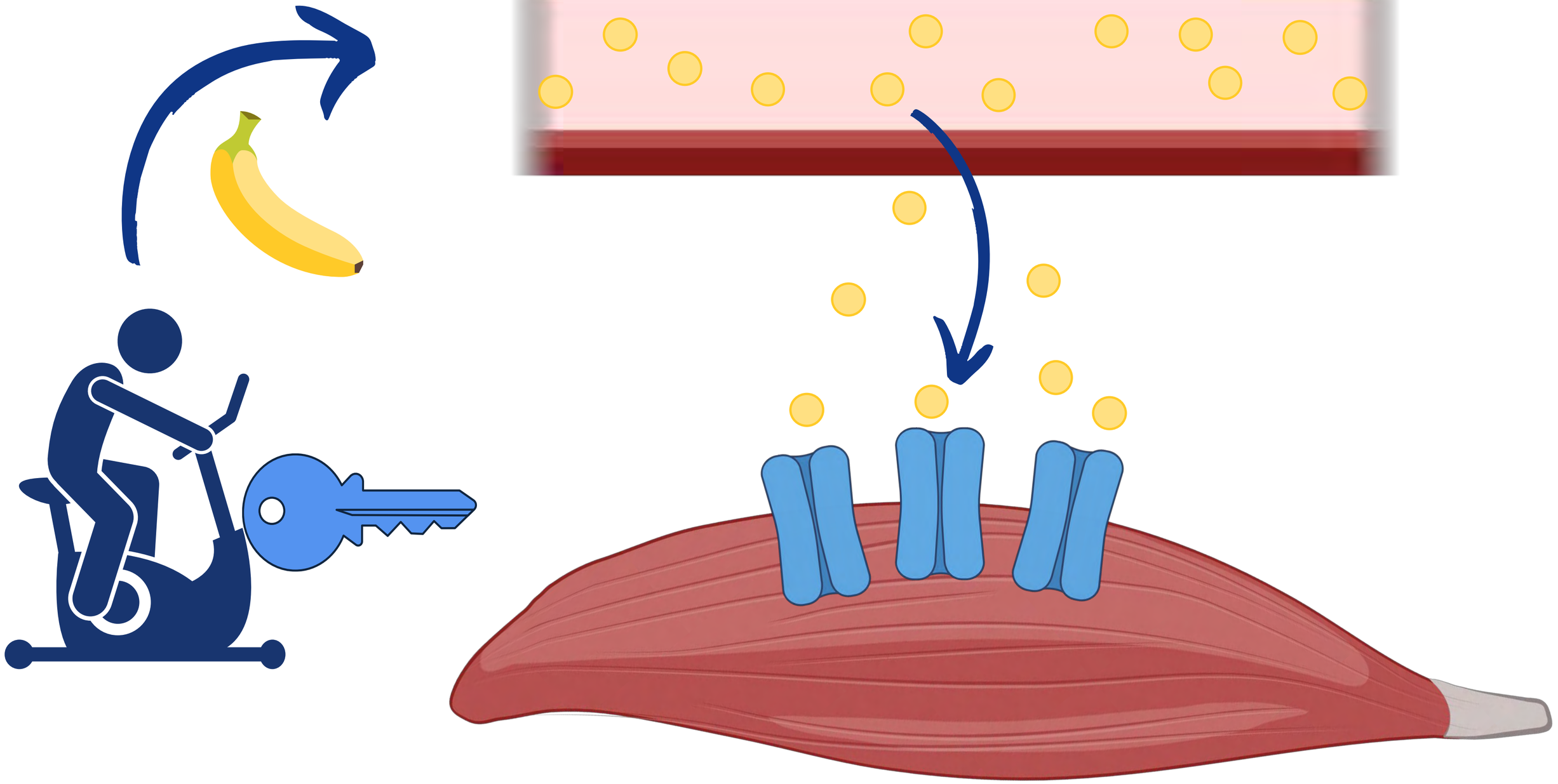


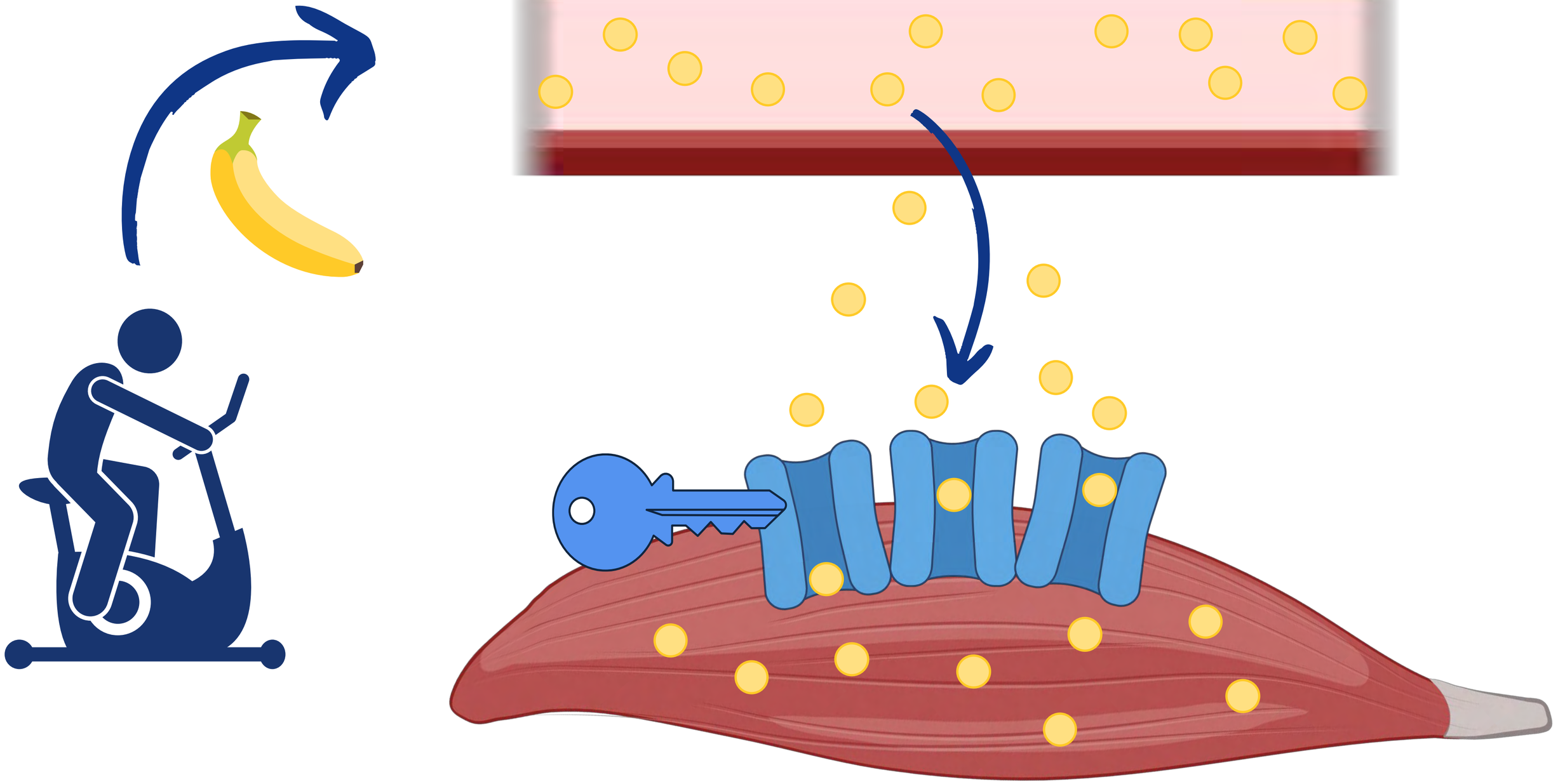
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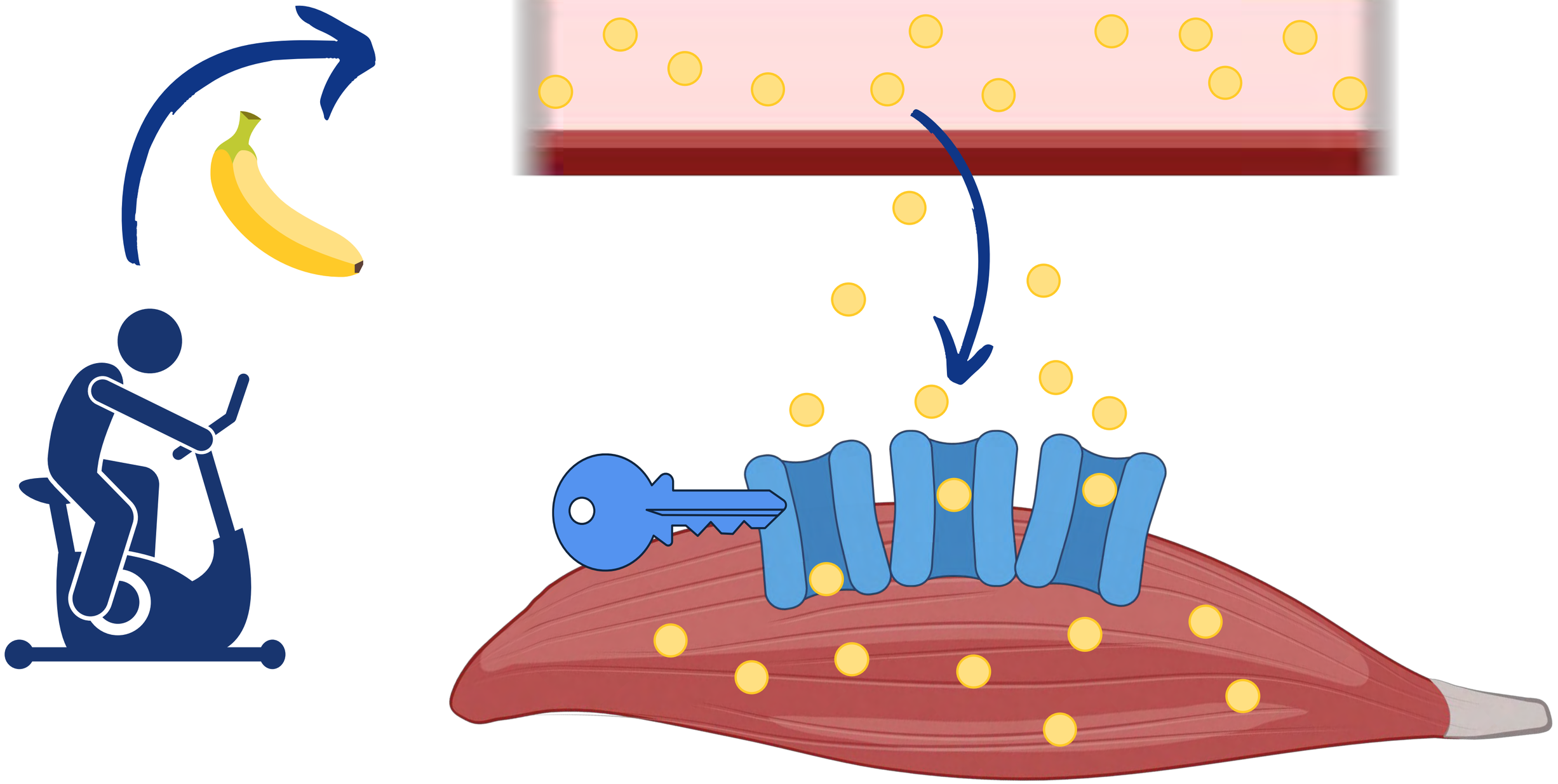












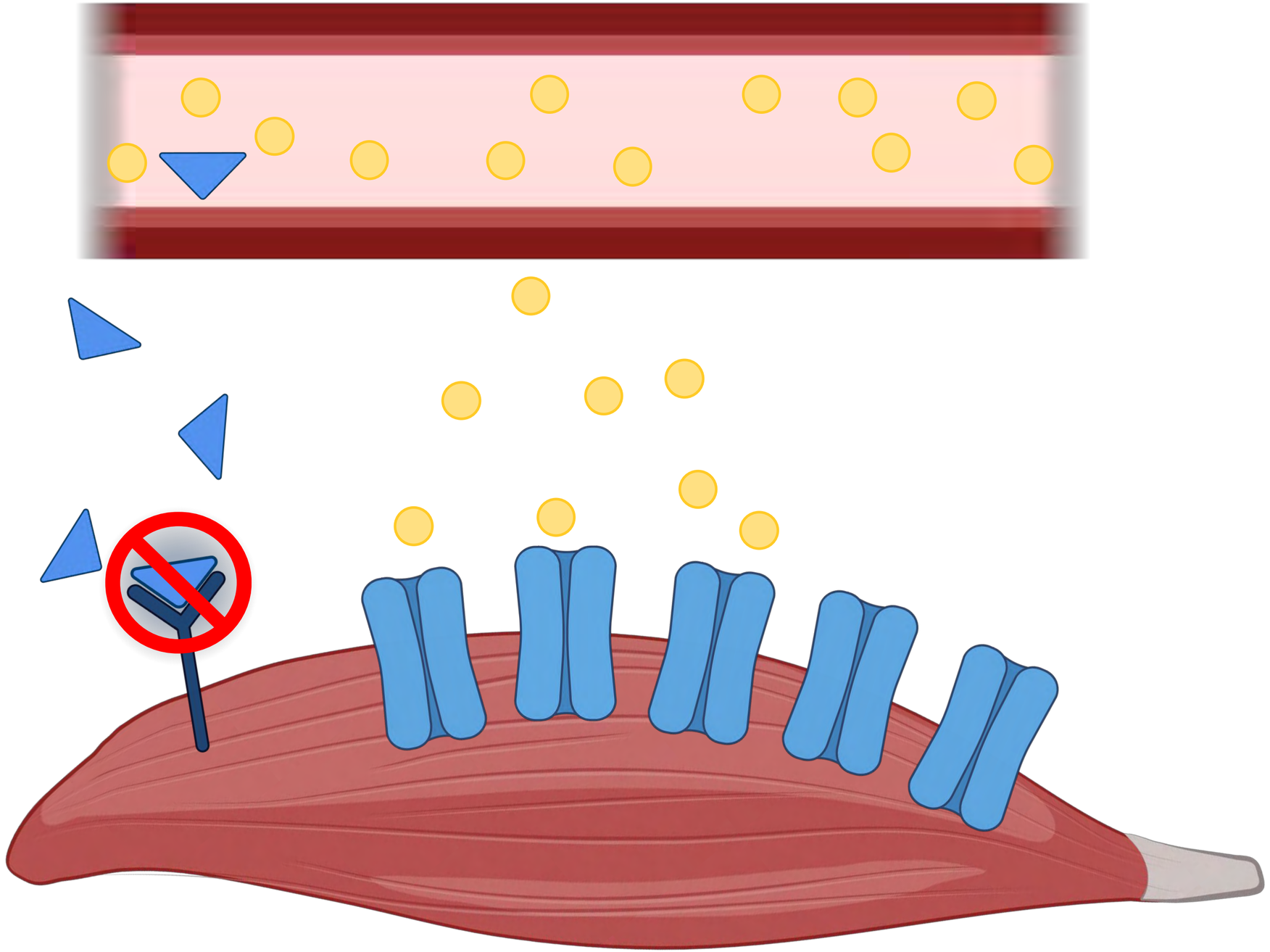


Aigue

Faire de l’exercice peut réduire immédiatement votre taux de sucre dans le sang !

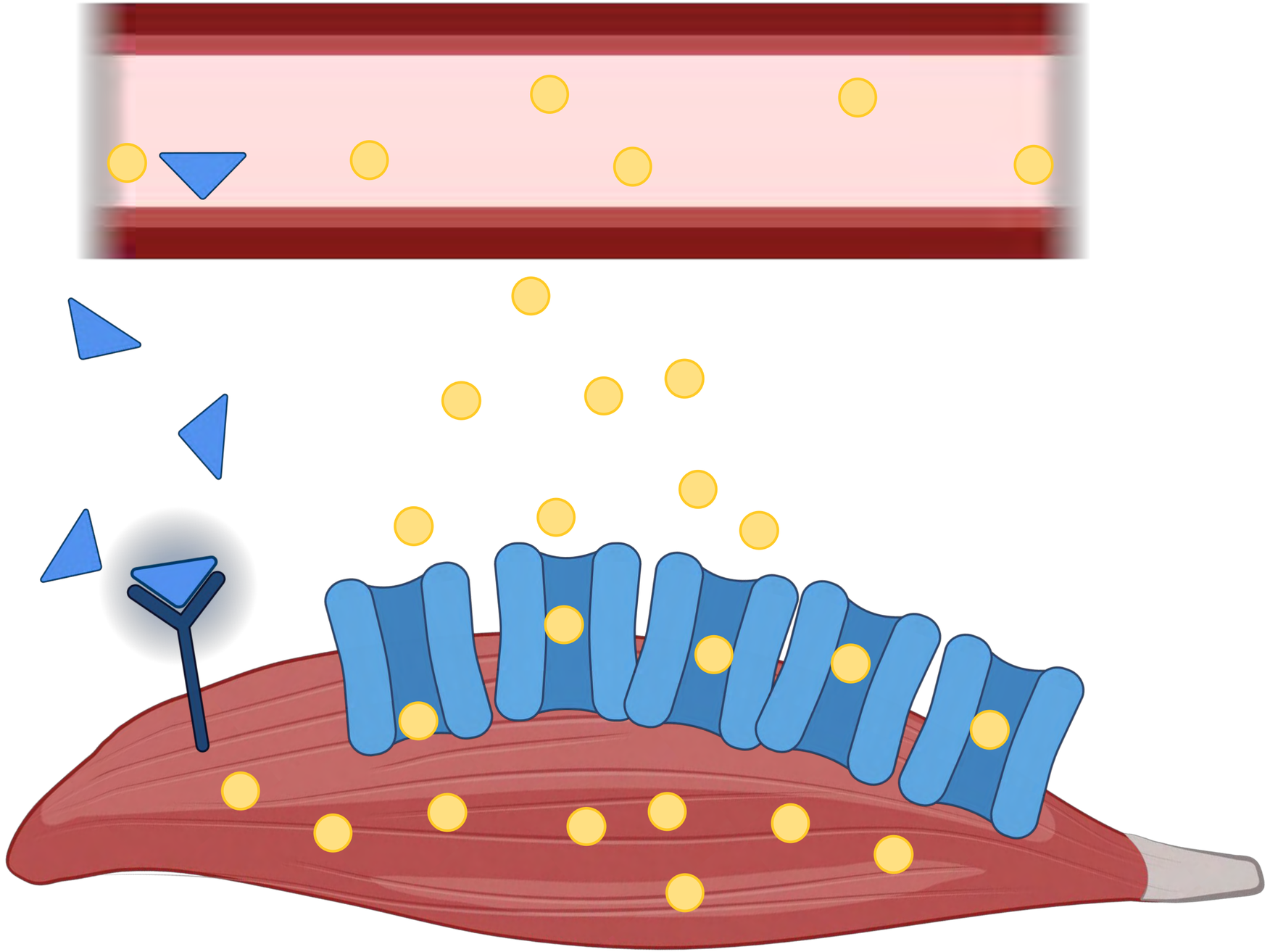


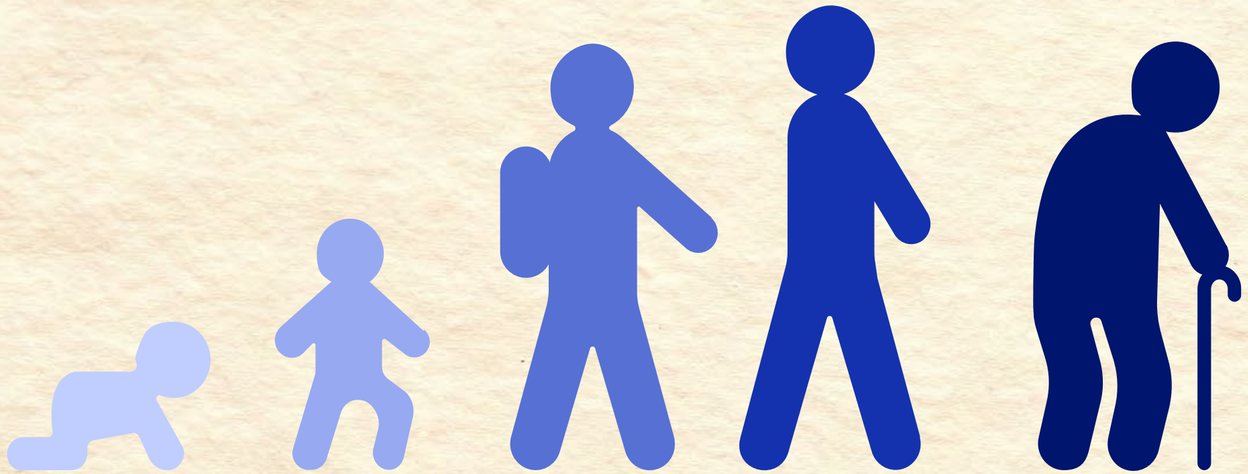
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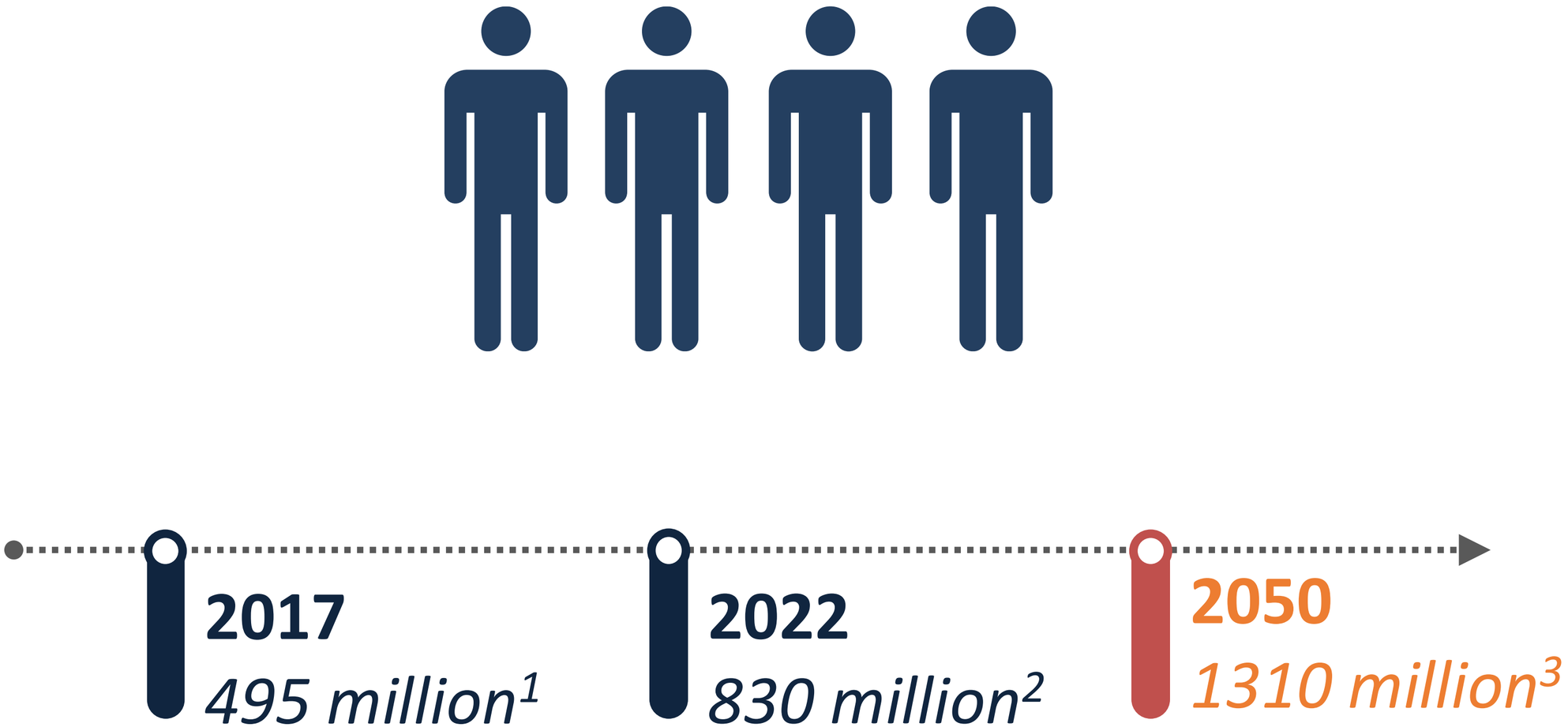




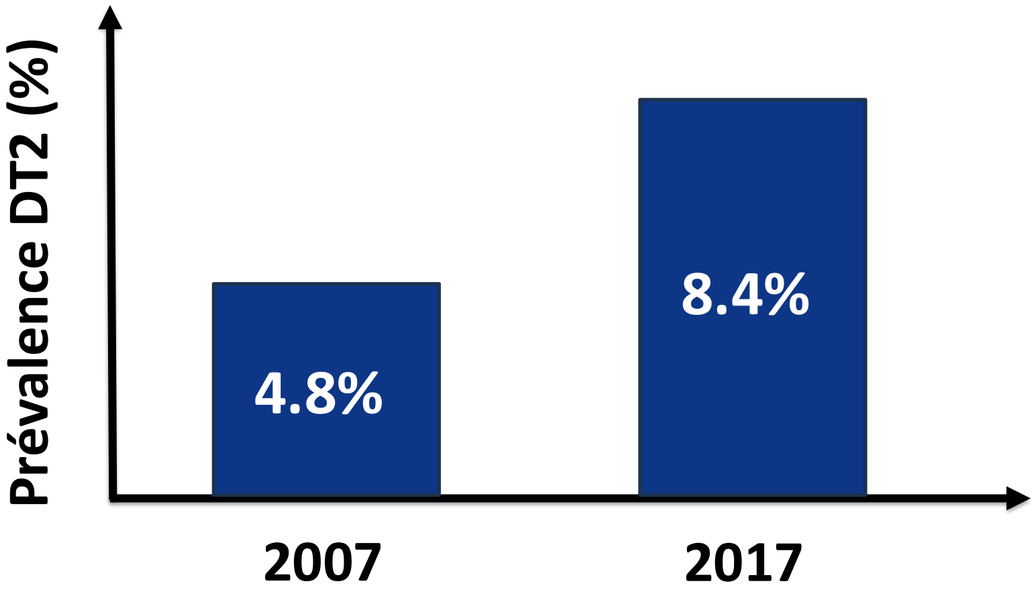
Vieillissement de la population



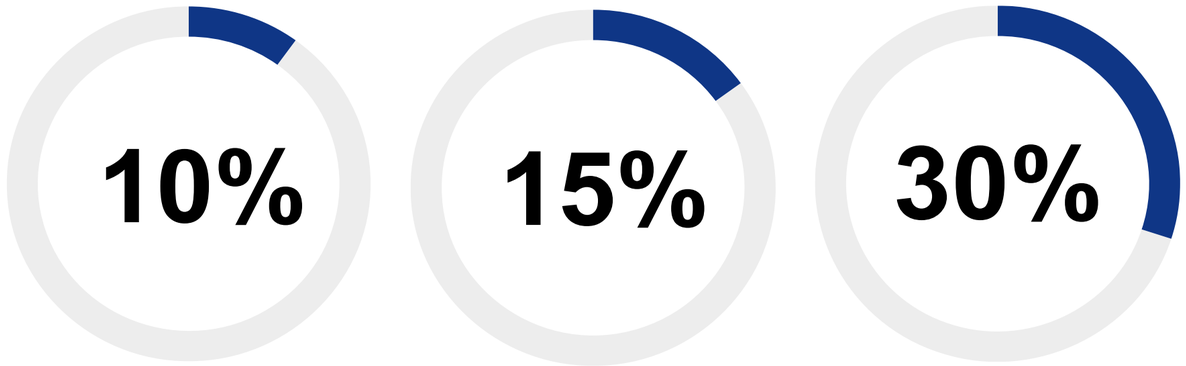
Diabète de type 2



1) Wild et al., 2004; 2) Cho et al., 2018; BDB Lancet 2024



[2]



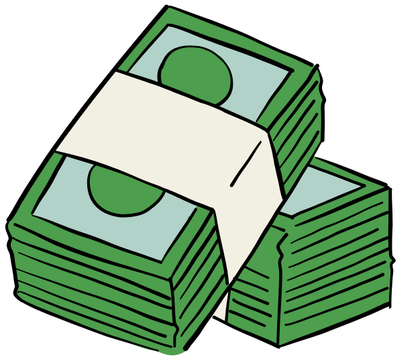
DT2 diagnostiqué

DT2 + non diagnostiqué

DT2 + non diagnostiqué + prédiabète



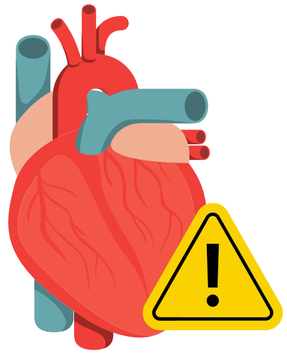
1) Marcotte-Chénard et al., 2024; 2) Diabetes Canada 2020



20 milliards [1]



$76 - $10,014 [1]

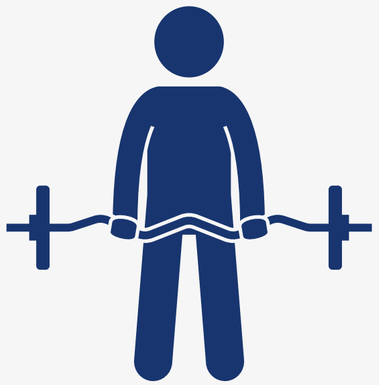


Comorbidité
Mortalité prématurée [2]

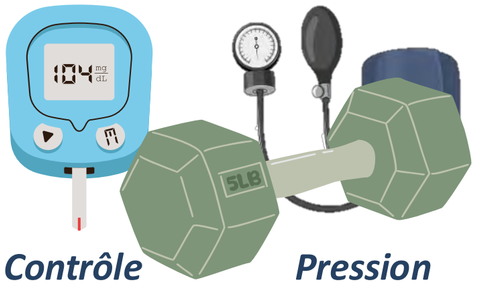


1) Diabetes Canada 2020; 2) Baena-Díez et al., 2016



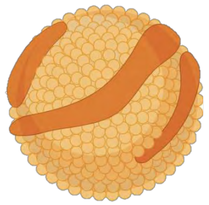


150 min/Semaine + **2 x contre-résistance**

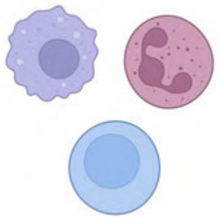


Contrôle glycémique

Pression artérielle



Profil lipidique



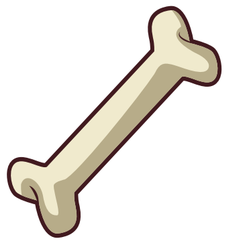
Fonction immunitare



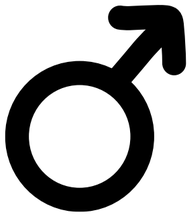
Santé mentale



Force musculaire



Densité minérale osseuse



dysfonction érectile



Risque de MCV



Mort prématuré

Can J Diabetes 42 (2018) S54–S63

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journal homepage: www.canadianjournalofdiabetes.com

2018 Clinical Practice Guidelines

Physical Activity and Diabetes

Diabetes Canada Clinical Practice Guidelines Expert Committee

Ronald J. Sigal MD, MPH, FRCPC, Marni J. Armstrong CEP, PhD, Simon L. Bacon PhD, Normand G. Boulé PhD, Kaberi Dasgupta MD, MSc, FRCPC, Glen P. Kenny PhD, Michael C. Riddell PhD

KEY MESSAGES

- Moderate to high levels of physical activity and cardiorespiratory fitness are associated with substantially lower morbidity and mortality in people with diabetes.
- Both aerobic and resistance exercise are beneficial, and it is optimal to do both types of exercise. At least 150 minutes per week of aerobic exercise and at least 2 sessions per week of resistance exercise are recommended, though smaller amounts of activity still provide some health benefits.
- A number of strategies that increase self-efficacy and motivation can be employed to increase physical activity uptake and maintenance, such as setting specific physical activity goals, using self-monitoring tools (pedometers or accelerometers) and developing strategies to overcome anticipated barriers.
- For people with type 2 diabetes, supervised exercise programs have been particularly effective in improving glycemic control, reducing the need for noninsulin antihyperglycemic agents and insulin, and producing modest but sustained weight loss.
- Habitual, prolonged sitting is associated with increased risk of death and major cardiovascular events.

KEY MESSAGES FOR PEOPLE WITH DIABETES

- Physical activity often improves glucose control and facilitates weight loss, but has multiple other health benefits even if weight and glucose control do not change.
- It is best to avoid prolonged sitting. Try to interrupt sitting time by getting up briefly every 20 to 30 minutes.
- Try to get at least 150 minutes per week of aerobic exercise (like walking, bicycling or jogging).
- Using a step monitor (pedometer or accelerometer) can be helpful in tracking your activity.
- In addition to aerobic exercise, try to do at least 2 sessions per week of strength training (like exercises with weights or weight machines).
- If you decide to begin strength training, you should ideally get some instruction from a qualified exercise specialist.
- If you cannot reach these recommended levels of activity, doing smaller amounts of activity still has some health benefits.

Types of Exercise

Physical activity is defined as any bodily movement produced by skeletal muscles that requires energy expenditure (1). Exercise is planned, structured physical activity (1) (see Table 1 for definitions of key exercise terms used in this article.) **Aerobic exercise** (like walking, bicycling, swimming or jogging) involves continuous, rhythmic movements of large muscle groups, normally at least 10 minutes at a time. In this chapter, we will refer to this type of exercise as "aerobic" for simplicity, even though when performed at a very high intensity, such as with high-intensity interval training, it also involves some anaerobic metabolism. **Resistance exercise** involves brief repetitive exercises with weights, weight machines, resistance bands or one's own body weight (e.g. push-ups) to increase muscle strength and/or endurance. **Flexibility exercise** (like lower back or hamstring stretching) aims to enhance the ability to move through fuller ranges of motion. Some types of exercise, such as yoga, can incorporate elements of both resistance and flexibility exercise.

Benefits of Physical Activity

Physical activity can help people with diabetes achieve a variety of goals, including increased ~~cardiorespiratory~~ fitness, increased vigour, improved glycemic control, decreased insulin resistance, improved lipid profile, blood pressure (BP) reduction and maintenance of weight loss (2–5).

Randomized trials have found that supervised exercise interventions improve glycated hemoglobin (A1C) (6–8), triglycerides (TG) and cholesterol (9) in people with type 2 diabetes when compared to no exercise comparison groups (10). Cohort studies have demonstrated that, in people with type 2 (11–13), and with type 1 diabetes (14,15), regular physical activity (11–13) and/or moderate to high cardiorespiratory fitness (16) are associated with reductions in cardiovascular (CV) and overall mortality.

Randomized trials have also demonstrated that aerobic exercise training increases cardiorespiratory fitness in both type 1 and type 2 diabetes (17), and slows the development of peripheral neuropathy (18). A meta-analysis (6) found that supervised exercise interventions improved A1C in people with type 2 diabetes when compared to no exercise comparison groups. In addition, interventions involving exercise durations of more than 150 minutes per week were associated with greater A1C reductions (mean change −0.89%) than interventions involving 150 minutes or less of exercise per week (mean change −0.36%) (6). A meta-analysis of head-to-head trials comparing the effects on A1C of aerobic exercise at higher vs. lower intensity found that the interventions with higher intensity reduced A1C more than those of lower intensity (mean A1C difference −0.22%) (8). It was unclear whether the greater

Conflict of interest statements can be found on page S60.

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https://doi.org/10.1016/j.jcjd.2017.10.008



Si l’on pouvait mettre l’exercice dans une pilule, ce serait le meilleur médicament jamais inventé!

Applied Physiology, Nutrition, and Metabolism

Article

Achievement of the ABC goal among Canadians with type 2 diabetes and the influence of physical activity: data from the Canadian Health Measures Survey

Alexis Marcotte-Chénard[a,b], **René Maréchal**[a,b], **Ahmed Ghachem**[c], **Alan Cohen**[d], **and Eléonor Riesco**[a,b]

[a]Faculty of Physical Activity Sciences, University of Sherbrooke, Sherbrooke, QC J1K 2R1, Canada; [b]Research Centre on Aging, CIUSSS de l'Estrie - CHUS, Sherbrooke, QC, J1H 4C4, Canada; [c]Institute for Excellence in Health and Social Services (INESS), Québec, QC, G1V 4M3, Canada; [d]Faculty of Medicine and Health Sciences, University of Sherbrooke, Sherbrooke, QC, J1H 5N4, Canada

Corresponding author: **Eléonor Riesco** (email. E.Riesco@usherbrooke.ca)

Appl. Physiol. Nutr. Metab. Downloaded from cdnsciencepub.com by 24.201.210.35 on 05/11/23
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Abstract

Achieving the three therapeutics targets known as ABC (A1c ≤ 7.0%, LDL-C < 2.0 mmol/L, and resting BP < 130/80 mmHg), limiting sedentary behaviors as well as accumulating a total of 150 min/week of moderate-to-vigorous aerobic exercise reduce the risk of cardiovascular disease in type 2 diabetes (T2D) individuals. However, more recent data regarding the achievement of ABC over time in Canada is needed and it remains to be determined how sedentary behaviors and physical activity levels can influence its achievement. Analyses were performed using a total of 17 582 individuals (18–79 years) from the 2007–2017 Canadian Health Measures Survey. Sedentary behaviors and physical activity levels were estimated using an accelerometer for a total of 7 consecutive days and quartiles of physical activity were used to categorize individuals. The prevalence of T2D has increased from 2007 to 2017 in the Canadian population (from 4.80% to 8.38%) with a considerable number of undiagnosed patients. The achievement of ABC went from 11.53% [11.49%–11.57%] in 2007 to 14.84% [14.80%–14.89%] in 2017 in T2D individuals. Moderate-to-vigorous physical activity (MVPA) levels were positively but weakly correlated to the achievement of the ABC ($r = 0.044$; $p = 0.001$), while sedentary time and light physical activity were not ($r < -0.014$; $p = 0.266$). Only 8.8% of individuals with the lowest level of MVPA (Q1) reached the ABC while 15.1% of the most active individuals (Q4) reached the triple target. In addition to physical activity, other important factors such as body mass index and medication use should also be considered as modifiable contributing factors.

Key words: triple target, A1c, blood pressure, LDL-cholesterol, cardiovascular disease, type 2 diabetes prevalence, Canadian Health Measures Survey

Take home message

Based on the achievement of the ABC, cardiovascular risk management is slowly improving in Canada. Even though body mass index and medication use are important contributing factors, physically active individuals are more likely to reach the ABC target.

Introduction

The worldwide prevalence of type 2 diabetes (T2D) has drastically increased in the past decade and Canada is no exception (Cho et al. 2018). In 2015, the estimated prevalence of diabetes was 3.4 million, with only 5%–10% being type 1 diabetes cases. The estimation for 2025 rises to 5 million, representing an increase of 44% (Houlden 2018). This increase in prevalence is not without repercussions on Canada's publicly funded healthcare system as well as on the economy. In 2020, the direct cost associated with the disease exceeded 3.8 billion (Diabetes Canada 2020). In addition to the financial burden, individuals suffering from T2D have a greater risk of developing co-morbidities which can decrease their health-related quality of life and increase their risk of premature mortality (Rubin and Peyrot 1999; Baena-Díez et al. 2016). It is, therefore, unequivocal that T2D significantly affects the Canadian economy and the quality of life of millions of people in Canada.

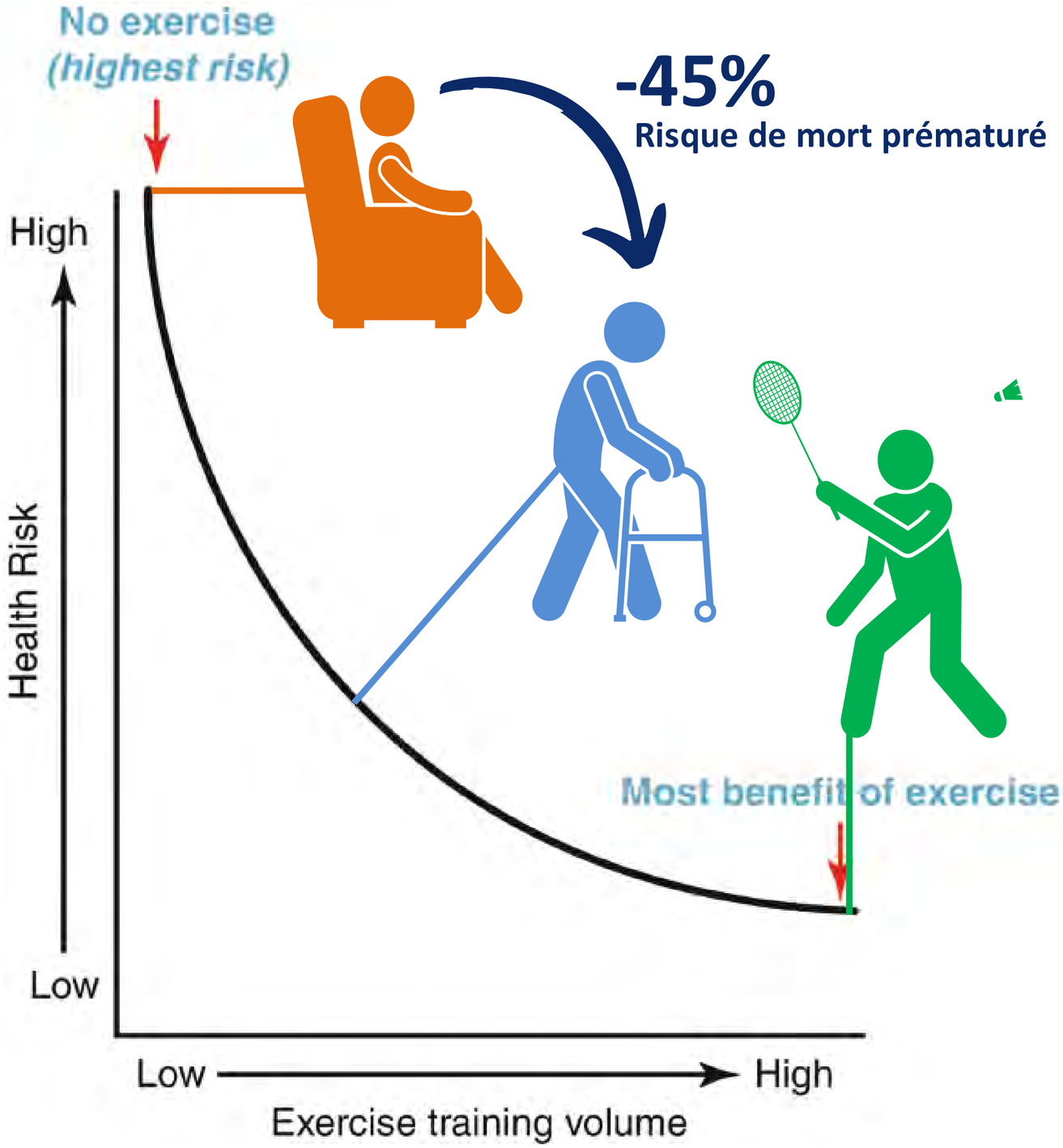
The repercussions associated with T2D are mainly due to poor management of the disease and the presence of co-morbidities rather than T2D per se. In people with T2D, the presence of cardiovascular disease (CVD) and hypertension increases the estimated medical cost by approximately 425% compared to individuals without comorbidity (estimated costs over 3 years: from $10 439 to $44 417; (Gilmer et al. 1997). Similarly, poor glycemic control, high cholesterol levels, and high blood pressure, are all associated with an increase in T2D complications (Hansson et al. 1998; UKPDS 1998; Heart Protection Study Collaborative Group. 1999).



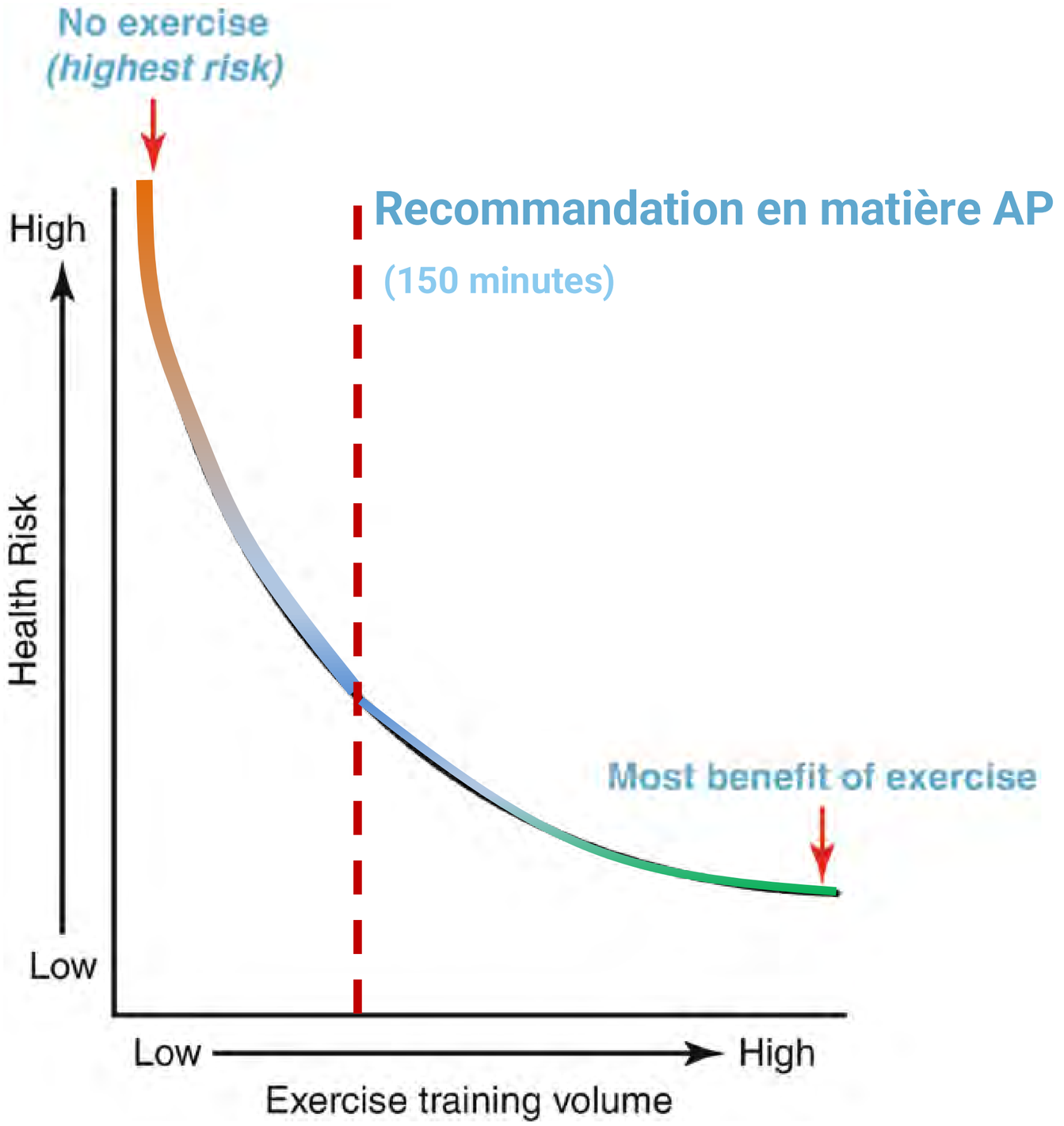
« Peu de gens bénéficient de la multitude de bienfaits qu'apporte l'activité physique »



Donc est-ce que ça veut dire que si je n'atteins pas ces recommandations, je n'en retirerai aucun bénéfice pour la santé ?



Rees-Punia et al., 2019



Faire moins que la recommandation actuelle en matière d'activité physique (150 minutes par semaine) apporte tout de même des bénéfices importants pour votre santé !



Rees-Punia et al., 2019

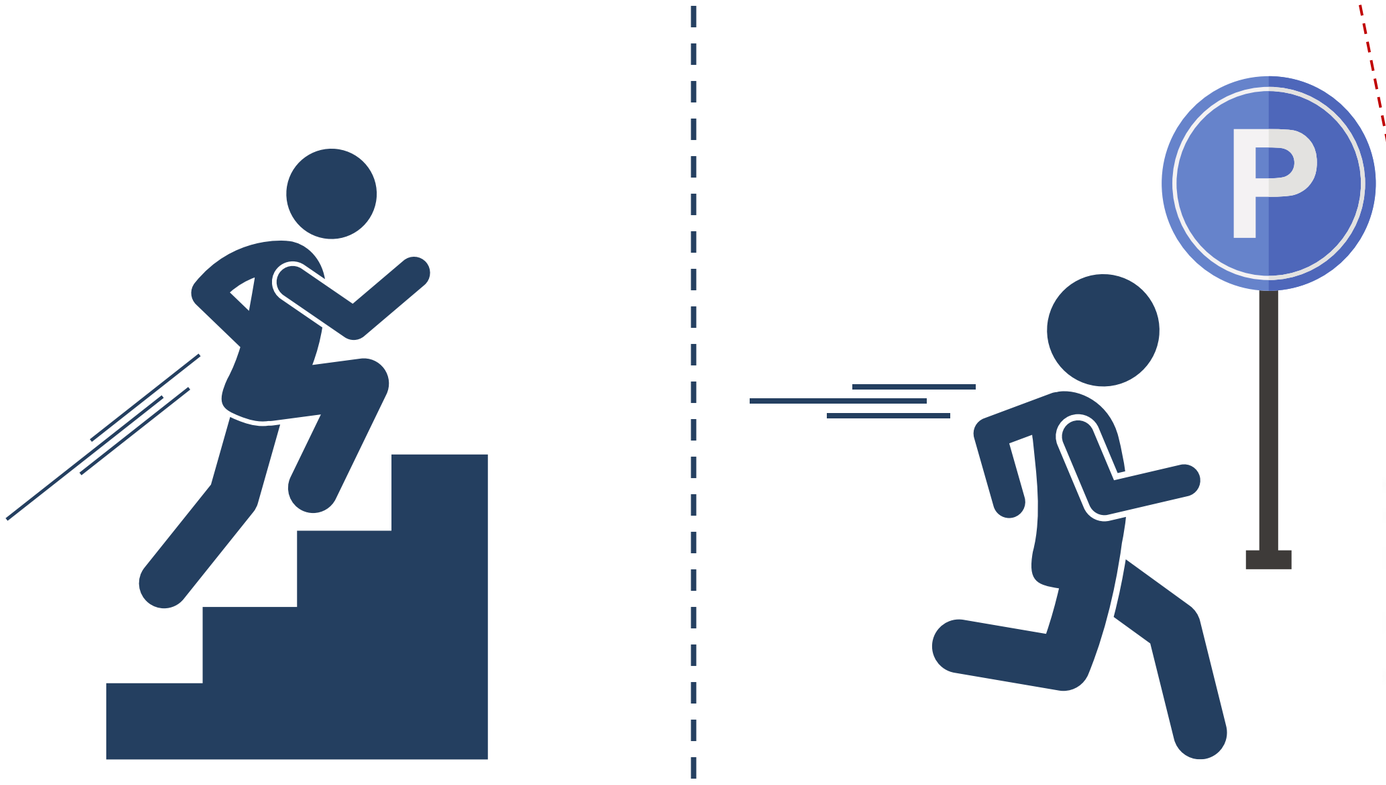
Mais jusqu'où peut-on réduire le volume d'entraînement?

Même de petites quantités d'exercice, si elles sont réalisées à intensité élevée, peuvent apporter des bénéfices pour la santé !





Les « exercise snacks » sont des séances isolées d'exercices d'intensité vigoureuse (≤ 1 min) effectuées sporadiquement durant la journée.



Trust et al., 2002; Hoare et al., 2017

ARTICLE

Exercise Snacks: A Novel Strategy to Improve Cardiometabolic Health

Hashim Islam[1], *Martin J. Gibala*[2], *and Jonathan P. Little*[1]

[1]School of Health and Exercise Sciences, University of British Columbia Okanagan, Kelowna, BC; and [2]Department of Kinesiology, McMaster University, Hamilton, ON, Canada

ISLAM, H., M.J. GIBALA, and J.P. LITTLE. Exercise snacks: a novel strategy to improve cardiometabolic health. *Exerc. Sport Sci. Rev.*, Vol. 50, No. 1, pp. 31–37, 2022. *We define exercise snacks as isolated ≤1-min bouts of vigorous exercise performed periodically throughout the day. We hypothesize that exercise snacks are a feasible, well-tolerated, and time-efficient approach to improve cardiorespiratory fitness and reduce the negative impact of sedentary behavior on cardiometabolic health. Efficacy has been demonstrated in small proof-of-concept studies. Additional research should investigate this novel physical activity strategy.* **Key Words:** maximal oxygen uptake, physical activity, sedentary behavior, exercise intensity, cardiovascular health, metabolic health

Key Points

- A perceived lack of time and access to facilities are commonly cited barriers to regular physical activity.
- Exercise snacks are isolated bouts of vigorous exercise lasting ≤1 min and performed periodically throughout the day.
- Recent small-scale proof-of-concept studies show that exercise snacks can improve cardiorespiratory fitness and indices of cardiometabolic health in previously inactive adults.
- Exercise snacks seem to be well tolerated and can also offset the detrimental effects of prolonged sitting on metabolic outcomes and vascular function.
- The cardiometabolic health benefits of exercise snacks are apparent using both laboratory-based cycling protocols and more practical approaches involving stair climbing, which may increase the likelihood of their adoption in a home-, office-, or school-based setting.
- The feasibility and time efficiency of exercise snacks make them suitable for incorporating in between activities of daily living, thereby alleviating the need for planning and allocating leisure time for structured exercise.

INTRODUCTION

Low cardiorespiratory fitness (CRF) and sedentary behavior (*i.e.*, waking behaviors characterized by an energy expenditure ≤1.5 metabolic equivalents (METs) while in a sitting or reclining posture) (1) are independently associated with increased all-cause mortality and cardiovascular disease risk (2,3). Although the detrimental effects of physical inactivity (*i.e.*, achieving insufficient amounts of weekly moderate-to-vigorous physical activity) (1) are widely recognized, many individuals fail to meet current physical activity guidelines because of a perceived lack of time and barriers accessing equipment and facilities (4,5). Vigorous intermittent exercise including various interventions deemed "high-intensity" and "sprint" interval training (HIIT and SIT, respectively) can enhance CRF and other health-related markers similar to traditional moderate-intensity continuous training (6–9). Although efficacious to improve fitness and health, these protocols typically require dedicated leisure time and can be difficult to implement outside controlled laboratory settings. There also is increasing appreciation for the independent effect of sedentary behavior on cardiometabolic risk (3,10,11) and the benefits of breaking up sedentary time with more frequent bouts of activity throughout the day (12–14).

The application of HIIT/SIT principles to more feasible and accessible forms of exercise that can improve CRF and simultaneously reduce the negative impacts of prolonged sedentary time offers a novel method to enhance health outcomes in the general population. One such strategy involves performing brief isolated bouts of vigorous exercise over the course of the day. This approach, called "exercise snacks," can obviate the requirement for specialized equipment and alleviates the need for planning and allocating leisure time for structured exercise. It can be incorporated in between or structured within activities of daily living and implemented in a home, office, or school setting. An important added benefit of exercise snacks beyond their potential to improve CRF in a practical manner (15) is that they can naturally break up periods of prolonged sitting to reduce sedentary behavior and the associated health consequences (16).

Several recent reports have shown that exercise snacks can boost indices of cardiometabolic health in young inactive adults

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Les « exercise snacks » sont des séances isolées d'exercices d'intensité vigoureuse (≤ 1 min) effectuées sporadiquement durant la journée.



Temps



Équipement

Trust et al., 2002; Hoare et al., 2017

ARTICLE

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Hashim Islam[1], *Martin J. Gibala*[2], *and Jonathan P. Little*[1]

[1]School of Health and Exercise Sciences, University of British Columbia Okanagan, Kelowna, BC; and [2]Department of Kinesiology, McMaster University, Hamilton, ON, Canada

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INTRODUCTION

Low cardiorespiratory fitness (CRF) and sedentary behavior (*i.e.*, waking behaviors characterized by an energy expenditure ≤1.5 metabolic equivalents (METs) while in a sitting or reclining posture) (1) are independently associated with increased all-cause mortality and cardiovascular disease risk (2,3). Although the detrimental effects of physical inactivity (*i.e.*, achieving insufficient amounts of weekly moderate-to-vigorous physical activity) (1) are widely recognized, many individuals fail to meet current physical activity guidelines because of a perceived lack of time and barriers accessing equipment and facilities (4,5). Vigorous intermittent exercise including various interventions deemed "high-intensity" and "sprint" interval training (HIIT and SIT, respectively) can enhance CRF and other health-related markers similar to traditional moderate-intensity continuous training (6–9). Although efficacious to improve fitness and health, these protocols typically require dedicated leisure time and can be difficult to implement outside controlled laboratory settings. There also is increasing appreciation for the independent effect of sedentary behavior on cardiometabolic risk (3,10,11) and the benefits of breaking up sedentary time with more frequent bouts of activity throughout the day (12–14).

The application of HIIT/SIT principles to more feasible and accessible forms of exercise that can improve CRF and simultaneously reduce the negative impacts of prolonged sedentary time offers a novel method to enhance health outcomes in the general population. One such strategy involves performing brief isolated bouts of vigorous exercise over the course of the day. This approach, called "exercise snacks," can obviate the requirement for specialized equipment and alleviates the need for planning and allocating leisure time for structured exercise. It can be incorporated in between or structured within activities of daily living and implemented in a home, office, or school setting. An important added benefit of exercise snacks beyond their potential to improve CRF in a practical manner (15) is that they can naturally break up periods of prolonged sitting to reduce sedentary behavior and the associated health consequences (16).

Several recent reports have shown that exercise snacks can boost indices of cardiometabolic health in young inactive adults

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Les « exercise snacks » sont des séances isolées d'exercices d'intensité vigoureuse (≤ 1 min) effectuées sporadiquement durant la journée.



⇧ Activité physique



Briser sédentarité

Trust et al., 2002; Hoare et al., 2017

ARTICLE

Exercise Snacks: A Novel Strategy to Improve Cardiometabolic Health

Hashim Islam[1], *Martin J. Gibala*[2], *and Jonathan P. Little*[1]

[1]School of Health and Exercise Sciences, University of British Columbia Okanagan, Kelowna, BC; and [2]Department of Kinesiology, McMaster University, Hamilton, ON, Canada

ISLAM, H., M.J. GIBALA, and J.P. LITTLE. Exercise snacks: a novel strategy to improve cardiometabolic health. *Exerc. Sport Sci. Rev.*, Vol. 50, No. 1, pp. 31–37, 2022. *We define exercise snacks as isolated ≤1-min bouts of vigorous exercise performed periodically throughout the day. We hypothesize that exercise snacks are a feasible, well-tolerated, and time-efficient approach to improve cardiorespiratory fitness and reduce the negative impact of sedentary behavior on cardiometabolic health. Efficacy has been demonstrated in small proof-of-concept studies. Additional research should investigate this novel physical activity strategy.* **Key Words:** maximal oxygen uptake, physical activity, sedentary behavior, exercise intensity, cardiovascular health, metabolic health

Key Points

- A perceived lack of time and access to facilities are commonly cited barriers to regular physical activity.
- Exercise snacks are isolated bouts of vigorous exercise lasting ≤1 min and performed periodically throughout the day.
- Recent small-scale proof-of-concept studies show that exercise snacks can improve cardiorespiratory fitness and indices of cardiometabolic health in previously inactive adults.
- Exercise snacks seem to be well tolerated and can also offset the detrimental effects of prolonged sitting on metabolic outcomes and vascular function.
- The cardiometabolic health benefits of exercise snacks are apparent using both laboratory-based cycling protocols and more practical approaches involving stair climbing, which may increase the likelihood of their adoption in a home-, office-, or school-based setting.
- The feasibility and time efficiency of exercise snacks make them suitable for incorporating in between activities of daily living, thereby alleviating the need for planning and allocating leisure time for structured exercise.

INTRODUCTION

Low cardiorespiratory fitness (CRF) and sedentary behavior (*i.e.*, waking behaviors characterized by an energy expenditure ≤1.5 metabolic equivalents (METs) while in a sitting or reclining posture) (1) are independently associated with increased all-cause mortality and cardiovascular disease risk (2,3). Although the detrimental effects of physical inactivity (*i.e.*, achieving insufficient amounts of weekly moderate-to-vigorous physical activity) (1) are widely recognized, many individuals fail to meet current physical activity guidelines because of a perceived lack of time and barriers accessing equipment and facilities (4,5). Vigorous intermittent exercise including various interventions deemed "high-intensity" and "sprint" interval training (HIIT and SIT, respectively) can enhance CRF and other health-related markers similar to traditional moderate-intensity continuous training (6–9). Although efficacious to improve fitness and health, these protocols typically require dedicated leisure time and can be difficult to implement outside controlled laboratory settings. There also is increasing appreciation for the independent effect of sedentary behavior on cardiometabolic risk (3,10,11) and the benefits of breaking up sedentary time with more frequent bouts of activity throughout the day (12–14).

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Applied Physiology, Nutrition, and Metabolism

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Exercise in the workplace: examining the receptivity of practical and time-efficient stair-climbing "exercise snacks"

Matthew J. Stork[a], Alexis Marcotte-Chénard[b,c], Mary E. Jung[a], and Jonathan P. Little[a]

[a]School of Health and Exercise Sciences, The University of British Columbia, Kelowna, BC V1V 1V7, Canada; [b]Faculty of Physical Activity Sciences, University of Sherbrooke, Sherbrooke, QC J1K 2R1, Canada; [c]Research Centre on Aging, CIUSSS de l'Estrie - CHUS, Sherbrooke, QC J1H 4C4, Canada

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Appl. Physiol. Nutr. Metab. Downloaded from cdnsciencepub.com by 142.126.51.114 on 11/02/23

Abstract

In the workplace, people are often sedentary for prolonged time and do not regularly engage in physical activity—two factors independently linked to premature morbidity and mortality. This study aimed to determine the receptivity of incorporating practical stair-climbing "exercise snacks" (Snacks; three isolated bouts of ascending 53–60 stairs performed sporadically throughout the day) into workplace settings compared to more traditional high-intensity interval training (HIIT; performed as three bouts of 53-60 stairs within a structured HIIT workout) and to explore if these exercise strategies could influence sedentary and physical activity behaviour. Fourteen participants (12 women; *M*age = 38.9 ± 10.2 years) completed two supervised exercise trials (Snacks and HIIT) followed by 1 week participating in either form of exercise in their workplace. Ratings of perceived exertion (RPE), affective valence, enjoyment, and self-efficacy were measured at the supervised exercise sessions. During the follow-up period, sedentary behaviour and physical activity were measured with an accelerometer. Affective valence was more positive ($p = 0.03$; $\eta^2p = 0.21$) and there was a lower rise in RPE ($p = 0.01$; $\eta^2p = 0.29$) during Snacks than HIIT. Post-exercise enjoyment of, and self-efficacy towards, Snacks and HIIT were high and similar ($ps > 0.05$). After the supervised trials, 10/14 of the participants preferred Snacks and 4/14 preferred HIIT ($p = 0.18$). On days when participants chose to perform either exercise modality, the average number of sit-to-stands in a 24 h period was increased (48.3 ± 8.7 to 52.8 ± 7.8; $p = 0.03$; Hedge's $g = 0.73$) and moderate-to-vigorous physical activity tended to increase (21.9 ± 18.2 to 38.1 ± 22.1 min; $p = 0.06$; Hedge's $g = 0.60$) compared to days when they chose not to exercise. Stair-climbing exercise snacks may be an attractive approach to implement in the workplace setting and has potential to positively impact sedentary behaviour and physical activity metrics.

Key words: exercise snacks, workplace, physical activity, stair climbing, interval exercise

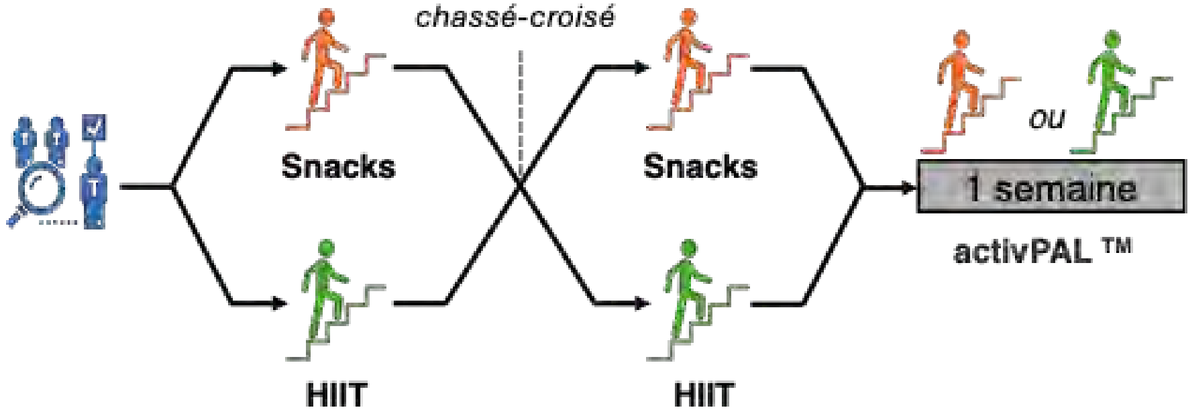
Introduction

Lack of physical activity is one of the leading causes of mortality worldwide causing more than 3.2 million deaths every year (WHO 2009, 2020; Ross et al. 2020). The healthcare system is also heavily impacted by physical inactivity, with a global conservative estimated cost of 53.8 billion dollars in 2013 (Ding et al. 2016). Unfortunately, more than 30% of adults worldwide are physically inactive and this prevalence is much higher in the Americas with around 43% of individuals not meeting the physical activity recommendations (Hallal et al. 2012). Several barriers could explain this low percentage of engagement in regular exercise, with some of the most common being a perceived lack of time and inaccessibility to equipment and facilities (Trost et al. 2002; Hoare et al. 2017). In addition to physical inactivity, sedentary behaviour has also been associated with an increased risk of cardiovascular disease and mortality, independently of physical activity level (Biswas et al. 2015). Therefore, time-efficient strategies that increase physical activity, which do not require any equipment and can simultaneously interrupt prolonged sedentary behaviour, hold promise to reduce mortality risk and healthcare costs.

In this context, the workplace seems to be a suitable environment for the implementation of time-sensitive strategies because people tend to be sedentary for prolonged periods of time and do not regularly engage in physical activity during the working hours (Bailey 2021). Breaking up prolonged sitting time with brief bouts of light-intensity activity has been shown to lower postprandial glucose and insulin levels in lab-based studies (Dunstan et al. 2012; Henson et al. 2016). In contrast, traditionally prescribed moderate-intensity continuous exercise training may be impractical for many office employees who are unfit and short on time (Malik et al. 2014). Interventions aimed at increasing physical activity in the

Exercice sur le milieu de travail

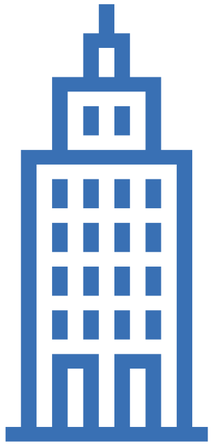






60 marches, 3 fois durant la journée (9am-Midi-2pm)

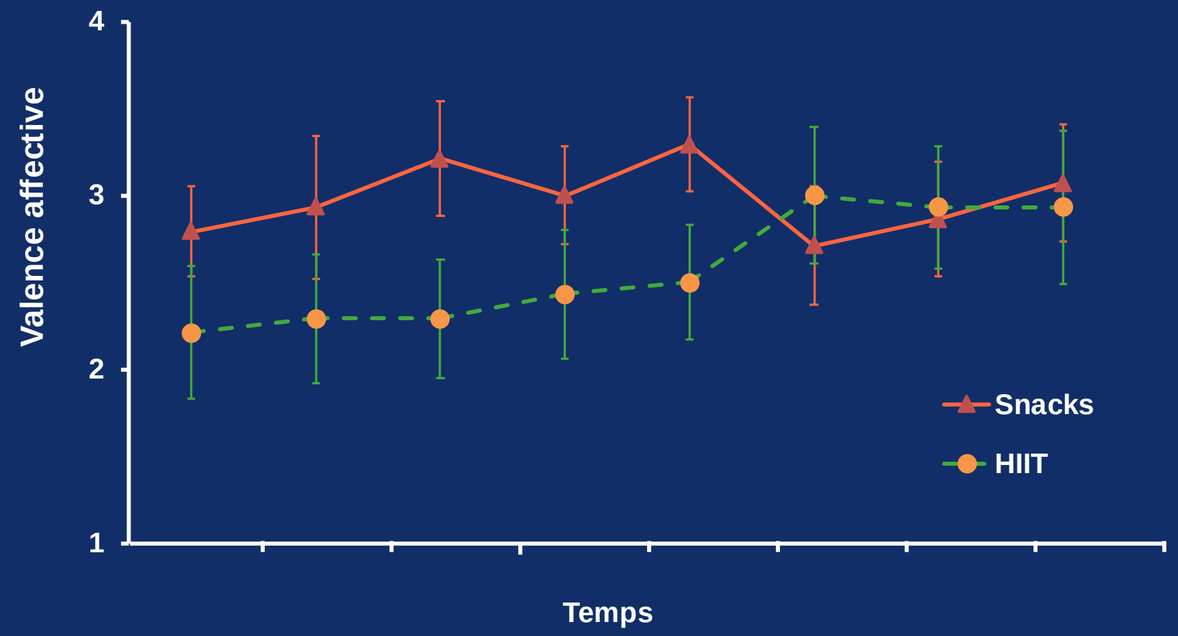
Snacks

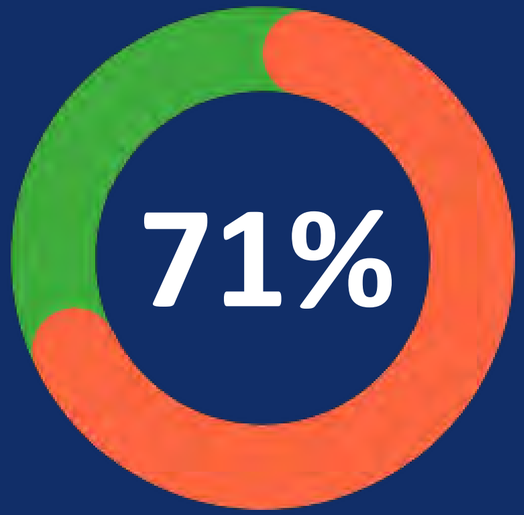




3 x 60 marches en une seule séance (9am)

HIIT

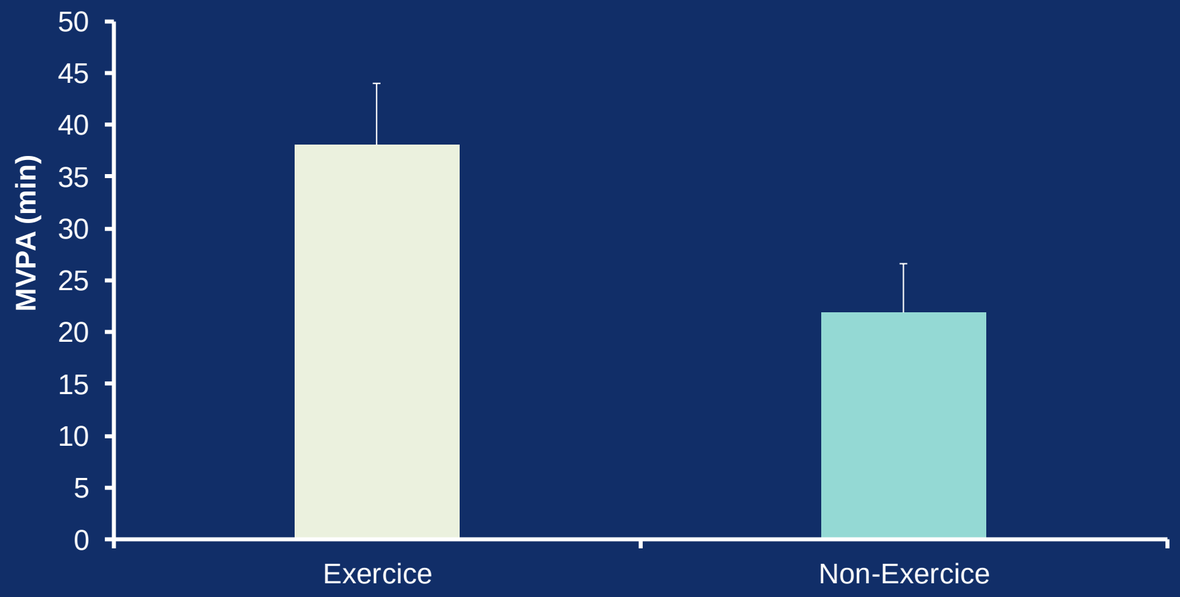




71% des gens ont préféré les snack plutôt que le HIIT

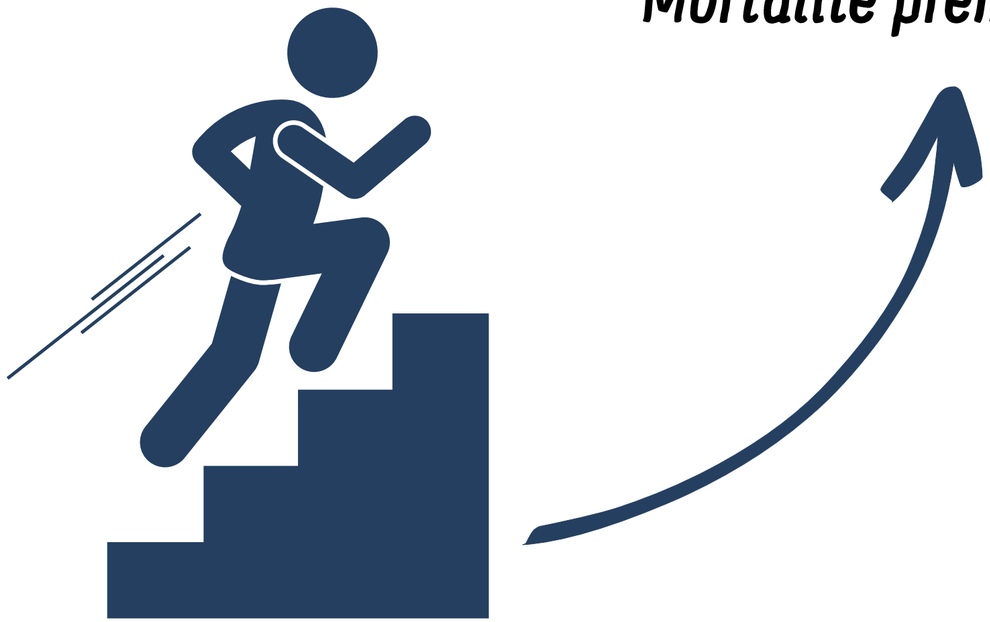


Sentiment d'auto-efficacité





Mortalité prématurée



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Article

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Association of wearable device-measured vigorous intermittent lifestyle physical activity with mortality

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Check for updates

Emmanuel Stamatakis[1], Matthew N. Ahmadi[1], Jason M. R. Gill[2], Cecilie Thøgersen-Ntoumani[3], Martin J. Gibala[4], Aiden Doherty[5] & Mark Hamer[6]

Wearable devices can capture unexplored movement patterns such as brief bursts of vigorous intermittent lifestyle physical activity (VILPA) that is embedded into everyday life, rather than being done as leisure time exercise. Here, we examined the association of VILPA with all-cause, cardiovascular disease (CVD) and cancer mortality in 25,241 nonexercisers (mean age 61.8 years, 14,178 women/11,063 men) in the UK Biobank. Over an average follow-up of 6.9 years, during which 852 deaths occurred, VILPA was inversely associated with all three of these outcomes in a near-linear fashion. Compared with participants who engaged in no VILPA, participants who engaged in VILPA at the sample median VILPA frequency of 3 length-standardized bouts per day (lasting 1 or 2 min each) showed a 38%–40% reduction in all-cause and cancer mortality risk and a 48%–49% reduction in CVD mortality risk. Moreover, the sample median VILPA duration of 4.4 min per day was associated with a 26%–30% reduction in all-cause and cancer mortality risk and a 32%–34% reduction in CVD mortality risk. We obtained similar results when repeating the above analyses for vigorous physical activity (VPA) in 62,344 UK Biobank participants who exercised (1,552 deaths, 35,290 women/27,054 men). These results indicate that small amounts of vigorous nonexercise physical activity are associated with substantially lower mortality. VILPA in nonexercisers appears to elicit similar effects to VPA in exercisers, suggesting that VILPA may be a suitable physical activity target, especially in people not able or willing to exercise.

Physical activity is associated with reduced mortality risk[1], and reduced risk of CVD[1] and certain cancers[2–4]. Recently updated guidelines[4,5], based mostly on questionnaire-derived evidence, recommend 150–300 min of moderate-intensity activity or 75–150 min of vigorous-intensity physical activity (≥6 metabolic equivalents) per week. New emphasis is placed on 'all activity counts' occurring across all life domains and regardless of bout duration. This recommendation contrasts with previous guidelines[6,7] that did not recognize the health value of physical activity bouts

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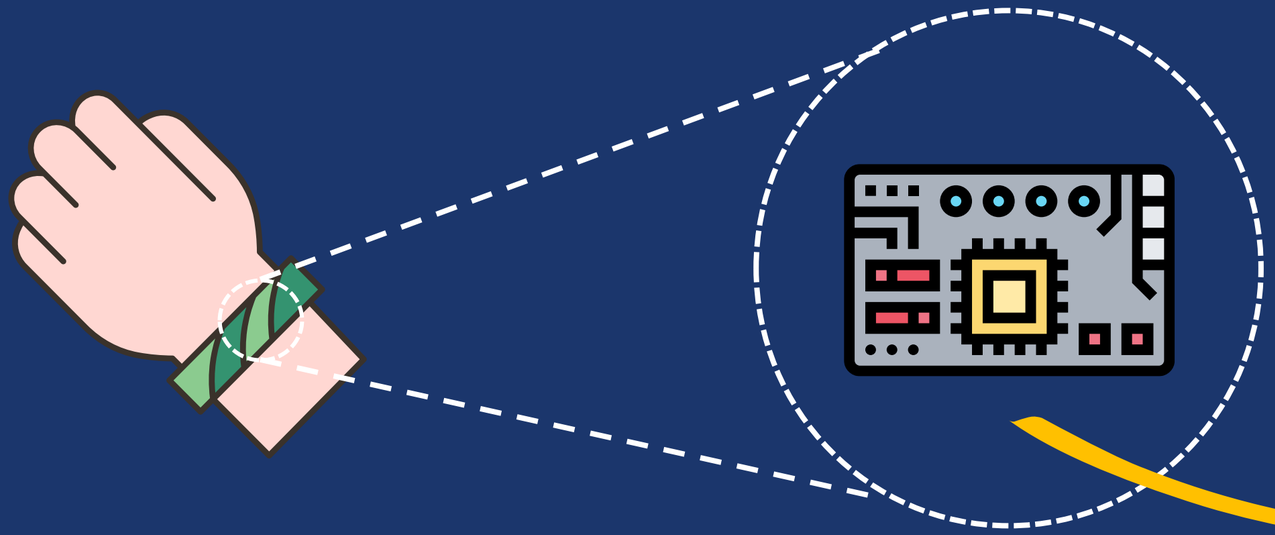


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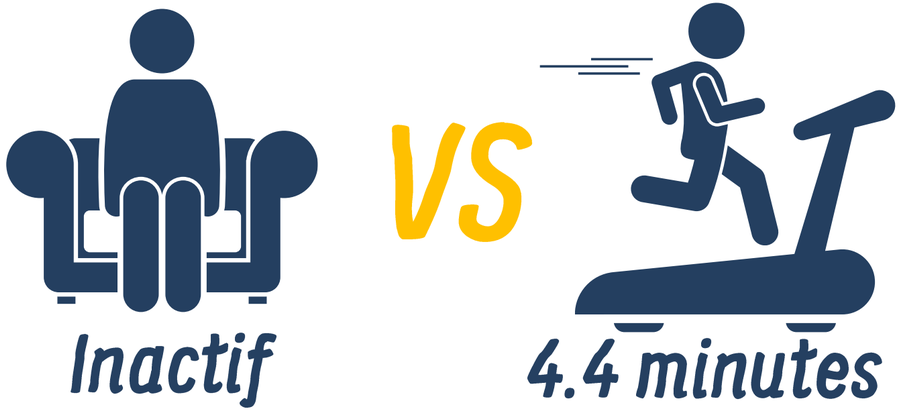
7 ans

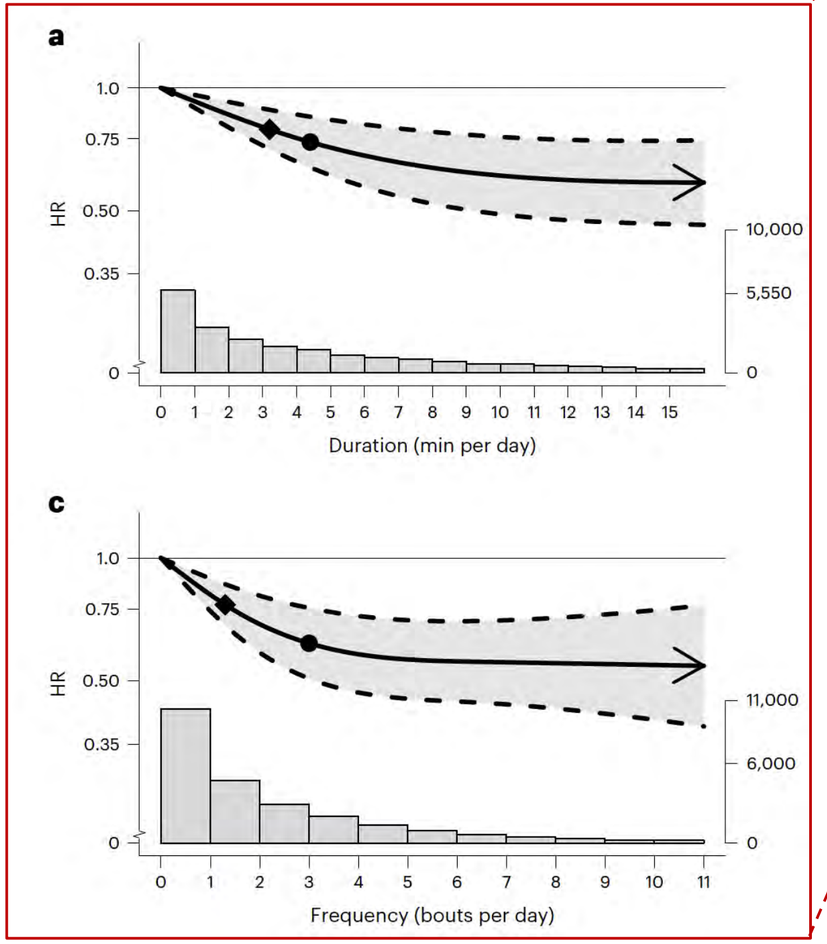
2006

2013



Niveau d'activité physique





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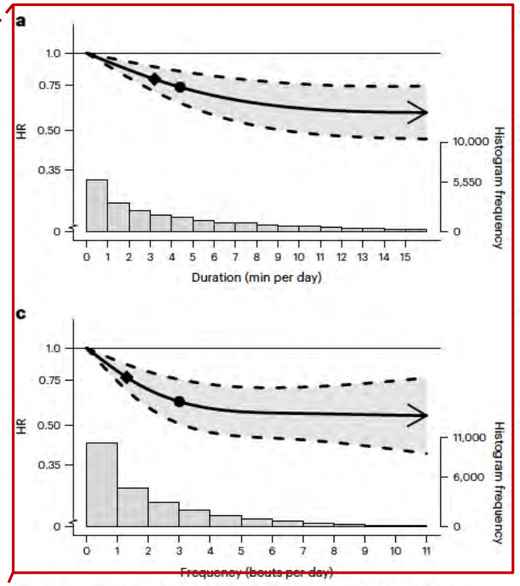


Fig. 2 | Association of the daily duration and frequency of VILPA with all-cause mortality. a,**b**, Dose–response curves showing all-cause mortality HR associated with increasing daily duration of VILPA, for bouts of VILPA up to 1 min (**a**) and 2 min (**b**) in duration. **c**,**d**, Dose–response curves showing all-cause mortality HR associated with increasing daily frequency of VILPA, for length-standardized bouts of VILPA 1 min (**c**) and 2 min (**d**) in duration. Data are shown for $n = 25{,}241$ participants with 852 events and with a mean follow-up of 6.9 (0.8) years. Diamond, minimal dose, as indicated by the ED_{50} statistic which estimates the daily duration/frequency of VILPA associated with 50% of optimal risk reduction. Circle, HR associated with the median VILPA value (see Supplementary Table 4 for the list of values). Data are adjusted for the covariates listed in the online Methods. The shaded region demarcated by dashed lines represents the 95% CI. The solid line that lies within the shaded region represents the HR. The arrowhead represents the absence of an observed inflection point (for example, larger risk reduction with higher amounts of VILPA). The histogram on the right shows the sample distribution.

0.78 (95% CI 0.70, 0.86). The median and maximum VILPA volumes for bouts lasting up to 1 min were associated with a HR of 0.73 (0.63,0.85) and 0.59 (0.46, 0.74). All-cause mortality findings for bouts lasting up to 2 min were similar in terms of the dose–response curves (Fig. 2b,d), the minimal dose values and the magnitude of the associations linked to the median and maximum VILPA daily duration and frequency (Supplementary Table 4A).

Associations of VILPA with CVD mortality

The beneficial associations found in the CVD mortality multivariable-adjusted analyses were more pronounced than the all-cause mortality findings for both bout lengths (Fig. 3a–d and Supplementary Table 4B). For example, the minimum frequency dose for length-standardized VILPA bouts lasting 1 min was 1.4 bouts per day corresponding to a HR of 0.67 (95% CI 0.52, 0.86), and the median and maximum VILPA frequency were associated with a HR of 0.51 (0.35, 0.74) and 0.35 (0.15, 0.81), respectively. The minimal CVD mortality daily duration dose for VILPA bouts lasting up to 1 min was 3.4 min per day corresponding to a HR of 0.73 (95% CI 0.58, 0.91). The median and maximum VILPA daily duration values were associated with a HR of 0.66 (0.50, 0.88) and 0.45 (0.29, 0.72), respectively. CVD mortality findings for bouts lasting up to 2 min were very similar in terms of the dose–response curves (Fig. 3b,d) and all other metrics (Supplementary Table 4B).

Associations of VILPA with cancer mortality

The findings of the cancer mortality multivariable-adjusted analyses were very consistent with the equivalent all-cause mortality analyses outlined above, in terms of both the dose–response curves (Fig. 4a–d) and the point estimates associated with the minimum dose and the median and maximum VILPA frequency and daily duration values (Supplementary Table 4C). For example, the minimum frequency dose for length-standardized VILPA bouts lasting 1 min was 1.5 bouts per day corresponding to a HR of 0.75 (95% CI 0.63, 0.88). The minimal cancer mortality daily duration dose for VILPA bouts lasting up to 1 min was 3.4 min per day corresponding to a HR of 0.76 (95% CI 0.66, 0.87), whereas the median and maximum VILPA daily duration values were associated with a HR of 0.70 (0.59, 0.84) and 0.51 (0.38, 0.69). Like the other two mortality outcomes, cancer mortality findings for bouts lasting up to 2 min were very similar to bouts lasting up to 1 min across all metrics (Fig. 4a–d and Supplementary Table 4C).

Sensitivity analyses

Excluding participants with poor health ($n = 1{,}223$) and additionally adjusting for body mass index (Extended Data Figs. 1–3) did not appreciably change the results.

E-values indicated that for our estimates to be null the association of an unmeasured confounder with exposures and mortality should be a HR (lower 95% CI) of 1.87 (1.54) to 3.26 (2.12) for all-cause mortality; 2.10 (1.44) to 5.16 (1.77) for CVD mortality; or 1.97 (1.56) to 3.50 (2.00) for cancer mortality (Supplementary Table 5).

Categorical analyses of VILPA daily duration (Extended Data Fig. 4a,b) and frequency (Extended Data Fig. 4c,d) by VILPA tertile-based groups produced results consistent with the main dose–response analyses. Similarly, restricting analyses to those who reported no



https://doi.org/10.1038/s41591-022-02100-x

Fig. 2 | Association of the daily duration and frequency of VILPA with all-cause mortality. a,**b**, Dose–response curves showing all-cause mortality HR associated with increasing daily duration of VILPA, for bouts of VILPA up to 1 min (**a**) and 2 min (**b**) in duration. **c**,**d**, Dose–response curves showing all-cause mortality HR associated with increasing daily frequency of VILPA, for length-standardized bouts of VILPA 1 min (**c**) and 2 min (**d**) in duration. Data are shown for $n = 25{,}241$ participants with 852 events and with a mean follow-up of 6.9 (0.8) years. Diamond, minimal dose, as indicated by the ED_{50} statistic which estimates the daily duration/frequency of VILPA associated with 50% of optimal risk reduction. Circle, HR associated with the median VILPA value (see Supplementary Table 4 for the list of values). Data are adjusted for the covariates listed in the online Methods. The shaded region demarcated by dashed lines represents the 95% CI. The solid line that lies within the shaded region represents the HR. The arrowhead represents the absence of an observed inflection point (for example, larger risk reduction with higher amounts of VILPA). The histogram in the right shows the sample distribution.

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The… neficial associations found… multi… iable-adjusted analyses were … all-… mortality findings for both bou… ple… tary Table 4B). For example, the m… len… standardized VILPA bouts lasting … co… ponding to a HR of 0.67 (95% CI 0.5… …imum VILPA frequency were associate… (0.35 (0.15, 0.81), respectively. The minim… …ily daily dura… …on dose for VILPA bouts lasting up to 1 m… …per day corre… …sponding to a HR of 0.73 (95% CI 0.58, 0.91… …and maximum VILPA daily duration values were associated … …66 (0.50, 0.88) and 0.45 (0.29, 0.72), respectively. CVD mortality findings for bouts lasting up to 2 min were very similar in terms of the dose–response curves (Fig. 3b,d) and all other metrics (Supplementary Table 4B).

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Metabolic Effect of Breaking Up Prolonged Sitting with Stair Climbing Exercise Snacks

HOSSEIN RAFIEI[1], KOSAR OMIDIAN[2], ÉTIENNE MYETTE-CÔTÉ[1], and JONATHAN PETER LITTLE[1]

[1]School of Health and Exercise Sciences, University of British Columbia, Okanagan Campus, Kelowna, British Columbia, CANADA; and [2]College of Pharmacy and Nutrition, University of Saskatchewan, Saskatoon, Saskatchewan, CANADA

ABSTRACT

RAFIEI, H., K. OMIDIAN, É. MYETTE-CÔTÉ, and J. P. LITTLE. Metabolic Effect of Breaking Up Prolonged Sitting with Stair Climbing Exercise Snacks. *Med. Sci. Sports Exerc.*, Vol. 53, No. 1, pp. 150–158, 2021. **Purpose:** Prolonged sitting is associated with cardiometabolic complications. The study purpose was to investigate whether breaking up prolonged sitting with brief stair climbing exercise "snacks" could lower postprandial insulin, glucose, and free fatty acids responses. **Methods:** In two separate randomized crossover studies, 12 young healthy-weight men (study 1) and 11 adults with overweight/obesity (OW; study 2) completed two experimental conditions: i) sedentary (SED; 9-h sitting) and ii) stair climbing snacks (SS; 8 × 15–30 s once per hour). The same high-glycemic index meals were consumed at 0, 3, and 6 h at each condition. The primary outcome was total insulin area under the curve (AUC) across 9 h. **Results:** In healthy-weight men, there were no significant differences between SS and SED for total (9-h) insulin AUC ($P = 0.24$, $d = 0.4$), total glucose AUC ($P = 0.17$, $d = 0.48$), total nonesterified fatty acid (NEFA) AUC ($P = 0.22$, $d = 0.4$), or total triglyceride AUC ($P = 0.72$). In adults with OW, total insulin AUC (−16.5%, $P = 0.036$, $d = 0.94$) and total NEFA AUC (−21%, $P = 0.016$, $d = 1.2$) were significantly lower in SS versus SED. No differences were found for total glucose and triglyceride AUC (all, $P > 0.31$) in participants with OW. **Conclusions:** Breaking up 9 h of prolonged sitting with hourly brief stair climbing exercise snacks lowered postprandial insulin and NEFA levels in adults with overweight/obesity. **Key Words:** STAIR CLIMBING, BRIEF INTENSE EXERCISE, POSTPRANDIAL METABOLISM, INSULIN RESISTANCE, INTERVAL TRAINING, INTERMITTENT EXERCISE

Representing the lowest end of the physical activity spectrum, sedentary behavior is formally defined as any waking behavior with an energy expenditure of ≤1.5 metabolic equivalents during sitting or reclining posture (1). Sedentary behavior is associated with impaired metabolism and increased cardiometabolic-related morbidity and mortality (reviewed in reference 2). Sedentary lifestyle is a known risk factor for comorbidities and mortality irrespective of physical activity level (3). In young healthy people, sedentary behaviors have been shown to cause a substantial increase in the amount of insulin required to clear infused glucose (4). Postprandial glucose (5), insulin (6), and triglycerides (TG) (7) are linked to risk of cardiovascular disease (CVD) morbidity and mortality. Such evidence warrants investigating novel interventions for interrupting prolonged sitting and targeting postprandial insulinemic, glycemic, and lipidemic responses that could decrease CVD risk. Studies report that reducing sedentary time and breaking up prolonged sitting improve markers of cardiometabolic health (reviewed in reference 8). For example, breaking up prolonged sitting every 20–30 min with 2- to 5-min light-moderate walks (9,10) decreases postprandial glycemia and insulin. The health benefits of such interventions are particularly attractive for individuals who are overweight or obese who often display insulin resistance and are at higher risk of developing type 2 diabetes (T2D) (11).

Accumulating evidence suggests that vigorous-intensity exercise may be particularly effective to promote health by improving cardiorespiratory fitness (12), increasing fat loss, and reducing cardiometabolic risk (13). Low-volume sprint interval training, involving repeated short (10–30 s) "all-out" exercise bouts interspersed by periods of recovery, is often regarded as the most time-efficient alternative for traditional endurance exercise (14,15). Studies report that as few as two to three, 20-s cycling sprints performed as part of a 10-min workout, three times a week over 6–12 wk, can improve fitness, insulin sensitivity, and glucose control (16,17). Recently, the concept of "sprint snacks" —whereby brief isolated bursts of exercise lasting ~20 s are performed with hours of rest in between—has emerged. Sprint snacks performed as three individual 20-s cycling sprints (18) or ~20-s stair climbing efforts (19) with 1- to 4-h rest in between has been shown to be effective at increasing cardiorespiratory fitness in inactive adults. Whether breaking up prolonged sitting with sprint exercise

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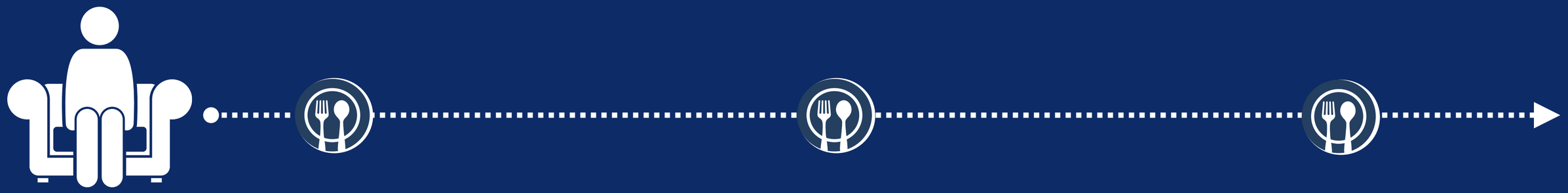
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Briser la sédentarité grâce aux Snacks d'Exercice

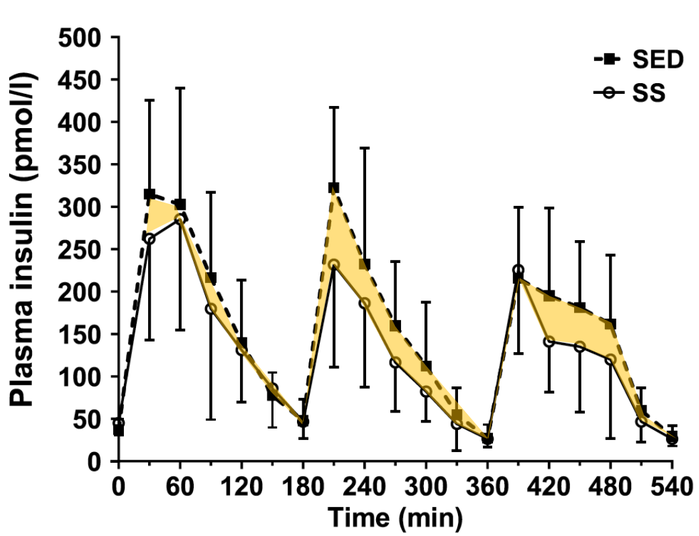


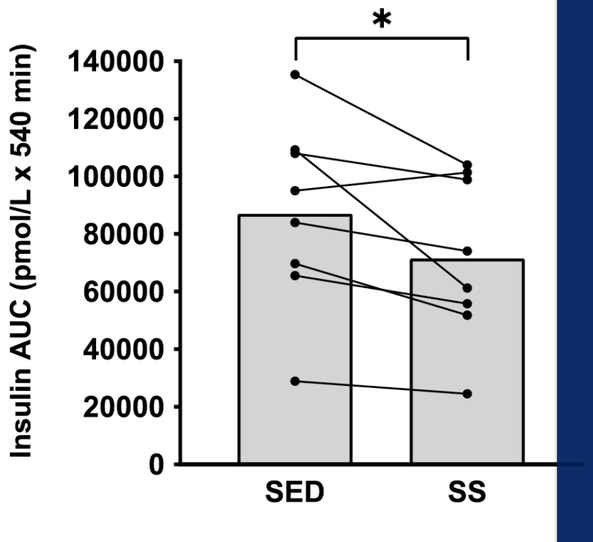
9 heures

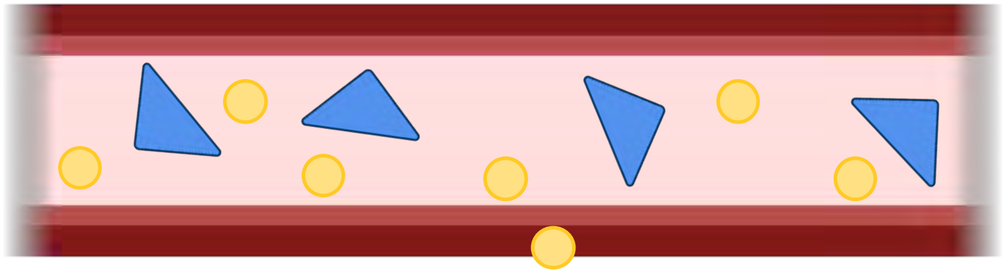


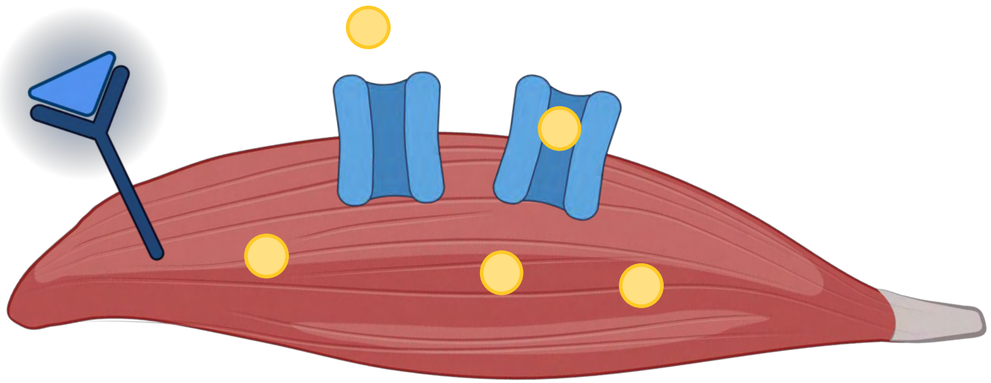
2 minutes de montée de marche à chaque heure

Insuline





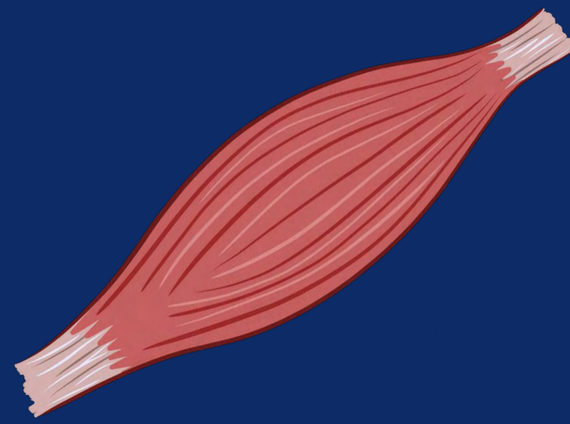






Snacks d'Exercice





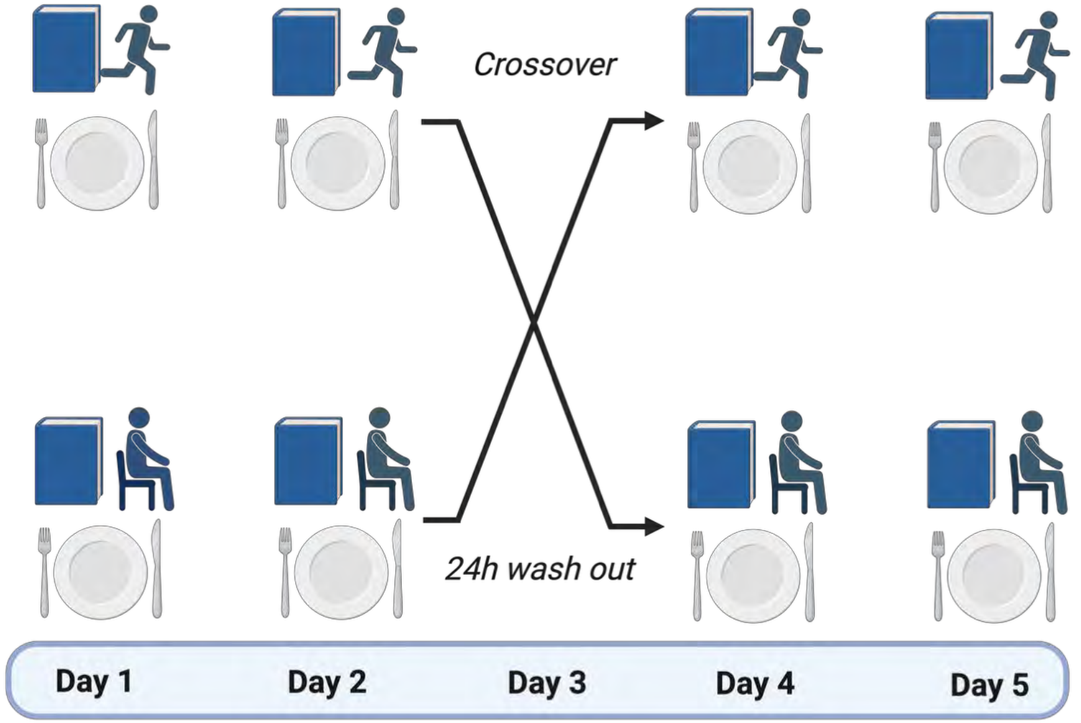
↑ Contrôle glycémique

DIABETES CANADA



31 adultes avec DT2

(Babir et al., Diabetologia 2026)





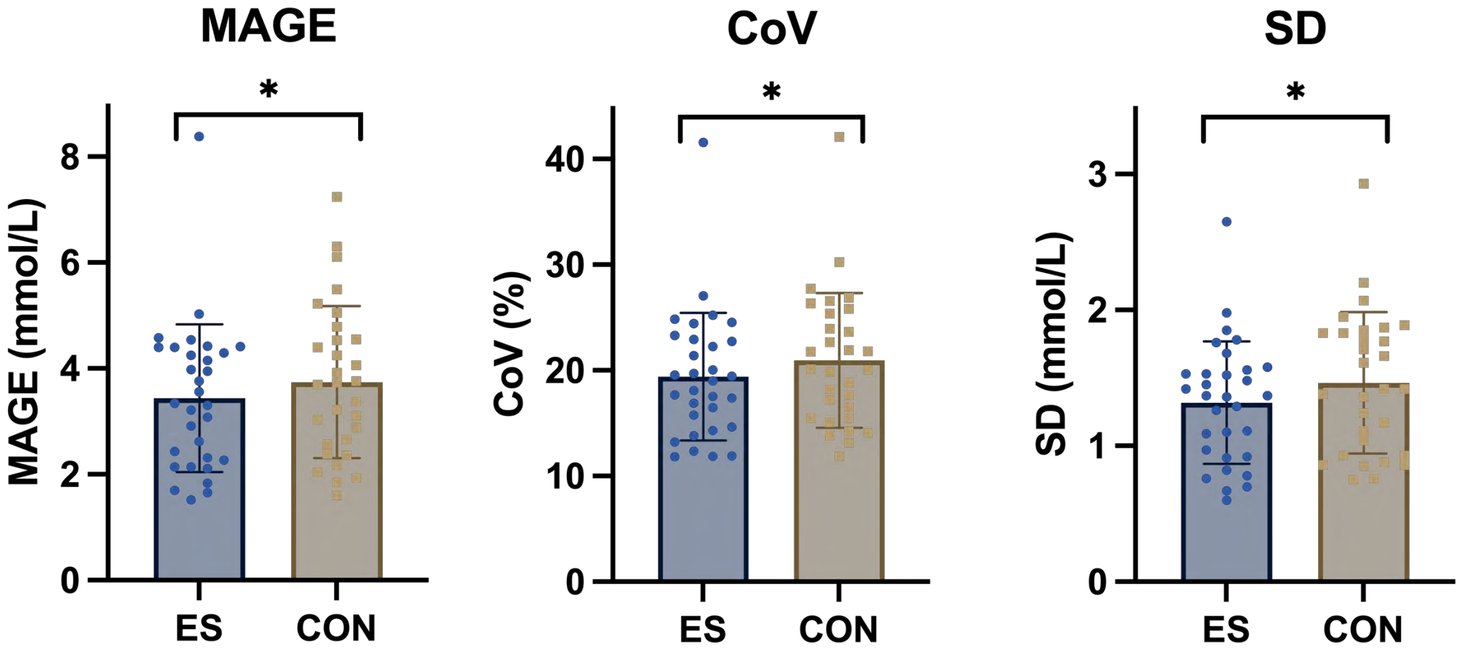
ES: Exercise Snacks
(4 x 1 min / jour)

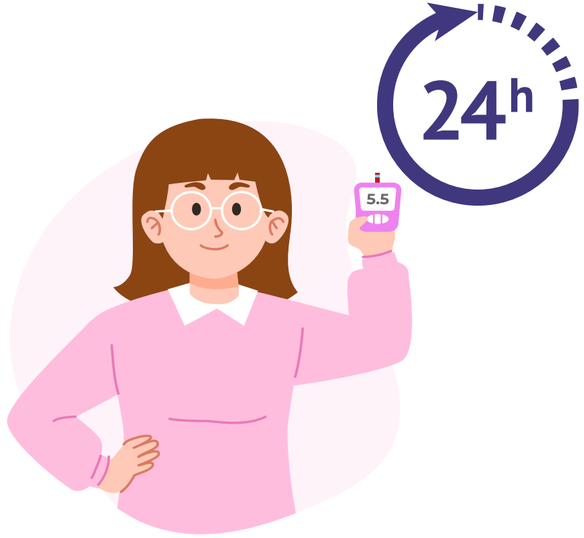




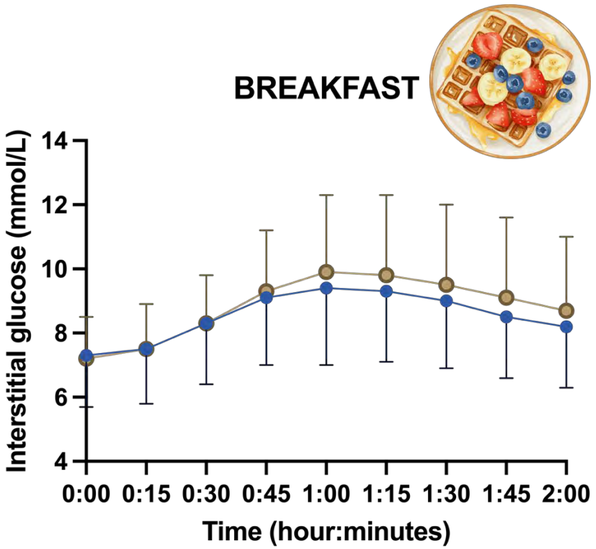


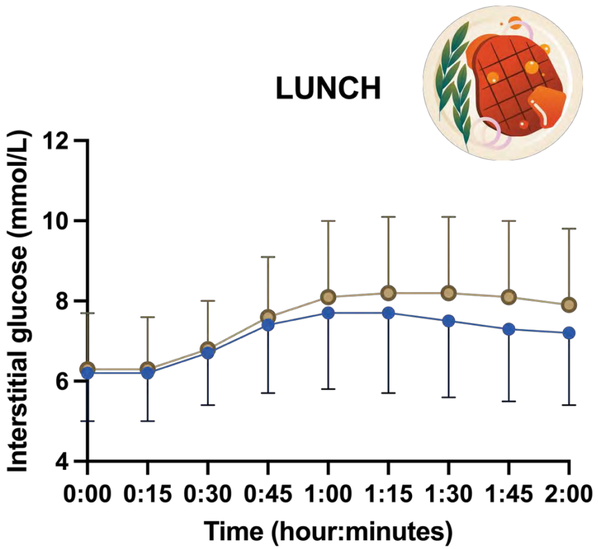
CON: Control
« AVQ »

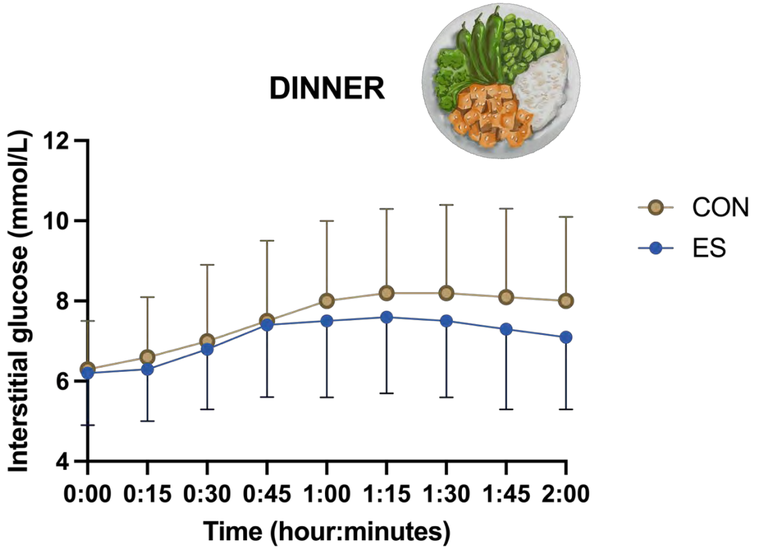


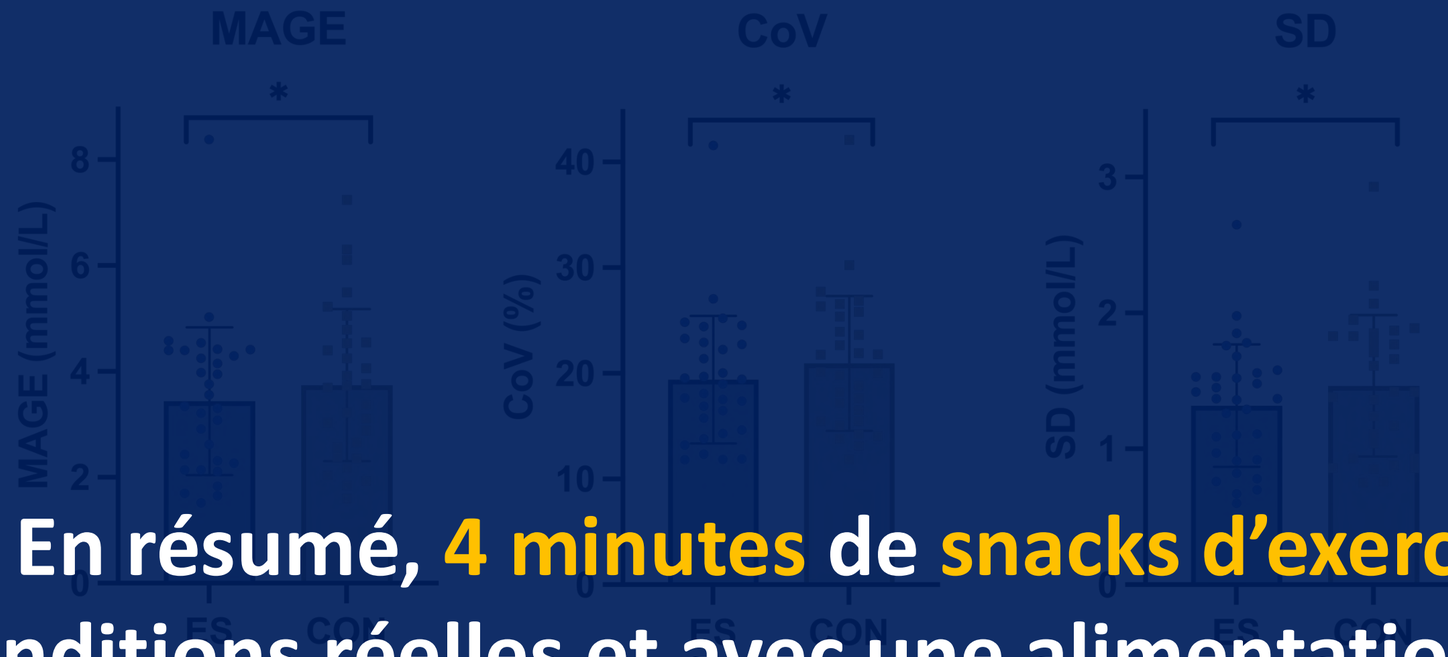


Diurnal= -0.36 mmol/L (p= 0.02)



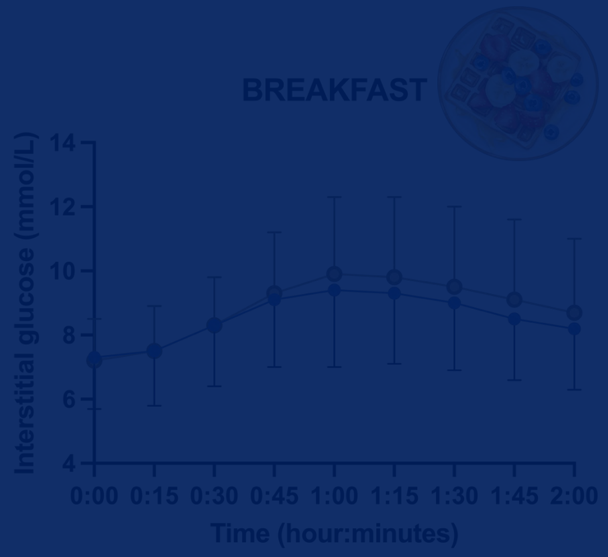


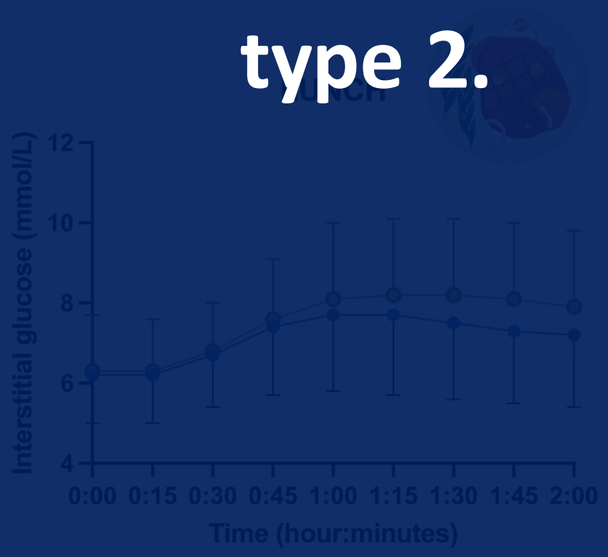






En résumé, 4 minutes de snacks d'exercice par jour, réalisés en conditions réelles et avec une alimentation contrôlée, améliorent la régulation glycémique chez des adultes vivant avec un diabète de type 2.









VS



Quelle est la contribution de l’intensité de l’exercice à cette réponse hypoglycémiante?

Évaluer la faisabilité des «*Exercise Snacks*» dans un contexte de vie réel chez les individus vivant avec le diabète de type 2

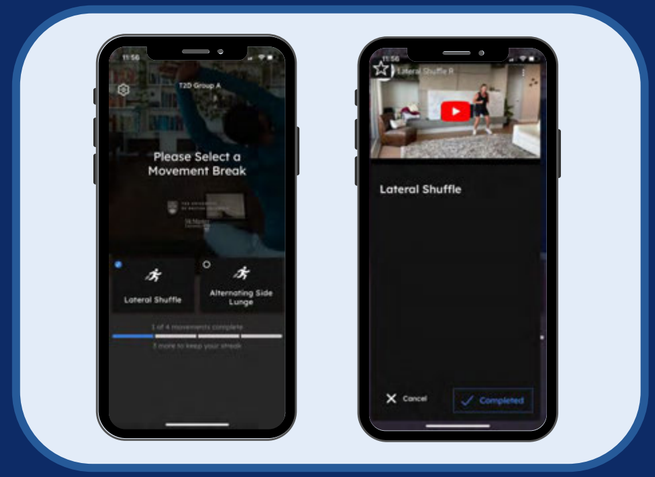




Diabète type 2 (n= 80)



Ex Snacks





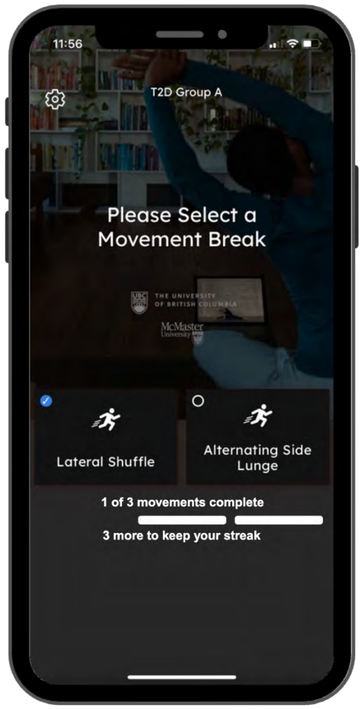
Étirements

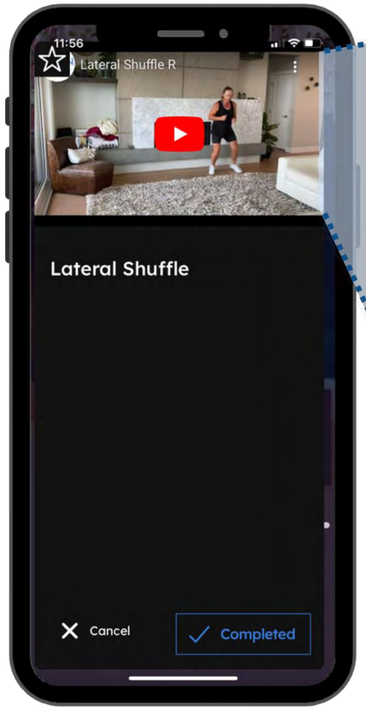


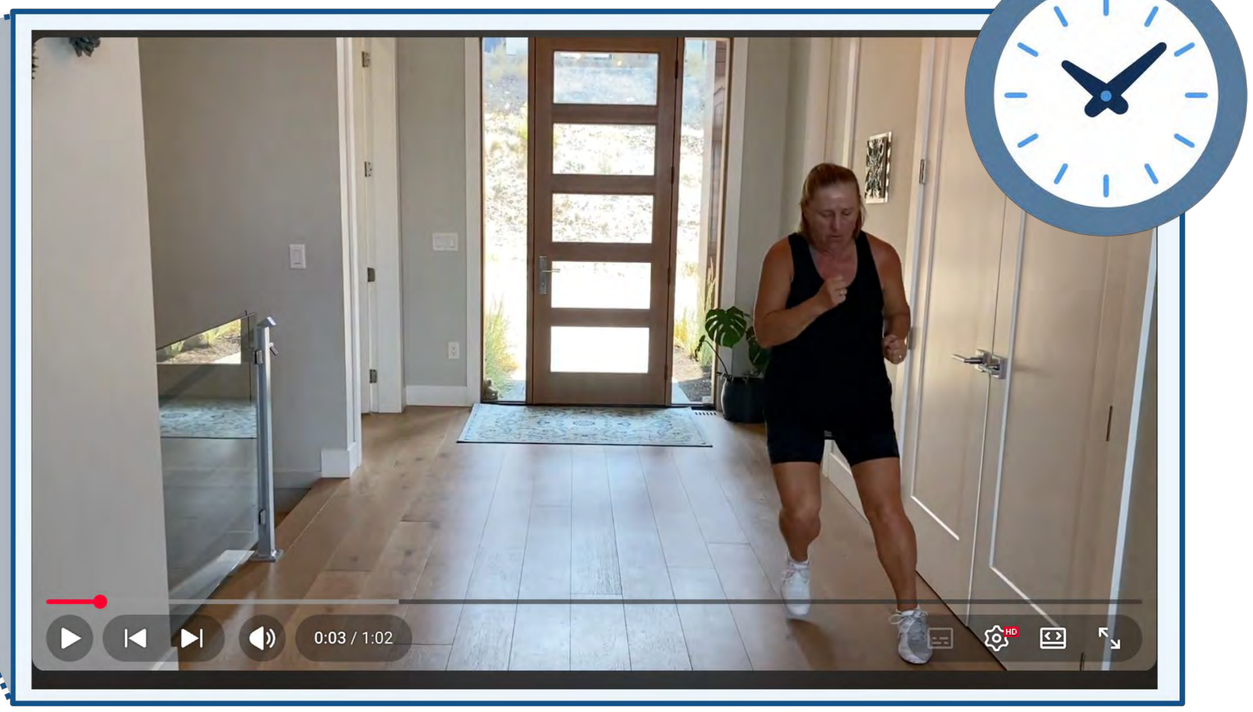
≥14-20 / semaine



Faisabilité









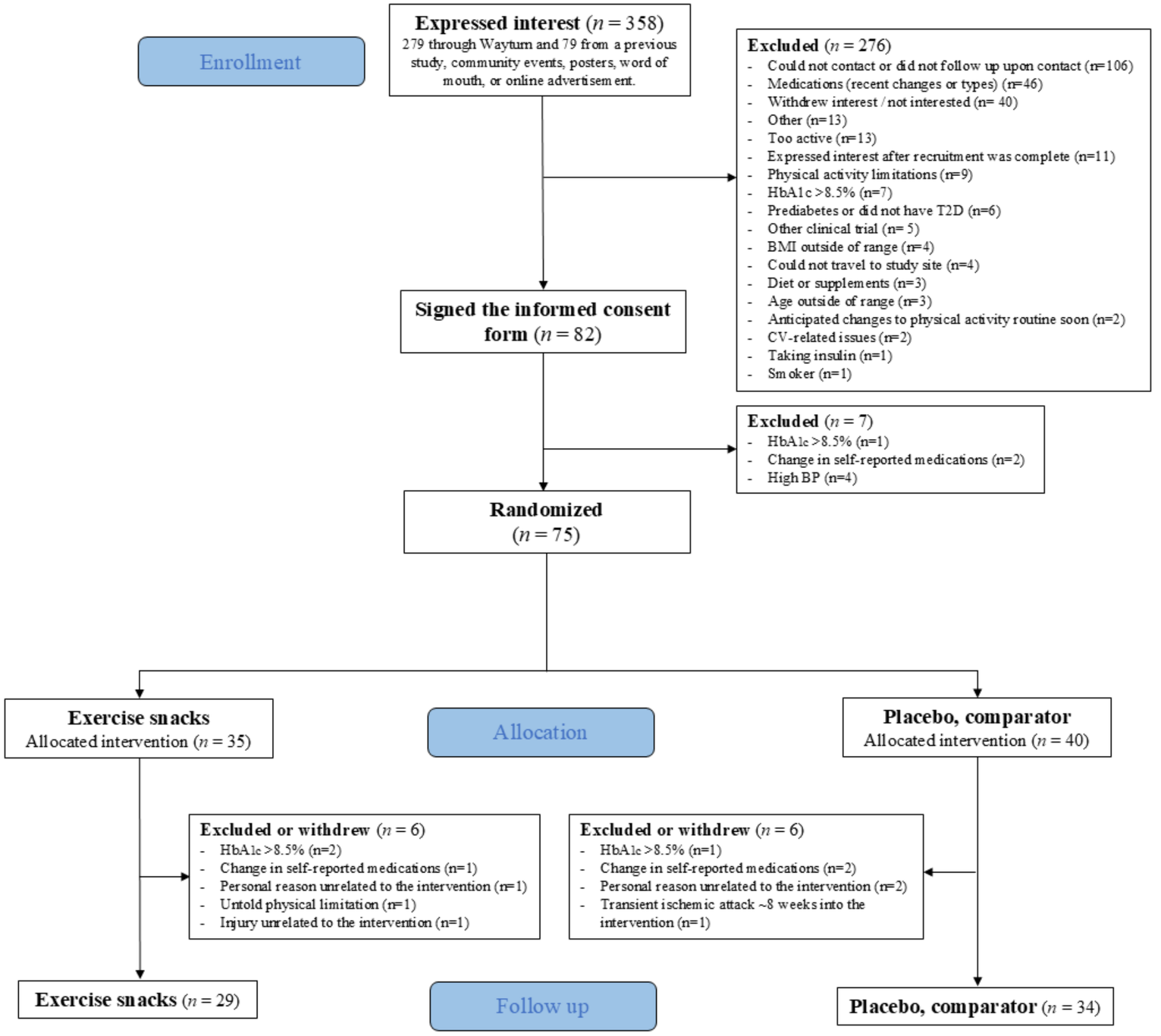
Échelle de Borg

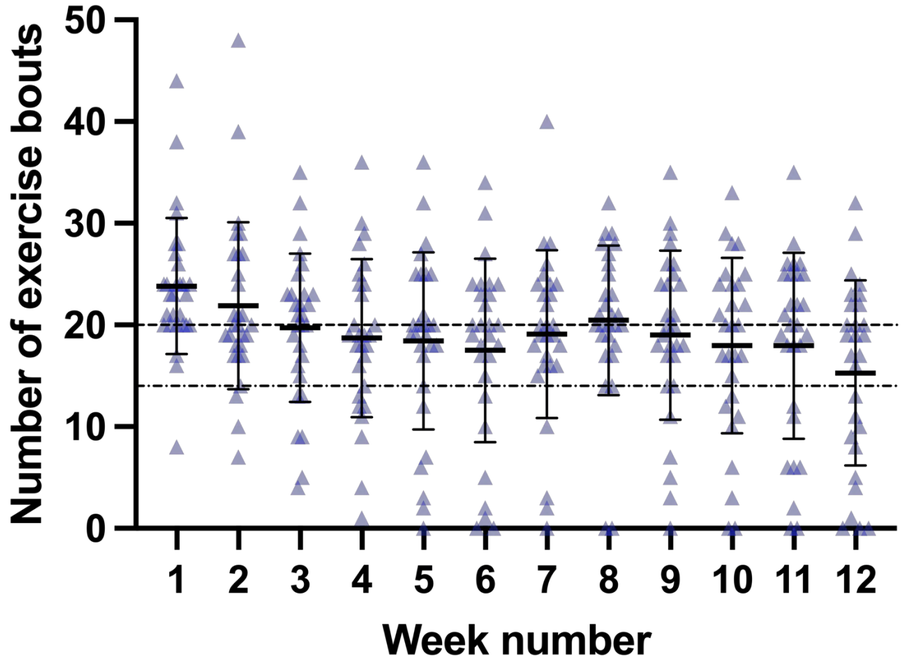


Valence affective



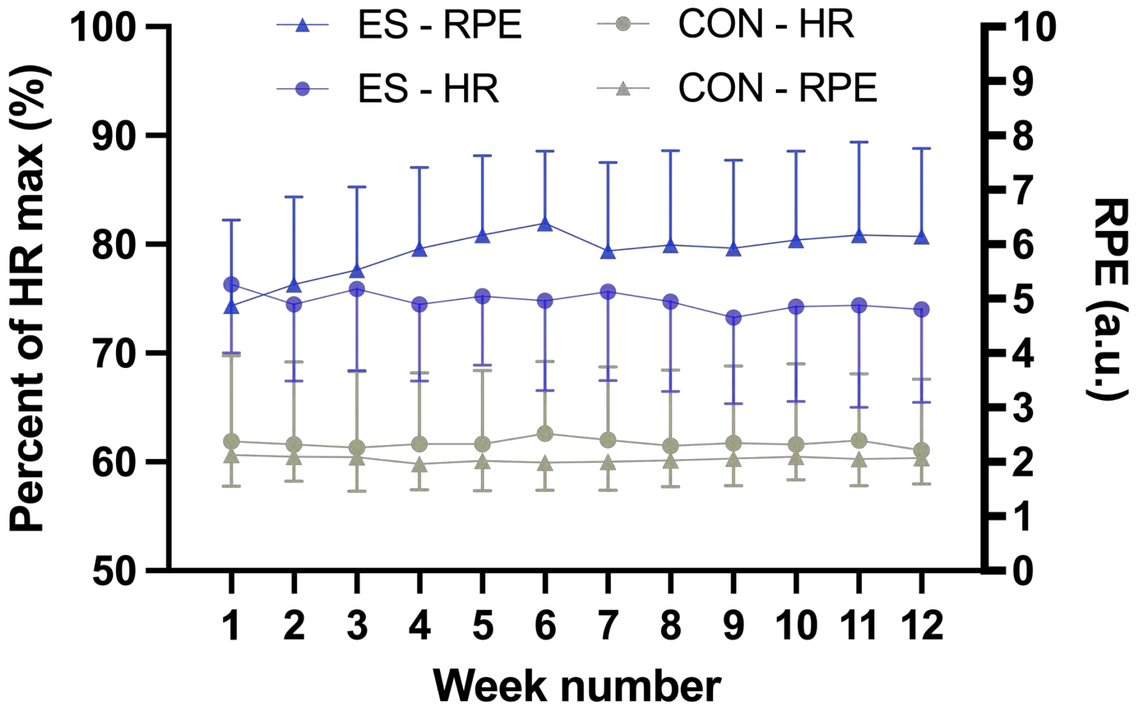
Adhérence


Enrollment
Expressed interest (n = 358)
279 through Wayturn and 79 from a previous study, community events, posters, word of mouth, or online advertisement.
Excluded (n = 276)
- Could not contact or did not follow up upon contact (n=106)
- Medications (recent changes or types) (n=46)
- Withdrew interest / not interested (n= 40)
- Other (n=13)
- Too active (n=13)
- Expressed interest after recruitment was complete (n=11)
- Physical activity limitations (n=9)
- HbA1c >8.5% (n=7)
- Prediabetes or did not have T2D (n=6)
- Other clinical trial (n= 5)
- BMI outside of range (n=4)
- Could not travel to study site (n=4)
- Diet or supplements (n=3)
- Age outside of range (n=3)
- Anticipated changes to physical activity routine soon (n=2)
- CV-related issues (n=2)
- Taking insulin (n=1)
- Smoker (n=1)
Signed the informed consent form (n = 82)
Excluded (n = 7)
- HbA1c >8.5% (n=1)
- Change in self-reported medications (n=2)
- High BP (n=4)
Randomized (n = 75)
Exercise snacks
Allocated intervention (n = 35)
Allocation
Placebo, comparator
Allocated intervention (n = 40)
Excluded or withdrew (n = 6)
- HbA1c >8.5% (n=2)
- Change in self-reported medications (n=1)
- Personal reason unrelated to the intervention (n=1)
- Untold physical limitation (n=1)
- Injury unrelated to the intervention (n=1)
Excluded or withdrew (n = 6)
- HbA1c >8.5% (n=1)
- Change in self-reported medications (n=2)
- Personal reason unrelated to the intervention (n=2)
- Transient ischemic attack ~8 weeks into the intervention (n=1)
Exercise snacks (n = 29)
Follow up
Placebo, comparator (n = 34)





ES



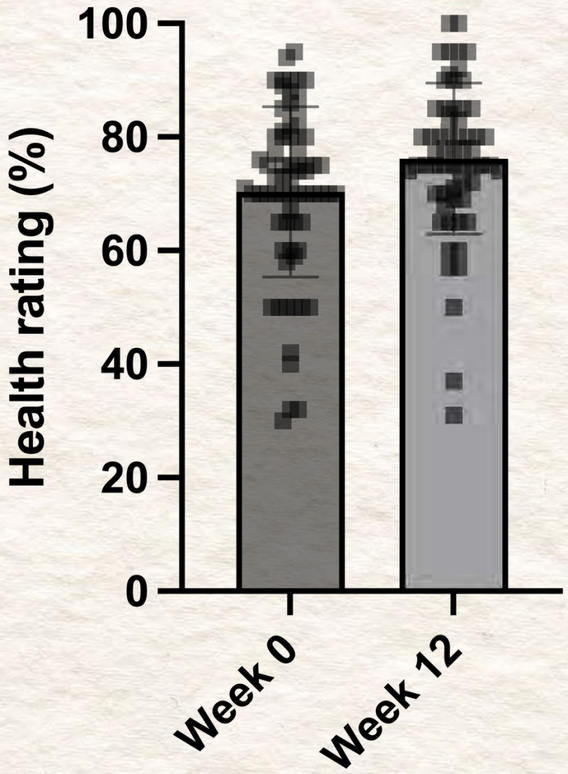
Sur 12 semaines, **86 %** des participants assignés au groupe ES ont présenté une **forte adhérence** (**>70 %, ≥168 séances**).

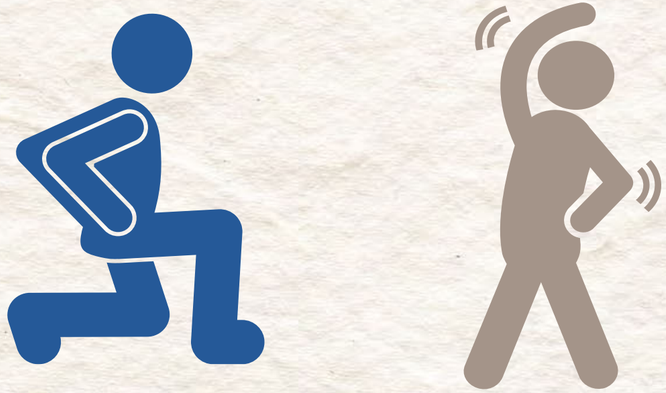
Les participants ont également effectué les snacks d'exercice à **haute intensité** (**RPE≥ 6**) un **niveau de plaisir élevé**, avec un score moyen de **4,5 ± 0,8 sur 7** après chaque séance.



P_{time}= 0.01

P_{int}= 0.13





Exercise snacks:

+4.5 [-19 to 30] a.u

Étirement:

+2 [-28 to 58] a.u



Health rating

Conclusion

Une intervention de **12 semaines** de **snacks d’exercice** supportée par la technologie, semble **faisable** et **agréable** chez les personnes vivant avec un **diabète de type 2**.



Quelle est la dose minimale?

NRC Research Press

BRIEF COMMUNICATION

Do stair climbing exercise "snacks" improve cardiorespiratory fitness?

E. Madison Jenkins, Leah N. Nairn, Lauren E. Skelly, Jonathan P. Little, and Martin J. Gibala

Abstract: We investigated the effect of stair climbing exercise "snacks" on peak oxygen uptake. Sedentary young adults were randomly assigned to perform 3 bouts/day of vigorously ascending a 3-flight stairwell (60 steps), separated by 1–4 h of recovery, 3 days/week for 6 weeks, or a nontraining control group (n = 12 each). Peak oxygen uptake was higher in the climbers after the intervention (P = 0.003), suggesting that stair climbing "snacks" are effective in improving cardiorespiratory fitness, although the absolute increase was modest.

Key words: sprint interval training, peak oxygen uptake.

Résumé : Nous étudions l'effet des exercices courts et rapides de montée d'escaliers sur la consommation d'oxygène de pointe. De jeunes adultes sédentaires sont répartis de façon aléatoire dans un groupe expérimental pour effectuer trois séances/jour de montées vigoureuses dans une cage d'escalier à trois volées (60 marches), intercalées de 1–4 h de récupération, 3 jours/semaine pendant 6 semaines ou à un groupe de contrôle sans entraînement (n = 12 chacun). La consommation d'oxygène de pointe est plus élevé chez les monteurs d'escalier après l'intervention (P = 0,003), ce qui suggère que les montées brèves et rapides des escaliers sont efficaces pour améliorer la condition cardiorespiratoire, bien que l'augmentation absolue soit modeste. [Traduit par la Rédaction]

Mots-clés : entraînement par intervalles de sprint, consommation d'oxygène de pointe.

Introduction

Low cardiorespiratory fitness (CRF) is associated with an increased risk of all-cause mortality and cardiovascular disease (Kodama et al. 2009). Habitual physical activity increases CRF but many individuals do not perform sufficient amounts as recommended by public health agencies, often citing "lack of time" as a perceived barrier (Colley et al. 2011). Sprint interval training (SIT), involving brief bouts of vigorous exercise interspersed with 2 min of recovery, increases CRF similar to traditional moderate-intensity continuous training despite reduced time commitment (Gillen et al. 2016; Gist et al. 2014). Most SIT studies involve specialized equipment and protocols that are not easily transferable outside of a laboratory setting. Vigorous stair climbing is a practical and accessible form of SIT that can increase CRF in previously sedentary individuals when performed for several weeks (Allison et al. 2017).

Francois et al. (2014) coined the term "exercise snacks" to describe breaking up a single session of continuous exercise into several shorter bouts spread throughout the day. A training program involving three ~12-min bouts of intermittent interval exercise was superior to a single daily bout of energy-matched continuous exercise for improving blood sugar control in people with insulin resistance (Francois et al. 2014). It is unknown if SIT exercise snacks, or brief bouts of vigorous exercise performed as single sprints spread throughout the day, is a sufficient stimulus to improve CRF. The design of the present study was modelled after work by Allison et al. (2017); however, in contrast to the original protocol, the 3 bouts of stair climbing were separated by a few hours of recovery, as compared with being performed in a single session with a few minutes in between bouts. We hypothesized that, as compared with a nontraining control group, a protocol involving 3 daily bouts of vigorously ascending a 3-flight stairwell (60 steps), with 1–4 h recovery, would enhance CRF when performed 3 days/week for 6 weeks.

Materials and methods

Participants

Twenty-four young adults were recruited primarily from the student population at McMaster University. Inclusion criteria were deemed healthy based on the Canadian Society for Exercise Physiology (CSEP) General Activity Questionnaire (GAQ) (CSEP 2017) and inactive as determined by a self-report of less than 1 h of structured physical activity per week using the International Physical Activity Questionnaire (Craig et al. 2003). Exclusion criteria were: diagnosed cardiometabolic disease, smoker, and answering "yes" to any of the questions on the GAQ form. Participants were assigned to either the stair-climbing intervention (n = 12; male/female = 3/9, age = 20.0 ± 1.8 years; body mass index = 21.9 ± 5.0 kg/m^2; mean ± SD) or a nontraining control group (n = 12; male/female = 2/10, age = 19.3 ± 1.6 years; body mass index = 23.8 ± 2.6 kg/m^2) using a block randomization scheme and block size of 2 to ensure an equal number of subjects in each group. Participants assigned to the control group were given the option to complete the exercise intervention following the main

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Corresponding author: Martin J. Gibala (email: gibalam@mcmaster.ca).

*Martin J. Gibala and Jonathan P. Little currently serve as Associated Editors; peer review and editorial decisions regarding this manuscript were handled by Philip Atherton and Terry E. Graham.

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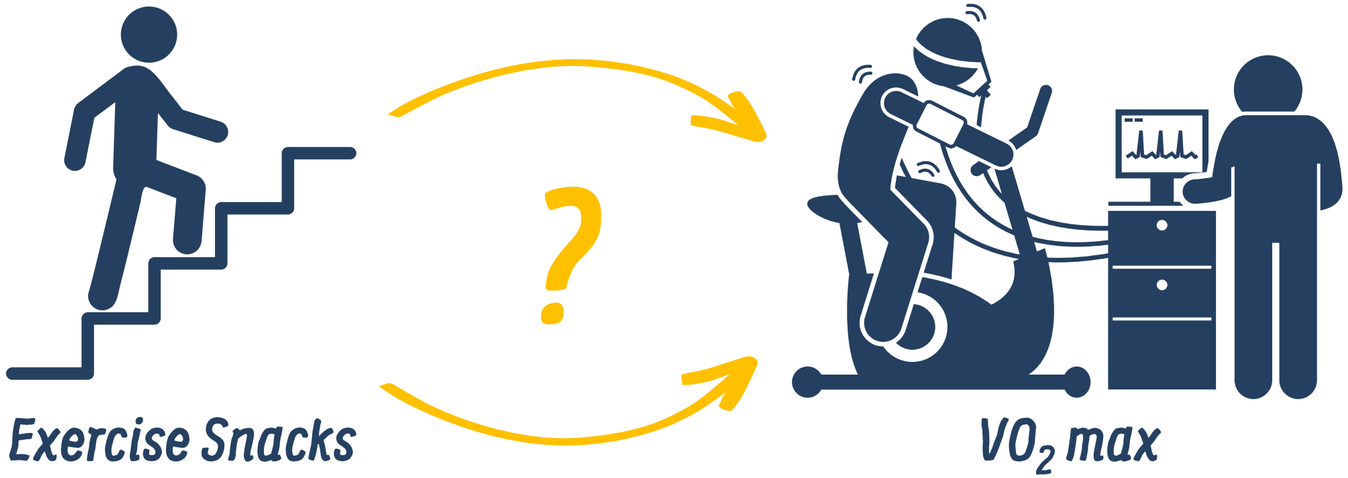
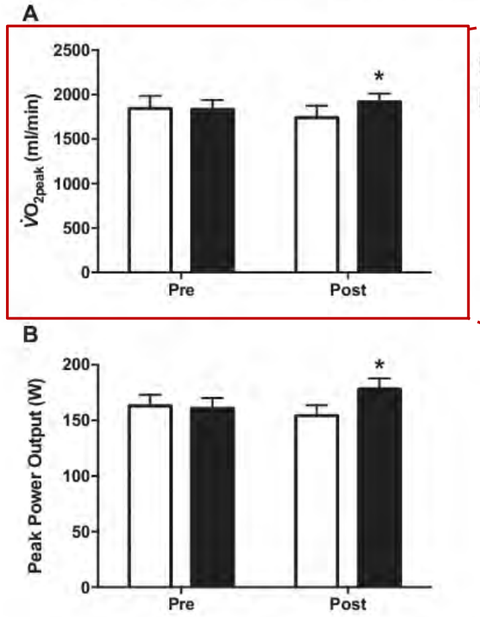
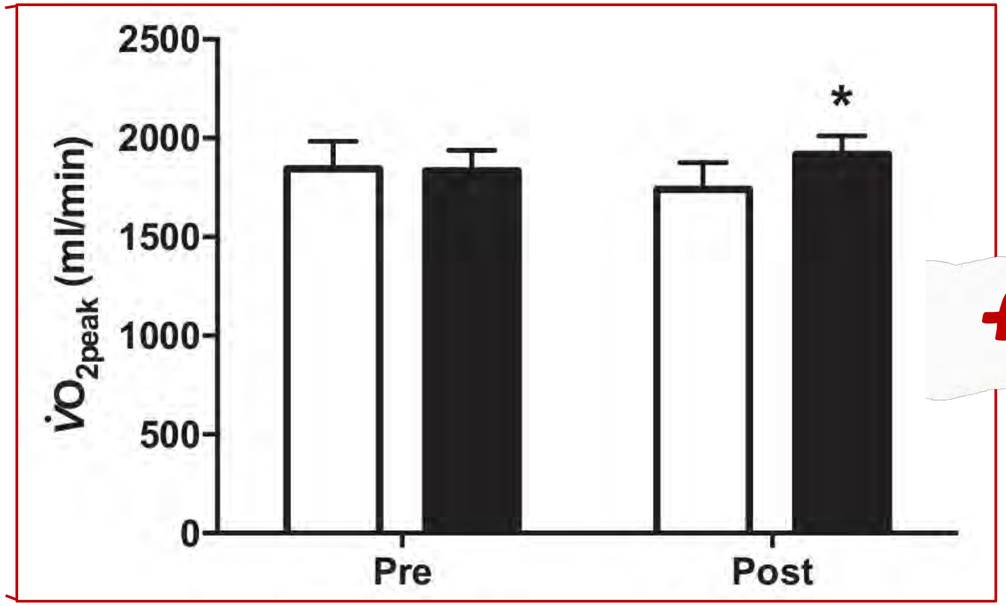


Fig. 2. Absolute peak oxygen uptake ($\dot{V}O_{2peak}$) (A) and peak power output (B) measured before (Pre) and after (Post) 6 weeks of stair climbing sessions or an equivalent period without a prescribed exercise intervention. Values are means ± SD. *. $P < 0.05$ between groups.





+5%

The stair climbing protocol in the present study was modelled after previous work in our laboratory (Allison et al. 2017), with the key difference being the duration of recovery between exercise bouts. The improvement in $\dot{V}O_{2peak}$ in the present study (~5%) was relatively smaller than observed in our previous study (Allison et al. 2017), in which bouts of intermittent stair climbing were performed with a few minutes of recovery periods (~12%). We attribute this smaller relative improvement in $\dot{V}O_{2peak}$ to the longer period of recovery between stair climbing bouts, i.e., 1–4 h (mean 2.4 ± 1.3 h) in the present study as compared with 2 min in our previous study (Allison et al. 2017). In support of this interpretation, mean RPE remained consistent across bouts of exercise in the present study, whereas in the work of Allison et al. (2017), RPE climbed over the course of the successive bouts, suggesting a greater relative stress when recovery periods are short and the stair climbing bouts are performed as a single training session.

Despite eliciting relatively smaller improvements in $\dot{V}O_{2peak}$ as compared with our previous study that used brief recovery periods (Allison et al. 2017), the improvements in W_{peak} were similar, suggesting less of an effect of recovery duration on the determinants of this measures. It is possible that the intense stair climbing efforts provided a greater stimulus for peripheral (i.e., skeletal muscle) adaptations, which contributing to the improved W_{peak}. It is also possible that the nature of the warm-up exercise, while brief, may have contributed to a leg-strengthening effect. The improvements in cycling W_{peak} occurred despite the training being performed as stair climbing, suggesting that overall exercise tolerance and capacity was improved.

Some limitations are to be addressed in our study: first, we did not employ a blinded randomization procedure, and a randomization concealment tool would have eliminated any potential bias introduced during this process. Another potential limitation is that while subjects were instructed to maintain their habitual living patterns it is possible that changes in behaviour (e.g., physical activity) could have influenced the measurement of $\dot{V}O_{2peak}$.

In conclusion, the stair climbing exercise snacking protocol tested in this study resulted in a 5% increase in CRF and 12% increase in cycling peak power output in healthy, sedentary adults, which was significantly higher when compared with a nontraining control group. The absolute increase in CRF was modest, however, and relatively smaller than we previously observed when a similar stair-climbing intervention was performed as a single session with a few minutes of recovery between bouts, as compared with the 1–4 h of recovery between bouts in the present study. We speculate that the longer recovery periods may reduce the overall metabolic stress as compared with traditional sprint interval training protocols and potentially attenuate the adaptive response in CRF. The present work nonetheless shows that the stair climbing exercise snacking protocol was feasible, and well-tolerated by sedentary individuals, and improved functional performance. Future research should investigate different exercise snacking protocols with varying recovery time to determine whether the increased time between snacks attenuates the metabolic stress characteristic of SIT and changes in CRF. Additionally, future research should examine the effect on other-health related indices such as blood pressure and glycemic control.

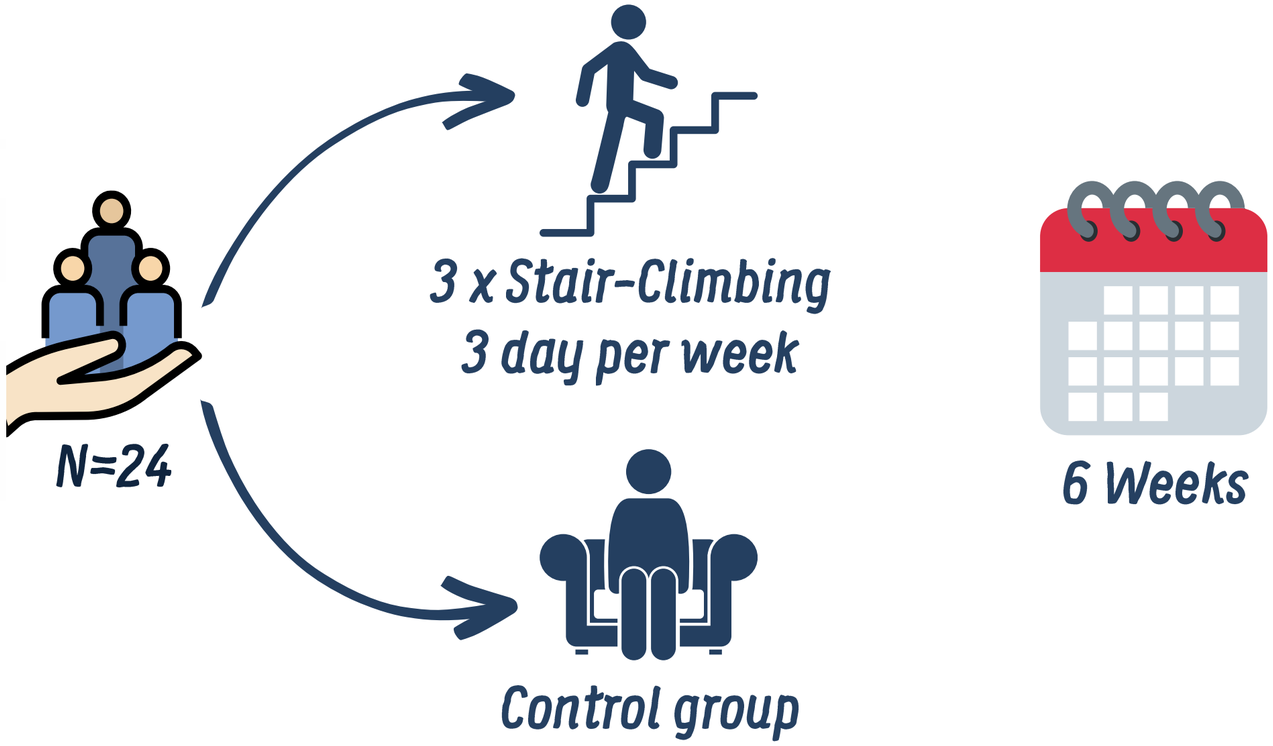
Conflict of interest statement

All authors report no conflicts of interest.

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Review

Effectiveness of exercise snacks on physical function: a systematic reviews with meta-analysis of randomized controlled trials

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ABSTRACT

Background: The effects of exercise snacks interventions on physical function in healthy or sub-healthy adults remain unclear. Exercise snacks intervention is defined as breaking up daily physical activity into brief, frequent bouts performed intermittently throughout the day (e.g., 1–2 min of stair climbing or bodyweight training hourly). This study aims to evaluate the effectiveness of exercise snacks interventions in improving physical function in this population.

Methods: The systematic search covered the China National Knowledge Infrastructure (CNKI), China Science and Technology Journals (VIP), Wanfang, PubMed, Embase, CINAHL, Web of Science, Cochrane Library, and Scopus databases, screening relevant randomized controlled trials published up to July 31, 2025. The risk of bias in the included studies was assessed using the Cochrane risk of bias tool, and data analysis was performed with RevMan 5.3.

Results: This study included 11 eligible randomized controlled trials involving 472 participants. Meta-analysis results demonstrated that exercise snacks interventions significantly increased absolute peak power output [MD = 16.53, 95%CI (2.93, 29.77), $P = 0.02$], maximal oxygen uptake [MD = 0.19, 95%CI (0.02, 0.36), $P = 0.03$], the number of repetitions in the 60-second sit-to-stand test [MD = 4.38, 95%CI (1.00, 7.77), $P = 0.01$], while significantly reducing body fat percentage [MD = −3.12, 95%CI (−5.51, −0.73), $P = 0.01$]. However, no statistically significant differences were observed in improving fatigue levels or BMI.

Conclusion: Among healthy and sub-healthy adults, exercise snacks interventions enhance cardiorespiratory endurance by increasing Wpeak and VO_{2max}. Concurrently, they improve functional movement capacity by increasing the number of 60-second sit-to-stand repetitions and reducing body fat percentage. As a feasible, convenient, and easily integrated exercise method, exercise snacks demonstrate significant potential for health promotion.

1. Introduction

In the context of contemporary fast-paced lifestyles, sub-health has emerged as a pressing global public health challenge affecting adults, with its prevalence expanding and shifting toward younger demographics. It represents a gray zone between health and disease: while not meeting clinical diagnostic thresholds, it is characterized by persistent physiological decline and metabolic dysregulation [1]. Globally, approximately 31% of healthy adults fail to meet public health recommendations for physical activity [2]. Sedentary behavior and psychological stress are driving healthy individuals toward suboptimal health states, and chronic physical inactivity not only accelerates this transition but also is strongly associated with elevated risks of cardiovascular disease, obesity, type 2 diabetes, and all-cause mortality [3–5]. Thus, there is an urgent need for flexible, feasible, and effective physical activity strategies that address both the preventive needs of healthy adults and the rehabilitative needs of those in sub-health.

Traditional exercise guidelines recommend 150–300 min of moderate-intensity physical activity per week [6], yet widespread adoption remains constrained by time, environmental, and

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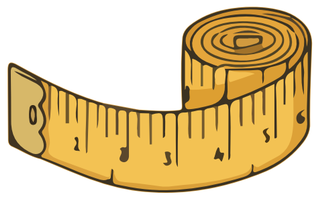
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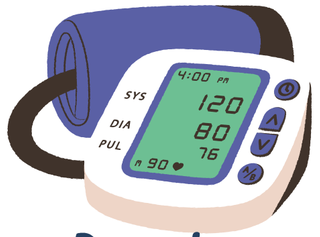
The effectiveness of exercise snacks as a time-efficient treatment for improving cardiometabolic health in adults: a systematic review and meta-analysis

Scandinavian Journal of Medicine & Science in Sports — WILEY

Effects of Exercise Snacks on Cardiometabolic Health and Body Composition in Adults: A Systematic Review and Meta-Analysis



Tour de taille



Pression



Profil lipidique



↑ Sit-to-stand
=
Capacité physique

Personnes âgées



↑ Sit-to-stand

4.4 repetitions [3.2 to 5.7]



Intensité?



60 personnes âgées (65 ans +)





FC/Accel



Effort



Plaisir

Comment implanter les snacks d’exercise?

Comment aider un patient à passer de:
« Je devrais bouger davantage » à « voici comment je peux intégrer quelques minutes d’activité physique dans ma journée ».

JAMA Insights | COMMUNICATING MEDICINE

Communicating With Patients About Physical Activity

Julie Midtgaard, PhD; Søren T. Skou, PhD; Alessio Bricca, PhD

Physical activity is an effective component of care for people with chronic medical conditions, and clinicians can help motivate behavior change.[1,2] A trial of 228 adults with 2 or more long-term conditions that limited daily activities reported that patients randomized to receive 12 weeks of personalized exercise therapy and self-management support had improved health-related quality of life at 1 year compared with usual care.[2] This article provides clinicians with suggested methods to promote physical activity for patients with chronic medical conditions (**Table**),[2,3] which should be adapted to an individual patient's context, preferences, needs, and values.

Multimedia

CME at jamacmelookup.com

Supportive Communication About Physical Activity

Seeking permission to discuss physical activity, acknowledging that difficulty adhering to physical activity recommendations may stem from barriers such as limited opportunity (eg, time, support, access) or limited capability (eg, pain, confidence, skills), and highlighting specific health benefits are cornerstones to constructive conversations. In a qualitative research study of disengagement from physical activity among 41 individuals with type 2 diabetes, participants largely associated physical activity with participation in structured exercise programs.[4] Not feeling able, willing, or ready to increase physical activity reflected perceptions of physical activity as burdensome or inaccessible, whereas inactivity was perceived as easy and pleasant. Clarifying the benefits of physical activity (ie, any energy-expending movement in daily life, such as walking to work or climbing stairs), instead of structured exercise (ie, planned activity to improve fitness or health, such as resistance training) can expand options for increased physical activity. Framing physical activity as avoiding inactivity and highlighting the value of light-intensity activity may also make it feel more achievable.

Conversely, simple questions or suggestions that give the impression that physical activity is easy and that failure to be physically active reflects a lack of compliance can foster self-blame and intentional nonadherence. Statements such as "You risk getting worse if you don't increase your activity" may provoke fear, guilt, or self-criticism that can inhibit motivation. Presenting physical activity as an opportunity, rather than communicating the negative health consequences of maintaining current behavior, is consistent with recommendations for patient-clinician communication about weight loss.[5] Similarly, care should be taken when discussing diagnoses and how physical activity may be beneficial. For example, in an online trial of 626 people with and without hip osteoarthritis, those told they had "persistent hip pain," compared with those told they had "hip degeneration," were more likely to believe that physical activity would be less damaging to their hip (mean difference, −1.8 [95% CI, −2.3 to −1.2]) and that surgery was less necessary (mean difference, −2.2 [95% CI, −2.7 to −1.6]) on a 0 to 10 scale (0 = definitely would not/unnecessary; 10 = definitely would/necessary).[6]

Table. Focus Points and Practical Examples for Discussing Physical Activity

Focus point	Practical example
Seeking permission to discuss physical activity	
Opening the conversation	"Is it okay if we talk about physical activity?"
	"Has a health care professional talked with you about exercise or physical activity?"
Supportive communication about physical activity	
Acknowledge that lack of physical activity is common	"Struggling to stay active is common; where we live and work can make physical activity difficult."
Build self-compassion	"Could we think about physical activity as a way of taking care of yourself? What might that look like for you?"
Promotion of safe physical activity dose and intensity	
Finding the right effort and dose	"When you're active, aim to breathe faster while still being able to talk (ie, somewhat hard effort) and allow mild discomfort or pain. Adjust so it feels right for you."
Promotion of effective behavior changes	
Self-monitoring	"Try keeping track of your activity using a wearable device or written log to track progress, build a routine, and ensure sufficient rest."
Goal setting	"If you're open to it, let's set a realistic goal for your activity, rather than the outcome."
Support for long-term maintenance of physical activity	
Social relatedness	"Are there people who could support you in becoming more active? If no one comes to mind, we can look at community options together."
Meaning	"You might make physical activity more enjoyable by pairing it with something you enjoy, such as listening to a podcast or spending time in nature."
Capability	"Notice your small steps. They show you're getting better at it, even when things don't go as planned."
Support for coping with chronic illness through physical activity	
Sense of coherence	"Physical activity can help restore a sense of control. It's something you can plan and shape to your needs and share with others."
Personal recovery	"Let activity reflect what matters to you, and when life disrupts routines, restart with small, realistic steps."

Practical examples are adapted from the exercise counseling interventions in Midtgaard et al[3] and Skou et al.[2]

Promotion of Safe Physical Activity Dose and Intensity

Patients with chronic medical conditions may find it difficult to meet the World Health Organization (WHO) target of at least 150 minutes of moderate-intensity activity per week. However, WHO highlights that any amount of physical activity counts, and even small increases provide benefit. In these cases, clinicians should provide clear, supportive explanations about the benefit of small increases in physical activity. An individual participant data meta-analysis of 40 327 participants in 7 prospective cohort studies estimated that increases in moderate to vigorous physical activity by 5 minutes per day in all participants, except the 20% who were most active, could prevent 10% of all deaths.[7] For these patients, the ideal physical activity dose is the one that improves health without worsening symptoms. This often means starting low and gradually increasing over time. Clinicians should encourage patients to determine a level of

1 Aborder l'activité physique

A) Ouverture et consentement
B) Reconnaître difficulté resté actif
C) Identifié les besoins
D) Proposer les snacks d'exercice
E) Modalité cohérente et SMART

2 Prescription

F: Fréquence
I: Intensité
T: Temps
T: Type
V: Volume
P: Progression

Il n’existe pas de prescription universelle pour les snacks d’exercice!

3 Ancrer le mouvement dans la routine

1) Brosser les dents
2) Préparer son café
3) Fin d’une réunion
4) Après un repas
5) Après être allé aux toilettes
6) En attendant que l’eau bouille
7) Avant de commencer une émission
8) Après avoir couché son enfant
9) Avant de démarrer une brassée de lavage
10) Après avoir arrosé les plantes
11) À chaque notification ou rappel choisi
12) Etc.

Cas clinique



Patiente : Monique, 67 ans, vivant avec un diabète de type 2, peu active et désirant améliorer sa glycémie ainsi que la force de ses membres supérieurs.

Prescription initiale possible

A

Après le déjeuner : monter et descendre les marches 3 fois.



B

Après la sieste: 15 push-up au mur.



C

Après le souper: 45 flexions des biceps avec bande élastique



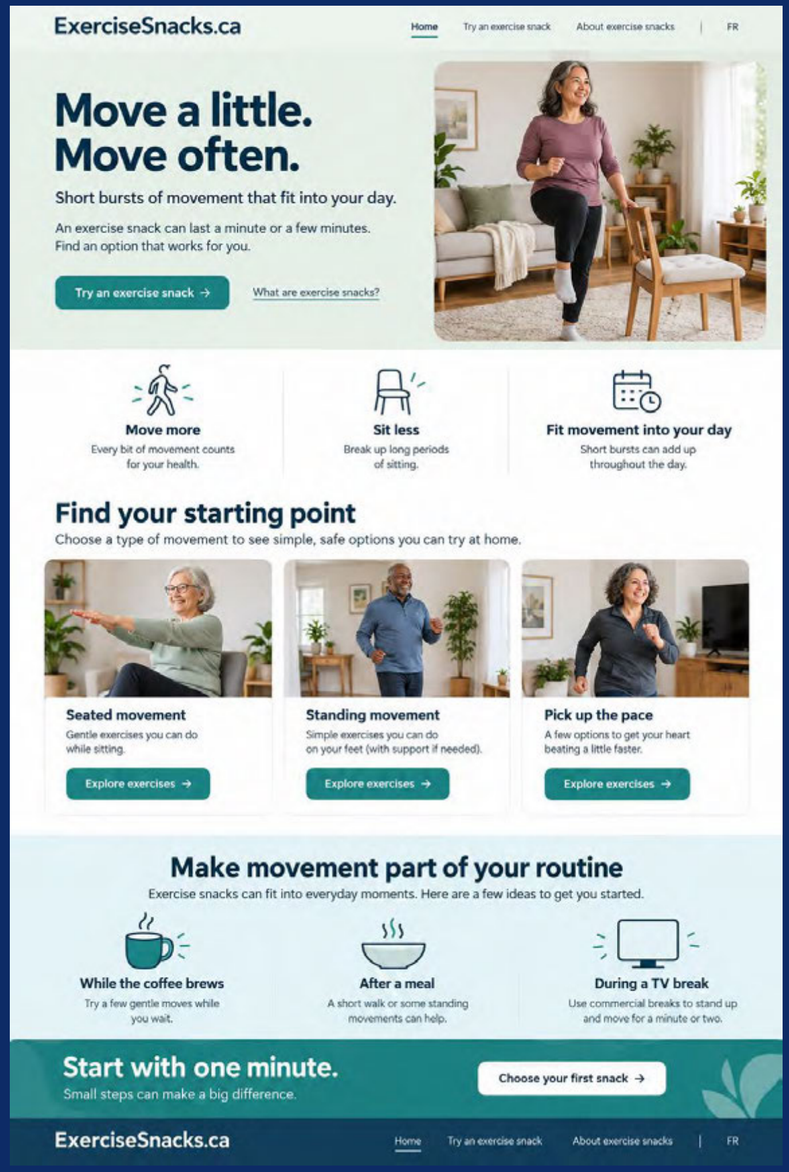
4 Outils technologiques pour favoriser l’adoption/adhérence



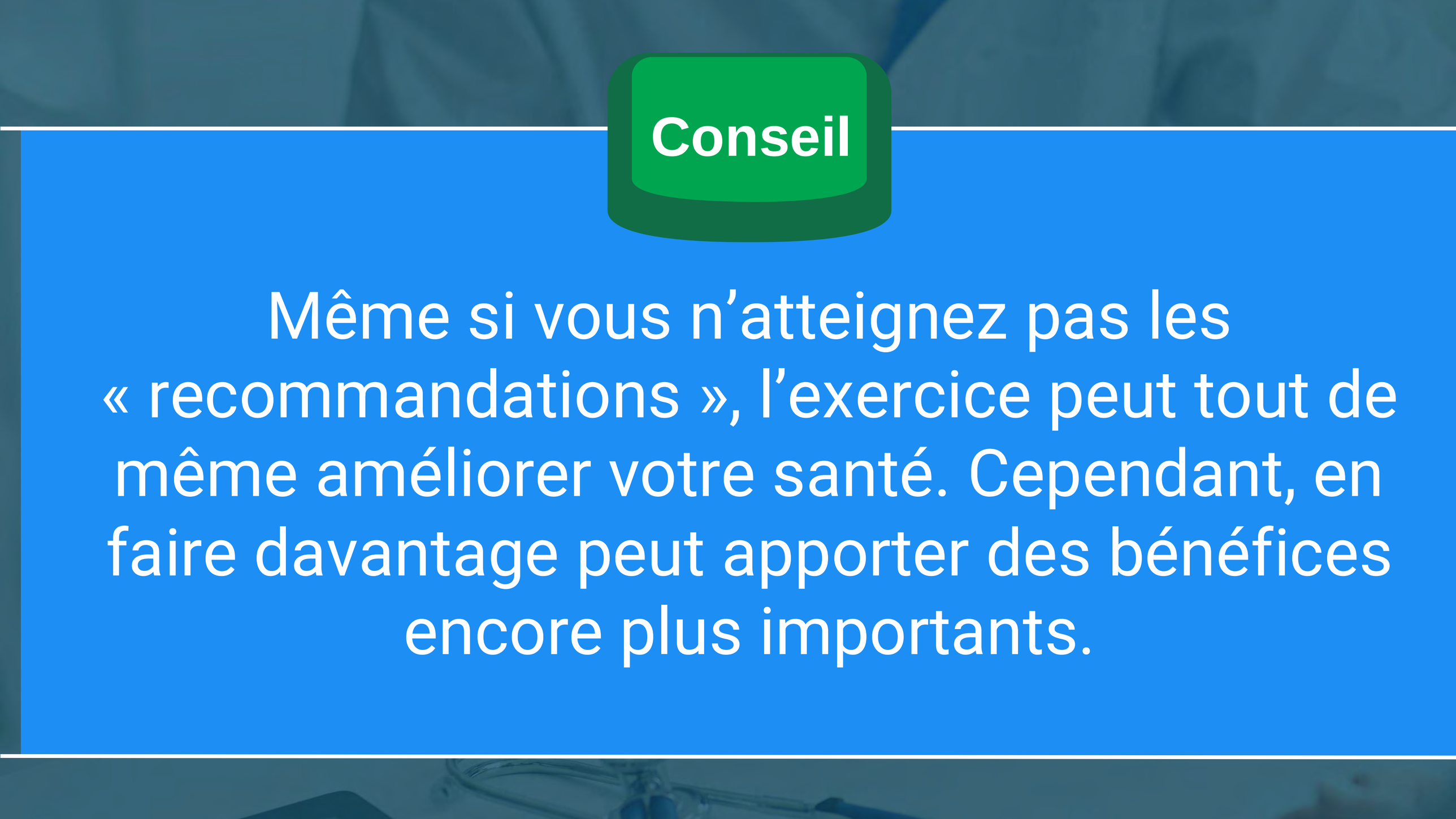




www.exercisesnacks.ca

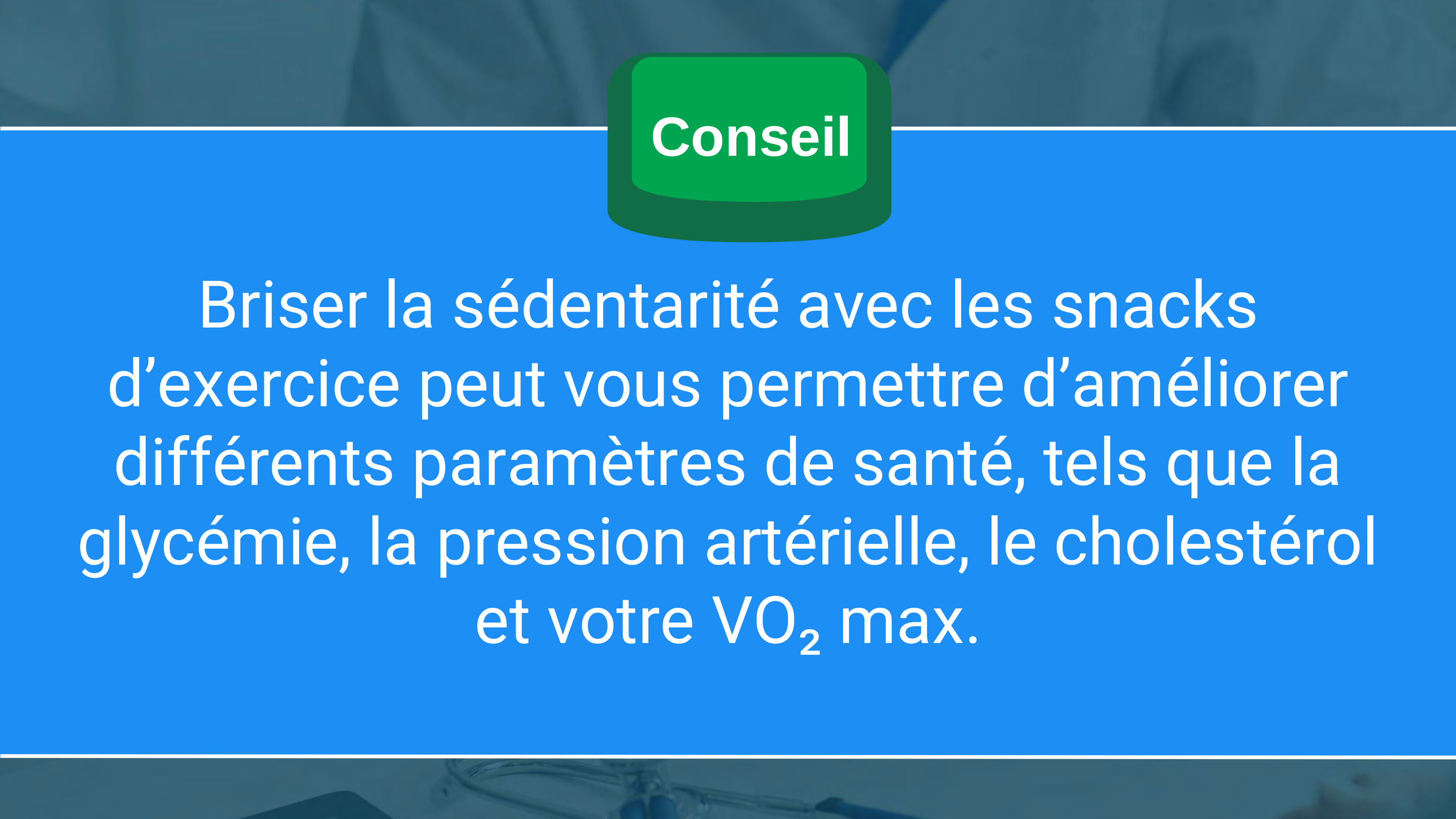


18 novembre 2026



Conseil

Même si vous n’atteignez pas les « recommandations », l’exercice peut tout de même améliorer votre santé. Cependant, en faire davantage peut apporter des bénéfices encore plus importants.



Conseil

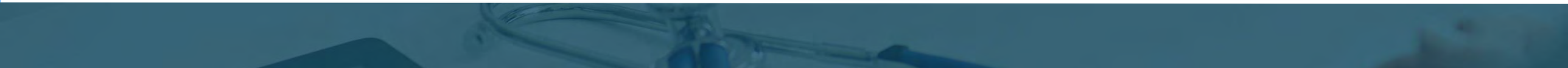
Briser la sédentarité avec les snacks d’exercice peut vous permettre d’améliorer différents paramètres de santé, tels que la glycémie, la pression artérielle, le cholestérol et votre VO_2 max.

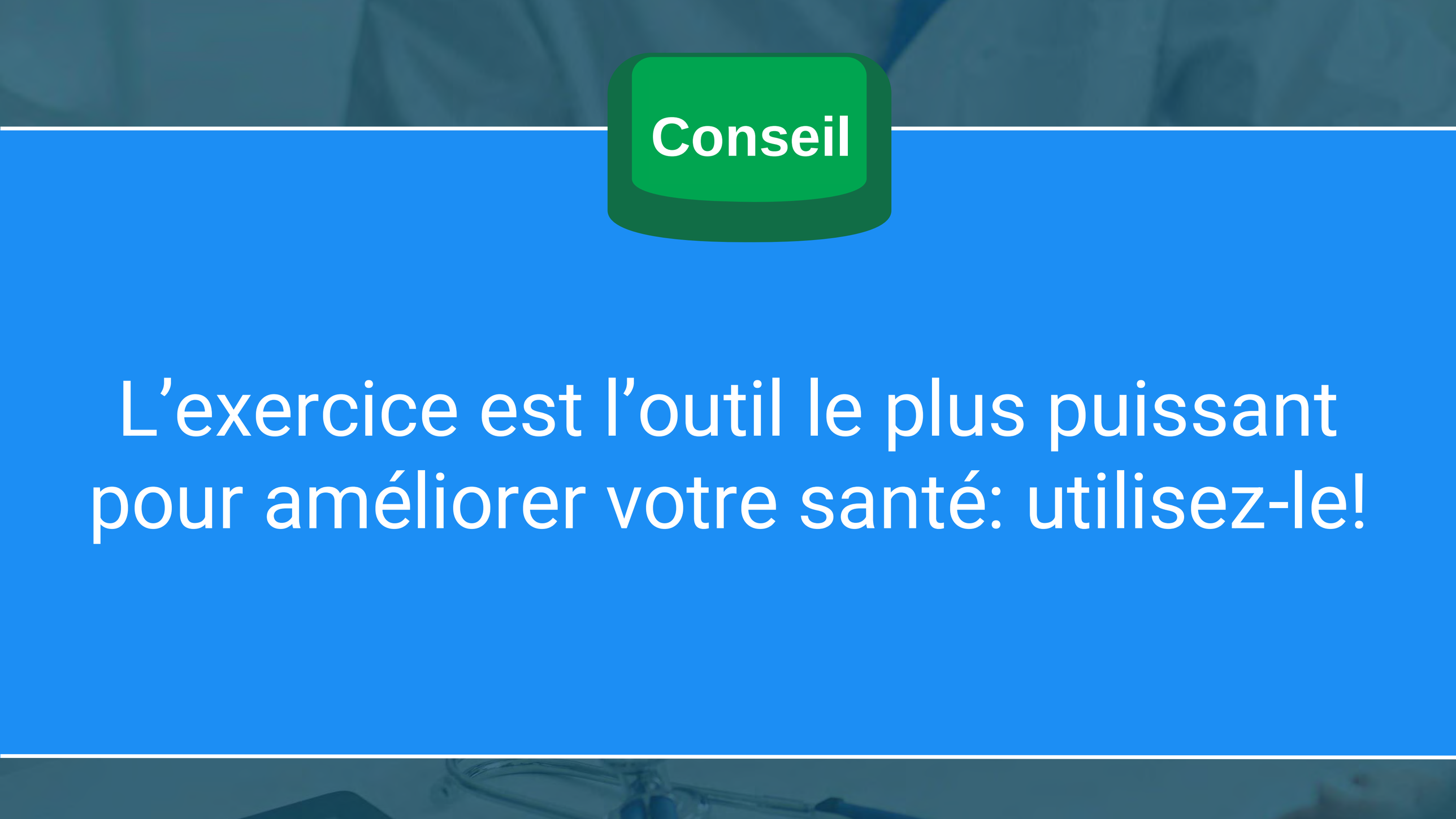


Conseil

Tous les types d’exercices sont bons: choisissez celui que vous aimez!

Gardez en tête que différents types d’exercice peuvent apporter des bénéfices variés.





Conseil

L’exercice est l’outil le plus puissant pour améliorer votre santé: utilisez-le!

Merci / Questions?

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