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Original Research Article

Prevalence of foot problems associated with wearing safety footwear in factory employees

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ABSTRACT

Background: In majority of heavy industries and factories safety footwear is a mandatory safety obligation, thus a necessity for workers in industrial settings, contributing to foot problems, interfering with work capacity. Therefore, there is an urgent need to find prevalence of foot problems occurring due to safety footwear. To find the prevalence of foot problem associated with wearing safety footwear in factory employees.
Methods: Factory employees working in industrial setting wearing safety footwear for prolonged duration on regular basis were included in the study. Subjects having any recent ankle and below knee fractures in last 6 months were excluded. Samples were collected from different industrial settings, with the help of a self-made questionnaire. Descriptive analysis of the data collected was done and the responses were converted into percentiles and represented in graphical form.
Results: 62.50% subjects complain pain in the heel and bottom of the foot (plantar fasciitis), 50.83% pain in the foot (radiating up to calf), 47.50% excessive heat/wet condition, 30.83% hard dead skin on the pressure areas of the foot (foot corn), 12.50% blisters/swelling on the foot, bump/bulge on the joint at the base of the big toe (bunion), numbness of great toe, 10.83% interference with blood circulation. 43.34% employees the intensity of pain caused by wearing safety footwear interfere with their working capacity. For 43.34% employees the intensity of pain caused by wearing safety footwear interferes with their working capacity.
Conclusions: It can be concluded that there is significant prevalence of foot problems caused due to wearing safety footwear. These foot problems limit the working capacity of the individual.

Keywords: Prevalence, Foot problems, Safety footwear

INTRODUCTION

Specialized footwear has been developed to enhance the safety and performance while an individual is involved in workplace activities.[1] The common components of various shoe types The American Academy of Orthopedic Surgeons has provided (AAOS, 2010) such as: toe box, sole, heel.[1]

To abide by the Occupational Safety and Health Administration (OSHA), protective footwear is included in the Personal Protective Equipment (PPE) section of the OSHA.[2] OSHA defines this type of protective shoe wear as: "having impact-resistant toes and heat resistant soles, the metal insoles to protect against puncture wounds, safety shoes may also be designed to be electrically non-conductive.[3] According to American National Standards

Institute (ANSI) minimum compression and impact performance standards in ANSI Z41 - 1991 (American National Standard for Personal Protection-Protective Footwear) or provide equivalent protection.[3]

In industries such as: electrical, mechanical, oil and gas industry, glass factory, chemical industry, cement industry, power plant and occupations such as: technicians, mechanics and services, safety footwear have to be worn as a mandatory safety obligation.[4] Foot injuries caused by puncture and compression events on work site are not rare.[5] Employees involved in heavy industries are potentially prone to many injuries in working conditions.[6] Footwear plays a vital role in progression of foot and toe problems like bunions, plantar fasciitis, etc.[7] Painful feet due to wearing safety footwear for prolonged working hours can be crippling and can disrupt in a productive working life.[8] Foot pain is the commonest problem being treated by the physical therapist.[7] Easy fluid movements in the workplace with the worker with foot problems being more vulnerable to slip, trips and falls (STF).[8] Accidents are the primary cause of numerous injuries, both in and out of the workplace.[9] Harder soled footwear provides less available friction, implying the greater risk for slip.[10] Safety footwear with a lower hardness of outsole gives a higher coefficient of friction.[11] Injuries to the ankle, foot and toes of workers working in the hazardous environment are common.[12]

METHODS

A self-made questionnaire was designed by authors and was validated. After ethical approval from the Institutional Review Board, 120 factory employees working in heavy industries and factories where wearing safety footwear is a mandatory obligation were invited to participate in the study through Google forms. It was a cross sectional observational study in which informed consent was taken from each participant and given brief introduction about the research preceded by handing out the questionnaire to be filled. In this study employees wearing safety footwear for prolonged duration on regular basis for 8-9 hours per day were included and participants with recent ankle and below knee fractures in last 6 months were excluded.

Statistical analysis

Descriptive analysis of the data collected was done using Microsoft Office Excel. The responses were converted into percentiles and represented in graphical form.

Ethical approval

The manuscript has been read and approved by all the authors, that the requirements for authorship as stated have been met, and that each author believes that the manuscript represents honest work.

RESULTS

120 factory employees working heavy industries and factories wearing safety footwear more than a year were included in the study with age group of 20-68 years, mean age: 42.633, standard deviation: ±8.661 with working duration of 6-12 hours, mean working duration: 9.275, standard deviation: ±1.533.

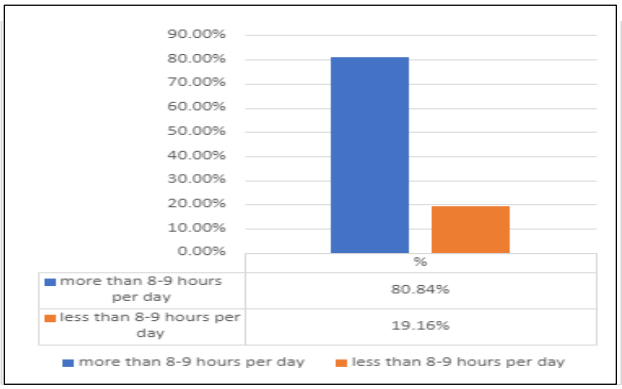

Figure 1: Average for how many hours per day do you wear safety footwear.

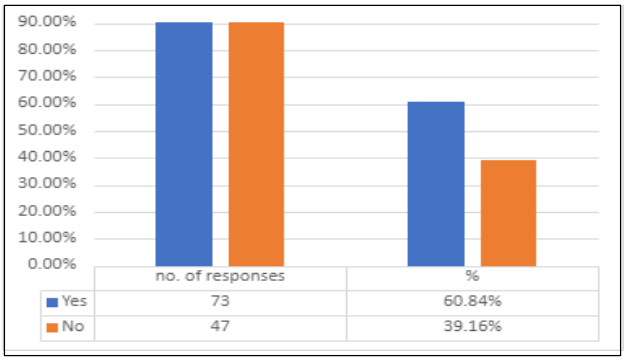

Figure 2: Do you have specifically designed footwear for the factory or industry you work in?

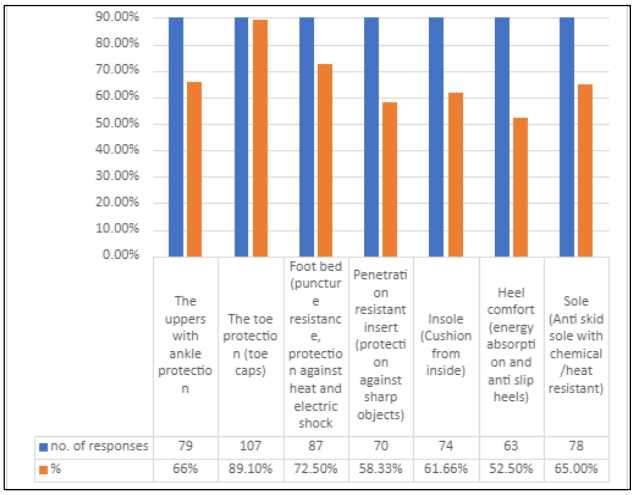

Figure 3: Does your safety footwear have the following; kindly select the appropriate?

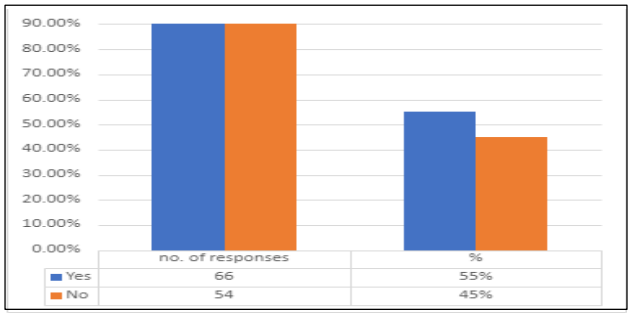

Figure 4: Does your safety footwear cause excessive pressure to your foot?

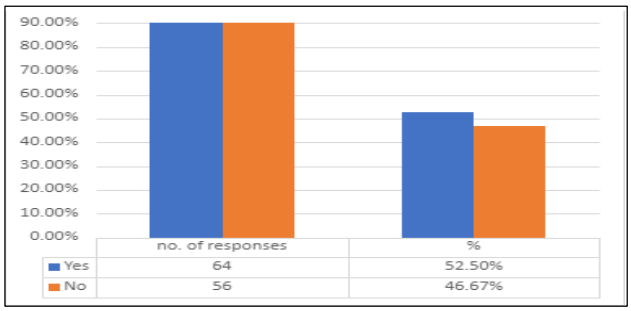

Figure 5: Is your footwear weight comfortable for your foot?

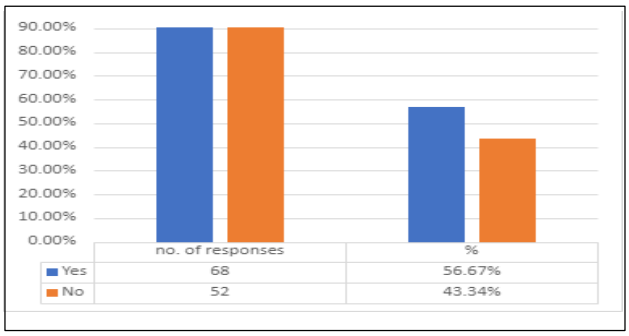

Figure 6: Are you aware of the foot problems that are caused by the wearing of safety footwear?

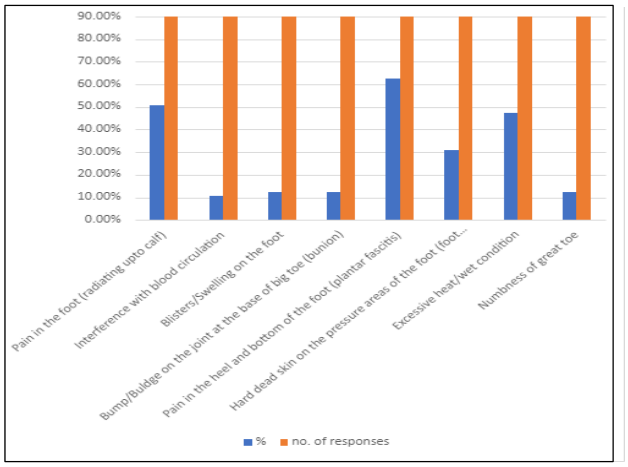

Figure 7: Kindly select the appropriate foot problems that affects your working capacity?

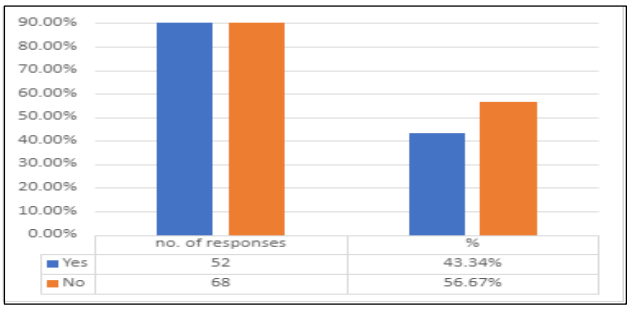

Figure 8: Does the intensity of pain interfere with your work?

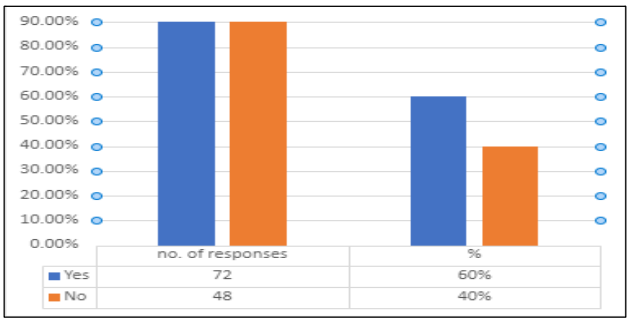

Figure 9: Do you change your footwear every 8-10 months?

DISCUSSION

The current study provides the prevalence of foot problems associated with wearing safety footwear in factory employees. Employees from 10 different industries/factories were selected which included: electrical, mechanical and chemical engineers, oil and gas factory employees, glass factory employees, mechanic, cement industry employees, power plant employees, technicians and services.

From the study conducted out of 120 employees, graph 1 indicates 80.84% factory employees wear safety footwear more than 8-9 hours per day 19.16% factory employees wear less than 8-9 hours per day, which states that many of the employees have to wear the safety footwear for prolonged duration which can cause excessive weight, pressure and varied temperatures (excessive sweat/wet condition) inside the safety footwear, that can contribute to be the reason for foot problems. Graph 2 depicts that 60.84% employees do have specifically designed safety footwear whereas 39.16% employees do not have specifically designed footwear for the industry they work in. This can be rationalized due to ignorance/unawareness or the funding problems in many industries/factories, where they are unable to provide their employees with the required safety footwear that are needed, whereas, who are aware of the foot problems that are caused by wearing the safety footwear, appears to have specifically designed footwear.

Graph 3 shows the percentages of the parts of the safety footwear majority of the employees have in their safety footwear. This indicates that majority of the employees are well aware of the anatomy of the safety footwear which is important while selecting the footwear, to wear for regular basis in the industry/factory they work in, highest being: The toe protection (toe caps) 89.10%, foot bed (puncture resistance, protection against heat and electric shock) 72.50%, the uppers with ankle protection 66%, sole (anti-skid sole with chemical/heat resistant) 65%, insole (cushion from inside) 61.66%, penetration resistant insert (protection against sharp objects) 58.33%, heel comfort (energy absorption and anti-slip heels) 52.50%.

In this study graph 4 shows, for 55% employee's safety footwear does cause excessive pressure to their foot whereas for 45% employees it does not. Rather a study done by Marr et al, conducted in Australia from 1990 to 1991 stated subjects were concerned that pressure from steel toe-cap caused foot problems.[6,8] This difference could be attributed to the subjects who suffer from the excessive pressure can be generalized under the category of not having specifically designed footwear for the industry they work in, whereas the employees that have specifically designed safety footwear, do not suffer from this problem.

In a study done by Marr et al, conducted in Australia from 1990 to 1991 stated that subjects reported concern regarding the weight of the safety footwear.[6,8] Similarly study done by Mancuso et al, conducted in Italy in 2017 stated that subjects were concerned with weight of the safety footwear that caused the foot problem.[10,15] In this study, graph 5 indicates that for 52.50% employees, the weight of their safety footwear is comfortable for their foot, whereas for 46.67% employees it is not. This can be associated with the varied conditions the employee is working in such as; the employees who work in cement industry or technicians require heavy safety footwear which has extra protection against anti shock and anti-slip agents, whereas the industries where heavy safety footwear is not required but the employees are needed to wear the heavy safety footwear, in such individuals weight of the safety footwear can contribute to foot problem. Graph 6 shows the percentage of the employees aware of the foot problems that are caused by wearing the safety footwear. 56.67% employees are aware of the problems whereas 43.34% employees are not. This can be explained by majority of the employees knowing about the important anatomy of the safety footwear required while selecting the footwear to prevent foot problems.

Graph 7 in this study shows that 62.50% subjects complain pain in the heel and bottom of the foot (plantar fasciitis) which can be caused by the hard foot beds or insoles or damaged heel comfort which can be found in worn-out safety footwear. 50.83% have pain in the foot (radiating up to calf), the source of this problem being weight and pressure of the safety footwear. 47.50% complain excessive heat/wet condition, the origin of this cause being the prolonged 8-9 hours of wearing safety footwear by the individual. A study done by Ochsmann et al, in 2016, the most frequently reported shoe concerns by the employees working in the factories are: the hot/wet conditions inside the safety footwear followed by weight, fit with narrowness and poor sole flexibility.[13] 30.83% suffer from hard dead skin on the pressure areas of the foot (foot corn), this could be due to heavy penetration resistant insert and worn-out soles that puts pressure over the points of the sole of the foot. 12.50% suffer from blisters/swelling on the foot, caused by varied temperature conditions inside the safety footwear along with misfit safety footwear. In a study conducted by Schwarzkopf et al, in 2011 in New York that states improper footwear fit can lead to pain, ulcers and similar foot problems.[14] 12.50% complain bump/bulge on the joint at the base of the big toe (bunion) and 12.50% numbness of great toe, due to presence of the toe protection (toe cap) inside the safety footwear. 10.83% complain interference with blood circulation, the root cause being the misfit safety footwear which can be too narrow for the individual's foot, thus hampering with the proper blood circulation to the foot. This differs from the study done by Marr et al, conducted in Australia from 1990 to 1991 stated that the most important shoe concern reported were excessive heat; inflexible sole.[6,8]

Similarly, a study conducted by Mancuso et al, in Italy in 2017 stated that the most important shoe concerns were hot/wet condition inside safety footwear; fit; narrowness and poor sole flexibility.[10,15] This can be accounted to the designing of the safety footwear the employees wear on regular basis, for prolonged duration as recorded in this study for more than 8-9 hours per day. The more the contents in the safety footwear, the more the chances of foot problems to occur can be recorded, thereby increasing the weight of the footwear and causing pressure over the foot, thus leading to above listed problems of foot. A study conducted by Mancuso et al, in 2017, state that safety footwear can contribute to new foot problems or negatively affect existing ones, therefore there is an urgent need to discuss changes to the design, steel toe caps, soles and other aspects of safety footwear.[15]

Graph 8, 43.34% employees the intensity of pain caused by wearing safety footwear interfere with their working capacity, whereas for 56.67% employees it does not. This can be explained with, excessive weight and pressure to the foot caused by the safety footwear, along with continuous wearing of safety footwear in addition to foot and footwear size mismatch. Graph 9, shows the percentage of employees changing their footwear every 8-10 months. 60% of the employees do change their footwear whereas 40% do not, indicating the awareness amongst the employees, of preventing foot problems caused by wearing worn out safety footwear.

Clinical implication

It is noted that the employees are ignorant about their safety footwear that can contribute to be one of the main reasons to have foot problems. Also, the industries who are unaware/do not have sufficient funds to provide specifically designed safety footwear to their employees., can contribute to limit their employee's working capacity. Hence, there is an urgent need to educate the individuals as well as the industries and factories who are unaware of the foot problems that are caused by wearing safety footwear. The importance of selecting a proper safety footwear for the specific industry or factory, by the employee is very important to avoid the foot problems associated with it.

Limitations

Proper assessment of the safety footwear owned by the individuals could not be recorded. The problems recorded by the individuals could not be assessed physically, if they happened to be present in the individual. Also, the industries they work in could not be assessed, as to what type of specific safety footwear is required for that industry, they work in. In addition to the above listed limitations, it could not be recorded whether the safety footwear owned by the individuals were provided to them by the company or industry they work in or they had bought it from the shop on their own. Body mass index of the subjects could not be recorded.

Further scope

The study could be conducted with a larger population group, taking the limitations into consideration. Also, interventional study can be performed taking the foot problems and assessment of safety footwear into consideration. Awareness to industries to provide their employees with specifically designed safety footwear can be provided. By applying physiotherapy techniques further study could be done to check the reduction in foot problems after advising the individuals for the same.

CONCLUSION

From the current study it can be concluded that there is significant prevalence of foot problems that are caused due to wearing safety footwear. The study shows that these foot problems limit the working capacity of the individual. The study also depicts the concerns of the employees regarding the weight of their safety footwear and the pressure caused by their safety footwear which interferes with their work. The highest prevalence of foot problem recorded was pain in the heel and bottom of the foot (plantar fasciitis) along with pain radiating up to calf, followed by varied conditions inside the footwear, foot corn, bunion, numbness and interference in blood circulation. The study also recorded the awareness employees have while selecting the appropriate footwear and the change in the footwear every 8-10 months that is important to prevent foot problems. The study also depicts that majority of the individuals do not have specifically designed footwear for the specified industry they work in, thus contributing to foot problems.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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