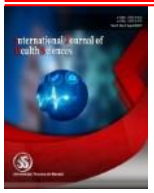

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Musculoskeletal pain in teleworking from home and workplaces: A narrative review

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Abstract

Objective: To do a narrative review of the literature about the relations between the workplaces and workspaces in working at home set-up during the COVID-19 pandemic and work-related musculoskeletal pain in teleworkers. Methods: PubMed and Scopus databases were searched. The period analysed was 2021 to 2023. Only articles examining the associations between workplaces and musculoskeletal disorders/pain in teleworkers working from home were considered for inclusion, and they had to be written in the English language. Results: The search revealed a total of 884 results, and at the end, 10 studies were selected for this narrative review of literature. In most of the studies emerged ergonomically inadequate workplaces emerged with associations to teleworkers' musculoskeletal pain. Conclusions: Inadequate workplaces were found in working from home set-ups during the pandemic, with frequent use of other furniture and equipment not ergonomically adequate, contributing to musculoskeletal pain. There is still a need for policies and regulations procedures to guarantee better working conditions at workplaces.

Contents

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1 Introduction

Working from home has been very common, especially during the COVID-19 pandemic. As teleworking is now commonly done from home, analyses of working conditions are still important. With the advent of the COVID-19 pandemic, teleworking was implemented abruptly due to stay-at-home mandates to meet social distancing requirements, and there was an increase in the number of people working from home (Xiao et al., 2021). During the pandemic, 81% of the global workforce had to change their work location, including a requirement for many people to undertake home-based work (ILO, 2020). Since the pandemic required a rapid shift to remote work, many workers did not have time to adapt their workplaces (Awada et al., 2021). In a systematic review carried out by Wütschert et al. (2022), it was found that, in many studies that most teleworkers did not have well-designed home workplaces.

As a result of the pandemic context, for most workers, the workplace during the pandemic was at home, which comprises the workspace physical design and the ambient. Also, according to Raisiene et al. (2020), the workers did not have a defined home workspace and conditions to accommodate a full-time teleworking job. For Larrea-Araujo et al. (2021), the workspace design refers to aspects related to the desk, chair, and the area of the house acting as the improvised office, which determine the teleworker's capacity as a user of a video display terminal (VDT). For many workers, telework was a new way of working, and there was a need for adaptation. Many workers during the COVID-19 pandemic were using household furniture as a kitchen table, dining chairs, and other furniture without adequate ergonomic configurations (Reznik et al., 2022; Du et al., 2022; Milaković et al., 2023). Laptops were frequently used, resulting in poor postures due to a low monitor position, no external keyboards, and a makeshift workstation (Gerding et al., 2021).

Also, in a cross-sectional study of Oakman et al. (2022), among workers working from home, only a few of them had a private room that allowed working without interruptions, with a dedicated workplace and equipment. Also, according to Caligiuri et al. (2022), limited space at home and permanent distractions made it difficult to concentrate during work, affecting the workers' ability to consider plausible alternatives, to remain open-minded, to concentrate and engage in cognitive tasks, and to expand their experiences to learn. Work-related musculoskeletal disorders (WRMSD) were more frequent in women in many studies (Du et al., 2022; Oakman et al., 2022; Radulović et al., 2021). Especially for women, professional and domestic work was left without clear spaces, worsening with the presence of children in the family (Zalat & Bolbol, 2022). Segbenya & Okorley, (2022), reported that teleworking during the COVID-19 pandemic had the propensity to increase work-life conflict of workers because they had to attend to family and personal needs. Also, the authors refer to the gender roles for women, such as for cooking, taking care of children, and house chores, that compete with working hours during the telework (Segbenya & Okorley, 2022). These facts highlight the complexities workers had to face at work from the home environment, especially women, during the pandemic period.

Besides that, musculoskeletal disorders were frequent in teleworkers during this period. Working with computers and other electronic devices has been frequently linked to WRMSD (Klussmann et al., 2008; Argus & Pääsuke, 2023). And working from home often involves sedentary computer screen work, and the home working environment might not be optimally equipped, which can lead to WRMSD (Bosma et al., 2023; Garcia et al., 2024). WRMSD affects workers' locomotor system, including muscles, tendons, ligaments, joints, and nervous system, and is prevalent in many countries, and these disorders are one of the most widespread problems, involving an important economic and social burden (Tang, 2022). WRMSD risk in teleworkers is frequently related to the ergonomic design of the workplace at home and available technology, the real work schedule and organizational demands, the disturbance by household members, and the long hours of work (Radulović et al., 2021).

In a rapid review study related to the COVID-19 pandemic, the highest prevalence of WRMSD was found in the neck, low back, and shoulder regions, being significantly correlated with workstation ergonomic

suitability (Gomez et al., 2023). In another systematic review, it was found that studies reported an increase in WRMSD during lockdowns compared to before, and with related ergonomic risk factors (Fadel et al., 2023). According to Radulović et al. (2021) poorer working conditions, mainly associated with workplace and ergonomic failures, represent an increased risk for developing WRMSD. In another mini-review study, telework was also a major contributor to the development or aggravation of work-related musculoskeletal disorders, where unsuited workstation, sedentary behaviour, as well as psychosocial and organizational risk factors played important roles (Milaković et al., 2023). Many people working from home during the pandemic also modified (some reduced and others improved) their physical activity habits, especially in the frequency and type of activity, and it seems the reduced activity has worse results (Rodríguez-Nogueira et al., 2021).

Even though there are other risks factors for WRMSD, individual characteristics as sex, age, and anthropometric features that should be also considered, besides organizational and psychosocial factors, the adequacy of workspaces at home and environment needs (ergonomic risk factors), are important to prevent work-related musculoskeletal disorders and promote a better teleworkers health. The objective of this study was to do a narrative review of the literature about the relations between the workplaces and workspaces in working at home set-ups during the COVID-19 pandemic and work-related musculoskeletal pain in teleworkers. The present article focuses on physical/ergonomic risk factors involving these workplaces and workspaces.

2 Materials and Methods

This is a narrative literature review. We followed the orientations of Suckera[24] for narrative reviews. This study based on searching for articles on the bases PubMed: ("Musculoskeletal disorder" [Mesh] OR "musculoskeletal pain" AND "workplace" OR "workspace" OR "workstation" AND "telework" OR "teleworking"), and for Scopus the terms: ("Musculoskeletal disorder*" OR "musculoskeletal pain") AND ('workspace" OR "workstation" OR "workplace") AND ("telework" OR "teleworking"). The period analysed was 2021 to 2023. The Fig. 1 shows the Flow Diagram with the search details.

The authors reviewed available articles and decided on appropriateness for the current review, and collaborated in all narrative literature review preparation. To define the inclusion criteria we used the Condition, Context, Population (CoCoPop) for selection in this review: (i) Condition - teleworkers with work-related musculoskeletal pain; (ii) Context -working at home, (iii) Population - teleworkers male and female, aged between 20 to 65 years old, from all ethnic groups, all educational levels, all family composition, and all professions, from public or private sector or both, sedentary or not. Only research articles examining associations of WRMSD with workplaces or workplace environments in teleworkers working at home during the COVID-19 pandemic with physical outcomes were considered for inclusion criteria, and in the English language. We excluded conference papers, theoretical research, intervention studies, studies analysing specific musculoskeletal diseases, and other texts not related to the inclusion criteria.

The question that inspired the investigation for this narrative review of literature was: What are the physical/ergonomic risk factors involving workplaces and workspaces at home during the COVID-19 pandemic that might increase the risk of musculoskeletal pain in teleworkers?

3 Results and Discussions

3.1 Results

The PubMed revealed 698 results of full texts, and the Scopus Search revealed 186 results, with a total of 884 results. We excluded repeated articles, reviews, proceedings, and other papers that did not fulfil the inclusion criteria. Figure 1 shows the flow diagram.

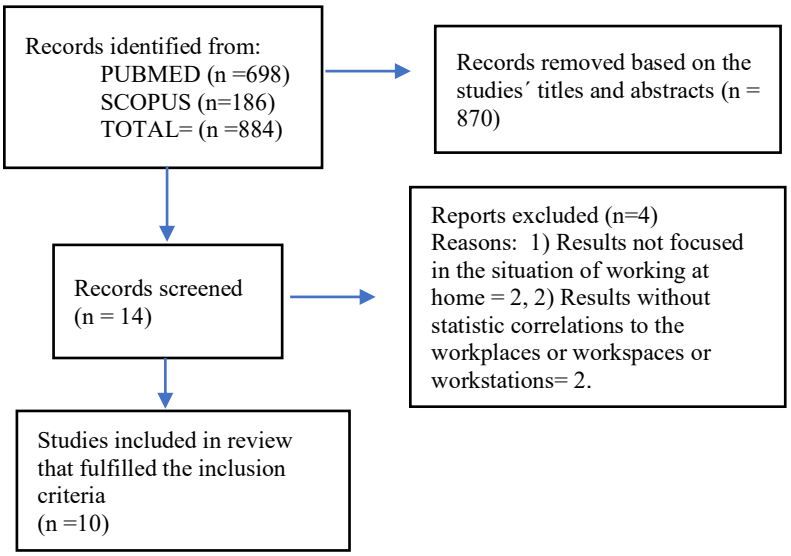

Fig 1. Flow Diagram

Finally, a total of 10 original research articles were included in this present narrative review. The selected articles are shown in Table 1.

Table 1
References, countries, characteristics of the studies, and the studies' outcomes

References	Countries	Characteristics of the studies	Main outcomes related to workplaces
Radulovic et al. (2021)	Croatia	Cross-sectional study	Among the participants who reported stronger musculoskeletal pain than in the office, more of them had no separate workspace.
Chim & Chen (2023)	China	Cross-sectional study	The type of chair homeworkers used and the type of display screen were statistically significant predictors of MSD. Also, no defined break meal.
Bosma et al. (2023)	Netherlands	Longitudinal study	The study showed that working from home conceivably has negative consequences on the musculoskeletal system.
Snodgrass et al. (2022)	Australia	Cross-sectional study	Body posture was associated with having lower back pain. There was a significant association between work location and upper back pain.
Gerding et al. (2021)	USA	Cross-sectional study	Correlation analyses showed strong relations between laptop usage and suboptimal workstation conditions.
Kadri Filho & Lucca (2022)	Brazil	Cross-sectional study	The assessment of the workstation using the method ROSA-Br presented a mean of the total score of 4.8 (1.6), close to the upper limit, which was considered to have an ergonomic risk and the need for immediate adaptation. The result was largely determined by the evaluation score of section A (chair), which obtained a score of

References	Countries	Characteristics of the studies	Main outcomes related to workplaces
			4.8(1.6).
Napkan et al. (2022)	Thailand	Cross-section study	According to multiple regression analyses, the result of neck discomfort is significantly associated with having no posture breaks every 30 minutes. The study highlighted the need to improve the "chair" section.
Larrea-Araujo et al. (2021)	Ecuador	Cross-sectional study	The study made possible some relations with MSD: related to neck and back (lumbar level), the most affected group was the participants who carried out the activities in the bedroom.
Oakman et al. (2022)	Australia	Cross-sectional study	More females reported neck/shoulder pain compared to men. Also, women had no dedicated workstation and so were using whatever location was available to them.
Du et al. (2022)	Japan	Cross-sectional study	Female workers were approximately 3 times more likely to develop mild neck/shoulder pain. Use of "other tables", floor chairs, and floor cushions was associated with severe lower back pain. Use of a floor chair and a floor cushion was associated with mild lower back pain. Use of other tables was associated with severe neck pain, and using a floor cushion and sofa was associated with mild neck/shoulder pain.

About the characteristics of the studies, most of them were cross-sectional studies (9), and one (1) a longitudinal study. The countries/regions of the studies were: Croatia (1), China (1), Netherlands (1), Australia (2), USA (1), Brazil (1), Thailand (1), Ecuador (1) and Japan (1), showing variety of countries. The common body regions of musculoskeletal pain in the selected studies are demonstrated in Table 2.

Table 2
Common body regions with complaints of WRMSD

Study	Common body regions with complains (WRMSD)
Radulovic et al. (2021)	Lower back, upper back/neck, hands
Chim & Chen (2023)	Neck, lower back, right shoulder
Bosma et al. (2023)	Lower back, upper back, neck
Snodgrass et al. (2022)	Neck, shoulders, lower back
Gerding et al. (2021)	Lower back, neck, upper back/shoulder
Kadri Filho & Luca (2022)	Shoulder, neck, wrist/hands
Napkan et al. (2023)	Neck, lower back, legs
Larrea-Araujo et al. (2021)	Lower back, neck, arm/forearm
Oakman et al. (2022)	Neck or shoulders, middle to lower back, hips, bottom, legs, or feet
Du et al. (2022)	Neck, lower back

The most prevalent body region with complaints (Table 2) was the neck in five (5) studies, followed by the lower back in four (4) studies. The neck region was found as a prevalent region of WRMSD in all (10) of the selected studies, and lower back pain in nine (9) studies. The risk factors associated with WRMSD in teleworkers working from home and related body regions are demonstrated in Table 3.

Table 3
Risk factors associated with WRMSD in teleworkers working from home and related body regions

Studies	Associated physical risk factors	Related body regions
Radulovic et al. (2021)	- Having no separate workspace at home	- Lower back, upper back/neck, hands.
Chim & Chen (2023)	- Work desk	- All body regions
	- Type of chair	- All body regions
	- Type of display screen	- Neck, upper back
	- Not taking a regular meal break	- All body regions
Bosma et al. (2023)	- Working from home (not informed details)	- Lower back, neck, shoulders, arms
Snodgrass et al. (2022)	- Body posture	- Lower back pain
	- Work location	- Upper back
Gerding et al. (2021)	- The back is not in contact with the chair	- Middle back, lower back, hips, and upper legs
	- Laptop usage	- Middle back, upper arms, and elbows
Kadri Filho & Luca (2022)	- Workstation (emphasis on chair)	- Presence of WRMSD (no body region specified)
Napkan et al. (2023)	- Not taking regular posture breaks	- Lower back
Larrea-Araujo et al. (2021)	- Working in the bedroom	- Lower back, neck
Oakman et al. (2022)	- Workstation location	-Neck/shoulder (woman)
Du et al. (2022)	- Use of other tables, floor chair, floor cushions	- Lower back
	- Use of other tables, floor cushions, sofa	- Neck

As observed (Table 3), most of the selected studies reported the main physical/ergonomic risk factors related to non-ergonomic settings during working from home.

3.2 Discussion

This narrative review of literature focused on the characteristics of workplaces and workspaces in working at home set-ups and related musculoskeletal pain in teleworkers, with emphasis on physical characteristics. The pandemic induced a dramatic upward shift in the prevalence of working from home (Eurofound, 2022), and with the rapid change to a telework setup at home, many workers did not have adequate environmental and ergonomics home conditions, mainly a workplace and proper equipment to work (Gerding et al., 2021).

Prevalent body regions affected

The prevalent body regions affected by WRMSD pain/symptoms in most of the selected studies were the neck and lower back. Other studies also reported neck and lower back pain as the prevalent body regions affected by WRMSD in teleworkers working from home during the pandemic (Milaković et al., 2023; Cruz-Ausejo et al., 2023).

Workplace

Teleworkers during the pandemic seemed to work in different places at home, using tables and chairs not adequate for the computer or laptop work setup (Larrea-Araujo et al., 2021; Du et al., 2022; Gerding et al.,

2021; Oakman et al., 2022; Radulović et al., 2021; Chim & Chen, 2023). These facts were also reported in other studies (Cruz-Ausejo et al., 2023; Dockrell & Culleton-Quinn, 2023). Different spaces at home were used to work, and according to Larrea-Araujo et al. (2021), some spaces, as the living room and bedroom, are designed for home life, not to telework. Wütschert et al. (2022), in a systematic review study, also found that most teleworkers in a home-based setup did not have well-designed home workplaces. Also, they reported that home-based teleworkers may use various spaces at home to work because they consider first what room in their home is available and secondly its ergonomic needs (Wütschert et al., 2022).

One observation reported by Chim & Chen (2023), study was related to the workers´ spaces of living spaces, which may vary. They reported that people in Hong Kong live in tiny spaces, and the space per person is approximately 25% smaller than in Tokyo, which may be worse depending on the number of family members living in the space. So, the telework environment may vary from home to home, and neither the size nor the quantity of the spaces at home was explored in the studies from this review. Bosma et al. (2023), also pointed out that it is possible there was too little space at home, so home workers were forced to sit for a long time in chairs and behind desks that were not ergonomically suitable. Further investigations about the size and quantity of spaces at home, the number of family members living at home, the division of workspaces, economic status, cultural habits, and the physical well-being of the teleworkers working from home are necessary in further studies. Also, the workers with the rapid changes due to the pandemic seemed not to have time, nor probably financial or companies' support, and home space conditions to adequate a well-designed workplace.

Not having a defined or proper workplace (office room) when working at home was reported in many studies from this review (Larrea-Araujo et al., 2021; Gerding et al., 2021; Radulović et al., 2021; Chim & Chen, 2023), and also in other studies (Milaković et al., 2023; Cruz-Ausejo et al., 2023). The problem of not having a proper or defined workplace when working at home may favour the use of other places wherever is available at home, and without adequate ergonomic settings, what was observed in some studies (Milaković et al., 2023; Cruz-Ausejo et al., 2023), besides the problems of disturbances during work.

In one study, it was found that during the pandemic, more females reported not having a dedicated workplace, and thus they were using whatever space was available at home, a practice likely associated with increased musculoskeletal pain (Oakman et al., 2022). For Zalat & Bolbol (2022), women were left without clear spaces during the pandemic, especially due to the presence of small children, and the absence of temporal delimitation between professional and domestic work. Besides gender rules, women tend to make more decisions for their husbands and are more worried about the domestic work and childcare. Also, the lack of a room or space to concentrate on work may cause psychological stress to teleworkers (Matsugaki et al., 2022). More investigations are needed to better understand the reasons for not having a defined workplace at home and how it contributes to the WRMSD risk, or not, for those who have a dedicated workplace. We suppose that the workspaces were switched between the family members when necessary and according to availability and work demand, and that many of the teleworkers did not have a home office (as defined workspace) proper and ergonomically adequate to telework because of economic factors, and the absence of companies' incentives.

The lack of an adequate chair and/or desk when working at home was mentioned in selected articles (Larrea-Araujo et al., 2021; Du et al., 2022; Radulović et al., 2021; Gerding et al., 2021; El Kadri Filho & de Lucca, 2022), even though in some studies, they were not statistically associated with WRMSD symptoms. The lack of an office chair or desk was also reported in another study during the pandemic (Nakpan et al., 2023; Cruz-Ausejo et al., 2023; Papalia et al., 2022). Napkan et al. (2023) highlighted the need for improvement in the chair used to work, and reported an association of having no armrests with low back discomfort. According to Cruz-Ausejo et al. (2023), work on dining or living room furniture that does not have armrests or a mechanism of adjustment of height may, in the long term, lead to WRMSD. Inadequate workplace conditions as inadequate arm or back rest, are mostly linked to musculoskeletal pain (Rodrigues et al., 2017). In a study carried out in a university by Garcia et al. (2024), many teleworkers reported seats with uncomfortable lumbar and arm support. Also, during the pandemic, teleworkers reported a significantly longer sitting time.[35] Sitting time may also be related to hours of work during the working day, and it was found that working at home during the pandemic increased the working hours of teleworkers (Du et al., 2022; Heggeness, 2020). And some studies indicated an increase in musculoskeletal disorders related to sitting in a poor posture (Xie et al., 2017; Yoshimoto et al., 2021). Related to posture, one study reported a great number of people sitting

more often with their bottom dropped, indicating a poor sitting posture (Snodgrass et al., 2022). Also, according to Papalia et al. (2022), the sedentary lifestyle and reduction of physical activity consequent to social distancing and travel restrictions during the pandemic may have provoked the worsening of musculoskeletal symptoms in the teleworkers working from home.

It was clear in many studies that the absence of an ergonomic chair and/or desk to work during telework and working from home, and an emphasis on the quality of the chair, was found in some studies. An ergonomic chair adapts itself to the body´s dimensions, providing stability, freedom of movement, and the ability to change or adequate the posture (Larrea-Araujo et al., 2021). In the study of Cram & Vinitzky (1995), results pointed to less general muscular fatigue of the lumbar muscles if the chair provides better support to the pelvis and lower spine while sitting.

About the desk, Sato et al. (2023), found that not having enough leg space under the desk and not having enough space on the desk to work were related to shoulder pain. Having sufficient foot space and space on the desk allows the worker to change posture when needed. According to Matsugaki et al. (2022), having enough space on the desk and for the feet is effective in maintaining good posture when working. These findings are well known in ergonomic workstation settings for office work. The lack of an ergonomic chair or desk may contribute to inadequate postures during work, which in the long term may influence the frequency and aggravation of musculoskeletal symptoms.

About the equipment used, many of the teleworkers were using laptops (Gerding et al., 2021; Oakman et al., 2022; Radulović et al., 2021). In another study, workers also reported teleworking frequently with a laptop (Garcia et al., 2024; Cruz-Ausejo et al., 2023; Fiorini, 2023). Using a laptop computer in telework may pose a higher risk of developing WRMSD (Argus & Pääsuke, 2023; Straker et al., 1997; Conte et al., 2014). It is well known that ergonomics tips for using laptops should consider elevating the laptop display with a laptop stand that will help satisfy some best practices for computer workstation setup, and working with laptops should also require an external keyboard and mouse (Garcia et al., 2024). The importance of elevating the laptop display with a laptop stand is related to the prevention of neck pain (Ye et al., 2017). And in cases where the worker has a desktop computer, the monitor should also be raised to eye level with the top edge of the screen (Larrea-Araujo et al., 2021), aspect also well known. Having the monitor not located in the front of the worker is significantly associated with neck pain (Ye et al., 2017). Holding the neck frequently extended increases the fatigue in neck muscles (Wu et al., 2012), so the quality of the posture during work plays an important role in preventing pain and WRMSD symptoms.

Few workers used a laptop with an external mouse (Chim & Chen, 2023; Snodgrass et al., 2022). Findings of Straker et al. (1997), highlighted that the use of a laptop promotes higher musculoskeletal discomfort compared to a desktop, because the laptop does not offer the possibility to adjust the screen, keyboard height, and the distance separately. Other findings from the study of Conte et al. (2014), points that the mouse should be preferred to the touchpad as an input device when using a laptop, because the motor tasks executed when using the mouse allow wider movements and reduce biomechanical stress, and touchpad users are forced to maintain a more static posture. People are increasingly switching to laptop computers because of their portability (Sahu et al., 2023), so attention should be paid to the risk factors related to the use of laptops, especially in the working from home environment. Also, other teleworkers were using more than a single device, such as desktops, laptops, tablets, and cell phones to carry out their work activities, and the working conditions using all these devices may also be more investigated during telework.

Various determinants involving poor ergonomic conditions of the workplaces emerged in this narrative review, especially related to furniture and equipment used that can lead to bad postures during work, depending also on organizational, psychosocial, and individual risk factors. According to Fiorini (2023), the presence of equipment alone may not be sufficient to impact musculoskeletal pain. Although studies from this review found significant associations with furniture and equipment to WRMSD. Since musculoskeletal disorders have a multifactorial etiology, for prevention, it is important to consider also other risk factors (organizational, psychosocial, and individual). But we emphasize that an ergonomic workspace/workstation plays an important role during teleworking.

We think that workers are adapting their workplaces during the pandemic period for more ergonomic and adequate places, according to their needs. El Kadri Filho & de Lucca (2022) observed differences in ergonomic risk factors concerning previous experience in telework. The authors suppose it happened due to an adaptation of each home workplace after a few months of teleworking, which allowed a better comfort to

teleworkers (El Kadri Filho & de Lucca, 2022). This fact was also not explored in the articles selected, except for the mentioned one (El Kadri Filho & de Lucca, 2022). It is important to highlight that having an adequate ergonomic place to work does not guarantee good postures because it is related to human behaviour, but it is well known that it might favour and stimulate good ones, so it is strictly recommended.

Breaks during work

Two studies from this review reported associations with WRMSD pain and breaks. One study reported that not having a regular posture break every 30 minutes was significantly associated with lower back symptoms (Nakpan et al., 2023). Failing to take regular breaks can increase the risk of physical and psychological fatigue (Cropley et al., 2023). Since some workers may remain long periods in inappropriate postures, breaks are important and necessary to provide postural changes and therefore interruption of constant and repetitive muscle contractions. Another review study found that an active break with a postural change influenced in pain reduction (Gomez et al., 2023).

Another study from this review referred to associations between not having a regular meal break to discomfort in all body regions (Chim & Chen, 2023). About the possibility of taking breaks whenever necessary, El Kadri Filho & de Lucca (2022) reported that teleworkers have great autonomy to decide when to take breaks. Although this autonomy may lead to irregular meal breaks, and/or prolonged hours sitting and/or long hours of work, depending on the situation (for example, goals to achieve, disturbance of household members, organisation, and others). But also, the great autonomy the teleworkers have may favor the possibility of breaks whenever anybody discomfort appears, which may influence well-being during work, which needs further studies. Also, more studies related to time and quality of breaks are necessary, and about the possibilities of posture changes during work, taking into account also, if possible, the behaviors and motivations.

Other risk factors related to the workplace

Besides the workstation furniture, equipment's and devices, ambient risk factors, as the room temperature, are also important for the workplace. From the selected studies, the temperature was not explored. In the study of Sato et al. (2023), if the temperature and humidity in the work room were comfortable, it was investigated, and the answer NO was significantly associated with shoulder pain. In a review study carried out by Farbu et al. (2022), they pointed to cold temperature as an important contributor to musculoskeletal pain risk. Also, in another study, Stjernbrandt et al. (2023) found significant associations with the presence of pain in the hands and upper arm region and cold temperature.

One study from this review found that increased glare influenced the tiredness and postures during work (Gerding et al., 2021). According to the authors, glare appeared to impact several body postures, which produced more flexion in the neck and back, as well as a neck bent sideways (Gerding et al., 2021). Environmental risk factors as poor lighting or glare, inadequate room temperature, and noise, are frequently forgotten in the workstations of workers working from home (Milaković et al., 2023).

Other comments

Many studies reported negative consequences on the musculoskeletal system in people working from home during the COVID-19 pandemic (Larrea-Araujo et al., 2021; Gerding et al., 2021; Radulović et al., 2021; Gomez et al., 2023; Fadel et al., 2023; Chim & Chen, 2023; Snodgrass et al., 2022; Nakpan et al., 2023; Cruz-Ausejo et al., 2023; Papalia et al., 2022). The unusual experiences of teleworkers during the pandemic, as social isolation, fear of contamination, insecurity, and all the stress that many workers suffered, were also important factors to analyse in the future.

It seemed that the context in which employees prepared the workplace was not friendly, and they were not supervised by Health and Safety at Work (HSW) employees, nor by the employer. According to El Kadri Filho & de Lucca (2022), the physical working conditions were frequently neglected. It was observed a lack of policies to support healthy home working environments during the COVID-19 pandemic period (Bosma et al., 2023). Also, Wütschert et al. (2022), reported that most companies did not offer compensation, and the

teleworkers did not ask for it. It is important that employers from companies or institutions support the workers´ needs during telework, for better working conditions.

Limitations of the study

This study has many limitations. This narrative review of literature focused on the characteristics of workplaces and workspaces in working at home set-ups and related musculoskeletal pain in teleworkers, with emphasis on physical aspects, analysing the aspects found in the selected studies. Other important organizational risk factors as work pace, type of supervision, and work control, among others, were not analysed. Also, psychosocial risks were not analysed. So, it may not fulfil all the relations to physical aspects, since mental and physical aspects are interconnected. However, the focus was to discuss especially the workstation risk factors found for WRMSD pain, and the article reflects on further necessary investigations for the health and safety of teleworkers working from home.

The articles selected used various instruments to analyse the workplace risk factors, besides other risk factors, and most of the studies had a cross-sectional design, which does not allow for a conclusion on causality of WRMSD pain. The selection criteria of subjects in most of the studies generally indicated a minimum of days in telework, but do not specify clearly if the workers had or did not have some hybrid model, and what the conditions were in those workplaces, which should also be investigated in further studies related to telework in hybrid model. The period of the studies was not the same, especially in a pandemic situation (ex., lockdown period or not, first year of pandemic or second), which may differ in context, working environment, and personal adaptation process. Mainly, we focused on the workplace, furniture, and equipment used as risk factors for WRMSD in the working at home during the pandemic and teleworking. Besides that, the article brings some results that may interest researchers for further analyses.

4 Conclusion

We found inadequate workplaces with furniture, equipment, and devices used in a working-from-home environment during the pandemic, different from an office set-up, which may justify the increased risk for WRMSD pain and symptoms in teleworkers. Many risk factors were found related to physical/ergonomics aspects of the workplaces and workspaces, which might need attention, especially for the continuation of working in a home environment nowadays. Education programs are necessary for the prevention of WRMSD pain during telework. There is a need for policies and regulation procedures to guarantee better working conditions at workplaces, namely for the teleworkers while working from home.

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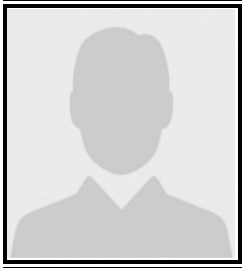

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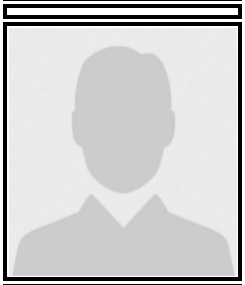

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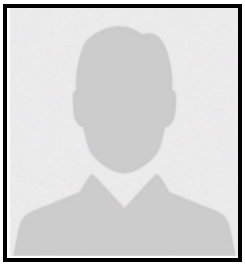

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