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Ergonomic assessment using quick exposure check among bescom electrical linemen in Bangalore, Karnataka

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Abstract
Background: Work-related musculoskeletal pain is a prevalent health issue and a leading cause of disability, often stemming from various workplace, individual, and psychological risk factors. Electrical linemen are exposed to the risk of musculoskeletal disorders due to the physical demands of tasks, such as posture, force, frequency of movement, task duration, and vibration exposure, exceeding the body's physical capacity and also performing physically demanding tasks like climbing and lifting in various conditions, putting them at a heightened risk for injuries and musculoskeletal disorders.
Method: In this cross-sectional study, 43 male BESCOM workers of the age group between 20-50 years were selected based on convenient sampling. Quick Exposure Check was used to examine the body posture of the sample when performing static and dynamic tasks involving movement and repetition elements of burden and work length to different parts of the body.
Conclusion: The study shows that BESCOM electrical linemen face significant ergonomic risks, especially related to musculoskeletal issues and stress. The high prevalence of neck followed by shoulder/arm, wrist/hand, and back pain highlights the need for immediate ergonomic interventions. It is crucial for BESCOM to prioritize interventions and implement stress management strategies to improve the health and safety of their linemen.

Keywords: Ergonomics, quick exposure check, musculoskeletal pain, electrical linemen

Introduction
Musculoskeletal disorders are highly prevalent in the current lifestyle [1]. It comprises of diverse conditions affecting bones, joints, muscles, and connective tissues. Chronic pain and a loss of function are the primary mechanisms through which musculoskeletal disorders lead to disability and work loss [2]. Chronic musculoskeletal pain is the main contributor to disability worldwide [3]. According to the World Health Organization (WHO), 20–33% of the world's population has some form of chronic musculoskeletal pain, translating to 1.75 billion people globally [4]. While sprained muscles, pain from a fracture, shoulder pain and other conditions are also considered musculoskeletal pain. The most common types of musculoskeletal pain are chronic low back pain, neck pain and pain from osteoarthritis and rheumatoid arthritis. Musculoskeletal pain can strike at any age but its likelihood increases with age [5]. Musculoskeletal disorders are common among electrical linemen. Linemen, also known as power-line staff, work with electricity in a variety of capacities including tracking, troubleshooting and maintenance of overhead power plants [6]. The distribution linemen were divided into three groups according to the types of tasks they performed. Live Line Lineman: Are those who work on the high- and low-voltage distribution networks in real-time. Maintenance/Emergency Linemen: Are those who respond to emergencies and pre-programmed services. They are in charge of checking and maintaining the medium- and low-voltage networks, as well as maintaining street lights. They employ ladders to complete duties and the linemen are belted to the pole or ladder. Commercial Linemen are in charge of cutting and restoring the energy supply as well as maintaining and removing energy consumption meters. These tasks necessitate the use of fewer ladders and less exertion, as well as the use of tools on occasion [8].
There is a strong correlation between the work environment of line workers and the high incidence of musculoskeletal disorders.8 These health conditions have been linked to occupational stress and exposure to harsh weather, such as cold climates, which may increase the development of musculoskeletal symptoms [9, 10].
Apart from the risk of electrocution, the physically demanding nature of lineman duties has raised concerns in recent years regarding work-related musculoskeletal disorders [11]. The Quick Exposure Check (QEC) is an observational tool designed by Occupational Safety and Health (OSH) professionals to evaluate exposure to potential risks for musculoskeletal disorders related to the workplace and act as a foundation for ergonomic interventions it makes it possible to evaluate a number of the most significant risk factors for musculoskeletal disorders associated with the workplace [12]. The Quick Exposure Check (QEC) was created to evaluate the degree of exposure to musculoskeletal risk factors associated with the workplace that affect the neck, wrist/hand, shoulder/arm, and back [13].

Statement of the problem
Bangalore Electricity Supply Company Limited (BESCOM) holds the responsibility for electricity supply throughout Bangalore, Karnataka. The issue lies in the potential ergonomic hazards faced by BESCOM electrical linemen during their daily operations. Factors such as awkward postures, repetitive motions and forceful exertions can contribute to musculoskeletal disorders and work-related injuries. The absence of a systematic ergonomic assessment

using tools like Quick Exposure Check (QEC) leaves a gap in identifying and mitigating these risks.

Need for the study

The need for an ergonomic assessment among BESCOM electrical linemen arises from the crucial role they play in maintaining the electrical infrastructure. Understanding and addressing ergonomic factors can lead to improved safety, reduced musculoskeletal issues, enhanced job satisfaction and increased overall efficiency within the workforce. Therefore, there is a pressing need to conduct a comprehensive ergonomic study to safeguard the health and well-being of BESCOM electrical linemen while optimizing their performance.

Methodology

Study design: Cross-Sectional Study
Study setting: BESCOM workstation
Inclusion Criteria: 20 to 50 aged male linemen
Exclusion Criteria: Not willing to participate
Sample Size: 43
Sampling method: Convenient Method

Procedure

The purpose of this cross-sectional study is to examine exposure levels among males aged between 20 to 50 years at the BESCOM work-station. A convenient sampling approach was used to gather the sample, which consisted of 43 participants. Exposure levels were evaluated using QEC and relevant demographic data was recorded. The study observed ethical standards and confidentially treated the acquired data.

Data analysis and results

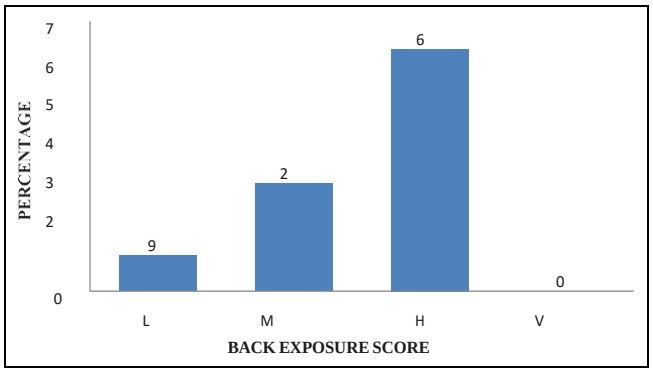
Statistical analysis of the data was performed using SPSS 20.0.

Age distribution of electrical linemen

The data analysis indicates a diverse age distribution among electrical linemen in the study. The majority of participants, comprising 15 individuals (34.9%) in 2029 years age group. Similarly, another 15 participants (34.9%) were in the age group of 40 to 50 year and 13 participants (30.2%) belonged to the 30-39 years age group.

Back exposure score of electrical linemen

The data reveals that the majority of occurrences were classified as high in terms of back, representing 62.8% (27). Following this, moderate occurrences make up 27.9% (12). Occurrences categorized as low constitute 9.3% (4).



Graph 1: Back exposure score of electrical linemen

Shoulder/arm exposure score of electrical linemen

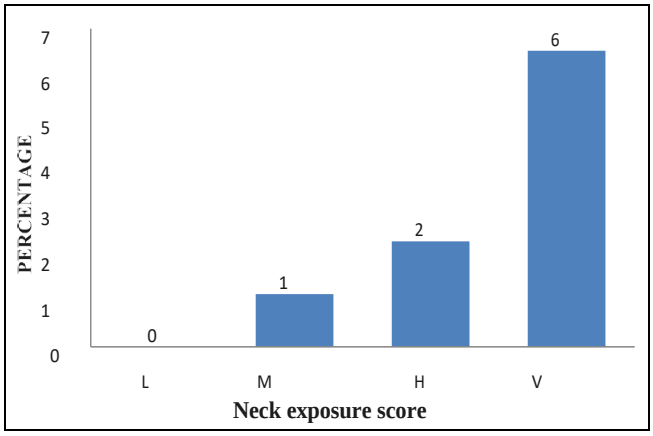
The data depicts the frequency and distribution among the total of 43 occurrences, the majority fall into the high category, constituting 67.4% (29), followed by moderate occurrences of 32.6% (14).

Wrist/hand exposure score of an electrical linemen

Among the total of 43 occurrences, the majority were classified as high, constituting 65.1% (28). Moderate occurrences make up 27.9% (12) of the total. Low occurrences represent 7.0% (3) of the total.

Neck exposure score of an electrical linemen

The data presents the frequency and distribution of exposure score of neck, ranging from moderate to very high. The majority were classified as very high, constituting 65.1% (28). High occurrences make up 23.3% (10), while moderate occurrences represent 11.6% (5).



Graph 2: Neck exposure score of electrical linemen

Driving exposure score of electrical linemen

The provided data presents the frequency and percentage distribution of the level of driving. Among the total of 43 occurrences, the majority fall into the moderate category, constituting 83.7% (36). Conversely, occurrences classified as low represent 16.3% (7) of the total.

Vibration exposure score of electrical linemen

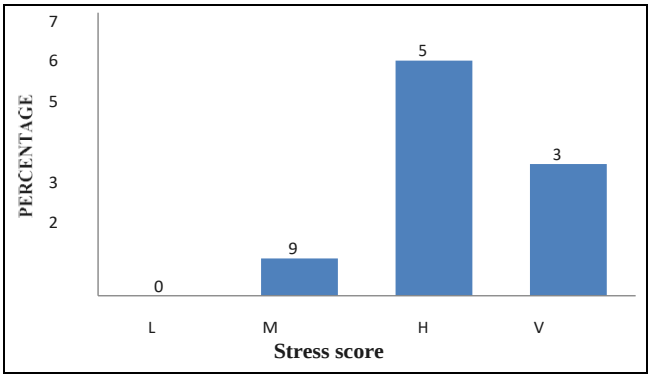
Among the total of 43 occurrences, all instances fall into the low category, representing 100% (43) of the total. There were no reported occurrences classified as moderate, high, or very high, indicating a lack of occurrences at these higher levels of vibration intensity.

Workspace exposure score of electrical linemen

Among the total of 43 occurrences, the majority fall into the moderate category, constituting 65.1% (28). Occurrences classified as high represent 34.9% (15) of the total.

Stress score of electrical linemen

The majority of the linemen fell into the high category constituting 58.1% (25). Additionally, very high represents 32.6% (14), followed by occurrences categorized as moderate constitute 9.3% (4).



Graph 3: Stress score of electrical lineman

Conclusion

Based on the findings of this study, it is evident that electrical linemen at Bangalore Electricity Supply Company Limited (BESCOM) face significant ergonomic risks, particularly related to musculoskeletal issues and stress. The prevalence of discomfort and pain in the neck is very high, followed by high discomfort in the shoulder/arm, wrist/hand and back, which underscores the need for immediate ergonomic interventions. The moderate impacts observed in driving and workspace issues, along
with the high levels of reported stress, further emphasizing the urgent need to implementing strategies to improve the work environment and enhance the overall well-being of linemen. In conclusion, it is imperative for BESCOM to prioritize the implementation of ergonomic interventions and stress management strategies to mitigate the risk of musculoskeletal disorders and improve the overall health and safety of their electrical linemen.

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