



Assessing the Change in Psychosocial Stress of Fireworks Workers of West Bengal During the Pre-Pandemic and During COVID-19 Pandemic

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Abstract

The fireworks industries of South 24 Parganas, West Bengal, are centuries-old, unorganized cottage industries. The goal of the current study was to evaluate how psychosocial stress of fireworks workers of Bengal had changed during the COVID-19 pre-pandemic and during pandemic period, and to determine the underlying causes of it. 152 male fireworks workers of varying ages were chosen for this purpose. To measure the psychosocial stress of fireworks employees, the Job Content Questionnaire (JCQ) based on Karasek's Demand-Control Model was used. A shortened Social Readjustment Rating Questionnaire (SRRQ- Holmes and Rahe, 1967) was followed to measure the life change value. The socioeconomic status related to psychosocial stress was also measured along with food habits. After analyzing psychosocial factors and outcomes, it was determined that financial condition and job stability of fireworks workers worsened notably during pandemic. There were prevalence of musculoskeletal disorders and lack of health awareness among them. Though, they were benefitted by different government schemes, low income and job stress led to increased psychosocial stress during the pandemic.

Keywords: COVID 19 Pandemic, Fireworks, Food Habit, Psychosocial Stress, Stressful Life Events

1. Introduction

In India, fireworks manufacturing is a well-known, hazardous cottage industry. Explosions of pyrotechnic chemicals in the fireworks produce predominantly light, sound, vapour, and heat¹. With that it spreads different types of pollutant, metal dusts, toxins, and other harmful chemicals within short time. Champahati, South 24 Parganas, is one of the main fireworks manufacturing centre in West Bengal. There are about 5000 people employed in this field. According to a report that appeared in The Times of India in 2019, an annual revenue collection of over 25 crores was reported. Normally, fireworks workers are poor and daily wage earner. It consists of different types of job categories according to their job nature. Such as leader, workers who involve in packaging, workers who struggle with chemical dusts, workers for trading fireworks, workers for cutting and shaping the fireworks, workers who dry the fireworks in the sunlight.

A lot of scientific researches confirmed that there is a relationship between job characteristic and worker's health. High pressure of work can lead to exhaustion and sleeping problems². International Labour Organization is also concerned about the psychosocial risk factors of the workers in different industries³. Nowadays, one of the most significant challenges for occupational health and safety is psychosocial risk. It has a negative impact on workers' physical and emotional wellbeing. Here also is shown a bad impact on organization and society⁴⁻⁸. There are many factors that influence the psychosocial stress in the workplace. As example, we can say that the exposure of different chemicals, long hours of work, strict schedules, and poor working conditions. Other factors are personal behaviour, lifestyle and housing conditions, institutional and economic background, and genetic make-up of workers. Huges *et al.* recognized that psychosocial factors might influence the prevalence of musculoskeletal symptoms (Morken *et al.*).

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The outbreak of a new health catastrophe brought on by a new member of the coronavirus group, which the World Health Organization (WHO) dubbed SARS-CoV-2, or severe acute respiratory syndrome corona virus-2, put the entire world under a state of global emergency and had spread to 206 countries including India⁹. To check its progression, both the central and state government declared lockdown from March 23, 2020 onwards. No public transport (except for vehicles going to and from hospitals and good carrying food and essential commodities) were allowed to be on streets. All shops, offices and factories etc., remained closed except essential services. After a few months, the cases of coronavirus decreased gradually and government started to unlock the situation step by step, and life stated to come back to normalcy¹⁰.

The products of fireworks industries are sold during Diwali and Kali Puja festivals, which are celebrated around October - November. But with the COVID restrictions, there were decreased demand and sale of fire crackers. Thus, the fireworks industry faced a big lose, and their production also effected. This might have led to joblessness, insecurity and stress among fireworks workers. But no study on this has been reported. Thus, the objective of this study was to evaluate the change in psychosocial stress of fireworks workers of Bengal during the Pre-Pandemic and During COVID-19 Pandemic.

2. Materials and Methods

2.1 Study Period and Working Area

A comparative cross-sectional study including the fireworks workers of the Champahati region of the South 24 Parganas district of West Bengal, India, was undertaken from July 2020 to June 2021.

2.2 Selection of Subjects

Male sex workers dominate the fireworks industry. As a result, 152 male fireworks employees were chosen for the experimental group in this study. Male workers over the age of 18 were included in the current study, and female workers and physically challenged male workers were excluded.

2.3 Data Collection

Using a Martin anthropometer (Takei, Japan) and a Crown weighing machine (Raymon Surgical, India), the fireworks workers' height and weight were measured. Additionally, the total individuals' Body Surface Area (BSA)¹¹ and Body Mass Index (BMI)¹² were calculated. The World Health Organisation (WHO) formula was used to determine body mass index (WHO, 1995). $BMI = W/H^2$, where, W = weight in kilograms, and H = height in meters. With the help of the software EPI

INFO 2007 (WHO), collected data were examined. Along with these, different socioeconomic data like age, marital status, caste, income, literacy, experience, psycho-social problems, etc., were also collected⁷.

2.4 Questionnaire

The Job Content Questionnaire (JCQ) based on Karasek's Demand-Control Model¹³ was followed to assay the psychosocial stress of fireworks workers. To identify psychosocial stresses five point Likert¹⁴ scale was used where the numbers represented the extent of agreement like 1- Strongly disagree, 2- disagree, 3 - neither agree nor disagree, 4 - agree, 5 - strongly agree. The occurrences of stressful life events of fireworks workers were recorded. A shortened Social Readjustment Rating questionnaire (SRRQ- Holmes and Rahe 1967)¹⁵ was used to measure the life change value.

2.5 Ethical Approval and Consent

All procedures used in human subjects studies complied with the Helsinki Declaration of 1964 and its subsequent modifications. All study participants signed a written informed consent form. The work permission was taken from the Institutional Human Ethics Committee of Aliah University (AU/2022/MZH/IEC003).

2.6 Statistical Analysis

The mean values and the Standard Deviation (SD) were calculated for quantitative variables. Student's t-test was applied between the data before the pandemic and after pandemic to determine whether there was a statistically significant difference in psychosocial stress among workers. P -values less than 0.05 ($p < 0.05$) were decided statistically significant.

3. Results

The study found five important factors that affect the psychosocial stress of fireworks workers in West Bengal which are described.

3.1 Socioeconomic Status and Demographic Variables

The fireworks workers came from different socioeconomic backgrounds. However, most of them belonged to a lower caste and were addicted to alcohol or smoking. The average age group of the workers were in their late 30s, and they worked six days a week before the pandemic, but it reduced to three days a week during the pandemic. Their monthly income was low, and few had alternative jobs or practices for income, which increased

Table 1. Socioeconomic details of fireworks workers pre and during pandemic

Socioeconomic status		Before pandemic (%)	During pandemic (%)
Caste	General	19.74	19.74
	OBC	5.92	5.92
	Schedule Caste	74.34	74.34
Marital status	Married	67.76	67.76
	Unmarried	32.24	32.24
Place for dwelling	With family	76.32	76.32
	Without family	23.68	23.68
Addiction	Alcohol	52.63	58.55
	Smoking	54.6	54.6
	Other	11.84	11.84
	None	32.24	26.32
Smoking status	Current smoker	55.92	55.92
	Ex – smoker	1.97	1.97
Educational status	Illiterate	3.95	3.95
	Primary	61.18	61.18
	Secondary	19.74	19.74
	Above	15.13	15.13
Monthly income	<5000	0	7.89
	5000 – 10000	93.42	92.11
	>10,000	5.92	0
Family type	Nuclear	57.89	57.89
	Joint family	40.13	40.13
Another job in weekend	No	52.63	0
	Farming	32.89	39.47
	Others	14.47	60.53
Status of a single member	Number of children	2.16	2.16
	Number of dependent	2.72	2.72

Table 2. Demographic details of fireworks workers pre and during pandemic

Variable	Before pandemic (Mean ± SD)	During pandemic (Mean ± SD)
Age (year)	38.32 ± 10.96	39.32 ± 10.96
Height (cm)	166.11 ± 9.45	166.11 ± 9.45
Weight (Kg)	57.19 ± 8.56	56.97 ± 8.25
BSA (m ²)	1.63 ± 0.15	1.63 ± 0.15
BMI (Kg/m ²)	20.73 ± 2.75	20.66 ± 2.696
Year of experience	14.11 ± 8.7	15.12 ± 8.699
Duration of work per day (Hours)	8.0	8.0
Duration of rest per day (Hour)	1.0	1.0
Number of working days per week	06	03

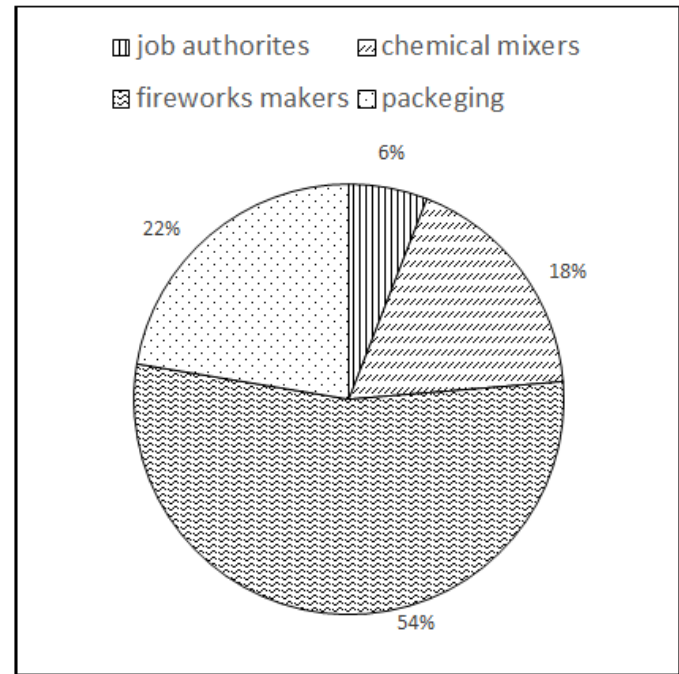


Figure 1. Distribution of workers according to their job.

during the pandemic, which may be because of the closure of the industry during a pandemic. The socioeconomic details of the fireworks workers are provided in Table 1, whereas the demographic variable are shown in Table 2.

3.2 Job Related Stress

The Job Content Questionnaire (JCQ) based on Karasek’s Demand-Control Model¹⁵ was followed to assay the psychosocial stress of fireworks workers. Significant differences in job satisfaction, job stress, and many other factors were found between pre and during pandemic conditions of the fireworks workers as shown in Tables 3 and 4.

3.3 Food intake and nutrition

Psychosocial stress is very much related to health which is, in turn, dependent on food intake and habits along physical activities and addictions (alcohol, smoking, etc.). The food intake and nutrition were studied amongst the fireworks workers between pre and during the pandemic period, and it was found that there was less intake of proteins and vitamins (which are generally found in fruits and vegetables) during the pandemic period. Also, calcium intake levels were found to be low during the pandemic period due to less availability of milk and dairy products. Other details of food intake and nutrition are shown in Tables 5 and 6.

3.4 Stressful Life Events

A shortened Social Readjustment Rating Questionnaire (SRRQ- Holmes and Rahe, 1967)¹⁶ was used to measure the

Table 3. JCQ variables of fireworks workers in pre- and during pandemic period

JCQ Variables	Before pandemic (Mean±SD)	During pandemic (Mean±SD)
Decision latitude –		
Decision authorization	1.24 ± 0.95	1.24 ± 0.95
Allow to give own suggestion	1.36 ± 1.00	1.36 ± 1.00
Little freedom of decision	1.49 ± 1.03	1.49 ± 1.03
Pressure to know new skills	1.34 ± 0.48	1.34 ± 0.48
Value of experience	1.11 ± 0.31	1.11 ± 0.31
Psychological demands and mental workload –		
Job satisfaction	2.80 ± 0.49	1.50 ± 0.598
Salary satisfaction	2.35 ± 0.59	2.89 ± 0.39
Job stress	3.58 ± 0.60	2.84 ± 0.37
Job demand	2.39 ± 0.49	4.17 ± 0.58
Social support –		
Job authority satisfaction	3.14 ± 0.53	3.14 ± 0.53
Helpful supervisor	2.94 ± 0.42	2.94 ± 0.42
Co-worker support	3.70 ± 0.52	3.70 ± 0.52
Physical demand –		
Work hard	1.14 ± 0.35	1.14 ± 0.35
Work fast	4.06 ± 0.34	4.06 ± 0.34
Enough time for doing work	2.14 ± 0.45	2.14 ± 0.45
Musculoskeletal pain	3.49 ± 0.80	3.01 ± 0.59
Enough time for taking rest	2.26 ± 0.44	2.26 ± 0.44
Thermal stress	3.95 ± 0.47	3.95 ± 0.47
Enough time for taking tiffin/ lunch	3.00 ± 0.33	3.00 ± 0.33
Job insecurity –		
Job insecurity	3.12 ± 0.50	4.36 ± 0.58

Table 5. Food intake by fireworks workers

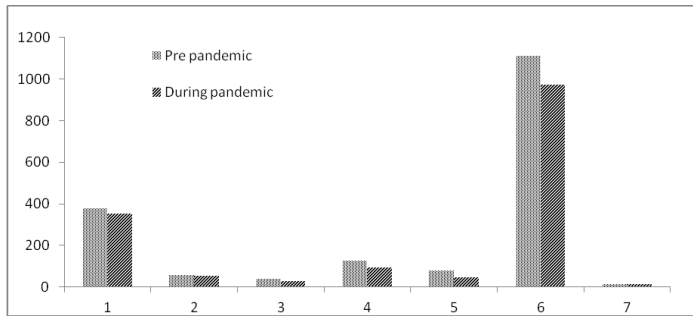
Food items	Pre pandemic(gm) (Mean±SD)	During pandemic(gm) (Mean ± SD)
Wheat	190 ± 20	190 ± 20
Rice	227 ± 29	227 ± 29
Root and tubers	176 ± 9	144 ± 15
Sugar	7 ± 2	5 ± 2
Pulse and nut	28 ± 4	29 ± 5
Vegetables	160 ± 11	60 ± 7
Fruits	25 ± 2	12 ± 2
Meat	13 ± 4	11 ± 2
Egg	6 ± 1	6 ± 1
Fish	60 ± 8	55 ± 8
Milk/milk products	14 ± 2	0
Fats and oils	16 ± 3	14 ± 2
Miscellaneous	17 ± 2	6 ± 2

Table 6. Nutrition intake by workers (per day)

Variables	Pre pandemic(gm)	Post pandemic(gm)
Carbohydrate	379	354
Protein	57	53
Fat	39	30
Vitamin B complex	126	93
Vitamin C	79	47
Calcium	1113	973
Iron	15	14

Table 4. Significance level of difference in JCQ variables of fireworks workers between pre- and during pandemic period

JCQ variables change during pandemic					
JCQ variables	Pre pandemic	Post pandemic	t- value	p value	Significance
Job satisfaction	2.80 ± 0.49	1.50 ± 0.598	20.73	<< 0.001	Highly Significant
Salary satisfaction	2.35 ± 0.59	2.89 ± 0.39	9.41	<< 0.001	Highly Significant
Job stress	3.58 ± 0.60	2.84 ± 0.37	12.94	<< 0.001	Highly Significant
Job demand	2.39 ± 0.49	4.17 ± 0.58	28.9	<< 0.001	Highly Significant
Musculoskeletal pain	3.49 ± 0.80	3.01 ± 0.59	5.95	<< 0.001	Highly Significant
Job insecurity	3.12 ± 0.50	4.36 ± 0.58	19.96	<< 0.001	Highly Significant



1: Carbohydrate, 2: Protein, 3: Fat, 4: Vitamin B complex, 5: Vitamin C, 6: Calcium, 7: Iron

Figure 2. Nutritional intake of fireworks workers in pre- and during pandemic period.



Figure 3. SRRQ score of stressful life events of fireworks workers during the pandemic.

life change value. It had 43 different events that contributed to stress. Each of the 43 stressful life events was assigned a Life Change Unit based on how painful it was perceived to be by a large sample of participants. The total value for stressful life events was calculated by adding the scores for each stressful life event that occurred over a 12-month period, which was found to be higher among most of the fireworks workers during the pandemic period.

4. Discussion

The study found that maximum of the fireworks workers came from lower caste community, but their literacy rate (>95%) was found to be more compared with general literacy (77.08%) rate of Bengal population as per the Census 2011 (West Bengal)¹⁷. The average height (166.11± 9.45) of the workers of present study was slightly higher than the Indian standard height (160.7±98 cms) (Chakrabarti, 1997)¹⁹. The mean weight of the studied subjects in pre pandemic (57.19±8.56) was also slightly higher than the average Indian's standard weight of 55.2±11.3 Kgs (Chakrabarti, 1997). But during pandemic, the mean

weight decreased slightly, that may be due to the change in food habits and low nutritional diets. The average BMI (20.73±2.75 kg/m²) slightly decreased during the pandemic compared to normal range (18.50 to 24.99 kg/m²). As per WHO, BMI is associated with degree of underweight and overweight. So, this may be associated with some sort of mental or physical stress developed amongst the fireworks workers during the pandemic^{18,19}.

About 56% of the fireworks workers were found to be smokers, whereas 53% of them were addicted to alcohol. Generally, workers drink alcohol to get relief from the work stress and strain and some time for enjoyment²⁰. During the pandemic, workers increased the quantity of alcohol. The loss of jobs and insufficient income during the lockdown pulled them to change their habit. Excess intake of alcohol resulted in misbehaviour with the general public and their family members. Excess intake of alcohol may also be responsible for the deterioration of mental state and increase of disease related to the liver.(Tiary & Gangopadhyay; Tiary *et al.*)^{20,21}.

The average work per week was about 48 hours before the pandemic period. With the imposition of lockdown during a pandemic, the working days in a week decreased to half. Moreover, Calcutta high court stopped the use of fireworks in this year, 2020. With this dual attack, many company owners reduced their production resulting in the joblessness of many workers. Though the fireworks workers got a free ration from the government helping them to survive, their monthly income decreases significantly. So, many workers started to work in other sectors besides the fireworks industry. All these factors significantly lead to a decrease in job satisfaction, salary satisfaction, and job demand, whereas increase in job stress and job insecurity significantly during the pandemic. With the decrease in work-related activities during lockdown, which involved working in awkward and painful postures, their musculoskeletal pain was found to be significantly decreased during the pandemic.

The food habit of fireworks workers changed during the pandemic. Maximum workers depended on a free ration which was given by the government. This resulted in a decrease in their nutrition level as they had reduced taking fruits, vegetables and other nutritional food like before. Most of the nutrition they have taken from carbohydrates (e.g., rice, wheat, potato, roots etc.). Food habit indicates the quality of life and is related to psychosocial stress²². This may one of the contributing reasons for the increased psychosocial stress of the fireworks workers during the pandemic.

There are limitations in our current investigation. Consequently, while interpreting the results, these must be taken into account. First, the absence of a control group may limit the generalizability of our findings. Additionally, some of the findings may have been skewed because our results are

based on self-report. Nonetheless, we only employed validated, very trustworthy and assessments that have proven to be quite valid.

5. Conclusion

The world economic growth deteriorated due to pandemic. With that the financial condition and job stability of fireworks workers also decreased notably during pandemic. With joblessness and low wages, the quality of life, and food nutritional level decreased. And with prevalence of health problems, there was also significant decrease in job satisfaction and significant increase in job related stress during the pandemic. These all-combined lead to a significant increase in psychosocial stress of the fireworks workers during the pandemic. Though they were benefitted by different social welfare schemes of the government and got health services from primary public health centers; but they were found not too much conscious about their health. A good number of workers were suffering from low back pain and musculoskeletal disorders. The backbone of national economy is industrial production. Investment in the skills, health and nutrition of the worker is right way for both to their welfare and to economic success. The study suggests some health-related awareness programs to be carried out involving the fireworks workers and plan out some programs for their job security and job satisfaction.

6. Acknowledgements

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