

**Original Article**

**PERCEIVED STRESS AND VARIATION OF BLOOD PRESSURE AMONG RE-ROLLING STEEL MILL WORKERS**

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**ABSTRACT**

**Background:** The steel industry is crucial to global infrastructure and economic growth, with rising demands fueled by urbanization and energy needs. In Bangladesh, the sector has grown significantly since the 1990s, but health risks for workers, such as stress-related disorders and hypertension, remain under-addressed. This study evaluates stress levels and blood pressure variations among re-rolling steel mill workers in Bangladesh, with the goal of guiding interventions to enhance worker health and occupational safety.

**Methods:** A cross-sectional study was carried out in a re-rolling steel mill in the Thana area of Bangladesh to assess stress levels and blood pressure variations among workers with at least one year of experience. The study involved protocol development, data collection, and final report submission. A semi-structured questionnaire was used to gather socio-demographic information, perceived stress levels, and blood pressure measurements. Data analysis was performed using descriptive statistics, chi-square tests, and statistical inference, with ethical considerations carefully observed throughout the study.

**Results:** The study surveyed respondents aged 19-52 years with a mean age of 34.72±8.948 years, predominantly Muslim with a majority completing primary education. Most (48.8%) had monthly income with 8,000 to 12,000 taka while mechanical workers being the largest of working sections (41.8%). The study revealed that the majority of respondents (53%) experienced moderate perceived stress, while 45.6% reported low levels of stress. A small proportion of respondents, comprising only 1.4%, reported experiencing highly perceived stress.

**Conclusion:** This study enhances our comprehension of the intricate relationship between occupational factors, psychosocial stress, and cardiovascular health outcomes in industrial environments, offering valuable insights for workplace health promotion and research.

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**Key Words:** Perceived Stress, Blood Pressure, Re-rolling Steel Mill Workers

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**INTRODUCTION**

The steel industry is a vital component of global infrastructure and economic development, serving various sectors such as construction, manufacturing, and transportation. Expected growth in construction, manufacturing, and infrastructure projects, alongside urbanization and rising energy demands, is projected to drive further demand for steel globally<sup>1</sup>. Rolling and re-rolling, common processes in steel manufacturing, involve shaping and refining steel into various forms such as sheets, plates, and bars. Re-rolling mills play a crucial role in this process, transforming unrefined steel into semi-finished or finished products for a wide range of industries<sup>2</sup>. The steel industry in Bangladesh has experienced significant growth since the 1990s, contributing to job creation and economic development. The sector,

primarily comprising small to large-scale steel melting and re-rolling plants, has witnessed a surge in demand driven by infrastructure projects and construction activities<sup>3</sup>.

Work-related stress is a prevalent issue in modern workplaces, affecting employee well-being and organizational performance. Stress, triggered by factors like heavy workloads and inadequate compensation, can lead to various physiological and psychological responses, impacting overall health and productivity<sup>4,5</sup>. Chronic diseases, including hypertension, pose significant health challenges globally, with lifestyle factors and environmental conditions contributing to their prevalence. Hypertension, in particular, is a leading cause of cardiovascular diseases and mortality, with its prevalence increasing in low and middle-income

countries like Bangladesh<sup>6,7</sup>. Psychosocial factors, including chronic stress, have been identified as potential risk factors for hypertension. Occupational stress, combined with environmental and lifestyle factors, can exacerbate the risk of hypertension among industrial workers, highlighting the importance of addressing work-related stress in occupational health management<sup>8</sup>. Despite the critical role of re-rolling steel mill workers in Bangladesh's industrial sector, their health and occupational risks have received limited attention. Research into the health impacts of occupational hazards, including stress-related disorders and non-communicable diseases, is essential to safeguarding the well-being of these workers and informing occupational health interventions<sup>9-11</sup>.

Understanding these dynamics is crucial for developing targeted interventions to promote worker health and improve occupational safety in the steel industry. The steel sector in Bangladesh has played a pivotal role in the nation's infrastructure development, yet it often neglects the physical and mental well-being of its workforce. Workers in this sector commonly face stress and non-communicable diseases such as hypertension due to factors like demanding work patterns, rapid task pace, rotating shifts, and job insecurity. This neglect of worker health leads to various organizational issues such as low job satisfaction, absenteeism, and poor productivity. While industrial stress is typically focused on stressors rather than workers' perceptions, there's a growing interest in understanding the impact of employment on individual stress levels and health outcomes. Given the lack of research in Bangladesh, particularly in the steel industry, this study seeks to assess perceived stress levels and blood pressure fluctuations among re-rolling steel mill workers, aiming to shed light on their health concerns and inform interventions for this critical sector's workforce.

## **MATERIALS AND METHODS**

A cross-sectional study was conducted to assess stress levels and blood pressure variations among workers at a re-rolling steel mill in the Bayejid Bostami Thana area of Chittagong, Bangladesh, which spans 17.58 square kilometers. The study spanned from January 1st to December 31st, 2021, involving protocol development, data collection, and report submission. The study targeted workers with at least one year of work experience, initially calculating a sample size of 341 which was increased to 375 to account for potential non-respondents. However, due to Covid-19-related delays, data collection began late, with only 22 working days allotted by Bangabandhu Sheikh Mujib Medical University (BSMMU), resulting in 285 data points. A convenience sampling technique was used based

on predefined criteria. Data collection involved a semi-structured questionnaire in English, assessing socio-demographic characteristics, perceived stress using Sheldon Cohen's Perceived Stress Scale (PSS), and measurement checklist for blood pressure with a manual ALPK 2 sphygmomanometer. The questionnaire was translated into Bengali and pretested. Data collection was conducted with permission from the General Manager of the Human Resources department, and participants provided written consent after being briefed on the study's details. Statistical analysis involved descriptive statistics, chi-square tests, and statistical inference with a significance level of 0.05, focusing on socio-demographic variables, perceived stress, and family history of hypertension. Ethical considerations included obtaining IRB approval from NIPSOM and informing respondents of their right to participate or withdraw from the study.

## **RESULTS**

The study surveyed respondents aged 19 to 52 years, with an average age of  $34.72 \pm 8.95$  years. The largest age group was 20-29 years (34.6%), followed by 30-39 years (27.2%), with a smaller proportion over 50 years old (9.3%). The majority of participants identified as Muslim (75.1%), with Hindus (20.4%) and Buddhists (4.6%) also represented. Educational attainment varied, with most respondents completing primary education (40.4%), followed by secondary (33.3%) and higher secondary education (19.6%). The majority were married (64.2%), while 35.8% were single, and 59.6% lived in nuclear families. Monthly income ranged from 8,000 to 12,000 taka for 48.8% of respondents, 12,000 to 17,000 taka for 37.2%, and over 17,000 taka for 14.0%. The average employment duration was  $5.13 \pm 3.40$  years, with most workers employed for less than 5 years (63.2%), followed by 5-10 years (28.1%), and over 10 years (8.8%).

Regarding work sections, mechanical workers comprised the largest group (41.8%), followed by production (14.0%), electrical (10.9%), CCL (10.2%), NOF (9.8%), delivery (7.4%), utility (7.0%), and quality control (6.3%). In terms of stress levels, 53% of respondents experienced moderate perceived stress, 45.6% reported low levels of stress, and only 1.4% experienced high stress levels. Blood pressure measurements revealed a mean systolic pressure of 116.78 mm Hg, diastolic pressure of 76.74 mm Hg, pulse pressure averaging 39.79 mm Hg, and mean arterial pressure of 89.76 mm Hg.

The data highlights the diverse socio-demographic background and varying stress levels among workers, providing crucial insights for targeted occupational health interventions.

**Table 1:** Determination of socio-demographic perceived stress and variation of blood pressure among re-rolling steel mill workers

Variables	f (%)	
<b>Age</b>	Minimum: 19 years, Maximum: 52 years, Mean±SD: 34.72±8.948 years	
<b>Religion</b>	Muslim	214 (75.1)
	Hindu	58 (20.4)
	Buddhist	13 (4.6)
<b>Education</b>	Illiterate/Sign Only	19 (6.7)
	Primary	115 (40.4)
	Secondary	95 (33.3)
	Higher secondary or above	56 (19.6)
<b>Marital status</b>	Single	102 (35.8)
	Married	183 (64.2)
<b>Family type</b>	Nuclear	117 (59.6)
	Joint	115 (40.4)
<b>Individual monthly income</b>	8000-12000	139 (48.8)
	12001-17000	106 (37.2)
	>17000	40 (14.0)
<b>Employment Years</b>	Minimum: 1 years, Maximum: 18 years, Mean±SD: 5.13±3.396 years	
<b>Family member’s hypertension history</b>	Father	82 (28.8)
	Mother	105 (36.8)
	Paternal grandfather	3 (1.1)
	Paternal grandmother	0 (0.0)
	Maternal grandfather	0 (0.0)
	Maternal grandmother	0 (0.0)
	Brother	0 (0.0)
	Sister	0 (0.0)

**Table 2:** Distribution of the respondents by level of perceived stress

Level of stress	Frequency	Percentage
Low stress	130	45.6
Moderate stress	151	53.0
Highly perceived stress	4	1.4
Total	285	100.0

**Table 3:** Distribution of the respondents by differences in different types of blood pressure

Dependent Variable	Mean	Std. Deviation	Sig.
Average measurement of systolic blood pressure	116.78	15.827	0.013
Average measurement of diastolic blood pressure	76.74	9.405	0.000
Pulse blood pressure	39.79	89.76	0.815
Mean arterial blood pressure	89.76	10.631	0.002

**DISCUSSION**

The findings of this study shed light on various demographic characteristics, socioeconomic factors, and health indicators among workers in a re-rolling steel mill. The majority of participants fell within the younger age groups, with a mean age of 34.72 years, which is consistent with findings from similar occupational settings<sup>12</sup>. This demographic trend may reflect the nature of employment in such industries,

where younger individuals often comprise the workforce due to physical demands and entry-level positions<sup>13</sup>. The predominance of Muslim respondents aligns with the religious composition of the region where the study was conducted<sup>14</sup>.

Education and income levels among participants also merit attention, as they are crucial determinants of socioeconomic status and health outcomes<sup>15</sup>. The high proportion of participants with primary

education and moderate-income levels underscores the importance of considering socioeconomic factors in occupational health research and intervention planning<sup>16</sup>. Similarly, the predominance of nuclear families and the relatively short employment duration highlight the transient nature of employment in industrial settings and its potential implications for health and well-being<sup>17</sup>.

Furthermore, the study's assessment of family history of hypertension provides valuable insights into potential risk factors for cardiovascular health among workers in the steel mill industry<sup>18</sup>. The low prevalence of reported hypertension history among family members suggests a need for further exploration of genetic and environmental influences on cardiovascular health in this population.

In terms of perceived stress levels, the study revealed a significant proportion of workers experiencing moderate stress, which may have implications for their overall health and job performance<sup>19</sup>. The observed associations between perceived stress and systolic and diastolic blood pressure underscore the complex interplay between psychosocial factors and cardiovascular health outcomes<sup>20</sup>. While the lack of significant associations with pulse blood pressure warrants further investigation, the findings highlight the importance of considering multiple indicators of cardiovascular health in occupational health research.

Overall, the study contributes valuable insights into the demographic characteristics, socioeconomic determinants, and health indicators among workers in the re-rolling steel mill industry. These findings underscore the need for comprehensive occupational health interventions addressing both physical and psychosocial determinants of health to promote the well-being of workers in industrial settings.

## CONCLUSION

The findings of this study contribute to our understanding of the complex interplay between occupational factors, psychosocial stress, and cardiovascular health outcomes in industrial settings, providing valuable insights for workplace health promotion initiatives and occupational health research endeavors.

## RECOMMENDATIONS

The study suggests that management should prioritize health checkups and implement measures to minimize perceived stress among workers. Healthcare professionals should evaluate workers' economic status and environmental conditions to address stress determinants. Tailored stress reduction programs should be developed for garment workers

with high stress levels. Regular blood pressure monitoring and prompt treatment should be provided to those with high blood pressure. Further research is needed to understand workplace factors contributing to occupational stress and high blood pressure.

## DECLARATION

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