Preventive Medicine 70 (2015) 50–58

Contents lists available at ScienceDirect

Preventive Medicine

journal homepage: www.elsevier.com/locate/ypmed

Review

A systematic review of standing and treadmill desks in the workplace

Brittany T. MacEwen [a], Dany J. MacDonald [b], Jamie F. Burr [a,*]

[a] Department of Applied Human Sciences, Human Performance and Health Research Laboratory, University of Prince Edward Island, Charlottetown, Canada
[b] Department of Applied Human Sciences, Sport Psychology Research Centre, University of Prince Edward Island, Charlottetown, Canada

ARTICLE INFO

Available online 28 November 2014

Keywords:
Sedentary lifestyle
Exercise
Work
Chronic illness
Productivity

ABSTRACT

Objectives. Standing and treadmill desks are intended to reduce the amount of time spent sitting in today's otherwise sedentary office. Proponents of these desks suggest that health benefits may be acquired as standing desk use discourages long periods of sitting, which has been identified as an independent health risk factor. Our objectives were thus to analyze the evidence for standing and treadmill desk use in relation to physiological (chronic disease prevention and management) and psychological (worker productivity, well-being) outcomes.

Methods. A computer-assisted systematic search of Medline, PubMed, PsycINFO, SPORTDiscus, CINAHL, CENTRAL, and EMBASE databases was employed to identify all relevant articles related to standing and treadmill desk use.

Results. Treadmill desks led to the greatest improvement in physiological outcomes including postprandial glucose, HDL cholesterol, and anthropometrics, while standing desk use was associated with few physiological changes. Standing and treadmill desks both showed mixed results for improving psychological well-being with little impact on work performance.

Discussion. Standing and treadmill desks show some utility for breaking up sitting time and potentially improving select components of health. At present; however, there exist substantial evidence gaps to comprehensively evaluate the utility of each type of desk to enhance health benefits by reducing sedentary time.

Contents

* Corresponding author. Rm. 327, Health Sciences Building, 550 University Ave., University of Prince Edward Island, Charlottetown C1A 4P3, PE, Canada. Fax: +1 902 628 4367.
E-mail address: jburr@upei.ca (J.F. Burr).

http://dx.doi.org/10.1016/j.ypmed.2014.11.011
0091-7435/

Introduction

It has long been understood that a physically active lifestyle is important in overall health and well-being along with reducing the risk for chronic diseases (Warburton et al., 2006). In order to observe health benefits, including reduced risk for chronic diseases, the Global Physical Activity (PA) Guidelines currently recommend a minimum of 150 min of moderate to vigorous PA per week for adults aged 18–64 years (World Health Organization, 2010), which have been adopted by most developed nations. However, it has been conservatively estimated that only 15% of Canadians currently meet these guidelines with the average Canadian adult spending 69% or 9.5 of their waking hours engaging in sedentary behaviors (Colley et al., 2011). Owing to increases in non-physically demanding occupational tasks, among other factors, a majority of current sedentary behavior is associated with the workplace where a large proportion of workers spend the day sitting (Juneau and Potvin, 2010).

Increased sedentary behavior is significantly associated with an elevated risk of diabetes, cardiovascular disease, and all-cause mortality (Wilmot et al., 2012). More specifically, time spent sitting is strongly associated with increased rates of the metabolic syndrome, type-2 diabetes mellitus, and obesity (Hamilton et al., 2007). Distinct health outcomes observed between sitting, non-exercise PA, and exercise suggest that sitting has an independent association with overall health and mortality that must be considered independently of other PA (Katzmarzyk et al., 2009; Hamilton et al., 2007). Positive correlations and dose–response relationships have been shown between sitting time and mortality, even in individuals who are otherwise physically active. For example, Katzmarzyk et al. (2009) found that the group of individuals who spent the highest amount of time sitting had a significantly higher risk of mortality than did the reference group, regardless of their level of PA. This suggests that compensation for time spent sitting cannot be achieved by meeting or even exceeding the current PA guidelines (Katzmarzyk et al., 2009), thus addressing the cause of the sedentary behavior itself is of increased importance. Furthermore, Katzmarzyk et al.'s (2009) group showed that sitting time and mortality were associated independent of body mass index (BMI), thus this effect was not simply the result of the typical complications resulting from overweight or obesity. However, the highest mortality rates were observed for obese individuals who spent most of their time sitting, suggesting that prolonged sitting may be most detrimental to obese individuals.

The overall effectiveness of current workplace interventions to reduce sitting time was recently shown by Chau et al. (2010) to lack strong supporting evidence. This suggests that it is difficult for workers to incorporate non-exercise PA into their workday and thus novel interventions to off-set sitting must be explored. One novel intervention to decrease sitting in the workplace utilizes a workstation wherein the user does not sit in a standard chair, but rather stands or walks using a specially designed “standing desk” or “treadmill desk” instead. Standing or treadmill walking while working is intended to reduce sitting time and encourage non-exercise PA in the workplace and thus improve health. Anecdotally, many users claim that standing at work also increases their energy levels and consequent motivation for leisure time PA as well, but this remains speculative.

To date, numerous studies have found that these desks are effective in reducing the amount of time spent sitting during the workday (Straker et al., 2009; Grunseit et al., 2012). Multiple studies have further examined the feasibility and usage of standing desks and treadmill workstations. It has been shown that both desks are practical for the workplace and will be used if available (Grunseit et al., 2012; Thompson et al., 2008). Consistent with the contention that education is an important component to use, Wilks et al. (2006) found that participants who received instructions on the use and benefits of sit–stand workstations used them more frequently than those who did not receive any instructions. Additionally, desks with electronically adjustable tables (for height adjustment from sitting to standing) resulted in more frequent usage than those needing manual adjustments (Wilks et al., 2006; Grunseit et al., 2012). These results suggest that standing and treadmill desks are feasible in the workplace if properly implemented. However, the extent of health benefit outcomes from the use of these desks and whether their use should reasonably be expected to decrease the incidence or progression of chronic disease are unclear. Therefore, the objective of this systematic review is to examine the current literature investigating the use of standing and treadmill desks to understand how these interventions can be used in the prevention or treatment of common chronic diseases including obesity, diabetes and cardiovascular disease. Additionally, cognitive function, workplace performance, job satisfaction, mood states and quality of life are important psychological outcomes that may influence a person's performance at work and their overall well-being. Therefore, this review further considered psychological variables and their resulting impacts of standing desk or treadmill desk use.

Methods

Literature search

A computer assisted database search of Medline, PubMed, PsychINFO, SPORTDiscus, CINAHL, CENTRAL (Cochrane Central Register of Controlled Trials) and EMBASE up to June 2013 was conducted to find English language studies investigating sitting, standing, or treadmill walking at work with physiological or psychological outcomes. Search words (outlined in Supplementary Table 1) included variations of possible interventions and terms related to the physiological and psychological variables of interest. Reference lists of articles retrieved were manually checked for additional articles.

Inclusion criteria

Peer-reviewed studies published in academic journals which involved a standing or treadmill walking intervention (standing desk or treadmill desk) compared to regular seated desk work or investigations that compared sitting to either standing or treadmill walking at work were eligible for inclusion. Studies with participants of working age (>18) and of any health status were included. To be eligible for inclusion, the study must have evaluated at least one relevant physiological or psychological outcome listed in Table 1. A specific

Table 1
Physiological and psychological outcomes of interest.

Physiological outcomes	–Cardiovascular disease (cholesterol, blood lipids, blood pressure, heart rate, chronic venous insufficiency, varicose veins, deep vein thrombosis) –Diabetes (insulin, glucose) –Obesity (energy expenditure, weight loss, BMI, waist/hip circumference)
Psychological outcomes	–Cognitive function –Job satisfaction –Mood states –Productivity (workplace performance) –Quality of life