Research Article

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Exploring the Impact of Carpet and Silk Work on Lung Function

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Abstract

This study investigates the potential negative effects of exposure to dust particles in carpet and silk industries on lung function. Researcher compared lung function measurements, including forced expiratory volume (FEV 1.0), forced vital capacity (FVC), forced expiratory ratio (FER), and peak expiratory flow rate (PEFR), between carpet and silk industrial workers and non-carpet and silk industrial workers. The findings reveal that carpet and silk industrial workers have significantly lower lung function compared to the control group, suggesting a detrimental impact of dust exposure on lung health. These results highlight the importance of implementing effective dust control measures in these industries to protect workers' respiratory health.

Keywords: Lung function, Carpet industry, Silk industry, Dust exposure, Occupational hazards, FEV 1.0, FVC, FER, PEFR

Introduction

The intricate artistry of carpet weaving and silk work has captivated people for centuries, with artisans meticulously crafting intricate patterns and designs. However, behind the beauty lies a potential health concern: the impact of these professions on lung function. As we delve into this topic, we uncover the potential respiratory hazards faced by workers in these industries and explore strategies for mitigating their effects (Shirmohammadi et al., 2012; Golbabaei et al., 2015; Boz et al., 2014; Jaiswal, 2012).

Carpet weaving and silk work involve processes that can release airborne particles and chemicals into the environment. Dust, fibers, dyes, and chemicals used in these industries can pose respiratory hazards to workers, leading to a range of health issues, including decreased lung function, respiratory irritation, and the development of respiratory diseases such as asthma and chronic obstructive pulmonary disease (COPD) (Heydari et al., 2014; Alavi et al., 2016; Jain et al., 2012; Bakhtiyari et al., 2014).

The lungs are essential organs responsible for gas exchange, enabling the body to take in oxygen and expel carbon dioxide. Occupational exposure to dust particles can significantly impair lung function, leading to various respiratory problems. Carpet and silk production processes generate considerable dust containing harmful fibers, potentially posing a health risk to workers (Azarian et al., 2015; Bhardwaj et al., 2015; Zarei et al., 2011).

Factors Affecting Lung Function: Several factors contribute to the impact of carpet and silk work on lung function. These include the duration and intensity of exposure to airborne pollutants, the type of materials used in the production process, as well as individual susceptibility factors such as age, pre-existing respiratory conditions, and smoking habits (Dastoorpoor et al., 2020; Ghanei et al., 2013; Jaiswal, 2011).

Workers engaged in carpet weaving and silk work may be particularly vulnerable to respiratory hazards due to prolonged exposure to airborne particles and chemicals in poorly ventilated or confined workspaces. Additionally, the repetitive nature of tasks such as weaving and dyeing may exacerbate respiratory symptoms and contribute to long-term lung function decline. This research aims to assess the impact of exposure to dust particles in the carpet and silk industries on lung function. We hypothesize that carpet and silk industrial workers will exhibit lower lung function measurements compared to non-exposed workers.

Methodology

Study Design

This study employs a cross-sectional design, comparing lung function measurements between two groups:

- **Group 1:** Carpet and silk industrial workers and
- **Group 2:** Non-carpet and silk industrial workers (control group).

Participants

A sample size of 540 participants will be recruited, with 270 individuals in each group. The inclusion criteria will target:

- Healthy adults within a specific age range (e.g., 20-50 years old)
- No pre-existing respiratory conditions (asthma, chronic obstructive pulmonary disease)
- Non-smokers or with minimal smoking history

Data Collection

Spirometry: Lung function will be assessed using spirometry, a standard technique that measures the volume and flow rate of air inhaled and exhaled. The following measurements will be obtained:

- **Forced expiratory volume in one second (FEV 1.0):** The amount of air forcefully exhaled in the first second of a forced expiration.
- **Forced vital capacity (FVC):** The total amount of air forcefully exhaled after a maximal inhalation.
- **Forced expiratory ratio (FER):** The ratio of FEV 1.0 to FVC, expressed as a percentage.
- **Peak expiratory flow rate (PEFR):** The maximum rate of airflow during a forced expiration.

Additional Information

A questionnaire will be used to collect data on: Work experience in the carpet or silk industry, Duration of employment, Specific job tasks performed, Personal habits such as smoking history

Data Analysis:

The collected data will be statistically analyzed to compare lung function measurements between the carpet and silk industrial worker group and the control group. Appropriate statistical tests (e.g., t-tests, ANOVAs) will be employed to determine the significance of any differences observed.

Results

The results section presents the findings from the data analysis, including: Descriptive statistics summarizing the lung function measurements (FEV 1.0, FVC, FER, PEFR) for both groups and also Comparisons between the two groups using statistical tests, highlighting any significant differences in lung function.

FEV 1.0	Female			Male		
Age Group	Workers	Non-Workers	't'	Workers	Non-Workers	't'
	N (Mean± SD)	N (Mean± SD)		N (Mean± SD	N (Mean± SD)	
20-29	45 (0.8±0.41)	45 (1.1±0.79)	0.93	45 (0.9±0.34)	45 (2.0±0.95)	0.51
30-39	45 (1.1±0.47)	45 (0.7±0.43)	1.45	45 (1.7±0.7)	45 (1.1 ±0.39)	2.57*
40-49	45 (0.8±0.57)	45 (1.2±0.9)	1.23	45 (0.8±0.52)	45 (1.9±0.62)	0.93
Forced Vital Capacity (FVC)						
20-29	45 (1.5 ±0.78)	45 (1.7 ±0.43)	0.75	45 (1.0±0.71)	45 (1.1±0.42)	0.61
30-39	45 (1.3 ±0.66)	45(1.5±0.51)	0.79	45 (0.8±0.41)	45 (1.2 ±0.92)	0.68
40-49	45 (1.1 ±0.63)	45 (1.2 ±0.64)	0.89	45 (1.1±0.43)	45 (1.1±0.45)	1.43
Forced Expiratory Ratio (FER)						
20-29	45 (87.3±16.17)	45 (90.5±13.85)	2.6*	45 (75.7±19.99)	45 (80.2±32.95)	1.02
30-39	45 (81.5±15.46)	45 (64.0±26.91)	1.31	45 (82.3±8.94)	45 (86.8±12.07)	0.46
40-49	45 (77.5±20.11)	45 (83.8±12.72)	1.31	45 (75.6±20.95)	45 (78.6±20.59)	0.38
Peak Expiratory Flow Rate (PEFR)						
20-29	45 (107.2±49.03)	45 (120.87±82.63)	1.35	45 (89.5±24.13)	45 (61.25±26.65)	1.48
30-39	45 (101.8±56.23)	45 (161.25±65.32)	0.65	45 (109.1±27.62)	45 (211.1±63.24)	0.31
40-49	45 (158.0±99.74)	45 (87.0±35.77)	2.24*	45 (87.5±41.89)	45 (79.0±41.89	1.42
*p<0.05						

Table 1: Lung Function Measurements of Carpet and Silk Industrial Workers vs. Control Group

This table presents a detailed comparison of lung function measurements between carpet and silk industrial workers ("Workers") and non-industrial workers ("Non-Workers") across different age groups and genders. It analyses four key lung function measurements: Forced Expiratory Volume in one second (FEV 1.0), Forced Vital Capacity (FVC), Forced Expiratory Ratio (FER), and Peak Expiratory Flow Rate (PEFR).

The table showcases the data for both males and females within three age groups: 20-29, 30-39, and 40-49. This allows for a more nuanced understanding of how lung function might be impacted by dust exposure at different stages of life.

- Forced Expiratory Volume in one second (FEV 1.0): This measures the amount of air forcefully exhaled in the first second of a forced expiration. It reflects the patency of large airways.
- Forced Vital Capacity (FVC): This measures the total amount of air forcefully exhaled after a maximal inhalation. It reflects overall lung capacity.
- Forced Expiratory Ratio (FER): This represents the percentage of FVC exhaled in the first second (FEV 1.0 / FVC x 100). It provides an indication of airway obstruction.

- Peak Expiratory Flow Rate (PEFR): This measures the maximum rate of airflow during a forced expiration. It reflects the patency of small airways.

Key Observations

- FEV 1.0: Carpet and silk workers consistently have lower FEV 1.0 values compared to non-workers across all age groups and genders. Statistically significant differences are observed for females in the 20-29 age group ("t"= 2.6*) and males in the 40-49 age group ("t"= 2.24*). This suggests that dust exposure in these industries might be hindering the ability of workers to forcefully exhale air, potentially indicating airway obstruction.
- FVC: The table shows mixed results for FVC. While some worker groups have lower values, the differences are not statistically significant. This might imply that dust exposure doesn't significantly affect total lung capacity in all cases.
- FER: Similar to FEV 1.0, carpet and silk workers generally have lower FER values compared to non-workers, although the significance varies. A statistically significant difference is observed only for females in the 20-29 age group ("t"= 2.6*). This could indicate that dust exposure might be impacting the ratio of air exhaled in the first second to the total lung capacity, further suggesting potential airway obstruction.
- PEFR: The results for PEFR are also mixed. While some worker groups show lower values, the differences are not statistically significant across all age groups and genders. This suggests that dust exposure might not have a consistent effect on the maximum rate of airflow during forced expiration.

Additional Notes

- The "*" symbol next to the "t" value indicates a statistically significant difference between the worker and non-worker groups (typically, p-value < 0.05).
- The table provides information on the number of participants (N) in each group for each measurement.
- The values represent the mean (average) and standard deviation (SD) of the lung function measurements for each group.

Discussion

The findings of this study suggest a potential link between dust exposure in carpet and silk industries and lower lung function, particularly for FEV 1.0 and FER in some worker groups. These results align with previous research that has established the detrimental effects of occupational dust exposure on lung health (Farshchi et al., 2012; Khazaei et al., 2012; Khaliq et al., 2015).

Respiratory ailments pose a significant health risk to workers in the carpet and silk industries. These workers often experience systemic health issues in addition to respiratory problems. Other common health complaints include hearing loss due to noise exposure (Shake, 1996; Jaiswal, 2004), low back pain (Industrial Health, 1997; Jaiswal, 2007), respiratory symptoms and impaired lung function (Ming yih et al., 2003; Jaiswal, 2011), byssinosis (Shamssain & Shamsian 1996; Zuskin et al., 1990; Jaiswal 2012). and color vision abnormalities linked to long-term solvent exposure (Ihrig et al., 2002; Jaiswal et al., 2011).

Explanations

- **Airway Obstruction:** Consistently lower FEV 1.0 and potentially lower FER values in worker groups suggest that dust exposure might be causing airway obstruction. Inhaled dust particles can irritate and inflame the airways, leading to narrowing and reduced airflow.
- **Specificity of Lung Function Measures:** FEV 1.0 and FER are more sensitive to detecting airway obstruction compared to FVC and PEFR. This could explain why the effects on these measures were more pronounced.
- **Age and Gender Differences:** The observed variations in lung function across age groups and genders might be due to differences in susceptibility to dust exposure, pre-existing respiratory conditions, or smoking habits. Further research could explore these factors in more detail.

Limitations

- **Cross-Sectional Design:** This study employs a cross-sectional design, which only captures a snapshot in time and cannot establish causality. We cannot definitively conclude that dust exposure caused the observed differences in lung function.
- **Self-Reported Data:** The data on work experience and smoking history relies on self-reporting, which can be prone to inaccuracies.
- **Sample Size:** The sample size used in this study may not be large enough to generalize the findings to the entire population of carpet and silk workers.

Mitigating Strategies

Addressing the impact of carpet and silk work on lung function requires a multifaceted approach that prioritizes both occupational health and safety measures and worker empowerment.

Occupational Health and Safety Measures

- Implementation of effective ventilation systems to reduce airborne particle and chemical exposure.
- Provision of personal protective equipment (PPE) such as respirators and masks to workers.
- Regular monitoring of air quality in work environments to identify and mitigate potential hazards.
- Training programs for workers on proper handling and disposal of hazardous materials.

Worker Empowerment

- Encouraging workers to take regular breaks and practice respiratory exercises to minimize the impact of prolonged exposure.
- Providing access to healthcare services for early detection and management of respiratory conditions.

- Empowering workers to advocate for safer working conditions and participate in decision-making processes related to occupational health and safety.

As we navigate the complex interplay between artistry and occupational health, it is essential to recognize the potential impact of carpet and silk work on lung function. By implementing proactive measures to mitigate respiratory hazards and empowering workers to advocate for their health and safety, we can create healthier and more sustainable work environments for artisans around the world.

Conclusion

This study provides preliminary evidence suggesting that dust exposure in carpet and silk industries might negatively impact lung function. Lower FEV 1.0 and FER values in some worker groups indicate potential airway obstruction. However, the limitations of the study design necessitate further research with a larger sample size, longitudinal design, and objective measures of dust exposure to strengthen these findings.

Overall, the data suggests a potential negative impact of dust exposure in carpet and silk industries on lung function, particularly for FEV 1.0 and FER in some groups. Further research with a larger sample size might be needed to solidify these findings.

Suggestions

Based on these results, the following suggestions are warranted:

- **Implement Dust Control Measures:** Carpet and silk industries should prioritize implementing effective dust control measures, such as ventilation systems, personal protective equipment (respirators), and regular cleaning protocols.
- **Regular Lung Function Monitoring:** Workers in these industries should undergo regular lung function monitoring to detect early signs of respiratory problems.
- **Health Education:** Educational programs should be implemented to raise awareness among workers about the risks of dust exposure and the importance of preventive measures.
- **Further Research:** Conduct longitudinal studies with larger samples to definitively establish the causal link between dust exposure and lung function decline in carpet and silk workers. Additionally, research could investigate the specific types of dust particles present in these industries and their potential health effects.

By implementing these suggestions, we can create safer work environments for carpet and silk industrial workers and protect their long-term lung health.

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The Competing Interests

The author declares that there are no competing interests.

Conflict of Interest

No conflict of interest

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