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A LITERATURE REVIEW ON WORK-RELATED MUSCULOSKELETAL DISORDERS AMONG PROLONGED STANDING OCCUPATIONS

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ABSTRACT

Background: *Prolonged standing at work raises the risk of developing work-related musculoskeletal diseases (WRMSDs) in workers. According to studies, extended standing causes pain, discomfort, tiredness, and a variety of other musculoskeletal disorders. The goal of this literature review is to guide future research and interventions to promote musculoskeletal health in the workplace, and to further our understanding of WRMSDs among individuals in standing employment by synthesizing the available information.*

Study design: *Systematic Review.*

Objective*: This overview of the literature was conducted to identify the occurrences of musculoskeletal problems linked to long-term standing occupations.*

Method*: The randomized controlled studies, systemic reviews and experimental studies that included evaluations of the information that was available on musculoskeletal disorders associated with prolonged standing at work in long-standing occupations were gathered by the authors through searches on PubMed and Google Scholar. The entire texts of the articles were gathered. 20 out of a total of 53 recognized articles were selected for review.*

Results: *All of this research points to the adverse effects that long-standing at work has on musculoskeletal health. Long-standing relates to pain, exhaustion, and a various kind of musculoskeletal disorder in settings ranging from industrial enterprises to schools.*

Conclusion: *In conclusion, this review confirms that prolonged standing at work significantly increases the risk of musculoskeletal disorders, causing pain, discomfort, and fatigue among workers in various occupations. Comprehending these hazards is essential for implementing efficient interventions and ergonomic fixes to enhance employees' well-being.*

Keywords: *Work-related musculoskeletal disorder, pain, discomfort, standing occupations.*

INTRODUCTION

A wide spectrum of inflammatory and degenerative conditions that cause discomfort and functional impairment affecting the neck, shoulders, elbows, wrists, hands, lower back and legs are collectively referred to as work-related musculoskeletal disorders. Musculoskeletal disorders associated with work are regarded as a serious occupational health issue that lowers productivity and working capacity in the working population. According to the Oxford Dictionary, "standing" refers to being straight and supported by one's feet, and "prolonged" refers to maintaining the same position for a longer period than usual. "Prolonged standing" is defined as a work environment in which employees must maintain a standing posture for the majority of their shift and spend more than half of their working hours in this posture. When there is no movement, prolonged standing can be very detrimental; nevertheless, even little motions within a one-meter radius can improve worker health. Over four hours day of standing and more than an hour without getting away from one's desk is referred to as extended standing by the Dutch Health Council.[2]

Musculoskeletal disorders associated with work are regarded as a serious occupational health issue that lowers productivity and working capacity in the working population. Risks associated with repeated motions, bad posture, pushing and transporting heavy weights, carrying large objects, and bending are experienced by workers in a variety of industries and occupations. The risk of musculoskeletal injuries rises with exposure to certain risk factors. The degree and length of exposure, in addition to the work environment, all influence the likelihood of health hazards.[9]

WRMSDs are excruciating conditions affecting the ligaments, tendons, and muscles. The main causes are uncomfortable working postures and repeated tasks. Muscles, tendons, and nerves are the soft tissue types that are typically damaged. When a muscle contracts, lactic acid from the blood is produced, building up within the muscle and causing irritation and discomfort. A robust, fibrous collagen structure called a tendon connects

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muscle to bone. It is neither elastic nor flexible. It falls into two categories: sheathed tendons, which are found in the hands and wrist, and unsheathed tendons, which are located in the shoulder, elbow, and forearm. Cells within the sheaths generate a fluid. This liquid lubricates the joint between the muscle and the tendon. The tendon becomes inflamed and swollen between the tendon and sheath when it moves too much or repetitively, which inhibits lubrication and may not generate enough fluid for it. Owing to the thickening of the tendon sheath caused by fibrous tissue growth, recurrent inflammation inhibits tendon mobility.[9]

Workers are prone to weariness and injuries due to the fact that their occupations necessitate them to use the same muscles and tendons repeatedly throughout the day. Repetitive motions can be dangerous when the same joints and muscle groups are used repeatedly, rapidly, and for extended periods. Performing repetitive tasks in an uncomfortable posture is the primary cause of musculoskeletal disorders .[9]

When joints are repeatedly functioned outside of the neutral position for prolonged periods of time without adequate rest, the likelihood of developing a musculoskeletal condition rises. The physical strain brought on by maintaining the same position or posture for an extended amount of time is known as static posture. Fatigue is a result of the increased load or stresses that these kinds of exertions place on the muscles and tendons. Long-term static postures cause workers' muscles to stiffen up while they are working without a chance to relax. Injuries might result from repeatedly adopting this stationary position.[9]

Muscle cramps, varicose veins and foot and ankle issues are the results of prolong standing. When standing for an extended amount of time, muscles must maintain the posture of the body. This causes the muscles blood vessels to constrict, lowering the amount of blood flowing through them. Inadequate blood flow causes muscles to become more easily fatigued and more vulnerable to damage.[2]

Blood pooling was the most often mentioned mechanism for lower extremities discomfort after extended standing. Extended standing times have been linked to higher amounts of blood flow, skin temperature, and leg volume, perhaps exacerbating the beginning of musculoskeletal complaints.[10]

Long periods of standing can also cause static spasms in the legs and back, which can exacerbate lower back discomfort by transferring the weight of the upper body to the lower extremities.[14]

METHODOLOGY

Study design: It is a systematic review, which was described according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)

Eligibility criteria:

Inclusion criteria:

- Articles were included from year 2010 to 2023.
- Articles include the incidence of workplace musculoskeletal disorder due to long periods of standing in different occupations.

Exclusion criteria:

- Articles before the year 2010 not be included.
- No pathological disorders, fractures, or neurological conditions were included which caused work-related musculoskeletal disorders.

Information sources: Internet-based search engines that were used to collect journals are Google Scholar, PubMed and ScienceDirect. Journals from the year 2023 -2010 were searched

Search strategy: Internet-based search engines that are used to collect journals are Google Scholar, PubMed and ScienceDirect.

Selection process: The authors identified articles according to the keywords. The whole text of the articles was gathered. A total of 53 articles were collected and only 20 articles were used in this study for the research. Articles were included from year 2010 to 2023. Articles include the incidence of workplace musculoskeletal disorder due to long periods of standing in different occupations.

Data collection process: The randomized controlled studies, systemic reviews and experimental studies that included evaluations of the information that was available on musculoskeletal disorders associated with prolonged standing at work in long-standing occupations were gathered by the authors through searches on PubMed and Google Scholar.

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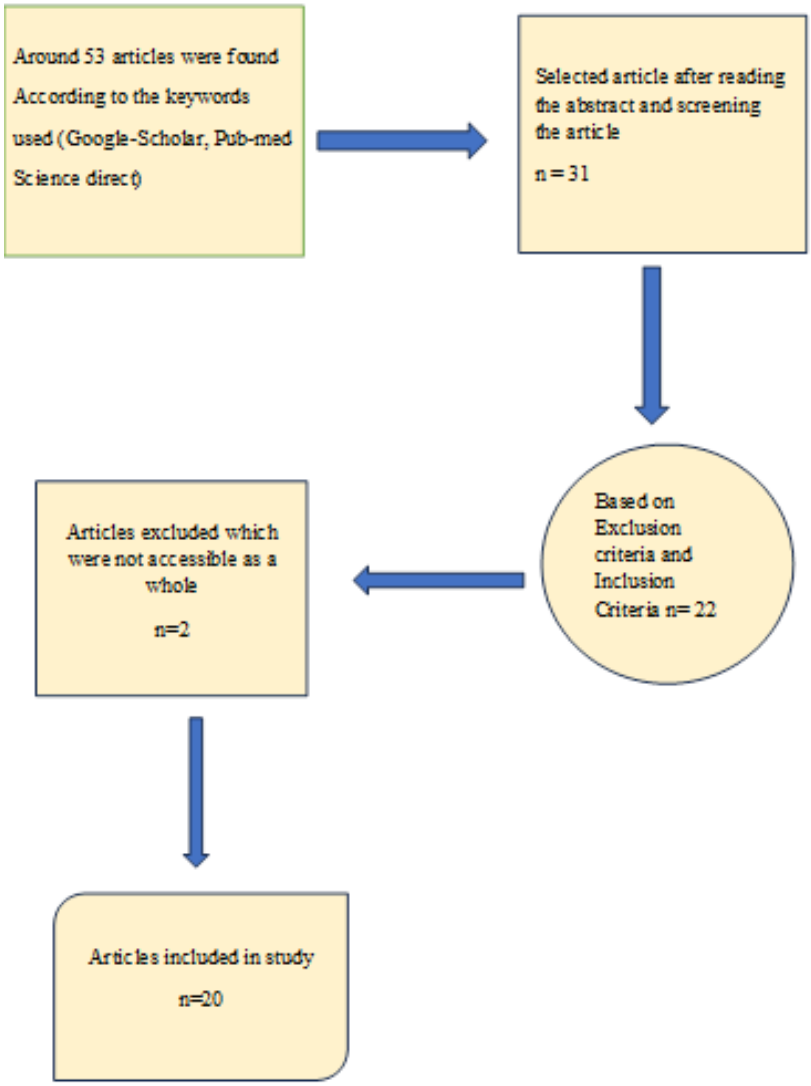
Study Flowchart



REVIEW OF LITERATURE:

- **Hoon Jo, One-bin Lim et al 2021**; conducted a study on the Negative Impacts of Prolonged Standing at Work on Musculoskeletal Symptoms and Physical Fatigue. This study sought to ascertain the consequences of varying durations of standing work on the potential for low back discomfort, lower extremity muscle soreness, and general body exhaustion, taking into account exposure to risk variables and rest periods. Their findings demonstrated that, even after adjusting for a number of factors, the incidence of lower extremity muscular discomfort rose significantly with the length of time spent standing.[1]
- **Nicolien de Langen et al 2020,** investigated the hazards and health effects of extended standing at work. Frequently standing for extended periods can cause weariness and discomfort in the feet, lower back, and lower limbs. It is linked to low blood pressure, leg pain, premature birth, musculoskeletal pain, chronic venous insufficiency, and spontaneous abortions. The worst cases of prolonged standing occur when there is little to no movement; even modest motions within a one-meter radius can improve worker health.[2]
- **Ayuni Nabilah Alias et al 2020**, conducted a study on Does Prolonged Standing at Work Among Teachers Associated With Musculoskeletal Disorders (MSDs).This study reviews the MSDs that result from standing for extended periods and disseminates information about current ergonomic and non-ergonomic strategies to reduce standing for pain that lasts for a long time. Teachers frequently stand for prolonged lengths of time, which can cause soreness, weariness in the muscles, and even musculoskeletal illnesses (MSDs). It is recommended to maintain the same posture for over half of the working hours which is known as prolonged standing. This could result in muscle discomfort and exhaustion by the end of the workday., which may eventually compromise posture.[3]

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- **Fatima Bashir et al 2020,** conducted a study on Frequency of Work-Related Musculoskeletal Disorders of Lower Extremity Among Construction Workers. Lower extremity pain from musculoskeletal (MSK) disorders is a significant occupational danger for construction workers. Because labourers must perform heavy lifting, constant bending, twisting, prolonged standing, and uncomfortable sitting. 20 people (13.2%) reported having hip discomfort, 25 had knee pain (16.6%), and 29 reported ankle/foot pain (19.9%). Age and the kind of work has a strong correlation with lower extremity discomfort. Due to the nature of their work, construction workers frequently have lower extremity musculoskeletal pain.[4]
- **Olanrewaju O Okunribido. David Lewis et al 2020,** examined lower limb musculoskeletal disorders at work and their impact on quality of life. Their findings emphasized the prevalence of lower limb disorders in various workplace settings and highlighted the economic and social impacts of these injuries, stressing the importance of preventive measures to reduce lost productivity.[5]
- **Zutiqa Aqmar Yazuli1 et al 2019** conducted a study on Discomfort, fatigue and work-related musculoskeletal disorders associated with prolonged standing among Malaysian manufacturing workers: A mini - review. Extended periods of standing, particularly in the absence of sufficient rest, may lead to weariness, musculoskeletal disorders (WMSDs), and soreness in the muscles. Pain can arise from awkward standing positions, and extended standing can cause muscle exhaustion as early as ninety minutes. Additionally, research shows that muscular soreness gets greater with time, especially during the first 30 and 90 minutes of standing. The body sections commonly afflicted include the foot, ankle, upper back, lower leg, hips, and lower back.[6]
- **Amara Afzal, Qaseem Idrees et al 2018**, conducted study on Prevalence Musculoskeletal Disorder of Lower Quadrant among teachers**.** The aim of this article is to determine how common lower quadrant musculoskeletal disorders are among educators. A questionnaire was utilized in this cross-sectional research to collect data from 184 school teachers, and the NPRS was accustomed to gauge each teacher's level of discomfort. Findings: Of the 184 participants, 60 reported low back discomfort, 15 pelvic pain, 26 knee pain, and 22 ankle/foot pain. In conclusion, the job routines of teachers lead to the development of musculoskeletal disorders. Musculoskeletal disorders are caused by prolonged work hours and uncomfortable standing positions.[7]
- **Jae-Gwang Lee, Guang Hwi Kim et al 2018,**investigated the association between long working hours and work-related musculoskeletal symptoms of Korean wage workers using data from the Fourth Korean Working Conditions Survey (KWCS). Furthermore, in the previous year, 26.4% of male participants and 33.0% of female participants experienced upper limb pain due to their jobs, whereas 16.4% of male participants and 23.4% of female participants reported lower limb pain. The study demonstrated the link between extended work hours and musculoskeletal symptoms linked with the workplace by showing that the frequency of upper and lower extremities pain rose in both genders as weekly working hours increased.[8]
- **Leela Paudel et al 2018**, examined musculoskeletal complaints among traffic police officers that were related to their jobs. Considering that they have to stand for extended periods of time while on duty, traffic cops frequently run health hazards. Workers who adopt static postures, where they stay remaining stationary for protracted lengths of time, put more strain on their muscles and tendons, increasing the risk of tiredness and injury. Varicose veins, foot issues, and leg tiredness can all result from prolonged standing. Moreover, it lessens the blood flow to the muscles, hastening their tiredness and making them more susceptible to harm.[9]
- **Coenen, P. and Parry, S. et al 2017,** A systematic evaluation of laboratory studies on the health effects of extended standing was carried out in 2017 by Coenen, Parry, and associates. Long hour of standing has been associated to negative health effects, such as venous problems of the lower extremities, issues during pregnancy, and musculoskeletal complaints like pain and stiffness. In particular, there was a negative correlation found between extended standing and low back pain, however there was conflicting data for lower extremities pain.[10]
- **Shaikh Abdus Samad et al 2016,** reviewed the issue of workers in manufacturing businesses who must stand for extended hours of time in 2016. Such professions require a lot of standing, which can cause a several health problems, such as stiff neck and shoulders, low back discomfort, muscular exhaustion, varicose veins, aching feet, and leg swelling. Industrial workers frequently experience pain, which lowers their productivity. Prolonged standing can cause work-related musculoskeletal diseases (WMSD), which

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can affect muscles, tendons, nerves, and supporting structures. These disorders can cause pain, discomfort, swelling, numbness, and other symptoms.[11]

- **Edda Maria Capodaglio 2016,** assessed the postural risks associated with prolonged standing among garment sales associates. Their study identified potential interventions to prevent lower limb fatigue, such as postural adjustments and ergonomic workstation design. They emphasized the real risk of discomfort and musculoskeletal disorders in occupations requiring prolonged standing, underscoring the need for ergonomic interventions to protect worker health.[12]
- **Thomas R. Waters, Ph.D. and Robert B. Dick, Ph.D. et al 2015 ,** A review of the health hazards and interventions associated with standing for long periods of time at work was carried out in 2015 by Thomas R. Waters and Robert B. Dick. According to the research, even brief static standing sessions as little as thirty minutes can cause pain, discomfort, and physical exhaustion. Furthermore, age affects how people react to standing for extended periods. In conclusion, a wealth of research points to a negative correlation between extended standing at work and health outcomes.[13]
- **Ahmad Alghadir, PT, et al 2015.** Investigated musculoskeletal disorders associated with dentistry professionals' jobs. Their objectives were to ascertain the frequency of these illnesses, their contributing variables, and their effects, and suggested preventive actions. The study brought to light the high frequency of musculoskeletal problems related to the workplace among dental professionals, which can have an impact on their day-to-day activities and occasionally require adjustments to their work environments.[14]
- **Isa Halim et al 2012** created the Prolonged Standing Strain Index (PSSI) in 2012 to evaluate the risk levels related to standing work. Standing for long periods can lead to pain and weariness in the muscles, particularly in the legs and back. The PSSI takes into account several risk variables associated with standing occupations, including whole-body vibration, working posture, muscular activity, length of standing, holding time, and indoor air quality. The PSSI measures the degree of risk by multiplying these parameters by the multipliers that are assigned to them. Based on the PSSI, the study suggests precautions to reduce these risks, but it also points out that more investigation is required to confirm these measures' efficacy.[15]
- **Isa HALIM, Abdul Rahman et al 2012 ,** studied the effects of prolonged standing on production workers' psychological and physical exhaustion in 2012. In order to assess psychological exhaustion, they employed questionnaire surveys and surface electromyography (sEMG) measurements to examine lower extremity muscle activation, namely in the erector spinae, tibialis anterior, and gastrocnemius. The results showed that extended standing caused psychological weariness in all of the male manufacturing workers, while sEMG readings also confirmed physical fatigue. As a result, the study found that these workers' prolonged standing caused both psychological and physical exhaustion**.**[16]
- **Isa Halim & Abdul Rahman Omar et al 2011,** reviewed the health impacts, evaluation techniques, and preventative actions associated with extended standing in industrial settings in 2011. If a worker spends more than 50% of their working hours standing, they are said to be exposed to prolonged standing. This prolonged standing can cause discomfort by wearing down your muscles, particularly in your legs and back. The analysis comes to the conclusion that extended standing is linked to a number of health issues, including musculoskeletal diseases related to the job**.** [17]
- **Christopher R. Reidet et al 2010,** conducted a review on occupational postural activity and lower extremity discomfort. The study examines the main extrinsic factors associated with profession that produce discomfort on the job. These factors include individual joint position, whole or partial body posture, and occupational activity. The review's findings show that the three joints or segments most impacted by work postures are the knee, lower leg, and foot. The hip, lower leg, ankle, and foot appear to be commonly impacted by work-related activities. Study reviews indicate that stooping positions have the greatest impact on LE.[18]
- **Robert A. Werner et al 2010,** determine risk factors for foot and ankle problems linked to extended standing and walking. Werner studied assembly line workers in 2010. The study discovered a correlation between a higher risk of foot and ankle diseases and variables such as greater metatarsal pressure while walking and increased walking time**.**[19]
- **Anil Sobti, MB, Cyrus Cooper et al 2010,** studied the relationship between physical activity at work and musculoskeletal discomfort in 2010. They polled 5,042 retired post office workers in their 70s and 75s. Over a month, 20–50% of individuals in the study reported having pain or stiffness in various

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musculoskeletal regions, including the knee, hip, shoulder, hand, or lower back. Women experienced these sensations more frequently, and they frequently happened in groups at various locations. [20]

DISCUSSION

The findings presented in the study possess important ramifications for policy, practice, and research. First of all, they highlight how vital it is to take preventative action to mitigate the negative consequences of extended standing on the health and well-being of workers. To reduce the incidence of musculoskeletal problems, this involves implementing ergonomic solutions including sit-stand desks and frequent rests. Furthermore, the results highlight the need to educate employers and workers about the risks associated with extended standing and the necessity of implementing preventative measures.

The 2021 study by Hoon Jo et al. revealed that long periods of standing at occupation led to increased risks of low back discomfort, lower extremity muscle ache, and whole-body fatigue. Workers in the manufacturing sector reported higher rates of plantar fasciitis and lower limbs muscle tightness due to long period of standing. Checkout counter workers, who often stand for extended periods, experienced elevated rates of lower limb and ankle/foot discomfort. Additionally, the study highlighted that awkward or unsafe standing postures contributed to work-related musculoskeletal pain.

In 2020, Nicolien de Langen and colleagues investigated the risks and consequences on health linked with prolonged standing work. They investigated that working for over 8 hours regularly while standing was linked to many health issues, such as persistent venous insufficiency, musculoskeletal pain, preterm birth, low blood pressure, and upper and lower leg pain. The study emphasized the importance of incorporating movement within a restricted radius to mitigate the adverse effects of prolonged standing.

A 2020 study by Fatima Bashir et al. explored the frequency of musculoskeletal problems linked with construction workers who faced demands such as heavy lifting, repetitive bending, twisting extended standing and uncomfortable seating. The research revealed an increased frequency of musculoskeletal discomfort in the lower limbs among construction workers, highlighting the significant impact of their occupational demands on their health. The 2020 study by Ayuni Nabilah Alias et al. focused on the discomfort, muscle fatigue, and musculoskeletal disorders (MSDs) resulting from prolonged standing in classrooms, particularly among school teachers. The research found that teachers, due to their prolonged standing during school hours, often experienced body pain and discomfort, which could lead to MSDs.

In 2019, Zutiqa Aqmar Yazuli et al. assessed discomfort, fatigue and musculoskeletal problems associated with the workplace among Malaysian manufacturing workers. Prolonged standing was identified as a leading contributor to muscle discomfort and fatigue, especially in the back and lower extremities.

A 2018 study by Amara Afzal and Qaseem Idrees examined the incidence of musculoskeletal conditions in the lower quadrant among teachers. The research found that long job durations and prolonged periods of standing in uncomfortable positions were contributing factors to musculoskeletal disorders among teachers. In2018, Jae-Gwang Lee and Guang Hwi Kim carried out research on the relationship between Korean wage earners' lengthy work hours and musculoskeletal ailments related to their jobs. The study emphasised the negative effects of extended workdays on employees discomfort in their legs and upper extremities'. In 2018, Leela Paudel and colleagues conducted a study to examine musculoskeletal complaints associated with job among traffic police officers, who frequently stand for extended periods of time. The study found that discomfort and weariness were common among traffic cops, highlighting the significance of extended standing, still positions, and repeated motions as risk factors.

In 2017, Coenen, P. and Parry, S. et al. conducted a systematic review on the associations of prolonged standing with musculoskeletal symptoms. The review underscored the adverse impacts on health associated with prolonged standing, including lower extremity venous disorders, perinatal health complications, and musculoskeletal symptoms.

Thomas R. Waters, Ph.D., and Robert B. Dick, Ph.D., presented a report in 2015 that demonstrated the health hazards and efficacy of interventions related to long hour of standing at work. The study covered consequences of extended standing on cardiovascular issues, weariness, discomfort, lumbar and lower extremity pain, and pregnancy-related health consequences. In order to lessen the risks associated with extended standing, it also suggested interventions such as floor carpets, sit-stand workstations, shoes, shoe inserts, and hosiery or stockings. Additionally, a study conducted in 2015 by Ahmad Alghadir, PT, et al. looked at musculoskeletal diseases associated with the dental profession in Saudi Arabia. The study found that long periods of standing

and other work-related variables commonly caused dental practitioners to feel pain in different parts of their bodies.

Isa Halim created the Prolonged Standing Strain Index (PSSI) in 2012 to measure the dangers connected to standing occupations and to suggest ways to reduce them. The study emphasized how crucial it is to Frequently take breaks from extended standing and wear appropriate footwear to avoid weariness and pain.

Isa Halim and Abdul Rahman Omar's 2011 research shed light on the negative health impacts of standing for extended periods at industrial jobs. The study made clear that extended standing may cause pain and exhaustion in the muscles, particularly in the back and legs, even though it facilitated mobility and efficient functioning. Extended standing has been connected to work-related musculoskeletal diseases (WMSD), which are brought on by severe strain at work on the body and mind and develop over time.

An analysis of lower extremity discomfort and occupational postural activity was carried out in 2010 by Christopher R. Reid and colleagues. Their analysis revealed that distinct lower extremity regions were impacted by diverse work-related postures and activities, with the foot, lower leg, and knee being the most frequently afflicted.

Finally, in order to investigate the connection between musculoskeletal pain syndromes and occupational physical activity, Anil Sobti and Cyrus Cooper surveyed post-office pensioners in 2010. According to the survey, a sizable fraction of retirees had musculoskeletal complaints, which included pain or stiffness in the knee, hip, shoulder, hand, and lower back, among other body parts. By highlighting links between particular occupational activities and regional pain syndromes, the study emphasized the necessity of workplace preventive measures to lower the frequency of musculoskeletal illnesses.

LIMITATIONS AND PROSPECTS FOR UPCOMING STUDIES

It is crucial to recognise the inherent constraints of the studies presented in the table. Small sample sizes, the application of self-reported data, and possible confounding variables are a few examples of these. Future studies should use bigger sample sizes, longitudinal study designs, and objective measures of musculoskeletal health in an effort to overcome these limitations. More studies that concentrate on certain occupational groups and examine the efficacy of various interventions in the therapy and avoidance of musculoskeletal disorders connected to the place of employment are also required.

CONCLUSION

In conclusion, all of this research points to the negative consequences of extended standing at work on musculoskeletal health. Long hours of standing have been connected to weariness, discomfort, and various muscular-skeletal disorders in settings ranging from manufacturing enterprises to schools. Comprehending these hazards is essential for implementing efficient interventions and ergonomic fixes to enhance employees' well-being.

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