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| RESEARCH ARTICLE

Occupational Exposure and Physiological Risk Perception among Workers in the Textile Sector: A Cross-Sectional Study from Hyderabad, Pakistan

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| ABSTRACT

The textile sector in Pakistan, particularly in Kotri, Sindh. One of the country's key industrial hubs exposes spinning workers to multiple occupational hazards. Prolonged exposure to chemicals, noise, and dust may contribute to adverse physiological outcomes and reduced quality of life. Understanding workers' perceptions of these hazards and their safety behaviors is crucial for improving workplace health and productivity. A cross-sectional study was conducted at Sapphire Textile Mill in Kotri, Sindh, targeting spinning factory workers with at least one year of employment. Data were collected using a structured questionnaire adapted from Musa et al. (2012), covering 42 items related to occupational exposure, PPE usage, and health outcomes. A total of 450 workers participated (response rate: 100%). Descriptive statistics and Chi-square analyses were conducted using SPSS Version 26 to assess associations between occupational health and safety (OHS) training and personal protective equipment (PPE) usage. The majority of participants were male (≈75%), aged 26–45 (69.6%), and 40% reported smoking. While 84.5% had received OHS training in the past year, 19.3% reported not using PPE primarily due to discomfort, lack of knowledge, or doubts about efficacy. Among those exposed to chemical hazards (21.1%), 68.4% used chemical-resistant PPE; 8.4% reported skin-related symptoms in the past week. Excessive noise was reported by 75.5% of participants, with 12.7% experiencing hearing-related issues. Dust exposure was noted by 65.9%, with 11.5% reporting respiratory complaints and 17.5% eye irritation. OHS training was significantly associated with increased use of chemical-resistant gear, hearing protection, and respiratory masks ($p < .05$). Textile workers in Kotri face considerable occupational exposure risks, especially from chemicals, noise, and dust. Despite moderate symptom prevalence, suboptimal PPE usage mainly among untrained workers underscores the need for continuous education and stricter safety protocols. Enhancing OHS training programs, ensuring consistent PPE availability, and reinforcing safety protocols could improve health outcomes, increase awareness, and enhance productivity across Pakistan's textile industry.

| KEYWORDS

Employee health, work environments, chemicals, noise, dust

| ARTICLE INFORMATION

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1. Introduction

Approximately 430 million individuals, accounting for 12.6% of the global workforce, are engaged in fashion, clothing, and textile production. A significant proportion of these workers are employed informally, often without job security or access to the benefits associated with full-time employment **(**ILO, 2021**).** The global fashion industry holds an estimated value of $2 trillion, with textile and apparel exports from leading manufacturing nations exceeding $8 billion in 2021 **(**UNCTAD, 2022). The textile sector is a key driver of employment and economic growth and represents one of the most vital components of national economies such as Pakistan's **(**WTO, 2022). Despite its economic importance, the industry exposes workers to a range of occupational health hazards**,** particularly with the rapid pace of industrialization and technological advancement (OECD, 2021)**.** The textile spinning sector is especially critical due to its unique exposure conditions and demanding work environment (Karim et al., 2020). Ghori et al. (2017) found cerebrovascular accidents as the main cause of non-traumatic coma, highlighting serious health risks linked to systemic conditions. In textile workers from Hyderabad, prolonged exposure to chemicals and poor working conditions may increase risks of such health problems. Addressing occupational hazards and improving risk awareness is key to preventing severe outcomes like coma (Ghori et al. 2017). Workers in this sub-sector are regularly exposed to noise pollution, airborne dust, and chemical agents, which contribute to a higher risk of occupational illness (Lee & Park, 2021). In particular, dust generated during the spinning process made from natural fibers such as cotton, wool, jute, and hemp has been linked to respiratory ailments**,** including byssinosis, occupational asthma, and chronic bronchitis (Singh et al., 2021). Studies have confirmed that prolonged inhalation of cotton and other organic fibers in textile environments is strongly associated with impaired pulmonary function and long-term respiratory conditions (Ahmed et al., 2019). Noise exposure remains a persistent occupational hazard in the textile industry, particularly in developing countries, where older machinery and limited enforcement of safety regulations prevail (Rahman et al., 2013). Beyond its direct impact on hearing loss, prolonged industrial noise exposure has been associated with sleep disturbances, heightened anxiety levels, and increased risk of occupational injuries due to reduced concentration (Chen & Varghese, 2014). In addition to physical hazards, chemical agents used throughout textile manufacturing such as formaldehyde, sodium hydroxide, chlorine-based bleaches, acetic acid, surfactants, and cyanide derivatives pose serious health threats to workers (Jain et al., 2023). Chemical exposure during the spinning process has been linked to endocrine disruption, hepatotoxicity, nephrotoxicity, and carcinogenic outcomes (Singh & Patel, 2022). Despite the textile industry's prominence in countries like Pakistan, where it serves as a pillar of the national economy, there remains a notable scarcity of research addressing the unique occupational health risks faced by spinning workers (Kara & Demir, 2020). Shaikh et al. (2017) reported a high prevalence of bacterial infections, mainly from respiratory and urinary sources, among sepsis patients. In industrial areas like Hyderabad, Pakistan, textile workers face chronic exposure to chemicals and poor hygiene conditions, which may weaken immunity and increase infection risks potentially leading to sepsis, as reflected in Shaikh et al.'s findings. While prior investigations often explore general risks within the textile sector, they tend to overlook the compounding hazards specific to the spinning stage particularly simultaneous exposure to noise, airborne fibers, and chemical agents.

This study seeks to fill this research gap by examining the nature of workplace hazards and the factors contributing to risk perception among textile spinning workers. The findings aim to support occupational and environmental health professionals in designing targeted interventions that can reduce disease burden, improve preventive strategies, and enhance overall workplace safety in this high-risk industry segment.

1.1 Implications for Occupational Health Policy and Practice

There are various disciplines which are related with Occupational Health and Safety like epidemiology, industrial hygiene, occupational nursing, toxicology, engineering and occupational nursing. It involves the conditions and surroundings that influence workers and other related human beings at working environment Bakri et al (2006). Occupational health and safety management is largely concern for the protection from hazards at workplace. According to the International labor organization (ILO) and World Health Organization (WHO) occupational health is described as "Occupational health should be a goal at the maintenance and promotion of the topmost quality of mental, physical and social well-being of employees in all kinds of work". Such initiatives not only contribute to safer working environments but also help prevent chronic illnesses and support a healthier, more efficient workforce within the textile industry.

1.2 Occupational Hazards: Current Perspectives and Gaps

Occupational health and safety (OHS) remain pivotal concerns in industrial sectors globally, especially in high-risk environments like the textile industry. In developing countries such as Pakistan, textile workers are frequently exposed to multifactorial hazards including chemical agents, excessive noise, and airborne particulates, all of which can adversely impact health and productivity (Shaikh et al., 2018; Shaikh et al., 2019). Prior research has underscored the need for effective risk assessment frameworks and adaptive safety management strategies to mitigate these risks (Sidra et al., 2025). In this context, decision-making tools such as comparative risk analysis and multi-criteria decision analysis are gaining prominence for improving hazard management practices (Sidra et al., 2025). Moreover, enhanced awareness, safety training, and institutional support are shown to significantly reduce turnover intentions and improve overall safety compliance (Shaikh et al., 2025a; Shaikh & Song, 2018).

Recent findings also indicate that case-based learning in physiology and applied workplace health sciences can play a transformative role in preparing clinical and industrial professionals to manage chronic conditions and workplace hazards (Sidra et al., 2025; Sidra et al., 2025). Fire safety, often under-addressed, poses an additional threat in industrial environments, particularly in densely populated urban areas, necessitating structured evacuation protocols and forensic accident modeling (Shaikh et al., 2024; Saif-ul-Islam et al., 2024). Furthermore, earlier studies evaluating workplace hazard awareness and the availability of medical facilities have highlighted significant gaps in both policy and practice (Shaikh et al., 2017; Mohsin et al., 2016). Taken together, these multidisciplinary investigations advocate for a comprehensive, education-driven, and policy-supported approach to worker safety in Pakistan's manufacturing and textile sectors.

1.3 Textile Spinning Industries in Pakistan

Express Tribune (2013) has reported that in Asia, Pakistan is the 8th biggest textile goods exporter and 3rd largest spinning unit. It contributes the 9.5% GDP in the economy of Pakistan. It also delivers the employment30 % of the 49 million workforces of the country which are the highest employment ratio in Pakistan. Pakistan has 1221 Ginning units, 442 Spinning units, 124 large Spinning units and 425 small units. The textile export in Pakistan is RKR. 1090643 Million As shown in Table.1.

Table 1: Textile spinning industries in Pakistan

Total Textile Industries	Employment Size	GDP	Annual Export
2212 Units	30% of the 49 million workforce of the country	9.5%	Up to RKR. 1090643 Million

Source: The Express Tribune, March 18th, 2013

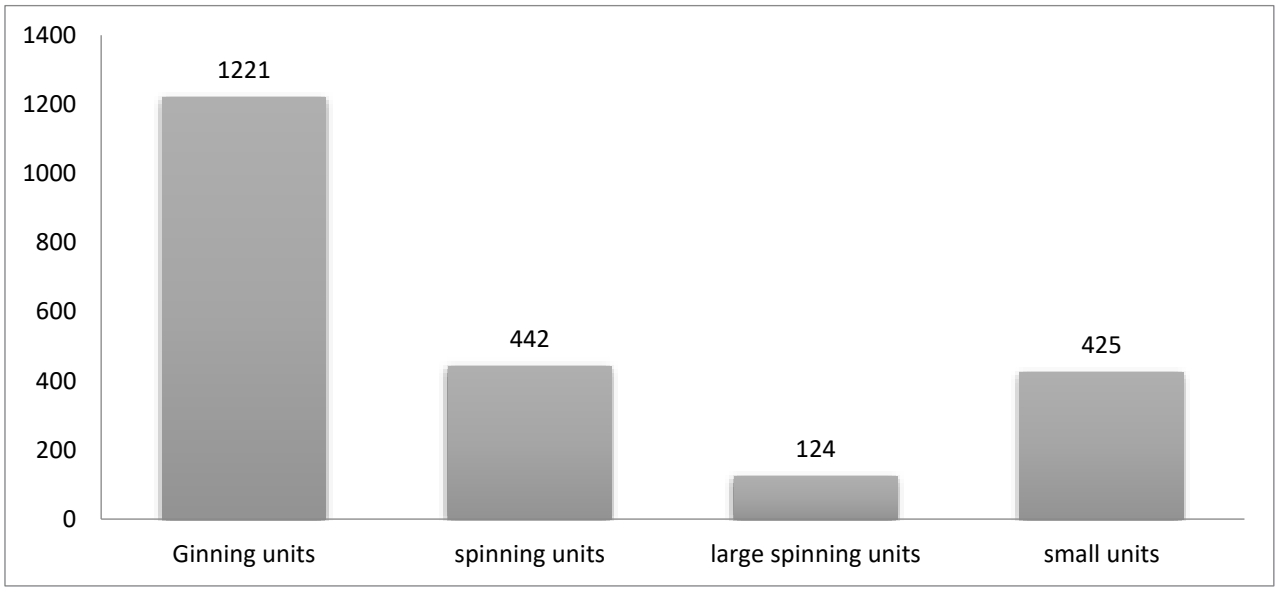

Fig. 1: Textile spinning industries in Pakistan

1.4 Occupational diseases and accidents in Pakistan

Pasha and Liesivuori (2003) have suggested that most accidents and diseases occur due to hazards issues in the occupational places in Pakistan. The manufacturing industries are trying to make latest technology machines which are helpful to reduce the hazards at the workplace. National Workshop (2013) has calculated that approximately 97% of labor union is uninformed about the health and safety problems in Pakistan. There are different sectors in Pakistan where workers are working without health and safety at workplace. Approximately 50,000 workers are working in power looms in Punjab but, only 5% power looms are certified with International Standard Organization (ISO 9001). Power looms generate huge noises which cause serious problems like tuberculosis, hepatitis and deafness.

2. Methods

2.1 Design and sampling

This cross-sectional study was carried out in spinning factories located in Kotri, Jamshoro District, and Sindh, Pakistan. Kotri ranks fourth in textile exports among Pakistan's four provinces, underscoring the city's economic significance in the textile sector. The study population consisted of workers who had been employed in spinning factories for a minimum duration of one year. The

total workforce across the surveyed factories comprised approximately 1,500 employees. The primary objective of this research was to examine the Occupational Exposure and Physiological Risk Perception among Workers in the Textile Sector Kotri, Sindh. This chapter outlines both the data collection procedures and the analytical methods used, employing SPSS Version 20 (portable version). Descriptive statistics including mean, standard deviation, and variance were used to determine frequencies and percentages for the analysis.

3. Data Collection

Data was collected at Sapphire Textile Mill**,** located in Kotri, Sindh, using a structured questionnaire adapted from Musa et al. (2012)**,** with modifications made to fit the local context. The questionnaire comprised 42 items, organized into various sections to assess workers' exposure to occupational risks and their safety-related practices. Sapphire Textile Mill consists of two units; data for this study was gathered exclusively from Unit 1**,** where approximately 600 workers are employed. In line with the guidelines suggested by Draugalis et al. (2008)**,** which emphasize the importance of collecting data through structured surveys in industrial settings to assess knowledge, attitudes, and practices, this survey approach was chosen. Prior to participation, written informed consent was obtained from all respondents. Participation was entirely voluntary**,** and respondents were assured of anonymity and confidentiality in all aspects of data handling and reporting.

3.1 Study Variables

This study considered a range of independent variables, including gender, age, educational attainment, total and weekly working hours, department of employment, smoking status, job type, frequency of periodic medical examinations, exposure to workplace risk factors, use of personal protective equipment (PPE), occupational health and safety (OHS) training, availability of protective measures**,** and health problems associated with workplace exposures**.**

The dependent variables were defined as the use of chemical-resistant PPE, hearing protection devices**,** and respiratory protective masks**.** Based on an extensive literature review, it was hypothesized that the usage of these protective measures may be significantly associated with OHS training received within the past year**.** Therefore, statistical analyses were conducted with a focus on these relationships.

Variables specifically related to exposure to chemical substances, noise, and dust were further examined within relevant subgroups particularly among participants who reported encountering these occupational hazards.

3.2 Statistical Analysis

This study sought to address the research gap by identifying and evaluating Occupational Exposure and Physiological Risk Perception among Workers in the Textile Sector especially spinning workers. The data were analyzed using IBM SPSS Statistics for Windows, Version 26.0**.** Descriptive statistics including frequencies, percentages, means, ranges, and standard deviations were used to summarize the sociodemographic data**,** work-related characteristics**,** and exposure profiles of the participants.

To assess associations between categorical variables, appropriate statistical tests such as Pearson's Chi-square test**,** Fisher's exact test**,** and Yates' Continuity Correction were employed, depending on the data distribution and expected frequencies. A p-value of less than 0.05 was considered statistically significant for all analyses.

4. Results

Out of 450 eligible workers, all participated in the study, achieving a participation rate of 100%. Regarding demographics, approximately three-quarters of the participants were male, 69.6% were aged between 26 and 45 years, 36.9% had completed high school, and 40.0% were smokers. Half of the participants had a total working period of less than 5 years, while 55.8% worked more than 45 hours per week.

In terms of occupational health practices, nearly all participants (99.2%) reported undergoing a pre-employment medical examination, 82.0% reported having annual periodic medical examinations, and 84.5% had received training on occupational health and safety in the last year. Regarding the use of personal protective equipment (PPE), 19.3% of participants admitted not using PPE while working. The top three reasons for not using PPE were the perception that PPE did not provide adequate protection (40.3%), discomfort or interference with work caused by PPE (29.9%), and lack of knowledge about how to use PPE (20.9%). Almost a quarter of participants believed their work negatively impacted their health [Table 1].

Chemical substances were used in the departments where 21.1% of the participants worked. Among these participants, 66.7% could not identify the chemicals used. More than three-quarters of participants reported that chemicals had labels with safety precaution information. Ninety-six percent reported the presence of instructions and warning signs about chemicals in the work

environment, and 93.3% reported the presence of emergency eye and body shower stations. According to occupational safety experts, measurements have been conducted for 82.7% of workplace chemicals, and 92.0% of participants received training on the health effects of chemical substances, safety precautions, use of PPE, and procedures after exposure. Health records showed that 69.3% of participants had blood tests for chemicals during periodic examinations. Overall, 86.7% used personal protective equipment such as gloves, protective clothing, shoes, and goggles while working. About 10% reported skin complaints such as itching, redness, dryness, scaling, staining, and blisters due to chemical exposure in the last week [Table 2].

About three-quarters of the participants (75.5%) reported excessive noise in the workplace. Of those exposed to noise, more than a quarter did not receive rest breaks away from noise during working hours. Eighty percent had protective measures against noise in the workplace, including insulation, damping, screening, closures, and absorbent covers. Approximately three-quarters had regular personal noise exposure measurements and hearing tests during periodic examinations. Over 90% received training on noise-related health effects, precautions, and correct use of PPE for hearing protection. However, 12.7% experienced temporary or permanent hearing loss or ringing (tinnitus) in the last week. One-seventh reported other noise-related complaints such as headaches, distraction, sleep disturbance, irritability, restlessness, and hypertension [Table 3].

About two-thirds of participants (65.9%) reported dusty working environments. Of these, 80.3% had proper ventilation, 65.8% had respirable dust monitoring, 72.6% had chest X-rays, and 73.1% had pulmonary function tests during periodic examinations. Most participants (91.9%) received training on dust health effects, protective measures, and appropriate mask use, with 85.9% using respiratory protective masks at work. Respiratory complaints such as coughing, shortness of breath, burning, and chest tightness were reported by 11.5% in the last week, while 17.5% reported eye problems like redness, itching, and watering. Respiratory complaints after a few hours at work were reported by 8.1% [Table 4].

Among participants who had received occupational health and safety training in the past year, 79.5% reported using chemical-resistant personal protective equipment, while only 20.5% of untrained participants reported using such equipment. Conversely, 68.2% of untrained participants did not use chemical-resistant PPE, compared to 31.8% of those who had received training.

In terms of hearing protection, 87.8% of trained participants reported using personal protective equipment for hearing, whereas only 12.2% of untrained participants did so. Additionally, 69.0% of trained individuals who did not use hearing protection contrasts with 31.0% among those without training. Similarly, 88.3% of participants who had undergone training used respiratory protective masks, while just 11.75% of untrained participants used them. In contrast, 64.5% of trained participants who did not use respiratory masks is significantly lower than the 35.5% among those untrained. Overall, significant differences were found across all PPE categories, indicating that occupational health and safety training was associated with higher PPE usage rates ($p < .05$; Table 5).

Table 1. Participants' Sociodemographic and Work-Related Characteristics (N = 450)

Sociodemographic and Work-Related Characteristics	n	%
Gender		
Male	341	75.8%
Female	109	24.2%
Age Groups		
18–25 years old	71	15.8%
26–35 years old	165	36.6%
36–45 years old	149	33.0%
46 years and over	65	14.6%
Educational Level		
Elementary school	127	28.2%
Middle school	126	27.9%
High school	166	36.9%
College and higher	31	7.0%
Smoking Status		
Yes	180	40.0%
No	270	60.0%

Sociodemographic and Work-Related Characteristics	n	%
Total Working Years		
1–2 years	99	22.0%
3–4 years	129	28.7%
5–9 years	113	25.1%
10 years and more	109	24.2%
Weekly Working Hours		
45 hours or less	199	44.2%
More than 45 hours	251	55.8%
Pre-employment Medical Examination		
Yes	447	99.3%
No	3	0.7%
Annual Periodic Medical Examination		
Yes	369	82.0%
No	81	18.0%
OHS Training in the Last Year		
Yes	380	84.4%
No	70	15.6%
Use of Personal Protective Equipment (PPE)		
Yes	363	80.7%
No	87	19.3%
Reasons for Not Using PPE *(n = 87)*		
It is annoying/interferes with work	35	40.3%
It does not provide adequate protection	26	29.9%
Worker does not know how to use it	18	20.7%
Worker thinks there is no need for it	8	9.1%
Perception: Work Affects Health Negatively		
Yes	112	24.8%
No	338	75.2%

Table 2. Participants' Occupational Chemical Exposure Characteristics (n = 95)

Occupational Chemical Exposure Characteristics	n	%
Using chemicals in the workplace		
Yes	95	21.1%
No	355	78.9%
Recognizing chemicals in the workplace		
Yes	63	66.3%
No	32	33.7%
Hazard labels on chemicals in the workplace		
Yes	58	61.1%
No	37	38.9%
Warning signs about chemicals in the workplace		
Yes	72	75.8%
No	23	24.2%
Eye and body shower in the workplace		

Occupational Chemical Exposure Characteristics	n	%
Yes	70	73.7%
No	25	26.3%
Monitoring for chemicals in the workplace		
Yes	62	65.3%
No	33	34.7%
Blood tests for chemicals during periodic examination		
Yes	52	68.4%
No	24	31.6%
Health and safety training on chemical use		
Yes	69	72.6%
No	26	27.4%
Use of chemical-resistant personal protective equipment		
Yes	65	68.4%
No	30	31.6%
Skin problems due to chemicals (in the last week)		
Yes	8	8.4%
No	87	91.6%

Table 3. Participants' Occupational Noise Exposure Characteristics (n = 95)

Occupational Noise Exposure Characteristics	n	%
Excessive noise in the workplace		
Yes	340	75.5%
No	110	24.5%
Taking rest break at work (among those with excessive noise)		
Yes	245	72.0%
No	95	28.0%
Warning signs about noise in the workplace		
Yes	422	93.7%
No	28	6.3%
Protective practices for noise in the workplace		
Yes	363	80.6%
No	87	19.4%
Measurement of personal noise exposure		
Yes	333	73.9%
No	117	26.1%
Hearing test at periodic examination		
Yes	341	75.7%
No	109	24.3%
Health and safety training on noise in the workplace		
Yes	420	93.3%
No	30	6.7%
Personal protective equipment for hearing		
Using	395	87.7%
Not using	55	12.3%

Occupational Noise Exposure Characteristics	n	%
Noise-related hearing problems in the last week		
Yes	57	12.7%
No	393	87.3%
Other noise-related complaints in the last week		
Yes	60	13.4%
No	390	86.6%

Table 4. Participants' Occupational Dust Exposure Characteristics (n = 297)

Occupational Dust Exposure Characteristics (N=297)	n	%
Dust in the workplace		
Yes	297	65.9%
No	153	34.1%
Proper ventilation in the workplace		
Yes	238	80.3%
No	59	19.7%
Work environment monitoring for dust		
Made	195	65.8%
Not made	102	34.2%
Chest X-ray at periodic examination		
Made	216	72.6%
Not made	81	27.4%
Pulmonary function test at periodic examination		
Made	217	73.1%
Not made	80	26.9%
Health and safety training on dust in the workplace		
Yes	273	91.9%
No	24	8.1%
Respiratory protective mask use		
Using	255	85.9%
Not using	42	14.1%
Respiratory complaints due to dust in the last week		
Yes	34	11.5%
No	263	88.5%
Eye problems due to dust in the last week		
Yes	52	17.5%
No	245	82.5%
Respiratory complaints after a few hours in the workplace		
Yes	24	8.1%
No	273	91.9%

Table 5. Participants' Personal Protective Equipment Use by Occupational Health and Safety Training Status

Personal protective equipment use	Occupational health and safety training last year			
	yes		no	
	n	%	n	%
Chemical resistant personal protective equipment (n=95)**				
Using	58	79.5%	7	20.5%
Not using	15	31.8%	15	68.2%
Personal protective equipment for hearing (n=450)**				
using	395	87.8%	29	12.2%
Not using	55	69.0%	13	31%
Respiratory protective mask (n=297)#				
Using	235	88.3%	20	11.75%
Not using	31	64.5%	11	35.5%

*p = .005. **p = .006. #p<.001.

This study, conducted at Sapphire Textile Mill, Kotri, Sindh, revealed critical insights into occupational exposures and health-related behaviors among textile workers. The structured questionnaire, adapted from *Musa et al. (2012)* and tailored for the local context, enabled comprehensive data collection across several domains.

Among the workers, 21.1% reported using chemicals in their workplace, yet only 68.4% reported using chemical-resistant PPE. Notably, skin problems due to chemical exposure in the last week were reported by 8.4% of the exposed workers. Although this is lower than prevalence rates reported in studies from Morocco (69%) and China (29%), it remains substantially higher than in the general population of Europe (5.5%). The relatively low prevalence in this study could be partially attributed to high rates of PPE usage (68.4%) and the presence of hazard communication tools like warning signs (75.8%) and hazard labels (61.1%). However, gaps remain in awareness, as one-third of the workers could not recognize workplace chemicals. This highlights the need for targeted training programs on chemical safety.

The study found that 75.5% of participants were exposed to excessive noise, and 12.7% reported hearing issues in the past week. This prevalence is lower than that found in India (36%), Nigeria (85%), and Myanmar (25%), suggesting comparatively better conditions or preventive practices. Nonetheless, the 12.7% figure still warrants concern. Encouragingly, 87.7% of the exposed workers reported using hearing protection, and 93.3% had received training on noise hazards. Moreover, 73.9% underwent personal noise exposure assessments, reflecting moderate adherence to occupational health protocols. These findings reinforce the importance of routine auditory testing and continuous education to prevent occupational hearing loss.

Dust exposure was reported by 65.9% of the workforce, with 11.5% experiencing respiratory issues and 17.5% reporting eye problems in the previous week. Although lower than findings in studies from Ethiopia (47.8% respiratory symptoms) and India (38.7% eye issues), these rates are still indicative of considerable occupational risk. Encouragingly, 85.9% of workers exposed to dust reported using respiratory masks, and 91.9% received safety training. Periodic health checks, including pulmonary function tests (73.1%) and chest X-rays (72.6%), were also relatively common, suggesting a reasonably well-implemented monitoring system. Still, nearly 1 in 5 workers reported inadequate ventilation, a gap that should be addressed through engineering controls.

A consistent trend observed was the strong positive association between PPE use and recent OHS training. Among those who had received training, over 90% used chemical-resistant gloves, hearing protection, and respiratory masks. In contrast, PPE use was substantially lower among those without recent training (50.0%–72.7%). This finding aligns with international literature, including studies from Iran, Uganda, and Ethiopia, which similarly reported increased PPE usage following training interventions. The data clearly underscores the critical role of continuous, context-specific occupational safety training in enhancing compliance with protective practices.

While 99.3% of the participants underwent pre-employment medical evaluations, only 82% reported receiving annual periodic checkups. This gap is concerning, especially for those exposed to high-risk factors like chemicals, noise, and dust. Periodic health monitoring is vital for early detection and prevention of occupational illnesses, yet its inconsistent implementation remains a key issue—echoing findings from other studies in Türkiye and globally. Stronger regulatory enforcement and employer accountability are needed to ensure compliance with occupational health standards.

5. Limitations

This study, conducted at Sapphire Textile Mill in Kotri, Sindh, offers valuable insights into occupational exposures and health-related behaviors among textile workers. However, several limitations must be acknowledged when interpreting the findings. As the research was limited to a single spinning mill, the results may not be generalizable to other textile sectors or regions. Furthermore, the study relied primarily on self-reported data for variables such as the use of personal protective equipment (PPE), exposure experiences, and health complaints, which may have introduced recall or reporting bias. Although efforts were made to enhance accuracy through the review of health records and on-site observations, the absence of objective measurements such as air quality monitoring or clinical testing limits the depth of environmental and health assessments. Additionally, the study did not extensively explore psychological stressors or ergonomic conditions, which are also critical to understanding the full spectrum of occupational health risks. Future research should employ mixed-methods approaches, include diverse textile units, and integrate quantitative exposure assessments and ergonomic evaluations to develop a more comprehensive understanding of occupational health challenges in the textile industry.

5.1 Implications for Occupational Health Nursing Practice

The findings from this study underscore significant occupational health risks faced by workers in the spinning sector, particularly exposure to textile dust, noise, and chemicals, coupled with low levels of PPE usage. These factors are associated with a heightened risk of respiratory conditions, hearing impairment, and other chronic health issues. Occupational health nurses can play a key role in addressing these concerns by implementing targeted health and safety interventions at the workplace. Educational programs tailored to the local workforce should emphasize the correct usage, care, and benefits of PPE, while addressing common barriers such as discomfort or lack of awareness. In addition, nurses should advocate for institutional policies that support regular health monitoring, including periodic medical check-ups, spirometry tests, and hearing assessments, to detect early symptoms of occupational diseases.

Given the observed prevalence of smoking among workers, occupational health nurses are also well-positioned to lead smoking cessation initiatives within the mill environment. These could include individual counseling, peer support groups, and incentive-based programs to encourage healthy behavior change. Furthermore, promoting a culture of safety through regular training, hazard communication, and employee engagement in occupational health initiatives can significantly enhance worker well-being. By adopting these strategies, occupational health nurses can play a vital role in preventing occupational illnesses, improving health outcomes, and fostering a safer and healthier working environment in the textile industry of Sindh and beyond.

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Appendix

Section A: Sociodemographic Information

1. **Gender:**
   - ☐ Male
   - ☐ Female
2. **Age:**
   - ☐ 18–25 years
   - ☐ 26–35 years
   - ☐ 36–45 years
   - ☐ 46 years and over
3. **Educational Level:**
   - ☐ Elementary School
   - ☐ Middle School
   - ☐ High School
   - ☐ College or Higher
4. **Smoking Status:**
   - ☐ Yes
   - ☐ No

Section B: Work-Related Characteristics

5. **Total Working Years in the Textile Industry:**
   - ☐ 1–2 years
   - ☐ 3–4 years
   - ☐ 5–9 years
   - ☐ 10 years or more
6. **Weekly Working Hours:**
   - ☐ 45 hours or less
   - ☐ More than 45 hours
7. **Did you undergo a pre-employment medical examination?**
   - ☐ Yes
   - ☐ No
8. **Do you receive annual periodic medical examinations?**
   - ☐ Yes
   - ☐ No
9. **Have you received Occupational Health and Safety (OHS) training in the last year?**
   - ☐ Yes
   - ☐ No

Section C: Use of Personal Protective Equipment (PPE)

10. **Do you use personal protective equipment at work?**
    - ☐ Yes
    - ☐ No
11. *(If NO)* What is the main reason you do not use PPE?
    - ☐ It is annoying/interferes with work
    - ☐ It does not provide adequate protection
    - ☐ I do not know how to use it
    - ☐ I believe there is no need for it
12. **Do you think your work negatively affects your health?**
    - ☐ Yes
    - ☐ No

Section D: Chemical Exposure

13. **Do you use or come into contact with chemicals at work?**
    - ☐ Yes
    - ☐ No
14. *(If YES)* Do you recognize the chemicals used in your workplace?

- ☐ Yes
- ☐ No

15. Are hazard labels present on chemical containers?
    - ☐ Yes
    - ☐ No
16. Are warning signs about chemicals displayed at the workplace?
    - ☐ Yes
    - ☐ No
17. Is there an eye/body shower available in case of chemical exposure?
    - ☐ Yes
    - ☐ No
18. Is there monitoring for chemical levels at your workplace?
    - ☐ Yes
    - ☐ No
19. During periodic examinations, do you undergo blood tests for chemical exposure?
    - ☐ Yes
    - ☐ No
20. Have you received training on safe chemical handling?
    - ☐ Yes
    - ☐ No
21. Do you use chemical-resistant PPE (e.g., gloves, apron)?
    - ☐ Yes
    - ☐ No
22. Have you experienced skin problems due to chemicals in the past week?
    - ☐ Yes
    - ☐ No

Section E: Noise Exposure

23. **Do you experience excessive noise at your workplace?**
    - ☐ Yes
    - ☐ No
24. *(If YES)* Are rest breaks provided to reduce noise exposure?
    - ☐ Yes
    - ☐ No
25. Are there warning signs about noise hazards displayed?
    - ☐ Yes
    - ☐ No
26. Are there protective practices (e.g., noise barriers, soundproofing)?
    - ☐ Yes
    - ☐ No
27. Has your personal noise exposure been measured?
    - ☐ Yes
    - ☐ No
28. Do you undergo hearing tests during periodic medical exams?
    - ☐ Yes
    - ☐ No
29. Have you received training on noise-related occupational hazards?
    - ☐ Yes
    - ☐ No
30. Do you use hearing protection equipment (e.g., earplugs)?
    - ☐ Yes
    - ☐ No
31. Have you experienced hearing problems in the past week?
    - ☐ Yes
    - ☐ No
32. Have you experienced other noise-related symptoms (e.g., headache, dizziness)?

- ☐ Yes
- ☐ No

Section F: Dust Exposure

33. **Is there dust exposure at your workplace?**
    - ☐ Yes
    - ☐ No
34. Is proper ventilation available to reduce dust?
    - ☐ Yes
    - ☐ No
35. Has workplace dust monitoring been conducted?
    - ☐ Yes
    - ☐ No
36. During periodic exams, do you undergo a chest X-ray?
    - ☐ Yes
    - ☐ No
37. Do you receive pulmonary function tests during check-ups?
    - ☐ Yes
    - ☐ No
38. Have you received training on dust-related risks and protection?
    - ☐ Yes
    - ☐ No
39. Do you use a respiratory protective mask at work?
    - ☐ Yes
    - ☐ No
40. Have you experienced respiratory issues due to dust in the last week?
    - ☐ Yes
    - ☐ No
41. Have you experienced eye problems due to dust in the last week?
    - ☐ Yes
    - ☐ No
42. Do you face breathing problems after a few hours of work?
    - ☐ Yes
    - ☐ No