



## RESEARCH ARTICLE

### ERGONOMIC ASSESSMENT OF WORK-WORKER-WORKPLACE INTERFACE IN SELECTED HOSIERY UNITS OF LUDHIANA CITY

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#### ABSTRACT

The present study was carried out to assess the work-worker-workplace interface using survey method on 120 women worker in selected hosiery units of Ludhiana City. Data pertaining to physical characteristics of workers, anthropometric measurements, ergonomic assessment of work and workplace was collected by using duly pretested and finalized interview schedule. It was observed that most ignored environmental aspect was: no air circulation, less light and climate too hot in summer and cold in winter. Affective, temporal, cognitive and physical are major four components of work which have been appropriately studied. As far as the physical component is concerned it has to be seen how much strain and fatigue the 'work' produces in workers' body; particularly strain on eyes and finer muscles of neck and fingers when they perform finer tasks. Since the work assigned to workers in hosiery units was to meet specified dead line, was fine in nature and required lot of visual effort, mostly respondents complained of strain on eyes (mean score 3.09) and time pressures (mean score 2.10).

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## INTRODUCTION

An ergonomic assessment ensures that worker's workplace and work environment is safe and ergonomically designed. Whereas workplace is the place where one is employed and performs work. Since, ergonomic assessment of any occupation at its setting is essential for attaining optimum output, making profits by the manufactures and for health and safety of the workers. This kind of assessment can pin point the potential hazards and drawbacks in the workplace; device ways to make work, worker friendly and for this both work and work place are needed to be humanized; which may enhance satisfaction. In the context of present study, ergonomic assessment was done for work site, work itself and its interaction with worker. Ergonomic assessment of work and work place and problems faced by the workers are the one dimension to determine and influence the amount and type of drudgery one can feel in a particular type of work. More importantly if the work is done in un-ergonomic workplace; and the scenario of work is in 'unorganized work sector' as in case of present study, their workplace is in hosiery industry. Role of workers in unorganised sector such as hosiery industry goes widely

un noticed, unrecorded and undocumented; with the result any voice raised for the issues concerning their welfare and safety goes unheard. It becomes very important to gather base line data at grass root level regarding their work, work environment and health related problems. Women workers in the unorganized sector deserve special emphasis in view of the double burden of work that distinguishes women from men. There fore ergonomic assessment of work and workplace is needed to ascertain worker's physical health status which plays a major role in handling manual labour and major kind of work performed in any unorganised work sector.

## MATERIALS AND METHODS

The research methodology followed for conducting the present study has been done through field survey. Field survey was conducted on casual women labourers engaged in hosiery industry in the Ludhiana city. For conducting the field survey, out of industrial hosiery hubs of Ludhiana city, two localities were purposively selected. Out of each selected locality, six hosiery units were also purposely selected where women workers have strong strength. Out of each unit, 10 female workers were randomly selected. Criteria for selecting these workers were; who were regularly employed by hosiery owners and who have been working there for 3-5 years.

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Thus the total constituted sample was 120 respondents. A pre-structured interview schedule was used to ergonomically evaluate the work environment in the hosiery industry. Observation method was also used for making objective assessment of worker, which included taking anthropometric measurements, weighting them and calculating their Body Mass Index (BMI). Observation method was used for examining work environment which included dimensions and physical features of workplace. Light intensity, temperature, relative humidity and noise level were observed both subjectively and objectively. The results were analyzed using simple percentages, averages and mean score were presented in the form of tables.

## RESULTS AND DISCUSSION

### Ergonomic Assessment of Work place

It is clear from Table 1 that the humidity was found to be congenial and tolerable as this aspect earned high mean score of 3.98, followed by adequate ventilation with a mean score of 2.07. Quietness was also in accordance with the work environment as respondents gave this aspect a high mean score of 3.17. Light adequacy did not seem to be very satisfactory as respondents gave it mediocre score (mean score 2.23) and also seen in Plate 9. It was also significant to note that there was no spot light provided in any hosiery unit. The feeling for congeniality of indoor climate which included temperature was less (mean score 2.13) as there were no mechanical means to beat the cold. Bharara (2012) too concluded in her study similar results while assessing the construction sites ergonomically; as she pointed out at very harsh climate and respondents under her study suffered extremely hot environment while performing hard manual tasks 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 and respondents felt the heat to be very high. However, since present study was conducted during winters; too much of cold made the environment hostile.

**Table 1. Subjective assessment of work site of hosiery units where women work**

(a) Environmental	Mean score
Tolerable humidity	3.98
Quietness	3.17
Light Adequacy	2.23
Congenial temperature	2.13
Adequate Ventilation	2.07
(b) Physical	
Hygienic surrounding	3.25
Sharp Work tools	2.95
Orderly Environment	2.30
Work place comfort	1.45

Table 1 further highlighted that congeniality of work environment provided a mediocre level of physical comfort only, as revealed by the mean score of 1.45 given by the respondents. However they did find the surroundings of the hosiery units and their work area in particular satisfactory as it is clear from high score given to hygiene (mean score 3.25) and orderly environment of the work place (mean score 2.30). Physical surroundings are equally important in any occupational setting for ideal work-worker and workplace relationship. These findings are in line with studies conducted by Bharara (2012) and Nauriyal (2006). Tools and supplies need to be in ideal working condition, in adequate number and at right place.

When work tools are in proper working condition, well maintained, well sharpened than they provide the worker with full efficiency and output at work. Work tools provided to the hosiery worker by the employer were observed in the Table 1. It was seen that generally all tools were well sharpened and seemed in good working condition. Respondents gave mean score of 2.95 to sharp work tools. It may be due to the reason that employer is solely interested in higher productivity and quality output. The finished product must come out to be a neat and well cut garment, with no extra threads to be seen and for that, it is essential to provide the worker with tools in excellent working condition.

However, this practice in-evidently reduced the stress on the eyes and neck of the worker and they were also able to perform work with ease; thus reducing drudgery of the work and avoiding any occupational health hazards. It can be thus concluded that work place being poorly designed, (in terms of old constructions) did not receive enough day light and fresh air. This may be due to less number of windows and other openings in the walls. By and large in such industrial buildings, such aspects are grossly neglected because; the kind of work going on is not fine in nature. However, in hosiery units, a manufactured garment needs to be finished, and add-ons like embroidery, crocheting, patchwork, buttoning, hemming, thread cutting etc. are required and for doing all these activities workplace should be very comfortable (both environmentally and physically) specially in terms of receiving enough light and air changes.

### Objective Assessment of Physical Environment at Work Place

For humanizing any work environment to the worker; especially when it has to be made women friendly; it needs to be assessed objectively. Light intensity in lx; temperature in centigrade and noise in decibels were observed objectively for this purpose. Humidity was calculated in percentage of water vapour present in air. Data in Table 2 revealed that almost half of respondents (52.50 percent) received day light of intensity from 250-900 lx and a significant number of respondents (41.66 percent) worked in inadequate light; when they had to work in light intensity less than 250 lx (Plate 9). Mean light intensity at their work site was observed to be 374.02 lx ( $\pm$  452.13).

The mean temperature was 16.11<sup>0</sup>C ( $\pm$  0.96); maximum number of respondents (66.66 percent) reeled under harsh cold weather condition while they worked in hosiery units. As far as the humidity is concerned; the percentage of water vapour seen in atmosphere was 55.80 ( $\pm$  4.48); which was an ideal level for comfortable work setting. Recommendations for healthy level of humidity in atmosphere is 45 percent (Grandjean, 1988). Too less humidity causes dryness in nasal passage, damaging inner waxing of nasal lining which may cause bleeding in addition to hampering filtration and moistening of the air before it reaches lungs. Although 68.33 percent respondents agreed to humidity level comfortable for them; however rest had not so much comfort feeling. Noise at work site was found to be beyond permissible limits. In any commercial complex, the permissible noise limits are 55 dB-65 dB. According to specifications of Punjab State Pollution Board; noise limit in any commercial hub should not be more than 65 dB, and 40.83 percent respondents worked in the noise level of 61-75 dB.

About one fourth of workers (27.50 percent) had to bear noise beyond 75 dB at the site where they worked. Any noise beyond 75 dB may cause damage to ears, disturb night sleep, increase blood pressure and disrupt regular heart beats; thus adversely affecting health of the person.

**Table 2. Objective assessment of work environment of women workers in hosiery units**

Environmental parameters	No.	Percentage	Mean ( $\pm$ S.D.)
Day Light (lx)			
Upto 250	50	41.66	374.02 ( $\pm$ 452.13)
251-900	63	52.50	
Above 900	7	5.83	
Temperature (°C)			
Extreme cold	80	66.66	16.11 ( $\pm$ 0.96)
Very cold	29	24.16	
Cold	11	9.16	
Humidity (percentage)			
Dry	16	13.33	55.80 ( $\pm$ 4.49)
Comfortable	82	68.33	
Humid	12	10.00	
Noise (dB)			
Upto 60	38	31.66	65.29 ( $\pm$ 0.48)
61-75	49	40.83	
Above 75	33	27.50	

### Ergonomic Assessment of the Work

Mean scores in Table 3 revealed that respondents gave highest score to overall strain in upper part the body due to repetitive nature of work (mean score 3.45), wherein there was strain felt by them in finger muscles and neck also, due to nature of work (mean score 3.12).

**Table 3. Subjective assessment of work of women worker in hosiery units**

Physical component	Mean score
Overall strain due repetitive nature of work	3.45
Strain on finer muscles e.g. neck	3.12
Strain on eyes	3.09
Strain on back	3.01
Temporal, Affective and cognitive components	
Temporal component time pressure decreases quality outcome of work	2.10
Time pressure affect home environment	2.02
Work not like much so seems difficult	1.99
Repetitive nature of work makes it boring	1.78
Work seems difficult due to lack of skill	0.05

There was comparatively also some strain on eyes as they gave 3.09 score to this aspect. This may be due to the reason that being young in age, their eyes were able to adapt to any light inadequacies; but because there finer muscles of neck were not well trained; so they felt more discomfort and pain in upper region of the body. This was also due to the reason that some of them have to work in squatting posture, because they are not provided any furniture to sit and work (Plate 10) and that is the reason they complained of upper back pain (mean score 3.01). In hosiery industry, Indian women are not assigned main job of creating a garment but just given the task of finishing and packing the garments, which puts strain only on finer muscles of neck, fingers and eyes. Table3 further revealed that work seems difficult due to certain lacking aspects of cognitive component of assigned work, mainly lack of skill or training and provision of 'insufficient tools'.

However, mean score 1.99 was given to insufficient tools but it seemed that they did not feel lack of skill at all, as they entered this occupation because they were at ease with the hosiery operations they were expected to do. Temporal component was adversely affected in the present study as revealed by respondents who gave comparatively high score to 'time pressure decreases quality outcome' with mean score 2.10. Many of them also agreed that such time pressures also have impact on their home environment adversely as revealed by 2.02 mean score allotted to this statement by them. Bharara (2012) and Gupta (2012) too highlighted importance of similar aspects on well being of workers while studying work.

### Conclusion

It was concluded that physical environment as perceived by workers was: tolerable humidity, adequate ventilation, noise in tolerable limits and insufficient light. There were no artificial means to control harshness of the temperature, increase in light and better ventilation as disclosed by respondents. Most ignored environmental aspect was: no air circulation, less light and climate too hot in summer and cold in winter. Surrounding and level of cleanliness were satisfactory as disclosed by workers. Since the work assigned to workers in hosiery units was to meet specified dead line, was fine in nature and required lot of visual effort, mostly respondents complained of strain on eyes (mean score 3.09) and time pressures (mean score 2.10).

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