A WALKING INTERVENTION FOR SEDENTARY EMPLOYEES: EFFECTS ON SELF-REGULATION AND SELF-EFFICACY

INTERVENCIÓN DE CAMINATA PARA EMPLEADOS SEDENTARIOS: EFECTO SOBRE LA AUTORREGULACIÓN Y LA AUTO EFICACIA

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Abstract

A 10-week walking intervention was designed to examine how physical activity affects self-regulation and self-efficacy in sedentary employees. The intervention was completed by 68 participants randomly assigned to three groups: intermittent walking, continuous walking, or control. Self-regulation, self-efficacy and walking behavior were measured at baseline, week-6, and week-11. Walking activity significantly ($p<.05$) increased for the continuous walking group from baseline to week-6 ($p=.033$), the percentage of change was significantly higher compared to the control group from baseline to week-11 ($p=0.042$). Significant improvements on self-regulation were observed with the continuous group from baseline to week-6 and week-11 ($p<0.05$). However, self-efficacy decreased from baseline to week-6 ($p=.047$) and week-11 ($p=.008$) for all groups. Sedentary employees may benefit more from a continuous walking program due to enhanced self-regulatory skills. Intermittent walking activity may be also a feasible approach to reduce sedentary behavior, however more research is needed to test whether or not sedentary employees can meet daily physical activity recommendations. It is also important to review in future research, the link between physical activity and self-efficacy.

Key words: self-regulation, self-efficacy, sedentary behavior, walking activity

Resumen

Se diseñó una intervención de caminata de 10 semanas para examinar cómo la actividad física afecta la autorregulación y la autoeficacia en empleados sedentarios. La intervención fue realizada por 68 participantes asignados a tres grupos al azar: caminata intermitente, caminata continua o control. La autorregulación, la autoeficacia y la actividad física se midieron al inicio, a la semana 6 y la semana 11. La actividad de caminata aumentó significativamente ($p<.05$) con el grupo de caminata continua desde el inicio a la semana 6 ($p=.033$), el porcentaje de cambio fue mayor en comparación con el grupo control desde el inicio a la semana 11 ($p=0{,}042$). Se observaron mejoras significativas en la autorregulación con el grupo de caminata continua desde el inicio a la semana 6 y a la semana 11 ($p<0.05$). Sin embargo, la autoeficacia disminuyó desde el inicio a la semana 6 ($p=.047$) y a la semana 11 ($p=.008$) para todos los grupos. Los empleados sedentarios tendrían más ventajas si se les prescribe un programa de caminata continua, ya que puede mejorar las habilidades de autorregulación. La actividad de caminata intermitente también puede ser un enfoque factible para reducir el comportamiento sedentario, sin embargo, se necesita más investigación para evaluar si los empleados sedentarios pueden o no cumplir con las recomendaciones diarias de actividad física. También es importante revisar en futuras investigaciones el vínculo entre la actividad física y la autoeficacia.

Palabras clave: autorregulación, autoeficacia, comportamiento sedentario, actividad para caminar

Introduction

Despite the known benefits of physical activity on the overall health and quality of life, a majority of the United States adult population is inactive. According to the Center for Disease Control and Prevention (Centers for Disease Control and Prevention [CDC], 2015) in 2013, approximately 80% of the United States population did not meet physical activity recommendations based on self-report measures. Utilizing objective measures of physical activity, about 95% of American adults are inactive (Troiano et al., 2008). Promoting walking is one potential strategy to increase physical activity. Walking is related to many health benefits while reducing the possibility of injuries or overstress (Pelssers et al., 2013; Taylor et al., 2004). Walking is the most preferred physical activity (Williams, Matthews, Rutt, Napolitano, & Marcus, 2008), and a good alternative for people who are sedentary and/or never engaged in an exercise program before (Ogilvie et al., 2007).

Recently, walking interventions have shifted the focus from increasing physical activity to disrupting or decreasing sedentary behavior with intermittent bouts of walking (Prince, Saunders, Gresty, & Reid, 2014). Intermittent physical activity is thought to have similar health benefits compared to continuous based physical activity (Bassett, Freedson, & Kozey, 2010; Owen, Healy, Howard, & Dunstan, 2012; Parry, Straker, Gilson, & Smith, 2013; Taylor, 2011). Intermittent physical activity may require less time commitment (Dunstan, Howard, Healy, & Owen, 2012), and may increase motivation once people realize it is easier to perform (Jakicic, Winters, Lang, & Wing, 1999; Sherwood & Jeffery, 2000) compared to continuous bouts of 30 minutes or more. Moreover, short bouts of physical activity may be a better way for people that are not currently performing any exercise and this also may be easier to achieve and incorporate to the daily living (Sherwood & Jeffery, 2000), such as individuals who are employed in offices and are sedentary a majority of the work day (Kaewthummanukul & Brown, 2006).

In previous reports, the inability of interventions to change physical activity over time, has been linked to a lack of change in key mediators of continued physical activity and walking participation such as self-regulation and self-efficacy (Williams & French, 2011). If key mediators are not considered as part of the intervention to improve physical activity, it is unlikely that physical activity and walking behavior will continue (Dishman et al., 2005; Jung & Brawley, 2013).

Self-regulation for physical activity requires attention to one's own capacities and the ability to modulate thoughts, affects, behavior, or attention by cognitive control mechanisms (Buckley, Cohen, Kramer, McAuley, & Mullen, 2014; Karoly, 1993). Some key aspects to positively self-regulate and adhere to a physically active behavior are self-monitoring and time management (Fletcher, Behrens, & Domina, 2008). In a meta-regression (Michie, Abraham, Whittington, McAteer, & Gupta, 2009), researchers stated that interventions targeting behavior change that used different self-monitoring tools produce positive effects on physical activity outcomes. For walking, a pedometer and/or wrist worn devices are typically used to measure physical activity. Previous studies reported that people who track steps significantly increased physical activity by around 27% compared to baseline (Bravata et al., 2007). In qualitative studies, people reported that step trackers helped them increase physical activity due to the awareness of the steps and the motivational and meaningful goal setting by being able to see steps taken per day (Lauzon, Chan, Myers, & Tudor-Locke, 2008). In a meta-analysis using 32 studies (Kang, Marshall, Barreira, & Lee, 2009), the investigators found that as a self-monitoring tool, pedometers have a moderate and positive effect on incremental physical activity over the course of interventions, and 10,000 steps/day goal is an effective strategy for adult women to increase physical activity.

In addition to self-regulation, self-efficacy, the confidence that a person can perform a specific behavior (Bandura, 1997), is related to continued exercise participation. Previous reports indicate that self-efficacy is a key predictor of physical activity adherence and high levels of self-efficacy are related to higher levels of physical activity participation (Fletcher et al., 2008; Kaewthummanukul & Brown, 2006), as well as, a predictive factor for adoption and maintenance of physical activity (Sallis et al., 1986; Strachan, Woodgate, Brawley, & Tse, 2005). Furthermore, several studies have shown that self-efficacy is a strong predictor of changes in physical activity behavior in long-term interventions (McAuley & Blissmer, 2000; Oman & King, 1998; Sallis et al., 1986). Specifically, interventions that consider techniques such as vicarious experience and feedback have higher levels of physical activity and self-efficacy compared to those interventions that use persuasion, graded mastery, and barrier identification (Ashford, Edmunds, & French, 2010). The use of self-efficacy strategies seems to be effective to improve physical activity over time and interventions that target physical activity behavior should include strategies to produce the knowledge and application of this skill (Dishman et al., 2005; Iwasaki et al., 2017).

Although self-regulation and self-efficacy appear necessary to continue long-term exercise, there are gaps in the literature as to how different types of physical activity (i.e. continuous versus intermittent) affect self-efficacy and self-regulation in sedentary adults. Furthermore, changes in physical activity levels and its relationship with self-regulation and self-efficacy remain unclear. Therefore, the purpose of this study was to examine the effect of two different walking programs on self-regulation and self-efficacy in sedentary office workers who participated in a 10-week physical activity program.

Methods

Detailed methodology for this long-term experimental study has been published before (Rodriguez-Hernandez & Wadsworth, 2019). However, this section of the study adds psychological aspects that are believed to have important influence on physical activity increments and adherence over time. A brief methodology is described below.

Participants

Following Cohen's recommendations for a representative sample for behavioral analysis like physical activity (conservative calculation a_1=.05, r=.30, and power =.80 with a desirable sample size of 68), eighty-four subjects were randomly assigned (based on initial BMI and gender) to one of three groups to complete a 10-week intervention, consisting of two walking protocols; intermittent walking and continuous walking. A third group served as the control group and were not given an exercise prescription nor self-regulatory training. Figure 1 shows the intervention design. Sixteen participants withdrew from the study during the first weeks of the intervention and data were removed from all analysis. Therefore, the final sample size was 22 for the continuous group, 24 for the intermittent group and 22 for the control group.

This protocol was approved by the Institutional Review Board of Auburn University and followed the standards set by the latest revision of the Declaration of Helsinki. Each participant signed a written informed consent and completed the Physical Activity Readiness Questionnaire (PAR-Q) prior participation.

Walking Protocol	Baseline Assessment	Initial Groups	Tasks	Walking Prescription	Self-Regulation	Self-Efficacy	Assessments	Final Groups
Recruitment N=84	Randomization Gender BMI	Intermittent Walking n=28 (6 male & 22 female)	Multiple bouts/day Walking program + Advise 10,000 steps per day	**Week 1** 4 break/5-min/3 day/week 30-60% HR/3-6 RPE **Week 2-3** 6 break/5-min/3 day/week 30-60% HR/3-6 RPE **Week 4-5** 6 break/5-min/4 day/week 30-60% HR/3-6 RPE **Week 6-7** 6 break/5-min/5 day/week 30-60% HR/3-6 RPE **Week 8-10** 8 break/5-min/5 day/week 30-60% HR/3-6 RPE	**Week 1-2:** N/A **Week 3:** 1 EM, 3 TM **Week 4:** 2 EM, 1 TM **Week 5:** 1 EM, 2 TM **Week 6:** 1 EM, 2 TM **Week 7:** 1 EM, 2 TM **Week 8:** 1 EM, 2 TM **Week 9:** 2 EM **Week 10:** 1 EM	**Week 1-2:** N/A **Week 3:** 4 TM **Week 4:** 1 EM, 2 TM **Week 5:** 1 EM, 2 TM **Week 6:** 1 EM, 2 TM **Week 7:** 1 EM, 1 TM **Week 8:** 1 EM, 1 TM **Week 9:** 1 EM, 2 TM **Week 10:** 1 EM, 2 TM	Week 6 Week 11	Intermittent Walking n=24 (5 male & 19 female) • 85.7% attrition
		Continuous walking n= 28 (6 male & 22 female)	1 single bout /day Walking program + Advise 10,000 steps per day	**Week 1** 20 min/3 day/week 30-60% HR/3-6 RPE **Week 2-3** 30 min/3 day/week 30-60% HR/3-6 RPE **Week 4-5** 30 min/4 day/week 30-60% HR/3-6 RPE **Week 6-7** 30 min/5 day/week 30-60% HR/3-6 RPE **Week 8-10** 40 min/5 day/week 30-60% HR/3-6 RPE			Week 6 Week 11	Continuous walking n= 22 (6 male & 16 female) • 78.6% attrition
		Control n=28 (5 male & 23 female)	No PA prescription + Advise 10,00 steps per day	N/A	N/A	N/A	Week 6 Week 11	Control n=22 (5 male & 17 female) • 78.6% attrition

Figure 1. Study design, PA (Physical Activity), EM (email message containing videos or documents for training purpose), TM (Text Messages). Source: author's elaboration

Procedures

At the starting point, participants were assessed for self-regulation and self-efficacy via questionnaires and then randomly assigned, based on gender and BMI, to one of three groups. A MOVband, wrist worn accelerometer (DHS Group, Houston, TX), was assigned to each participant to wear for the entire intervention with access to online cloud software to synchronize and view data from the device.

The 10-week walking prescription for the intermittent and continuous groups followed an incremental increase in walking behavior over 10-weeks. These two groups were targeted with weekly strategies to improve self-efficacy and self-regulation skills via text messages, e-mails and videos targeting specific variables as shown in table 1. All contents were linked to tactics to improve control over personal actions and to improve self-confidence in changing physical activity behavior. The control group had access to the MOVband account but did not have access to a walking program nor to self-regulatory or self- efficacy strategies sent via text messages, e-mails and videos.

Table 1

Text messaging and email containing videos targeting self-regulation and self-efficacy during the 10-week intervention

Text and email messaging system and videos for self-regulation and self-efficacy				
	Self-Regulation		**Self-Efficacy**	
	Target	**Example**	**Target**	**Example**
Week 1- 2	N/A		N/A	
Week 3	**Goal setting**	Video: Goal setting TM: "Park your vehicle further, take the stars, and walk to your friend's office. Walk when you getting your lunch. Stand up from your chair frequently"	**Personal inventory**	TM: "Make an inventory of your past experience with exercise. List all positive and negative you can recall"
Week 4	**Self-monitoring**	Video: Self-monitoring TM: "are you aware of the time you spend being physically inactive?"	**Obstacles**	TM: "stay aware of negative events that may set you back from your walking routine"
Week 5	**Time management**	Video: Time management TM: "are you making time to meet your physical activity recommendations?"	**Vicarious experience**	TM: "Look for what others are doing to keep up with physical activity and the benefits they are getting"
Week 6	**Relapse prevention**	Video: Relapse prevention TM: "if something unexpected comes up and it feels like the perfect excuse to do not do exercise, are you able to make and apply plan B?"	**Persuasion**	TM: "make sure you have a plan to keep up with your walking prescription. Physical inactivity is really dangerous for your quality of life and overall health"
Week 7	**Social support**	Video: Social support TM: "keep doing physical activity with your friends, family, coworker, etc. If you don't have one yet, find someone with similar goals to workout with"	**Self-appraisal**	TM: "take a moment to think how are you doing with your physical activity program"
Week 8	**Reinforcements**	Video: Reinforcements TM: "reward yourself for keeping up with the physical activity program"	**Motivation**	TM: "keep walking you are making a huge progress. Way to go!"
Week 9		Video: Goal setting, self-monitoring, and time management	**Time**	TM: "are you having troubles to meet the physical activity prescription? Make sure you put it within your priorities. Try to separate the time to work out?"
Week 10		Video: Relapse prevention, social support, and reinforcements		TM: "share your achievements with your friends, family, and coworkers. Show them your improvements".

Source: author's elaboration

Participants were asked to complete a self-regulation and a self-efficacy questionnaire again on week-6 of the program, and at the end of the 10-week intervention (week-11). MOVband data was monitored for the duration of the study and moves from baseline, week-6, and week-11 were used for comparison.

Measures

<u>*MOVband*</u>

To track daily physical activity, a movable wrist-worn device was given to the all three groups to track daily moves during the entire intervention (MOVband; DHS Group, Houston, TX.). Treadmill MOVband reliability has been reported as r=0.92, p<0.02 (Barkley, Rebold, Carnes, Glickman, & Kobak, 2014), and free living PA as r=0.974 (Williamson, Rebold, Carnes, Glickman, & Barkley, 2014). A cloud-based software allowed participants login, synchronize, download data and charge the device each week.

Self-regulation

Self-regulation was measured with a 43-item questionnaire (Petosa, 1993) in order to assess the degree to which self-regulation strategies are used to support the acquisition of regular exercise. This instrument contains six subscales 1) reinforcements (items 24-32) 2) social support (items 15-23) 3) goal setting (items 6-14) 4) self-monitoring (items 1-5) 5) time management (33-36) and 6) relapse prevention (items 37-43). All items are set in a Likert scale ranging from 1 (never) to 5 (very often). Self-regulation was defined as skills used to carry out exercise intentions and to overcome personal and situational barriers. Face and content validity were established in a two-stage expert panel review. The test-retest reliability for the total instrument was reported as $r=0.92$, $p<0.0001$. Internal consistency for the total instrument was reported as 0.88 (Cronbach's alpha). The minimum and maximum summed values are 43-215. A high score indicates frequent use of self-regulation skills.

Self-Efficacy

Self-efficacy was defined as the level of confidence in one's ability to change physical activity behavior, and assessed by a 12-item instrument (Sallis, Pinski, Grossman, Patterson, & Nader, 1988). This scale consists of two subscales: "Resisting relapse" (five items; e.g., stick to your exercise program when your family is demanding more time from you) and "Making time" for exercise (seven items; e.g., get up earlier to exercise). The questionnaire is measured with a Likert-type scale ranging from 1 ("I know I cannot do it") to 5 ("I know I can do it"), with higher scores indicating greater self-efficacy. Reported internal consistency reliability ranged from 0.83 and 0.85 in a college age population (Sallis et al., 1988). Also, Speck and Looney reported the internal consistency of this scale as 0.91 in middle age women participating in moderate or higher intensity physical activity. Factor test-retest reliabilities were 0.68 (Speck & Looney, 2001) When correlating self-efficacy factor score with reported physical activity habits both subscales were significantly correlated with reported vigorous activity ($r=0.32$, $p<0.001$) (Sallis et al., 1988).

Statistical analysis

Data were analyzed with the Statistical Package for Social Sciences version 24.0. A mixed design ANOVA examined the main effect over time and the main effect of time and group interaction. Between factors examined differences between groups, whereas, within factors assessed change over time within each group. For significant main effect (i.e. p<0.05), Bonferroni correction post-hoc test was performed for multiple comparisons. Independent t-test was performed to compare percentage of change from move data points measured by MOVband.

Results

Sixty-eight sedentary office employees were able to finalize the program. At the onset of the study, groups did not differ by BMI (p=0.279).

Physical activity results as moves

Figure 2 shows the average number of moves during the three weeks selected for evaluation and the corresponding percentage of change from baseline to week-6 and week-11.

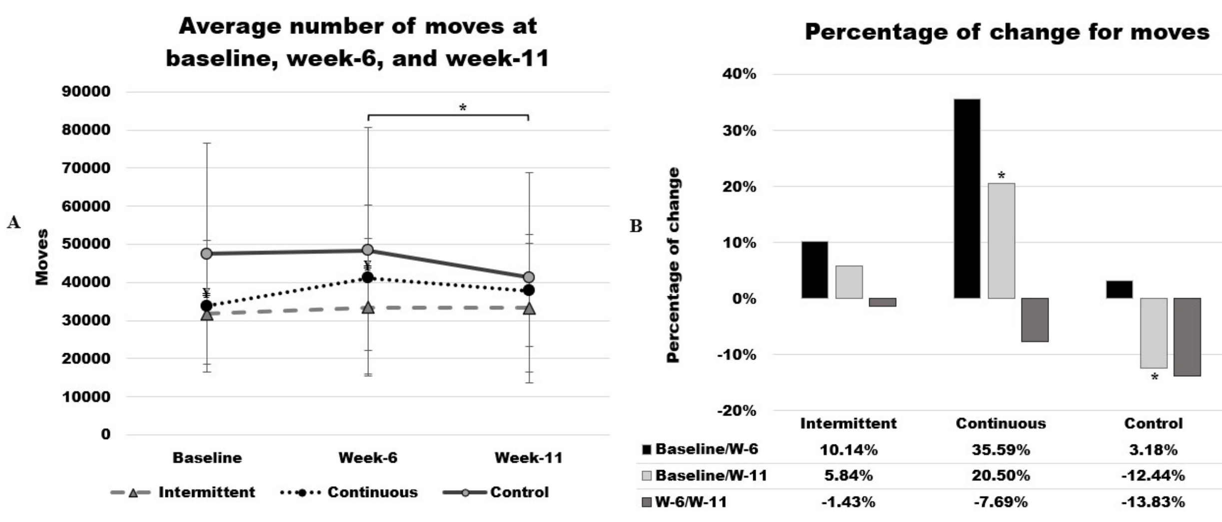

Figure 2. A. Moves by group, at baseline, week-6, and week-11. P<0.05, * Week-6 from week-11; ¥ Baseline from week-6, (p<0.05). B. p<0.05, percentage of change by group at baseline to week-6, from baseline to week-11, and from week-6 to week-11. Source: author's elaboration.

The results from the mixed design ANOVA show that for the three groups, physical activity measured by moves changed significantly over the course of the intervention with a main effect of time $F(2,130) = 4.497$, $p=.013$, a medium size effect of $n^2=.065$, and physical activity differed as main effect of time by group interaction $F(4,130)=2.526$, $p=.044$) with a medium size effect of $n^2=.072$. There was no main effect of group on physical activity measured as moves $F(2,65)=2.135$, $p=0.107$. A reduction on moves from week-6 to week-11 (p=.014) for all groups combined was found. The Bonferroni post-hoc test showed that the continuous walking group increased moves from baseline to week-6 (p=.033), did not showed changes in moves from week-6 to week-11, and from baseline to week-11 (p>0.05). Intermittent walking activity and the control groups did not change in PA between measures (p>0.05), Fig 2 A). The independent t-test showed that there were no differences on moves measured by percentage of change between intermittent and continuous walking groups from baseline to week-6 (p=169), from baseline to week-11 (p=.351), and from week-6 to week-11 (p=.417). Intermittent walking and control groups were not different from each other at baseline to week 6 (p=.527), from baseline to week-11 (p=.073), and from week-6 to week-11 (p=.087). Continuous walking and control groups were not different from each other from baseline to week-6 (p=.069) and from week-6 to week-11 (p=.0.433) but were significantly different from baseline to week-11 (p=.042).

Self-Regulation results

The effect of the intervention on self-regulation is presented in Table 2.

Table 2

Results from the overall mixed ANOVA by group for self-regulation questionnaire at baseline, 6-weeks, and week-11.

		Baseline	Week-6	Week-11	Main effect of group			Main effect of time			Time by group interaction			Baseline - Week-6	Baseline – Week-11
					F	p	n^2	F	p	n^2	F	p	n^2	p	p
Overall Mixed ANOVA	SELF-REGULATION				1.09	.343		20.04	.000*	.236	8.02	.000*	.198		
	Self-monitoring				.788	.459		18.99	.000*	.226	2.97	.022*	.084		
	Goal setting				.494	.612		15.09	.000*	.188	5.59	.000*	.147		
	Social support				.017	.983		10.14	.000*	.135	6.46	.000*	.166		
	Reinforcement				2.0	.143		7.11	.001*	.099	4.2	.003*	.114		
	Time management				.053	.948		32.93	.000*	.336	10.16	.000*	.238		
	Relapse prevention				6.33	.003¥	.163	33.86	.000*	.343	2.69	.034*	.077		
Intermittent	SELF-REGULATION	92.3±23.6	100.2±22.3	101.4±29.6											
	Self-monitoring	10.7±4.3	12.7±3.9	12.1±3.7											
	Goal setting	20.6±6.7	23.5±7.2	22.8±8.0											
	Social support	16.1±4.9	16.5±4.5	17.5±6.4											
	Reinforcement	24.0±6.7	24.7±4.9	25.0±6.7											
	Time management	8.5±3.1	9.2±3.3	9.4±3.7											
	Relapse prevention	12.5±4.2*	13.7±4.6	14.6±5.1*											.032**
Continuous	SELF-REGULATION	75.3±24.7	112.3±20.9*	108.2±23.1*										.000**	.000**
	Self-monitoring	8.1±3.2	14.1±4.0*	12.68±4.5*										.000**	.001**
	Goal setting	16.7±6.6	26.9±6.6*	25.27±6.9*										.000**	.001**
	Social support	12.6±4.7	18.8±5.8*	18.27±5.5*										.000**	.001**
	Reinforcement	20.5±7.8	26.9±6.0*	26.50±4.8*										.005**	.006**
	Time management	6.4±2.9	10.7±2.8*	10.18±3.2*										.000**	.001**
	Relapse prevention	11.1±3.5	15.0±4.4*	15.27±4.3*										.018**	.001**
Control	SELF-REGULATION	87.6±31.9	89.1±26.0	92.9±27.9											
	Self-monitoring	9.5±3.9	11.4±4.5	11.2±5.0											
	Goal setting	20.5±9.2	21.1±8.9	21.6±8.5											
	Social support	16.4±6.4	16.2±6.0	16.8±5.4											
	Reinforcement	21.6±7.9	21.2±5.9	22.6±7.3											
	Time management	8.1±4.0	7.2±2.9	8.1±3.0											
	Relapse prevention	11.7±3.7	11.9±3.7	12.7±4.0											

Note: Mixed ANOVA results are presented at the upper part of the table, degrees of freedom are: main effect of group (2,65), main effect of time (2,130), and time by group interaction (4,130). * p<0.05, main effect time and time by group interaction. ** P<0.05, continuous walking group improved all sub-scales at week-6 and week-11. Intermittent walking improved only the sub-scale relapse prevention at week-11. ¥ Control group different from intermittent and continuous groups (p=.011 and p=.007 respectively). Source: author's elaboration.

The results from the mixed-design ANOVA showed that total self-regulation changed as a main effect of time *F*(2,130) =20.140, *p*<.001, with a large effect size of n^2=.236. When comparing self-regulation by group there was an interaction *F*(4,130) =8.017, *p*<.001, and a large effect n^2= .198. Bonferoni post-hoc test showed that for the continuous group, overall self-regulation improved from baseline to week-6 (*p*<.001) and week-11 (*p*<.001). The intermittent walking group increased in relapse prevention from baseline to week-11 (p<.037). The control group did not change overall self-regulation at week-6 nor at week-11.

Self-efficacy results

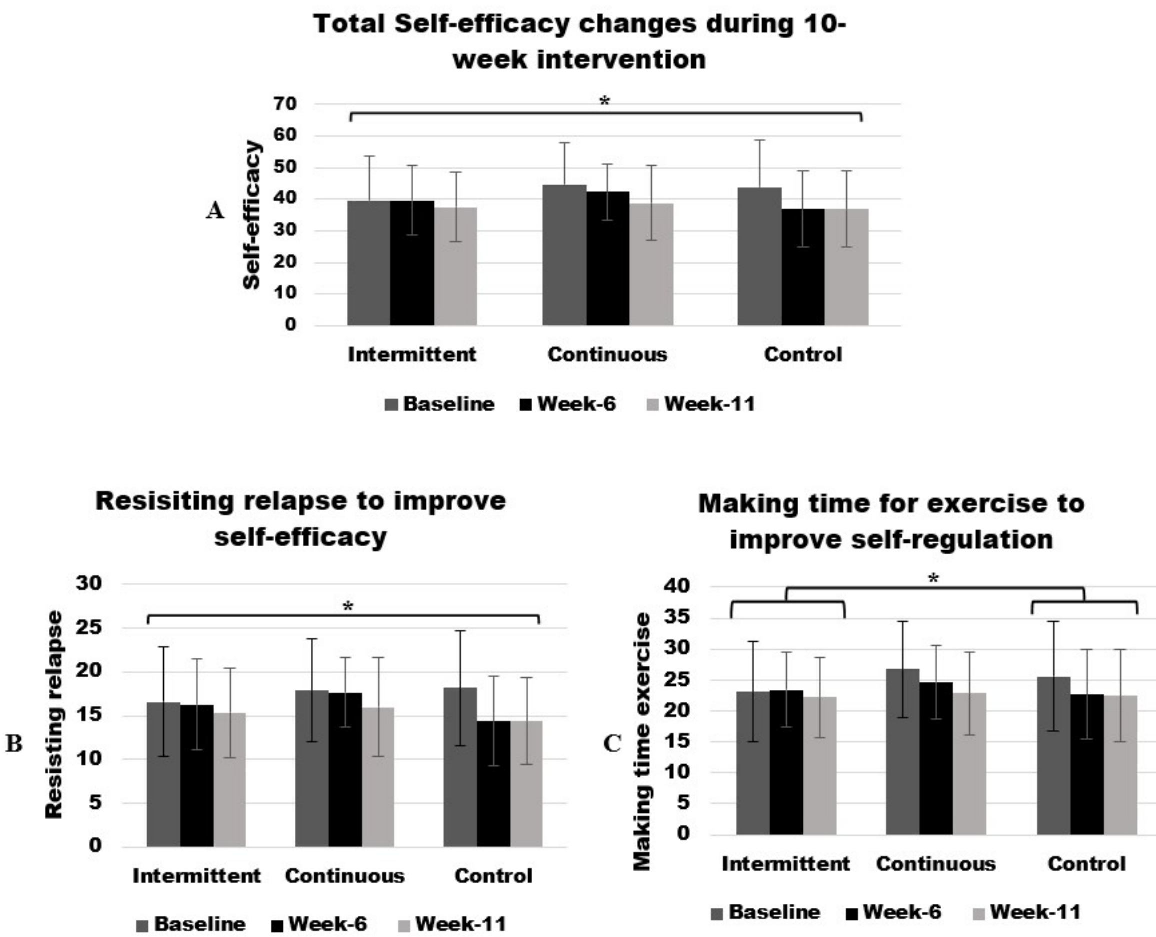

Figure 3. **A.** Overall self-efficacy results by group at baseline, week-6 test, and week-11. **B.** Self-efficacy for resisting relapse by group at baseline, week-6 test, and week-11. **C.** Self-efficacy for making time to perform exercise by group at baseline, week-6 test, and week-11. *p<.05. Source: author's elaboration.

For self-efficacy, figure 3 shows the results from the mixed-design ANOVA and demonstrates there was no effect of time by group interaction (*F*=1.207, *p*=.312) and groups were not different between them (*F*=.571, p=.568). There was no main effect of group on self-efficacy *F*(2,64)=0.571, p=0.568. Total self-efficacy decreased in all three groups as a main effect of time *F*(1.821,116.52) =6.341, *p*=.003), with a medium size effect of n^2=.090. Self-efficacy decreased significantly from baseline to week-6 (*p*=.047) and from baseline to week-11 (*p*=.008). There was not main effect of time and group interaction (*F*=1.917, *p*=.112) for resisting relapse. Resisting relapse as part of self-efficacy did not change as a main effect of group $F(2,64)=.653$, $p=0.524$, but it changed as a main effect of time $F(2,128)=7.012$, $p=.001$, with a medium size effect of $n^2=.099$. Resisting relapse decreased at week-6 (p=.038) and at week-11, (p=.003) in all three groups, compared to baseline measures. Finally, making time for exercise did not have a main effect of group $F(2,64)=.571$, $p=0.568$, however a main effect of time was observed $F(1.801,115.29)=4.682$, p=.014, with a medium size effect of $n^2=.068$. The three groups were lower at week-11 compared to baseline (p=.031).

Discussion

The purpose of this study was to examine the effect of two different walking programs on self-regulation and self-efficacy for physical activity in sedentary office workers after 10 weeks of intervention. The results showed individuals within a continuous walking program developed greater self-regulation skills compared to the control or intermittent walking group, and this was translated to physical activity at 6 weeks and 11 weeks. Self-efficacy decreased significantly over the course of the intervention for all groups, showing a decrease in confidence to improve physical activity behavior.

We defined self-regulation as the degree to which self-regulation strategies were used to support the acquisition of regular exercise. Strategies such as goal setting and self-monitoring require the individual to adopt a more conscious state about volition, planning, actions, monitoring, and inhibition. Meanwhile, following the cognitive process, self-regulation, will improve by changing tasks, increasing corporal activity, improving motivation and challenging the currently behavior (Bandura, 1991). Our results showed several significant changes in self-regulation, predominately in the continuous walking group. These findings suggest that performing a continuous walking program enabled individuals to self-regulate walking behavior better than those in the intermittent walking group and the control group. Both, the continuous and the intermittent walking groups were provided with the same mobile health intervention that targeted the six self-regulation skills assessed. However, only relapse prevention, the ability to overcome barriers associated with exercise, significantly changed over the course of the intervention for the intermittent group. This intervention shows that self-regulation can be changed via mobile health interventions, but that the exercise prescription for the intervention affects changes in self-regulation.

It is likely that the daily work demand and current sedentary behavior of the participants in the intermittent walking group interfered with motivation and cognitive control to overcome difficulties to meet the physical activity prescription. Thus, participants perceived more challenging and less achievable tasks to intersperse multiple short walking bouts every day. This finding is supported by a previous study where people prescribed long bouts of brisk walking (30 min) participated in more physical activity than those set in a short bout of walking activity (3x10 min), (Serwe, Swartz, Hart, & Strath, 2011). The present study targeted self-efficacy via pointed persuasion and barrier identification by text messages and emails. Our results showed that self-efficacy did not improve through the intervention, and in fact, self-efficacy decreased significantly over time showing that participants' confidence to keep up with physical activity decreased, and they were less able to make time for exercise and to resist relapses. Different studies have suggested that self-efficacy changes over time, being more potent during the stages of adoption and weaker during the maintenance stages of physical activity behavior (McAuley & Blissmer, 2000; Oman & King, 1998). In addition, in previous studies, researchers found that self-efficacy decreased overtime with an online intervention. This decrease in self-efficacy may occur because as one begins an exercise program, the level of barriers is unknown and may increase as one moves closer to adoption and maintenance (Wadsworth & Hallam, 2010).

All our participants were able to self-monitor their walking behavior throughout the duration of the study. Based on previous research, monitoring physical activity with a step tracker has an important impact over sedentary behavior in interventions lasting at least 8 weeks (Kang et al., 2009). Moreover, when women were instructed to walk 10000 steps per day, they were more active than those that were given with a walking prescription instructed to take a brisk walk 30 minutes per day all days of the week (Hultquist, Albright, & Thompson, 2005). In our design, all subjects received the MOVband and the goal to achieve 10,000 steps per day. However, having the self-monitoring tool did not translate to changes in physical activity for the control group and the intermittent group. Only the continuous group was able to improve moves significantly from baseline to week-6 and the percentage of change was significantly different from the control group at week-11. The continuous walking group showed a significantly higher change on moves from the baseline to week-11 compared to the control group, potentially due to changes in self-regulation. For all groups, there was a reduction in moves from week-6 to the end of the intervention. Based on anecdotal information from the participants, change to daylight savings, the Thanksgiving holidays and other social and work obligations were factors that determined a reduction in physical activity at the end of the intervention. This is supported by a systematic review that showed during the ending season of the year, people are more inactive (Tucker & Gilliland, 2007).

Our findings show that for sedentary employees a structured program based on a single continuous bout of walking may be a better approach to improve self-regulatory skills. Improvement in self-regulation has been shown as a key mediator of change and is associated with higher levels of adherence (Gell & Wadsworth, 2014; Wadsworth & Hallam, 2010). Therefore, a continuous walking program may provide a more feasible approach to prescribing exercise in sedentary office employees. Intermittent physical activity may have some positive impact on self-regulatory skills, however further research is necessary to determine how this can be achieved.

Limitations

The MOVband allowed us to observe daily physical activity, however, since all participants were asked to sync the device using the phone or computer, they were able to see their own information about accumulated moves during the day, this may have affected the results of the study. The participants in the control group were also able to track this information and they could have been motivated by the wrist band and the way it shows the information. Even though, this was not planned , it allowed us to understand in a better way human behavior and the possible external effect that a tracking device may have on physical activity, thus, for future trials it is important to blind the device in order to keep participants unaware of levels of physical activity taken per day.

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