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A Study On Employees' Perception Towards The Practice Of Ergonomics With Reference To Manufacturing Industry

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ABSTRACT

This study explores the role that ergonomics can play in improving workplace safety, preventing musculoskeletal disorders, and enhancing employee comfort, productivity, well-being, as well as safety. In recent years, emphasis on employee safety has thrust ergonomics to the forefront of contemporary industrial management. This study explores employees' perceptions of ergonomic practices in the Indian manufacturing sector. With data from a sample of 218 employees from various departments, this study established awareness gaps related to ergonomics, explored the physical discomfort associated with suboptimal ergonomics and investigated the role of ergonomic practices in absenteeism, job satisfaction, and productivity. The study concluded with the recognition of ergonomic interventions, the need for tailored ergonomic training, and the need for an occupational culture of health and safety. Recommendations were developed to improve workplace environments, practices, and expectations for ergonomics.

Index Terms **- Ergonomics, Manufacturing Industry, Workplace Safety, Musculoskeletal Disorders, Employee Well-being, Productivity.**

I. INTRODUCTION

The manufacturing industry is one of the more physically demanding professions, where workers over long periods of time may be required to perform repetitive tasks, utilize heavy machinery, and be in less than favorable working postures. Such environments are associated with work-related musculoskeletal disorders (WMSDs), fatigue and lack of job satisfaction. Ergonomics is the study of fitting the workplace to the worker and aims to remedy these scenarios through improved job design, tools and working environments. Much has been reported on the benefits of ergonomics; yet any success depends on the overall awareness of ergonomics on behalf of the worker and their attitudes towards work-related ergonomics. This study aims to investigate the overall understanding and attitudes towards ergonomics by workers in various levels of manufacturing, in an effort to unearth the factors inhibiting workplace ergonomics or supporting ergonomics in the workplace.

II. OBJECTIVES OF THE STUDY

1. To study the relationship between ergonomics and employee absenteeism due to work-related discomfort.
2. To analyse how ergonomic practices affect job satisfaction and motivation among employees.
3. To compare ergonomic awareness between different departments (Production, Office Staff, Supervisors).
4. To identify areas where ergonomic improvements are needed within the organization.
5. To provide recommendations for enhancing ergonomic policies and workplace design.

III. SCOPE OF THE STUDY

The study considers many of the workers in each job category such as production workers, machine operators, office employees, supervised employees, etc., and investigates the differences in experience level, educational achievements, and job tasks in comparison to their overall perception of ergonomics. The study also considers workstation design, the use of ergonomic tools, work breaks, and work training lessons. The study will provide focused analysis on a specific representative part of the Indian manufacturing sector and intends to provide information useful for similar industrial ecosystems.

IV. REVIEW OF LITERATURE

1. **Kamala, V., Yamini, S., & Gajanand, M.S. (2025), Journal of Workplace Health**

This study focused on the ergonomic risks associated with remote working environments during the pandemic. It revealed that lack of structured workstation setups contributed to increased musculoskeletal disorders. The authors emphasized the need for ergonomic education and awareness to prevent such health issues. Their findings are applicable in industrial contexts where posture and repetitive tasks dominate the work culture.

2. **Colenberg, S., Nichols, J., & Wu, H. (2024), Industrial Ergonomics Review**

This paper examined how proactive ergonomic programs improve employee engagement and reduce injury-related downtime in manufacturing units. The authors identified that continuous evaluation of workstations and participatory redesign had a measurable impact on both productivity and morale. They advocated that organizations must embed ergonomics into workplace strategy for sustainable improvement.

3. **Smith, J.A. & Lee, K. (2023), Safety Science Quarterly**

This research focused specifically on the impact of ergonomic improvements in industrial settings. The authors conducted longitudinal studies in manufacturing plants and found a 35% decrease in reported injuries after ergonomic modifications. Their work provides solid evidence for the economic and health-related benefits of investing in workplace ergonomics.t carriers with the highest fuel burn/market ratio gain the most from outsourcing in the presence of performance-based offers.

4. **Nguyen, T., & Tran, L. (2022), Asia-Pacific Industrial Review**

In a study of textile workers, Nguyen and Tran documented how inadequate lighting, seating, and workspace contributed to fatigue, eye strain, and postural injuries. Their work reinforces the importance of conducting regular ergonomic assessments and implementing ergonomic-friendly designs, especially in developing economies.

5. **Schwatka, N. V., Hecker, S., & Goldenhar, L. (2021), Journal of Occupational Safety and Ergonomics**

This study introduced the concept of "ergonomics climate," referring to the organizational culture around ergonomic support. The authors found that facilities with high ergonomics climate—characterized by leadership support, feedback mechanisms, and training—experienced fewer injuries and higher employee morale.

V. RESEARCH METHODOLOGY

A descriptive research design was used to investigate employees' ergonomic perceptions in a manufacturing company. A sample of 218 employees was selected using stratified random sampling techniques which included representation across the roles of production employees, office employees, and managers. Primary data were collected using a structured questionnaire which contained both closed and open-ended questions regarding the knowledge, experience and opinions of ergonomics and secondary sources were collected from academic journals, and books, as well as occupational health including OSHA and WHO guidelines, and the company's internal policies and procedure documents. Some data analyses were performed which included normality tests (Kolmogorov- Smirnov and Shapiro-Wilk) indicating non-normal data, and therefore using non-parametric statistical tests, such as the Chi-Square test, Mann-Whitney U test, and Wilcoxon Signed Rank tests and percentage analysis for additional interpretability.

5.1. CHI – SQUARE TEST

Chi-square is a non-parametric procedure, commonly used by research to test the analysis. CEO is the basic idea of chi-square; 'whether or not two or more group of data is significantly different. Chi-square is also used to find out if a significant relationship exists between two categorical variables, it is also used to determine how confident one would be about their data being significantly different than a population data (expected data) (or theoretical data). Chi-square is used specifically to find out if the differences between the observed frequencies and expected frequencies of data are because of chance, other words, to determine if there is a relationship between certain groups of data.

$$\chi^2 = \Sigma((O - E)^2 / E)$$

Where:
χ^2 = Chi-square statistic
O = Observed frequency
E = Expected frequency
Σ = Summation over all cells or categories
Expected frequency for a cell (for test of independence):
E = (Row Total × Column Total) / Grand Total

5.2. MANN-WHITNEY U TEST

The Mann-Whitney U Test (Wilcoxon rank-sum test) is a non-parametric statistical test that determines if there is a difference between two independent groups when it can be assumed that the data is not normally distributed or when the assumptions of parametric tests are not met. It is often used when you have two groups and you want to compare the distributions or central tendencies.

$$U = \min(U1, U2)$$

Where:
U1 is the sum of ranks for one of the groups.
U2 is the sum of ranks for the other group.

5.3. RUN TEST

A runs test is a statistical analysis used to measure the randomness in the data in order to reveal any variables that may influence the data patterns. It is a statistical procedure that is used to decide whether a designated sequence of data is random or is going through a non-random pattern. This is used to check a sample is random as it ought to be for the selected population.

VI. DATA ANALYSIS AND INTERPRETATIONS

Table 1: CHI – SQUARE TEST

In a company were selected and asked about their qualification and whether recognition is based on performance.
Null hypothesis: (H0), there is no significant difference between variables.
Alternative hypothesis: (H1), there is a significant difference between variables.

Test Statistics

	EA	JS	EA	EI	PW
Chi-Square	1.527E2	65.881	1.281E2	1.435E2	1.278E2
df	13	10	14	18	16
Asymp. Sig.	.000	.000	.000	.000	.000

- For EA, the Chi-Square statistic is 1.527E2 (which is 152.7), with 13 degrees of freedom (df), and the Asymptotic Significance (p-value) is .000.
- For JS, the Chi-Square statistic is 65.881, with 10 degrees of freedom (df), and the Asymptotic Significance (p-value) is .000.
- For EI, the Chi-Square statistic is 1.435E2 (which is 143.5), with 18 degrees of freedom (df), and the Asymptotic Significance (p-value) is .000.
- For PW, the Chi-Square statistic is 1.278E2 (which is 127.8), with 16 degrees of freedom (df), and the Asymptotic Significance (p-value) is .000.
- In all cases, the Asymptotic Significance (p-value) of .000 is substantially less than the conventional significance level of 0.05.

INFERENCE

For all variables assessed with the Chi-Square Goodness-of-Fit test, the asymptotic significance values (.000) were also well below the alpha level of 0.05. Consequently, the null hypothesis of normality was rejected for each variable. The substantial Chi-Square statistic values further indicate significant discrepancies between the observed data and a normal distribution.

Table 2: MANN-WHITNEY U TEST

Null hypothesis: (H0), there is no significant difference between gender and other variables.
Alternative hypothesis: (H1), there is a significant difference between gender and other variables.

Test Statistics

	EA	JS	EA	EI	PW
Mann-Whitney U	2.9723	2.6243	2.9703	3.0923	2.9173
Wilcoxon W	1.9994	1.9644	1.9994	3.6863	3.5123
Z	-.467	-1.504	-.469	-.109	-.628
Asymp. Sig. (2-tailed)	.640	.133	.639	.914	.530

a. Grouping Variable: Gender

The normality of variables EA, JS, EI, and PW was assessed using Kolmogorov-Smirnov and Chi-Square Goodness-of-Fit tests. Both tests consistently indicated a significant deviation from normality ($p < .05$) for all variables, suggesting that parametric statistical methods relying on the assumption of normality may not be appropriate.

INFERENCE

Subsequently, the Mann-Whitney U test, a non-parametric alternative, was employed to examine potential differences in these variables between male (n=184) and female (n=34) participants. The analysis revealed no statistically significant differences between genders for any of the variables. For EA (first instance), the p-value was .640; for JS, it was .133; for EA (second instance), it was .639; for EI, it was .914; and for PW, it was .530. All these p-values are greater than the conventional significance level of 0.05.

Table 3: WILCOXON SIGNED RANK

Null hypothesis: H0, there is no significant difference between gender, age group, and other variables.
Alternative hypothesis: H1, there is a significant difference between gender, age group, and other variables.

Test Statistics

	Gender - EA	Age Group - JS
Z	-12.829[a]	-12.823[a]
Asymp. Sig. (2-tailed)	.000	.000

a. Based on positive ranks.
b. Wilcoxon Signed Ranks Test

INFERENCE

- The fact that there are 218 negative ranks and 0 positive ranks indicates that for all 218 paired observations, the value in the second condition (EA for the Gender group that was subtracted) was greater than the value in the first condition (the other Gender group's EA).
- The Z-statistic is highly significant (-12.829).
- The Asymptotic Significance (p-value) is .000, which is far below the standard alpha level of 0.05.

Table 4: RUN TEST

A runs test is a statistical analysis that helps determine the randomness of data by revealing any variables that might affect data patterns.

Runs Test

	EA	JS	EA	EI	PW
Test Value[a]	12	12	24	28	19
Cases < Test Value	86	109	108	79	77
Cases >= Test Value	132	109	110	139	141
Total Cases	218	218	218	218	218
Number of Runs	103	111	128	94	96
Z	-.305	.136	2.445	-1.138	-.685
Asymp. Sig. (2-tailed)	.760	.892	.014	.255	.494

a. Median

INFERENCE

The Runs Test suggests that for most of the variables (EA - first instance, JS, EI, and PW), the sequence of values above and below their respective medians is random. However, for the second instance of EA, the pattern appears to be non-random, with more runs than expected by chance. This might indicate some underlying structure or trend in how these values are ordered in your dataset.

VII. SUMMARY OF FINDINGS

1. All variables (EA, JS, EI, PW) showed statistically significant differences (p = .000), indicating strong associations and rejecting the null hypothesis.
2. No significant differences were found between genders for any variable (all p-values > 0.05), suggesting gender does not influence the measured factors.
3. Significant differences were observed between gender for EA and age group for JS (p = .000), indicating meaningful group-based variations.
4. Most variables showed random distribution, except for EA (second instance), which displayed a non-random pattern (p = .014), suggesting a possible underlying trend.

VIII. SUGGESTIONS

1. To introduce regular ergonomic training sessions for all staff, especially in production roles.
2. To conduct ergonomic audits and modify workstations to reduce strain from repetitive motions and awkward postures.
3. It suggests to encourage workers to report ergonomic issues and participate in redesign decisions.
4. To implement short, frequent rest breaks to minimize fatigue and allow for physical recovery.
5. It suggests to include ergonomic objectives in health and safety policies and evaluate ergonomic compliance annually.

IX. CONCLUSION

Ergonomic practices are not just tools for compliance - they are strategic elements of a productive and healthy workplace. This study shows that although there is a baseline understanding of ergonomics in the manufacturing industry, much work is needed to close the gap between policy and practice. By prioritizing employee feedback, promoting training, and ensuring that ergonomics is an ongoing organizational commitment, manufacturing firms can expect improvements in worker satisfaction, safety, and operational efficiency.

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