

Risk Factors of Musculoskeletal Disorders in Office Workers

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ABSTRACT

Introduction: Musculoskeletal disorders (MSDs) are a collection of symptoms in the human skeletal and muscular systems, which are characterized by discomfort or pain. The International Labor Organization (ILO) stated that MSDs are the most common health problem among office workers in 27 countries under the European Union. Therefore, this study aims to determine the risk factors for MSDs among office workers. **Method:** This study used the literature review method by accessing an online database using different keywords, namely risk factors, musculoskeletal disorders, and office workers. Subsequently, 939, 1,421, and 243 articles were obtained from Google Scholar, ProQuest, and PubMed. Gov, respectively, with a total of 2,603. The inclusion criteria include papers published between 2011 and 2021, relevant titles and abstracts, primary study with a cross-sectional design, as well as full-text availability. Incomplete articles that are irrelevant to the topic were then excluded, after which a total of eight were selected for analysis. **Result:** Based on selected articles known that the risk factors for MSDs include age, gender, knowledge of ergonomics, work posture, work facilities, duration of work, physical activity, and psychosocial factors in the workplace. **Conclusion:** The significant risk factors for MSDs include increasing age, female gender, increased work duration, poor knowledge of ergonomics, wrong work posture, non-ergonomic support facilities, lack of physical activity, as well as poor psychosocial conditions in the workplace.

Keywords: risk factors, musculoskeletal disorders, office workers

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INTRODUCTION

Musculoskeletal Disorder (MSDs) are a collection of symptoms caused by damage to the musculoskeletal system, including the muscles, nerves, tendons, cartilage, and spinal discs. The term is also used medically to define diseases of the limbs and spine as well as multiple or localized pain syndromes (Roquelaure, 2019). Furthermore, MSDs include pain, numbness, tingling, inflammation, warmth, stiffness or tension, as well as burning sensation (Iñigo Isusi; Lorenzo Munar, 2020). They are influenced by individual, organizational, psychosocial, and occupational factors (Mayasari and Saftarina, 2016).

Office workers are a group of people with a high prevalence of MSDs, and most of them use computers as the main facility and tool to support their daily administrative tasks. The complaints are often felt in the hands, neck, arms, shoulders,

and wrists (Rahayu *et al.*, 2020). After low back pain, MSDs are the second largest contributor to the occurrence of disability in the world (Kurniawidjaja and Ramdhan, 2019). A previous study on this group in Nigeria showed that 70% had the complaints, where the lower back was the most common site (Okezue *et al.*, 2020). Another study in Indonesia showed that 91.7% experienced the condition, and the highest complaints were obtained from people with more than four years of service and high-risk work attitudes (Salsabila and Wartono, 2020).

MSDs have negative effects on employees, companies, and society. They can also affect an individual's physical and mental health significantly. These disorders cause a decline in the health status and productivity of workers, which then leads to the loss of their jobs. Furthermore, several studies stated that the number of people with the condition is expected to increase rapidly in low- and middle-income countries (Hartvigsen *et al.*, 2018). This high prevalence of MSDs has led to the development of studies on the risk factors to provide adequate preventive measures.

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METHOD

This study used the Literature Review method by accessing 3 online databases with the keywords "Risk Factors, Musculoskeletal Disorders, and Office Workers." Subsequently, 939, 1,421, and 243 papers were obtained from Google Scholar, ProQuest, and PubMed.Gov, respectively, with a total of 2,603. The inclusion criteria include articles published between 2011 and 2021 with relevant title and abstract, a cross-sectional design, and full-text availability. Incomplete studies that are irrelevant to the topic were then excluded, after which a total of eight were considered for further analysis. Figure 1 shows the flow of the method used.

Population, Intervention, Comparison, Outcome, and Context (PICOC) criteria were then used to develop the study questions (Kitchenham and Charters, 2007). Table 1 is a summary of the PICOC method used.

RESULTS

Based on the eight studies analyzed, the risk factors for MSDs include age, gender, knowledge of ergonomics, work posture, duration, physical activity, facilities, and psychosocial factors.

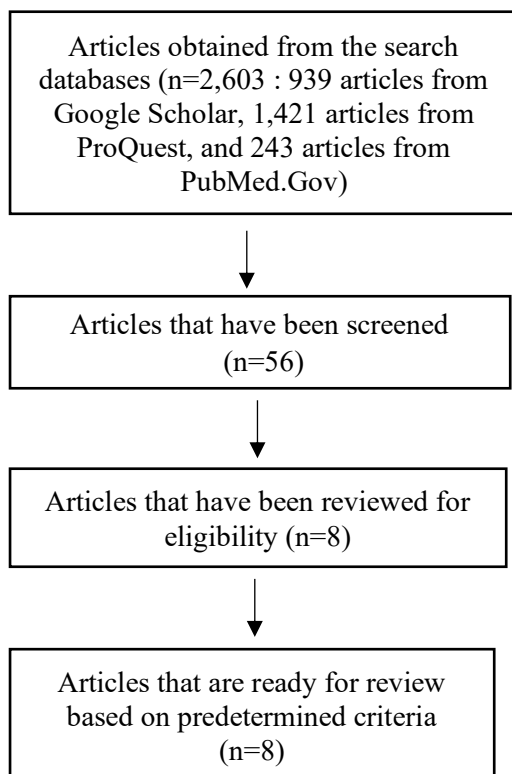


Figure 1. Research Steps

Table 1. Summary of the PICOC

Population	Office workers
Intervention	Risk factors of MSDs in office workers
Comparison	n/a
Outcomes	Specific risk factors related to Musculoskeletal Disorders
Context	Studies in academic and online literature

Age

The risk of experiencing MSDs increases along with age in workers. A previous study on office workers in Higher Education Institutions in Nigeria revealed that 83.9% of the respondents aged 51-60 years experienced the complaints compared to the 21-30 years group, where 60.9% were affected. Furthermore, statistical analysis showed that there is a significant relationship between age groups and MSDs (Okezue *et al.*, 2020), and this finding is consistent with the report from the Ministry of Health's Personnel Bureau. A previous study stated that the complaints are more experienced by workers aged > 37 years (Rahayu *et al.*, 2020).

Gender

Women are at greater risk of experiencing MSDs compared to men, and a previous study on workers at Bank X's Head Office in Pontianak City stated that they have a severe complaint rate of 18.9% compared to that of the men, namely 4.3%. Furthermore, the analysis results revealed a significant relationship between gender and MSDs (Hardianto, Trisnawati, and Rossa, 2015). This association was also observed among government office workers in Turkey where women experienced more pain in the shoulders, lower back, and neck (Ardahan and Simsek, 2016). This finding is consistent with a study on workers in Zonguldak, Turkey, where they had more complaints of MSDs in the lower back, neck, upper back, shoulders, legs, calves, arms, and wrists (Celik *et al.*, 2018).

A study on office workers in Higher Education Institution of Nigeria stated that women are at more risk of developing MSDs with a prevalence rate of 79.4% compared to 61.5% in men. The statistical analysis results revealed that gender was significantly associated with the complaints of the condition (Okezue *et al.*, 2020).

Table 2. Results of Literature Review

Researcher	Research Title	Research Design	Respondent	Research Variable	Research result
Okezue, O. C. <i>et al.</i> (2020)	Work-Related Musculoskeletal Disorders among Office Workers in Higher Education Institutions: A Cross-Sectional Study	Cross-sectional.	217 office workers in Higher Education Institutions in Nigeria. The participants were selected to carry out administrative, secretarial, clerkship, or typist tasks. Workers who have worked for less than one year, pregnant, have chronic diseases, and a history of fractures were excluded.	The prevalence rate of WMSDs, sex, age, working hours, work experience, awkward posture, sustained body position, improper bending, workplace stress, inappropriate furniture, and inadequate rest breaks.	Based on the Chi-Square Pearson test, musculoskeletal disorders have a significant relationship with gender, age, working hours, and work experience. There was also a significant association between the prevalence of MSDs and the risk factors, namely awkward posture, sustained posture, improper slouching, stress at work, inappropriate furniture, and inadequate rest.
Damanhuri, Z. <i>et al.</i> (2014)	Low Back Pain Among Office Workers In a Public University in Malaysia	Cross-sectional	The sample population consists of one hundred and fifty-five office workers at Putra Malaysia University that have worked for at least one year. Others that were pregnant and already have a history of back pain were omitted.	Prevalence of LBP gender, ethnic group, age, knowledge of ergonomics, working duration, work facilitation, leave, and length.	The results of the Chi-Square statistical test showed that the risk factors for Low Back Pain are women, workers with poor ergonomic knowledge, work duration of ten years, lack of ergonomic training, use of non-ergonomic chairs, and increased working hours.
Celik, S. <i>et al.</i> (2018)	Determination of Pain in Musculoskeletal System in Office Workers and the Risk Factors	Cross-sectional	The sample population consists of 720 office workers at universities, Ministry of National Education, Social Security Institutions, legal institutions, police, and tax offices in Zonguldak, Turkey	Age, marital status, workplace, work experience, Body mass index (BMI), exercise in daily life, the stress level of breaks taken, as well as the type of chair, arm, and leg position while working at the desk.	Based on the results of multivariate analysis, the variables associated with MSDs include sitting at a desk for a long time, working on a non-ergonomic chair, tilting the head 45°, lack of regular exercise, and a stressful workplace.
Piranveyseh, P. <i>et al.</i> (2016)	Association of Psychosocial, Organizational and Personal Factors with the Prevalence of Musculoskeletal Disorders in Office Workers	Cross-sectional	The samples were 300 office workers from the Iranian Gas Transmission Company in 2013, with the criteria of using a computer at least 3 hours per day, a minimum working period of 12 months, and has complained of MSDs.	Gender, marital status, age, work experience, working hours/day, BMI, work-family balance, job control, educational level, leadership, job-related resources, rewards, and cooperation within the workgroup.	Gender, marital status, age, work experience, working hours/day, BMI, work-family balance, job control, educational level, leadership, job-related resources, rewards, and cooperation within the workgroup.

Advanced Table 2. Results of Literature Review

Researcher	Research Title	Research Design	Respondent	Research variable	Research result
Ranasinghe, P. <i>et al.</i> (2011)	Work-Related Complaints in the Neck, Shoulder, and Arm among Computer Office Workers: A Cross-Sectional Evaluation of Prevalence and Risk Factors in a Developing Country	Cross-sectional	A total of 2,500 computer users from the telecommunications and training institutions in Nine provinces in Sri Lanka.	Age, working years and hours, region of pain (neck, shoulders, arm, forearm, and hands), body posture, work overload, breaks, work environment, social support, and ergonomic knowledge.	The binary logistic regression analysis results showed that age, gender, duration of work, wrong posture, poor work habits, and daily computer use were the significant independent predictors of the incidence of MSDs.
Hardianto, Trisnawati, and Rossa (2015)	Factors Associated with Complaints of Musculoskeletal Disorders (MSDs) in Bank X. Employees	Cross-sectional	Eighty-four computer users at the Head Office of Bank X Pontianak City. The technique used was the purposive sampling method.	Gender, relaxation, working hours, exercise habits, additional working time, type of chair, age, years of service, and body mass index	The results of the Chi-Square statistical test showed that there is a relationship between gender, relaxation, additional working time, exercise habits, non-ergonomic chairs, and the incidence of MSDs, but age, years of service, and body mass index have no association.
Rahayu, <i>et al.</i> (2020)	Relationship between Individual and Occupational Factors on Complaints of Musculoskeletal Disorders in Employees	Cross-Sectional	The sample population consists of 103 office employees at the Ministry of Health's Personnel Bureau, which were selected using the purposive sampling method.	Age, work period, posture, gender, BMI, physical activity, and work duration.	Based on the bivariate analysis results, there are variables related to MSDs complaint, namely age, years of service, and posture. Meanwhile, it has no association with gender, BMI, physical activity, and duration of work.
Ardahan, M. and Simsek, H. (2016)	Analyzing Musculoskeletal System Discomforts and Risk Factors in Computer-Based Office Workers	Cross-sectional	The samples were 395 government office workers in Manisa, Turkey with no history of cancer, neuropathy, or rheumatism and are currently on pain medication.	Gender, age, computer usage years, daily PC duration, non-resting duration, physical discomfort, and ergonomic knowledge.	Based on the Chi-Square statistical test and logistic regression analysis, the risk factors for MSDs were female gender, increased daily use of computers, increased working hours, and poor knowledge of ergonomics exercises.

Knowledge of Ergonomics

Workers with poor knowledge of ergonomics are at greater risk of experiencing MSDs. Furthermore, a study at Putra University Malaysia showed that the complaints were experienced by 41.2% of workers with poor understanding, while 91.2% suffering from MSDs did not attend the ergonomics training conducted in the office. The statistical analysis showed that there is a significant

relationship between knowledge and the complaints (Damanhuri *et al.*, 2014). This finding is consistent with a previous study on computer-based workers in Sri Lanka, where a significant association was observed between the 2 variables (Ranasinghe *et al.*, 2011). Similar results were also obtained among workers in government offices in Manisa, Turkey, where poor ergonomics knowledge increased the prevalence of lower back pain (Ardahan and Simsek, 2016).

Work Posture

Working in non-ergonomic postures can increase the risk of developing MSDs. A previous study on office workers at Higher Education Institutions in Nigeria revealed that improper posture, such as bending and incorrect fast movements while reaching for computer monitors, files in cupboards, or items on the floor can increase the prevalence of the condition (Okezue *et al.*, 2020). Furthermore, the statistical analysis results revealed that it has a relationship with MSDs. A similar association was also observed in a study on computer-based workers in Sri Lanka. Wrong work postures that are related to MSDs include bent head and body asymmetry, working with the shoulders raised, and performing the same movements repeatedly (Ranasinghe *et al.*, 2011).

Work Facilities

The use of work facilities that do not follow ergonomics rules can increase the incidence of MSDs complaints. A previous study revealed that inappropriate work facilities have a significant relationship with the incidence of the condition. Furthermore, workers with MSDs often express dissatisfaction with the equipment provided by their workplace. This finding is consistent with Ranasinghe *et al.* (2011) that inappropriate facilities have a significant relationship with the disorders, for example, chair designs without a back and armrests cannot be adjusted. A significant association was also observed in a study among office employee in Zonguldak, Turkey, where the use of non-ergonomic chairs and tables increased the prevalence of these complaints in the neck, shoulders, waist, and legs (Celik *et al.*, 2018). This finding is also in line with a study at the Indonesian Ministry of Health's Personnel Bureau, where people that sit on chairs that do not conform to anthropometry were more affected. This was because they have a hard texture, wide armrests, and the height of the backrest does not correspond with the body (Rahayu, *et al.*, 2020).

Working Duration

Increased duration of work causes an increase in the incidence of MSDs. Based on a study at Higher Education Institutions in Nigeria, employees that worked more than 8 hours per day (overtime) had

more complaints. Furthermore, the statistical analysis results showed that there is a significant relationship between work duration and MSDs (Okezue *et al.*, 2020). A significant association was also found in a study at Putra Malaysia University, where workers with longer working hours have high prevalence (Damanhuri *et al.*, 2014). In a study on computer users in Sri Lanka, 31.7% of complaints occurred in people that work for more than 9 hours/day. (Ranasinghe *et al.*, 2011). This finding is consistent with a previous study at the Head Office of Bank X, Pontianak City, where workers with an additional working time of more than 2 hours/day tend to experience MSDs with more severe complaints. The Statistical analysis showed that there is a significant relationship between work duration and the condition (Hardianto, Trisnawati, and Rossa, 2015). Similar findings were also obtained in Turkey, where government office employees that work continuously without rest experience more pain in their back, neck, and shoulders compared to others (Ardahan and Simsek, 2016).

Physical Activity

Lack of physical activity can increase the risk of MSDs complaints. A previous study on workers at the Bank X Head Office, Pontianak City revealed that the lack of exercise increased its prevalence (Hardianto, Trisnawati, and Rossa 2015). Furthermore, the statistical analysis results showed that there is a significant relationship between physical activity habits and MSDs complaints. Similar findings were obtained among office workers in Zonguldak, Turkey, where exercise habits in men and women significantly reduced the occurrence of the condition (Celik *et al.*, 2018).

Psychosocial

Poor psychosocial conditions in the work environment increases the risk of MSDs complaint. A previous study on workers from the Iranian Gas Transmission Company stated that psychosocial factors have a significant relationship with the condition. Furthermore, they include work balance, leadership quality, availability of human resources in specific jobs, rewards, teamwork, relationships between members, and support for workers' development (Piranveyseh *et al.*, 2016).

DISCUSSION

Age

Aging is one of the risk factors for MSDs because it causes degeneration of muscle cells as well as a decrease in their strength. It also causes a decrease in muscle mass through sarcopenia, which can lead to disability and complications in the future (Tuerah, Rumampuk and Lintong, 2020) as well as decreased elasticity of tendons, and an increase in the number of dead cells. Furthermore, aging causes a decrease in the function and capability of muscles, tendons, and ligaments, which then increase the body's response to mechanical stress as well as vulnerability to MSDs (Utami, Setyaningsih and Hemawayanti, 2018). These complaints are often experienced by the working class, namely people aged 25-65 years, and in most cases, the first symptom usually appears at the age of 35, after which the condition worsens. There is a positive correlation between aging, muscle strength, and endurance (Tarwaka and Bakri, 2016). Helmina, Diani and Hafifah (2019) revealed that nurses aged > 35 years experienced more severe complaints of MSDs, and the statistical analysis results showed that there is a relationship between age and the condition. Similar results were obtained in a study on office workers at universities in Saudi Arabia, where people >38 years had disabilities associated with the disorders (AlOmar *et al.*, 2021).

Gender

Women have a higher risk of developing MSD, and gender is a factor associated with individual muscle conditions. The ability or strength of women is only two-thirds that of men, hence, they are more prone to the disorder because their muscle capacity is physiologically low (Tarwaka and Bakri, 2016). Balaputra and Sutomo (2017) stated that there is a significant relationship between gender and MSDs complaints, and women have higher risk of developing the complaints up to the age of 60 years. Furthermore, musculoskeletal pain, which is more common in females was also found in telecommunications workers working from home and using computers in Malaysia. They complained of pain in the hands, lower back, and upper back/neck (Radulović *et al.*, 2021). Talpos *et al.* (2018) revealed that women can make the necessary efforts to reduce the risk by initiating internal ergonomic activities and exercises at home.

Knowledge of Ergonomic

Poor knowledge of ergonomics contributes to the incidence of MSDs, where workers with a good understanding have a lower risk of injury. Furthermore, knowledge, work attitude, and well-controlled working time help to reduce the risk of complaints (Ramadhani, 2021). Awareness and understanding of ergonomics and MSDs are necessary to prevent the prevalence of the condition among workers. Companies are advised to carry out promotion and prevention programs for low back pain, and the training can center around hazard ergonomics communication, avoiding awkward postures, adjusting work facilities using assistive devices, and urging workers to stretch within 5-10 minutes after 2 hours of working (Kurniawidjaja and Ramdhan, 2019).

A good understanding of ergonomics principles in the workplace helps to reduce the risk of physical injury and increase productivity (Balaputra and Sutomo, 2017). Implementing programs can effectively lower the rate of work-related complaints among the workforce. A previous study on operating room nurses, IGD, ICU, and ICCU Husada Hospital Jakarta showed that there is a relationship between knowledge of ergonomics and MSDs complaints. Furthermore, 64.9% of nurses with good understanding did not experience the complaints, while 61.5% and 100% with sufficient and poor knowledge, respectively, were affected. This finding shows that the better the understanding of ergonomics, the lesser the risk of MSDs (Utami, Setyaningsih and Hemawayanti, 2018).

Work Posture

Awkward work postures affect the occurrence of MSDs complaints among office workers. They occur when a body part is extended beyond its range of motion, which then causes muscle stretching, nerve compression (Vinothini *et al.*, 2018), stiffness and pressure in the musculoskeletal system, discomfort and pain (Dagne, Abebe and Getachew, 2020). Furthermore, office workers spend most of their working time in a static sitting position, which leads to extensive muscular activation, poor posture, and neuromuscular fatigue in the shoulders, lower back, and neck (Algarni and Alkhaldi, 2021). A study on education staff at the Faculty of Public Health showed that adopting the wrong body posture while working with a computer can influence MSDs complaints in the neck (Situmorang *et al.*, 2020).

This finding is in line with a study on administrative workers at the Jember University Headquarters, where pains were felt on the back, shoulders, arms, wrists, and neck. The statistical analysis showed that there is a significant relationship between work posture and complaints of MSDs (Dewi, 2019).

Work Facilities

The use of non-ergonomic/inappropriate work facilities contributes to the occurrence of MSDs among workers. Equipment, such as chairs and tables are often used for a long time, hence, they require an ergonomic design based on the user's body size (anthropometry) to prevent discomfort (Lubis *et al.*, 2021). The chairs must be designed with a back that can be adjusted to the waist position to support the spine. The seat height also needs to be adjusted to the size of each individual to prevent complaints in the neck and lower back (Ministry of Health, 2016). Furthermore, good ergonomic design helps to increase productivity, job satisfaction as well as reduce treatment costs and workers absenteeism due to health problems (Khan *et al.*, 2017).

Mindayani (2018) revealed that there was a decrease in MSDs complaint in the treatment group before and after the intervention, namely improving work facilities. Furthermore, a study on 307 office workers in Japan showed that inadequate facilities, such as table height, armrests on chairs, as well as the positions of the mouse, keyboard, and armrest had a significant positive relationship with elbow and wrist pain (Nakatsuka *et al.*, 2021).

Work Duration

Another risk factor associated with the incidence of MSDs in workers is the increased duration of work. Furthermore, these complaints are often felt along with daily computer usage without break due to excessive muscle contractions from heavy workloads and long working hours. The normal contraction is between 15-20% of maximum strength, and when the muscle exceeds 20%, it causes a decrease in blood circulation and oxygen supply. This can also inhibit carbohydrate metabolism and lead to the buildup of lactic acid, which causes pain (Jauhari *et al.*, 2017). Continuous extension of working hours increases the risk of injury, which can cause disability (Khan *et al.*, 2017).

A study revealed that additional two hours of prolonged sitting increases MSDs complaint in the lower back, hips, thighs, and buttocks (Baker *et*

al., 2018). Another study on employees that work for more than 52 hours/week in Korea stated that they experienced pains in the upper and lower extremities. The statistical analysis showed that there is a significant relationship between long working hours and MSDs (Lee *et al.*, 2018).

Physical Activity

Lack of physical activities affects the incidence of MSDs in workers because they contribute to the condition of the muscles. The short-term effects of proper exercise include increased flexibility, cardiac output, and lung tidal volume, while the long-term effects are increased muscle and bone mass as well functionality (Tuerah, Rumampuk and Lintong, 2020). A previous study reported that people with low body fitness are 7.1% at risk of MSDs, while values of 3.2% and 0.8% were obtained from others in the moderate and high categories, respectively. Lack of physical activity along with low body fitness leads to reduced flexibility and increases the risk of complaints (Adiatmika, 2020). Aulia, Ginanjar and Fathimah (2019) stated that there is a significant relationship between exercise habits and MSDs, where people with low habits are 3.4 times more at risk of MSDs. Physical exercise in the workplace as well as the provision of ergonomic facilities is an effective combined action in occupational health and safety to prevent musculoskeletal symptoms (AlOmar *et al.*, 2021).

Psychosocial

Poor psychosocial factors at work can also lead to an increase in the prevalence of MSDs. They are often caused by ineffective organization and management, which leads to inadequate social support, psychological aggression, conflicting demands, imbalances in work-family relationships, dissatisfaction, stress, and loss of motivation. Factors associated with MSDs include lack of appreciation, high job demands, inappropriate pay, stress, dissatisfaction, lack of work control, sleep disturbances, monotonous work, and family conflicts (Harahap and Widanarko, 2021). A poor work environment, as well as the inability to adapt to these conditions, can lead to work-related stress. Enhancement of stress can increase the relationship between physical workload and musculoskeletal symptoms (AlOmar *et al.*, 2021). It can also cause the release of norepinephrine and epinephrine, which leads to abnormal changes in heart rate and systolic blood pressure, thereby affecting muscle activity (Li

et al., 2021). Da Silva, da Silva and Gontijo (2017) examined footwear industry workers in Brazil, where stress and job dissatisfaction were the most influential psychosocial factors of MSDs complaints. This finding is consistent with a previous study on health workers in Switzerland, where it was significantly associated with the condition (Hämmig, 2020). People with higher job stress tend to respond more to uncomfortable symptoms or pain. This factor also affect their workability and adaptability, thereby increasing the risk of MSDs (Van Eerd *et al.*, 2016).

CONCLUSION

The significant risk factors for MSDs in office workers include increasing age, female gender, increased work duration, poor knowledge of ergonomics, wrong work posture, non-ergonomic support facilities, lack of physical activity, and inadequate psychosocial conditions at the workplace.

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