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Job Stress and Occupational Accident among Blue-Collar Workers of India: An Anthropological Insight

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ABSTRACT

A growing body of evidence suggests that long working hours adversely affect the health and wellbeing of workers. Job Stress can affect individuals and lead to job dissatisfaction. High stress levels impose costs for the subjects and their organizations. To clarify whether job stressors affecting injury due to labor accidents differ between Indian male and female blue-collar workers, the Job Content Questionnaire (JCQ), assessing dimensions of job stressors based on the demand-control-support model, was applied to 278 blue- collar workers in a manufacturing factory. Of them, 48 male and 30 female workers suffered from injuries at work. In the female workers with the experience of work injury, the job demand score and job strain index (i.e., the ratio of job demand to job control) of the JCQ were significantly higher and the score of coworker support was significantly lower, than those in the female workers without the experience. High job demand (or, high job strain and low coworker support) was significantly related to work injury in all the female workers. Between the male workers with and without work injury, however, there was no significant difference in any job stressors. This study suggests that high job strain (specifically, high job demand), as well as low coworker support, are important factors affecting work injury in Indian female blue-collar workers. Further research with a large number of male blue-collar workers will be required to seek other factors that may be associated with work injury.

Key words: Occupational Accident, Job stress, Job content questionnaire, Blue-collar workers,

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INTRODUCTION

Little information has been developed regarding whether the relation of job stress to injury due to labor accident differs between male and female workers, although the effects of job stress are well-known to vary by sex (Karasek and Theorell, 1990; Hellerstedt and Jeffery, 1997). Certainly, Anthropological and psychosocial factors at work appear to affect work-related injuries including musculoskeletal diseases (Bongers et.al,), because the involvement of the human element in accident and injury causation is ubiquitous (Feyer and Williamson, 1998) and the majority of work injuries have some contributory cause related to the interaction between the worker and the work system (Budnick, 1993). Moreover, there is evidence that occupational factors that cause Anthropological and psychosocial strain can affect physical and mental health such as cardiovascular disease (Karasek et.al, 1981; Johnson and Hall, 1988), epicondylitis (Ono et.al, 1988), psychiatric disorders (Iwata et.al, 1988; Broadhead et.al, 1990; Shigemi et.al, 1997), and alcohol dependence (Kawakami et.al, 1993); whereas, the findings are not always consistent1, (Kawakami and Haratani, 1999). Recently, Wilkins and Beaudet have reported a sex difference in the link between work injury and job strain, with use of the data obtained from the Canada's 1994/95 National Population Health Survey (1998). The definition of "work injury" may, however, have varied across individuals. For worksite health promotion, the sex difference in such associations should be verified in countries with different cultures. For assessing job stressors, two well-established questionnaires, i.e., the Job Content Questionnaire (JCQ) Karasek, 1985) and Generic Job Stress Questionnaire (GJSQ) (Hurrell and McLaney, 1988; Haratani et.al, 1993), are commonly used in the world. These two also have relatively high reliability and validity (Kawakami and Haratani, 1999). In this article, a cross-sectional study was conducted to clarify whether job stressors, based on the demand-control-support model (Karasek, 1985), affecting injury due to labor accident differ between Indian male and female blue-collar workers working in textile industry of Varanasi, Uttar Pradesh.

MATERIAL AND METHODS

In December 2015, a self-rating questionnaire was distributed to all of 402 full-time employees of a small textile manufacturing factory of Varanasi, Uttar Pradesh, India (approximately 160 part-time and seasonal laborers were excluded because their working duration was relatively short and their occupational histories were not fully followed up). The response rate to this questionnaire was 83.6% (of 66 non-respondents, 22 were white-collar workers, and 6 of the remaining 44 blue-collar workers had the experience of work injury). The study cohort, accordingly, consisted of 184 male and 152 female workers, aged 19–59 (mean 40) years. In them, four men with diabetes mellitus and twenty men with hypertension were included. This factory manufactured many different kinds of aerosol products seasonally, and the work system and work environment had been basically unchanged despite some minor improvements, at least for ten years. 152

men and 126 women had worked in divisions of weaving, dyuing, assembling, packing, carriage of goods, and machinery maintenance (i.e., blue-collar workers). Fifty Eight workers were engaged in administrative/clerical work, or research (i.e., white-collar workers). None of the 336 workers had changed their occupation between blue-collar and white-collar, but a few blue-collar workers shifted among production divisions when they could not accommodate themselves to the work absolutely.

The JCQ, developed by Karasek (1985), has been translated into hindi and english and its factor-based and construct validity and internal consistency reliability have been tested in several samples of Indian workers. The questionnaire included 22 questions selected from the full recommended version (45 items) of the JCQ. These items constituted a minimum set of questions for four major scales of the JCQ: (1) job demand (five items), (2) job control or decision latitude (nine items), (3) supervisor support (four items), and (4) coworker support (four items). Each of the items had a 4-point response ranging from 1 (strongly disagree) to 4 (strongly agree). According to the Scoring Manual of the JCQ (1985), a sum of weighted item scores was used as a scale score. Also, job strain index was defined as the score ratio of job demand to job control. All injuries due to labor accidents in the factory (except traffic accidents in commute) had been recorded by an occupational health nurse since December, 2005-06.

As shown in Table 1, this study included not only slight injuries such as contusion and incised wound, but also moderate and severe injuries which confined the worker to bed for more than half of the daylight hours on the date of the accident or following days (e.g., bone fracture). On the accident-basis, the proportion of the injury to a total of labor accidents for the period of December, 2005-06 to December 2015, was 27% both in males and females including resignees and accident-prone workers who experienced such accidents twice or over. Of the 278 blue- collar workers, 48 males and 30 females suffered from injuries in the workplace; 14 males and 4 females were accident- prone workers (29% and 13%, respectively).

Table 1. Labor accidents in a manufacturing factory during the period of December, 2005-06 to December 2015*

	Male workers	**Female workers**
Part of body injured		
Fingers	46	22
Legs/feet	8	10
Trunk	2	14
Head	12	2
Eyes	10	4
Arms	8	4

Hands	6	6
General	2	4
Injuries		
Contused wound	36	20
Contusion	18	28
Incised wound	20	2
Bone fracture	8	8
Injuries	8	4
Burn	2	2
Dermatitis	2	1
Low back pain	1	2

* Accident-based number. Resignees were included in these figures, but part-time and seasonal laborers were excluded.

The comparison of job stress scores between the workers with and without the experience of work injury was made by the Student's t test and analysis of covariance Sex difference was tested by the analysis of variance (ANOVA) with repeated measurements (SS model of type II). Also, the multiple logistic regression analysis, including age and working duration as confounders (i.e., independent variables), was used to examine which of job demand, job control, and supervisor and coworker support was closely associated with the presence/absence of work injury. All the analyses were performed using the Statistical Package i.e SPSS.16.0.

RESULTS

Table 2. Job stress scores of the Job Content Questionnaire in blue-collar and white-collar workers in a manufacturing factory

	Blue-collar workers	White-collar workers	Probability (P) by t test
Males (Number):	152	32	
Job demand	33.0± 5.1	34.2 ± 3.2	0.237 (0.471)*
Job control	63.6 ± 9.6	71.6 ± 8.7	0.003 (0.002)*
Supervisor support	11.2 ± 2.2	11.9 ± 2.7	0.308 (0.343)*
Coworker support	11.4 ± 1.7	12.2 ± 1.8	0.088 (0.111)*
Job strain index	0.531 ± 0.120	0.483 ± 0.062	0.026 (0.096)*
Age (years)	37.5 ± 11.2	35.1 ± 12.6	0.456

Working duration (years)	13.9 ± 9.8	10.2 ± 10.6	0.171 (0.249)*
Females (Number):	126	26	
Job demand	32.9 ± 5.4	30.5 ± 5.6	0.147 (0.497)*
Job control	53.5 ± 10.3	65.8 ± 8.4	<0.001 (0.002)*
Supervisor support	10.5 ± 2.8	11.2 ± 3.1	0.482 (0.573)*
Coworker support	11.3 ± 2.0	12.0 ± 2.2	0.299 (0.812)*
Job strain index	0.639 ± 0.169	0.465 ± 0.079	<0.001 (0.018)*
Age (years)	46.1 ± 12.4	28.8 ± 12.1	<0.001
Working duration (years)	9.5 ± 7.3	6.6 ± 5.7	0.180 (0.599)*

The job stress scores of the JCQ in white-collar and blue- collar workers are shown in Table 2. In both male and female workers, the score of job control was significantly lower in the blue-collar workers than in the white-collar workers (ANOVA, P<0.001). On the other hand, the job strain index was significantly higher in the blue-collar workers (ANOVA, P<0.001). Significant sex differences were also found in job control and job strain index (ANOVA, P<0.001).

Table 3. Job stress scores in blue-collar workers with and without the experience of work injury

	Workers with experience of work injury			**Workers without experience of work injury**	**Probability* (P)**	
	Total	**in 2005–10[c]**	**in 2010–15[c]**		**age-adjusted[a]**	**duration-adjusted[b]**
Males (Number):	48	22	26	104		
Job demand	33.5 ± 5.5	33.9 ± 6.0	33.1 ± 6.0	32.8 ± 5.0	0.662	0.554
Job control	61.3± 8.3	60.5± 9.4	62.0 ± 7.6	64.6± 10.0	0.176	0.161
Supervisor support	10.8 ± 2.1	10.8± 2.3	10.7± 2.0	11.4± 2.3	0.211	0.202
Coworker support	11.1 ± 2.0	11.2± 2.2	11.1± 1.8	11.5± 1.6	0.382	0.430
Job strain index	0.560 ± 0.148	0.581 ±0.166	0.543± 0.136	0.517± 0.104	0.1 63	0.126
Age (years)	36.7 ± 9.4	37.8 ± 7.4	35.8± 11.0	37.8± 12.0	0.687[d]	
Working duration (years)	14.6 ± 8.1	16.2 ± 6.7	13.2± 9.1	13.7± 10.5	0.703[d]	
Females (Number):	30	12	18	96		

Job demand	37.1 ± 4.1	37.8 ± 4.3[e]	36.6 ± 4.2[e]	31.6 ± 5.0	<0.001	<0.001
Job control	51.1 ± 11.9	53.0 ± 7.9	49.8 ± 14.2	54.3 ± 9.8	0.377	0.356
Supervisor support	9.8 ± 3.6	8.8 ± 3.4	10.4 ± 3.9	10.8 ± 2.5	0.292	0.290
Coworker support	10.3 ± 2.3	9.5 ± 2.4[e]	10.9 ± 2.2	11.7 ± 1.8	0.046	0.025
Job strain index	0.753 ± 0.151	0.726 ±0.131	0.771± 0.168[e]	0.6.3± 0.159	0.005	0.003
Age (years)	50.3 ± 9.5	47.2 ± 11.8	52.4 ± 7.7	44.7 ± 13.0	0.129[d]	
Working duration (years)	11.0 ± 3.9	11.7 ± 4.6	10.6 ± 3.6	9.0 ± 8.0	0.208[d]	

*Probability by the analysis of covariance, between two groups of workers with and without experience of work injury, used to control for either age ([a]) or working duration ([b]). [c] The latest year was adopted in case of the accident-prone worker; and, one way analysis of variance was made among workers with experience of work injuries in 2005–10, and in 2010–15, and those without the experience. [d] Student's t test (or Welch t test).

[e] P<0.05 (v.s. workers without injury, Scheffe's multiple comparison test).

In the female blue-collar workers with the experience of work injury, the job demand score and job strain index were significantly higher than those in the female workers without the experience (Table 3). Similarly, the coworker support score was significantly lower in the female blue-collar workers. Although all the scores of job stressors in the female blue-collar workers who suffered from injuries were comparable between two 5-year periods (i.e., of December, 2005 to November, 2010, and of December, 2010 to November, 2015), these subgroups had higher scores of job demand as compared to the women without the experience of work injury (Table 3). On the other hand, there was no significant difference between the male blue-collar workers with and without the experience of work injury (Table 3). Among three subgroups of the male blue-collar workers, i.e., workers without an accident, those with one accident and those with two or more accidents, no significant difference was found in any job stressors (one-way analysis of variance, P>0.05).

Table 4. Relations of job demand, job control, supervisor and coworker support scores, age and working duration to the presence/absence of work injury in blue-collar workers: results of multiple

logistic regression analysis

Independent variables	Estimated β	Standard error	Probability (P) by Wald test	Odds ratio
Males (N=152):				
Job demand	0.02627	0.05189	0.613	1.03
Job control	− 0.03992	0.02869	0.164	0.96
Supervisor support	− 0.15204	0.12937	0.240	0.86
Coworker support	− 0.01667	0.17332	0.923	0.98
Age	− 0.03723	0.03486	0.286	0.96
Working duration	0.04743	0.03994	0.235	1.05
Females (N=126):				
Job demand	0.26409	0.08331	0.002	1.30
Job control	− 0.05845	0.03650	0.109	0.94
Supervisor support	0.02261	0.12049	0.855	1.02
Coworker support	− 0.34609	0.18003	0.055	0.71
Age	0.01507	0.04177	0.718	1.02
Working duration	0.02747	0.05987	0.646	1.03

High job demand was significantly related to work injury in the female blue-collar workers, but any job stressors were not significantly related in the male blue-collar workers (Table

4). When the job strain index, instead of job demand and job control scales, was used as one of independent variables of the multiple logistic regression analysis, job strain (estimated □=6.00, standard error=2.18, P=0.006) and coworker support (estimated □ = −0.349, standard error=0.178, P=0.050) were significantly related to work injury in the female blue-collar workers, but any stressors were not related in the males.

DISCUSSION

In this study, the female blue-collar workers with the experience of work injury had high job demand and job strain, and low coworker support as compared to those without such an experience, although the job control score was comparable. In addition, high job demand (or, high job strain and low coworker support)

was significantly associated with work injury in the female blue-collar workers. In Canadian female workers, high job strain measured as a ratio of psychological demands to decision latitude, and low coworker support were linked with work injury in the past 12 months (Wilkins and Beaudet, 1998); which of the anthropological and psychological demand and decision latitude contributed to high job strain has not been discussed in the paper. Workers with back injury in Baltimore, US, also had a close relation to high job strain (Myers et.al, 1999). In a 5-year prospective study of American urban transit operators, spinal injury was significantly predicted by psychological job demands, job dissatisfaction and the frequency of job problems (Krause et.al, 1998). Thus, the outcome of this study suggests that high job strain (especially, high job demand) and low coworker support are important factors affecting work injury in Indian female blue-collar workers, as well as in Canadian female workers.

By contrast, no significant difference in job stressors was observed between the male blue-collar workers with and without the experience of work injury in the present study. In Canadian male workers, likewise, none of job strain, job insecurity, coworker support and supervisor support were significantly related to work injury in past 12 months, while the male blue-collar workers showed a significantly high odds ratio of 3.2 to work injury (Wilkins and Beaudet, 1998). The above results suggest that psychosocial factors affecting work injury may differ between both sexes. One reason for this difference may have been attributable to the fact that many female workers in India serve as assistants to male workers (Kawakami et.al, 1995). Actually, job contents in the female blue-collar workers of this study were not always the same as those in the male blue-collar workers.

In general, men are far more likely than women to have high control over their work process at the task level, and psychological job demands do not differ markedly between both sexes (Karasek and Theorell, 1990); thus, job strain has been thought to be higher in female workers than in male workers. Nevertheless, it was not low job control but high job demand that was prominent in the female blue-collar workers with the experience of work injury of the current study. Female blue-collar workers who have more complaints about the way the work is organized, including the work flow and pace, the hours that are worked and the communication flow within the workplace, may be likely to suffer from work injury. On the other hand, since the incidence of work injury was higher in the male than in the female workers (31.6% for men and 23.8% for women, respectively) and there were more accident-prone workers in the male blue-collar workers than in the female, attention should be directed toward other factors such as individual characteristics including the type A behavior and mental ill health (Bongers et.al, 1993), together with high physical demands (Wilkins and Beaudet, 1998) that could not be examined in this study.

The comparability of the present study was preserved because age and working duration were comparable between the workers with and without work injury. All the subjects worked in the same factory, and the

analyses were made in men and women separately. Moreover, the results of the significant difference in the age-adjusted score of job control between white- and blue-collar workers (Table 2) are concordant with other studies with a large number of samples (Karasek and Theorell, 1990; Kawakami et.al, 1995).

On the contrary, there may have been some limitations in this study: (1) One is selection bias. The blue-collar workers were divided into two groups with and without work injury on the basis of the record reported by one occupational health nurse. Although the record would cover the majority of injuries that occurred in the factory and not include any recall bias, some slight injuries such as scratch might not have been declared by the propositus in as much as the Indian workers generally tend to underreport. (2) The sample size, especially of workers with work injury, was too small. Moreover, the proportion of non-respondents in the current study was 16.4% (66 workers) and somewhat high as compared to other reports (Kawakami et.al, 1995; Niemcryk et.al,1987). (3) It is uncertain whether measures of chronic job stressors by the JCQ reflected the past 10-year psychological states fully, although job stress scores of the workers who suffered from work injury were comparable between the two periods of 2005–2010 and 2010–2015 (Table 3). (4) During the period of 2005–2015, about eight accident events per year occurred in the factory, mainly due to human errors (not skill-based errors but rule-based mistakes) 4); for this reason, the company conducted safety education to strengthen the motivation to be safe, together with some minor improvements of the work system and environment. Further research with many blue-collar workers is necessary to confirm whether such factors, including the effects of safety education and workplace improvements, have strengthened or weakened the outcome of this study. One goal of occupational health activities is to assess abnormal or excessive human stressors in the workplace, to eliminate the stress to improve performance and reliability, and to minimize error (e.g., accident and injury). In order to reduce work injury relevant to job stressors such as high job demand and low coworker support in vulnerable population (i.e., female workers), introduction of the participatory management system for workplace improvements (Kogi, 1993) and worksite stress reduction programs (Murphy, 1984) may be practical, and also enhance the functional quality of the workplace.

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