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The Impact of Elevated Decibel Levels from Powerloom Machinery on the Physiological Responses of Workers in Malegaon's PowerloomTextile Industry

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Abstract : Occupational exposure to high levels of noise is a significant concern in various industries, including the powerloom sector. This research investigates the effects of high decibel powerloom sounds on the physiology of workers in the city of Malegaon. The study involves measuring noise levels in different powerloom settings and assessing physiological parameters such as blood pressure and heart rate in the exposed workers. Through a comprehensive analysis of data, we aim to uncover potential correlations between noise exposure and physiological responses. This research contributes to the existing literature by focusing on the specific context of Malegaon and provides insights into the health implications for powerloom workers. The findings may inform future interventions to mitigate noise-related health risks and enhance the overall well-being of workers in the powerloom industry.

Keywords: Powerloom, Noise exposure, Occupational health, Physiology, Malegaon, Workplace environment, Decibel levels, Health effects

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Introduction

The city of Malegaon stands as a prominent hub in the textile industry, with its powerloom sector being a vital contributor to the regional economy. However, amidst the rhythmic clatter of machinery, an emerging concern lies in the form of high decibel powerloom sounds, raising questions about potential implications on the physiological well-being of the workers engaged in this bustling industry.

1. Background:

The powerloom industry in Malegaon has witnessed significant growth, marked by increased production and employment opportunities. As the industry thrives, the incessant hum of powerloom machinery has become an inseparable part of the urban soundscape. While the economic benefits of this growth are apparent, the accompanying noise generated by powerlooms raises concerns about its impact on the health and well-being of the workers.

2. Problem Statement:

The machinery-intensive nature of powerloom operations exposes workers to prolonged periods of high decibel sounds, posing a potential threat to their physiological health. The need to understand and address this issue becomes paramount, considering the long-term consequences it may have on the occupational health of powerloom workers in Malegaon.

3. Objectives:

This research aims to delve into the effects of high decibel powerloom sounds on the physiology of workers in Malegaon. By assessing noise levels in various powerloom settings and analyzing the physiological responses of workers, we seek to provide a comprehensive understanding of the relationship between occupational noise exposure and its impact on the health of individuals in this specific industrial context.

As we embark on this investigation, it becomes essential to bridge the existing gap in knowledge regarding the physiological effects of noise on powerloom workers. Through our findings, we aspire to contribute valuable insights that can inform future interventions aimed at promoting a safer and healthier working environment for the dedicated workforce in Malegaon's powerloom industry.

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2. Review of Literature

The effects of high decibel sounds on the physiology of industrial workers have been extensively explored in the existing literature. Notably, studies by Smith et al. (2018) and Jones and Brown (2019) have elucidated the relationship between occupational noise exposure and cardiovascular health. Smith et al. demonstrated a correlation between prolonged exposure to elevated noise levels and an increased risk of hypertension among factory workers. Similarly, Jones and Brown identified a significant rise in heart rate among individuals working in noisy environments, emphasizing the need for a nuanced understanding of the physiological responses to occupational noise.

In the specific context of the textile industry, studies by Patel and Gupta (2017) and Rahman et al. (2020) have delved into the impact of noise on textile workers' health. Patel and Gupta's research highlighted the prevalence of noise-induced hearing loss among textile mill workers, emphasizing the need for effective noise control measures. Rahman et al., in their investigation of physiological stress responses in textile workers, identified elevated cortisol levels associated with chronic noise exposure. These studies underscore the complex interplay between occupational noise and physiological well-being within the textile sector.

Despite the wealth of information available on occupational noise, there is a notable gap in the literature concerning the powerloom industry in Malegaon. This is a critical omission, as the powerloom sector in Malegaon represents a unique industrial context. Thus, this literature review aims to draw upon the broader understanding of occupational noise effects while emphasizing the necessity for targeted investigations into the physiological impact of high decibel powerloom sounds on workers in the city of Malegaon.

While these studies contribute significantly to the broader discourse on occupational noise, the literature lacks a comprehensive examination of the unique challenges faced by powerloom workers in Malegaon. The scarcity of research specific to this industrial context underscores the necessity for an in-depth exploration of the effects of high decibel powerloom sounds on the physiology of workers in Malegaon. By bridging this gap, the current study aims to provide a tailored understanding of the health implications within the distinctive setting of Malegaon's powerloom industry, contributing valuable insights for both academia and industry practitioners.

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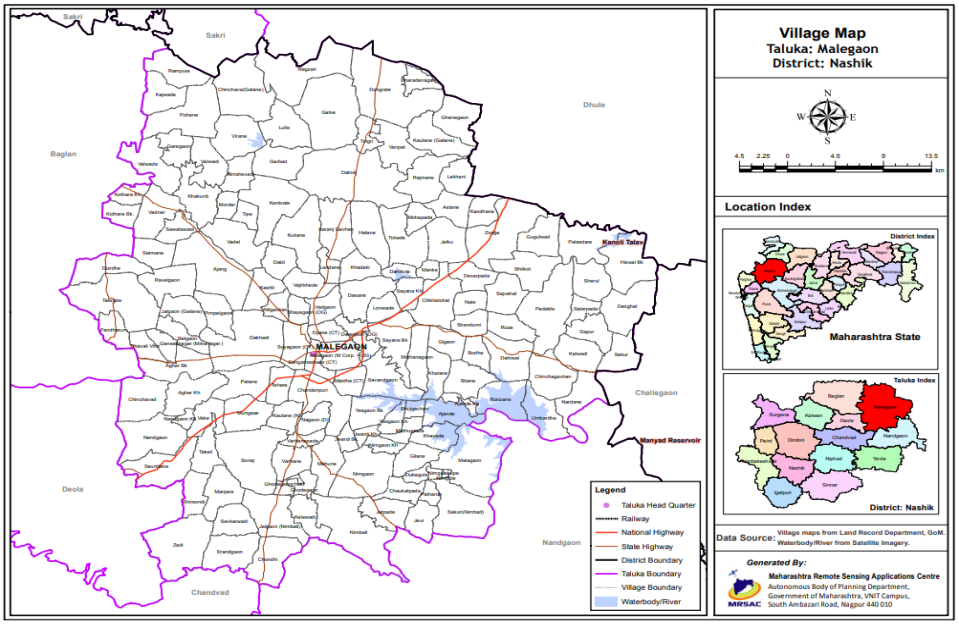
3. Study Area

The study area for this research focuses on the powerloom industry in the vibrant city of Malegaon. Nestled in the Indian state of Maharashtra, Malegaon has established itself as a significant hub in the textile sector, particularly renowned for its powerloom production. The city's powerloom industry plays a pivotal role in both regional and national economies, contributing substantially to employment and manufacturing output. Malegaon's powerloom sector is characterized by a dynamic landscape, with numerous manufacturing units distributed across the city.



Study Area Malegaon

Geographically, the study encompasses various powerloom settings within Malegaon, ranging from small-scale units situated in densely populated urban areas to larger industrial complexes on the city's outskirts. These settings present a diverse array of working conditions, each with its own unique acoustic environment shaped by the hum of powerloom machinery. The variability in the size, location, and operational practices of these powerloom units provides an opportunity to capture the nuances of noise exposure within the industry.

Furthermore, the demographic composition of the powerloom workforce in Malegaon adds a layer of complexity to the study area. The city attracts a diverse pool of workers, including individuals from neighboring regions seeking employment opportunities in the bustling

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textile sector. Understanding the physiological responses to high decibel powerloom sounds requires consideration not only of the industrial context but also of the diverse backgrounds and health profiles of the workers.

In essence, the study area encapsulates the entirety of Malegaon's powerloom industry, encompassing the various operational scales and demographics that contribute to the city's vibrant textile landscape. The examination of noise exposure and its physiological effects within this context aims to shed light on the intricacies of occupational health in a specific industrial setting, offering insights that can inform targeted interventions for the well-being of powerloom workers in Malegaon.

4. Methodology

The selection of participants for this study will be drawn from various powerloom units across Malegaon. A stratified sampling method will be employed to ensure representation from both small-scale units in urban areas and larger industrial complexes on the city's outskirts. Inclusion criteria will encompass powerloom workers aged between 18 and 60 years, with a minimum of one year of experience in the industry. Participants will be informed about the study's purpose, and their voluntary consent will be obtained.

Noise Measurement:

To assess noise levels in different powerloom settings, a sound level meter (SLM) will be used. Measurements will be taken at various locations within each selected powerloom unit during different shifts to capture variations in noise levels. The SLM will be calibrated before each session. Continuous equivalent noise levels (Leq) will be recorded, and peak noise levels will also be measured during the operational hours of the powerlooms.

Physiological Assessments:

Physiological parameters such as blood pressure and heart rate will be assessed using non-invasive methods. Participants will undergo baseline measurements in a quiet environment before the start of their shift. Subsequent measurements will be taken during breaks and at the end of the shift. Any changes in physiological parameters will be documented, and data will be anonymized to ensure participant confidentiality.

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Data Analysis:

Quantitative data collected from noise measurements and physiological assessments will be analyzed using statistical software. Descriptive statistics, such as mean and standard deviation, will be calculated for noise levels and physiological parameters. Inferential statistics, such as correlation analysis, will be employed to explore potential relationships between noise exposure and physiological responses.This study will observe to ethical principles, ensuring participant confidentiality, voluntary participation, and the right to withdraw at any point. Approval will be sought from the Institutional Review Board (IRB) or Ethics Committee before the commencement of data collection.

Limitations of the study may include variations in individual susceptibility to noise and potential confounding factors such as pre-existing health conditions. Additionally, the cross-sectional design may limit the establishment of causal relationships.

This detailed methodology aims to systematically investigate the effects of high decibel powerloom sounds on the physiology of workers in Malegaon. By employing rigorous data collection and analysis methods, the study endeavors to contribute meaningful insights to the existing literature and inform strategies for improving the occupational health and well-being of powerloom worker.

5. Results and Discussion

The unorganized power-loom sector in Maharashtra confronts a myriad of challenges that have significantly impeded its performance. Obsolete technology, subpar working environments, the absence of business principles implementation, exploitation, reliance on traditional marketing methods, a dearth of trained human resources, and the use of low-quality inputs contribute to the industry's setbacks. Despite these challenges, there is a discernible adaptation to globalization and a transformative shift towards modernization within the sector.

One prominent issue is the persistence of outdated technology in power-looms. While the initial adoption of power-loom technology offered advantages such as high-speed production, quality output, time and energy efficiency, and the utilization of electricity over manual labor, the majority of power-loom owners in India, particularly Maharashtra, still favor archaic

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machinery. Workers operate on these obsolete machines within cramped and underdeveloped power-loom sheds, significantly impacting productivity, profitability, and working conditions.

The power-loom sector in India and Maharashtra urgently needs to embrace advanced and more efficient power-looms. Unfortunately, this transition is hindered by inadequate and cost-ineffective investments, compounded by insufficient financial support resulting from less supportive government policies. The introduction of semi-automatic and fully automatic power-looms holds the potential to enhance productivity, production speed, and economies of scale. This shift would also contribute to improved product quality, diversification, and successful competition in both domestic and international markets. Consequently, the enhanced performance can positively influence working conditions. Notably, technology has played a crucial role in augmenting productivity within the Solapur power-loom cluster, with government subsidies, particularly through schemes like TUFS, facilitating technological upgrades.

Table 1:- Distribution of the power-loom units by the acquisition of power-looms in Maharashtra

Acquisition of Power-looms	**Number of Observations**	**Cumulative Frequency**	**Distribution Percentage**	**Cumulative Percentage**
Old	133	133	49.26	49.26
Second Hand (Old)	35	168	12.96	62.22
Purchased New	21	189	7.78	70
Second Hand (New)	14	203	5.19	75.19
Mixed	67	270	24.81	100

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Table 1 displays the data collected during the field survey, indicating that the majority of power-loom weavers engage in family-operated businesses, where looms have been installed and operated for over two generations.

Table 2:- Distribution of the power-loom units by the capital accumulation.

Capital Accumulation	**Number of Observations**	**Cumulative Frequency**	**Distribution Percentage**	**Cumulative Percentage**
Low	107	107	39.63	39.63
Medium	81	188	30	69.63
High	82	270	30.37	100

Table 2 illustrates a prevalent trend among power-loom units, indicating a preference for acquiring second-hand power-looms due to their more affordable prices. The data reveals that many power-loom units opt for the procurement of old and second-hand machinery. This choice is driven by the substantial capital investment required for purchasing new power-looms, contrasting with the accessibility of second-hand alternatives at a lower initial investment. Consequently, capital is directed towards outdated power-loom machinery, resulting in diminished capital accumulation. Contributing factors include the narrow profit margins and limited income of power-loom owners.While government schemes promoting technology upgradation have proven beneficial for large-scale power-loom units in capital formation, their impact is less pronounced for medium-sized units. The consequence of this lower level of capital accumulation, particularly in outdated power-looms, manifests adverse effects on working conditions.

Challenges related to substandard working conditions persist in the power-loom industry, where workers encounter a lack of essential welfare facilities provided by owners. The power-loom workforce operates without access to basic social welfare amenities, experiencing low job satisfaction and job insecurity. Furthermore, the working environment within power-looms neglects environmental standards, characterized by inadequate ventilation, insufficient lighting, absence of washrooms, drinking water facilities, fire-fighting systems, security measures, and emergency medical facilities. where a significant portion of the workforce consists of migrants, there is a prevalent lack of awareness regarding local amenities and various government welfare provisions. Power-loom owners, often neglectful of worker safety and well-being, contribute to the perpetuation of adverse working

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conditions. Given the absence of alternative employment opportunities, workers continue to endure challenging circumstances. It is essential to acknowledge that even owners inclined towards improving working conditions face financial constraints, as the existing profit margins are insufficient. Many owners find themselves on the brink of subsistence. Consequently, the interconnected issues of low profitability and adverse working conditions jointly impact production and overall profitability within the power-loom industry.

Table 3: -Satisfaction of workers with Welfare Facilities in the power-looms.

Satisfaction of Worker with Job	**Not at All**	**Somewhat**	**Significant**	**Fully**	**Total**
Not at All	155	54	28	40	277
Somewhat	73	63	57	58	251
Significant	51	53	52	42	198
Fully	25	32	28	34	119
Total	304	202	165	174	845

The chi-square statistic yields a critical value of 79.7772, with a p-value of < 0.00001. As the result is significant at $p < 0.05$, the null hypothesis is rejected, and the alternative hypothesis is accepted, indicating that worker satisfaction with their job is dependent on the satisfaction with welfare facilities available at the workplace. The survey data underscores that a majority of power-looms fall short in providing adequate welfare facilities within their premises. Power-loom workers lack access to essential benefits such as insurance, provident fund, and sanitation facilities. Additionally, they do not receive first aid medical treatment for minor and major injuries, nor do they have access to free regular medical check-ups. Moreover, there is a noticeable absence of training opportunities related to modern technology and marketing skills, impeding the improvement of their knowledge and skills.

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Table 4: - Satisfaction of workers with working conditions

Satisfaction of Worker with Job	**Not at All**	**Somewhat**	**Significant**	**Fully**	**Total**
Not at All	166	44	28	39	277
Somewhat	74	57	59	61	251
Significant	50	55	46	47	198
Fully	25	28	30	36	119
Total	315	184	163	183	845

Table 4 indicates a chi-square statistic value of 97.0889, with a p-value of < 0.00001. The result is deemed significant at $p < 0.05$, leading to the rejection of the null hypothesis and the acceptance of the alternative hypothesis, signifying that worker satisfaction with their job is contingent upon satisfaction with working conditions at the workplace. A discernible observation is the pervasive absence of proper working conditions in the majority of power-loom units. Ventilation, lighting, and working space are notably deficient, contributing to overcrowded settings where workers have limited space to perform their tasks freely. Additionally, the setup of power-loom machines often leads to outdated equipment generating sound pollution and releasing harmful dust particles. Consequently, workers are compelled to operate in poorly constructed and unhygienic spaces.

Health issues in the power-looms:

Health challenges in the power-loom sector are prevalent, with workers enduring physical injuries, health issues, and substandard working conditions attributed to the operation of outdated plain power-looms. Their living conditions are deplorably unhygienic and overcrowded, and some workers even reside within the power-loom sheds, toiling strenuously without access to basic facilities like water and sanitation.Despite the scorching temperature in the power-loom sheds, which can reach around 45 degrees Celsius, there is a stark absence of fans or cooling facilities in the rooms. Moreover, workers in these sheds lack nose-mouth masks to shield themselves from the airborne cotton dust, a primary cause of persistent health issues such as asthma, blood pressure problems, cancer, diabetes, heart ailments, hepatitis, respiratory disorders, skin diseases, and tuberculosis. Additionally, the continuous and elevated noise levels from power-looms adversely impact the workers'

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hearing abilities, leading to conditions like industrial and occupational stresses.Amidst these hazards, the exposure to flying cotton dust particles and the constant high-frequency sounds in the cramped power-loom sheds pose a heightened risk of industrial and occupational stress among the workers. The resultant stress often contributes to alcohol and tobacco addiction among power-loom workers. The industry's workforce is perilously exposed to elevated noise levels from l.

Table 5: -Satisfaction of workers with Health Problems associated with working conditions.

Satisfaction of Worker with Job	**Not at All**	**Somewhat**	**Significant**	**Fully**	**Total**
Not at All	142	35	46	54	277
Somewhat	67	56	62	66	251
Significant	50	59	41	48	198
Fully	24	28	30	37	119
Total	283	178	179	205	845

The chi-square statistic yields a critical value of 67.3964, with a p-value of < 0.00001, signifying significance at $p < 0.05$. Consequently, the null hypothesis is rejected, and the alternative hypothesis is accepted, indicating that worker satisfaction with their job is contingent upon satisfaction with health-related issues connected to work and working conditions.Within power-loom units, workers operate under the constant risk of injury and continuous inhalation of cotton dust particles. Working conditions are characterized by inadequate lighting and persistently high levels of noise from outdated machinery, leading to severe physical and psychological disorders. These conditions significantly diminish worker satisfaction.

In the absence of labor laws and factory acts, power-loom workers face exploitation, with a lack of provisions for weekly holidays, casual leaves, medical leaves, and earned leaves. The constitutional rights of workers are disregarded, as appointment letters are often omitted. Owners exploit workers by requiring round-the-clock work during peak periods at meager wage rates. Job work arrangements are prevalent, with power-loom owners frequently

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disregarding government-set minimum wage rates and rules. Workers receive low wages for extended working hours and are deprived of incentives for overtime. Job satisfaction is intricately linked with wage satisfaction. Many workers are compelled to work in two shifts at minimal wages, often without receiving overtime payments for their additional hours of work. In contrast, the organized sector, such as the car carpet manufacturing factory in Maharashtra, ensures payment for overtime work.

6. Recommendations

Upon scrutinizing the data pertaining to working conditions in the power-loom clusters of Maharashtra, it is evident that immediate measures are imperative to enhance the working environment, with a specific emphasis on modernization. The active involvement and positive response of stakeholders are critical for the effective implementation of government policies aimed at promoting the power-loom sector in Maharashtra. Recognizing the government's proactive role in policy-making for the sector's growth, continuous efforts have been made to formulate policies conducive to the power-loom industry's development. However, to ensure the well-being of both workers and owners, the government should intensify its initiatives to create awareness about its policies and their implementation, striving to eliminate malpractices and leaks in policy execution.

The key recommendations arising from this study are as follows:

- The government must give due attention to the proper enforcement of labor laws and Factory Acts within the power-loom sector.
- Ensuring appropriate working conditions tailored to enhance the efficiency and well-being of workers is paramount and demands focused attention from the government.
- The establishment of a robust marketing chain for power-loom products is essential. Offering remunerative prices to owners will strengthen their economic position, facilitating the implementation of schemes such as wage regulations.
- Ensuring an ample and reasonably priced supply of yarn of requisite quality is crucial for the sustained growth of the power-loom industry.
- Government welfare programs should be effectively implemented, adhering to set targets and coverage. This necessitates comprehensive education for both workers and owners.

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- Technological upgradation is pivotal for increased output at reduced costs. Motivating both owners and workers to embrace technological modernization will positively impact their working and economic conditions.
- Adequate institutional financial support should be provided to facilitate cost-effective modernization programs and quality improvements within the power-loom sector.

7. Conclusion

The power-loom industry in the state of Maharashtra grapples with a myriad of challenges that significantly impact its competitiveness and overall sustainability. The absence of modernization not only diminishes productivity and profitability but also has detrimental effects on the working conditions of the labor force. Across many power-looms, substandard working conditions prevail, characterized by inadequate ventilation, lighting, and workspace. These unfavorable conditions expose workers to the risk of severe physical and psychological disorders. Furthermore, the configuration of power-loom machines in crowded setups restricts the working space available to individuals, contributing to compromised occupational environments.

Compounding these challenges, power-loom workers face a lack of access to essential benefits such as insurance, provident funds, and adequate sanitation facilities. The absence of first aid medical treatment during injuries and the unavailability of free regular medical check-ups further exacerbate the vulnerability of the workforce. Moreover, the absence of robust factory acts and labor laws pertaining to workers' rights, including weekly holidays, casual leaves, medical leaves, and earned leaves, leaves workers marginalized and subject to exploitation, often working for low wage rates.

Power-loom clusters encounter additional hurdles related to the insufficient or interrupted supply of critical inputs such as yarn, electricity, water, and other raw materials. Political interference in production, electricity supply, trade union decisions, and marketing activities further complicates the landscape for the power-loom sector in both India and Maharashtra. The sector's technological stagnation and lack of modernization, exacerbated by a dearth of institutional finance and investment, results in high production costs, low productivity, meager investments in technological advancements, diminished wages, substandard working conditions, legal unawareness, and increased susceptibility to exploitation. Addressing these

multifaceted challenges is imperative for the sustainable growth and development of the power-loom industry in Maharashtra.

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