ELSEVIER

Alzheimer's & Dementia: Translational Research & Clinical Interventions ■ (2017) 1-10

Alzheimer's & Dementia

Perspective

Sedentary behavior as a risk factor for cognitive decline: A focus on the influence of glycemic control in brain health

Michael J. Wheeler[a,b,*], Paddy C. Dempsey[a,c], Megan S. Grace[a], Kathryn A. Ellis[d,e], Paul A. Gardiner[f,■,■,i], Daniel J. Green[b,j], David W. Dunstan[a,b,k]

[a]Baker Heart and Diabetes Institute, Melbourne, Victoria, Australia
[b]School of Sport Science, Exercise and Health, University of Western Australia, Perth, Western Australia, Australia
[c]Swinburne University of Technology, Melbourne, Victoria, Australia
[d]Department of Psychiatry, University of Melbourne, Parkville, Victoria, Australia
[e]The Florey Institute of Neuroscience and Mental Health, The University of Melbourne Parkville, Parkville, Victoria, Australia
[f]Centre for Health Services Research, The University of Queensland, Brisbane, Queensland, Australia
[g]Institute for Health and Ageing, Australian Catholic University, Melbourne, Victoria, Australia
[h]School of Public Health, The University of Hong Kong, Hong Kong
[i]Mater Research Institute-UQ, South Brisbane Queensland, Australia
[j]Research Institute for Sport and Exercise Sciences, Liverpool John Moores University, Liverpool, United Kingdom
[k]Mary MacKillop Institute for Health Research, Australian Catholic University, Melbourne, Victoria, Australia

Abstract Cognitive decline leading to dementia represents a global health burden. In the absence of targeted pharmacotherapy, lifestyle approaches remain the best option for slowing the onset of dementia. However, older adults spend very little time doing moderate to vigorous exercise and spend most of time in sedentary behavior. Sedentary behavior has been linked to poor glycemic control and increased risk of all-cause mortality. Here, we explore a potential link between sedentary behavior and brain health. We highlight the role of glycemic control in maintaining brain function and suggest that reducing and replacing sedentary behavior with intermittent light-intensity physical activity may protect against cognitive decline by reducing glycemic variability. Given that older adults find it difficult to achieve current exercise recommendations, an additional practical strategy may be to reduce and replace sedentary behavior with intermittent light-intensity physical activity. However, more research is needed to understand the impact of poor glycemic control on brain function and whether practical interventions aimed at reducing sedentary behavior can help slow cognitive decline.

Keywords: Dementia; Alzheimer's disease; Cognitive function; Diabetes; Glucose metabolism; Exercise; Physical activity; Light-intensity activity; Sitting; Sedentary behavior; Breaks in sedentary time

1. Introduction

Dementia, which is an umbrella term for conditions characterized by cognitive decline, is a growing global health issue. Combined projections from a meta-analysis predict that global dementia prevalence will double every 20 years [1]. Dementia prevalence also represents a huge global economic cost, estimated to be US $604 billion in 2010 [2]. Strategies that can delay or prevent dementia are urgently needed given the burden it places on individuals,

Declarations: The authors declare that this work is not under consideration for publication elsewhere, its publication is approved by all authors and tacitly or explicitly by the responsible authorities where the work was carried out, and if accepted, it will not be published elsewhere including electronically in the same form in English or any other language, without the written consent of the copyright holder.

*Corresponding author. Tel.: +61-85321898; Fax: ■■■.
E-mail address: michael.wheeler@bakeridi.edu.au

http://dx.doi.org/10.1016/j.trci.2017.04.001

families, and the wider community. It has been estimated that if interventions could delay by 1 year the onset of Alzheimer's disease (AD), the main cause of dementia worldwide, compared with no change in onset, there would be 11.8 million fewer cases of the disease by 2050 [3]. Because there is currently no targeted pharmacotherapy to reduce the risk of dementia in older adults, there is a need to investigate modifiable behavioral risk factors that can attenuate cognitive decline.

Physical activity acts on multiple mechanisms to elicit improvements in brain health [4]. Most randomized controlled trials supporting the benefits of physical activity for brain function have focused on moderate to vigorous intensity physical activity (MVPA) [4,5]. This focus is embodied within current public health guidelines, which are based on achieving a minimal level of MVPA. For adults (18–64 years) and older adults (>65 years), this is set at 150 minutes/week, accumulated in bouts >10 minutes [6]. However, nearly one-third of people worldwide do not achieve this minimum recommended level of MVPA [7]. Moreover, adherence is lowest in older adults, with some estimates indicating that 55% to 70% do not achieve the minimum recommended level of MVPA [8]. Fig. 1 highlights the small volume of time during waking hours, which is spent in MVPA, based on accelerometer data from a sample of older adults [9]. In contrast, a considerably larger volume of time is spent in sedentary behavior and light-intensity activity, but little is known about the implications of these behaviors for brain health.

Time spent in sedentary behavior and light-intensity activity may not be benign. Evidence suggests that excessive sedentary time can increase all-cause mortality and risk of chronic disease such as type 2 diabetes (T2D), even in the presence of regular MVPA to the level advocated within current public health guidelines [10,11]. Extending these investigations to brain function is a fascinating topic of current research, with early evidence hinting that sedentary behavior may also be detrimental to cognitive function [12]. However, more studies investigating this association are needed, specifically high-quality studies attempting to tease out the independent effects of sedentary behavior from physical activity using objective measures. Also of importance is gaining an understanding as to how sedentary behavior might affect brain function. Controlled

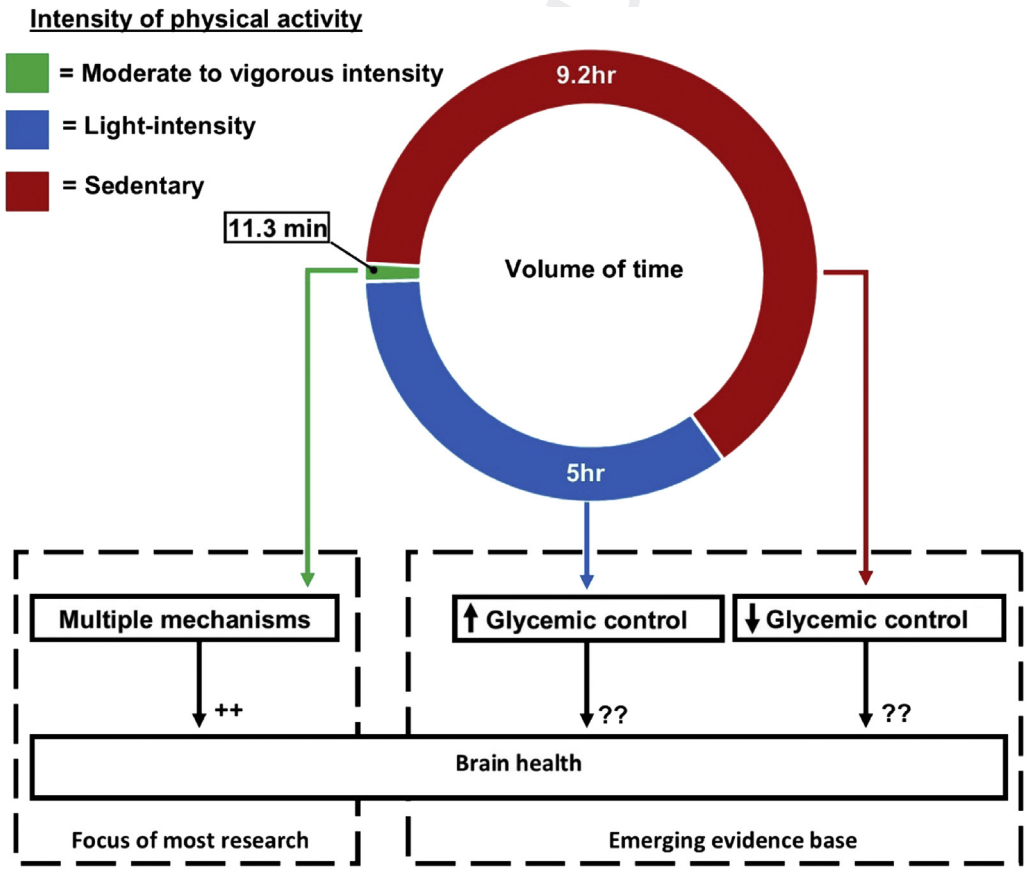

Fig. 1. This figure is based on accelerometer data from the U.S. National Health and Nutrition Examination Survey, which shows how 1367 older, overweight adults (mean age = 70.5 years; mean body mass index = 29.7 kg/m^2) allocate their time on average throughout the day [9]. Most research on physical activity and brain health focuses on MVPA. However, only a very small proportion of the day is spent in MVPA. Emerging evidence suggests that replacing time spent in sedentary behavior with lower intensity physical activity can also improve glycemic control. However, little is known about the implications of this for brain health. Abbreviation: MVPA, moderate to vigorous intensity physical activity.