

Pulmonary Function and Occupational Risk Among Metal Craftsmen of Handicraft Industry in Nepal

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Background

- Metal craftsmen in the traditional handicraft industry are routinely exposed to occupational hazards such as metal dust, fumes, poor ventilation, and prolonged working hours.
- These exposures may adversely affect respiratory health; however, evidence from Nepalese handicraft settings remains limited.
- Metal dust exposure results due to grinding, cutting, polishing metals, sanding metal surfaces.
- Metal fume exposure results due to welding, soldering, casting molten metals heating and vaporizing metals

Objective

- This study aims to assess pulmonary function status and examine occupational risk factors associated with respiratory impairment among metal craftsmen of handicraft industry in Lalitpur, Nepal.

Methodology

- **Research Approach**
- The study aimed to evaluate pulmonary function among metal craftsmen of handicraft industry working in different areas of Lalitpur.
- **Research Design**
- Cross-sectional study.
- **Research Setting**
- Different wards of Lalitpur Metropolitan City of Lalitpur district were selected for the study.
- Sample size= 100
- Purposive sampling technique

Methodology

The metalcraftsmen were divided into 3 broad categories on the basis of types of work they are involved in:

1. Detail work- engraving, fine carving, chiseling
2. High-heat work- melting metal, casting, welding
3. Finishing work- Polishing

Inclusion Criteria

- Workers who give written consent
- Workers with atleast five years of experience

Exclusion Criteria

- subjects with history of heart disease, chronic respiratory disease, recent thoraco-abdominal surgery, recent ophthalmic surgery.
- Subjects with physical abnormalities



Methodology

- Demographic variables like age, height, weight, working hours, work experience, work break hours, type of work and education level were taken.
- Pulmonary Function test was performed using spirometer('MEDSPIROR' RMS recorder and medicare system, Chandigarh, India) between 9a.m and 12 p.m.
- Forced expiratory volume in one second (FEV1), forced vital capacity (FVC), FEV1/FVC ratio, peak expiratory flow rate (PEFR), was measured. The best of three readings was considered for analysis.

Results

Demographic variables

Parameters	Engraver (n=58)	Melting metal/casting (n=17)	Polishing (n=25)
Age in years	33.34 ± 7.80	40.53 ± 7.203	32.36 ± 7.31
Height in cm	163.37± 6.41	165.29 ± 7.09	162.12 ± 7.79
Weight in kgs	64.64 ± 11.75	67.71 ± 9.81	67.04 ± 9.46
Education level			
Primary level (1-5)	22	8	6
Lower Secondary (6-8)	21	1	7
Secondary level (9-10)	9	6	7
Higher Secondary (11-12)	6	1	4
Bachelors level	0	1	1

Working hours of craftsmen

Working hour per week	Frequency of craftsmen
36	8
42	12
54	5
56	13
60	15
66	5
70	19
72	21
78	2

Pulmonary functions comparison among types of metal craftsmen

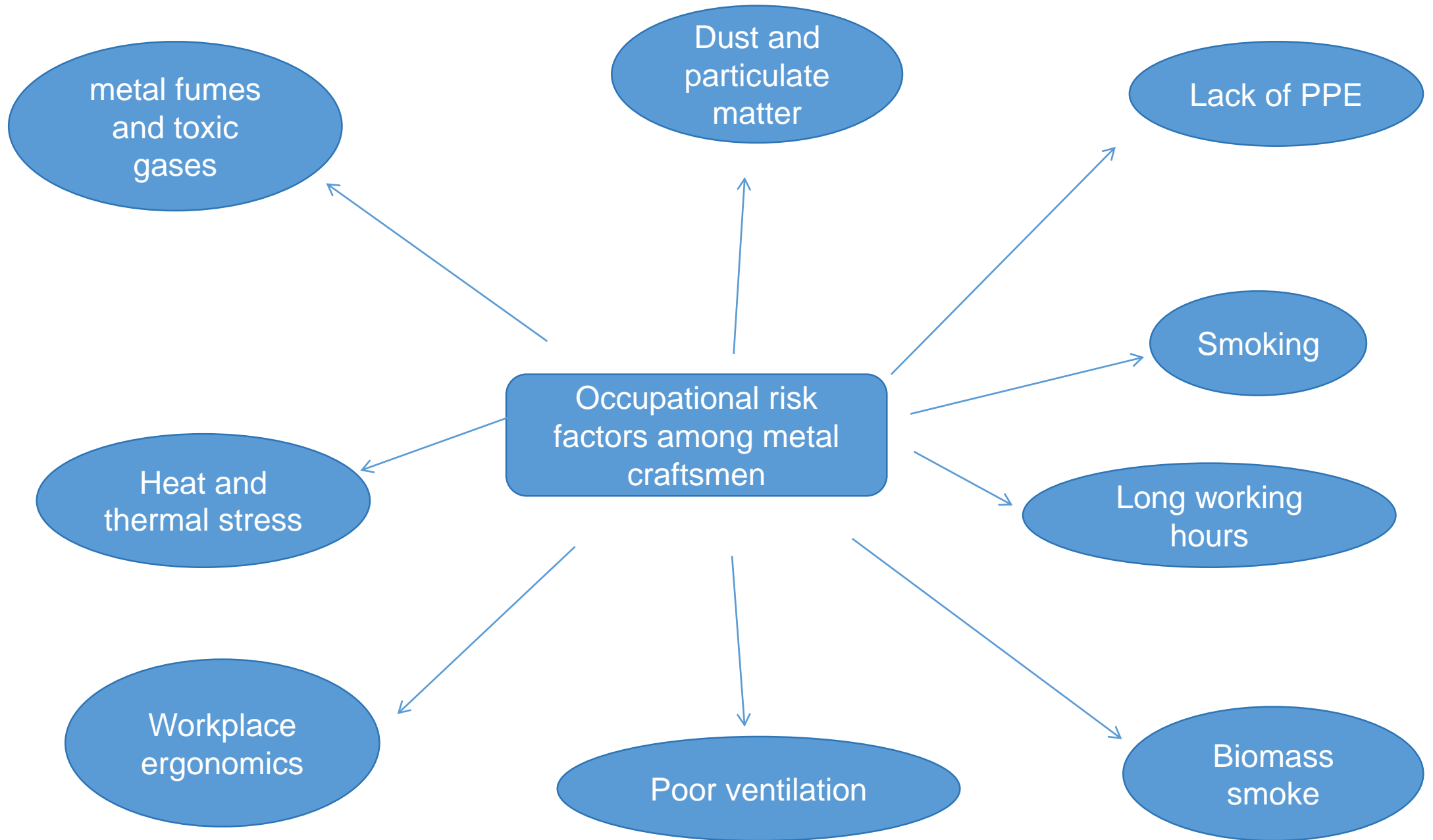
Parameters	Engraver/hammering	Melting metal/casting	Polishing	
	Mean ± SD	Mean ± SD	Mean ± SD	P value
FEV1 (L)	3.01 ± 0.78	2.00 ± 0.65	3.11 ± 0.67	0.001*
FVC (L)	3.73 ± 0.88	3.19 ± 0.66	3.66 ± 0.95	0.081
FEV1/FVC (%)	81.88 ± 14.22	66.17 ± 23.94	86.20 ± 7.60	0.001*
PEFR (L/min)	322.66 ± 123.37	256.01 ± 127.56	352.44 ± 124.82	0.049*

- The significantly lower PFT parameters observed among workers in the melting metal, casting, and welding group indicate a higher respiratory risk, likely attributable to prolonged exposure to metal fumes, high temperatures, and potentially inadequate respiratory protection.
- This highlights the need for improved occupational safety measures in these high-risk subgroups.

Pulmonary Functions comparison according to years of working experience

PFT parameters	Less than 10years (Mean±SD)	10-20 years (Mean±SD)	More than 10 years (Mean±SD)	p value
FEV1 (L)	3.09±0.68	2.91±0.80	2.09±0.87	<.001*
FVC (L)	3.73±0.94	3.67±0.74	3.17±1.08	.111
FEV1/FVC (%)	85.05±14.28	79.66±13.96	70.69±24.34	.018*
%Predicted FEV1	106.88±22.50	98.18±23.62	86.13±35.39	.032*
%Predicted FVC	111.51±27.84	105.31±20.29	106.11±38.14	.543
PEFR (L/min)	331.00±118.68	330.58±130.38	245.21±118.02	.064

- Workers with more than 10 years of exposure show markedly poorer lung function, particularly in FEV₁, FEV₁/FVC ratio, and % predicted FEV₁.
- Longer exposure significantly reduces FEV₁, suggesting obstructive or mixed impairment due to chronic exposure to dust, fumes, and metal particulates.
- A significant reduction in FEV₁/FVC (%) suggests a shift towards obstructive lung pattern in workers with longer exposure.
- Peak flow tends to decline with prolonged exposure, but statistical significance is borderline.



Conclusion

- Studies integrating pulmonary function in the context of ergonomic research are extremely limited in Nepal.
- Metal craftsmen frequently work in poorly ventilated workshops, using heat, fire, and chemical processes that emit airborne pollutants, yet the long-term respiratory consequences remain undocumented.
- Therefore, there should be prompt and forceful interventions at all levels, including those of the government, employers, and employees.
- This study aims to highlight necessary action to protect the health and safety of these unrecognized and understudied groups of metal craftsmen.

Thank you



- Archana Bhaila is an Associate Professor at the Department of Physiology, KIST Medical College. She has an experience of teaching MBBS and BDS students experience of over 13 years. Her research interest areas include ergonomics and occupational health. She is currently working on work-related disorders among metal craftsmen of Lalitpur, combining academic research with practical field experience.
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