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Research Paper

An analytical study into environmental hazards at construction sites for female labourers

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ABSTRACT : Women labourers are primarily employed as merely helpers to men but bear the equal or even more burn of occupational hazards at construction sites. Since environmental hazards impact their health and well being more, these were examined in detail in the present study. Main objectives were to know the environmental conditions, environmental risk factors and environmental hazards faced. Eighty such women were interviewed using pre structured interview schedule and data analysed using appropriate statistical tools. Results of study revealed that most of them belonged to the age group of 21-30 years, were married and lived in nuclear family setup. Observed temperature (43.5^{0}C) and humidity (75.6 %) at construction site were deviated from normal value (15-17^{o}C and 80 %, respectively). Even noise level (65.78 db) was much higher than recommended. Major environmental risk factors perceived by respondents were 'air full of dust and smells' (3.53-3.40 mean score), 'disturbing noise' (3.30 mean score), 'polluted water' (3.73 mean score), and the 'unhygienic, stinking and garbage filled surroundings'. The most prominent environmental hazards in this industry were identified (by respondents) as; sun burns, sun stroke, dehydration due to heat/physical stress, respiratory diseases, skin allergies, boils in feet, headache due to vibration/noise and mistakes due to vibration/noise/weather. The findings are indicative of immediate remedial measures to be taken by government and employers for ensuring health and well being of such women at large.

KEY WORDS : Environmental hazards, Construction industry, Risk factors, Physical stress

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Environmental hazard is a generic term for any situation or state of events which poses a threat to the surrounding environment and adversely affects people's health (from Wikipedia, the free encyclopedia). In context to any occupation, it is a component in the workplace environment that can cause injury, illness, or death. In a harsh working environment like construction of buildings or industries; the components are multifold. These may include polluted air (full of dust and chemicals fumes); annoying noises; unsafe water; and unhygienic, stinking and filthy surroundings inviting various diseases (Jaselskis *et al.*, 1994).

Every year International Women's Day is celebrated on March 8. It offers an opportunity to reflect on the situation of women and examine recent developments and overall trends. Women workforce constitutes an integral part of total workforce in India. Their proportion in the country's workforce has increased during the last three decades. In 1981 it was 19.67 per cent and rose to 25.68 per cent in 2001, according to the Census of India 2001 (Anonymous, 2001). However, there are more women in unorganized sector mainly due to lack of education and opportunities to train themselves for better employment. They enter unorganized sector along with men particularly if they migrate for greener pastures with family and construction industry being the lone employment provider (Nandal, 2006). In mega city like Ludhiana, these women are a common site, but are facing pathetic employment conditions. They are considered only for load carrying or helping men and paid lowly. As mentioned by Self Employed Women Association (SEWA, 2000), women in construction sector face multidimensional problems, environmental hazards

being one of the major one, which needs to be examined in detail for knowing the impact on health and well being of such women. Present study was thus conducted with following objectives in mind : to examine the existing environmental conditions of selected construction sites in Ludhiana city, to the analyse environmental risk factors at construction sites as perceived by women workforce and to the study environmental hazards at selected construction sites in Ludhiana city.

■ RESEARCH METHODS

The study was conducted in 2011 in randomly selected two sites, one in within and another in outer skirts of Ludhiana city. A sample consisting of 80 female workers upto the age of 40 years engaged in construction industry as unskilled labourer were selected from 8 randomly selected construction sites. Four sites were taken from within and another four from outer skirts of Ludhiana city. These sites were: construction sites for auditorium and international guest house at PAU; a showroom in Ghumar Mandi; a shopping Complex at Bharat Nagar Chawk; industry at Jalandhar bypass; a showroom at Samrala Chawk; a Mall at Ambala Road and Basant Avenue extension between Pakhowal and Dugri Road. The average number of female workers was 10 from each site, thus comprising total sample of 80 workers. Pretested interview schedule was used to seek both background and specific information from the selected respondents. Collected data were analyzed and interpreted using frequency and percentage mean score and ANOVA.

■ RESEARCH FINDINGS AND DISCUSSION

The findings obtained from the present study have been discussed under the following sub-heads:

Demographic features of women workers in construction industry:

The data in Table 1 indicates that majority of the respondents (55.00%) were in the age group of 21-30 years, followed by 37.50 per cent who were of 31-40 years. Madhok (2005) also indicated in her report on National Commission on Women, that none of the women was over 40 years of age, as contractors prefer young women only. She further disclosed that as construction work is extremely taxing, most of the women are young (average age 25) having joined the workforce even before they reached their teens. Majority (97.50%) of the respondents were married. It was probably due to the fact that when men migrated to construction sites, they brought their wives along, so married women were part of major female workforce.

Caste is an independent cohesion of any society, and people generally want to live and move as a cohesive group. In the present study, all the respondents belonged to scheduled caste. It may be due to the reason that this caste was characterized very low socio-economic status and thus they had no other option than to join unorganized work force. Madhok (2005) too reported that the rural groups most likely to migrate in search of work are those who own the least land or are landless labourers. SC and ST are the largest landless groups in rural India, so they are likely to comprise a significant section of construction workers.

Table 1 : Demographic features of respondents (n=80)

Demographic features	No.	%age
Age (years)		
Up to 20	6	7.50
21-30	44	55.00
31-40	30	37.50
Marital status		
Married	78	97.50
Unmarried	2	2.50
Family type		
Joint	32	40.00
Nuclear	48	60.00
Education		
Literate	0	0.00
Illiterate	80	100.0

*multiple responses

Table 1 further elucidates that 60.00 per cent of the respondents belonged to nuclear family. Since generally workers migrated to work site as couples; they hardly brought along their extended families and parents for paucity of living space, hence nuclear families dominated. It was also conspicuous to note that all the respondents were illiterate. Madhok (2005) too presented similar results.

Environmental parameters of the construction sites:

The environmental parameters of the construction sites included temperature, noise level, humidity and light intensity. Table 2 depicts that the mean temperature and the humidity in the month of July and August was 43.5^0C±2.62 and 75.6±5.78, respectively. Although the recommendations of surroundings temperature given by Grandjean (1980) for heavy manual labour is 15-17^0C but since data were collected in summer months in a northern plains of the country where climatic conditions are very harsh, the observed value was much higher. Moreover, the work place in an open area with no fans or coolers, it was not possible to control atmospheric temperature and respondents under study suffered extremely hot environment while performing hard manual labour which left them sweating and gasping for fresh breath. High level of humidity further hindered evaporation of sweat and thus provided no cooling of skin.

It was also observed that the noise level in construction

Table 2 : Environmental parameters of the construction sites (n=80)

Environmental	Observed mean value	Recommended value/norm*	Deviation from recommendation
Temperature (^{0}C)	43.5±2.62	36-38^{0}C	14.94%
Noise Level (db)	65.78±3.15	45-55db	23.98%
Humidity (percentage)	75.6±5.78	80%	5.82%
Light Intensity inside buildings (lux)	51.11±3.68	30-50 lux	21.73%

*Grandjean E (1980) Ergonomics of the Home. Taylor and Francis, London

sites was more than the normal range (45-55 db) which may be due to the use of different machines and tools. The normal range of light which was required for the construction work was 30-50 lux and it was observed that light was enough at construction sites (51.11±3.68 lux). Since women worked in under construction sites; there were no artificial sources of light to illuminate the area for more favourable environment. Walls, flooring and ceilings being unfinished (without paints) added to the dimming of light especially once the roof was laid on walls. However, respondents did not perceive these conditions as any hindrance to their performance of work.

Physical and environmental risk factors:

Table 3 discusses physical and environmental factors at work site experienced by the working women. Data in the table show that the most frequently occurred physical factors were found to be 'ground being uneven' and 'ladders without safety belt/hook' with mean score 4.21 and 5.00, respectively, followed by least frequently occurred one as observed by respondents to be 'ground being too cold' and 'unstable ladders' (mean score 2.88 and 3.15, respectively). It was also found that most frequently occurred environmental factors were found to be 'air full of smells', 'noise disturbing the work', 'polluted water' and 'unhygienic eating place' (mean scores 3.40, 3.30, 3.73 and 4.90, respectively). Least frequently occurred factor was rated to be 'suffocated air', 'noise beyond tolerance', 'stagnated water at site' and 'infested canteen' with mean scores 2.68, 1.58, 3.00 and 0.73, respectively.

This may be due to the construction work going on work site; which filled air with dust and smells, noise due to heavy machinery and rubbles all around making environment dirty and unhealthy, thus increasing the risk of safety and health hazards. Sen *et al.* (2002) also identified difficulty in breathing by female construction workers (most probably due to the presence of dust) and problem associated with high noise mostly causing hearing loss. Sharma *et al.* (2008) also mentioned that respondents were suffering from shoulder-aches, back pains, skin related diseases, problems in the eyes, breathing and noise irritations.

Madhok (2005) too reported similar findings that women walked on slippery slops holding babies in one arm and carrying heavy head loads. There were no railings to hold onto, thus increasing un-safety at work. As building rises

Table 3 : Perceived physical and environmental factors at construction sites

Physical and environmental factors	Frequency of occurrence (mean score)	Exposure level (mean score)
Physical factors		
Ground		
Uneven	4.20	3.90
Too muddy	3.95	3.65
Full of sharp residues of building materials	3.80	3.45
Slippery	3.40	3.23
Too hot	3.05	2.88
Too cold	2.88	2.65
Ladder/Stairs		
Without safety belt/hook	5.00	4.88
Without support	4.85	4.63
Too steep	4.20	3.85
Unstable	3.15	2.80
Confined space	2.30	2.00
Obstructed pathway	3.78	3.43
Environmental factors		
Air		
Full of smells	3.40	3.23
Full of dust	3.53	3.18
Full of fumes	3.00	2.78
Suffocating	2.68	2.30
Noise		
Disturbing for work	3.30	3.08
Very high	2.30	2.18
Very annoying	2.25	2.03
Beyond tolerance	1.58	1.50
Water		
Polluted drinking water	3.73	3.43
Stagnated water at site	3.00	2.63
Miscellaneous		
Unhygienic eating place	4.90	4.68
Stinking toilets	4.63	4.40
Litter filled work site	4.05	3.70
Garbage of decomposing nature	0.93	0.73
Infested canteen	0.73	0.50

Table 4 : Environmental hazards at construction site as perceived by respondents

Environmental hazards	Dimension of hazards			
	Frequency of occurrence (mean)	Intensity of hazard (mean)	Level of risk (mean)	Overall rank
Sun burn	2.90	2.48	2.83	1
Sunstroke	2.90	1.45	3.35	2
Dehydration due to heat/physical stress	2.45	1.00	3.33	3
Respiratory diseases	2.38	1.15	2.30	4
Skin allergies	2.03	0.88	2.43	5
Boils in feet	2.35	1.33	1.43	6
Headache due to vibration/noise	1.35	2.60	1.13	7
Mistakes due to vibration/noise/weather	1.80	0.90	2.05	8
Numbness due to extreme cold	2.63	0.03	1.55	9
Bites/stings	1.80	0.10	2.20	10
Asthma	0.08	1.30	2.53	11
Hearing loss due to noise	1.33	0.33	2.08	12

there are open staircases to negotiate; or just a wooden plank going up and down in an open shaft which they used to carry loads with their babies on their hips. These factors multiply environmental risks.

Data further revealed the highest 'exposure level' of physical and environmental factors (as perceived by respondents) was also found to be same as 'frequency of occurrence'. Minimum exposure level was found to be associated with minimum frequency of occurrence. Physical factors which went unreported (by respondents) were: elevation without boundary and being unmarked, since there were no elevations on selected work sites. Madhok (2005) in her report also said that the polluted, dirty living environment spreads diseases among workers and their families.

Environmental hazards:

Table 4 discusses the frequency of occurrence, intensity and assessed risk for environmental hazards faced by women working at construction sites. From this table, it can be inferred that most frequently occurring environmental hazards at construction site was 'sun burn' and 'sunstroke' (mean score 2.90 for both). This may be due to the fact that respondents worked in extreme temperature and there were no shady place for their rest. 'Asthma' was found to be the least frequently occurring environmental hazard with mean score of 0.08 (as assigned by respondents).

Data further revealed that 'sun burn' was identified as most intense hazard (by respondents) with highest mean score of 2.48. It was followed by least intense environmental hazard 'hearing loss due to noise', and 'numbness due to extreme cold' with lowest mean scores (0.33 and 0.03, respectively). Risk was assessed at Matrix Scale and it was found that highest risks was from (at construction site) 'sunstroke' and 'dehydration due to heat/physical stress' with mean scores of 3.35 and 3.33, respectively. Grandjean (1980) also revealed that the exposure to different environmental conditions like noise, light and heat may be responsible for health impairment. The results also revealed that minimum level of risk at construction site from vibrations or noise leading to headache (mean 1.13).

Since the impact of these hazards cannot be studied in isolation, so risk assessment was also done at Matrix Scale to identify the urgency of action to be taken (if need be). Overall ranking was assigned to each hazard. Table 4 presents the data. It was revealed that major environmental hazard thus faced by respondents was 'sun burn' and 'sunstroke'. Further, the data showed that respondents also faced 'dehydration due to heat/physical stress' and 'respiratory diseases' (due to air pollution). Least faced environmental hazard was 'asthma' and 'hearing loss due to noise'. Thorevskij (1985) also reported that difficulty in breathing was most probably due to the presence of dust and problem associated with high noise and vibration mostly caused hearing loss to people working in construction industry.

Conclusion:

It can thus be concluded from the present study that observed construction sites were full of physical and environmental hazards, mainly due to lot of dust, fumes harsh climatic conditions (temperature too high/low), noise beyond tolerance and light less than desired. Female workers perceived multiple factors like undrinkable water, polluted and unhygienic surroundings which they attributed to environmental hazards they faced in high magnitude and intensity. Construction industry is certainly not a right place to work for fairer sex unless some immediate measures are taken to make it less environmentally hazardous.

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