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An Analysis of Ergonomical Hazards/Risks in Construction Industry

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Abstract: Ergonomic hazards that expose construction workers to include awkward positions, repetitive work, heavy lifting and sustained stationary positions may result in musculoskeletal disorders (MSDs) and low productivity. This study explores ergonomic risks prevalence among construction workers and analyses the correlation among the work conditions, work awareness, and training. A structured questionnaire was utilized in data collection of 80 respondents and SPSS software was used in data analysis. To be knowledgeable of the trends of physical strain, fatigue, and ergonomic awareness, descriptive statistics, one-way ANOVA, correlation, and chi-square tests were implemented. The findings are that a good percentage of workers are having physical discomfort, with moderate levels of repetitions and still postures. Training and ergonomic equipment, rest break and safety awareness gaps were identified. The paper points to the necessity of planned ergonomic measures, regular safety education, and the participation of the management in the study to minimise health risks of workers and improve their well-being in the construction industry.

Keywords: Ergonomics, Construction Industry, Musculoskeletal Disorders, SPSS, Occupational Health, Survey Analysis.

I. INTRODUCTION

The construction business is a physically involved activity that subjects the workers to a broad scope of job risks. Among them, the ergonomic hazards such as awkward postures, manual material handling, repetitive movements, long-term stationary positions, and repetitive movements are the most common; hence, they bear huge consequences to the health and productivity of workers [1], [2]. These ergonomic risks have been frequently reported to cause musculoskeletal disorders (MSDs) like back pain, neck strains, shoulder injuries among construction workers [3], [4].

Ergonomic evaluation within the construction industry has gained significance as it allows determining the high-risk activity, assessing the effect of work poses, and taking steps to prevent harmful events [5], [6]. Research shows that the inability to manage ergonomic risks does not only amplify the risk of injuries but also minimizes the level of operational efficiency and raises the overall healthcare expenses in the long term [7], [8]. Indicatively, repetitive lifting and awkward postures have been identified to be the main causes of chronic musculoskeletal in workers [9], [10].

Recent studies have highlighted the importance of training, awareness, and ergonomic interventions as a way of reducing these risks. Adequate education on the safe lifting practices, application of ergonomic equipment and compliance on the ergonomic rules and regulations can significantly help in reducing the cases of MSDs [11], [12]. Also, the introduction of the new technological solutions like wearable sensors and motion analysis systems is being applied to control the work posture of workers and identify dangerous movements in real-time [13], [14], [15].

Nonetheless, in the light of these developments, there are still gaps relating to practical implementation especially in the developing nations where the construction sites are usually devoid of organized ergonomic programs [16], [17]. Physical strain is also an exposure where workers receive outdated training, rest time, and ergonomic appliances [18], [19], [20]]. Therefore, it is highly important to evaluate the ergonomic risks and the level of awareness and experiences of the workers to enhance the level of occupational safety and health in the construction industry [21], [22].

The purpose of the current study will be to examine the prevalence of ergonomic hazards among building workers, how much they are aware of the risks involved, and how well the established training and preventive strategies work with the help of survey data that will be analyzed by using SPSS. The knowledge will be used to establish the holes in the ergonomic behaviors and prescription of measures to improve the safety of workers and avert musculoskeletal disorders.

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II. RESEARCH METHODOLOGY

In this research, a quantitative research methodology will be used to determine the ergonomic risks and hazards among construction workers. The research methodology entails a structured data collection, statistical analysis and interpretation of findings in order to determine patterns, and correlations among ergonomic practices, awareness, and physical outcomes.

A. Research Design

The use of the descriptive survey design led to collection of primary data on the construction workers. The design is suitable because it provides the ability to collect information on the experience of the workers, their perception and exposure to ergonomic risks systematically [1], [2]. The survey contained both structured and demographic questionnaires as well as ergonomics-related questions, which gave quantitative data, which could be analyzed statistically using SPSS.

B. Population and Sampling

The target population consists of the employees working at different construction sites. The sample of 80 respondents was obtained through the convenience sampling method and was representative of the various age, job position, and years of experience. Welders, Electricians, Laborers, Masons, Carpenters, and Supervisors were incorporated into the sample as the variety of the construction workforce [3], [4].

C. Data Collection

Data is collected through a structured questionnaire. The structured questionnaire consisted of three sections where data have been collected.

- Demographic information (age, gender, job role, experience)
- Ergonomic exposure (posture, repetitive operations, manual handling, length of stationary positions)
- Awareness, training and perception of ergonomic interventions.

It is a scale where the extent of agreement to the statements about the ergonomic risk factors, physical strain, and safety practices can be measured [5], [6].

D. Data Analysis

IBM SPSS Statistics was used to analyze the collected data. The application of the following techniques was done:

- Descriptive Statistics is used to outline demographic data and numerically measure the prevalence of ergonomic hazards [7].
- One-Way ANOVA is used to test the differences in physical strain by age groups, job roles as well as experience levels [8].
- Correlation Analysis is used to estimate the relationships among training, awareness and reported physical discomfort [9].
- Chi-square Test is used to establish relationships between two or more categorical variables, i.e. rest breaks and physical exhaustion [10].

The integration of the techniques gives an in-depth insight into ergonomic hazards, perceptions of workers and safety intervention efficacy.

E. Ethical Considerations

The respondents were given the opportunity to participate in the study willingly and were made aware of the mission of the research. The confidentiality of the data and anonymity was strongly kept and the ethical consideration was met during the study [11].

III. RESULTS AND DISCUSSION

The study findings help in understanding the level of ergonomic risks and hazards, the level of awareness among the workers of the risk and the level of effectiveness of training and preventions. A total of 80 construction workers provided the data that were examined with the help of SPSS.

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A. Demographic Profile

Most respondents (32.5) belong to the 36 45 years of age bracket, 27.5 to respondents under 25 years and 25 to respondents between 26 and 35 years. The proportion of individuals older than 45 years was only 15 percent, which implies the equal representation of workers in various stages of their career development [1], [3].

The following distribution of job roles was provided: Welders (22.5%), Supervisors (17.5%), Electricians (13.8%), Laborers (11.3%), Masons (10%), and Carpenters (10%). There was a data anomaly that was designated as 7.00 15% and needs to be explained. Such distribution discloses the variety of construction work and concentrates technical and supervisory positions [2], [4].

B. Ergonomic Exposure

This was evidenced by the analysis of questionnaire answers: a considerable number of workers are subjected to physical strains:

- Awkward Postures: 45 percent said they have to work with awkward or uncomfortable postures often, which implies a high-risk factor of musculoskeletal disorders [5].
- Manual Handling: 36.3 percent always or often carry or lift heavy materials, 46.3 percent never carry or lift heavy materials indicating that not everybody always lifts heavy materials [6].
- Repetitive Tasks: 41.3% wrote that they had done repetitive physical movements, which was another 43.8% that did not agree, so they were exposed to variations in tasks [7].
- Musculoskeletal Pain: 41.3 per cent reported back, shoulder or neck pain after work, which underscores the importance of ergonomic measures [8].

Statistical Postures: 43.8 percent of the respondents stand still in the same quarters, and 41.3 percent did not agree, which reported job-related risks [9].

C. Ergonomic Consciousness and Training

The proportion of the workers who received training on safe posture and material handling was only 40.1 percent and the proportion of workers who were aware of health risks of poor posture and repetitive movements was 43.8 percent. This implies that there is a weakness in the ergonomic awareness and training efficiency, which can be a factor in increasing the occurrence of MSDs [10], [11].

D. Statistical Analysis

One-Way ANOVA

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Do you feel physically exhausted at the end of your workday	Between Groups	4.719	3	1.573	.877	.457
	Within Groups	136.269	76	1.793		
	Total	140.987	79			
Do you experience pain in any part of your body (e.g., back, shoulders, neck) after work	Between Groups	12.363	3	4.121	2.145	.102
	Within Groups	146.024	76	1.921		
	Total	158.388	79			

- Physical Exhaustion: F = 0.877, p = 0.457. There was no real difference between age or job-role in regard to physical exhaustion.
- Musculoskeletal Pain: F = 2.145, p = 0.102. The differences in the pain between groups were not significant.

These findings signify that physical strain typically is homogenous in various demographic groups [12].

Correlation Analysis

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Correlations

		Have you received any training on safe posture and material handling techniques	Are you aware of the health risks associated with poor working posture and repetitive movements
Have you received any training on safe posture and material handling techniques	Pearson Correlation	1	.030
	Sig. (2-tailed)		.794
	N	80	80
Are you aware of the health risks associated with poor working posture and repetitive movements	Pearson Correlation	.030	1
	Sig. (2-tailed)	.794	
	N	80	80

Pearson correlation of training obtained and awareness of health risks: r = 0.030, p = 0.794.

This low positive correlation is not significant, and it is possible to say that training alone might not be enough to raise awareness [13].

Chi-Square Test

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	15.643a	16	.478
Likelihood Ratio	18.161	16	.315
Linear-by-Linear Association	.367	1	.544
N of Valid Cases	80		

a. 22 cells (88.0%) have expected count less than 5. The minimum expected count is 1.79.

Correlation between rest break and physical exhaustion: $\chi 2 = 15.643$, p = 0.478.

The relationship was not found to be significant suggesting that other factors other than rest breaks might be the cause of fatigue [14].

Descriptive Statistics

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Do you have to remain in the same position (standing, bending, kneeling, etc.) for long periods	80	1.00	5.00	3.0000	1.51783
Do you perform the same physical movement repeatedly throughout your shift	80	1.00	5.00	3.0125	1.47977
Are ergonomic safety procedures properly followed at your construction site	80	1.00	5.00	3.0625	1.40833
Valid N (listwise)	80				

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The moderate agreement was observed when workers were asked to stay in the same posture (Mean = 3.00, SD = 1.52) and make repetitive tasks (Mean = 3.01, SD = 1.48).

Ergonomic safety procedures perception was above average (Mean = 3.06, SD = 1.41) but had a significant variation among the respondents [15].

E. Discussion

The results reveal that there is a moderate amount of ergonomic risk in the construction activities, such as awkward posture, repeated movements, and sitting in a stationary position. Although physical strain does not differ by age or job-role group, the training, rest-break, and ergonomic equipment discontinuities indicate the necessity of planned interventions.

In line with previous research [1], [5], and [6], the study has indicated that musculoskeletal disorders are a significant issue and can be reduced by:

- Organised posture and safe handling training programs.
- Supply of ergonomic equipment and aids.
- Adoption of rest breaks and job rotation in order to eliminate fatigue and repetitive strain.
- Frequent control and reinforcement of ergonomic safety processes in the field.

In general, the research provides the relevance of considering the ergonomic principles in the construction work practices to improve the health, productivity, and safety of workers [7], [9].

IV. CONCLUSION AND RECOMMENDATIONS

The research indicates that the ergonomic risks are common in different jobs in the construction sector, such as Welders, Supervisors, Electricians, Laborers, Masons, and Carpenters. Employees often do superficial processing, repetitive work, working with manual materials, and spend too much of their free time in awkward postures, which leads to musculoskeletal pain, stress, and future chronic health problems. Irrespective of the fact that there are some training and awareness campaigns in place, the supply of ergonomic equipment, rest break and regular implementation of the safety practices have not been well done. Statistical data such as ANOVA, correlation and Chi-Square tests have not found any significant demographic differences in physical strain or pain, indicating that there is no homogenization of ergonomic risks between workers of different ages, occupations, and experience.

Recommendations:

- Hold periodic training programs about safe posture, manual hand-handling, and utilization of ergonomic aids.
- Install ergonomic tools like scaffolding which can be adjusted, lifting aids, anti-vibration handles and cushion mats.
- Re-engineer workstations and work processes to reduce awkward bending, twisting and reaching and encouraging neutral postures.
- In a bid to decrease repetitive strain, allocate tasks equally to ensure that physical workload is equally distributed.
- Have frequent and sufficient rest intervals to avoid fatigue and musculoskeletal stress.
- Close compliance to ergonomic practices by the supervisors and safety officers assigned.
- Create awareness about poor posture and repetitive movements that can result in health risks through posters and short talks, as well as, workshops.
- Promote the reporting of pain or tension, so that prompt measures and changes could be implemented.
- Foster the involvement of the management in the implementation and enforcement of ergonomic policies.
- Encourage a workplace culture that is health, safety and ergonomic compliant at all levels of the construction site.

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