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Comparing the effects of two different break strategies on occupational sedentary behavior in a real world setting: A randomized trial

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ABSTRACT

Developing interventions to reduce sedentary behavior in the workplace is an important public health priority. Furthermore, research is needed to determine whether different approaches to breaking up prolonged sitting during the workday are equally feasible and effective. Thus, the purpose of this study was to determine whether varying the frequency and duration of activity breaks during the workday would differentially impact sedentary behavior and health outcomes. Inactive females ($N = 49$) working full-time sedentary jobs were recruited for this parallel-group randomized trial. Participants were randomly assigned to take short, frequent breaks from sitting (1–2 min every half hour; SB) or longer, planned breaks from sitting (two 15-minute breaks per workday; LB) during each workday across an 8-week intervention. Sedentary time and health outcomes were assessed at baseline and post-intervention. The study ran from March 2014–June 2015. Results showed sedentary time during the workday decreased significantly in the SB group (−35.6 min; $d = -0.75$; $p = 0.03$), but did not change in the LB group (+4.5 min; $d = 0.12$). Participants in the SB group also demonstrated small-to-moderate declines in total cholesterol ($d = -0.33$; $p = 0.10$), triglycerides ($d = -0.38$; $p = 0.06$) and fasting blood glucose ($d = -0.29$; $p = 0.01$) from pre to post-intervention. Health outcomes did not change in the LB group. This study demonstrated that taking short, frequent breaks from sitting during the workday is a feasible and effective approach for reducing sedentary time at work. These results have implications for the development of public health messages addressing sedentary behavior, and inform future interventions to reduce sedentary time in the workplace.

Trial registration. This study is registered at www.clinicaltrials.gov: NCT02609438.

1. Introduction

Prolonged sitting is a significant public health concern and high levels of chronic sedentary behavior are associated with increased risk of obesity, diabetes, cardiovascular disease, some cancers, and mortality (Dunstan et al., 2005; Healy et al., 2008a; Katzmarzyk et al., 2009; Patel et al., 2010; Wilmot et al., 2012; George et al., 2013). Until recently, sedentary behavior was considered synonymous with a lack of moderate/vigorous physical activity, but accumulating evidence suggests metabolic health is compromised in those who spend the majority of their days engaged in sedentary behaviors, even if they are engaging in moderate/vigorous physical activity (Owen et al., 2010). In other words, sedentary behavior is an independent risk factor for obesity and chronic disease; therefore, interventions designed to target this outcome specifically are warranted (Hamilton et al., 2008; Dunstan et al., 2010).

Long bouts of uninterrupted sedentary behavior are likely to result in moderate to large reductions in glucose tolerance and insulin sensitivity (Dunstan et al., 2012; Saunders et al., 2012; Stephens et al., 2011). However, there is some evidence that breaking up sedentary time may help counteract some of these negative metabolic effects (Owen 2012). Short-term laboratory-based experiments have demonstrated that when sitting is interrupted every 30 min by brief activity breaks (i.e., two minutes of treadmill walking), postprandial glucose and insulin levels are significantly reduced (Dunstan et al., 2012; Peddie et al., 2013). One observational study also demonstrated a significant relationship between health outcomes (i.e., triglycerides, glucose, waist circumference) and the total number of breaks from sitting, independent of total sedentary time (Healy et al., 2008b). A recent meta-analysis, however, cautioned that more research is needed to better understand the relative importance of the frequency, duration, and intensity of activity breaks (Chastin et al., 2015).

Unfortunately, sitting has become increasingly ubiquitous in most workplaces. Since the 1960s, jobs that require moderate physical activity have declined significantly (Church et al., 2011). Up to 80% of adults in the United States now have sedentary occupations, during which 70–80% of the workday is spent sitting, primarily in bouts over 20 min without a break (Clemes et al., 2014; Parry and Straker 2013; Thorp et al.,

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2012). As technology advances and labor-saving devices proliferate, these trends are likely to persist unless interventions are implemented.

In 2010, Chau and colleagues published a review highlighting a paucity of workplace interventions to reduce sitting (Chau et al., 2010). Since that time, sedentary behavior has garnered increasing interest and a number of interventions designed to reduce sitting time at work have been developed. In 2014, Neuhaus and colleagues reviewed workplace interventions using activity-permissive workstations and found a mean reduction in sedentary time of 77 min per 8-hour workday across 8 studies (Neuhaus et al., 2014). A recent Cochrane review also supported the potential effectiveness of sit-to-stand desks, but found no evidence to support other approaches (e.g., information and counseling), and concluded overall that much more research is needed to determine whether interventions to decrease occupational sitting are effective, particularly in the long-term (Shrestha et al., 2016). Additionally, to date only a handful of studies have measured cardiometabolic risk factors in the context of a workplace intervention to reduce sitting time, and the results thus far have been inconclusive (Alkhajah et al., 2012; Carr et al., 2013; Carr et al., 2015; Puig-Ribera et al., 2015).

Despite emerging evidence from laboratory studies that breaking up sedentary time confers cardiometabolic benefits, the extent to which such benefits can be observed in the context of a real-world intervention warrants further investigation. Furthermore, no studies to date have examined whether different approaches to breaking up prolonged sitting during the workday are equally feasible and effective. Multiple countries (e.g., Australia, Canada) now provide general sedentary behavior guidelines that recommend reducing time spent in prolonged sitting (Australian Department of Health, 2014; Canadian Society for Exercise Physiology, 2011), but in order to make specific recommendations about *how* one should go about breaking up sitting time, it is important to determine the relative effectiveness of various approaches. Thus, the purpose of the present study was to compare the effects of short, frequent breaks from sitting versus longer, planned breaks from sitting on sedentary behavior during the workday and cardiometabolic health among inactive female office employees.

2. Methods

2.1. Overview of study design

This parallel-group randomized trial employed an 8-week intervention to compare the two break strategies. All participants were advised to accumulate 30 min of activity/non-sitting time across the course of each workday, but half were randomly assigned to a short break (SB) group, and half were assigned to a long break (LB) group. Specifically, participants in the SB group were instructed to stand/move for 1–2 min every half hour, and participants in the LB group were instructed to take two 15-minute breaks from sitting each workday. All participants were advised to stand at a minimum, and move around or walk if possible during each break. Height-adjustable desks were not provided for this study. Outcomes were assessed at baseline and immediately following the 8-week intervention. All procedures were approved by the Kansas State University institutional review board (protocol 7031). Participant recruitment began in March 2014 and data collection was complete in June 2015.

2.2. Participants

Participants were recruited via university email lists and flyers distributed at local businesses. Interested individuals were directed to an online survey to assess eligibility. In order to be eligible to participate, individuals had to be premenopausal females over 21 years old, work at least 35 h per week, self-report sitting for at least 80% of working hours, and engage in <60 min per week of moderate/vigorous physical activity (MVPA). To determine MVPA, participants described their exercise habits (frequency, duration, type) during the past month, and research staff followed up to clarify if necessary. Individuals who were pregnant or actively attempting to lose weight were excluded. Participants were primarily university employees in office settings with set hours (8:00 a.m.-5:00 p.m.) but not set break schedules.

2.3. Procedures

Individuals who met inclusion criteria received a packet containing the informed consent document, an Actigraph GT3X accelerometer, and a log sheet for documenting accelerometer wear time. Participants were asked to wear the accelerometer on the left hip during waking hours for 7 consecutive days and to document the exact times they wore the monitor each day, as well as any periods of monitor removal. Following the week of accelerometer wear, participants attended a baseline testing and orientation appointment, during which they submitted the signed the informed consent document, returned the accelerometer, and completed the health assessments. Prior to the appointment, participants were randomized to the SB or LB group, by an investigator not involved with testing, using a random digit generator in Microsoft Excel. Participants were blinded to treatment group assignment until their orientation session. For the post-intervention assessments, participants wore the accelerometer for one week beginning Monday of week 8, and reported to the laboratory during the week immediately following the intervention to repeat the health assessments.

2.4. Intervention

Immediately following the baseline health assessments, each participant attended a 30-minute individual orientation session with a trained research assistant. After an overview of the study objectives and procedures, participants were informed of their group assignment and completed a planning worksheet with the research assistant. Specifically, participants identified 3–4 specific strategies they would use to take daily activity breaks, and devised strategies for overcoming potential barriers. Participants also received a list of computer/mobile applications they could use to prompt daily activity breaks, and 8 weeks of daily activity logs.

Participants began the intervention on the Monday following their orientation session. Every Monday morning, they received an email from the research team containing information or tips related to reducing sitting time at work. During week 4 of the intervention, participants received a brief phone call from a research assistant to discuss any questions or concerns.

All participants were asked to keep daily activity logs across the 8-week duration of the intervention. For the SB group, participants were asked to record (in real time) the start time and duration of every activity break (standing or walking) that was at least one minute in duration. For the LB group, participants were asked to record the time they planned to take their two breaks, then indicate the actual time and duration of the breaks. The LB activity log also included a section to record additional breaks from sitting (time and duration) that were outside of the planned 15-minute breaks. At the end of each week, participants submitted their logs in a pre-addressed envelope or via email.

2.5. Measures

2.5.1. Demographics

At baseline, participants completed a brief demographics survey to indicate age, race, education, income, and hours worked per week.

2.5.2. Adherence

Adherence to the intervention protocols was assessed using the daily activity logs. Each day was coded as: (1) full adherence, (2) partial adherence, (3) no adherence, or (4) did not attend work. For the SB group, full adherence was defined as a minimum of 12 activity breaks