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The Effect of Workplace Multi-component Intervention on Sedentary Behavior in Portuguese Office Workers

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Abstract

Nowadays, office workers spend up to 70% to 90% of the workday in a prolonged sitting posture. Sedentary behavior (SB) negatively affects their health and increases the risk of obesity and diabetes, besides adverse effects on well-being and productivity. Portugal has the lowest levels of physical activity (PA) in Europe and high levels of sedentary behavior. This study aimed to analyze the effect of a 6-month multi-component intervention to decrease sedentary time and improve physical activity among Portuguese office workers. Furthermore, it evaluated the influence of the amount of sedentary behavior and physical activity on perceived musculoskeletal symptoms, well-being, and job satisfaction in real office work. The workplace intervention included organizational (managers support), individual (face-to-face and online training, sending pamphlets by email), and environmental (installing posters and reminder software) measures. The intervention was implemented in an intervention group (n=40), and its results were compared with a control group (n=40). Participants involved were followed from baseline and six months after the intervention. To measure the SB and PA levels before and after interventions, ActiGraph WGT3X-BT was used. Furthermore, a Portuguese version of the Nordic Musculoskeletal Questionnaire, Short Form Health Survey (SF-12), and Minnesota Satisfaction Questionnaires were used to assess musculoskeletal symptoms, well-being, and job satisfaction. In general, for all participants, sedentary behavior was high, and light and moderate to vigorous physical activity were low at the baseline. The intervention effects were seen to decrease sedentary behavior ($p = 0.017$) and improve moderate to vigorous physical activity ($p=0.021$) in the intervention group; however, the light physical activity was reduced ($p = 0.043$) after 6 months. The severity of musculoskeletal pain after the intervention was reduced in the intervention group in the neck ($p = 0.005$), right shoulder ($p = 0.007$), upper back(p = 0.004), lower back($p = 0.046$), left/right wrist ($p = 0.027/0.035$) and ankles/feet($p = 0.019$). Also, the mean value of the mental health score in the intervention group was slightly improved after intervention (69; 70.23*)*. However, this result did not have statistically significant differences ($p=0.141$). There has been no observed increase in the perception of job satisfaction. In conclusion, the results showed that medium-term intervention increased physical activity and decreased sedentary behavior in office workers, but the changes did not improve light physical activity. A combination of factors influences sedentary behaviors among office workers, such as physical environment, job type, workload, social support, and musculoskeletal symptoms. For designing an intervention, a comprehensive understanding of the individual characteristics, levels of sedentary behavior and physical activity, the work context, and organizational aspects of the workplace are needed.

Further research can use a participatory approach to choose the appropriate intervention and actively engage employees in this program.

Keywords: Physical Activity, Well-being, Job Satisfaction- Musculoskeletal Symptoms, Participatory Approach

Resumo

Atualmente, os trabalhadores de escritório passam entre 70% a 90% do dia de trabalho numa postura sentada. O comportamento sedentário afeta negativamente a saúde e aumenta o risco de obesidade e diabetes, além de efeitos adversos no bem-estar e na produtividade. Portugal tem os níveis mais baixos de atividade física da Europa e elevados níveis de comportamento sedentário. Este estudo teve como objetivo analisar o efeito de uma intervenção multicomponente com uma duração de seis meses, para diminuir o tempo de trabalho sedentário e melhorar a atividade física entre trabalhadores de escritório portugueses. Além disso, foi analisado o impacto do comportamento sedentário e atividade física na perceção dos trabalhadores sobre a sintomatologia musculosquelética , bem-estar e satisfação no trabalho em contexto real. A intervenção no local de trabalho incluiu medidas organizacionais (apoio dos gestores), individuais (treinos presenciais e online, envio de panfletos por e-mail) e ambientais (instalação de cartazes e *software* de lembrete). A intervenção foi implementada num grupo de intervenção (n=40), e seus resultados foram comparados com um grupo de controlo (n=40). Os participantes envolvidos foram avaliados no início e seis meses após a intervenção. Para medir os níveis de comportamento sedentário e atividade física antes e depois das intervenções, foi utilizado o *ActiGraph WGT3XBT*. Além disso, as versões portuguesas do questionário Nórdico músculo-esquelético, questionário de Estado de Saúde (SF-12) e *Minnesota Satisfaction Questionnaire* foram utilizados para avaliar a sintomatologia musculosquelética, bem-estar e satisfação no trabalho, respetivamente. Na generalidade, todos os participantes apresentaram níveis elevados de comportamento sedentário e a atividade física leve e moderada a vigorosa foi baixa. A intervenção contribuiu para a diminuição do comportamento sedentário (p = 0.017) e na melhoria da atividade física moderada a vigorosa (p=0.021) no grupo experimental; atividade física leve foi reduzido (p = 0.043) após 6 meses. A gravidade da dor musculoesquelética após a intervenção foi reduzida no grupo de intervenção no pescoço (p = 0,005), ombro direito (p = 0,007), parte superior das costas (p = 0,004), parte inferior das costas (p = 0,046), punho esquerdo/direito (p = 0,027/0,035) e tornozelos/pés (p = 0,019). Além disso, o valor médio da pontuação para saúde mental no grupo de intervenção melhorou ligeiramente após a intervenção (69; 70.23). No entanto, esse resultado não apresentou diferenças estatisticamente significativas (p=0,141). A intervenção não teve um impacto significativo na perceção sobre satisfação no trabalho. Assim, os resultados revelaram aumentos a longo prazo na atividade física e diminuição do comportamento sedentário em trabalhadores de escritório, contudo não se verificaram os níveis de atividade física leve não melhoraram. A combinação como o ambiente físico, tipo de trabalho, carga de trabalho, apoio social e sintomatologia musculoesquelética influenciam os comportamentos sedentários em trabalhadores de escritório. Para desenvolver uma intervenção nos locais de trabalho é necessário conhecer as características individuais dos trabalhadores, o comportamento sedentário e os níveis de atividade física, bem como os aspetos organizacionais do local de trabalho. A investigação futura nesta área deve recorrer a uma abordagem participativa dos trabalhadores para uma definição adequada da intervenção.

Palavras-chave: Atividade Física, Bem-estar, Satisfação no Trabalho, Sintomas Musculoesqueléticos, Abordagem Participativa.

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Abbreviations

IPAQ	International Physical Activity Questionnaire
PA	Physical Activity
SB	Sedentary Behavior
SDT	Self-Determination Theory
SFMQ	Short-Form Minnesota Questionnaire
LBP	Low Back Pain
MSDs	Musculoskeletal Disorders
MTVPA	moderate-to-vigorous physical activity
MET	Metabolic Equivalent
PAPM	Precaution Adoption Process Model
TTM	Trans Theoretical Model
WHO	Word Health Organization

List of Publications

Maheronnaghsh, Sara; Santos, Joana; Vaz, M. (2018)"Methods of posture analysis for computer workers". *International Journal of Occupational and Environmental Safety*, 2, 41-49. doi: 10.24840/2184-0954_002.002_0005.

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Ramos, Sofia; Maheronnaghsh, Sara; Vila-Chã, Carolina; Vaz, M.; Santos, Joana. (2019)"The Influence of Active Workstations on Work Performance, Productivity Indicators and Sedentary Time: A Systematic Review". *Occupational and Environmental Safety and Health*, 477-483. Studies in Systems, Decision and Control, vol 202. Springer, Cham. doi: 10.1007/978-3-03014730-3_51.

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Chapter 1.

Introduction

1.1. Sedentary Behavior and Physical Activity

Many studies reported a large amount of Sedentary Behavior (SB) in adult's daily life (Bauman et al., 2011; Bennie et al., 2013; Thivel et al., 2018). Changing the nature of jobs causes shifting from manufacturing to services, decreasing manual occupations with increased amounts of seated work; also, with the advancement of technologies, there has been an increase in sitting positions (Wilmot et al., 2012) and changing the behavior in the workplaces (N Owen et al., 2011). Nowadays, office workers spend up to 70% to 90% of the workday in a prolonged sitting posture (L Smith et al., 2015; A A Thorp et al., 2012). According to Thivel (2018), SB is time spent sitting or reclining during waking hours and is increasingly present in people's professional lives and negatively affects their health.

SB increases about 5% the risk of obesity and by 7% the risk of diabetes (Biswas et al., 2015; Rezende et al., 2014). Additionally, there is growing evidence that prolonged sitting is associated with multiple health risks, including musculoskeletal disorders (MSDS), cardiovascular diseases, and some forms of cancer (Gao et al., 2016), which in workplaces consequently causes direct (e.g., healthcare costs) and indirect costs (e.g., sick leave, disabilities) (OMS, 2015; Pfeiffer et al., 2011), and decreases well-being (Qi et al., 2018).

Currently, sedentary behaviors are characterized as low energy expenditure (≤1.5 metabolic equivalents (METs)) and as sitting or reclining posture (Bleser et al., 2015; Thivel et al., 2018; M S Tremblay et al., 2010). In the sport and exercise literature, the term "sedentary" is used to describe the absence of compliance with recommended guidelines (Bull et al., 2020) (Table 1). Individuals can be sufficiently active, based on the World Health Organization (WHO) recommended PA guidelines (Bull et al., 2020) (see Table 1) but also spend most of their waking hours engaging in sedentary behavior. Alternatively, people can be inactive and have SB (Saunders et al., 2014). (see Figure 1)

The Sedentary Behaviour Research Network (2012) proposed a common terminology to all scientific journals, referring that SB is independent of a lack of physical activity (PA); the term "sedentary" is used to refer specifically to waking behaviors characterized by energy expenditure ≤1.5 Metabolic Equivalent (MET) while in a sitting or reclining posture, and energy expenditures at or near resting levels (Network, 2012).In contrast, they suggested that the term "inactive" can describe those performing insufficient amounts of MTVPA (moderate to vigorous physical activity)(i.e., not meeting specified physical activity guidelines).

Table 1: Summary of the WHO Guidelines on physical activity and sedentary behavior, Adopted from Bull et al. (2020)

Physical activity	Sedentary behaviour
It is recommended that: ►All adults should undertake regular physical activity; ►Adults should do at least 150–300 min of moderate-intensity aerobic physical activity, or at least 75–150min of vigorous-intensity aerobic physical activity, or an equivalent combination of moderate-intensity and vigorous-intensity activity throughout the week for substantial health benefits; ►Adults should also do muscle-strengthening activities at moderate or greater intensity that involve all major muscle groups on 2 or more days a week, as these provide additional health benefits. *Strong recommendation* ►Adults may increase moderate-intensity aerobic physical activity to >300min, or do >150min of vigorous-intensity aerobic physical activity, or an equivalent combination of moderate-intensity and vigorous-intensity activity throughout the week for additional health benefits (when not contraindicated for those with chronic conditions). *Conditional recommendation*	It is recommended that: ►Adults should limit the amount of time spent being sedentary. Replacing sedentary time with physical activity of any intensity (including light intensity) provides health benefits; ►To help reduce the detrimental effects of high levels of sedentary behaviour on health, adults should aim to do more than the recommended levels of moderate to vigorous physical activity. *Strong recommendation*

Figure 1 characterizes the individuals according to the definitions of physical activity and sedentary behavior. The first group (Inactive, not sedentary) is those who do not have sedentary time but are inactive individuals and do not meet PA guidelines; the second group (Active, not sedentary) also does not have sedentary time but are active individuals who meet PA guidelines. The third category (Sedentary and inactive) spends not only a long period of time sitting but also does an insufficient amount of PA to meet guidelines. The last group (Sedentary and active) is those with prolonged sitting but a sufficient active level of activity (Saunders et al., 2014). Since people daily engage in both behaviors, the combined effects of SB and PA should be considered in health research (Ekelund et al., 2016). Studies concluded that the adverse effects of SB on health are independent of MTVPA, but substituting SB with light-intensity PA may reduce the risk of chronic disease and mortality (Wilmot et al., 2012).

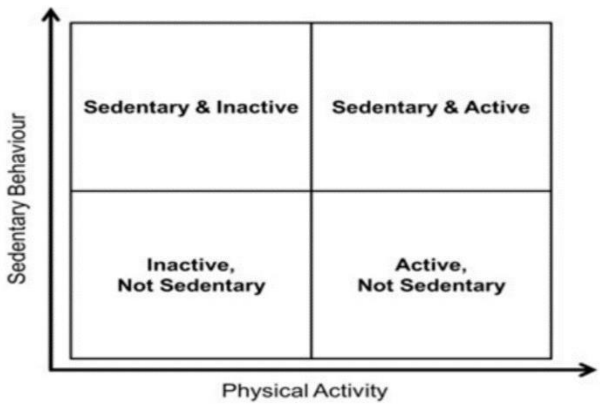


Figure 1: Sedentary behavior and physical activity as distinct constructs (Saunders et al., 2014)

The definition of SB used in this study has dual components, including energy expenditure and posture, and it is defined as “any waking behavior characterized by an energy expenditure ≤1.5 METs while in a sitting or reclining posture”(Network, 2012).

1.2. Implications of Sedentary Behavior on Work-Related Musculoskeletal Disorders

Neville Owen (2017) suggests that sedentary behaviors are likely “determined more strongly by the situations people are in than by their characteristics.” Indeed, routines and habits depend more on the context than do single unique behavior.Therefore, the workplace context might play a key role in reducing sitting and improving PA. Thorp et al. (2012) emphasize the importance of working days compared to non-working days in the amount of sedentary time. The results showed that sedentary and light-intensity PA time accumulated during employees’ work hours were the main basis for the differences observed between work and non-work days.

In this regard, the European Union (2011) mentioned the workplace as a primary site in adult life. They determined guidelines to create interventions in the workplace environment to improve PA and decrease the risk of work-related musculoskeletal disorders (WMSDS). Furthermore, in Portugal, a commission involving four ministries of the Portuguese Government has been launched to prepare action plans for improving the health-enhancing PA and reducing sedentary behavior in workplaces (Commission, 2018).

WMSDs are injuries or disorders affecting muscles, tendons, bones, nerves, ligaments, joints, cartilage, and spinal discs. WMSDs include sprains, strains, tears, and connective tissue injuries (CDC, 2020). They include medical conditions characterized by symptoms that often include localized pain, heaviness, paraesthesia, fatigue (or discomfort) located in the body segment, and a feeling of loss of strength (Kuorinka et al., 1987). Some MSDS pathologic cases include back and neck pain, carpal tunnel syndrome, musculoskeletal system, and connective tissue diseases (CDC, 2020). The development of WMSDs results from combined interactions that include occupational exposures and many interdependent individual characteristics (Barondess JA, 2001). External factors of occupational exposure like exposure to ergonomic risk factors, e.g., awkward postures, lack of variation in movement, and extended use of keyboard/mouse (S. P. Parry et al., 2019), and prolonged sitting contribute to the development of MSDs (Ariëns et al., 2001).In addition, some organizational/psychosocial factors have also been demonstrated as additional contributing factors for MSDs, like intense rhythms of work, the monotony of tasks, time pressure, style of leadership, low social support, and low control at the workplace, performance evaluation, and productivity requirements (Barondess JA, 2001; Widanarko et al., 2015). On the other hand, individual factors include age, sex, educational level, and perhaps genetics, and participation in leisure activities may influence biological and clinical responses to occupational exposures and occur WMSDs. Although MSDs are multifactorial, a substantial variety of evidence has revealed that musculoskeletal disorders are strongly associated with work-related factors (Barondess JA,2001; EU-OSHA, 2019). The prevalence of MSDs among office workers is reported by more than 90% (Cho et al., 2012), and 63% of office workers attributed their MSDs over the previous 12 months to work (Janwantanakul et al., 2008). Bureau Labour Statistics, (2016) reports showed that around 75 percent of days away from work are due to sprains and strains, most often involving backache. The European Commission estimates that 49.9% of absences from work lasting three days or longer are due to MSDs, and cause 60% of permanent work incapacity (Bennie et al., 2013). Furthermore, the annual total costs of WMSDs in European countries are €240 billion, equivalent to 2% of the Gross domestic product (GDP) (Bevan, 2015). In this regard, WHO has established a strategy for promoting PA to decrease MSDs, and improve workplace well-being. One of its priorities is supporting evidence-based research to strengthen effective interventions promoting PA (OMS, 2015).

Back and neck pain ranks first and second in Portugal for years living with disability, respectively (Vos et al., 2015). Among those with non-fatal injuries, one-fifth needed a work absence of over a month. Regarding occupational diseases, musculoskeletal conditions were the most certified group in Portugal in 2014 (Monjardino T, Amaro J, Batista A, Norton P, Lucas R, 2016). Moreover, WMSDs were the main reason why 31.3% of Portuguese workers had to, at least once, ask for sick leave (Carneiro, 2012). In this context, evaluating the WMSDS, general state of health, and well-being of working individuals is crucial. The 'Flash Eurobarometer – Occupational safety and health in post-pandemic workplaces (OSH Pulse) survey,' commissioned by EU-OSHA in an interview with 1020 Portuguese in post-pandemic, showed that 34% of them had experienced bone, joint, or muscle problems or pain caused or made worse by your work (EU-OSHA, 2022).

Some studies showed that SB had been associated with MSDs, including pain in the lower back and lower extremities (Al-Eisa et al., 2006; Brakenridge et al., 2018; Messing et al., 2015). In a systematic literature review, Reid et al. (2010) showed that prolonged sitting with little or no leg movement had been associated with MSDS, including lower extremities discomfort. Also, Pope et al. (2002) demonstrated a correlation between cumulative chair sitting greater than two hours and hip discomfort. In another study, Brakenridge et al. (2018) illustrated that sitting time is associated with lower back pain in office workers and lower back pain can be reduced with a reduction in sitting time. In other studies, authors mentioned that sustained sitting is associated with spinal loading (Pope et al., 2002), specific sitting postures, increased activation of spinal muscles (K.A. et al., 2015; Waongenngarm et al., 2015), and lack of variation in movement occurs MSDs during prolonged sitting (Srinivasan & Mathiassen, 2012). Costa et al. (2008) mentioned that prolonged static exertion compresses veins and capillaries inside the muscles, and it may cause an absence of oxygenation and nutrition and, consequently, cause micro-lesions. On the other hand, venous pooling (swelling) can occur in the lower legs and feet during prolonged periods of sitting (at least four hours) which is reported to be associated with discomfort as well (Winkel, Jorgensen, 1986). Nilsen et al. (2011) found that decreasing SB and one or more hours of physical exercise per week were inversely related to the risk of chronic musculoskeletal pain. Previous studies showed any interventions (e.g., scheduled breaks)that could reduce static muscle overload and increase blood circulation in workers might cause decreasing MSDs (Mathiassen, 2006; Srinivasan & Mathiassen, 2012; Tikkanen et al., 2013). Nevertheless, few studies have considered the effect of breaking up workplace sitting time on MSDs (S. P. Parry et al., 2019; Alicia A Thorp et al., 2014). They mostly use just one or two interventions to increase standing/walking situations without strengthening an exercise program, and their results did not show that interventions reduce MSDs, among office workers (S. P. Parry et al., 2019). While more focus on posture variation, strengthening or stretching programs is required to reduce MSDs (da Costa & Vieira, 2008; Gasibat et al., 2017; Serra et al., 2018).

1.3. Implications of Sedentary Behaviour on Well-being and Job Satisfaction

Well-being has been defined as the combination of feeling good and functioning well; the experience of positive emotions such as happiness and satisfaction, also the improvement of one’s potential, having some control over one's life, having a sense of purpose, and experiencing concrete relationships are also attributes that characterize this concept (Huppert, 2009).

Physical inactivity has been associated with lower emotional well-being (Galper et al., 2006). On the other hand, some studies showed that an active lifestyle can improve physical and mental well-being and decrease the risk of chronic diseases (Hassmén et al., 2000; Anna Puig-Ribera et al., 2015; Warburton et al., 2006). On the other hand, Izawa & Oka, 2018 showed that SB affects physical pathology and has also been linked with negative mental outcomes (e.g., depression, lower cognitive functioning, increased risk of dementia, and overall lower quality of life). Freak-Poli et al. (2014) assessed for the first time the general well-being of the working adult population rather than psychological factors, and they found that achieving a greater number of steps during the program was associated with immediate well-being improvement. Another study showed that frequent short breaks from continuous computer work improve workers’ well-being, although they mentioned that breaks need to be integrated with task demands (Henning et al., 1997). Based on the moderate-to-high quality evidence provided in Radwan et al. (2022) systematic review, there are some physical and mental benefits associated with the implementation of active microbreaks (2–3 minutes of light PA for every 30 minutes of sedentary work) without posing detrimental effects to employee's productivity. Job satisfaction is "any combination of psychological, physiological, and environmental circumstances that causes a person truthfully to say; I am satisfied with my job"(Dawis, 2004).

On the other hand, job satisfaction is an emotional response of employees to fulfill their needs and what they believe the company has to offer (Juliet Hassard,2018;Locke,1976).

Furthermore, job satisfaction is an important factor influencing workers' health. Reduced job satisfaction is linked with mental-health well-being problems, such as depression and anxiety, burnout, and low self-esteem (Faragher et al., 2005). Therefore, comprehending job satisfaction is also a crucial variable in managing human resources, as stated by (Bernabe et al., 2016), with a primary association with service quality. Several factors, including physiological, psychological, and working environment conditions, affect job satisfaction (Kafui Agbozo, 2017); these factors are the incentives for tasks and activity, consequently impacting workers' performance. Loghmani et al. (2013) found that MSDs are associated with low job satisfaction among office workers. Improving the working environment also has an essential role in increasing job satisfaction. A cross-sectional study conducted with sedentary employees, who sat at least eight hours per day, demonstrated that regular physical activity might increase overall job satisfaction, and employees who did not participate in regular physical activity had lower job satisfaction (Arslan et al., 2019). There is increasing evidence about the effectiveness of PA on work-related outcomes, such as job satisfaction, job stress, productivity, workability, and sickness absence. In a meta-analysis of workplace interventions, Conn et al. (2009) showed that increasing employees' physical activity at work might lead to reduced job stress and increased job satisfaction. Fang et al. (2019) designed an individual-based PA program for overweight and inactive office workers. This study showed that the PA program could increase physical fitness and health outcomes, reduce occupational stress, and increase job satisfaction for employees of high-tech industries. Rosenkranz et al. (2020) showed that, although sitting time at work is not associated with productivity, office workers with the lowest time spent sitting report higher job satisfaction. They suggested that additional research is required to examine sedentary behavior and job satisfaction to explain the relationship between these two variables. Furthermore, according to Mailey et al. (2017) and Thorp et al. (2014), job satisfaction and fatigue might be important factors that could help to explain a potential relationship between workplace sedentary behavior and productivity (Mailey et al., 2017; Alicia A Thorp et al., 2014). Another cross-sectional study indicated that walking or standing during work was associated with greater changes in reporting being“ very satisfy” with the job (Andersen et al., 2017). Nowadays, many companies offer health promotions at workplaces. It can broadly be viewed as the combined effort and benefit for employers, employees, and society to improve the health and well-being of people at work.

1.4. Office Work

Office workers perform administrative or information-based work in an office environment, have sedentary work, and use a computer for more than 50% of the working day. Office layout refers to the physical office space, including open-plan, individual (private), and shared offices. Some studies showed that higher background noise, open space offices, and shared rooms have a negative effect on health and cause lower levels of both physical and psychological well-being and sick leaves (Bodin Danielsson et al., 2014; Morrison & Macky, 2017; Pejtersen et al., 2006); this is related to either air contamination or stress or noise caused by the other people, and feeling cramped (Colenberg et al., 2021). Working at open paces with six or more occupants negatively affects well-being, especially if employees do not have any activity-based work. Nevertheless, open space offices have some benefits, like encouraging employees to do physical activity and positively affect their social and physical well-being (Mailey et al., 2017). Furniture is another crucial setting in office spaces. There are two types of furniture (1) ergonomic furniture designed to fit the user's body to reduce musculoskeletal or visual discomfort while sitting, like adjustable chairs and desks to reduce the discomfort that is often accompanied by ergonomics training (Robertson et al., 2013; Terek et al., 2014) and (2) activating furniture (e.g., sit-stand workstations, bike desk) to reduce sitting time and increase PA (Carr, Swift, et al., 2016). The experiments with activating furniture showed that their use leads to beneficial changes in blood pressure (Graves et al., 2015) and blood glucose levels (Genevieve N. Healy et al., 2013). Adequate light levels (natural or artificial) spread through wall openings, translucent materials, and reflection on polished and light-colored surfaces contribute to physical and mental well-being (Lamb & Kwok, 2016). Another important factor that positively affects office workers' mental and physical well-being is controlling their work environment. It can be the possibility of adjusting the conditions of the workspace (Boerstra et al., 2015; Joines et al., 2015) and personalizing the workstation (Wells, m. m, 2000). The findings showed that actual control of one aspect of the work environment leads to perceived control of other aspects, which is an important psychological factor in reducing stress (Boerstra et al., 2015). Spatial arrangements, room dimensions, and materials influence noise by absorption or reflection of sound waves. The high levels of background noise and speech intelligibility in the workplace cause higher self-rated fatigue, disturbance, and annoyance, slightly increase physiological stress, and negatively affect both physical and psychological well-being (Schlittmeier & Liebl, 2015; Shafiee Motlagh et al., 2019) and office's acoustic qualities affect health (Shafiee Motlagh et al., 2018).

1.4.1. Interventions to reduce Sedentary Behavior of Office Workers

Due to the prevalence of occupational SB and its adverse effects on health and work-related factors, many studies evaluated the effect of interventions on the amount of sedentary time among office workers. Also, the interventions have some health-related outcomes like decreasing MSDs, and obesity, and effect on work-related outcomes like cognitive performance and job performance, as well as sickness absence (Josephine Y Chau et al., 2016), work performance, absenteeism, presentism (Neuhaus, Eakin, et al., 2014).

The following studies were analyzed and classified into four levels according to the type of workplace intervention:

1. Physical changes in a workplace environment (see Figure 2):
    a. **Sit-stand desk**; some studies assessed the effect of a sit-stand desk. The intervention was assessed alone (Alkhajah et al., 2012; Josephine Y Chau et al., 2014; (Danquah et al., 2017; Dutta et al., 2014; E. F. Graves et al., 2015; Gao et al., 2016; Neuhaus, Healy, et al., 2014) as well as in combination with information and counseling (Genevieve N Healy et al., 2013; Neuhaus, Healy, et al., 2014).
    b. **Treadmill workstation**; Some studies (Levine & Miller, 2007; TudorLocke et al., 2014) assessed the effectiveness of a treadmill workstation.
    c. **Changes in chairs** enable more activity, such as inflated balloon chairs or therapy balls (Beers et al., 2008).

d. **Cycle workstation** (stepping/pedaling, elliptical/desk cycle device placed under the desk) (D. A. C. M. Commissaris et al., 2014; McAlpine et al., 2007; Rovniak et al., 2014; Sabia & Anger Jr., 2016).

e. **Changing the layout of the workplace** (placing printer further away from desk) (D. a. C. M. Commissaris et al., 2006)

f. **Set up walking or other exercise groups** like dance or gym groups during work time (Chung & Diffee, 2012; Ogilvie et al., 2007; ThøgersenNtoumani et al., 2010).

g.

Figure 2: Examples of physical changes

2. A policy to change the organization of work:
   a. Support the social environment: walking strategies or standing meetings (Nicholas D Gilson et al., 2009).
   b. Breaks (periodic, frequent, or purposive) to sit less, stand up, and take an exercise break within the organizational schedule for short bouts of the activity or other exercise groups during work time (Carter et al., 2015; Alicia A Thorp et al., 2014).
   c. Encouraging employees to walk around office buildings during breaks or to take a walk to communicate with fellow employees instead of using the telephone or email.

3. Information and counseling:
   a. Make the sign or prompts at the workstation (Computer prompts) (Donath et al., 2015; Evans et al., 2012; A M Swartz et al., 2014).
   b. Put the sign or prompts at the workplace (e.g. posters)
   c. An e-health intervention (Pedersen, Cooley, and Mainsbridge 2014).
   d. Distribution of leaflets.

e. Counseling (face to face, information session, email, or telephone) (Coffeng et al., 2014; van Berkel et al., 2014; Verweij et al., 2009).

4. Multiple interventions:

Interventions are composed of multiple elements that include more than one of the above categories (Coffeng et al., 2014; Ohlendorf et al., 2015, Ellegast et al.,.2012). Ellegast et al. (2012) assessed the effectiveness of multiple environment interventions combined with a walking strategy. The intervention consisted in measures aiming to change working conditions (e.g., sit-stand tables) and behavior (e.g., pedometers as activity feedback and face-to-face motivation for lunch walks and an incentive system for bicycle commuting or sports activities).

Different studies have evaluated primary outcomes, including:

- Physical activity per day (moderate-to-vigorous physical activity and total physical activity) (K. A. De Cocker et al., 2010; Faghri et al., 2008; G Healy et al., 2008) with some methods like various Questionnaires,
- Energy expenditure (MET minutes per day) (Pedersen et al., 2014; Peterman et al., 2012; Speck & Schmitz, 2011) with Self-report techniques and devices,
- Steps per day (N D Gilson et al., 2013; Thompson et al., 2008; Tobin et al., 2016) with a pedometer or accelerometer,
- Sedentary behavior time (minutes per day) (K. De Cocker et al., 2015; N D Gilson et al., 2012; G Healy et al., 2008) with a questionnaire and accelerometer.
- Number and length of sedentary breaks (Cooley & Pedersen, 2013; Fountaine, C. J., Piacentini, M., & Liguori, 2014; Shrestha et al., 2015)

Furthermore, some of the studies have measured secondary outcomes:

- Workplace absenteeism or sick days (Josephine Y Chau et al., 2016; Marzec et al., 2011; Shrestha et al., 2016),
- Presenteeism (A Puig-Ribera et al., 2017; Sjogaard et al., 2014),
- Work productivity or job satisfaction (Buckley et al., 2015; Buman et al., 2017; Josephine Y Chau et al., 2016b),
- Quality of life and mental and physical well-being (Blake et al., 2017; Torbeyns et al., 2014),

- Total time spent sitting at and outside work (Miller & Brown, 2004; Shrestha et al., 2016),
- Adverse effects include any reported musculoskeletal symptoms (Finni et al., 2014),
- Problems workers may have with attention or concentration on work with intervention (Carr, Leonhard, et al., 2016; Alicia A Thorp et al., 2014).

Nevertheless, to design interventions and build evidence-based strategies for addressing sedentary behavior and well-being, researchers need to develop high-quality measures, understand the personal, social, and environmental determinants that influence sedentary behaviors, and then improve and examine the appropriate interventions (N Owen et al., 2011). The Ecological Framework (Figure 3) shows that the policy environment is one of the crucial factors affecting physical activity program performance in the occupation domain, including rules for breaks, parking regulation, transportation investment, etc. The accessibility and characteristics of the setting in the workplace, like furniture designed for sitting-standing, neighborhood walkability, building design, stair design, and availability of some facilities like pedals or bikes, are determinant factors in SB at the workplace (Owen et al., 2011b).

The perceived environment has been defined as awareness about the SB in their environment, like perceived management discouragement of unscheduled breaks, perceived office social environment, perceived distance to office destinations, and perceived office comfort (Sawyer et al., 2017). In terms of socio-cultural influences, some factors like prompts to sit, strong social connections, social norms, safety, the awkwardness of standing, and advocacy by individuals and organizations affect the amount of SB or participation in higher levels of physical activity. Furthermore, informal discussions, like health care counseling and information, are crucial in SB. Moreover, demographical, biological, psychological, and family situations are considered interpersonal factors that influence SB.

The last factor is the natural environment; for example, weather topography, air condition, and energy policies might influence sedentary time (Owen et al., 2011b).

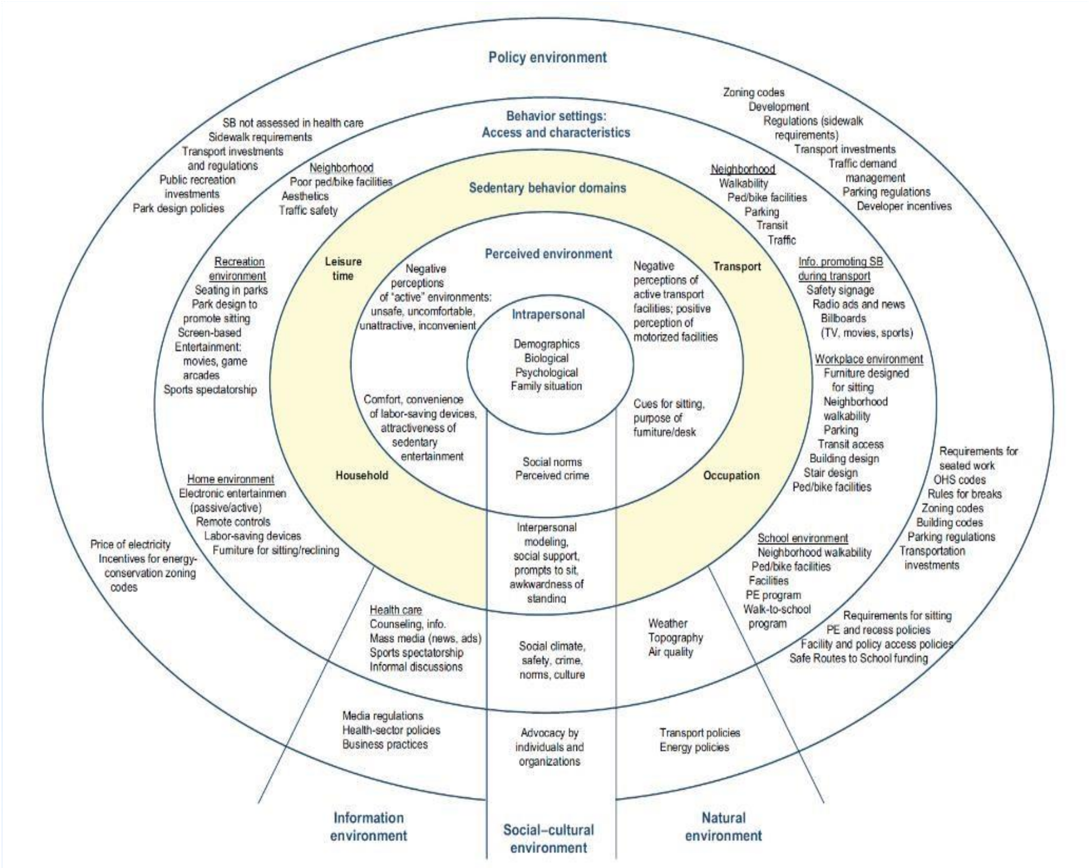


Figure 3: Ecological framework of sedentary behavior (Owen, 2011)

1.5. Methods to assess Sedentary Behavior

Considering that SB as an independent detrimental factor for several adverse health outcomes (Katzmarzyk et al., 2009; Wilmot et al., 2012), there has been developed research to measure accurately this behavior, as well as the levels of physical activity (Owen et al., 2000; Rosenberg et al., 2008). Many studies have used subjective measurement tools like questionnaires for assessing SB and PA. There have been focused on measuring total daily sitting time (Katzmarzyk et al., 2009; Kilpatrick et al., 2013; Wilmot et al., 2012), leisure time SB (Pope et al., 2002), occupational sitting and PA Occupational Sitting and Physical Activity Questionnaire (OSPAQ) (J Y Chau et al., 2012). The International Physical Activity Questionnaire (IPAQ) is the most used to assess total sitting time, vigorous PA, moderate PA, and walking in epidemiological research (Bauman et al., 2011). However, studies have shown that total daily sitting time is underestimated in IPAQ (Atkin et al., 2012), and this tool cannot identify the differentiation between various types of SB and sitting time (Miller & Brown, 2004). Although some questionnaires like Marchall et al. (2010) and Chau et al. (2012) provide more details of daily sitting times, according to where sedentary behaviors are taking place, IPAQ has still been used in studies broadly due to some advantages, including household and work-related PA with useful examples for moderate and vigorous PA. Other self-report methods that have been used in epidemiological research to assess PA and SB were diaries, self-administered questionnaires, and in-person and telephone interviews (Atkin et al., 2012; W. Brown et al., 2004; Freene et al., 2014). Generally, measures like self-report, which are the simplest to use, have the lowest levels of accuracy. Recently, accelerometers and inclinometers have increasingly been used to provide objective measurements of SB and PA by recording activities and body position over time in non-laboratory environments (e.g., at home or work) (Hagstromer et al., 2010; Genevieve Healy et al., 2008). These small devices are easy to use, have a reasonable price, and provide numerical data. Some of them are located on the body regions by adhesive, and some by using a belt (Figure 4). However, laboratory-based studies mostly stick devices on the body, but for real work, using the belt is more common and feasible.

Figure 4: various types of accelerometers and the possibilities of locations

One of the most popular accelerometers for measuring the SB and PA is the ActiGraph (GT3Xs Actigraph, Pensacola, FL, USA). This device is lightweight and compact with a weight of 27 grams and dimensions of 1.5” x 1.44” x . 70” (3.8cm x 3.7cm x 1.8cm), which can be worn on the hip, thigh, waist, wrist, and ankle according to the aim of the study (Figure 5).

Figure5: Actigraph GTX3and its belt and cables

It integrates a tri-axial sensor to measure acceleration in three axes at sampling rates up to 100 Hz. Using cut points of counts per minute (CPM) can estimate sedentary time and intensity of PA (light, moderate, vigorous). ActiGraph also contains an inclinometer algorithm that classifies the user posture into sitting, lying, standing, or device off. However, the postural classification can be calculated when Actigraph is worn on the thigh or hip. Figure 6 presents a range of measurement tools according to their ease of use and precision levels. Measures of PA energy expenditure are the most accurate methods. This measure includes the indirect calorimetry assessment of energy expenditure that assesses carbon dioxide production and oxygen consumption during rest and steady-state exercise (Carter et al., 2015). Also, doubly-labeled water measures the PA energy expenditure and provides a valid measure of energy expenditure. Although energy expenditure measures (such as room calorimetry, doubly-labeled water, indirect calorimetry, and direct observation) have the most validity, they only measure the energy cost of specific activities and are often used as the criterion measures for validating subjective SB and PA monitoring tools.

The more practical measures for assessing free-living SB and PA are accelerometers and self-report tools that have been validated against these criterion measures. The most suitable method to assess SB and PA depends on the research question, population, and budget.

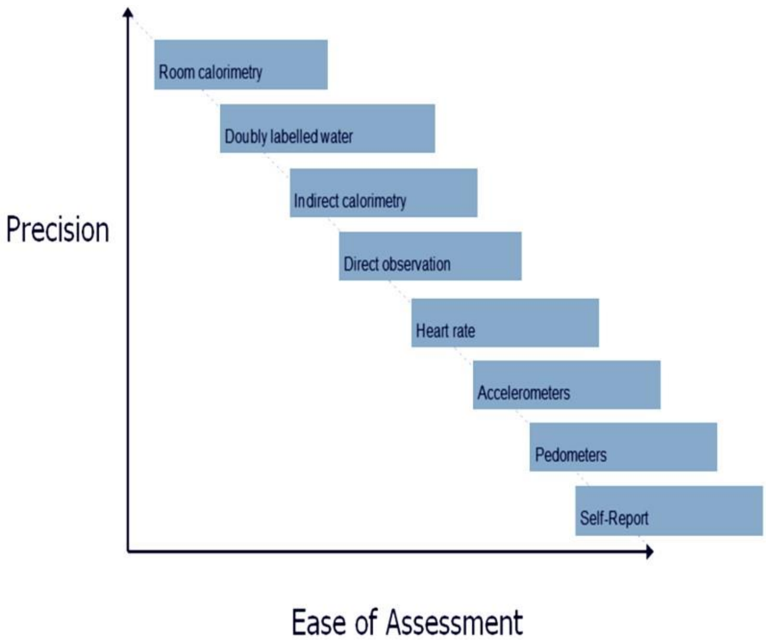


Figure 6: Different methods of physical activity assessment (Mansoubi et al. 2019)

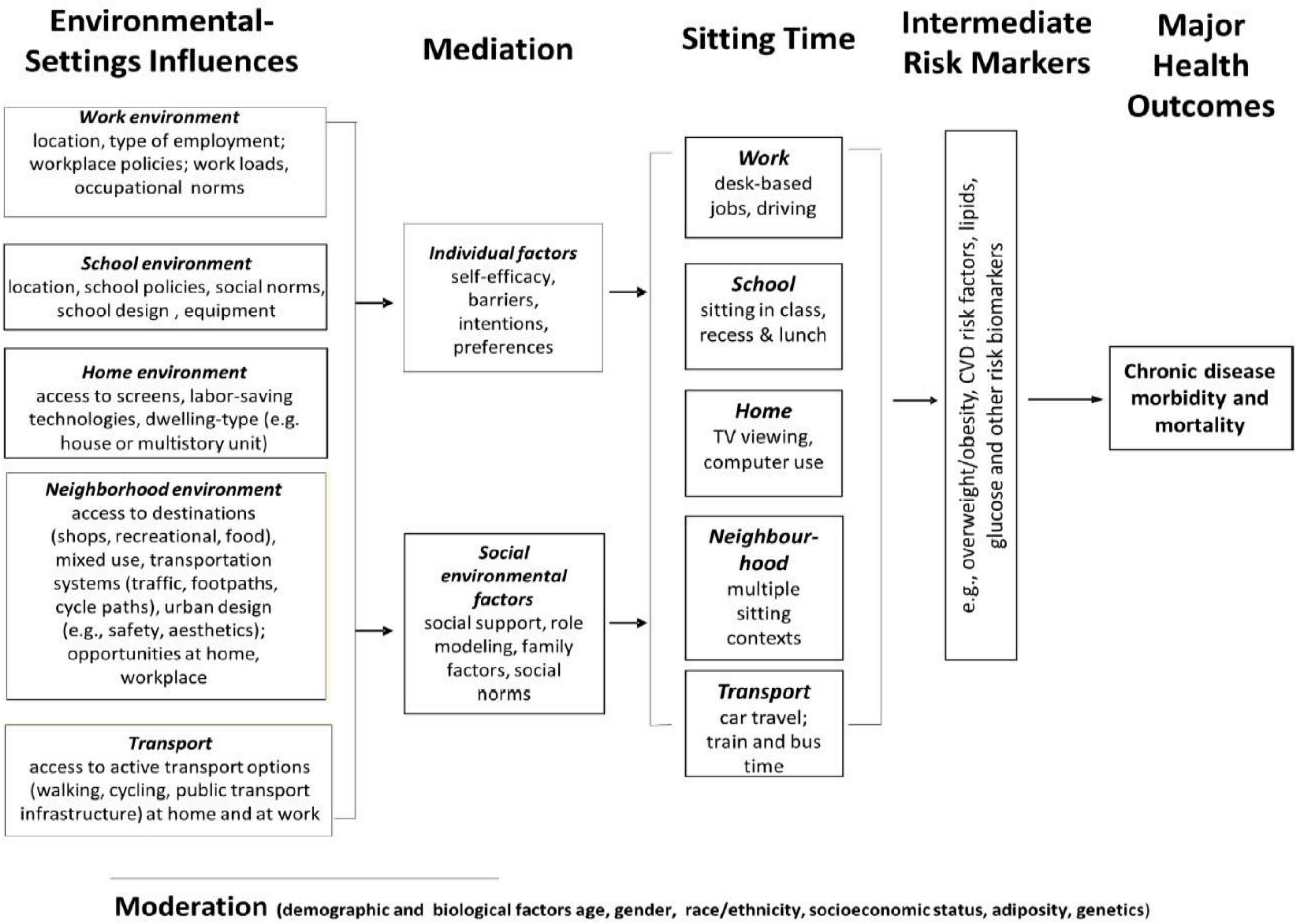
1.6.Overview and aim of the thesis

The time that adults spend sedentary – any waking behavior characterized by an energy expenditure ≤1.5METs while in a sitting or reclining posture - has recently been introduced to have a ubiquitous impact on health outcomes like MSDs, cardiovascular diseases, and obesity (Biswas et al., 2015; Gao et al., 2016; Rezende et al., 2014), and work-related outcomes such as cognitive performance and job performance (OMS, 2015; Pfeiffer et al., 2011), as well as sickness absence (Qi et al., 2018). In the context of the"diseases of inactivity," SB has emerged as a significant component of chronic disease (Lee et al., 2012). Also, sedentary time is likely to be added to the risks associated with insufficient moderate-to-vigorous physical activity, which researchers need to be concerned about in their worksite interventions and prevention programs to decrease sedentary time and improve employees' health (Lee et al., 2012). Physical inactivity has been associated with lower well-being (Galper et al., 2006). Studies have shown that an active lifestyle like frequent short breaks from computer work (Henning et al., 1997) and daily routine walking (Freak-Poli et al., 2014) can improve well-being and also decrease chronic diseases risk, including MSDs (Nilsen et al., 2011), and increase job satisfaction (Arslan et al., 2019). WMSDs, including pain in the lower back and lower extremities

(Al-Eisa et al., 2006; Messing et al., 2015), and hip discomfort (D. P. Pope et al., 2003), have been associated with occupational SB. Therefore, WMSDs are a crucial determinant that has an adverse effect on the well-being of office workers (Malmberg-Ceder et al., 2017) and has been associated with low job satisfaction among office workers (Loghmani et al., 2013). Office workers have an increased risk of mortality due to accumulated and prolonged sedentary time at work (S. Parry & Straker, 2013). For many of them, most daily sitting time occurs at work hours rather than non-work hours (W. J. Brown et al., 2003); therefore, the office is a crucial key setting to reduce prolonged sitting (van Uffelen et al., 2010). On the other hand, some studies showed that exercise for fitness does not decrease the time of muscular inactivity and increases only 3% of the time spent at MTVPA during the workday; slight modifications in non-exercise activities need to be made with interventions (Finni et al., 2012; Hamilton et al., 2007). Furthermore, sedentary time is independent of almost any level of PA, which may explain why people need time to recover after moderate to vigorous exercises, which may be done by sedentary time (e.g., sitting or lying down) (Westerterp, 2001). According to the evidence for achieving a health outcome, work-based interventions should be implemented in the workplace to reduce total sedentary time and provide opportunities to participate in light PA, interrupting sedentary time (Baruth et al., 2013). Light PA is defined as any activities involving energy expenditure between 1.6 and 3.0 METs that do not result in a substantial increase in heart rate or breathing rate, like, slow walking or other incidental activities (Bull et al., 2020). For changing the SB of office workers, a broad understanding of the factors (e.g., environmental, individual, and sitting context) that influence SB is required (Neville Owen et al., 2014). Owen et al. (2014) conceptual framework (Figure 7) has the advantage for researchers to select their interventions according to the environmental settings in which SB has happened, like location, type of environment, workplace policies, workload, and social norm (the informal rules or standards of acceptable behavior operating within a group (i.e., social group, family, community, or society as a whole).

Also, mediation factors such as workers' self-efficacy, barriers, intention, and preferences; intermediate-risk marks such as obesity, and cardiovascular disease, can be considered critical determinants that increase the risk of chronic disease, morbidity, and mortality due to SB.

Figure 7: Conceptual framework of sedentary behavior (Owen et al., 2014)



Some studies have been conducted in recent decades to assess occupational SB among office workers and the association of sedentary time and PA with MSDs, well-being, and job satisfaction (da Costa & Vieira, 2008; Gasibat et al., 2017; Serra et al., 2018). However, most of them were cross-sectional or longitudinal studies, and if they conducted interventional studies, they just had one or two interventions to increase standing/walking without any strengthening or stretching exercise program during work hours; meanwhile, more focus on posture variation for reducing MSDs is required. On the other hand, the rest of them just evaluated the effect of the exercise program during work on the MSDs; and they didn't evaluate the effect of multi-component interventions like increasing breaks, light PA, and information on MSDs. Having a plan and strategies to reduce SB risks is an important consideration in the context of the employer's duty of care obligations to ensure the preparation and maintenance of a work environment for employees without risks to health and safety (van Uffelen et al., 2010). However, most interventions need workers to leave their desks or spend expenses to buy equipment (Toomingas et al., 2012); therefore, many employers declined these programs. To address these gaps, the interventions need to be designed to consider multiple interrelated factors(N Owen et al., 2011) appropriate to the job type and task requirement of employees who can become participants in the program and their productivity stays the same or increases. For this purpose, some incidental activity breaks on their workstation, and low-cost intervention needs to be used to initiate the intervention to evaluate their effect on job satisfaction and well-being.

A survey between 2006-2008 in Portugal illustrated that 70% of adults (aged 18-64 years) reached the WHO recommendation in 2004 (30 minutes per day of moderate PA), and 4%–9% of the same population had 10 minutes per day vigorous PA. Although that study does not mention the percentage of time in SB in general, results showed that the SB was between 9-10 hours per day and that the lowest sedentary time for the whole day was observed in adult females (Baptista et al., 2012). A recent study in 2020 demonstrated that Portugal as a country with the lowest levels of PA in Europe, and high levels of SB, which led the Directorate General of Health to establish Physical Activity as a priority health program and develop the National Strategy for Promotion of PA (Shinn et al., 2020a). Previous studies showed that SB is strongly and inversely linked with time spent in light PA (e.g., active standing and slow walking) (G N Healy et al., 2008), also due to the association of amount of non-exercise light physical activity with improved metabolic health, and its independence from MTVPA (Alkhajah et al., 2012), our interventions in this study primarily focused on replacing SB with light P.A., and then tried to improve MTVPA (Júdice, 2016). In this study, we want to decrease SB and increase PA (standing, light, moderate to vigorous) with multi-component interventions and improve the working environment, make some organizational changes (e.g., make rules, and have the support of human resources and manager), and also some individual changes (e.g., leaflets, end email and face to face consultant).

1.6.1. Purpose of this study :

The primary aim of this thesis was to characterize the prevalence and variations of SB and PA in university office workers and their association with well-being, job satisfaction, and musculoskeletal symptoms. The secondary aim was to evaluate the effect of the multi-component interventions, including organizational, individual, and environmental, on SB and PA (standing, light, moderate and vigorous activity), well-being, job satisfaction, and musculoskeletal symptoms of office workers after six months followup. Furthermore, the feasibility and acceptability of interventions for participants and the investigation of individual, organizational and environmental barriers to implementing the interventions and attending the program will be assessed.

To our knowledge, this is the first study that investigates the effect of the multicomponent interventions to make the breaks and exercise to decrease sedentary time, improve PA, and evaluate its influences on musculoskeletal symptoms, as well as wellbeing and job satisfaction in office workers in real work in Portugal.

1.6.2. Specific aims:

Determine if the interventions led to changes in objectively measured SB and light PA at the office works.

Determine if increasing the break numbers and/or length is related to the amount of light PA.

Determine if the interventions positively affect job satisfaction and perceived well-being and musculoskeletal symptoms.

Determine the underlying factors related to SB and PA among office workers.

Determine the factors that might have affected the success of the intervention based on the worker's perception.

1.6.3. Hypotheses

In this study, we hypothesized that implementing multi-component interventions would decrease SB time and increase light PA. for the office workers compared to the control group with regular office work.

Also, we hypothesize that increasing break numbers or break length can develop the light PA.

Furthermore, we hypothesized that a decrease in SB and an increase in breaks from prolonged sitting and increased light PA would positively affect job satisfaction and perceived well-being, and musculoskeletal symptoms.

Chapter 2.

Materials and Methods:

2.1. Study Design

This study was longitudinal and followed the same sample in the intervention and control group with six-month follow-up measures from May 2021 to October 2021. According to a review of intervention studies to reduce sitting time in the workplace by Shrestha et al.(2016), studies up to three months followed up were defined as short-term. Studies that followed participants between three to 12 months were identified as medium-term, and finally, the ones that had a follow-up longer than 12 months were long-term follow-ups. Therefore, this study is defined as a medium-term study. At the baseline, workers had returned to office work after the pandemic and teleworking, and around 8 % had telework and office work simultaneously; others (92%) had just office work. This number was reduced after 6 months to 5%. A workplace is an optimal place for addressing individual health due to having access to employees through a controlled environment and the possibility of providing required social support to change behavior. To enhance employee participation in this health promotion program, a participatory approach to tailor the intervention was used to recognize the specific needs of the workplace and the employee who were owners of the intervention. A participatory approach tried to improve employees' knowledge about the importance and differences between PA and SB with information and evaluated the intervention's acceptability and feasibility to develop an effective intervention. Also, a variety of options to improve SB/PA was given to the participants so that they could selected the "just right" one according to their task, condition, and workload.

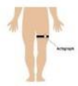
Considering Owen et al. (2011) ecology framework, multiple levels of influence can be identified for effective intervention. According to this model, the need to address participants' preferences, perceived barriers, and support system needs for achieving and maintaining good health. All intervention group participants were selected from one department but were stationed in 3 different buildings.

Office-based workers with the same criteria as intervention groups from other departments without interventions are included in the control group. During the baseline data-gathering, both groups were asked to do their usual work, and we were in close contact with them to answer their questions. Before the measurements, they were asked to sign the informed consent form. Each participant received one accelerometer with its instructions and a diary logbook to write down the wearing time of the device (Figure 8).

How to wear Actigraph

This small device records general movement and gives overall activity level. We will **not** be able to tell what kind of specific activity is happening; we have just information about walking, sitting, standing and lying time per day.

It is **extremely** important for our study that you wear Actigraph properly. If it is not worn properly, we may have to ask you wear it again. Please follow these instructions carefully:



- Wear the Actigraph attached to the belt around your **right thigh** for **5 workdays**. You can wear it either underneath or on top of your cloths.
- **Keep The** Actigraph all working day.
- Go about your normal activities - don't do anything different
- Wear Actigraph so that the little circle door is facing **up**.
- Wear Actigraph snug again your body. If you have to, you can adjust the belt by pulling the end of the strap to make it tighter. Or, to loosen the belt, push more of the strap through the loop. **Wear the belt tight enough so that the Actigraph does not move when you are being active.**
- Please **put it on first thing when you enter to your work place.**(Put next to your table or cell phone where you will see)
- **Do not submerge the** Actigraph in water. (swimming, bathing, …)
- End of your workday, **take if off right before you go to home.** You should be wearing the Actigraph for at least **7 hours**.
- Do not let anyone else wear it.
- If you cannot wear it or have any questions please call 966632931 as soon as possible.
  * There is no "On" or "OFF" switch that you need to worry about it. Actigraph is programmed to run continuously.

Actigraph logbook

Wear Actigraph for 5 days. In the table below write down the dates and day on which you wear. Also note the reason you took it off, as a sample:

Date	Feb.26.2019	
Day	Tuesday	
	On	**Off**
	9:00	11;30
	Take a shower	
	11:50	17:30

We have included extra spaces in case you need to take off Actigraph **for more than 5 minutes**, record when you take it off and put it back on.

If you are unable to wear the meter for 5 days consecutive days, add additional days at the end of week.

Date												
Day												
	On	Off	On	Off	On	Off	On	Off	On	Off	On	Off

Office place: Actigraph Serial :
Number:
Participant ID: Date Initialized:
Researcher: Valid days:

Figure 8: Logbook to fill daily working hours by participants

The study was approved by the Ethics Committee of the University of Porto to ensure compliance with the General Data Protection Regulation and to ensure that risks for participants are responsibly managed; also, reviewing research involving human participants to ensure that their dignity, rights, and welfare are protected. (EU2016/679) (EU GDPR).

2.2. Recruitment

Eighty office workers were recruited into two groups randomly (intervention and control) from the responses obtained via an invitation email that was sent by human resources (HR); furthermore, after sending the email, the study and its aim were described again in person for office workers with the collaboration of HR personnel, including HR's manager. The email included a short explanation of the aim and steps of the research. Participants filled out the online questionnaires - explained in 2.5.1.2- including their demographic data like age, height, weight (for initializing the accelerometer), and confirmed date/time for a meeting in their office (Figure 9).

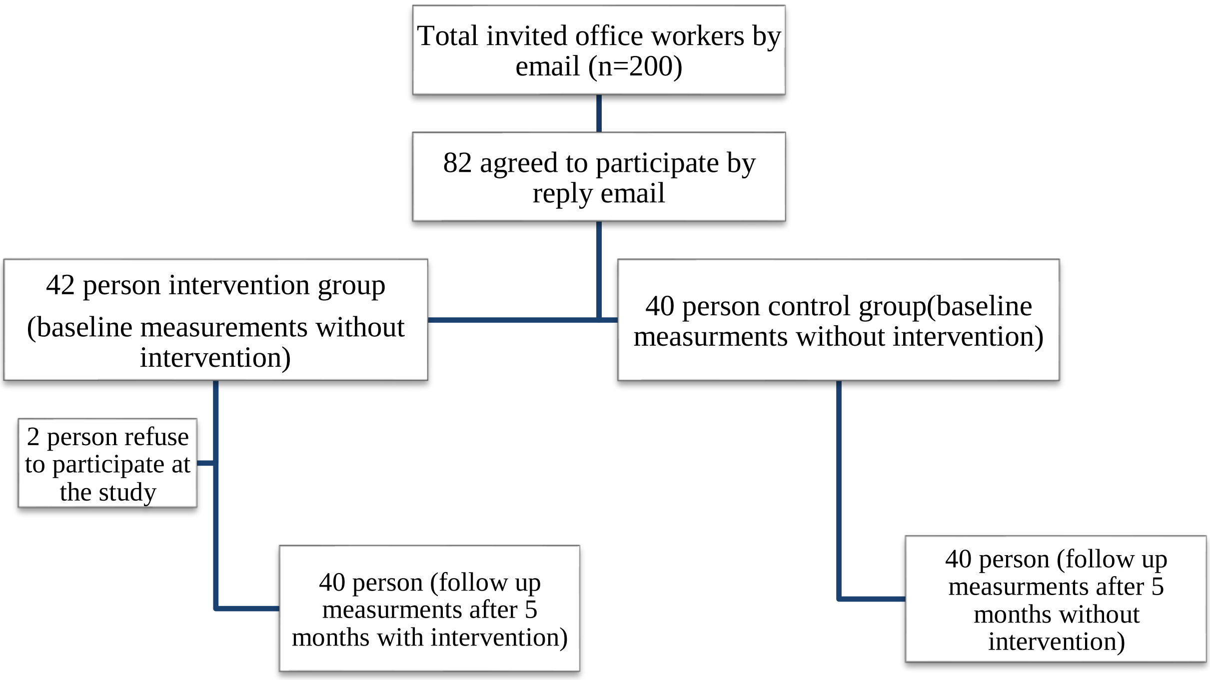


Figure 9: Study design

2.3. Inclusion and Exclusion Criteria

Participants needed to have office-based work where they spent at least 6 out of 8 hours per day sitting from at least three months before until six months after the intervention program. Those who were pregnant or physically incapable of standing for at least 10 minutes, doing exercise, walking, or having a problem using the accelerometer were excluded.

2.4. Multi-component Intervention

The expected behavioral changes with the intervention were to increase the light PA time during work hours and decrease prolonged and unbroken sedentary bouts that were more than 30 minutes long. Another expected behavioral change of the intervention was to have accumulated 30 minutes or more light and MTVPA during each workday. This target was selected based on WHO 2020 guidelines (Bull et al., 2020), which recommended replacing sedentary time with any physical activity to provide health benefits. The intervention of this study was designed based on the socioecological framework, emphasizing organizational, individual, and environmental factors (N Owen et al., 2011) (Table 1). The intervention structure is extremely dependent on worksite administrators' and managers' related knowledge and engagement to determine policy modifications, implement environmental changes (e.g., posters and exercises), and model and promote behavior change (Buman 2017).

For selecting the interventions several meetings were held with department's executives and HR to discuss the volunteers' job type, location, routine breaks, and lunchtime and possibilities and barriers in implementing the interventions. Also, the suggested interventions, the implementation process, and the expected results were described. Then, firstly, strategies were applied at the organizational level, including giving information to them and explaining the adverse effect of SB, the benefits of decreasing sedentary time, and improving PA. After introducing suggested interventions, a brainstorming about appropriate interventions for their organization was held. Also, the aim of this study was described for each volunteer and their routine task and possibilities to increase light and moderate physical activity were discussed.

A series of interventions were chosen according to the individual's preference and environmental situation and the organization's capabilities (Table 2).

Table 2: Description of interventions and their timetable

	Timing	Intervention level		
		Organizational	**Environmental**	**Individual**
Intervention elements	*First month*	Meeting with Executive management and HR		
	Second month	HR email (sending invitation email, then sending encouraging emails to have short breaks, attend the online gym, follow leaflets hints per month)	Online gym	Face-to-face talk + Sending email including leaflets+ video+ image
	Third month	Direct manager (sending an encouraging email or talk ing face-to-face)	Put posters about having a short break, stand meeting, walking during the break, schematic stretching exercise	Sending email include leaflets +video+ image
	Fourth month	HR encouraging email	Poster + Software (breaks and exercise)	Face-to-face talk +Sending email include leaflets+ video+ image
	Fifth month	HR encouraging email	Poster +software	Sending emails include leaflets video images + Online session
	Sixth months	HR encouraging email	Poster +software	Face-to-face talk + Sending email include leaflets+ video+ image + Online session

The HR, in their email, mentioned that volunteers could have more short breaks instead of one long coffee break (e.g., 5 minutes per hour instead of 15 minutes in 3 hours). Besides, they sent a prompt email to volunteers to encourage them to collaborate in the intervention program. Also, the direct manager of each volunteer sends them an encouraging email once per month to support them to continue to engage in the program.

The individual-level was included leaflets that were sent each week via emails to provide appropriate information and to raise awareness about the definition of SB, the influenced factor in occupational SB, its adverse effect on MSDs symptoms (e.g., upper/lower limb symptoms), well-being (e.g., mental, physical) and job satisfaction, also the list of strategies to decrease sedentary time and improve PA. In addition, a guideline for ergonomic workplace adjustment and body posture improvement was provided, and they sent them to do a self-assessment and self-adjust their workstation (Table 3).

The possible road around the buildings was depicted in one of the leaflets. That road map shows the estimated distance, steps, and time to walk around in breaks and come back office. The road maps were 6-minute' walk suggestions, meaning they could walk around the building during their routine breaks without spending extra time. Since there was no possibility for layout changing because of renovating the buildings, one of the strategies in the leaflets was suggesting the use of the printer or restroom on another floor.

Besides sending emails, face-to-face talk with participants about the study's aim describes definitions, introduces suggested interventions, and asks if they have attended relevant courses or programs so far and if their effectiveness was made.

Also, to change office workers' behavior regarding SB and PA, the adverse effects of SB and the benefits of improving PA were described through face-to-face training. In addition, besides this training, the workplace was visited to assess volunteers' workstations, consult about ergonomics, and readjust their workstations according to their bodies. A photo of each workstation and body posture was taken to assess the changes before and after the intervention. The group of participants who had teleworking and office work during the week were asked to continue to do interventions at home as well as at the office.

Table 3: Content of leaflets (Annex 1)

Number	Contents
1st leaflet	Explain the aim and duration of the study, describe interventions and online gym, and send its Zoom meeting Link and its timetable; ask them to connect with me and tell me their suggestion and problems;
2nd leaflet	Work-related musculoskeletal disorder in Office workers (identification, individual, physical, and organizational factors cause MSDs, prevention methods, and a video about the ergonomic setup of their desk);
3rd leaflet	Sedentary behavior (general information like definition, adverse effects, importance of decreasing sitting time, guides for breaks during work, Key Guidelines for Safe Physical Activity);
4th leaflet	Workplace ergonomic adjustment (seat height, seat depth, armrest, the height of back support, Position of the computer screen, Computer screen height, Keyboard, Mouse(pad),) and body posture (back, neck, shoulder, arms, hand, wrist, forearm, general) in addition on an image and two videos about workplace adjustment;
5th leaflet	Solutions to decrease sitting time and have more physical activity;
6th leaflet	Sedentary behavior (specific information like explaining more based on scientific papers, How sitting is killing us, why we sit so much?, What Can We Do?);
7th leaflet	Methods to reduce SB and improve PA at work;
8th leaflet	Explain stretching exercises and their effect on MSDs, send software to remind and perform exercises;
9th leaflet	Methods to do stretching exercises on the desk for computer workers with text, images, and video;
10th leaflet	Work stress, technostress, techniques to reduce them like breaks and activity;
11th leaflet	Well-being, mental health, and solutions to reduce work stress include “take a break”, and “keep active.”
12th leaflet	Sedentary behavior and well-being, methods for changing a habit(Micro habits);
13thleaftlet	Methods to do stretching exercises on the desk for computer workers with text, images, and video;

For environment intervention, access to the online exercises that were designed specifically for office workers was attached to all emails. They had access to the online gym held every day at 11 a.m. and three days at 3 p.m., and they could select an appropriate time according to their job.

On the other hand, several posters were printed and installed according to the environment (e.g., size of the office, number of volunteers in the same office) and individual preferences (Annex 2). Putting posters on the wall demonstrates organizational support for the program and intent to change the cultural norm. Some posters depicted stretching exercises, while others encouraged and reminded workers to walk during coffee breaks, use stairs, attend online exercises, or have more light activities (e.g., stand meetings). The size of the posters was selected according to the number of volunteers in each department. For instance, if we had many volunteers in open spaces or had individual offices, the A3 posters were put on the walls. However, some preferred to have an A4 stretching poser on their desk. Nevertheless, if fewer persons were in open spaces, an A4 stretching poster was given to them to put in front of them or on their desks, and one A3 reminder poster on the wall (Figure 10).

Figure 10: Samples of posters located on office walls or desks

Another individual intervention was installing software (Wellnomics® 5.5.9 LTD., New Zealand) on their computers. It contains videos of stretching exercises combined with the exercise's explanation and reminders for office workers (Figure 11). We also sent them the process of installing and utilizing the software. They could select the number of stretch exercises per hour; however, we asked them to configure it to pop up once per hour, each time three exercises each. During setup, they were asked by software if they had MSDs symptoms or had been experiencing any pain or discomfort. Using this software affected the frequency and length of micro pauses and breaks and recommended daily computer usage limit. Also, the software had a micropause, a small, regular break from the computer (e.g., a 20-second rest every 10 minutes that can change the setting at any point) when they were advised to put their arms down at their side to reduce fatigue.

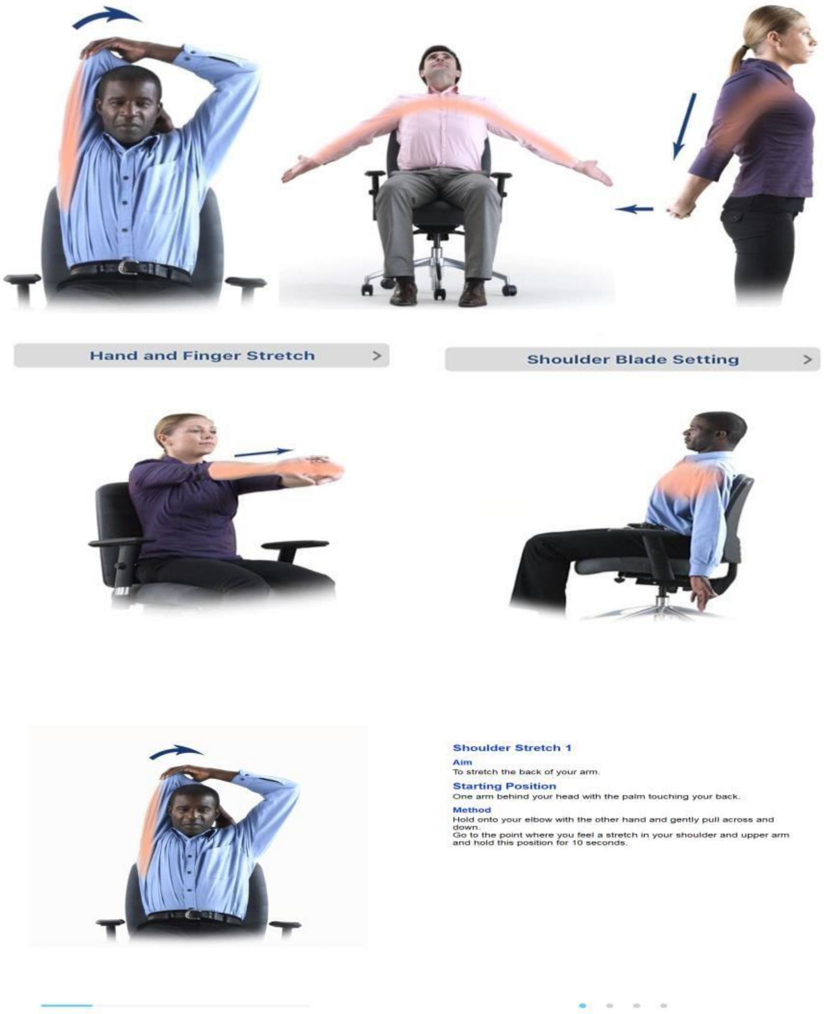


Figure 11: Some examples of stretch exercises shown in the software

We asked them if they could stand and do exercises, but might they feel a bit uncomfortable copying the moves in front of colleagues, they can do the exercises while sitting down (e.g., rolling their necks). They can get up and stretch their legs if they do not want to stand and do the stretches. Either way, enforced breaks every hour are a great reminder to move around.

A professor from the faculty sport held three online sessions for participants. During these sessions, she asked how they managed to be sufficiently active and cope with barriers. Also, participants who fail to perform their planned activities are asked to adjust their physical activity plan to make it more feasible. For participants who have not decided to change their behavior and start to have more PA and reduce SB, the teacher raised awareness and emphasized the positive aspects of PA and breaks (Table 4).

If participants have decided to change their behavior but have not started yet, the teacher discussed barriers with the other participants.

If participants started to change their behavior, the teacher encouraged this behavior and shared their solution with other volunteers. If some volunteers could not attend online sessions, the summary of the session was sent to them by email.

Volunteers were regularly visited to check if they were still connecting with the program, talked with them about the barriers to collaboration, and asked for their suggestions.

Table 4: Online session content

Number	Contents
1st	1) Provide information about MSDs, for example, neck and upper limb symptoms 2) Discus risk factors: workplace adjustment and body posture, static workload and insufficient breaks, high workload, and work stress. 3) Techniques for making a break, for example, stand call/ use reminder software, and adjusting workstation and posture according to leaflets are sent Ask them: Whether they could adjust their workstation? Whether they are using software or not? Whether they add short breaks during each one-hour sitting, work? (give them some clue like does not have the support of managers, type of task, other colleagues perceived, does not have reminders) Barriers, simple solutions
2nd	1)To provide information about the importance of physical activity in the prevention or reduction of MSDs: • To raise awareness about participants' physical activity patterns according to WHO guidelines, 150–300 min of moderate-intensity and or at least 75–150 min of vigorous-intensity aerobic (30 min 5 days, and 20 min 3 days). • To guide them to plan their activities to make them more feasible according to their job requirements. 2)Adverse effects of SB and disease cause • (LIMIT SB time, REPLACE with PA) to reduce the detrimental effects of SB on health, adults should aim to do more than the recommended levels of moderate- to vigorous physical activity. Ask them : Whether they could reduce SB and increase PA; Participants are requested to check whether or not their own daily physical activity pattern meets these guidelines. Write down perceived barriers that prevented them from being physically active as planned. The most frequently barriers are discussed

2.5. Data collection and processing

2.5.1. Demographic data

Participants were asked to complete a self-administered questionnaire about demographics, including gender, age, married situation, height, weight, education (Bachelor's and less, master's degree, doctorate, and more), and job category (investigator, administrative).

2.5.2. Objective measures

For measuring SB and PA levels, including standing, light-intensity, or MTVPA before and after interventions, ActiGraph WGT3X-BT (ActiGraph LLC, Pensacola, FL, USA) was used. The Actigraph GT3X (3.8×3.7×1.8 cm; 27 g) is a triaxial accelerometer-based PA and SB monitor and has been shown to be valid and reliable in monitoring activities among various populations(Ann M Swartz et al., 2018). Accelerometer data were recorded with a 30 HZ sampling rate (A A Thorp et al., 2012) and initialized with the participants' date of birth, height, weight, and name (Figure 12).

Figure 12: Location of Actigraph on the thigh

Before bringing the device to participants, an appropriate date and time were scheduled by email. To manage all Actigraph data and track them, in a Microsoft Excel sheet, all characteristics of employees (e.g., age, height, weight, race, building, office number, phone, date delivered, and date of return) were inserted and synced with the Actigraph's serial number. Since data gathering was performed at two moments, each participant had a specific ID number used during two moments of data gathering. This ID was used to attach the answers to the questionnaires. A small sticker was put on each ActiGraph, indicating the “up” side, and they were asked to wear the device while the sign was on the top. Also, a label with the researcher's address and phone number was put on the device, so it could be returned if lost. Actigraph was strapped on the participants' thighs (Montoye et al., 2016) during five consecutive working days (Lee Smith et al., 2015) to achieve more accurate data.

When the Actigraph returned and was screened, enter the database's relevant information (date received, date downloaded (or not downloaded), valid days, etc.).Accelerometer data were downloaded using ActiLife 6.13.4 software (Actilife 6.13.4, Actigraph, LLC, Pensacola, FL, USA) with 60 s epochs, low-frequency extension, inclinometer, and steps were used to analyze PA intensity(Montoye et al., 2016)(Figure13).

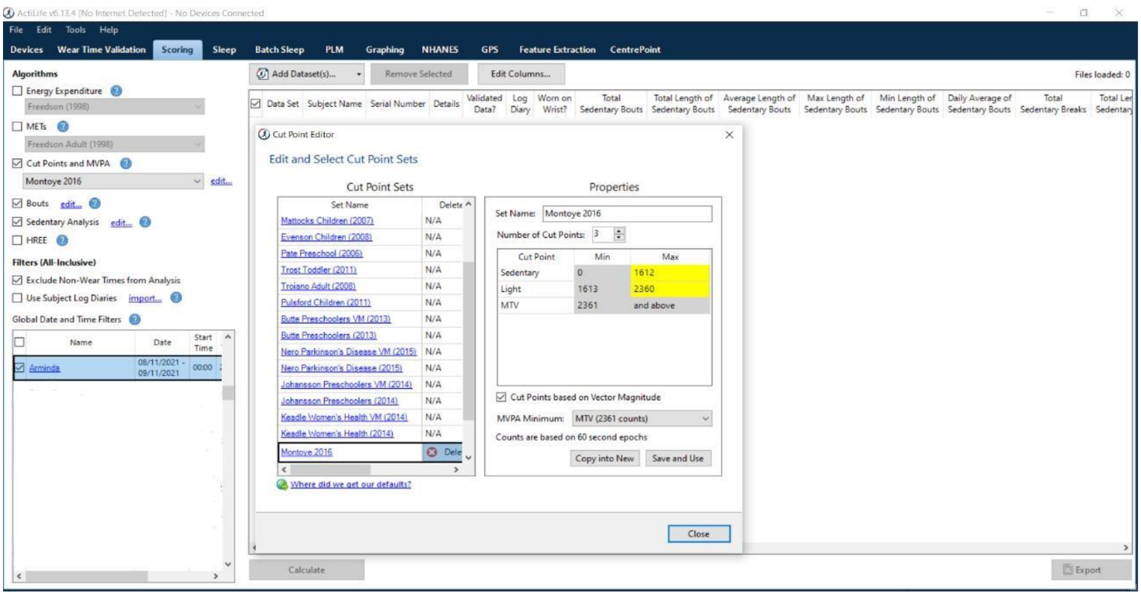


Figure 13: Example of a window of Actilife software

Low-frequency extension filters increased the device’s sensitivity to activities with lower intensity, thereby allowing for the measurement of a bigger range of PA intensities (Cain et al., 2013). Activity counts categorize as sedentary (<1612 cpm), light-intensity activity (1613-2360 cpm), and moderate to vigorous activity (≥ 2316 cpm) (Montoye et al., 2016).

Data validity was determined by wearing time and valid days to wear (5 days). If the participant did not wear the Actigraph for 75% of the workday's hour (Van Der Ploeg et al., 2010), they were asked to wear it again. The non-wear time was defined as ≥60 consecutive minutes of counts equalling zero, or the participant reported non-wear time (Hallman et al., 2015). The exact date and time selected according to the participant's report in the logbook by filtering the data in Actilife (Figure 14)

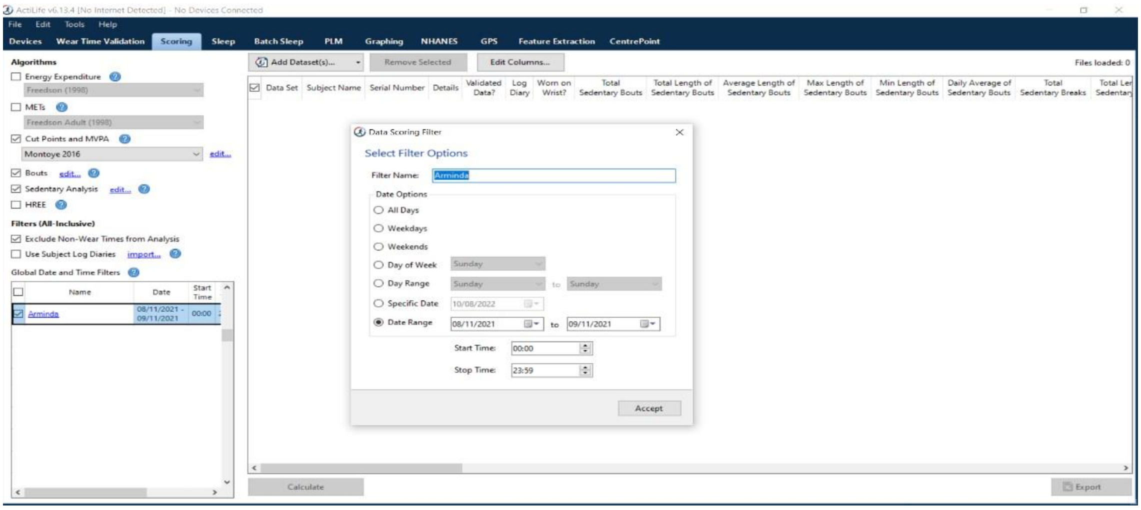


Figure 14: Filtering the date and time by Actilife software

Thus, the data were not included in the computation of sedentary time (Thorp et al., 2012). Actigraph cannot differentiate between sitting and standing, and it is appropriate for measuring light PA, MTVPA, and sedentary time. Due to this reason, in our result, standing still is considered as SB, while according to WHO (2020), standing is categorized in the light PA. Furthermore, standing situations cause muscle activation in the legs and can prevent MSDs (Yves Roquelaure, 2018), so standing time will be asked by a question besides measuring light-intensity PA (Paradoxical muscle movement in human standing). The accelerometer data will be gathered in two moments in both groups (intervention and control): at baseline and six months after the intervention.

2.5.3. Subjective measures

International Physical Activity Questionnaire

The Portuguese version of the International Physical Activity Questionnaire Short Form

(IPAQ-SF; (Craig et al., 2003)) was used to assess participants' PA during work and nonwork hours, including leisure time and weekends, which classified participants into three intensity PA levels (e.g., low, moderate, and high). Participants sitting time (hours per day) was also recorded on the IPAQ-SF. The definition of the various intensities of PA as well as some examples. Validity and reliability for the Portuguese version of IPAQ-SF were previously tested (Sardinha, Campaniço, 2016). (Annex 3)

This questionnaire was measured in two moments in both groups (intervention and control): at baseline and six months after the intervention.

Musculoskeletal Symptoms

To evaluate MSDs symptoms, a self-administered questionnaire was used. The Standardized Nordic Questionnaires for the Analysis of Musculoskeletal Symptoms are commonly used questionnaires for researchers to assess MSDs symptoms (Kuorinka et al., 1987). The validated and reliable Portuguese version of the questionnaires was used in this study (Mesquita et al., 2010). The questionnaire consists of three binary choice questions (yes or no) correlating nine anatomic regions (neck, shoulders, wrists/hands, upper back, low back, hips/thighs, knees, ankles/feet). The first question is, "Had some troubles or pain in the last 12 months" The second is, "In the last 12 months, felt some limitation caused by work in the daily activities", and the third is, "Had some troubles or pain in the last seven day." Furthermore, pain intensity during the last seven days was classified on a ten-point scale (Mesquita et al., 2010). This questionnaire will be measured in two moments in both groups (intervention and control): at baseline and six months after the intervention.

Well-being

The well-being was measured with the Portuguese version of the Health Questionnaire SF-12 (Pais Ribeiro, 2005). It measures functional health and well-being from the participant's point of view and will be used as a quantitative measure of the health outcome that reflects the participant's health judgment. It has twelve items on eight different scales

(21): "General health (1 item), Physical functioning (2 items), Role physical (2 items), Role emotional (2 items), Body pain (1 item), Mental health (2 items), Vitality (1 item) and Social functioning (1 item)". Each item has a Likert scale that participants rate themselves from 0 (lowest level of health) to 100 (highest level of health), and then scale scores are computed using the responses to items. The scores range from 0 to 100, where higher scores indicate better health (Ware et al., 1998.). This questionnaire will be measured in two moments in both groups (intervention and control): at baseline and six months after the intervention.

Job satisfaction assessment

The employee's job satisfaction was measured with a Portuguese version of the short-form Minnesota Questionnaire (SFMQ) (Ferreira et al., 2009). The 20 MSQ-short version items are rated on a 5-point Likert scale (1 "very dissatisfied with this aspect of my job", 2 "dissatisfied with this aspect of my job," 3 "cannot decide if I am satisfied or dissatisfied with this aspect of my job," 4 "satisfied with this aspect of my job" and 5 "very satisfied with this aspect of my job"). Item responses are summed and averaged to create a total score – the lower score is the lower level of job satisfaction. The possible score ranges from 20 to 100. SFMQ scores are computed into one overall level of satisfaction score and combined to form subscales measuring the extrinsic, intrinsic, and general satisfaction factors(Weiss et al., 1967). This questionnaire will be measured in two moments in both groups (intervention and control): at baseline and six months after the intervention.

2.5.4. Behavior change and Effectiveness of interventions

The phase of behavioral change with interventions was assessed with two theoretical models, i.e., the Trans Theoretical Model (TTM) and the Precaution Adoption Process Model (PAPM) (Bernaard 2006). The TTM separates the behavior change process into five stages represented by a person's past behavior and plans for future action (Prochaska et al., 1992). The PAPM follows the TTM stages but includes two new stages. These new stages differentiate between people who are already unaware of a subject (Stage 1) and those who know something about a subject but have never actively thought about it (Stage 2) (Weinstein et al., 1998). The PAPM and TTM concepts, such as stage of change, awareness, self-efficacy, and decisional balance, are used in the intervention and control groups. The readiness of participants to change behavior was identified by asking them these three questions: "Do you engage in behaviors for correct body posture/workstation adjustment?", "Do you engage in behaviors for using sufficient breaks?", "Do you engage in behaviors for physical activity during your work hours?".Answering categories were as follows: 1. Never thought about it; 2. I thought about it but am undecided; 3. Decided not to change behavior; 4. Decided to change behavior but has not started yet; 5. Recently initiated the desired behavior; and 6. The desired behavior has been maintained through time(Bernaards et al., 2008). Based on these answering categories, participants were assigned to the pre-contemplation phase (answering categories 1–3), the contemplation phase (answering category 4), the action phase (answering category 5), or the maintenance phase (answering category 6). To measure the effectiveness of interventions in the breaks more precisely, besides analyzing the changes in the variables like the number of sedentary breaks, duration of sedentary breaks, and sedentary bouts/number; the following eight questions were asked to assess the effectiveness of each intervention on the Sedentary breaks: "Do you use breaks reminder software on your computer, watch, or mobile ?", "How often do you have short breaks (e,g. 5-60 s) during one-hour computer work ?", "How many 5min breaks do you have in an hour during the working day? ", "How much do you walk instead of standing during your breaks?", "How much do you use stairs instead of the elevator?", "How much do you exercise during the break?", "How much do you stand up instead of sitting during your computer work?", "How much do you attend an online/in-person gym during work hours?". Answers were dichotomized into never/sometimes/ or regularly/always (Bernaards et al., 2008). The effectiveness of Environmental (e.g., software and posters), organizational (e.g., rules about having short breaks), and individual (e.g., face-to-face training, leaflets by email) can be measured by these questions.

2.5.5. Perceived environment

The Ecological framework of SB hypothesizes that policy, information, socio-cultural environment, and access to facilities, and interpersonal factors influence sedentary time and activity level (N Owen et al., 2011). Implementing interventions tried to improve the situation, but workers' perception of the environment has an important influence on the amount of SB and PA and the effectiveness of the intervention.

For this reason, employees were prompted to discuss the following topics through a series of open-ended questions to assess their perception of the physical and sociocultural environment (Sawyer et al., 2017) - "the workplace (your desk, restaurant, coffee point) design helps you sit less and active more?"; "Do you discourage standing/having short unscheduled breaks during your work by the management?"; "Do your colleagues accompany you in walking during breaks or doing exercise?"; "Do you guess how many minutes will spend during the day if you have short breaks or walk during your work "). During this interview, they talked about barriers, opportunities, and strategies to reduce SB in the workplace, and crucial determinants have been identified that influence the number of SB and PA during work hours.

2.5.6. Data analysis

Means, standard deviations, and percentages were used for the descriptive evaluation of the characteristics data of participants. The Shapiro-Wilk test was used to assess the normality of data. Differences in continuous variables between groups at baseline and after intervention were tested using an independent t-test. Continuous variables were found not to be normally distributed in McNemar's/Wilcoxon test used for continuous variables were found not to be normally distributed in used to determine differences respectively between and within groups. Moreover, the Chi-square test with Fisher's exact test for categorical variables was not found normally distributed is used to determine differences between groups. The results were analyzed using SPSS 26.0 statistical software.

Chapter 3.

Results and Discussion

3.1. Sociodemographic data

Table 5 shows the demographic data for participants who performed measurements of SB and PA and answered the questionnaires.

The intervention group comprised similar numbers of females and males (21.2%), and the control group had more women than men (31.92%). The average age of participants in the intervention group was 38.4 years old, and i n the control group was 35.6 years old. Most participants had a master's degree 24% (intervention), 24% (control))and were researchers (28% (intervention), 33% (control)) with 1-5 years of experience 24%(intervention), 32%(control)). Eighty percent of the intervention group worked in the open space; this number was around 50 percent for the control group in the open space.

Table 5: Demographic data of participants (Frequency (%))

Demographic Data		Intervention group (n=40)	Control group (n=40)
Gender	Female	21(52.52)	31(77.5)
	Male	19(47.53)	9(22.5)
Education	Doctorate and more	6(15.04)	8(20.03)
	Bachelor and less	10(25.03)	4(10.04)
	Master degree	24(60.07)	28(70.02)
Profession	Administrative	12(30.00)	7(17.52)
	Researcher	28(70)	33(82.5)
Experience	1-5 years	24(60.0)	32(80)
	5-10 years	5(12.5)	1(2.5)
	More than 10	11(27.5)	7(17.5)
Type of work	Telework and office	8(20.0)	21(52.5)
	Office work	32(80.0)	19(47.5)
Type of office	Individual office	8(20.0)	22(55.0)
	Open space	32(80.0)	17(42.5)

According to the WHO (2020) recommendation, the amounts for physical activity accrued at work, leisure, home, or during transportation need to be average weekly volumes of 150–300 minutes of moderate-intensity or 75–150 minutes of vigorousintensity or an equivalent combination of MTVPA. Although the strong recommendations in adult guidelines are based on weekly volumes of aerobic and musclestrengthening physical activity, health benefits occur with levels of physical activity below the recommendations, supporting the statement that some physical activity is better than none (Bull et al., 2020).

In general, at the baseline, the intervention group answered the questions of the IPAQ and stated that they had around 83 minutes of vigorous PA (including exercise and musclestrengthening PA) throughout the week. This amount illustrates that the participants reached the recommendation of WHO about vigorous PA (Table 6).

However, the same number of office workers noticed that they had 53.8 minutes of moderate PA, comprising 35.5 minutes of walking per week. The result shows they did not meet the guidelines recommended in the case of moderate PA.

Table 6: International Physical Activity Questionnaire (IPAQ) data)

	Intervention group (Mean(SD) (n=40)		Control Group (Mean(SD) (n=40)	
	Before	After	Before	After
Minutes per week Vigorous	83.8(11.5)	87.4(12.2)	38.5(5.6)	36.3(6.5)
Minutes per week moderate	53.7(20.2)	65.3(18.3)	83.7(30.2)	33.6(12.5)
Days per week walking 10min	4.7(2.1)	4.6(1.9)	5.4(1.7)	5.9(1.6)
Minutes per day walking	35.4(20.5)	36.1(22.9)	39.5(19.1)	38.3(15.5)
Minutes per week day sitting	489.2(140.9)	447.0(108.4)	454.2(78.0)	458.5(82.8)
Minutes per weekend sitting	245(1.9)	251(2.0)	262(3.3)	800(84.7)
Days per last7days with exercise	2.0(1.9)	1.8(1.8)	1.9(2.0)	1.6(2.0)
Minutes per day with exercise	43.40(47.9)	46.12(47)	66.25(77.0)	44.00(48.1)

They also mentioned that they sat 8.12± 2.13 hours per working day and 4.05 ±1.82 hours per day at the weekend. The mean values show that participants reported a reduction in sitting time during the week; however, at the weekend, they reported a slight increase.

Although there was no specific quantitative threshold for sedentary time, WHO recommended that adults limit the amount of time spent being sedentary, and replacing this time with any intensity (including light intensity) provides health benefits.

3.2.Objective measures

3.2.1. Sedentary Behavior and Physical Activity

According to Table 7, at baseline, the intervention group had around 93.57% (±2.31) (mean ± SD) percentage of time at work spent sedentary (7.5 hour±0.86). It was in the range of 5.5 to 10 working hours per day. The percentage of sedentary time was slightly reduced to 92.96% after intervention (in the range of 5.8 to 9 hours per day) and (7.4 hours ± 0.87). There was a significant difference between the intervention and control group after the intervention (p = 0.017).

However, at the same time, the sedentary percentage in the control group almost increased (93.29% ±3.27; 93.47%± 4.06); the result of the independent t-test, after intervention between groups demonstrates the reduction time in sedentary behavior observed in the intervention group is significantly different to that's been observed in the control group (p = 0,017). (p= 0.017). The percentage of light PA was reduced in the intervention group after 6 months (p = 0.043), and no changes were seen between groups (p=0.110).

Table 7: Percentage of Light, MTVP intervention group (Percentage(SD))

Type of Activity	Intervention group (n=40)		Sig.a	Control group (n=40)		Sig.a	Difference p-value after Sig.b
	Before	After		Before	After		
Sedentary	93.57(2.31)	92.96(3.06)	0.108	93.29(3.27)	93.47(4.06)	0.355	**0.017**
Light	2.52(0.82)	2.34(0.87)	**0.043**	2.35(1.02)	2.46(1.48)	0.281	0.110
MTVPA	3.58(1.98)	4.69(2.62)	**0.003**	4.31(2.77)	4.39(3.46)	0.474	**0.021**
a: pair *t*-test, b: independent *t*-test Bold number had significant Sig							

In the percentage of MTVPA the differences were observed in the intervention group (3.58%; 4.69%)(before; after) that statistically was significant(p = 0.003), they had 6.31 minutes/day improvement in MTVPA after intervention (17.78 minutes/day; 24.09 minutes/day)(before; after) which in the same period in the control group no differences were seen (p= 0.474)(Table 7). The significant increase observed in the intervention group (p = 0,003) is significantly different from that observed in the control group (p =0,021). In this study, a 0,61% decrease in sedentary behavior was observed in the intervention group but not in the control group. . Similar to our result, in Parry et al. (2013) study, after implementing multi-component interventions for 12 weeks in the office work enhanced occupational sedentary behavior and reduced sedentary time, the differences were small, in the order of 1–2% during work hours (S. Parry et al., 2013). In another study with a multicomponent intervention in different office types to promote physical activity and decrease sedentary behavior, no changes were seen regarding the sedentary time at work after the eighteen-month program (Wahlström, 2019). Given that light PA typically comprises active standing and light movement, a previous systematic review reported that these incidental light PA happen more when an individual does not have more sedentary time. According to this possible association, Mansoubi et al. (2014) stated that sedentary behavior could diminish the benefits of light-intensity PA and is more likely to displace light PA activities than MTVPA (Mansoubi et al., 2014). This association occurred in the Päivärinne et al. (2018) study in which the sample group with the lowest PA had replaced occupational light PA (e.g. active standing and light walking) with sitting (Päivärinne et al., 2018). The lower amount of light PA in our study also could be due to the highest amount of sedentary time in the sample group. Clarke et al. (2021) stated that reallocating time into MTVPA from any other activity would be associated with lower mortality risk and mobility. Likewise, removing time from MTVPA and adding this to any other movement behavior would cause a more significant risk of mortality (Clarke & Janssen, 2021). The MTVPA in this study improved by 1.11 % (6.31 minutes/working hour), which means the sedentary behavior or light PA is replaced with a small amount of MTVPA. Like Wahlström (2019) and Parry (2013), although we have a small reduction in sedentary time, an increase happened in MTVPA, and steps were identified in the intervention group.

3.2.2. Prolonged sedentary bout

In this study, sedentary bouts were defined as any uninterrupted duration of time within the sedentary behavior time (Boerema et al., 2020). There are no official guidelines for sedentary behavior, WHO just recommended replacing this time with any intensity of PA (Bull et al., 2020).

Moreover, the average daily length of sedentary bouts at working hours before and after the intervention has small changes between groups ($p = 0.035$).

In addition, the Maximum Length of Sedentary Bouts decrease observed in the intervention group [(151.90± 47.40 min (before), 148.71±53.81min (after) (mean(SD))(p=0.000) it was different to that observed in the control group. (165.21±53.79) min, 188.19 ±77.54 min) (p =0.025) (Table 8). This again, because within groups there were no statistically significant differences (p-values of 0,367 and 0,48).

Table 8: Compare Sedentary Bouts before and after intervention (mean (SD))

	Intervention group (n=40)		Sig.[a]	Control group (n=40)		Sig.[a]	Difference p-value Sig.[b]
	Before	After		Before	After		
Average length of sedentary bouts	34.91(7.21)	33.9(6.90)	**0.000**	47.82(7.53)	59.59(9.22)	0.182	**0.035**
Maximum minutes of sedentary bouts	151.90(47.43)	148.71(53.81)	0.367	165.21(53.79)	188.19(77.54)	0.48	**0.025**
a: pair *t*-test, b: independent *t*-test Bold number had significant Sig							

According to available recommendations, the length of sedentary bouts per day was divided into four categories Falck et al.(2017). Table 9 shows categories and changes that happened before and after the intervention. Of the daily sitting time, just 2.5% of the intervention group had a break in less than 20 minutes. The 20-minute recommendation taken by Dunstan et al. (2012) showed that 20 minutes of breaking up prolonged sitting has beneficial associations with cardiometabolic risk markers. The 30-minute recommendation was based on information given to individuals with acute low back pain (LBP) (Atlas and Deyo, 2001).

Table 9: Sedentary time according to the recommendations (Frequency (%))

Intervention group (n = 40)			Control Group (n = 40)	
	Length of Sedentary	Length of Sedentary	Length of Sedentary	Length of Sedentary
	Before	After	Before	After
< 20 minutes	1(2.5%)	1(2.5%)	1(2.5%)	0
20-30 minutes	12(30 %)	9(22.5%)	7(17.5%)	10(25%)
30-55 minutes	25(62.5%)	30(75.5%)	26(65%)	20(50%)
>55 minutes	2(5%)	0	6(15%)	10(25%)

Also, Falck et al. (2017) suggested standing up and moving after 30 minutes of uninterrupted sitting to promote cognitive function. In this study, 30 % of participants broke their sedentary time every 30 minutes, and after 6 months, it turned to 25%.
The remarkable change in the intervention group was a 5 % reduction in the number of people who did not have a break per hour and sat for more than 55 minutes. In contrast, in the control group, participants who had sedentary time for more than an hour without a break had a 10 % increase at the same time. The 5-minute breaks per hour recommended by Owen et al.(2009) were developed to focus on metabolic health and were based on the potential clinical implications of objectively measured sitting data.

3.2.3. Sedentary breaks

A break in sedentary time was defined as any duration of time between sedentary bouts (Mark S Tremblay et al., 2017). Table 10 demonstrates

Table 10: Compare Sedentary Breaks before and after intervention (mean (SD))

	Intervention group (n = 40)		Sig.a	Control group (n = 40)		Sig.a	Sig.b
	Before	After		Before	After		
Number of breaks in the entire time	65.80(17.09)	62.78(17.87)	0.064	44.39(17.91)	49.50(19.25)	0.01 5	0.18 8
Daily Average minute of Sedentary Breaks	62.80(26.40)	85.63(36.90)	**0.000**	90.40(42.99)	64.84(33.92)	0.10 0	**0.01 2**
Max Length of Sedentary Breaks(minute)	61.33(62.85)	88.075(67.16)	**.023**	117.05(75.69)	82.73(65.80)	**0.01 3**	0.23 6
Break time per hour (minutes)	8.71	11.76	0.001	13.65	8.23	0.000	0.000
a: pair *t*-test, b: independent *t*-test Bold number had significant Sig							

The significant increase in daily sedentary breaks observed in the intervention group (p =0,000) was significantly different from the decrease observed in the control group (p = 0,012), while the maximum length of sedentary breaks significantly increased in the intervention group (p = 0,023) and decreased in the control group (p= 0,013).

It means that the break time (including standing, walking, etc.) during their sedentary time in the intervention group was increased (62.80±26.40; 85.63±36.90) (before; after, mean(SD)) (*p*= 0.000). It statistically showed that interventions had significant changes between groups in the average daily length of sedentary breaks (*p*= 0.012). Furthermore, the max length of breaks increased in the intervention group after 6 months (61.33±62.85; 88.075±67.16)(before; after, mean(SD)). These amounts were completely inverse for the control group, and their break time was reduced simultaneously (*p*=0.013). Results of previous studies highlighted the importance of considering prolonged sedentary time as a specific health risk behavior that deserves detailed recommendations in future public health guidelines (Haskell et al., 2007). Given the significant associations between sedentary behavior and light PA, interventions targeting sedentary behavior by breaking up sedentary time initially increase light PA. In their study, Healy et al.(2011) examined the associations of sedentary time and breaks with cardio-metabolic and inflammatory risk biomarkers. The results showed that breaks, independent of sedentary time, were associated with decreasing waist circumference (Genevieve N. Healy et al., 2011). In another study, interventions increased the call center's break rate (breaks/sedentary hour) by around 2 minutes (S. Parry et al., 2013). However, they mentioned that in this organization, since productivity and compliance measures were monitored regularly, employees did not have the flexibility and control to vary their tasks and have more short breaks during work, either during coffee or meal breaks.

In the current study, one of the crucial aims was increasing breaks number/time during working hours, these result is similar to S. Parry et al. (2013), and no significant improvement was identified. However, the results showed that, due to the intervention, not only the daily average sedentary break but also break time per hour was increased from 8.71 minutes to 11.76 minutes after six months (*p*=0.001), and statistically, the changes between groups were significant (p= 0.000).

3.2.4. Sedentary behavior/physical activity and profession

Table 11, 12 shows that researchers have more daily average sedentary time than administrative before intervention (466.88±50; 442.50±52). Sedentary time has increased significantly in administrative while reduced significantly in researchers after intervention (p= 0.049; 0.013). Furthermore, there was a trend for the administrative workers to have more daily average sedentary breaks than researchers before the intervention (75.37±26; 57.41±24).

Table 11: Daily average sedentary bouts and profession before and after intervention (n = 40) (Mean(SD))

	Administrative (Mean(SD))			Researcher (Mean(SD))		
	Before	After	Sig. a	Before	After	Sig. a
Daily average sedentary Bouts (minutes)	442.50(52)	472.21(49)	**0.049**	466.88(50)	435.10(51)	**0.013**
Daily Average of Sedentary Breaks (minutes)	75.37(26)	91.4429()	0.210	57.41(24)	83.14(30)	**0.001**
a: sig: pair *t*-test Bold number had significant Sig						

increase has been seen in break time for researchers after 6 months (p= 0.001). The percentage of light PA in both groups had a significant decrease (0.019; 0.002) (administrative; researcher) (see Table 12).

Table 12: Percentage of PA and profession before and after intervention (n = 40)

	Administrative (Mean(SD))			Researcher (Mean(SD))		
	Before	After	Sig. a	Before	After	Sig. a
Sedentary (%)	93.33(2.31)	93.44(2.01)	0.895	93.68(2.44)	92.76(3.29)	0.139
Light (%)	2.84(0.61)	2.26(0.91)	**0.019**	2.45(0.21)	2.37(0.96)	**0.002**
MTVP (%)	3.84(1.21)	4.30(1.23)	0.575	3.48(2.06)	4.86(2.41)	**0.002**
a: sig: pair *t*-test Bold number had significant Sig						

3.2.5. Sedentary behavior/physical activity and office type

Table 13 shows that before implementing the interventions, the daily average of the sedentary bout in open spaces and the individual office was likely the same (460.07±48 (before open space); 457.81±64 (before individual office)); however, intervention could reduce the sedentary time workers in open spaces more than the individual office (441.95±53(after open space); 461±48min(after individual office).

Table 13: Daily average sedentary bouts and type of office before and after intervention (n = 40) (Mean)

	Open space			Individual office		
	Before	After	Sig.a	Before	After	Sig. a
Daily average sedentary Bouts (minutes)	460.07(48)	441.95(39)	0.114	457.81(64)	461.00(66)	0.900
Daily Average Sedentary Breaks (minutes)	59.16(22)	85.69(33)	**0.000**	75.36(34)	85.42(37)	0.484

a: sig: pair *t*-test
Bold number had significant Sig

Furthermore, the daily average of sedentary breaks among participants in the open space office was less than in the individual office (59.16± 22; 75.36±34). However, these amounts had a remarkable rise after 6 months compared to before onlyin open space offices (p=0.00). Although the sedentary percentage in the Individual office groups does not have a statistical decrease, however, In the Open spaces group had a slight reduction. Also, workers in the Open space office had a statically significant increase in the amount of MTVPA (p= 0.0014) (Table 14).
(Table 14).

Table 14: Percentage of PA and type of office before and after intervention (n = 40)

	Open space (Mean(SD))			Individual office (Mean(SD))		
	Before	After	Sig. a	Before	After	Sig. a
Sedentary (%)	93.96(2.11)	92.74(1.51)	**0.011**	92.24(2.65)	93.74(2.14)	0.290
Light (%)	2.57(0.89)	2.37(0.69)	0.200	2.55(0.91)	2.23(0.71)	0.216
MTVP (%)	3.46(1.33)	4.89(1.89)	**0.001**	4.02(1.75)	4.02(1.10)	0.996

a: sig: pair *t*-test
Bold number had significant Sig

3.2.6. Sedentary behavior/physical activity and gender

According to Table 15 about gender differences, females had longer sedentary bouts than males before and after the intervention, although, in both groups, the reduction was seen in the average of sedentary bouts. The average length of sedentary breaks was different between males and females. Both groups saw significant improvements before and after the intervention; however, females had more break duration than males (*p*=0.007) (Table 15).

Although the sedentary percentage in both groups does not have a statistical decrease, however, men have a slight reduction. However, females had a statistically significant increase in the amount of MTVPA (*p*= 0.0014) (Table 16).

Table 15: Sedentary Bouts and gender before and after intervention (n = 40)

(Mean(SD))	Female			Male (Mean(SD))		
	Before	After	Sig.	Before	After	Sig.
Daily average sedentary Bouts (minutes)	468.11(43.49)	452.68 (51.09)	0.256	450.13(59.10)	439.11(54.87)	**0.504**
Daily Average of Sedentary Breaks (minutes)	64.52 (28.58)	90.37 (39.01)	**0.007**	60.91 (24.40)	80.39 (34.70)	**0.020**
a: sig: pair *t*-test Bold number had significant Sig						

These results are similar to Healy et al. (2011), in which females were more sedentary and had more breaks than males; however, Hallman et al.(2018) did not see any statistically significant results for gender-related sedentary time and PA at work (Table 16).

Table 16: Percentage of physical activity and gender before and after intervention (n = 40)

	Female (Mean(SD))			Male (Mean(SD))		
	Before	After	Sig.	Before	After	Sig.
Sedentary (%)	93.80 (2.28)	93.56 (2.23)	0.720	93.33 (2.37)	92.31 (3.73)	0.174
Light (%)	2.78 (0.87)	2.36 (0.89)	**0.023**	2.33 (0.71)	2.32 (0.87)	0.974
MTVP (%)	2.90 (1.29)	4.08 (1.93)	**0.014**	4.35 (2.34)	5.37 (3.13)	0.126

a: sig: pair *t*-test Bold number had significant Sig

3.3.Job satisfaction

The 20-item short-form MSQ, was rated on a 5-point Likert scale to the level of job satisfaction of workers. Table 17 shows each question's mean and standard aviation before and after the intervention. Table 17 shows smallest value in the intervention group belongs to questions 13,14, and 12, respectively representative of compensation, advancement, and company policies and practices.

Table 17: Content of Minnesota Job Satisfaction Qestionnaire(n= 40) Mean(SD)

Items	Factors	Before	After
1. Being able to keep busy all the time.	Activity	4.43(0.63)	4.17(0.71)
2. The chance to work alone on the job.	Independency	4.27(0.71)	4.13(0.88)
3. The chance to do different things from time to time.	Variety	4.10(0.92)	3.90(0.81)
4. The chance to be "somebody" in the community.	Social status	3.90(0.84)	3.70(0.91)
5. The way my boss handles his/her workers.	Supervision(human relations)-	4.05(0.87)	3.95(0.98)
6. The competence of my supervisor in making decisions.	Supervision (Technical)	4.07(0.65)	3.85(0.89)
7. Being able to do things that don't go against my conscience.	Moral values	4.35(0.83)	4.20(0.72)
8. The way my job provides for steady employment.	Security	4.18(1.01)	4.22(0.73)
9. The chance to do things for other people.	Social service	4.18(0.747)	4.05(0.87)
10. The chance to tell people what to do.	Authority	3.75(0.87)	3.68(0.76)
11. The chance to do something that makes use of my abilities.	Ability utilization	4.22(0.76)	4.00(0.93)
12. The way company policies are put into practice.	Company policies and practices	3.63(0.92)	3.45(0.84)
13. My pay and the amount of work I do.	Compensation	3.18(1.08)	3.18(1.03)
14. The chances for advancement on this job.	Advancement	3.22(1.14)	3.15(1.05)
15. The freedom to use my own judgment.	Responsibility	4.05(0.84)	3.87(0.82)
16. The chance to try my own methods of doing the job.	Creativity	4.17(0.87)	4.00(0.81)
17. The working conditions.	Working conditions	4.17(0.71)	4.00(0.67)
18. The way my co-workers get along with each other.	Coworkers	4.18(0.71)	3.93(0.94)
19.The praise I get for doing a good job.	Recognition	3.95(0.87)	3.80(0.88)
20. The feeling of accomplishment I get from the job.	Achievement	3.87(0.96)	3.80(0.82)

Furthermore, the item responses were summed to create the three total scores: intrinsic job satisfaction, extrinsic job satisfaction, and general job satisfaction. According to the validated Portuguese version of MSQ, Intrinsic factors contain various dimensions like Activity, Independence, Variety, Moral values, Social service, Authority, Ability utilization, Responsibility, Creativity, and Achievement. The intrinsic scale refers to how people feel about the nature of the job tasks themselves.

Furthermore, Extrinsic factors include some factors that identify the score of Supervision (human relations and technical), Security, Company policies and practices, Working conditions, and Coworkers); and refer to how people feel about aspects of the work situation that are external to the job tasks or work itself. On the other hand, the

General factor subscales measure different dimensions (e.g., Social status, Compensation, Advancement, and Recognition) (Ferreira et al., 2009). Table 18 shows the mean scores of factors and standard deviations. The intrinsic, extrinsic, and general factors were slightly reduced after 6 months. (Table 18).

Table 18: Job satisfaction factor before and after intervention

	Intervention (n=40)		Sig (paired t-test)	Control (n=40)		Sig (paired t-test)	P value independent t-test
	Before	After		Before	After		
General	3.56	3.45	0.385	3.46	3.54	0.486	0.587
Intrinsic	4.14	3.98	**0.034**	4.00	3.95	0.519	0.869
Extrinsic	4.04	3.90	0.138	3.80	3.65	0.052	0.059

a: sig: pair *t*-test
Bold number had significant Sig

Previous studies demonstrated that job satisfaction is associated with turnover intention, absenteeism, organizational factors, exhaustion, physical and mental well-being, the joy of life, productivity, leadership, personality, and employee relationship (Hanisch & Hulin, 1991; Koustelios, 2001; Mathieu, 1991; Ostroff, 1992; K. D. Scott & Taylor, 1985; Staw, 1984). Ferreira et al. (2009) indicated that more satisfied workers present higher levels of subjective well-being and higher productivity (Ferreira et al., 2009). Some pre-post studies have observed meaningful effects on work performance and job satisfaction improved after intervention (i.e., designed workplace for more activity and less sitting) in office workers (Gorman et al., 2013). A cross-sectional study indicated that walking or standing during work was associated with greater changes in reporting being“ very satisfied” with the job (Andersen et al., 2017).

The current study findings did not support the previous research and did not have any improvement in job satisfaction after implementing interventions. It might be due to the various methods to measure job satisfaction or the type of implemented interventions. Also, this result could be due to various factors that might affect job satisfaction at work. Furthermore, this study was consistent with Roessler's (2012) result and shows that work-site exercise programs (i.e., strength training) do not affect job satisfaction (Roessler et al., 2013).

3.4. Well-being (SF-12)

Well-being has been defined as the combination of feeling good and functioning well (Huppert, 2009); the experience of positive emotions such as happiness and satisfaction, also the improvement of one’s potential, having some control over one's life, having a sense of purpose, and experiencing concrete relationships (Huppert, 2009). Well-being was assessed using the SF-12 questionnaire, which included 12 items which are shown in Table 15. Participants rate their health on a Likert scale for each item, which was then summed to provide a score for each scale and two summary scores on physical and mental health. Mental component scores (MCS) and physical component scores (PCS) were computed using the responses to items from 0 to 100, where 0 indicates the lowest level of health and 100 indicates the highest level of health (A Puig-Ribera et al., 2008; Ware et al., 1996). The MCS(includes Vitality, Social Functioning, Role-Emotional, and Mental Health) and PCS (comprise Physical Functioning, Role-Physical, Bodily Pain, and General Health) measured the participant’s perceived impact of mental/physical health on their routine activity during the last four weeks before and after the intervention. The higher scores indicate better physical and mental health functioning. A score of 50 or less on the PCS-12 has been recommended as a cut-off to determine a physical condition, while a score of 42 or less on the MCS-12 may be indicative of ‘clinical depression(Ware et al., 2008).

There was a higher decrease in General health in the control than in the intervention group (p = 0,01); Also, there was a higher decrease in physical functioning in the control than in the intervention group (p = 0,05)

Table 19: Well-being factors before and after intervention (Mean)

	Sub items		Item description	Intervention group (n= 40) Before	Intervention group (n= 40) After	Control group (n= 40) Before	Control group (n= 40) After	Sig
Physical Component Summary	GH		Health in general	65.63	63.75	58.75	52.50	**0.01**
	PF	PF1	Moderate activities	95.00	93.75	91.25	91.25	0.60
		PF2	Climb several flights	100.00	98.75	96.25	92.50	**0.05**
	RP	RP 1	Accomplished less(physical)	95.00	95.00	80.00	92.50	0.64
		RP2	Limited in kind of work	95.00	90.00	67.50	92.50	0.69
	BP		Pain interferes	89.38	86.87	78.13	81.88	0.29
Mental Component Summary	RE	RE 1	Accomplished less(emotional)	***75.00***	***80.00***	62.50	57.50	0.30
		RE 2	Did work less carefully	***57.50***	***62.50***	60.00	45.00	0.11
	MH	MH 1	Calm and peaceful	57.50	56.00	56.00	60.50	0.34
		MH 2	Blue/sad	66.00	65.00	66.00	69.50	0.30
	Vitality		Energy or vitality	***83.00***	***84.50***	72.50	72.00	0.26
	Social Functioning		Social limitation	75.00	74.38	76.87	72.50	0.69
	MCS		Mental score	***69.00***	***70.23***	65.64	63.98	0.14
	PCS		Physical score	90.00	88.02	78.64	82.85	0.17

Sig: independent *t*-test, the Bold shows the statistically significant changes The *italic* number shows the improvement

GH = General health ;PF= Physical Functioning; RP= Role-Physical; RE= Role-Emotional; BP = Body Pain; MH = Mental Health ; MCS= Mental score Scale; PCS= Physical score

The mean values of all factors for SF-12 scales for participants are shown in Table 19. Questions are integrated into eight factors and twelve sub-factors. The mean value of SF12 in mental health score in this population is 69 out of 100, slightly improving after intervention 70.23. Some studies showed that an active lifestyle could improve physical and mental well-being and also decrease chronic disease risk (Hassmén et al., 2000; Anna Puig-Ribera et al., 2015; Warburton et al., 2006). One of the large population studies showed that sedentary behavior had been associated with lower emotional well-being

(Galper et al., 2006); and having a daily routine physical activity like frequently walking or increasing breaks decreases chronic diseases, including MSDs (Nilsen et al., 2011) and improve the energy, social functioning, and reduce pain, and sleep disturbance (Hergenroeder et al., 2022). In general, at the baseline, the scores for mental health and its subscales were less than the physical health score, which showed a slight increase in the intervention group. This result was consistent with Dutta et al. (2014), who implemented a four-week intervention for sedentary workers, which could reduce the sedentary time by 4.8 min/work-hr and increase energy/vitality in office workers. Like this result, Hergenroeder et al. (2022) implemented 6 months intervention for office workers in their study. The result demonstrated 1.5 hours/day less sitting time for the intervention group, with caused improvement in energy/vitality, while their productivity, concentration, and presenteeism were unchanged. Furthermore, it has previously been reported that even in office workers who did not meet WHO's physical activity recommendations (75 minutes vigorous, 150 minutes moderate PA per week), those who had less sedentary had significantly upper energy levels than others who had more sedentary time(Ellingson et al., 2014). Gibson et al. (2017) demonstrated that weekday sitting time, including working hours below 8 hours/day, was associated with workers' better perceived mental health (Gibson et al., 2017). Päivärinne et al. (2018) described that mental health summary was negatively related to sitting time; in other words, subjects who are less physically active and sit more feel less energetic. They also had the highest incidence of mental disorders (Päivärinne et al., 2018). Dale et al. (2019) recently reviewed 32 studies and demonstrated that prolonged sitting increases the risk of depression and anxiety. They also mentioned that lower self-esteem is associated with increased sedentary behavior leading to isolation and depression. On the other hand, Lubas et al.(2016) proposed some theoretical frameworks which support this relationship that increased levels of physical activity and reduced sedentary behavior might help to meet basic psychological needs (e.g., social connectedness, self-acceptance, and purpose in life), and consequently improve overall mental health (Lubans et al., 2016). Even though the mechanisms which are responsible for the effects of physical activity and sedentary behavior on mental health are unclear; however, several hypotheses have been presented. Höglund et al. (2019) stated that some potential physiological mechanisms underlie depression and anxiety altered 5hydroxytryptamine synthesis, lower serotonin, brain-derived neurotrophic factor, and depletion of tryptophan. Dishman et al., 2009 et al. proposed another physiological mechanism and demonstrated that persons who participate in a physical activity program might improve their mental health via the release of endorphins, which increases brainderived neurotrophic factors. Also, the involvement of the endocannabinoid system may be more crucial for mood improvements after exercise (Fuss et al., 2015). However, the current study's findings do not support the previous research and show no association between SB/PA and mental/physical health in office workers. This result can be due to the small number of participants. Also, the post-pandemic situation and hybrid work (A flexible work model that supports a blend of in-office, remote, and on-the-go workers.) caused the intervention couldn’t be implemented in all workplaces in the same manner, and people also could not follow and do all interventions consistently. Furthermore, organizational issues (e.g., merging offices due to construction in the workplace and overload tasks because of returning to work after around one year of teleworking) might affect the perceived well-being.

3.5.Musculoskeletal symptom

The prevalence of musculoskeletal symptoms during 12 months in the intervention group differed in various body regions (Table 20). The most prevalence of MSDs during the last 12 months and the limitation in work caused by pain were in the lower back (52.5 %, 7.5%), neck (50%, 15%), knee (32.5%,10%), and upper back (27.5%, 7.5%)(% of symptom during 12 months, % of limit activity, respectively). As Table 20 shows, there has been a statistically significant reduction in pain during the last 12 months in the intervention group in the neck(p=0.035), shoulder right(p=0.033), wrist right (p=0.042), and upper back(p=0.000); however, during the same period, the pain increased in the control group. Also, in the lower back, although the change was not significant, the improvement in the last 12 months symptom had seen in the intervention group (52.5%;40%) (% before; % after), while in the control group, there increase in symptom happened (42.5%; 50%)(% before; % after). After six months, the percentage of the workers in the intervention group who felt less limitation caused by pain in their daily activities decreased for the neck (15%; 10%), left shoulder (7.5%;5%), elbows(2.5%;0%), upper(7.5%;5%), and lower back(7.5%;5%) compared control group. Following the application of intervention, a significant increase in the “symptom in the last 7 days” between groups in the neck (p=0.001), shoulder right(p=0.005), shoulder left (p=0.227), upper back (p=0.007), hip/thigh (p=0.179), and ankle/feet (p=0.044) was recorded. The left shoulder and hip/thigh did not have significant changes, but as Table 20 shows, slight changes happened in the percentage of workers with pain in the intervention group (67.5%; 22.5%), (20%;10%).

Table 20: Percentage of musculoskeletal pain in last 7 days/ 12 months and limitation in work before and after the intervention.

	Intervention			Control group			P (T0C*T0I) chi-square	P (T1C*T1I) chi-square
	T0	T1	p-value (McNemar)	T0	T1	p-value (McNemar)		
Neck								
12m (% yes)	20(50%)	18(45%)	0.363	23(57.5%)	27(67.5%)	0.172	0.327	**0.035**
Limit (% yes)	6(15%)	4(10%)	0.313	8(20%)	8(20%)	**0.035**	0.385	0.338
7days (% yes)	19 (47.5%)	13(32.5%)	**0.031**	22(55%)	28(70%)	0.073	0.327	**0.001**
Shoulders Right								
12m (% yes)	14(35%)	11(27.5%)	0.227	21(52.5%)	20(50%)	0.500	0.088	**0.033**
Limit (% yes)	4(10%)	4(10%)	0.688	4(10%)	5(12.5%)	0.500	0.644	0.500
7days (% yes)	12(30%)	9(22.5%)	0.125	20(50%)	21(52.5%)	0.500	0.055	**0.005**
Shoulder Left								
12m (% yes)	12(30%)	11(27.5)	0.500	10(25%)	8(20%)	0.344	0.401	0.300
Limit (% yes)	3(7.5%)	2(5%)	0.500	2(5%)	2(5%)	0.750	0.500	0.692
7days (% yes)	13(67.5%)	9(22.5%)	0.109	14(35%)	13(67.5%)	0.500	0.500	0.227
Elbows Right								
12m (% yes)	3(7.5%)	1(2.5%)	0.250	2(5%)	2(5%)	1.00	0.500	0.500
Limit (% yes)	1(2.5%)	0	0.500	1(2.5%)	2(5%)	0.500	0.753	0.247
7days (% yes)	2(5%)	2(5%)	0.750	2(5%)	1(2.5%)	0.500	0.692	0.500
Elbows Left								
12m (% yes)	3(7.5%)	1(2.5%)	0.250	2(5%)	2(5%)	1.000	0.500	0.500
Limit (% yes)	1(2.5%)	0	0.500	1(2.5%)	1(2.5%)	0.750	0.753	0.500
7days (% yes)	2(5%)	2(5%)	0688	2(5%)	1(2.5%)	0.500	0.692	0.500
Wrist hands right								
12m (% yes)	7(17.5%)	4(10%)	0.227	12(30%)	11(27.5)	0.500	0.147	**0.042**
Limit (% yes)	3(7.5%)	3(7.5%)	0.688	1(2.5%)	1(2.5%)	0.750	0.308	0.308
7days (% yes)	2(5%)	3(7.5%)	0.500	13(67.5%)	9(22.5%)	0.145	0.002	0.057
Wrist hands Left								
12m (% yes)	4(10%)	6(15%)	0.344	3(7.5%)	1(2.5%)	0.250	0.500	**0.054**
Limit (% yes)	1(2.5%)	3(7.5%)	0.250	1(2.5%)	1(2.5%)	0.750	0.753	0.308
7days (% yes)	2(5%)	5(12.5%)	0.188	9(22.5%)	4(10%)	0.063	0.338	0.027
Upper back								
12m (% yes)	11(27.5%)	3(7.5%)	**0.019**	14(35%)	18(45%)	0.194	0.315	**0.000**
Limit (% yes)	3(7.5%)	2(5%)	0.688	5(12.5%)	3(7.5%)	0.344	0.216	0.500
7days (% yes)	11(27.5%)	4(10%)	**0.033**	11(27.5%)	14(35%)	0.304	0.599	**0.007**
Lower back								
12m (% yes)	21(52.5%)	16(40%)	0.113	17(42.5%)	20(50%)	0.227	0.251	0.250
Limit (% yes)	3(7.5%)	2(5%)	0.500	5(12.5%)	5(12.5%)	0.656	0.356	0.500
7days (% yes)	13(67.5%)	14(35%)	0.500	15(37.5%)	22(55%)	0.059	0.407	**0.058**

Table 20: Percentage of musculoskeletal pain in last 7 days/ 12 months and limitation in work before and after the intervention.

	Intervention			Control group			P (T0C*T0I) chi-square	P (T1C*T1I) chi-square
	T0	T1	p-value (McNemar)	T0	T1	p-value (McNemar)		
Hip/thigh								
12m (% yes)	4(10%)	4(10%)	0.637	7(17.5%)	2(5%)	**0.016**	0.259	0.179
Limit (% yes)	0	0	----	2(5%)	1(2.5%)	0.750	0.500	0.500
7days (% yes)	5(20%)	4(10%)	0.500	6(15%)	1(2.5%)	**0.031**	0.500	0.179
Knee								
12m (% yes)	13(32.5%)	11(27.5%)	0.387	18(45%)	14(35%)	0.063	0.179	0.404
Limit (% yes)	4(10%)	5(12.5%)	0.500	5(12.5%)	0	0.31	0.500	**0.027**
7days (% yes)	9(22.5%)	10(25%)	0.500	14(35%)	11(27.5%)	0.254	0.162	0.500
Ankles feet								
12m (% yes)	9(22.5%)	5(12.5%)	0.172	3(7.5%)	9(22.5%)	**0.016**	**0.057**	0.189
Limit (% yes)	2(5%)	2(5%)	0.750	1(2.5%)	2(5%)	0.500	0.500	0.692
7days (% yes)	6(15%)	2(5%)	0.063	3(7.5%)	8(20%)	0.063	0.241	**0.044**

The bold number shows the improvement

T0: baseline; T1: after 6 months; T0C: baseline control group; T0I: baseline intervention group; T1C: after 6 months control group; T1I: after 6 months in intervention group

If we compare the differences between the two groups in the severity of pain after the intervention, we can verify that the intervention group felt less severity of pain in daily activities in the past 7 days in the neck (p = 0.005), shoulder right (p = 0.007), upper back(p = 0.004), lower back(p = 0.046), left/right wrist (p = 0.027/0.035) and ankles/feet(p = 0.019). Although not statistically significant, some results demonstrated a decrease in the intensity of pain in the left shoulder (1.35 (2.35); 0.85(1.83), (p = 0.205)), and right elbow (0.25 (1.12); 0.15(0.80)), (p = 0.500) (Table 21).

Table 21: Severity of pain in the body areas during the last 7 days according to the Numeric Rating Scale (0 - 10) before and after Intervention (Mean (SD))

	Intervention			Control				
	T0	T1	p-value Wilcoxon	T0	T1	p-value Wilcoxon	P (T0C*T0I) Man-Witney	P (T1C*T1I) ManWitney
Pain Neck	1.65 (2.23)	1.25 (2)	0.107	1.58	2.17	0.062	0.460	**0.005**
Pain shoulder right	1.20 (2.35)	1.07 (2.25)	0.394	2.62	1.94	0.227	**0.013**	**0.007**
Pain shoulder left	1.35 (2.35)	0.85 (1.83)	0.158	1.1	0.81	0.449	0.470	0.205
	Intervention			Control				
Pain Elbow right	0.25 (1.12)	0.15 (0.80)	0.375	0.3	0	0.250	0.50	0.500
Pain Elbow left	0.15 (0.69)	0.1 (0.49)	0.438	0.3	0	0.250	0.436	0.373
Pain Wrist/hand right	0.25 (1.19)	0.3 (1.13)	**0.00**	1.45	0.97	**0.036**	**0.001**	**0.035**
Pain Wrist/hand left	0.25 (1.29)	0.42 (1.17)	0.00	0.45	0	**0.000**	0.227	**0.027**
Pain Upper back	0.95 (1.89)	0.25 (0.80)	**0.031**	0.74	1	0.166	0.416	**0.004**
Pain Lower back	1 (1.86)	1.07 (1.67)	0.30	1.35	1.97	**0.040**	0.256	**0.046**
Pain Hip/thigh	0.25 (0.77)	0.27 (0.87)	0.406	0.4	0.075	**0.031**	0.280	0.149
Pain Knee	0.67 (1.50)	0.9 (1.83)	0.170	1.025	0.46	**0.035**	0.117	0.458
Pain Ankles/feet	0.47 (1.24)	0.17 (0.95)	0.094	0.25	0.78	**0.035**	0.233	**0.019**

The bold number shows the improvement

T0: baseline; T1: after 6 months; T0C: baseline control group; T0I: baseline intervention group; T1C: after 6 months control group; T1I: after 6 months in intervention group

Dzakpasu et al. (2021), in a systematic review, examined evidence on the associations of SB with musculoskeletal pain in observational and intervention studies, and they found a positive association between self-reported workplace sitting time (4 h/day) and the risk of pain in the low back, neck, and shoulder**.** They also demonstrated that intervention studies that reduce prolonged sitting at work reduce musculoskeletal pain and discomfort in LBP, neck/shoulder pain, and general musculoskeletal pain. Their findings were also reported by Agarwal et al.(2018). Additionally, this literature review also found that the self-reported standing time had a negative relationship between light PA and pain in the hand /wrist(Dzakpasu et al., 2021). Foley et al. (2016) implemented an activity-based work environment (e.g., changing the layout, no food consumption at the desk, and adjusting the furniture) for office workers to reduce sedentary time and increase physical activity. The result showed a reduction in self-reported sedentary behavior, and increased standing time caused a reduction in the LBP and improved well-being at work(Foley et al., 2016). Other experimental studies also indicated that a reduction in sitting time at work with the intervention was significantly associated with small reductions in lower back pain and with a not significant reduction in other musculoskeletal pain symptoms (Brakenridge 2018, Gao et al. 2016). This finding was also reported by Thorp et al. (2014). They demonstrated that reducing sitting time with 30 min standing break was positively associated with a reduction of lower back pain; No significant association was reported in other body regions (Thorp et al., 2014b). In another study on office work,with a subjective method to measure SB and PA, no significant association was found between workplace sitting and LBP, UBP, shoulder, and wrist pain. However, a negative association was found between workplace sitting time with neck and extremities pain (arm, leg, and foot) (Celik et al., 2018). However, Danquah et al. (2017) finding was based on objective measures of SB/PA (ACTIGRAPH) and contrary to other studies. It demonstrated that sitting reduction was positively associated with a reduction in neck/shoulder pain but no significant association with a reduction in LBP and extremities pain (Danquah et al., 2017). The association between uninterrupted sitting and the increased immediate report of LBP in adults has been shown by Carvalho et al. (2020), who reviewed the experimental studies with objective measures. Their result showed that prolonged sitting and LBP are prevalent in workplaces; furthermore, the complex multifactorial nature of LBP likely contributes to the confusion, and their review could not make any conclusion between sitting and clinical episodes of LBP. It can be due to distinctions for each population (e.g., for different body mass, occupation, or clinical history). Besides these factors, several methodological factors play a role in the association of the SB and LBP. On the other hand, according to this systematic review, the association between LBP and SB in self-reported and device-measured studies was inconsistent. This inconsistency may be due to the increased potential of self-reported tools to either underestimate or overestimate SB. For instance, the self-reported time spent sedentary at work was around 40 minutes higher than when assessed by devices; however, it underestimated sedentary time by ~1.74 hours per entire day compared to devise measures (Prince et al., 2020). Besides the studies that implement interventions to reduce prolonged sitting time at work, studies that try to increase physical activity and exercise to reduce musculoskeletal disorders reported that replacing 30 minutes of a full day's total sedentary time with 30 minutes of MTVPA may decrease general musculoskeletal pain (MSP) by 29% (C. G. Ryan et al., 2017). Osama et al. (2016)demonstrated that office workers with active micro-breaks (10 minutes per hour) provide better protection and better musculoskeletal discomfort significantly at work than the group having rest breaks without exercise (Osama et al., 2016). Their funding may support current WHO physical activity and sedentary behavior guidelines, which recommend reducing and interrupting prolonged SB or sitting with physical activity of any intensity for improved health outcomes (Bull et al., 2020). In another study, Steffens et al. (2016) investigated the effectiveness of intervention studies for the prevention of LBP, and they demonstrated that exercise in combination with training or alone was likely to decrease the risk of LBP, and consequently, limitation in their activity due to LBP, at least for the short-term. They also suggested that education alone does not prevent LBP(Steffens et al., 2016). Besides WHO practice guidelines, these studies could be encouraged in adults, especially in occupational settings, to minimize the risk of MSDs (Dzakpasu 2021).

Our result was consistent with Danquah et al. (2017), in which the employees, after the intervention, had a reduction of pain intensity in the last seven in the neck and shoulder. Furthermore, our results, in contrast with previous studies, showed pain reduction in LBP, upper back, wrist, and ankle. However, our result is contrary to previous studies that reported no significant changes in musculoskeletal symptoms as a result of the intervention (De Carvalho et al., 2020; Saunders et al., 2020). Nevertheless, Saunders et al. (2020) suggested that SB is generally associated with negative health outcomes, and reducing prolonged sitting may have beneficial effects on markers of cardiometabolic risk and body composition. Some studies have investigated the biomechanical and physiological mechanisms of LBP and illustrate that prolonged occupational sitting increases the spinal load, and the accumulation of metabolites can accelerate degenerative changes in vertebral discs. Nonetheless, there is an observation in these studies that indicates LBP may be modulated by overweight/obesity, type 2 diabetes, and cardiovascular diseases(Kastelic et al., 2018). Future research in this direction needs to provide insight into understanding the potential biological mechanisms of sedentary behavior and MSDs associations.

In our results, however, some changes have been seen in pain intensity in the intervention group, but there was statistically a very weak or weak correlation between variables of
SB (objective measures) and intensity of the pain (Nordic Musculoskeletal Questionnaire).

3.6.Study context

For contextual aspects, at the baseline, the intervention group participants returned to office work after the pandemic and teleworking. After 6 months of intervention, just 5% of participants had office/telework simultaneously. Their interest in attending this volunteer study without any obligation or reward described how individuals were interested in improving their physical activity and were looking forward to its benefits on their health and wellbeing. They accepted to participate in this study, despite some efforts like needing to wear a device on their thigh the entire working day in front of those who did not attend the study. Also, they had to follow instructions and interventions and spend time answering questionnaires for two moments. All participants followed procedures and read the training material sent to them. They continued collaboration until the end of 6 months of intervention, except for one who quit his job. These factors and observations show their interest in this topic and their level of individual acceptance.

At the baseline, some office workers pointed out that they recently initiated having breaks (37.55%) and PA(42.5%). However, at the baseline, 7.5% said they never thought about short breaks between sedentary time, and 2.5% never thought about PA. 22.5% and 12.5% of participants reported that they decided to change behavior and have breaks and PA, respectively, but have not started yet. Organizational support also had an important role in encouraging them to attend this study. HR and senior managers supported the implementation of this study among workers, sending the invitation and contributing by encouraging emails once per week; also, they accompanied during the periodic visits and interviews with the participants. Before this study, the company held an ergonomic course about appropriate workstations for office workers and emphasized the importance of some posture improvement and corrective movements.

In the face-to-face interviews, employees described how their human resources and direct managers supported them to have shorter breaks and do physical activity during this study, and they acted as role models. However, the final decision to change behaviors was up to the individual, and they had various reasons not to have breaks and PA.

"Our managers talk a lot about the health and wellness hour and have an active break. We saw the posters about Walking/standing meetings and things like this. So, it is not the managers' fault if I do not do it.

Fifty percent of the workers adjusted the height of their monitors; as part of this study, information about the ergonomics of computer workers was sent to volunteers. According to the instructions, they were asked to adjust their workstation; after 6 months, around 70 percent of participants adjusted their monitors, chairs, and desks as much as possible. For two of them, the sit-stand desk has been bought.

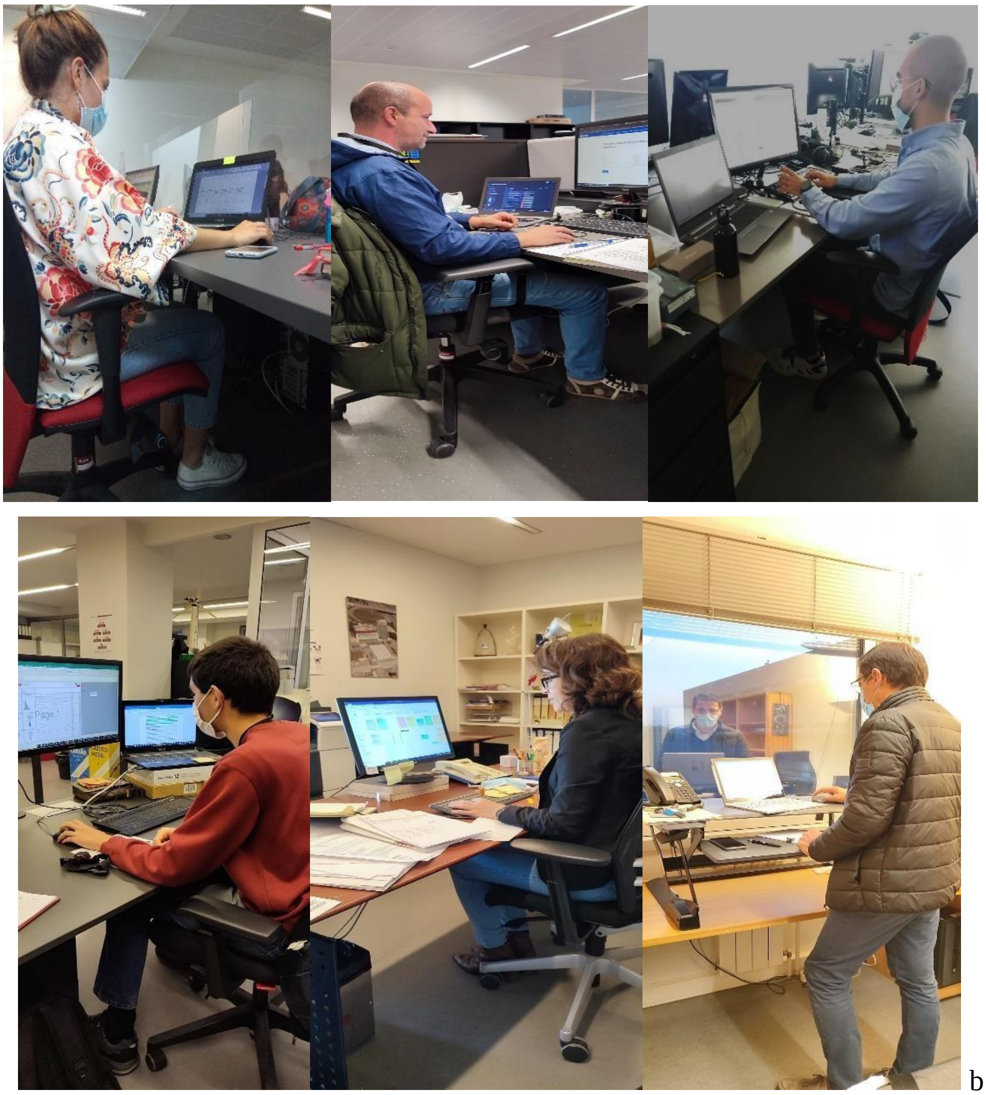
3.6.1. Barriers to ergonomic self-adjustment

The Ergonomics Self-Adjustment is adjusting the worker's workstation through an interactive process that identifies whether there is a need for minor equipment and/or follow-up action items. For the 30 % with unadjustable desks, we just suggested that they increase breaks, change their positions regularly, and do exercise during their sedentary time and breaks. Figure 16 shows some employees after intervention with and without adjusting their workstations. In the interview, they explained the reason for not changing their tables and chairs based on the guidelines:

"It is difficult to adjust my laptop to the ergonomic height daily. I need to have an extra keyboard and mouse. Sometimes I do it. Sometimes I do not have time and energy or forget to do this."

"I am not worried about my workstation; I think some movement during coffee breaks is enough. However, I may have had some musculoskeletal system problems over time."

“Our desk height is not adjustable; even if I want to adjust my chair, it can not be arranged with the desk, making my situation uncomfortable.”



a

b

Figure 16: a: The upper photos show unchanged or semi-adjusted situations; b: adjusted workstations

3.6.2. Barriers to having short breaks and PA during work

Although the individuals spent time following instructions like standing more, walking, and exercising, sometimes it was difficult for participants in an open space office in front of other colleagues to have breaks and do PA and change the normal routines while others were working. According to this evidence, social acceptance was low for walking, standing, or exercising at work, as they said:

" I would say I am afraid others think that I do not work while standing, walking, or exercising; otherwise, I think I would move much more."

"I prefer to sit and do my job constantly, even for many hours, then take breaks to walk and come back."

"If I stand during my work and have short breaks, I am afraid my productivity will be reduced, and I will waste my time."

"I really want to do it, but I am busy and forget to do it. Even if I remember (by software reminder) this, I prefer to continue my work as usual since changing habits makes me uncomfortable at first."

"I am really interested in doing this, but I forgot. Installing the reminder helps me to improve PA."

"I do not have a bad feeling about prolonged sedentary time. Occasionally walking and having 2 breaks per day is enough for me. However, maybe I have some problems over time."

"My hands are full. In the pressure of work and lack of time, I cannot change my routine and have more instant breaks or exercise."

Despite individual and environmental limitations to attending the online gym, some employees do exercises through a zoom link daily. The employees had a sense of choice for the time to attend the online gym (each Monday and Wednesday at 10:30 and each Tuesday and Thursday at 14:30). Notably, when they worked from home, they attended more at the online gym. Also, they preferred not to turn on their camera while doing exercises (Figure 17).

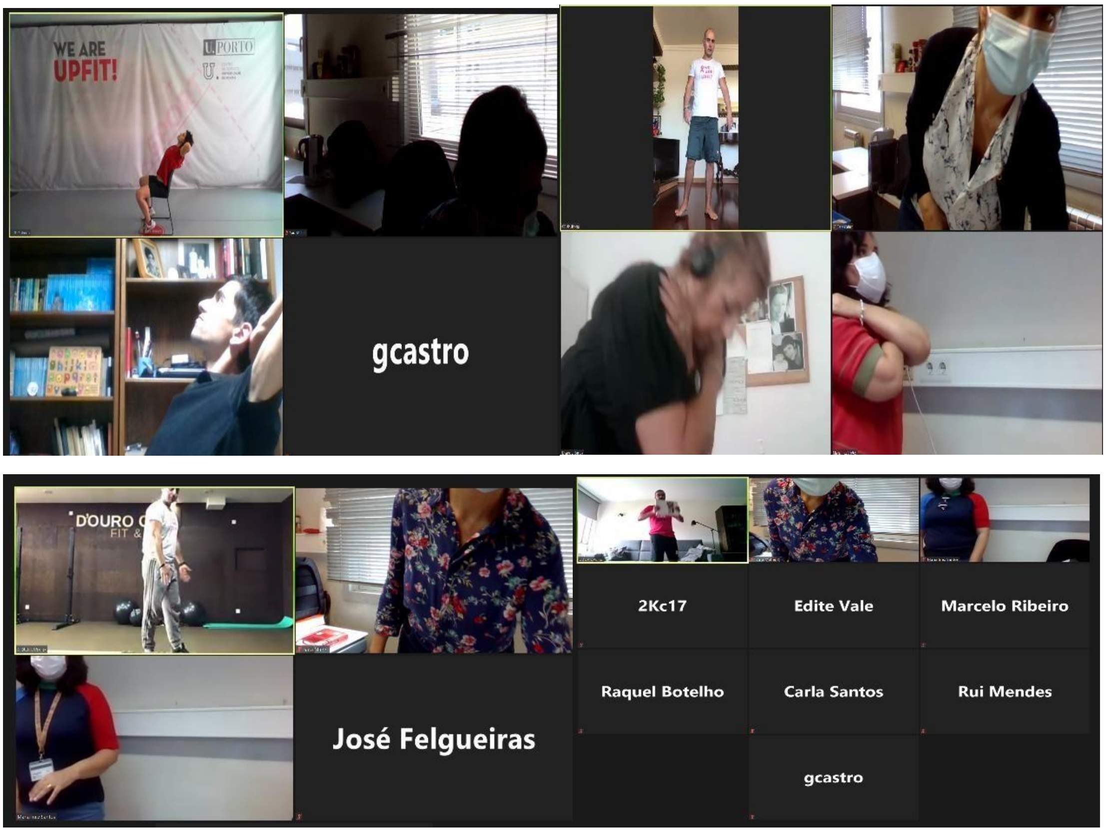


Figure 17: Employees attend online gym

Barriers to spending more time standing were a lack of a non-adjustable table, their problem accessing the computer, and, consequently, lack of proper vision on their monitor:

"Standing while working a computer without a sit-stand desk is a bit annoying."

However, two participants with sit-stand desks mentioned that they were standing half of the time during working hours:

"I have back/neck pain, so personally, the use of the sit-stand workstations has saved me; also, because of the effectiveness of the sit-stand desk and its positive effect on my productivity, I decided to start gym after work."

"When I feel pain in my back or feel blue, immediately change my posture and put the desk on the standing situation, then with changing position, I feel fresh, and it can increase my productivity."

In the interviews, employees said they prefer that instead of having short breaks behind their desks, they have some PA during their coffee breaks or lunchtime. It can be because the lack of a sit-stand desk, the habit of sitting, the pressure of workload and lack of time, and an awkward feeling of "standing out" while others are working were described as barriers to having short breaks standing and exercising during work. Nevertheless, they had more PA during breaks time like walking instead of standing and doing exercise instead of having more short breaks during sedentary times.

3.6.3. Environmental barriers:

The face-to-face interviews and observations of the environmental barriers influencing PA behaviors were recognized. During the study, the organization needed to place more employees in the same building, and the timing of the intervention somehow conflicted with needs related to the relocation of offices, which caused the challenge of finding a proper balance in health messaging at the workplace. Due to this, the open space office became crowded, and employees described walking around the office or doing exercise as more difficult. It was perceived as frustrating and time-consuming to have a short walk or break. The lack of an appropriate workstation with adjustable height and length was also an environmental barrier to doing more PA:

"Maybe it was better participants in the study be placed on the same floor, next to each other, and they could encourage and motivate each other"

The most appreciated possibilities for volunteers to be active at work were to use the stairs, increase normal walking (e.g., use the bathroom/printer on other floors, go to their colleague's office instead of calling, walk during coffee breaks) or stand more while working at labs or in breaks; also they stand while calling phone or reading emails.

3.7.Effectiveness of interventions

3.7.1. Stage of behavior change

Table 22 shows the intervention effect over time for phase of behavioral change in all three parts of work style behavior according to TTM. This model explains an individual's readiness to change their behavior. The process of behavior change includes four stages. Stage one is *Pre-contemplation* which shows there is no intention of taking action. The second stage is *Contemplation*; There are intentions to take action and plans to do so soon.

Action is the third stage that shows behavior has been changed for a short time. Moreover, the last stage is *Maintenance* which demonstrates that behavior has been changed and continues to be maintained for the long term (Bernaards et al., 2008). The percentage of the pre-contemplation phase before and after 6 months illustrates that the interventions were effective in moving participants from the earlier stages (i.e., (pre)contemplation) to the later stages (i.e., action and maintenance) concerning body posture/workstation adjustment and also in having breaks.

Concerning doing exercise and PA, the interventions were ineffective in moving participants from earlier ((pre)contemplation) to later stages (Contemplation) during 6 months. However, a slight increase happened in the "Action" phase before and after interventions.

Table 22: Stage of change at baseline and follow-up measurements and intervention effect before and after 6 months

	Intervention (n=40)		Control (n=40)	
Phase of behavioral change	Before	After	Before	After
Body posture/workstation adjustment				
Precontemplation (%)	20	12.5	20	12.5
Contemplation (%)	5	12.5	7.5	7.5
Action (%)	40	52.5	30	42.5
Maintenance (%)	35	22.5	25	17.5
Breaks				
Precontemplation (%)	30	15	25	27.5
Contemplation (%)	5	7.5	5	5
Action (%)	27.5	40	52.5	35
Maintenance (%)	37.5	37.5	17.5	32.5
Exercise and physical activity				
Precontemplation (%)	15	17.5	17.5	20
Contemplation (%)	27.5	25	35	22.5
Action (%)	15	17.5	27.5	30
Maintenance (%)	42.5	40	20	27.5

Figure 18 demonstrates the result of self-reported behavior changes with regard to the use of breaks and exercise reminder software and the use of sufficient breaks in general at baseline and after 6 months. Answers were dichotomized into “never/sometimes” or “regularly/always”; to illustrate the possible changes during 6 months, the differences compared in the percentage of answers to “regularly/always” before and after intervention (Bernaards et al., 2008).

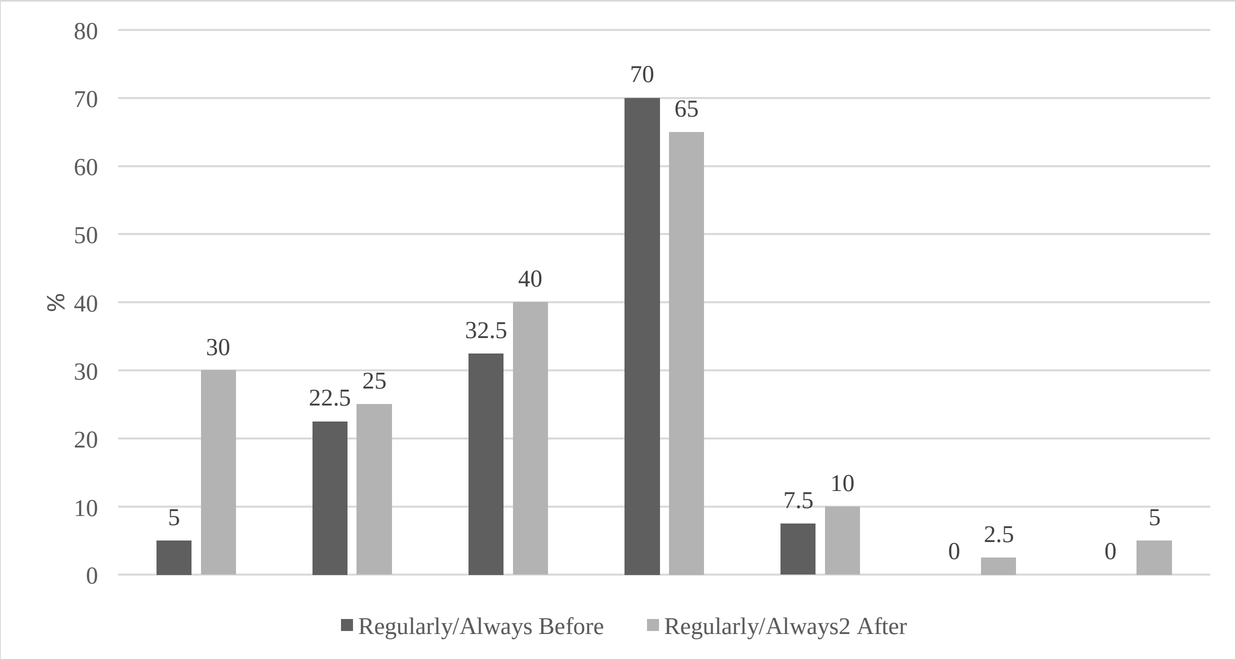


Figure 18: Result of self-reported behavior changes about breaks during work hours

The results of the questionnaires showed that the intervention group regularly/always used stairs during the work day; however, after 6 months, 5 % decreased. The notable changes have been seen in using reminders (for changing posture and having breaks), which increased by 25 % after implementing the intervention. There is a slight increase in other variables like “having 5 minutes breaks per hour”, “walking instead of standing” , and “Exercise at the break.” Concerning the “standing instead of sitting while computer work” and “attending gym online,” a slight rise happened, while before the intervention, people never/sometimes did these activities.

3.8.Practical implications

This study has shown that it is possible to decrease SB and increase PA among office workers. Furthermore, barriers, possibilities, and facilitators to decrease sitting and increase PA among office workers were evaluated. Moreover, the environment and furniture design have been monitored to have an overall perspective on this specific workplace. At this organization, they had some courses about ergonomics for computer workers, which aim to reduce the risk of musculoskeletal symptoms related to bad posture. However, previous courses were not exactly about increasing awareness related to the risks of SB. Although interest in health promotion among volunteers was high, this interest was more about PA and exercising during the break time and not about reducing the sitting time during work hours. The interview data with HR and Managers confirmed that there was a good organizational culture to promote general health (e.g., healthy eating and health courses), but not specifically in improving PA through work and also having a sit-stand desk or encouraging to have active transport. According to Actigraph data, the intervention group increased their number of steps and MTVPA compared to the control group. There was a compensatory effect, with an increase in sitting time in the nonworking and leisure time in the intervention group after intervention. This study was participatory research that tried to actively involve workers in creating and implementing workplace modifications that will enhance productivity and well-being and decrease safety and health risks. This participatory study tried to increase the knowledge and understanding given phenomenon and to integrate the knowledge gained with interventions for the policy or social changes benefiting the community members (Institute of Development Studies, 2022). It may also reveal why they do not use specific interventions that are intended to help them (Burgess-Limerick, 2018). This study revealed which activities in the program were performed as planned and illustrated the barriers and motivations. Also, it showed that various factors, such as leadership support, individual habits, job scope, and workload, influenced PA behaviors among office workers. The timing of the intervention somehow conflicted with needs related to the relocation of offices, and it caused the challenge of finding a proper balance in health messaging at the workplace.

As previously described, the accumulation of sedentary time adversely affects metabolic response and health. Light-PA like active standing during meetings/ phone calls, stand/walk meetings, and screen-based reminders have been described as feasible possibilities to decrease sedentary time and increase break number/time (Engelen et al., 2016; Neuhaus, et al., 2014;Thorp et al., 2014). This study, through various methods like weekly emails, posters, and face-to-face consultants, tried to highlight the importance of breaking up prolonged sitting and taking breaks. Reducing occupational SB is common in some countries, like Scandinavian countries, with minimum SB at work. In this study, sedentary time after the intervention was reduced to 92.96% (around 0.61 %) during working hours which is a slight modification. To our knowledge having an active workstation like using sit-stand tables, doing exercise at the workstation (short breaks), standing meetings, etc., are not common in office work in Portugal. Portugal has the lowest levels of PA in Europe and high levels of a sedentary lifestyle, which led to the Directorate Generals of Health to establish Physical Activity as a priority health program and develop the National Strategy for Promotion of Physical Activity (Shinn et al., 2020b). The high levels of SB in this study were probably due to the unavailability of appropriate equipment like sit-stand workstations. Although the break time per day/hour has been improved during the intervention, there was a significant decrease in the light PA in the intervention group, which this increase might have happened in the amount of MTVPA. Hence, after the intervention, the increase in MTVPA at work was more pronounced than light PA in the intervention group; this was probably due to limitations to having light PA during work at the office (e.g., the design of the office and lack of spaces for exercise, does not have a sit-stand workstation, feel uncomfortable to have short breaks or to do PA in front of other colleagues, etc.). Because of this, they might have MTVPA (e.g., using stairs, riding the bicycle, etc.) during long breaks out of the office and at lunchtime. Furthermore, the result of IPAQ showed that exercise time increased in the intervention group after 6 months; however, the interview demonstrated that, except for a few workers who go to the gym during working hours, most of them did exercise after work hours. The employees did not have any organizational limitations in case of having breaks, doing stretch exercises, or sitting less and standing more. The Managers and Human Resources supported them, and employees had flexibility and control over their own time and could adjust their breaks according to their situation, they did not have a district schedule or monitoring about break time. However, they mostly have some deadlines, lack time and pressure to finish the projects/tasks, and sometimes multi-tasking, and they cannot manage their time in case of more breaks or less sedentary time. On the other hand, some environmental and social factors can cause fewer breaks and small changes in sedentary time. Sometimes employees do not like to exercise in front of other colleagues; even they don’t like that we put posters on their office wall and prefer to have the posters on their own desks. Considering all factors that affect sedentary bouts and breaks, the result showed that although the number of breaks has not significantly changed, they tried to increase the break time during their routine breaks at work. Therefore, to make effective and sustainable changes in sedentary behavior in office workers, individual, social, and environmental factor needs to be modified.

SB, light PA, and MTVPA are separate behaviors, but their amounts and proportions are not clear for health outcomes. Because most workers are sedentary and active during the day, it is important to understand how SB and PA interact. Ekelund et al., in 2016, published a meta-analysis based on self-reported data. Their result showed that among people who sat many hours per day, those who had at least 60-75 minutes/day of PA reduced the mortality risk. Another meta-analysis by Ekelund et al. 2019 demonstrated the dose-response associations between PA/sedentary time and all-cause mortality. Their result showed that SB over 9.5 hours/day significantly increased the risk of death, and maximal risk reductions were seen at 375 minutes of light PA and 24 minutes per day of MTVPA. WHO also published a guideline for PA and SB; however, according to this recommendation, the amounts for MTVP accrued per week are separated into moderate PA(150–300 minutes) and vigorous PA(75–150 minutes) PA, which means 32-64 minutes MTVPA per day. This guideline just suggested having less SB and replacing it with any type of PA and does not mention a certain amount of light PA. In another study, the strongest positive effects were found between BMI, waist circumference, triglycerides, plasma glucose, plasma insulin and blood pressure, and the proportion of time in MTVPA(Chastin et al., 2015). Their result showed that although MTVPA needs to be the most important target for intervention, transferring time from SB to light PA might reduce the adverse effects of the low amount of MTVPA. When mortality was an outcome of a PA intervention, a short follow-up period was a limitation.

On the other hand, some studies demonstrated the association of SB and PA with well-being and showed that an active lifestyle could improve physical and mental well-being and decrease chronic disease risk (and also decrease chronic disease risk. One of the large population studies shows that increased SB has been associated with lower emotional well-being (Galper et al., 2006) ; and having daily routine light PA like walking or increasing breaks frequently decreases chronic diseases risk, including MSDs (Nilsen et al., 2011) Gibson et al. (2017) demonstrated that a weekday's sitting time (including working hours) below 8 hours/day is associated with workers' better perceived mental health (Gibson et al., 2017). Also, Hergenroeder et al. (2022) illustrated that 1.5 hours less sitting time per day causes an improvement in energy/vitality. Furthermore, it has previously been reported that even in office workers who did not meet WHO's physical activity recommendations(75 minutes vigorous, 150 minutes moderate PA per week), those who were less sedentary had significantly higher energy levels than others who had more sedentary time(Dutta et al., 2014; Ellingson et al., 2014). Studies mostly found a positive association between workplace sitting time (more than four h/day) and the risk of pain in the low back, neck, and shoulder (Celik et al., 2018; De Carvalho et al., 2020; N Owen et al., 2010). Dzakpasu et al. (2021) demonstrated that replacing a portion of SB time with PA could beneficially impact musculoskeletal pain. In their reviewed studies, Ryan et al. (2017) reported that substituting 30 minutes of a full day's total sedentary time with 30 minutes of MTVPA may reduce general MSP by 29%. In another study, Thorp et al. 2014. demonstrated that reducing sitting time with 30 30-minute standing break (light PA) is positively associated with a reduction of lower back pain. Additionally, there is some evidence that standing and light PA may be necessary to reduce MSDs (Owen et al. 2010). Osama et al. demonstrated that office workers with active micro breaks with MTVPA (10 minutes per hour) significantly provide better protection from musculoskeletal discomfort at work than those with rest breaks without exercise (Osama et al., 2016). Besides WHO practice guidelines, these studies could encourage adults, especially in occupational settings, to minimize the risk of MSP (Dzakpasu 2021). Our study shows that increasing MTVPA and reducing SB might be associated with a slight increase in mental health and some subscales like energy/vitality and role-emotional. Furthermore, replacing the SB with MTVPA could reduce the intensity of pain in the intervention group's neck, shoulder, right, and upper/lower back. Although MTVPA increased at work in the intervention group, the compensatory decline in light PA might have led to a detreated effect from total PA. Also, another compensatory happens at the sitting time during the weekends; however, during the week, we have seen a reduction in sitting time that could be the effectiveness of interventions. According to their answers, their MTVPA mostly used stairs, bicycle riding, and speed walking during lunch/coffee time.

Several researches have been done on the underlying factors influencing SB and PA office work. Some studies have illustrated the importance of leadership encouragement, organizational culture, the physical environment, and social support as factors that could be possible barriers or facilitators, depending on the existing organizational culture and norms(Hadgraft et al., 2016; Nooijen et al., 2018; Sara Maheronnaghsh at al., 2019). In our study, the management encouragement and support for making policies to being physically active were strong; for example, workers had a sense of choice to have breaks any time they wanted; however, leadership did not prepare the facilities related to PA/SB like a sit-stand desk, except for two of workers. On the other hand, although leadership had appropriate knowledge about the importance of PA at work, their awareness of the differences between PA and SB was less; therefore, the intervention for increasing SB could be argued. For this reason, the aim of the study and its possible advantages of decreasing SB and its association with MSDs, well-being, and productivity were explained to managers in a series of meetings, and they were convinced to have some intervention to reduce SB at offices. Furthermore, at the beginning of this study, employees had returned to the office after around one year of teleworking, and the managers and HR were worried about long-time SB and lack of PA at home offices and its adverse effect on workers. Therefore, they showed their support and encouraged workers to collaborate on this project and do interventions by sending regular emails, face-to-face communication, and accompanying the researcher in offices while she was working on implementing the intervention.

Nevertheless, at this company, social acceptance about having PA during work hours and decreasing SB was low, especially the social norm around suitable workplace behavior (e.g., standing calls, standing meetings, and stretch exercises behind the desk). For participants in the intervention program, it was difficult to change their workstations or stand/walk at the office in front of their colleagues. Besides these factors, workload pressures were perceived to be barriers to the uptake of these strategies. However, some employees were motivated to increase PA during coffee breaks or lunchtime by going to the gym or speed/long walking. Also, some of them started to go to the gym after work or during weekends.

In the interviews with human resources and some of the employees, the right time/frequency and type of communication were discussed. Due to the post-pandemic situation and some worries about getting sick, we mostly chose the communication method by email, zoom meetings, and sometimes face-to-face. The difficult part was balancing acts regarding how much leadership to emphasize the importance of PA and less SB (by sending encouraging emails, acting as a role model, face-to-face, etc.), and they believed that the final decision on behavior is up to the individuals. Other studies also illustrated that organizations could provide possibilities and encourage PA, but the final decision on behavior must be up to the employee (K. De Cocker et al., 2015; Wahlström et al., 2020).

Changing the SB at individual and organizational levels can be complex to affect and measure. For this reason, using health communication strategies and best practices (e.g., methods and strategies published by the Centers for Disease Control and Prevention) can streamline and often improve behavior change initiatives for public health.

Due to this fact, the importance of having a participatory process during the intervention to increase workers' knowledge to involve them actively in implementing workplace modifications was confirmed by our results. In this study, the participatory process was used to improve their knowledge about the importance and differences between PA and SB with information and pamphlets sent to them. Also, a variety of options to improve SB/PA was given to the participants so that they could select the "just right" one according to their task, condition, and workload.

By using a participatory approach, our results indicate that we could have a significant increase in the MTVPA and a slight reduction in SB; however, there was a significant decrease in the light PA in the intervention group (p = 0,043). Like previous studies, our results showed that workplace interventions need to be tailored to the workplace's specific needs, and the employee had ownership of the intervention (Mackenzie et al., 2018; S. Parry et al., 2013). Moreover, previous studies showed the complexity of fitting an intervention to employees' actual needs and achieving sustainable behavioral change within the organization. For this reason, keeping employees motivated to commit to the intervention, in the absence of organizational encouragement, physical environment, or social support is crucial.

Self-Determination Theory (SDT) provides a framework for developing intervention by setting out the necessary means like autonomy support, basic psychological needs, intrinsic/extrinsic motivation, and regulations (Fortier et al., 2012). Besides indicating the importance of organizational encouragement, physical environment, and social support, Ryan et al (2017) illustrated the underlying factors, which are individuals and their psychological needs, and the type of motivations within health interventions, which was called self-determination theory (SDT). There is strong evidence for the efficacy of interventions based on SDT across a wide range of health domains that aim to foster health-conducive behaviors like environmental behaviors Pelletier & Sharp (2008), abstaining from the use of tobacco (Williams et al., 2009), increased physical activity (Amiri et al., 2018; Edmunds et al., 2008), and decreasing SB (Gaston et al., 2016; Jensen, 2020; Quartiroli & Maeda, 2014). The first underlying factor in the SDT is motivation. Human behaviors are influenced greatly by personal and contextual motivational factors (Ryan et al., 2017). One of the self-determined motivations is intrinsic motivation, reflecting behavioral engagement resulting from enjoyment and personal interest in the behavior. In contrast, four types of extrinsic motivation are identified in SDT; external regulation, introjected regulation, identified regulation, and integrated regulation

Integrated regulation represents reasons for behavioral undertaking that align with one's identity and core values. On the other hand, identified regulation refers to motivation from personal values and acceptance of behavior or its consequences. For example, a person might accept a physical activity intervention because of intrinsic motivation and understanding of its value for long-term health; and they are motivated by contingent self-esteem and desire for self or other approval. However, extrinsic motivation is a controlled form of regulation and represents behaviors motivated by external pressures or contingent rewards, such as social support. Individuals can be motivated to engage in the intervention (e.g., be more physically active or have less SB) for a diverse array of reasons, including enjoyment of exercise, experiencing its health benefits, avoiding letting oneself or others down by not exercising, or being pressured by a spouse or a health professional to be active. Introjected regulation refers to acting due to a sense of obligation rather than an internal desire or enjoyment (Ryan et al., 2017).

The second element in the SDT is basic psychological needs, which include three key needs (Ryan et al., 2017): Autonomy (feeling a sense of choice about behavior); competence (being able to make a positive change and the desired outcomes); and relatedness (feeling accepted by society).

Previous intervention studies suggested that the satisfaction of these three psychological needs indicates autonomous motivation, adaptive behaviors, and health (e.g., Kinnafick, Thogersen-Ntoumani, & Duda, 2016). Furthermore, Ryan and Deci (2017) have also emphasized the role of social support in one or more of the three psychological needs. For example, a colleague can support the one's short breaks or stretching exercises while working at the office, provide positive and enlightening feedback, or accompany the employee during the breaks or exercises. In contrast, leadership can try to force them to sit less and do PA by using pressure or offering rewards to use interventions if they agree to commit to the intervention program.

A meta-analysis in 2020 shows a significant effect of SDT interventions on PA and SB. Their result demonstrated that autonomous motivation and perceived competence mediate intervention effects on PA and SB, and the effectiveness of SDT interventions was largely unaffected by features of the sample, intervention, and methodology (Sheeran et al., 2020).

According to Ryan and Deci (2017), participants' autonomy is an important option for achieving specific behavioral goals such as increased physical activity. A reflective and right choice could be that they do not engage in particular health behavior (e.g., not participating in any exercise program or trying to reduce sitting time) and should, according to Ryan and Deci (2017), be supported by health practitioners. There are cultural, financial, and political limitations that policymakers, practitioners, and researchers must navigate as they try to promote health behavior changes that participants may not be fully interested in. Wahlström et al. 2020 also suggested that the ethical perspective and the aspects of equality and inclusiveness, besides a thorough understanding of the local conditions, were important aspects to consider in SB intervention development. The intervention designs for SB and PA at the starting point in an organization can differ from others considerably in terms of culture, work tasks, and physical environment(Wahlström et al., 2020).

In the current study, we also tried to, besides improving participant's knowledge about PA/SB and demonstrating their differences, they had autonomy in choosing the interventions, and we let them see the effect of breaks and increasing PA on their health status to earn intrinsic motivation to have a commitment to the intervention even after finishing the project. Also, by inviting the HR and direct managers to collaborate on this study as a participant and asking them to send emails to the participants, we planned to increase social support.

However, the small modification in SB and light PA could improve by focusing more on the individual level and their psychological needs and motivation. Since, in some cases, they do not have a short break and do PA just because of lack of time and workload pressure. In this case, by identifying the appropriate workplace needs, job type, and personality, the right time for communication and the right type of intervention could be chosen for volunteers.

On the other hand, in the case of persons who were motivated to do interventions and did not do it just because of their colleague's feedback, considering social support would have been more useful in increasing the commitment and collaboration in the program. Future studies can use the SDT concept in the intervention and consider employees' psychological needs and motivation to achieve more significant results in decreasing SB. The performance of interventions (e.g., training course, online gym, face-to-face training, etc.) with managers and workers might have been perceived in another way and was more effective if they had been performed after the remodeling of company buildings in a stable situation. Also, it would be better if the intervention was implemented when more time had passed since the employees returned from teleworking and they had reached a normal office work routine.

Future studies can be developed with these outcomes in mind. Since these variables (employees' psychological needs, motivation, Social support, and physical environment) could affect intervention effects and influence outcomes, is better data gathered with a comprehensive perspective.

Social support and physical environment are essential for promoting PA at the office regardless of office type. A supportive culture includes managerial support, social acceptance, and positive attitudes toward stand-and-walk behaviors while working.

Physical environment support or supportive interior design makes it easy for workers to choose whether to sit or stand while working or walk and ride a bicycle during coffee/lunch. Appropriating these supports can be part of the intervention to increase PA further. Our results showed an extensive variation in PA type between workers. These variations are due to many factors, such as motivation, knowledge, MSDS symptoms, workload, job type, and well-being. Since employees choose different approaches to increase workplace PA, we recommend offering various opportunities to increase PA and decrease SB. In this context, the activities could target both posture variation, stretch exercise, and light PA during work, for example, by standing, walking, using stairs, and possibilities to be active in MTVPA.

In this study, the effectiveness of interventions was investigated on certain elements of sedentary behavior in the workplace, including having breaks, PA, and workplace adjustment. The result showed that interventions were effective in behavior change in the workstation/body adjustment and also for “having a break during work hours.” For these two factors, an increase happened in the percentage of workers who moved to the “Action” phase from Pre-contemplation/ contemplation.

The intervention was not effective in adopting behavior in the PA/exercise during work hours. However, the “Action” phase slightly improved from 15 % to 17.5 % in this factor. The result of the self-reported questionnaire about the behavior changes phase showed significant increases in most activities, including standing, walking, and short breaks, and confirmed the result of objective measures for these variables. This study's results can help improve work interventions to make them more effective in reducing MSDs and improving well-being and job satisfaction. In contrast to many other workplace intervention studies, we used a stage-based approach to analyzing behavioral change and behavioral maintenance to improve SB and PA.

Chapter 4.

Conclusions and Future Research

According to previous studies, Portugal demonstrated as a country with the lowest levels of PA in Europe and high levels of SB. Although some studies were conducted to survey SB of Portuguese, they were mostly about children/youth or mainly focused on the whole day SB for adults and not exactly about occupational SB. The primary aim of this thesis was to characterize the prevalence and variations of occupational SB and PA in university office workers. Furthermore, we investigated the association of the amount of SB/PA with well-being, job satisfaction, and musculoskeletal symptoms in the Portuguese population. Also, by implementing some interventions for office workers, this study aims to decrease SB and increase PA. Since SB is strongly and inversely linked with time spent in light PA (e.g., active standing and slow walking) (G N Healy et al., 2008), our multicomponent interventions (e.g., Organizational, individual, and environmental changes) in this study primarily focused on replacing SB with light P.A. Then they tried to improve MTVPA. The result of the intervention group was compared with the control group. The effect of the interventions on SB and PA (standing, light, moderate, and vigorous activity), well-being, job satisfaction, and musculoskeletal symptoms of office workers were evaluated after six months of follow-up.

Furthermore, the feasibility and acceptability of interventions for participants and individual, organizational, and environmental barriers to implementing the interventions were assessed. The result showed that office workers spent in sedentary around 93.57% of their time at work; however, the outcomes demonstrated that decreasing SB and increasing PA in office settings in the medium term is possible. This multi-component intervention reduced sedentary time at work among office workers and significantly improved MTVPA; however, there was a significant decrease in the light PA in the intervention group ($p = 0{,}043$). Increasing MTVPA could increase mental components in well-being and reduce pain in the neck, shoulder right, upper back, lower back, left wrist, and ankles/feet with no changes in job satisfaction. However, there is a risk of compensatory behaviors in light PA with increasing MTVPA when walking time, using stairs, or riding a bicycle at lunchtime increased. Social acceptance for PA and breaks during work hours could not increase following this multi-component intervention except in individual offices, all of which were participants of the program. Investigating the influence factor on worker's behavior showed that a combination of factors influences PA/SB behaviors, such as physical environment, job type, workload, social support, and musculoskeletal symptoms.

This study's result illustrated that a comprehensive understanding of the context, current status of SB and PA behaviors, organizational needs/individual needs, and a participatory approach are required for designing an intervention for the workplace.

Study limitations

The result showed that the starting point in our studies differed from many other studies due to various reasons like the pandemic situation, remodeling of the building, and relocating office workers who were volunteers in two separate buildings. It caused some interventions not to be implemented effectively, like putting posters on the walls since they changed their offices many times and we needed to replace posters in their new location. Also, due to the construction project in the building, some workers join their colleague's offices. Because of these reasons and lack of space, some do not have enough space to walk around for short breaks or exercise at their desk. On the other hand, after the pandemic and returning to work, workers were trying to switch to the new situation after a long time of teleworking, so they were under more pressure than normal workdays. Another limitation was their avoidance of using Actigraph after working hours and during their leisure time. Since they attended the project as volunteers, we could not force them to do it. On the other hand, the software of Actigraph (Actilife) could define the intensity of activity (Sedentary, light, MTVPA) and does not demonstrate the type of physical activity (e.g., sitting, standing).

Future research

To date, the knowledge about the effects of the intervention on SB in office settings is limited, and the effects of each individual, organizational, and environmental approach need to be identified in future research. In this regard, in the future study, it would be of interest to consider:

- To measure the relationship between SB and PA intensity and health effects (e.g., MSDS, well-being) using objective measurements (e.g., examination of the muscles, bones, joints, waist circumference, BMI, waist circumference, triglycerides, plasma glucose, plasma insulin, and blood pressure) to provide a solid base for guidelines about SB and PA at work.

- Additional studies are needed to determine the ceiling effect for sitting time among office workers to determine the minimum time to have breaks.
- A study is required to evaluate the effects of breaking up prolonged sitting (e.g., standing or walking) on energy levels in office workers to assess whether any such developments are related to productivity in office settings.
- To assess the impact of SDT intervention on PA and SB in office workers.
- There is a need for studies that include health economic evaluations (e.g., contingent valuation method) to assess the possible return on investment of decreasing SB and increasing PA among office workers.
- In future studies, the number of participants needs to be increased to have adequate data for statistical analysis. Also, the interventions need to be implemented in the long term instead of the short or medium term to consider the sustainability of the changes in the sample.

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Annex

Annex 1: Content of leaflets

Leaflet 1

aro participante do programa "Saúde no Trabalho",

Quero agradecer a sua participação na minha tese de doutoramento. Durante este programa de três meses, queremos melhorar seu bem-estar e saúde ajustando sua estação de trabalho, aumentando sua atividade física e diminuindo distúrbios musculoesqueléticos.

Abaixo, encontra a programação. Tente cumprir todas as partes para obter o melhor resultado.

"Atividade física" online que pode fazer no seu escritório ou em casa, acontece via reunião de zoom às Segundas a às sextas às 11h e Segundas, quarta e sextas às 15h. Cada sessão tem a durançäo de 15 min, e são concebidos para que os trabalhadores de escritório se exercitem no seu local de trabalho. Aqui está o acesso aos exercícios de hoje às 11h e às 15h:
Sextas às 11:00h

Entrar na reunião Zoom
https://us05web.zoom.us/j/89521864403?pwd=WUMyU3Ywb3V4T3VoQ1RBVUxMZzhEUT09

ID da reunião: 895 2186 4403
Senha de acesso: 4Kxusr

AND

Sextas às 15:10h

Entrar na reunião Zoom
https://us05web.zoom.us/j/86499336469?pwd=dDhNRHpzVElUZDJTb0tJQU9kcFdsdz09 ID da reunião: 864 9933 6469
Senha de acesso: 7GypP0

(Envio outros links de reuniões do Zoom em anexo);

Também, terão lugar sessões de formação online com a uma das professoras de ciências do desporto da Faculdade de Desporto, sobre as intervenções para melhorar a saúde no trabalho. Além disso, você pode discutir as barreiras e oportunidades e dar sugestões nessa área.

Receberá alguns panfletos que incluem técnicas de ajuste ergonômico de sua mesa e de tarefas.

Ser-lhe-á enviado o Aplicativo de Lembrete para instalar em seu computador, que irá lembrá-lo de fazer exercícios de alongamento durante seu tempo sentado.

Espero que este programa lhe seja útil para e desejo-lhe muita saúde e segurança no seu trabalho.

Be healthy and happy,

---------------------- **Leaflet 2**

Caro participante do programa "Saúde no Trabalho",

O QUE É O DISTÚRBIO MUSCULO-ESQUELÉTICO RELACIONADO AO TRABALHO
EM TRABALHADORES DE ESCRITÓRIO?

Os distúrbios músculo-esqueléticos relacionados ao trabalho são deficiências de estruturas corporais, como músculos, articulações, tendões, ligamentos, nervos, ossos.

Esses distúrbios afetam principalmente as costas, pescoço, ombros e membros superiores, mas também podem afetar os membros inferiores.

QUE TIPO DE FATORES DE RISCO EM TRABALHADORES DE ESCRITÓRIO PODEM CAUSAR

DISTÚRBIOS MUSCULO-ESQUELÉTICOS?

Fatores individuais:

• Historial médico anterior
• Capacidade física
• Idade
• Obesidade
• Fumar

Fatores físicos:

• Mobilidade limitada (por exemplo, permanecer sentado por longos períodos de tempo)
• Repetição de movimentos (por exemplo, trabalhar com o rato de computador)
• Posturas inadequadas (por exemplo, cadeira e mesa desajustadas)
• Pausas insuficientes
• Stresse no trabalho

Fatores organizacionais e psicossociais:

• Trabalho exigente, falta de controlo sobre as tarefas realizadas e baixos níveis de autonomia
• Baixos níveis de satisfação no trabalho
• Falta de apoio de colegas, supervisores e gerentes

Quais são as soluções?

1.1. Faça pausas suficientes como:
1.1.1. De pé
1.1.2. Andando
1.2. Exercícios de alongamento no local de trabalho,

1.3. Ajuste ergonómico do local de trabalho e postura corporal.

Mais informações: https://www.youtube.com/watch?v=F8_ME4VwTiw Duração: 3 min

Aqui está o acesso aos exercícios de hoje às 11h e às 15:10:

Monday 11:00h

Entrar na reunião Zoom
https://us05web.zoom.us/j/88202077985?pwd=TWNxU0lJMmVTckZwR0hDM1M5MlhBQT09

ID da reunião: 882 0207 7985
Senha de acesso: 2kc17j

AND

Monday 15:10h

Entrar na reunião Zoom
https://us05web.zoom.us/j/84740647378?pwd=NGZGQklPZ3B5TmlBSUI4WUJVVjg4dz09

ID da reunião: 847 4064 7378
Senha de acesso: 9x7tZy

Be healthy and happy,

Leaflet 3

Caro participante do programa "Saúde no Trabalho", Bom dia!

O QUE É COMPORTAMENTO SEDENTÁRIO?

Quando as pessoas permanecem sentadas por longos períodos de tempo sem intervalos ativos suficientes, a isto chama-se comportamento sedentário.

A longo prazo, o comportamento sedentário pode resultar em vários problemas de saúde, tais como:

- Obesidade
- Cancro do colon distal e cancro retal,
- Diabetes tipo II,
- Doenças cardiovasculares,
- Circunferência da cintura aumentada,
- Colesterol alto no sangue,
- Hipertensão,
- Lesões músculo-esqueléticas.

Os trabalhadores de escritório passam cerca de 90% do tempo no trabalho de forma sedentária!

“Sentar é o novo fumar !!”

“Não importa o tempo que gaste no ginásio, que coma bem, evite fumar ou acrescente outros hábitos saudáveis, ficar sentado em excesso pode causar problemas. Cada hora que passa na sua cadeira ... arruína sua saúde ” (Eat, Move, Sleep por Tom Rath).

Portanto, estamos a tentar diminuir o tempo sentado durante o dia de trabalho. Participe da “pausa ativa” online (link abaixo) e faça mais movimentos durante o seu trabalho.

Diretrizes principais para atividade física segura:

- Comece devagar e vá devagar - Aumente a atividade física gradualmente ao longo do tempo para atender às principais diretrizes ou metas de saúde. Comece com atividades de menor intensidade e aumente gradualmente a frequência e a duração das atividades. Se alguma coisa doer, pare.

- Se tiver doenças ou sintomas crónicos, fale com um profissional de saúde ou especialista em atividades físicas sobre os tipos e quantidades de atividades apropriadas para iniciar um programa.

Guias para pausas para atividades físicas:

A parte mais difícil de fazer pausas regulares durante o dia de trabalho é que pode ser incrivelmente difícil desligar. Mas a pesquisa mostra que esse foco intenso torna-nos menos focados a longo prazo. Então….

- Pelo menos uma vez por hora, levante-se e mova-se por 3-4 minutos.
- Use as escadas.
- Desloque-se até à impressora ou casa de banho num andar diferente. • Desloque-se até outros funcionários em vez de ligar ou enviar e-mail.
- Levante-se ao falar ao telemóvel / telefone.
- Levante-se ao falar com seu amigo. Se for possível, faça uma reunião de pé também.
- Continue a mover-se durante o intervalo - ande pelo prédio em vez de ficar em pé.
- Estacione o carro mais longe.

Aqui está o acesso aos exercícios de hoje às 11h:

Entrar na reunião Zoom
https://us05web.zoom.us/j/89544765738?pwd=amRyL3JLRGZBYjhYUUdPNGRYUTdaZz09

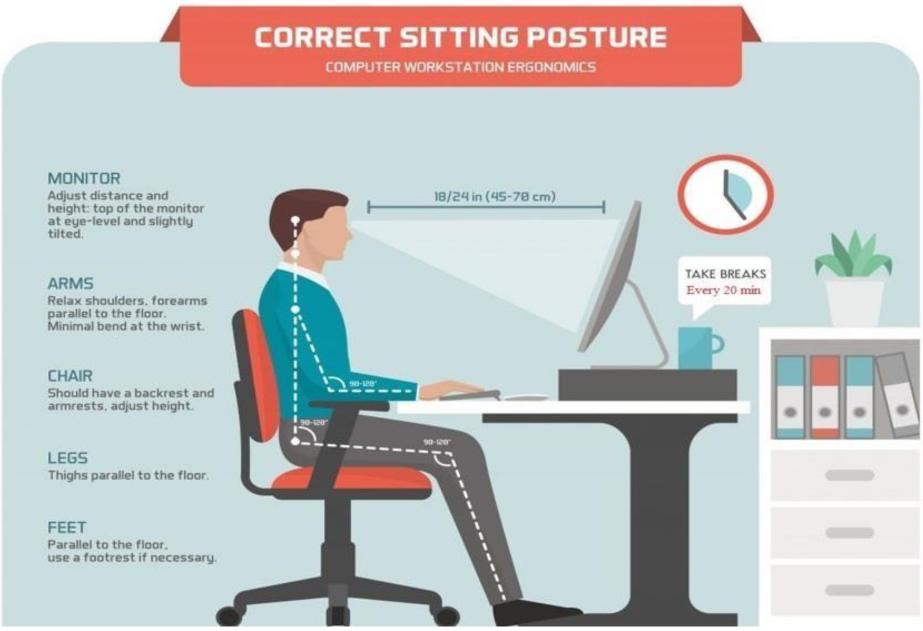
Leaflet 4

Ajuste ergonómico do local de trabalho e postura corporal

Caro participante do programa "Saúde no Trabalho", Bom dia!

Postura é a posição em que mantém o corpo ereto contra as forças da gravidade enquanto está de pé ou sentado. A chave para uma boa postura é treinar o corpo para sentar, ficar de pé e andar em posições onde o mínimo esforço é colocado nos músculos e ligamentos de suporte durante as atividades de levantamento de peso.
Tornando a sua estação de trabalho sentada confortável, com o guia para ergonomia da estação de trabalho sentado no anexo.

Tema	Conselho
Ergonomia do Local de Trabalho	
Altura do Assento	Pés apoiados no chão, coxa totalmente apoiada
Profundidade do Assento	Parte inferior e superior das costas completamente apoiadas, cerca de 10cm entre a parte de trás do joelho e a frente do assento
Apoios de Braço	Apoie os cotovelos (e antebraços)
Altura do apoio das costas	Espessamento do suporte das costas na altura do cinto
Altura da mesa	Mesma altura do apoio de braço durante a digitação, 5 cm acima do apoito de braço durante a leitura.
Posição do Ecrã de Computador	Diretamente em frente ao trabalhador. Rotação inferior a 10º. Colocar o ecrã perpendicular à janela. Distância entre ecrã e olhos dependente das dimensões, mas pelo menos 50cm.
Altura do Ecrã de Computador	O topo do ecrã deve estar à mesma altura dos olhos.
Teclado	Em frente ao ecrã, plano na mesa.
(Tapete de) Rato	Perto do teclado. Tente alternar a posição do (tapete de) rato entre o lado direito e esquerdo do teclado.
Postura Corporal	
Costas	Direitas. Completamente apoiadas no encosto.
Pescoço	Rotação da cabeça inferior a 20°. Flexão / extensão mínima do pescoço (veja a posição do ecrã do computador).
Ombros	Relaxados.
Braços	Perto do corpo.
Mão, Punho, Antebraço	Em linha reta. Desvio ulnar entre -5° e 20°.
Geral	Os trabalhadores são aconselhados a mudar a postura durante o dia de trabalho.



Mais Informação:

https://www.youtube.com/watch?v=Ree1CWifQTg Duração: 4min

https://www.youtube.com/watch?v=x12GnuV9Qgw Duração: 8min Aqui também está o acesso aos exercícios de hoje às 11h:

Terça-feira 11:00h :
https://us05web.zoom.us/j/84184000393?pwd=TVNYMnluM1JYWjgyYWRVMlBSM0RjZz09

Leaflet 5

Caro participante, Bom Dia!

Há quatro semanas, iniciamos o programa “Saúde no Trabalho”. Enviamos quatro e-mails sobre distúrbios musculoesqueléticos comuns relacionados ao trabalho em escritório (como distúrbios no pescoço, ombro, região lombar e pulso) e algumas soluções de ajuste para o seu local de trabalho.

Além disso, explicamos o comportamento sedentário e seus efeitos adversos na saúde, bem-estar e distúrbios musculoesqueléticos, além de algumas técnicas para diminuir o tempo prolongado sentado, como:

- Faça exercícios curtos durante o dia de trabalho;
- Pelo menos uma vez por hora, faça pequenos intervalos (por exemplo, 5-60 s);
- Pelo menos uma vez por hora, levante-se e / ou mova-se por 3-5 minutos;
- Use escadas em vez do elevador;
- Caminhe até a impressora ou casa-de-banho noutro andar;
- Caminhe até seu colega de trabalho em vez de fazer chamadas ou enviar e-mails;
- Levante-se ao fazer chamadas no seu telemóvel / telefone;
- Levante-se ao falar com seu colega. Se for possível, faça uma reunião de pé também;
- Continue a mover-se durante o intervalo - ande pelo edifício em vez de ficar em pé;
- Estacione o carro mais longe.

Alegra-me ver-te a frequentar o ginásio online todas as manhãs em casa ou no escritório às 11:00, segundas, quartas, e sextas-feiras à tarde.

No entanto, esses cursos online vão terminar no final de julho. Mas pode continuar a ser mais ativos com as soluções sugeridas durante o mês de agosto no trabalho ou durante as férias.

O exercício e a atividade física previnem / diminuem os distúrbios musculoesqueléticos e ajudam a melhorar a saúde mental (reduzindo a hormona do stresse, o cortisol), fornecendo clareza para lidar melhor com o stresse de forma eficaz.

Eu agradecia que respondesse a estas duas perguntas sobre sua situação de trabalho antes de participar neste programa:

https://forms.gle/ZDwuD78ZQcekeBLd8

Aproveito para te desejar e à sua família boa saúde e, se for o caso, boas férias!

Um hábito não pode ser atirado pela janela; deve ser persuadido a descer as escadas um degrau de cada vez (Mark Twain).

Mais Informação:
https://www.youtube.com/watch?v=oJjgEXMLgks   Duração: 3 min

Aqui também está o acesso aos exercícios de hoje às 11h: Entrar na reunião Zoom
https://us05web.zoom.us/j/88202077985?pwd=TWNxU0lJMmVTckZwR0hDM1M5MlhBQT09

E
Segunda às 15:10h
Entrar na reunião Zoom
https://us05web.zoom.us/j/84740647378?pwd=NGZGQklPZ3B5TmlBSUI4WUJVVjg4dz09

Be happy and healthy,

Leaflet 6

Caros participantes, Bom
Dia!

Hoje temos um tópico chocante :)

Como estar sentado nos está a matar

O comportamento sedentário é geralmente definido como gasto de energia menor ou igual a 1,5 equivalente metabólico enquanto está sentado, reclinado ou deitado. Por essa definição, quase qualquer atividade sentada, incluindo trabalhar no computador, ver TV ou mesmo andar de carro, é considerada comportamento sedentário.

Em média, uma pessoa passa mais de 8 a 10 horas sentada por dia, provavelmente mais do que a dormir. Cada hora que passa sentado tem implicações significativas para a saúde. Um estudo estimou que para cada hora adicional de TV a que uma pessoa assistia (um substituto para o tempo sedentário), o risco de mortalidade por todas as causas aumentava em 11% (Dunstan et al.,2010).

Por que nos sentamos tanto?

Neville Owen sugere que os comportamentos sedentários são provavelmente "determinados mais fortemente pelas situações em que as pessoas se encontram do que por suas características" (Owen., 2017; see also Mullane et al., 2017).

Na verdade, rotinas e hábitos dependem mais do contexto do que comportamentos únicos.
Logo, o contexto do local de trabalho pode desempenhar um papel fundamental para reduzir o número de pessoas sentadas.

O que podemos fazer?

Um estudo descobriu que pontuar longos períodos de tempo sentado com breves períodos em pé, alongamentos ou movimento reverte alguns dos impactos adversos do comportamento sedentário (Healy et al., 2008). Portanto, encontrar maneiras de interromper ou limitar o comportamento sedentário, mesmo em quantidades modestas, pode afetar positivamente a saúde.

Assim, levante-se, alongue-se, mova-se e adote uma variedade de posturas ao longo do dia - em casa e no trabalho: essas atividades não apenas ajudam a reduzir as consequências adversas para a saúde de ficar sentado por muito tempo, mas também promovem a criatividade, a cognição e a reflexão (Jensen , 2005).

A postura de qualquer pessoa - sentada ou em pé - pode causar danos ao corpo com o tempo; evidências epidemiológicas sugerem fortemente que a variação postural é o que devemos tentar alcançar, tanto no trabalho quanto em casa.

Gostaríamos de ouvir a tua opinião!

O que viu no seu local de trabalho que ajuda a reduzir a posição sentada ou promove a variação postural? O que faz para se sentar menos durante o dia de trabalho?

Se não tem tempo para o seu bem-estar,
Será forçado a arranjar tempo para a sua doença!
--

Leaflet 7

Caro participante!

Espero que tenham passado férias incríveis, cheias de alegria e atividades físicas!

Se pretende manter a sensação de frescura que adquiriu nas férias, nesse caso, sugiro que continue a seguir as nossas recomendações que se seguem em anexo, nomeadamente, estar menos tempo sentado e mais tempo de pé, andar e movimentar-se durante período laboral.

Está sentado enquanto lê isto?

Talvez não devesse. Talvez se devesse levantar enquanto termina de ler este post. Na verdade, depois de delinear esta peça, vou levantar-me.

Além disso, quando quero ler um dos vossos e-mails que incluem sugestões e ideias sobre este programa, eu levanto-me.

Então, por que estou de pé?

Porque relatórios recentes sugerem que todo o "sentar" que fazemos num dia normal pode estar a encurtar as nossas vidas de maneiras mensuráveis - e assustadoras. No mínimo, estar sentado por seis ou mais horas por dia aumenta o risco de ataque cardíaco em mais de 50%. Já pensou em quanto tempo passa sentado? Numa mesa, no sofá, em restaurantes, no carro, ao computador?

Senta-se no café ou na padaria? Já pensou em ficar no balcão em vez de usar a cadeira?

Continue. Some tudo isso e considere a realidade de que é verão e, apesar da oportunidade extra que isso lhe dá de estar ao ar livre e explorar seus passatempos ou desportos favoritos, descobre que se senta ainda mais. O Dr. David Alter, especialista cardíaco da Universidade de Toronto, descobriu que ficar sentado demais - mesmo entre pessoas que se exercitam regularmente - leva a taxas mais altas de hospitalização, doenças cardíacas e cancro, e morte prematura.

Como ficar sentado destrói seu corpo

Assim que se sentar:

- A atividade elétrica nos músculos das pernas é interrompida
- A queima de calorias cai para 1 por minuto

- Enzimas que ajudam a quebrar a gordura caem em 90% Após 2 horas:
- O colesterol bom cai 20% Após 24 horas:
- A eficácia da insulina diminui 24% e o risco de diabetes aumenta.

Então o que pode fazer?

Pode começar por descobrir como gasta seu tempo sentado. Pode levantar-se e fazer a mesma coisa em pé? Falar ao telefone? Sim. Joga jogos no telemóvel? Sim. Almoçar? Sim. Ler os seus e-mails mais recentes ou até mesmo participar numa reunião no ZOOM? Sim. Além disso, pense numa situação em que pode andar em vez de ficar em pé.

Ficará surpreendido ao descobrir que, quando pensa no assunto, pode levantar-se e continuar a fazer muitas das coisas de que gosta.

Bem-estar é uma conexão de caminhos: CONHECIMENTO e AÇÃO!

Leaflet 8

Caros participantes,

Os exercícios de alongamento fazem parte de nosso programa que pode ajudar a prevenir distúrbios musculoesqueléticos (DME), bem como dores e desconforto em geral.

O alongamento permite que o seu corpo tenha tempo para recuperar, relaxar e preparar-se para a próxima sessão. Faz o mesmo com a mente, permitindo que descontraia para que possa retornar ao trabalho com mais energia e foco.

O alongamento frequente também ajuda a evitar que os músculos fiquem rígidos e a reduzir o desconforto.

Quando se trata de alongamentos para prevenir DME, pausas mais curtas e frequentes são preferidas em vez de pausas longas.

Em geral, é recomendável fazer uma pausa e alongar pelo menos uma vez por hora.

Se o seu trabalho consiste na entrada contínua de dados, é recomendável que faça uma pausa de 5 minutos para alongar a cada 30 minutos. Se for impraticável fazer uma pausa tão longa, lembre-se de que fazer uma pausa curta, mesmo 30 segundos, é melhor do que nada.

É essencial ficar de pé e movimentar-se durante o alongamento. Isto permite que seu corpo mude de postura e também ajudará a minimizar a rigidez e a fadiga.

Também é sugerido que fique de pé enquanto executa atividades que não exijam estar sentado, como falar ao telefone.

O seguinte software de lembrete de alongamentos (Wellnomics) tem um período de teste gratuito de um mês, com lembretes e exercícios de alongamento em vídeo. Embora possa selecionar o número de exercícios por hora, sugerimos configurá-lo para aparecer pelo menos uma vez por hora. Pode usar o link abaixo e seguir as instruções de instalação no seu computador (mais informações em anexo):

https://wellnomics.com/workpace-download-trial/

Diretrizes Principais para Atividade Física Segura:

- Comece devagar e vá devagar - Aumente a atividade física gradualmente para alcançar as principais diretrizes ou metas de saúde. Comece com atividades de menor intensidade e aumente gradualmente a frequência e a duração das atividades. Se alguma coisa doer, pare.

- Se tiver condições ou sintomas crónicos, converse com um profissional de saúde ou especialista em atividade física sobre os tipos e quantidades de atividades apropriadas antes de iniciar um programa.

Leaflet 9

Caros participantes,

Gostava que me confirmasse a instalação do software para relembrar os períodos de atividade física intercalar (Wellnomic). Agradeço que me informe caso surja alguma dificuldade, quer na instalação, quer na utilização.

Por favor, utilize esta software para criar o hábito de se levantar, pelo menos, 3 vezes por hora durante o dia de trabalho.

Pode memorizar os exercícios de alongamento ou imprimi-los, como o que encontrará no anexo, e colocá-los na mesa ou na parede para se lembrar de fazer as atividades durante o trabalho.

Pode também agendar caminhadas com os colegas durante os intervalos de trabalho ou no período de almoço.

Coloquei o link de download do software aqui novamente:

https://wellnomics.com/workpace-download-trial/

Pode encontrar mais informações no anexo.

"Os hábitos são formados pela repetição de atos particulares. Eles são fortalecidos por um aumento no número de atos repetidos.
Hábitos também são enfraquecidos ou quebrados, e hábitos contrários são formados por atos contrários."
- Mortimer J.Adler

Leaflet10

Caros participantes,

Os exercícios de alongamento fazem parte de nosso programa que pode ajudar a prevenir distúrbios **musculoesqueléticos (DME**), bem como dores e desconforto em geral.

O alongamento permite que o seu corpo tenha tempo para **recuperar, relaxar e preparar-se** para a próxima sessão. Faz o mesmo com a mente, permitindo que descontraia para que possa retornar ao trabalho com **mais energia e foco**.

O alongamento frequente também ajuda a evitar que os músculos fiquem rígidos e a reduzir o desconforto.

Quando se trata de alongamentos para prevenir DME, pausas mais curtas e frequentes são preferidas em vez de pausas longas.

Em geral, é recomendável fazer uma pausa e alongar pelo menos uma vez por hora.

Se o seu trabalho consiste na entrada contínua de dados, é recomendável que faça uma pausa de **5 minutos para alongar a cada 30 minutos**.

Se for impraticável fazer uma pausa tão longa, lembre-se de que fazer uma pausa curta, mesmo **30 segundos**, é melhor do que nada.

É essencial ficar de pé e movimentar-se durante o alongamento. Isto permite que seu corpo mude de postura e também ajudará a **minimizar a rigidez e a fadiga**.

Também é sugerido que fique de pé enquanto executa atividades que não exijam estar sentado, como falar ao telefone.

O seguinte software de lembrete de alongamentos (Wellnomics) tem um período de teste gratuito de um mês, com lembretes e exercícios de alongamento em vídeo. Embora possa selecionar o número de exercícios por hora, sugerimos configurá-lo para aparecer pelo menos uma vez por hora. Pode usar o link abaixo e seguir as instruções de instalação no seu computador (mais informações em anexo):

https://wellnomics.com/workpace-download-trial/

Diretrizes Principais para Atividade Física Segura:

• Comece devagar e vá devagar - Aumente a atividade física gradualmente para alcançar as principais diretrizes ou metas de saúde.

• Comece com atividades de menor intensidade e aumente gradualmente a frequência e a duração das atividades. Se alguma coisa doer, pare.

• Se tiver condições ou sintomas crónicos, converse com um profissional de saúde ou especialista em atividade física sobre os tipos e quantidades de atividades apropriadas antes de iniciar um programa.

Leaflet 11

Já alguma vez ouviram falar de ***stress*** **tecnológico**?

O *stress* tecnológico surge quando alguém *avalia negativamente a sua experiência na realização de tarefas que envolvem a utilização de novas tecnologias*.

O *stress* tecnológico é frequentemente definido com uma doença moderna que resulta da incapacidade dos indivíduos se adaptarem às novas tecnologias integradas nos computadores, o que pode afetar a sua saúde mental e comprometer a aceitação da utilização dos mesmos.

Também é definido de forma mais geral como qualquer impacto negativo nas atitudes, pensamentos, comportamentos ou respostas fisiológicas do corpo humano, que seja causado direta ou indiretamente pela tecnologia, sempre que existe uma obrigação de utilização da mesma.

Causas de *stress* tecnológico:

- Sobrecarga tecnológica (mais trabalho e executado a maior velocidade)
- Invasão tecnológica (trabalho continuo)

- Complexidade tecnológica (necessidade de aprendizagem na utilização de novos programas)
- Insegurança tecnológica (a ameaça de substituição por colegas mais competentes; competitividade)
- Incerteza tecnológica (grande rotatividade do hardware e software)
-

Caso tenha interesse em obter mais informação sobre ***stress*** **tecnológico** pode obtê-la aqui:
https://www.researchgate.net/publication/254002413_Crossing_to_the_Dark_Side_Examining_Creators_Outcomes_and_Inhibitors_of_Technostress

Sente que neste momento está sujeito a *stress* tecnológico?
Existem várias soluções para reduzir o *stress* associado à tecnologia moderna, tais como: ativar os filtros de e-mail, evitar multitarefas, bloquear as distrações, criar uma lista de tarefas pendentes, estabelecer algum tempo livre de *gadgets* (dispositivos tecnológicos), ou planear a semana com antecedência para manter o equilíbrio entre vida pessoal e profissional. Existem ainda formas de eliminar o *stress* tecnológico, como por exemplo exercício físico, realizar relaxamento muscular progressivo, manterse saudável e ter uma dieta equilibrada.
De seguida, são apresentadas **2 soluções** que o ajudarão a lidar com o *stress* relacionado com o trabalho:

Utilize a regra 20:20:20 e 2 - A obsessão com a tecnologia digital não é apenas fonte de *stress* psicológico – ela é também causa de fadiga ocular e outros efeitos nocivos. Para minorar a fadiga ocular experimente a regra 20: 20: 20: 2 a **cada 20 minutos, desvie o olhar do computador para um objeto a 6 metros (20 pés) de distância por cerca de 20 segundos e feche os olhos por 2 minutos**[1].

Também é uma boa maneira de limpar a mente, focar noutro objeto quando sentir a vista cansada e assim permitir que os seus olhos descansem.

Tente descarregar uma aplicação que emita um som específico (geralmente um toque de campainha ou uma vibração) em intervalos de tempo pré-estabelecidos. Este som também o pode lembrar de respirar profundamente por alguns minutos ou **dar um passeio ao ar livre**. Embora intuitivamente possa sentir que interromper as suas tarefas vai interferir na sua produtividade, ao inserir esses intervalos na sua rotina de trabalho descobrirá que sua produtividade não é afetada e que após essas paragens se sentirá mais apto para continuar o trabalho.

Desligue o ecrã e saia - Para a maioria de nós há um momento em que podemos interromper as atividades informáticas e sair para disfrutar da Natureza. Os **benefícios para a saúde resultantes da exposição diária à luz natural com caminhadas ao ar livre na natureza são imensos**, embora muitos de nós optem por um estilo de vida sedentário.

Neste *website* poderá encontrar mais informação sobre os benefícios das caminhadas e da atividade física na melhoria do seu humor:
https://www.betterhealth.vic.gov.au/health/healthyliving/exercise-and-mood

Leaflet 12
Olá estimado participante;

10 de outubro é o Dia Mundial da Saúde Mental, uma oportunidade para falar sobre saúde mental em geral, como necessitamos cuidar dela e como é importante falar sobre os nossos problemas e obter ajuda quando passamos por dificuldades.
Todos nós podemos contribuir para melhorar a nossa saúde mental e aumentar a nossa resiliência e capacidade para lidar com as adversidades. O autocontrolo é uma competência que precisa ser praticada. Não é fácil, especialmente se nos sentirmos ansiosos, deprimidos ou com baixa autoestima.
O *stress* no trabalho, como o technostress mencionado em nosso e-mail da semana passada, está entre as questões de segurança e saúde ocupacional mais desafiadoras. Com a abordagem certa, o *stress* relacionado com o trabalho pode ser prevenido e controlado com sucesso.

Mais informação pode ser encontrada
em: https://osha.europa.eu/en/highlights/promoting-mental-health-and-wellbeing-workplace

Enviamos na semana passada algumas soluções para reduzir seu technostress. Hoje enviamos sugestões para fazer mudanças simples sem custos elevados e que tomam pouco tempo:
Tente examinar as 10 maneiras, baseadas em evidências, para melhorar a sua saúde mental e são indicadas abaixo:

1. Fale sobre aquilo que sente 2. Coma bem e saudável 3. Beba commoderação 4. Mantenha-se em contacto com os que o rodeiam 5. Peça ajuda 6. Faça qualquer coisa em que seja bom 7. Aceite-se tal como é 8. Cuide dos outros 9. Mantenha-se ativo

O **exercício regular** pode aumentar sua autoestima e ajudá-lo a **concentrar-se, dormir e sentir-se melhor**. Fazer exercícios não significa apenas praticar desporto ou ir ao ginásio. Os especialistas dizem que a maioria das pessoas deve fazer cerca de **30 minutos de exercícios pelo menos cinco dias por semana**. Este exercício pode ser qualquer tipo de atividade física *que goste de fazer durante parte do seu dia*. Trabalhando numa secretária pode dar um passeio, assistir ou dar uma aula na hora do almoço ou fazer exercícios antes ou depois do trabalho. Assim pode melhorar o seu dia criando intervalos entre o horário de trabalho e o horário pessoal.

10. Faça um intervalo

Pode ser uma pausa de **três a cinco minutos na sua atividade**, ler um **livro ou ver um podcast** durante o trajeto, uma pausa de **meia hora para o almoço** ou um fim de semana **explorando um novo lugar**. Alguns minutos podem ser suficientes para reduzir o *stress*. Dê a si mesmo algum **'tempo para mim'.**

Como o foco deste projeto é melhorar a saúde física e mental aumentando a atividade física e realizando pausas, caso esteja interessado em saber mais sobre este método, poderá encontrar informação neste endereço:
https://www.mentalhealth.org.uk/publications/how-support-mental-health-work ou https://osha.europa.eu/en/tools-and-resources/e-guides/e-guide-managing-stress-andpsychosocial-risks

Procure um ou dois desafios que considera **difíceis** ou procure uma ou duas áreas nas quais acha que pode trabalhar ou experimentar. Esses podem ser os seus **objetivos**. Os seus objetivos e desafios podem ser os mesmos, mas às vezes é mais agradável ter alguns *objetivos que podem ser cumpridos com mais facilidade.*
Quando foi a última vez que você definiu uma GRANDE meta para sua saúde (mental ou fisicamente)?

Na próxima semana, compartilharemos com alguns conselhos para atingir os seus objetivos de saúde física e mental com muito mais facilidade.

Be happy and healthy ,
Sara Maheronnaghsh
PhD candidate of Occupational safety and health

Leaflet 13

Caro participante,

Já escolheu uma ou duas estratégias para aliviar o stresse no trabalho do folheto 11 enviado na semana passada?

Já se desafiou a estabelecer metas para melhorar o seu bem-estar? (Como fazer mais pausas curtas, usar as escadas, melhorar sua comunicação e rede social, ir ao ginásio, comer alimentos saudáveis, etc.)

Foi fácil atingir esse objetivo? Conseguiu?

Ou o trabalho ficou muito ocupado, muito stressante, muito frustrante? Não viu progresso. Por isso parou.

Se isso aconteceu consigo, não está sozinho. Começar um novo hábito é um trabalho árduo. E é por isso que EU AMO micro-hábitos.

"O homem que move uma montanha começa por carregar pequenas pedras." - Confúcio.

- Um micro-hábito é uma pequena mudança na sua rotina;
- Para micro-hábitos, não precisa de encontrar uma hora extra no dia e não precisa fazer uma grande mudança na sua programação diária;
- Por serem pequenos, é mais fácil comprometer-se, ter disciplina e ser consistente. **E isso leva a uma mudança real e duradoura**.

Eu tenho um desafio de micro-hábito para ti:

Micro-hábito 1: Fique de pé enquanto usa o telefone,

Micro-hábito 2: Use lembretes para mudar de posição ou fazer alguns alongamentos,
Micro-hábito 3: Ficar em pé em vez de sentar nos intervalos, **Micro-hábito 4:** Andar em vez de ficar de pé nos intervalos.

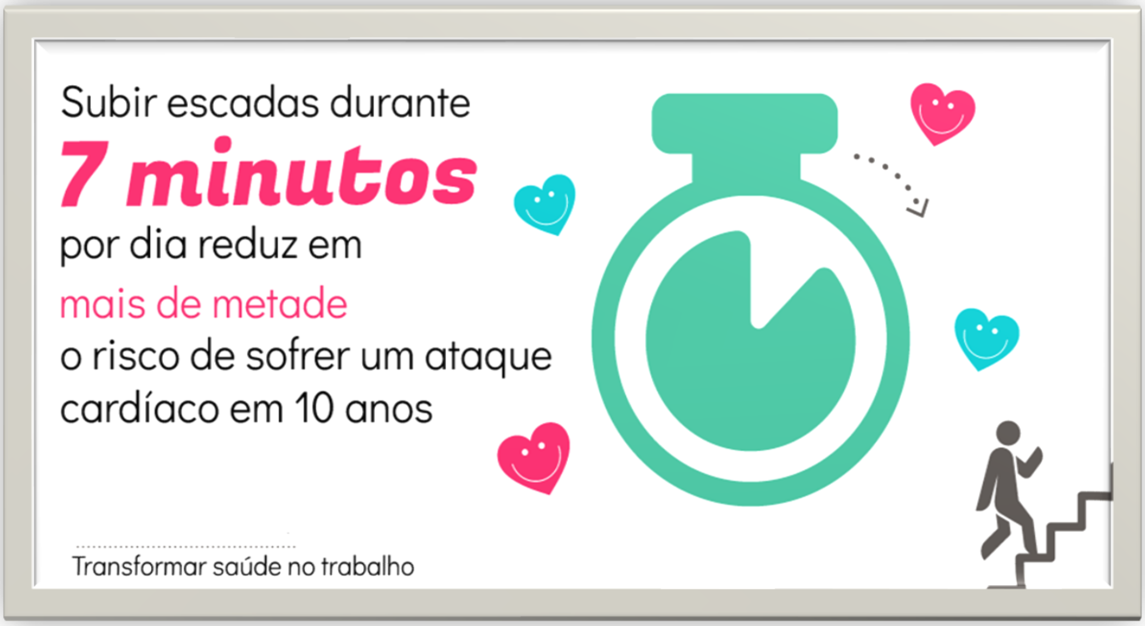
Encontre métodos adequados para reduzir o tempo sentado e torne-se mais ativo entre o trabalho que seja compatível com a SUA situação.

Eu espero que me envie um e-mail de volta quando decidir qual micro-hábito está comprometido a realizar.

Boa Sorte!
Obrigado por fazer parte da nossa comunidade ☺

Annex 2: Posters


Continue
Assim!
Mais saudável todos os dias


Subir escadas durante
7 minutos
por dia reduz em
mais de metade
o risco de sofrer um ataque
cardíaco em 10 anos
Transformar saúde no trabalho


Dê um passeio
rápido na pausa
para o café


Dê uma caminhada rápida na hora do almoço

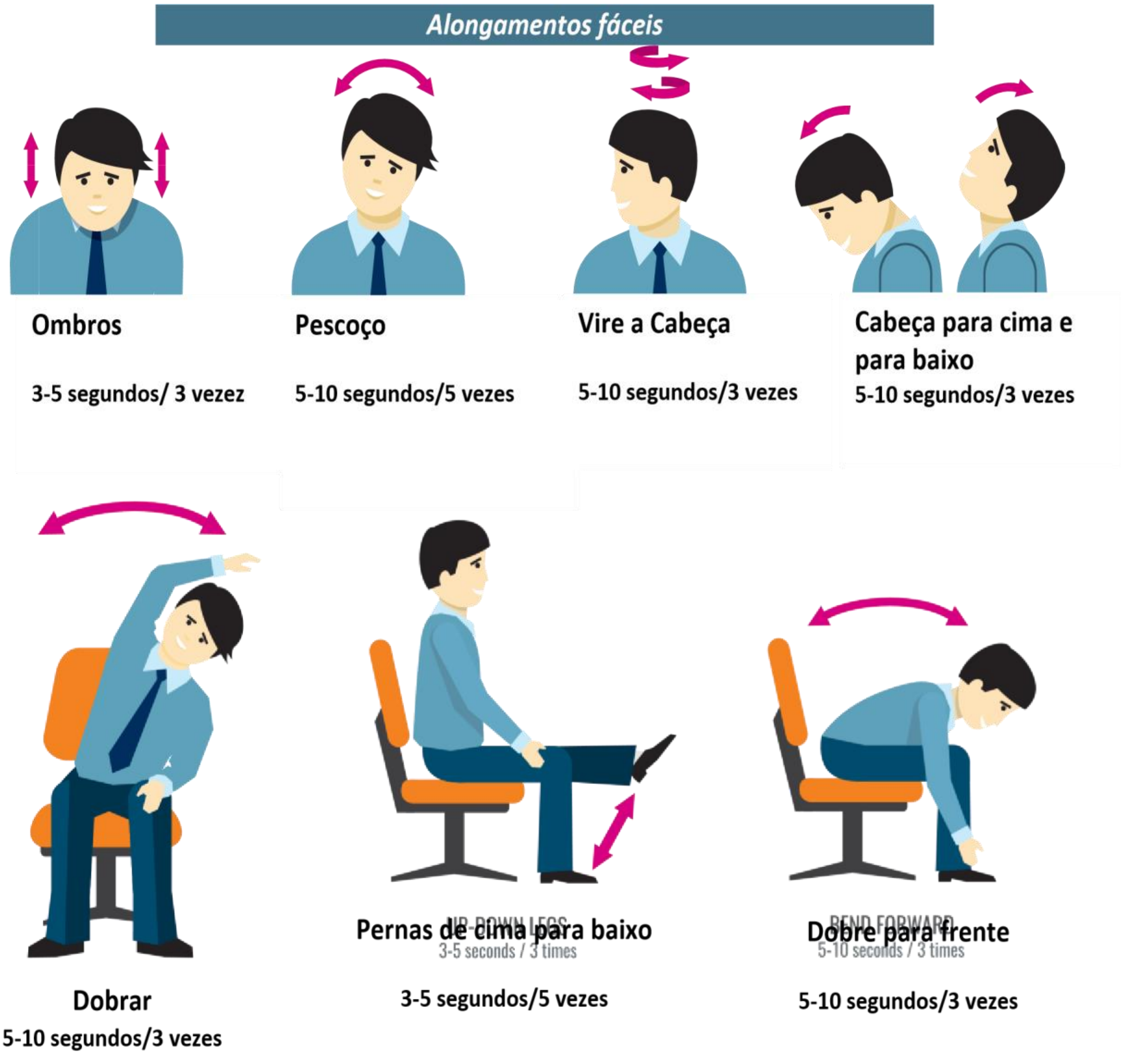

Pessoas ativas
têm
mentes ativas
Mais saudável todos os dias


Participe em sessões de ginástica online


Reunião de pé,
reunião eficaz

Exercícios de alongamento para fazer na sua secretária

O alongamento traz muitos benefícios à saúde, incluindo melhor flexibilidade e postura. Pode ajudar a aliviar a dor dos músculos tensos e os efeitos de ficar sentado por longos períodos. O alongamento também pode ajudá-lo a sentir-se mais energizado e a reduzir o estresse. Reserve alguns minutos todos os dias para se alongar na sua secretária. Pode descobrir que se sente melhor, física e mentalmente.



Annex 3: Questionnaires

U.PORTO
DemSSO
PROGRAMA DOUTORAL EM SEGURANÇA E SAÚDE OCUPACIONAIS

O presente estudo enquadra-se num projeto de investigação do Programa Doutoral em Segurança e Saúde Ocupacionais da Faculdade de Engenharia da Universidade do Porto (FEUP). Este estudo tem como objetivo desenvolver, implementar e avaliar uma intervenção multicomponente que visa aumentar o nível de atividade física durante o trabalho e reduzir o comportamento sedentário e, consequentemente, reduzir a sintomatologia musculosquelética e o stress e aumentar a satisfação no trabalho.

Para concretizar este objetivo serão aplicados questionários a todos os participantes, assim como será avaliado o nível de atividade física durante o trabalho, utilizando um acelerómetro (*ActiGraph accelerometer*) de fácil aplicação, antes e após a intervenção.

<u>Questionários</u>

Estes questionários integram o projeto de investigação do Programa Doutoral em Segurança e Saúde Ocupacionais "Promoção da atividade física no trabalho: implementação de uma intervenção multicomponente para trabalhadores de escritório da Universidade do Porto".

Todas as respostas que lhe solicitamos são confidenciais e anónimas.

Leia com atenção as instruções que lhe são dadas, certificando-se de que compreendeu corretamente o modo como deverá responder.

Não há respostas certas ou erradas, e a sua opinião sincera é essencial.

O questionário deve levar cerca de 25 minutos para ser concluído.

Muito obrigado pela sua colaboração.

Declaro que que aceito participar voluntariamente nestes questionários, tendo lido a informação descrita acima.

Dados sociodemográficos

Idade

Género

Masculino Feminino

Nacionalidade

Estado civil

Casada/o

Solteira/o

Peso (Kg) *

Altura (cm) *

Nível de Escolaridade

Ensino

Secundário

Licenciatura

Mestrado
Doutoramento

Categoria profissional

Investigadora/o ,

Professora/o

Administrativa/o

Há quanto tempo trabalha nesta organização (meses)?

Número de horas trabalhadas por dia

Número de dias que trabalha por semana

Considerando a situação pandémica atual, neste momento encontra-se em regime de trabalho:

a) Presencial
b) Teletrabalho
c) Ambos

Se selecionou AMBOS, quantos dias por semana se encontra em regime de teletrabalho?

1	2	3	4	5	6	7

Se você gostaria de participar de um programa de 6 meses para melhorar sua saúde no trabalho, insira seu Nome e E-mail :

Se você não gostaria de participar do programa, posso enviar este questionário para você 6 meses depois?

IPAQ

1a Habitualmente, por semana, quantos dias faz actividades físicas **vigorosas** como levantar e/ou transportar objectos pesados, cavar, ginástica aeróbica ou andar de bicicleta a uma velocidade acelerada?

___ dias por semana

___ Nenhum (passe para a questão **2a**)

1b Quanto tempo costuma fazer actividade física vigorosa por dia?

____ horas ___ minutos

2a Normalmente, por semana, quantos dias faz actividade física **moderada** como levantar e/ou transportar objectos leves, andar de bicicleta a uma velocidade moderada ou jogar ténis? Não inclua o andar/caminhar.

_______ dias por semana

_______ Nenhum (passe para a questão **3a**)

2b Quanto tempo costuma fazer actividade física moderada por dia?

____ horas ___ minutos

3a Habitualmente, por semana, quantos dias **caminha** durante pelo menos 10 minutos seguidos? Inclua caminhadas para o trabalho e para casa, para se deslocar de um lado para outro e qualquer outra caminhada que possa fazer somente para recreação, desporto ou lazer.

____ dias por semana
____ Nenhum (passe para a questão **4a**)

3b Quanto tempo costuma caminhar por dia?

____ horas ___ minutos

3c A que passo costuma caminhar?

_____ Passo **vigoroso**, que torna a sua respiração muito mais intensa que o normal;

_____ Passo **moderado**, que torna a sua respiração um pouco mais intensa que o normal;

_____ Passo **lento**, que não causa qualquer alteração na sua respiração;

As últimas questões referem-se ao tempo que está sentado diariamente no trabalho, em casa, no percurso para o trabalho e durante os tempos livres. Estas questões incluem o tempo em que está sentado numa secretária, a visitar amigos, a ler ou sentado/deitado a ver televisão.

4a Quanto tempo costuma estar sentado num **dia de semana**?

____ horas ___ minutos

4b Quanto tempo costuma estar sentado num **dia de fim-de-semana**?

____ horas ___ minutos

Occupational Sitting and Physical Activity Questionnaire (OSPAQ)

1. Quantas horas trabalhou nos últimos 7 dias? __________ horas 2.

Durante os últimos 7 dias, quantos dias foi trabalhar? ____________ dias

Para responder à questão 3, considere o exemplo que se segue:
A Joana é uma trabalhadora de escritório. O seu dia de trabalho envolve trabalhar ao computador na sua secretária, atender o telefone, preencher documentos, tirar fotocópias e andar um pouco pelo escritório. Considerando os últimos 7 dias, a Joana descreveria um dia típico de trabalho como:

Estar sentado (incluindo conduzir)	90%
Estar em pé	5%
A caminhar	5%
Trabalho pesado ou tarefas fisicamente exigentes	0%
Total	100%

3. Como é que descreveria o seu dia típico de trabalho nos últimos 7 dias? (isto inclui apenas o seu dia de trabalho típico, e não viagens de ida e volta para trabalho ou o que fez no seu tempo de lazer)

Estar sentado (incluindo conduzir)	90%
Estar em pé	_5%
A caminhar	__5%
Trabalho pesado ou tarefas fisicamente exigentes	__0%
Total	100%

Deve g arantir que o total é 100 %

Minnesota Satisfaction Questionnaire

Coloque a seguinte questão a si mesmo: Quão satisfeito estou com este aspecto do meu trabalho?
Muito Sat. significa que estou muito satisfeito com este aspecto do meu trabalho.
Sat. significa que estou satisfeito com este aspecto do meu trabalho.
Indec. significa que não consigo decidir-me se estou ou não satisfeito com este aspecto do meu trabalho.
Insat. significa que estou insatisfeito com este aspecto do meu trabalho.
Muito Insat. significa que estou muito insatisfeito com este aspecto do meu trabalho.

No meu actual trabalho esta é a forma como eu me sinto acerca…	**Muito Sat.**	**Sat.**	**Indec.**	**Insat.**	**Muito Insat.**
1. de ser capaz de me manter ocupado(a) durante todo o tempo.............................	☐	☐	☐	☐	☐
2. da possibilidade de trabalhar de modo independente no meu cargo..................	☐	☐	☐	☐	☐
3. da oportunidade de fazer coisas diferentes de tempos a tempos………..............	☐	☐	☐	☐	☐
4. da oportunidade de “ser alguém na vida”..	☐	☐	☐	☐	☐
5. do modo como o meu superior lida com os seus subordinados(as).....................	☐	☐	☐	☐	☐
6. da competência do meu supervisor na tomada de decisões..................................	☐	☐	☐	☐	☐
7. da possibilidade de fazer coisas que não vão contra a minha consciência/valores	☐	☐	☐	☐	☐
8. da segurança/estabilidade que o meu emprego me fornece.................................	☐	☐	☐	☐	☐
9. da possibilidade de ajudar outras pessoas…………………………………….	☐	☐	☐	☐	☐
10. da possibilidade de dizer às pessoas o que fazer..	☐	☐	☐	☐	☐
11. da possibilidade de fazer algo em que faça uso das minhas competências.........	☐	☐	☐	☐	☐
12. da forma como as políticas da instituição são implementadas...........................	☐	☐	☐	☐	☐
13. do meu salário e da quantidade de trabalho que realizo....................................	☐	☐	☐	☐	☐
14. da possibilidade de progressão profissional...	☐	☐	☐	☐	☐
15. da possibilidade de tomada de decisões por mim próprio(a).............................	☐	☐	☐	☐	☐
16. da possibilidade de utilização dos meus próprios métodos para a realização do meu trabalho..	☐	☐	☐	☐	☐
17. das condições de trabalho.. …	☐	☐	☐	☐	☐
18. do modo como os meus colegas se relacionam entre si...	☐	☐	☐	☐	☐
19. do reconhecimento por fazer um bom trabalho..	☐	☐	☐	☐	☐
20. do sentimento de realização pessoal que obtenho no trabalho.................................	☐	☐	☐	☐	☐

Questionário do Estado de Saúde SF-12

(Pais Ribeiro, 2005)

1. Em geral, como diria que a sua Saú de é?

Óptima	Muito Boa	Boa	Razoável	Fraca
□ **5**	□ **4,4**	□ **3,4**	□ **2**	□ **1**

2. As perguntas que se seguem são sobre actividades que executa no seu dia a dia. Será que a sua Saúde o(a) limita nestas actividades? Se sim, quanto?

	Sim, muito limitado(a)	Sim, um pouco limitado(a)	Não, nada limitado(a)
a) **Actividades moderadas**, tais como deslocar uma mesa ou aspirar a casa	□ **1**	□ **2**	□ **3**
b) Andar **mais de 1 Quilómetro**	□ **1**	□ **2**	□ **3**

3. Durante as últimas quatro semanas, teve no seu trabalho ou actividades diárias algum dos problemas apresentados a seguir, como consequência do seu estado de Saúde física?

	Sim	Não
a) Sentiu-se limitado(a) no **tipo** de trabalho ou outras actividades	□ **1**	□ **2**
b) Teve **dificuldade** em executar o seu trabalho ou outras actividades (por exemplo, foi preciso mais esforço)	□ **1**	□ **2**

4. Durante as últimas quatro semanas, teve com o seu trabalho ou com as suas actividades diárias algum dos problemas apresentados a seguir, devido a quaisquer problemas emocionais [tal como, sentir-se deprimido(a) ou ansioso(a)]?

	Sim	Não
a) Diminuiu o **tempo gasto** a trabalhar ou noutras actividades	□ **1**	□ **2**
b) **Fez menos** do que queria	□ **1**	□ **2**

5. Durante as últimas quatro semanas, de que forma é que a dor interferiu com o seu trabalho normal (tanto o trabalho fora de casa como o trabalho doméstico)?

Absolutamente nada	Um pouco	Moderadamente	Bastante	Imenso
◻ **5**	◻ **4**	◻ **3**	◻ **2**	◻ **1**

6. As perguntas que se seguem pretendem avaliar a forma como se sentiu e como lhe correram as coisas nas últimas quatro semanas. (Para cada pergunta, destaque responda que melhor descreve a forma como se sentiu) Quanto tempo nas últimas quatro semanas:

	Sempre	A maior parte do tempo	Bastante tempo	Algum tempo	Pouco tempo	Nunca
a) Se sentiu cheio(a) de vitalidade?	◻ **6**	◻ **5**	◻ **4**	◻ **3**	◻ **2**	◻ **1**
b) Se sentiu muito nervoso(a)?	◻ **1**	◻ **2**	◻ **3**	◻ **4**	◻ **5**	◻ **6**
c) Se sentiu tão deprimido(a) que nada o(a) animava?	◻ **1**	◻ **2**	◻ **3**	◻ **4**	◻ **5**	◻ **6**

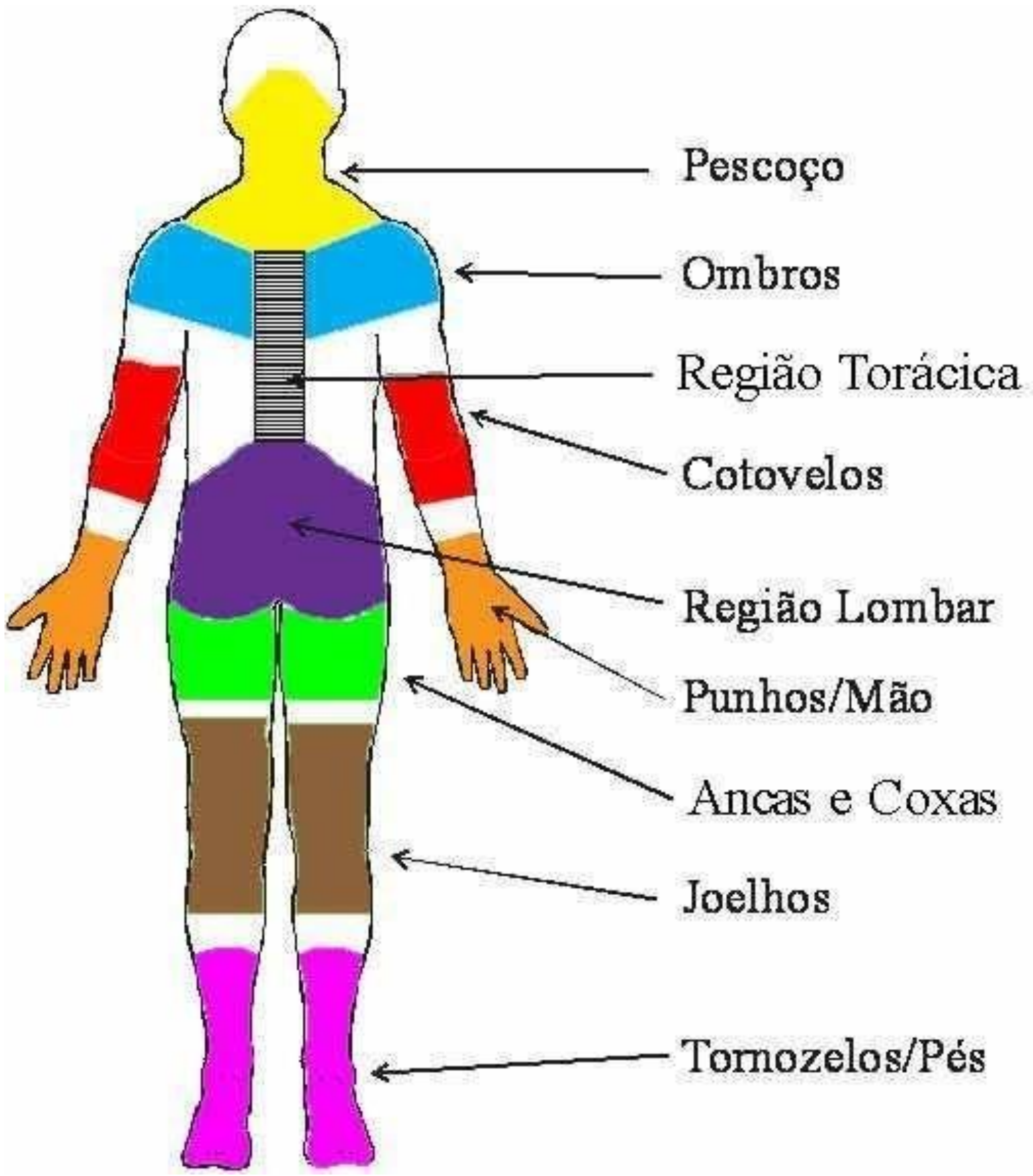
7. Durante as últimas quatro semanas, em que medida éque a sua Saúde física ou problemas emocionais interferiram com o seu relacionamento social normal com a família, amigos, vizinhos ou outras pessoas?

Sempre	A maior parte do tempo	Algum tempo	Pouco tempo	Nunca
◻ **1**	◻ **2**	◻ **3**	◻ **4**	◻ **5**

Questionário Nórdico Músculo-esquelético

Instruções para o preenchimento

- Não deixe nenhuma questão em branco, mesmo se não tiver nenhum problema em qualquer parte do corpo.
- Destaque a intensidade do problema no quarto do lado direito;
- Para responder, considere as regiões do corpo conforme ilustra a figura abaixo.



	Responda, apenas, se tiver algum problema		
Considerando **os últimos 12 meses**, teve algum **problema (tal como dor, desconforto ou dormência)** nas seguintes regiões:	Durante os **últimos 12 meses** teve que evitar as suas actividades normais (trabalho, serviço doméstico ou passatempos) por causa de **problemas** nas seguintes regiões:	Teve algum problema nos **últimos 7 dias,** nas seguintes regiões:	
1. Pescoço? Não Sim 1 2	2. Pescoço? Não Sim 1 2	3. Pescoço? Não Sim 1 2	4. **Sem Dor** | **0** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **Dor Máxima**
5. Ombros? Não Sim 1 2 , no ombro direito 3 , no ombro esquerdo 4 , em ambos	6. Ombros? Não Sim 1 2 , no ombro direito 3 , no ombro esquerdo 4 , em ambos	7. Ombros? Não Sim 1 2 , no ombro direito 3 , no ombro esquerdo 4 , em ambos	8. **Sem Dor** | **0** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **Dor Máxima**

9. Cotovelo? Não Sim 1 2 , no cotovelo direito 3 , no cotovelo esquerdo 4 , em ambos	10. Cotovelo? Não Sim 1 2 , no cotovelo direito 3 , no cotovelo esquerdo 4 , em ambos	11. Cotovelo? Não Sim 1 2 , no cotovelo direito 3 , no cotovelo esquerdo 4 , em ambos	12. **Sem Dor** **0 1 2 3 4 5 6 7 8 9 10** **Dor Máxima**
13. Punho/Mãos? Não Sim 1 2 , no punho/mãos direitos 3 , no punho/mãos esquerdos 4 , em ambos	14. Punho/Mãos? Não Sim 1 2 , no punho/mãos direitos 3 , no punho/mãos esquerdos 4 , em ambos	15. Punho/Mãos? Não Sim 1 2 , no punho/mãos direitos 3 , no punho/mãos esquerdos 4 , em ambos	16. **Sem Dor** **0 1 2 3 4 5 6 7 8 9 10** **Dor Máxima**
17. Região Torácica? Não Sim 1 2	18. Região Torácica? Não Sim 1 2	19. Região Torácica? Não Sim 1 2	20. **Sem Dor** **0 1 2 3 4 5 6 7 8 9 10** **Dor Máxima**
21. Região Lombar? Não Sim 1 2	22. Região Lombar? Não Sim 1 2	23. Região Lombar? Não Sim 1 2	24. **Sem Dor** **0 1 2 3 4 5 6 7 8 9 10** **Dor Máxima**
25. Ancas/Coxas? Não Sim 1 2	26. Ancas/Coxas? Não Sim 1 2	27. Ancas/Coxas? Não Sim 1 2	28. **Sem Dor** **0 1 2 3 4 5 6 7 8 9 10** **Dor Máxima**
29. Joelhos? Não Sim 1 2	30. Joelhos? Não Sim 1 2	31. Joelhos? Não Sim 1 2	32. **Sem Dor** **0 1 2 3 4 5 6 7 8 9 10** **Dor Máxima**
33. Tornozelo/Pés? Não Sim 1 2	34. Tornozelo/Pés? Não Sim 1 2	35. Tornozelo/Pés? Não Sim 1 2	36. **Sem Dor** **0 1 2 3 4 5 6 7 8 9 10** **Dor Máxima**

Adota comportamentos para ajustar corretamente a sua postura corporal no seu posto de trabalho?

a) Nunca pensei sobre isso

b) Pensei sobre isso mas ainda não tomei uma decisão

c) Decidi não mudar o comportamento

d) Decidi mudar de comportamento, mas ainda não comecei

e) Iniciei recentemente o comportamento desejado

f) O comportamento desejado manteve-se ao longo do tempo.

Adota comportamentos para ter pausas suficientes?

a) Nunca pensei sobre isso

b) Pensei sobre isso mas ainda não tomei uma decisão

c) Decidi não mudar o comportamento

d) Decidi mudar de comportamento, mas ainda não comecei

e) Iniciei recentemente o comportamento desejado

f) O comportamento desejado manteve-se ao longo do tempo.

Adota comportamentos para fazer atividade física?

a) Nunca pensei sobre isso

b) Pensei sobre isso mas ainda não tomei uma decisão

c) Decidi não mudar o comportamento

d) Decidi mudar de comportamento, mas ainda não comecei

e) Iniciei recentemente o comportamento desejado

f) O comportamento desejado manteve-se ao longo do tempo.

Adota comportamentos para lidar com o stress tecnológico?

a) Nunca pensei sobre isso

b) Pensei sobre isso mas ainda não tomei uma decisão

c) Decidi não mudar o comportamento

d) Decidi mudar de comportamento, mas ainda não comecei

e) Iniciei recentemente o comportamento desejado

f) O comportamento desejado manteve-se ao longo do tempo.

The Effect of Workplace Multi-component Intervention on Sedentary Behavior in Portuguese Office Workers

Sara Maheronnaghsh

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