Acta Scientific Orthopaedics (ISSN: 2581-8635)

Volume 7 Issue 12 December 2024

Research Article

Effects of an Intervention to Promote Physical Activity in the Workplace During the Covid-19 Lockdown

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DOI: 10.31080/ASOR.2024.07.1008

Received: November 07, 2024

Published: November 29, 2024

Abstract

Introduction: A large part of the population spends most of its waking time in the workplace being an ideal place to implement health promotion programs. One of the gold habits to maintain and increase quality of life is physical activity. Inactive people have a greater risk of developing multiple diseases, compared to active individuals. However, more than 30% of adults do not reach the minimum recommended levels of physical activity, situation that was aggravated during the COVID-19 lockdown.

Objective: Given this situation, the present research studied the impact of a physical activity promotion program developed in the workplace during the COVID-19 lockdown, analyzing its effects on the level of physical activity and the sedentary behavior, as well as on the degree of knowledge of recommendations of physical activity for health, furthermore how the program impacted on the identification of workers with the organization. This research has the uniqueness of coinciding with the start of the COVID-19 pandemic (including home lockdown), so that, it is able to show the effects of healthy physical activity promotion program in these singular circumstances, where physical mobility was restricted.

Methods: 53 office workers (15 women; 47.1 ± 8.9 years) participated in the study. The 19-week intervention was based on the theoretical model of behavior change Behavior Change Wheel and included the prescription of an individualized physical activity program and 9 workshops with the aim of increasing the participants' knowledge about the positive impact of physical activity on health.

Results: The program was effective in increasing total PA (METS/week), vigorous physical activity (VPA), walking-derived physical activity (WPA), as well as the level of knowledge about the physical activity recommendations for health and the workers' identity fusion with the company ($p > .05$). In addition, a borderline significance ($p < .10$) was observed for the improvement of sedentary behavior pattern during work activity.

Keywords: Workplace; Health Promotion; COVID-19; Physical Activity; Identity Fusion

Introduction

In recent decades, the physical demands of work have been considerably reduced, giving way to sedentary tasks, often linked to intellectual activities. In addition, performing physical activity (PA) during leisure time is much lower than recommended, not compensating for inactivity during working hours [1]. On average, adults spend more than a quarter of their life at work, with the work

environment becoming a powerful agent of social change capable of directly or indirectly affecting the well-being of individuals in their lives [2]. For this reason, during the last decades there has been an increase in the number of occupational physical activity programs within health promotion programs in companies. These seem promising in terms of increasing physical activity levels [3] or reducing the level of sedentary lifestyle [4], among other aspects. However, the most rigorous reviews highlight that the heterogeneity of the interventions and the poor methodological quality of much of the research still prevent the establishment of solid evidence on the real impact of these programs. Among the most recurrent limitations is the absence of a theoretical model of behavior change that supports the intervention or the lack of objective evaluation indicators [5]. Likewise, in order to generate a more solid body of knowledge in this regard, some authors highlight the need to accurately and in-depth report on the design of the interventions, as well as on the prescription of physical activity during the interventions [6]. Similarly, according to Malik., *et al*. [3] it is convenient to carry out interventions focused exclusively on the promotion of physical activity, since the multicomponent design makes it difficult to interpret the results.

As everyone knows, at the end of December 2019 there was an epidemic of cases of unknown respiratory infections in Wuhan (China) caused by a new coronavirus, responsible for coronavirus disease 2019 (COVID-19), which was declared a global pandemic by the WHO on March 11, 2020 [7]. One of the main measures that many countries adopted to contain the spread of the virus was home confinement, which directly affected the way people worked and lived in society.

The increase in the number of Internet searches related to physical activity in the United States, Australia, and the United Kingdom during the first weeks of the pandemic [8] and the results of some surveys in which 62% of adults considered that being active was more important during the pandemic than before this period [9] could be interpreted as an increase in the population's interest in maintaining adequate levels of physical activity. However, several studies reported a total decrease in physical activity of 36 minutes per week -from 108 minutes per week before the pandemic to 72 minutes per week during confinement [10] and an increase in sedentary time of more than 3 hours per day -8.4h vs 5.3h before confinement [11]. These data are also corroborated by the study by Deschasaux-Tanguy., *et al*. [12] on 37,000 French adults, in which a 36% decrease in PA levels and a 21% increase in sedentary time are observed in more than 63% of the sample, or that of Lopez-Bueno., *et al*. [11] in the Spanish adult population, in which the percentage of the population that met the minimum PA recommendations for health was reduced from 60% before the pandemic to 49% during confinement.

Given this situation, the current research studied the impact of a physical activity promotion program in the workplace during the COVID-19 pandemic, analyzing its effect on the level of physical activity, the volume and pattern of sedentary behavior and on the degree of knowledge of the global recommendations for physical activity for health. Additionally, it was also studied the participants' perception of satisfaction with the program, as well as the impact of the intervention on the identification of workers with the organization (feeling of belonging).

Method

Participants

A total of 53 office workers (38 men and 15 women; 47.1 ± 8.9 years; height: 1.73 ± 0.09 m; body weight: 78.0 ± 12.5 kg; BMI: 26.0 ± 3.7 kg/m^2) belonging to a multinational company with headquarters in Madrid (Spain) participated in the study after signing the informed consent approved by the Research Ethics Committee of the Autonomous University of Madrid, in accordance with the provisions of the Declaration of Helsinki, and being qualified as fit to participate in the intervention by the company's Medical Service.

Design and description of the intervention

The intervention was based on the theoretical model of behavior change Behavior Change Wheel (BCW), which proposes the need to: i) define the determinants of behavior using the COM-B model (capacities, opportunities, and motivations), ii) select intervention functions, iii) select behavior change techniques [13]. Figure 1 shows the selection made for the purpose of this study.

The intervention lasted 19 weeks (February-June 2020) in which 9 workshops were developed with the aim of increasing the participants' knowledge about the positive impact of physical activity on health. Each workshop lasted approximately 15-20

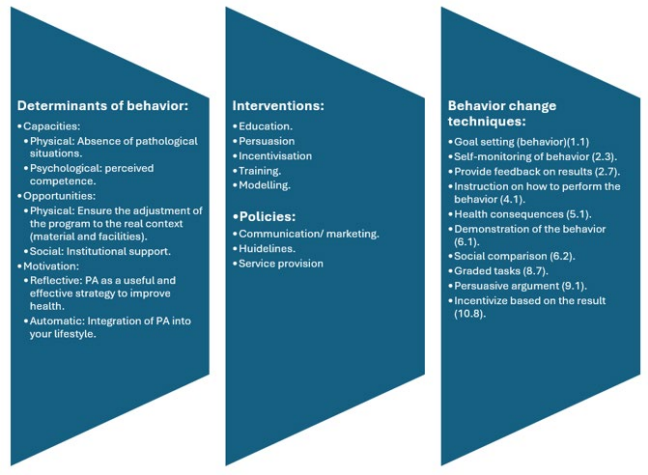

Figure 1: Overview of the determinants of behavior and the selection of intervention functions, regulatory policies and behavior change techniques based on Behavior Change Wheel.

minutes. Initially they were held every 15 days in a face-to-face format, although after the outbreak of the COVID-19 health crisis (March 10, 2020) they were carried out by videoconference with the same frequency. Likewise, a personalized physical activity program was prescribed, sent, and discussed for each participant. The prescription of physical activity during the program was structured with the aim of complying with the principles of individualization and progression in training. In the same way, the need for a standardized physical activity program was kept in mind, so that it could be replicated in future research. Therefore, it was considered that all the participants should have common general objectives, which should be accessible at the beginning and more demanding as the intervention progressed, referring to the principles of standardization and progression, respectively. It was also determined that all participants should work to improve endurance, strength, and flexibility, also with the aim of standardizing the intervention. Finally, the physical activity prescription of each participant had to vary depending on the previous experience and the initial physical fitness level, the availability of time and material resources, as well as the preferences of each subject, attending to the principle of individualization.

Taking all the above into account, the endurance exercises were chosen, as mentioned above, according to the characteristics of each participant. Nevertheless, activities of a continuous or cyclical nature, such as walking, climbing stairs, running, swimming, or cycling, were always selected. Likewise, after the outbreak of the COVID-19 health crisis, these activities were modified so that they could be carried out in the participants' homes (climbing stairs, running on a treadmill, choreographed activities with musical support, stationary bicycle, etc.) due to the lockdown situation. For strength workouts, a program with three levels of difficulty was designed. The first of them contained exercises in which isometric contractions predominated (isometric squat, isometric gluteal bridge, isometric planks, etc.), while the intermediate level progressed in difficulty by incorporating more dynamic exercises (squat without weight, lunge, dynamic gluteal bridge, push-ups, etc.). Likewise, a third level was designed, which included exercises with external load (barbell squat, hip thrust, deadlift, bench press, etc.), for those people who progressed in strength training and could have access to more material resources. A protocol focused on working on range of motion and flexibility was also designed, common to all participants and to be performed at the end of each training session. This included exercises such as ankle dorsiflexion, camel-cat, or stretching of the quadriceps, hamstrings, and adductors. Both strength and flexibility exercises did not require the use of any equipment other than a simple mat. In this way, the exercises could be performed in any space, with the aim that they could be carried out even in the participants' own homes, an aspect that was especially relevant during the confinement period.

Assessments and evaluation instruments

Quantification of physical activity during the intervention period: The recording of the physical activity performed by the participants during the intervention period was carried out by adding the arbitrary units (AU) from the session-RPE quantification method [14]. Each participant answered an online questionnaire weekly, self-reporting to the researchers their level of physical activity during the last 7 days. The competitive element of the intervention was conveyed through the publication of weekly and general rankings (computing the sum of the overall intervention) in which the five participants who had accumulated more UA were highlighted. These standings were sent weekly by email.

In addition, both before and after the 19 weeks of intervention, the following evaluations were performed.

- **Level of physical activity (IPAQ-SF):** The International Physical Activity Questionnaire (IPAQ), developed by Craig., *et al*. [15] and subsequently translated and validated for the Spanish population [16], was used to assess the level of physical activity. The short version was used, referring to the physical activity performed in a typical week. This questionnaire includes six questions asking about physical activity performed at different intensity thresholds (vigorous, moderate, and walking). Initially, the weekly frequency is asked, followed by the volume of physical activity usually performed on each of these days. The IPAQ also includes a seventh question that refers to sedentary time on a typical day. This last question was not included as we use another specific instrument to assess sedentary lifestyle, which is detailed below.
- **Level of sedentary lifestyle and sedentary behavior pattern (SIT-Q):** In order to assess the level of sedentary behavior, the SIT-Q questionnaire [17] was used. This instrument collects several questions about sedentary time on a typical day and in different situations. These include sedentary time (hours and minutes per day) during meals, in means of transport, in leisure time or time spent caring for children or dependent persons. The answers are divided into two: sedentary time on a typical working day and sedentary time on a typical non-working day. Finally, it also includes a question about the sedentary behavior pattern, referring to the frequency with which the sedentary time is "broken", both during the working day and during leisure time. Six categories of response are possible for these two questions, which are codified in the following way: 1 = every 3 hours or more, 2 = every 2-3h; 3 = every 90' approximately, 4 = every 60' approximately, 5 = every 30' approximately, 6 = I do not sit down for more than 30 minutes at a time.
- **Level of knowledge about physical activity recommendations for health:** To assess the level of knowledge about physical activity recommendations for health, a six-item questionnaire was designed based on the WHO recommendations [18]. The questions were the following: i) Are there global recommendations on physical activity for health? ii) For the adult population (18-64 years), how much physical activity is recommended, as a minimum, on a weekly basis? iii) Are there recommendations on strength exercises? iv) How many days per week is strength exercise recommended? v) Are there recommendations on flexibility exercises? vi) How many days per week is flexibility exercise recommended? Questions i, iii and v had three response options: yes, no and don't know/no answer. Question ii had 11 response options, from "90 minutes of AFM per week" to "200 minutes of AFM or 100 minutes of AFV", plus the option "none of the above" and "don't know". To facilitate interpretation, the questionnaire was evaluated by grading the number of correct answers on a scale of 0-10.
- **Satisfaction with the program:** To know the perceived satisfaction with the intervention, as well as the usefulness granted to the program, a self-made questionnaire was designed with several blocks of questions that were answered on a 10-point Likert scale. The aspects on which the questionnaire collects information are: i) global perception of the program (2 items) ii) perception of the usefulness of various components of the program (4 items) ii) perception of the improvement of healthy behaviors (4 items) iii) perception of the improvement of physical health (3 items) iv) perception of the improvement of psychological health (4 items). See table 3.
- **Identity fusion and identification of workers with the company:** The verbal identity fusion scale [19] was used for this purpose. This instrument includes seven items that make statements about the relationship between the worker and the company, always in the first person ("my company is me", "I have a deep emotional bond with my company", etc.). Each of these is rated on a Likert-type scale from 1 to 6, depending on the level of agreement or disagreement with the statements they make. The identity fusion score is obtained as the sum of the item scores (range 7-42).

Statistical analysis

First, the normality of the study variables was tested using the Kolmogorov-Smirnov test. When verifying that the analyzed variables presented non-normal distributions, non-parametric tests were used. Specifically, the Mann-Whitney U test was used for the comparison of two independent samples, the Wilcoxon signed rank test for the comparison of two related samples, and the Friedman test for the comparison of k related samples. Post-hoc comparison was also performed with the Wilcoxon signed

rank test for each pair. In all cases, the level of significance was established at $p < .05$. Finally, the effect size was calculated using the point-biserial correlation coefficient r [20].

Results

Focusing on the levels of adherence and participation during the program, Table 1 shows how the submission of self-reported forms of physical activity performed decreased progressively over time. The percentage of submissions during the pre-confinement phase was higher than in the de-escalation phase ($p = .017$). On the other hand, the level of physical activity was reduced during confinement by 8.7% compared to the first 4 weeks of the intervention. However, in the de-escalation phase, the level of physical activity increased above pre-confinement levels (+15.8%), and statistically significant differences were obtained in the comparison between the confinement and de-escalation phases (+26.9%; $p < .05$).

	Total	Pre-lockdown	Lockdown	De-escalation	*p*
Forms submitted (average %) [1]	68.8 (34.4)	76.4 (31.9) $_{a}$	69.8 (38.7) $_{ab}$	63.3 (41.0) $_{b}$	.017
PA done (AU) [2]	1350 (697)	1332 (859) $_{ab}$	1215 (760) $_{a}$	1542 (869) $_{b}$	.091^{+}

Table 1: Adherence, participation, and level of physical activity during the intervention.

Results are presented as mean (standard deviation). Significance levels < .05 appear in bold. $^{+}$ Tendentially significant ($p > .050$ and < .100). Data from the same row that do not share a subscript differ in a statistically significant way ($p < .05$). Pre-lockdown (weeks 1-4); Lockdown (weeks 5-11); De-escalation (weeks 12-18). [1]The average percentage of submissions in each sub-sample was calculated from each subject's individual submission percentage. [2] Participants who reported at least one form in each phase of the project were included for the analysis. AU: arbitrary units quantified using the sRPE method.

Table 2 shows that total physical activity, as well as the volume of vigorous physical activity (VPA) and physical activity derived from walking (WPA) increased in a statistically significant way after the intervention (p < .05).

	Pre	Post	*p*	ES
Physical activity				
Total PA (METS/week)	1311 (894)	1926 (1063)	.000	0.54
VPA (mins/week)	60.7 (70.3)	94.3 (87.5)	.004	0.40
MPA (mins/week)	78.0 (96.0)	105 (105)	.104	0.22
WPA (mins/week)	156 (145)	228 (156)	.005	0.39
Sedentary Behavior				
Total SB (h/week)	69.5 (13.0)	72.9 (16.4)	.245	0.16
SB working (h/day)	11.4 (2.02)	12.0 (2.6)	.185	0.18
SB non-working (h/day)	5.93 (2.37)	6.12 (2.21)	.775	0.04
SB break at work [1]	2.83 (1.24)	3.06 (1.03)	.083 $^{+}$	0.24
SB break at leisure [1]	3.79 (1.36)	3.57 (1.19)	.203	0.18
PARHQ [2]	2.30 (1.77)	4.15 (2.03)	.000	0.66

Table 2: Effect of the program on physical activity levels, sedentary behavior, and level of knowledge about physical activity recommendations for health.

Results are presented as mean (standard deviation). Significance levels < .05 appear in bold. $^{+}$ Tendentially significant (p > .050 and < .100). Total PA: total physical activity; VPA: vigorous physical activity; MPA: moderate physical activity; WPA: physical activity derived from walking; SB: sedentary behavior. [1] The frequency of breaking the sedentary behavior both at work and during leisure was assessed through a scale with values 1-6. 1: every 3 hours or more; 2: every 2-3h; 3: every 90' approx.; 4: every 60' approx.; 5: every 30' approx.; 6: I do not sit down for more than 30 minutes at a time. [2] PARHQ: Physical activity recommendations for health questionnaire. Assessment scale 0-10 (0: no knowledge; 10: maximum knowledge). ES: Effect size calculated through the point biserial correlation coefficient r (Interpretation: < 0.10 no effect, 0.10-0.29 small, 0.30-0.49 medium, > 0.50 large effect).

Moderate physical activity (MPA) was also increased by 27 minutes per week, although this improvement was not statistically significant. The increase in total physical activity presented a large effect size (ES = 0.54; $p < .001$). In the rest of the cases, the effect size was medium (ES = 0.39-0.40; $p < .005$). Also significantly improved, and with a large effect size, was the level of knowledge about physical activity recommendations for health (ES = 0.66; $p < .001$). Likewise, there was a borderline significant correlation ($r = .230$; $p = .098$) between the change in the level of knowledge about physical activity recommendations for health and the change in total physical activity. This association became statistically significant when controlling for the baseline level of knowledge about the recommendations of PA for health ($r = .276$; $p = .048$) and increased when including only those participants under 55 years of age ($r = .360$; $p = .025$). On the other hand, the total volume of sedentary behavior did not present notable variations, although an upward trend is observed in all the variables related to sedentary behavior. The frequency of breaking sedentary behavior during the working day shows an increase with borderline statistical significance ($p = .083$) and did not present relevant changes in leisure time.

Table 3 collects the results of the final program evaluation questionnaire. As can be seen, overall satisfaction with the company for the development of the project was very high (8.51 out of 10 on average). The usefulness granted to the workshops is greater than that which the participants confer on the self-reporting of physical activity or personalized counseling. In addition, participants stated that the project had mainly helped them to become more aware of the importance of physical activity in health, to improve their company image, to increase their level of physical activity, to improve their physical health and to increase their physical condition. On the contrary, they argued that the project helped them less to reduce their stress level, improve their diet or increase their sleep quality. However, in all cases the average ratings were above 5. Another aspect related to satisfaction with the company is identity fusion, which improved significantly and with a medium effect size (ES = 0.36; $p = .010$).

Overall perception				
Satisfaction with the company for the project			8.51 (1.46)	
It has improved the image of the company			6.79 (2.34)	
Perception of usefulness of program components				
Utility granted to the project as a whole			7.25 (1.99)	
Utility granted to workshops			7.66 (1.87)	
Utility granted to personalized counseling			6.89 (2.38)	
Utility granted to PA self-reporting			7.09 (2.63)	
Perception about improving healthy behaviors				
Helped them to become more aware of the importance of PA			7.42 (2.51)	
Helped them to increase their PA level			6.79 (2.40)	
Helped them to reduce their sedentary level			6.47 (2.55)	
Helped them to improve their diet			5.45 (2.66)	
Perception of physical health improvement				
Helped them to improve their physical health			6.75 (2.50)	
Helped them to improve their physical condition			6.74 (2.32)	
Helped them to control/reduce their weight			5.87 (2.90)	
Perception of psychological health				
Helped them to improve their psychological well-being			5.92 (2.55)	
Helped them to reduce their stress level			5.60 (2.53)	
Helped them to improve their vitality			6.17 (2.31)	
Helped them to improve their sleep quality			5.13 (2.46)	
	Pre	Post	*p*	ES
Identity Fusion Verbal Scale	22.9 (8.58)	25.1 (8.89)	.010	0.36

Table 3: Analysis of participants' satisfaction with the project and the impact on identity fusion.

Results are presented as mean (standard deviation). PA: physical activity. Rating scale 0-10 (0: no satisfaction/usefulness; 10: maximum satisfaction/usefulness).

Table 4 shows the results relative to the change in the physical activity level before and after the intervention, considering the baseline physical activity levels of the subjects. Participants with a low baseline level of physical activity markedly increased the volume of physical activity during the program, while those with a high baseline level did not improve as much. These changes seem to be specific for each of the intensity thresholds, that is, participants who had a low level of MPA before starting the intervention significantly increased their MPA compared to those with a high baseline level, who maintained their levels. practically the same (60 vs -4.6 min; ES = 0.31; p = .026) as occurred with the WPA (136 vs 10.4 min; ES = 0.35; p = .011), while total PA showed a tendentially significant difference between both groups (841 vs 396 min; ES = 0.24; p = .084).

	Low baseline level (n = 26)	**High baseline level (n = 27)**	***p***	**ES**
Δ Total PA (METS/week)	841 (902)	396 (1258)	.084 [+]	0.24
Δ VPA (mins/week)	49.6 (67.9)	18.2 (118)	.140	0.20
Δ MPA (mins/week)	60.0 (92.3)	-4.6 (134)	.026	0.31
Δ WPA (mins/week)	136 (153)	10.4 (158)	.011	0.35
	Least active group (n = 25)	Most active group (n = 28)	*p*	ES
Δ Verbal Identity Fusion Scale	-0.13 (5.58)	3.96 (7.43)	.013	0.35

Table 4: Influence of the baseline physical activity level and the level of physical activity during the intervention on the level of physical activity at different intensity thresholds and identity fusion, respectively.

Finally, the influence of the physical activity level during the project on changes in identity fusion was analyzed. This analysis reveals that subjects with a higher level of physical activity significantly increased their level of identity fusion with the company, while participants who were less active during the program slightly reduced it. The difference between these two groups was statistically significant and had a medium effect size. Previously, it was verified that the initial values of both groups (less active and more active) in the verbal identity fusion scale variable were equivalent (p = .908).

Results are presented as mean (standard deviation). Significance levels < .05 appear in bold. [+] Tendentially significant (p > .050 and < .100). Low initial level thresholds: total AF < 1067; VPA < 60; MFA < 50; CFA < 135. Total PA: total physical activity; VPA: vigorous physical activity; AFM: moderate physical activity; AFC: physical activity derived from walking. Level of physical activity during the program (AU/week) differentiated by the median: less active group < 1125.5 AU; most active group < 1125.5 AU. AU: arbitrary units quantified using the sRPE method. Assessment scale in the identity fusion questionnaire (7-42). ES: Effect size calculated through the point biserial correlation coefficient r (Interpretation: < 0.10 no effect, 0.10-0.29 small, 0.30-0.49 medium, > 0.50 large).

Discussion

The current research has analyzed the effects of an intervention to promote physical activity in the workplace during the COVID-19 pandemic being, to our knowledge, a unique study to date. The results showed that the intervention was effective in significantly increasing total PA (METS/week), vigorous physical activity (VPA), and walking-derived physical activity (WPA). Increases were also observed both in the level of knowledge about the physical activity recommendations for health and in the workers' identity with the company. In addition, a borderline significant improvement was observed in the pattern of sedentary behavior during work activity. Also, the participants reported a high satisfaction with the project. On the contrary, the volume of sedentary behavior did not show any variation with respect to the initial moment.

The results of the current study reveal a statistically significant increase in total energy expenditure derived from physical activity. This increase was slightly more than 700 METS/week (1311 vs. 1926 METS/week). These effects are similar to those published by different authors [21,22].

Focusing on the impact of the intervention on the level of physical activity for each of the intensity thresholds, the results of our study seem to indicate the influence of the main focus and the duration of the intervention on its results. The increase in MVPA experienced by our participants is higher than that reported in interventions with a shorter duration [21,23]. On the contrary, compared to studies of longer duration [24], the increase in MVPA is lower in our study. In relation to the increase in WPA, our results (+71.8 min/week) are lower than those published by authors whose intervention design prioritized WPA as the main strategy to increase PA level [21,25], but higher than those published in other studies whose main focus was the increase in VPA [22,24].

This result is especially relevant given the context and circumstances surrounding the intervention. As described above, this research was carried out between the months of February and June 2020, the peak of the first wave of the COVID-19 pandemic in Spain. A study conducted by Ammar., *et al.* [10] on populations from different countries reported an average decrease of 36 minutes per week in total physical activity. Similarly, another study carried out in Italy reported decreases of more than 800 METS per week in energy expenditure during confinement [26]. In the Spanish context, some authors revealed decreases of 20% in the physical activity of adults, with respect to pre-confinement levels, which translates into 45 minutes less physical activity on a weekly basis [11]. In contrast, our results revealed a non-statistically significant 8% decrease in total physical activity, equivalent to about 20 minutes of MPA, during the confinement period, much lower than the 100-minute decrease during the same period reported by different authors [27]. In addition, an increase of 132 minutes in total physical activity was reported, derived from the increase of 33 min in VPA, 27 min in MPA and 72 min in WPA, between February and June 2020. This represented an increase of more 600 METS/week in total energy expenditure.

Another aspect that we consider relevant is the influence of the participants baseline PA level on the results of the intervention. As can be seen in Table 2, the participants with a low initial level of total physical activity increased their level of physical activity more than twice as much as those who were initially more active. Moreover, this fact was repeated in each of the intensity thresholds. These effects are in line with those published by several authors [28].

Our study also showed a statistically significant improvement, with a large effect size, in the knowledge about physical activity recommendations for health. According to the preceding scientific literature, general knowledge about these recommendations is low. Different surveys carried out on the United States, Canadian and British population between 2003 and 2020 concluded that 22-36% of the population claimed to be aware of the existence of recommendations, but a much lower proportion, established between 1 and 3%, defined the dose accurately [29-31].

Likewise, similar to previous studies [29], there was a borderline significant correlation between the change in the level of knowledge about physical activity recommendations for health and the change in total physical activity level. This association became statistically significant when controlling for the baseline level of knowledge about the recommendations and increased when exclusively including those participants younger than 55 years, in agreement with Cheung., *et al*. [32]. In our opinion, this is a particularly interesting result since it seems to support the hypothesis that the improvement in the level of knowledge about physical activity recommendations is positively related to the increase in the physical activity level performed in adults. However, further research is needed to determine whether it is a causal relationship or simply an association.

Regarding the volume of sedentary behavior, no significant differences were observed between baseline moment and post-intervention. These results are similar to those published by Chau., *et al.* [33] whose systematic review found that none of the included studies achieved a statistically significant reduction in sedentary behavior. In contrast, more recent studies in which the reduction of sedentary behavior was the main objective have demonstrated their effectiveness for this purpose [34,35], and especially those in which the workstation was restructured, removing traditional chairs, and including height-adjustable monitors and keyboards [36]. In short, the lack of impact on the total sedentary volume reported in our study can be explained by several reasons. First, reducing time spent in sedentary behaviors was not the main objective of the intervention, a fact that has been shown to be of paramount importance in the interventions results on sedentary behavior [37]. Secondly, no environmental modifications were made, which have been presented as the most effective strategies for reducing sedentary time [4]. Third, we were also unable to use

activity monitors to provide participants with constant feedback on their sedentary behavior, instruments that have also been quite successful in previous experiences [38]. Finally, our intervention took place during the first months of the health crisis caused by COVID-19. The available scientific evidence is conclusive regarding the changes that occurred during confinement in the sedentary habits of the population. Studies conclude that sedentary behavior increased significantly during this period, specifically between 1.6 and 3 hours a day [10,39]. Although it was not possible to reduce sedentary time, the results of our intervention do not show statistically significant differences between the pre- and post-intervention periods, with an increase of 36 minutes per day, much lower than that reported by the aforementioned studies. For this reason, despite not improving the sedentary behavior, and even taking into account that the temporality of the studies is not fully comparable, our intervention seemed to mitigate in some way the negative effects of the COVID-19 crisis on sedentary behavior.

Likewise, our participants experienced a borderline significant improvement in the sedentary behavior pattern during the working day, understanding this concept as the increase in the frequency of sedentary breaks during working hours. The improvement in the pattern of sedentary behavior is consistent with what has been published in research prior to the COVID-19 pandemic [38,40]. On the contrary, it contrasts with the studies that analyzed the changes in the pattern of sedentary behavior during the health crisis caused by this disease, during which several authors reported a decrease in the frequency of sedentary breaks [41,42].

Conclusion

We can also conclude that participants' satisfaction with the intervention was high. An improvement in the workers' identity fusion with the company was also observed, which was statistically significant compared to the baseline moment. Likewise, it should be noted that the workers who reported a higher level of physical activity during the program were also those who improved the most in their assessment of the level of identity fusion with the company. This result highlights the potential of interventions to promote physical activity in the workplace to improve workers' identification with the organizations in which they work. Likewise, it seems that adherence and participation during the program are moderating variables in relation to the change in identity fusion.

This study has some limitations. At first, the absence of a control group stands out, which, despite being included in the initial design of the researchers, could not finally be incorporated due to a practical impossibility in the workplace context. Second, the use of self-reported measures to record physical activity and sedentary behavior may not be ideal, in terms of objectivity and precision. This was due to the lack of financial resources to use activity monitors. However, previously validated self-registration instruments and widely used in research were chosen.

As strengths, this study has a unique component as it was carried out during the outbreak of the COVID-19 pandemic, including the lockdown. Likewise, it is based on a theoretical model of behavior change intervention (BCW). In addition, it incorporates for the evaluation several elements that are not usually considered in other studies, as the identity fusion between workers and company being, to our knowledge, the first time that it is included in a study in this area, so more research is needed to establish solid evidence in this regard.

Taking all that in consideration, more methodologically rigorous studies are needed, which include a control group, use activity monitors to assess the level of physical activity and include post-intervention follow-up periods. Future studies should continue to analyze the impact of physical activity and health promotion programs in workplaces on workers' identification and identity fusion with the company. It is also necessary to compare the effectiveness of different theoretical models of behavior change in relation to health in the workplace, to analyze if there is one more effective than the rest for this purpose.

Conflicts of Interest

The authors declare they have nothing to disclose.

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