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Workers' Health and Workplace Condition Evaluation (WCE) Of the Footwear Industries in Bangladesh

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Abstract: *Footwear industries in Bangladesh are considered as a potential sector to get a strong economic status in export era. Worker's health issues as well as workplace environment have to give priority unconditionally, to keep the incremental development of this sector. Footwear manufacturing process involves exposed to a number of hazardous compounds such as volatile organic compounds, hydrocarbons, toxic organic solvents, adhesives, shoe polishes, noise, over temperature, inadequate lighting and ergonomics risks which may lead to respiratory problem, eye irritation, asthma, pain in different parts of human body, hearing loss and so on. In this study, an experiment has conducted using specific questionnaire over400 workers (different category) and supervisors from selected twenty footwear industries in Bangladesh. The results have shown that adverse health effect among the participants where frequent headache (41.5%), stomachache (18.5%), eye problem (11%) and pain in joints (9.5%) were the most reported problems by the respondents. On the other hand, respiratory problem, skin irritation, coughing and ear problems were also found at an observable level. It also revealed that personal protective equipment and drinking water were not used by the workers in the most of the footwear industries in Bangladesh. Almost 90% of the industry did not maintain favorable hygienic work conditions such as temperature, noise and proper lighting. The experimental results indicated that many workers left or shifted their job from footwear industry due to unhealthy workplace, illness and work inability. Direct expose to hazardous chemicals and many ergonomic hazardous were mainly regulating those unwanted health problems which could be mitigated by alternative or substitute chemicals and new technology.*
Keyword: *Footwear Industry, Workplace, VOCs, Health*

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I. Introduction

Footwear sector of Bangladesh is playing a vital role in export sector as well as forward movement of our country's economy. Due to good product quality, availability of raw material, low labor cost, and exchange rate advantage, Bangladesh has become an attractive destination for investors. In 2016, Bangladesh exported about 308 million pair of shoes which was about 1.2% of world total export [1]. Now this sector is growing and import demands are rising tremendously. To hold this rising demand endlessly and better survive in the world market, it is now having an essential requirement for industry owners to keep the workers job environment as an international standard.

Occupational diseases reflect health hazards brought on by exposure within the work environment [2]. Due to lack of education, unaware of hazards of their occupations, general backwardness in the sanitation, poor nutrition and climatic proneness of this geographic region to epidemics prolong worker's health hazards from work environment [3]. In fact, occupational health and safety (OHS) is a cross-disciplinary area where health is associated to the physical conditions of both mind and body, of all people at the workplace including the workers, contractors and visitors, and their protection from harm in the form of injury or disease [4]. Without a proper healthy condition, workers will be unable to give their complete efficiency and industry would be loser their maximum profitability.

Shoe-making is a labor-intensive process that involves exposure to a number of hazardous compounds, such as leather dust, volatile organic compound, adhesives and shoe polish, hydrocarbons and different gases [5]. Each of these processes is associated with different types of health hazards. But most insidious of all are toxic organic solvents present particularly in adhesives and also in the hardeners, cleaning solutions and degreasers used in shoe-making processes [5]. The primary chemical exposures to organic solvents in footwear manufacturing industries come from the hand application of glues, cements and degreasing and cleaning solvents to the footwear component as they are assembled [6]. Acute poisoning of adhesives may lead to respiratory and cardiovascular failure and death [7]. Mixtures of organic solvents and plasticizers have been associated with dermatitis, mucous membrane irritation, eye irritation and sore eyes [8-12]. Water based

substitutes require the addition of highly reactive and toxic iso-cyanate cross-linkers that have been associated with impaired pulmonary function and occupational asthma [13-14]. Job functions and workstations in footwear and athletic manufacturing industries can present ergonomic risks due to repetitive movements, fixed and awkward body positions, vibration and the exertion of undue force when assembling shoe [6]. Operation of sewing machines with rapid speed performance and fixed working positions create risks for musculoskeletal disorders, especially low-back pain and shoulder pain [15]. Workers, who remained seated for long periods of time, have experienced adverse effects on their spinal segments and shoulders and occupational fatigue [16-17]. Asbestos (used in rubber sole manufacturing) related mesothelioma which is a cancer affecting the lungs and abdomen can be an extreme example, it may occur from about 30 to 40 years after being exposed to it while working in an industry [18]. On the other hand, high noise level, temperature and unbalanced light intensity level inside the industries give so much annoyance to the workers' job life.

There are a very few researches have done in the case of workers health issue at footwear industries in Bangladesh. So, to exempt the workers' health from burden of disease, unhealthy working environment and harmful threats that are coming from various job operations and to hold a sustainable development, there is a continuous need doing research in this sector. In this research, the current health condition of workers at footwear industries have been figured out and determined the present status of drinking water, using of personal protective equipment and medical facilities.

II. Materials and Methods

Almost 80% of all footwear industries are located in and around Dhaka city with some footwear industries existing in Chittagong and Khulna city. Within Dhaka city, there is a concentration of small footwear making units (having 15-50 workers) in two areas known as Siddique Bazaar and Bongshal. This study has carried out 20 footwear industries named as A, B, C…S, and T from different area around Dhaka and Gazipur cities.

Figure 1: Geographical locations of the study area

2.1. Description of the selected industries

The twenty footwear industries including small, medium and large scale production had a range of 180 to 6000 employees where some of them had around 30 years' working experience at same footwear industry. Approximately 70% of the total employees at these industries were women. Among the 20 sample footwear industries, 10 footwear industries produced footwear only for local market and 4 industries both for local market of Bangladesh and export oriented. The restof6 footwear industries exported good quality footwear at different countries in the world. Most of the buyers were from Russia, Poland, Canada Italy, and Japan. The industries have various departments and long assembly lines with long conveyor chain where workers performed variety of operations such as cutting, sewing, fitting, lasting, sole preparation, and finishing. In the closing department, the components of the shoe upper and the linings attached together. In the lasting department, the insole and shoe upper were joined together by sewn or adhesive or both. Heels, insoles, soles were prepared for next operation in the sole press department by using primer, adhesive. Then the sole was joined with the insole either

using adhesive technique or the injection molding technique. Roughing and scouring operation were done before sole assembly which released high amount of fine particulate dusts. In the finishing department, coloring, brilliant varnishing, glazing were done through hardener, finishing agent and cleaning solution. Workers were manually applied the adhesive, primer, cleaners, paint and polishing creams using a variety of hand tools. As a result, a part of the workers was direct exposed to chemicals and other part of the workers were involved in ergonomic risks included pressing, cutting, sewing trimming, skiving, stapling, scouring, grinding, lasting, de-lasting and roughing.

2.2. Selection of subject

Under the exploratory study, both quantitative and qualitative data were used in this experiment. Personal observation, group discussion and interview schedule methods were used to conduct the experiment with the help of a checklist. The study covered both local and foreign brand footwear industries of Bangladesh. At the first stage, out of all footwear industries around Dhaka and Gazipur cities, a total of 20 industries were selected by random sampling technique. Industries where more than 150 workers are working were selected. Among all the employees of each industry, 20 people (minimum 2-3 years of work experience in the study industry) were selected randomly as the sample size, where 18 workers were in different departments, 2 were concerned supervisors of the footwear industry. The study was conducted in the month from August 2017 to January 2018.

2.3. Questionnaires

The questionnaires were prepared to evaluate the health aspect of workers with regard to occupational hazards. The questionnaire included questions about workers age, sex, working hours, job title, health outcomes and use of personal protective equipment. Symptom questions were based upon chemical use in industries and thorough review of relevant journal, literature. The asked symptoms were eye problems/irritation, headache (frequent), respiratory problem, stomach ache, frequent body ache, backache, skin irritation, pain in joints, blood pressure, coughing for long time, ear problem, lung problem and accidents. For each symptom, the workers had to answer yes or no regarding to before starting job and after starting the job. Workers from each department were invited to participate an interview to conduct this study.

2.4. Exposure classification

At first, all the respondents were categorized between before Joining and after Joining. Here, before joining category included the respondents who had a symptom history before starting the job and after joining included the persons who faced a symptom history after starting the job at the footwear industry. Then, this two were also categorized into two groups in accordance to direct expose to chemicals or indirect expose to chemicals. For direct exposure, if the worker marked direct use of chemicals, they were considered as 'direct exposed' group. On the other hand, those who were experienced ergonomics hazard such as repetitive motion, standing or sitting on the hard surface for long time, forceful job operation, except direct use of any chemicals were considered as 'indirect exposed' group.

2.5. Statistical analysis

Personal observations, face to face interview, completion of the questionnaire checklist were conducted among the workers who were randomly selected in the presence of in-charged supervisors. All the information's provided by the workers were the main sources of primary data. Primary data was also collected through informal conversation in the absence of supervisors as they can clarify their provided information. Occupational health related relevant journal, health and safety policy of the surveyed organization has taken as secondary source of data. The analysis procedure has been divided into three steps. In the first step, the data were calculated according to their different categories and then it was cross checked. In the second step, the calculated data were comprised into the excel software and the analyzing procedure was done through excel software following the research questions. Finally, the whole findings were analyzed.

III. Results

This research was administrated to 400 workers through in-charged supervisors where they tried to give their best effort. Though men comfortably replied the entire questions, some women were felt shy in giving information about their problem. As a result, all respondents participated in this study giving an average response rate 90%. Table 1 shows the demographics of all respondents at the surveyed footwear industries. A total of 176, 122, 60, 22, 20 workers were from age range 20-24, 25-29, 30-40, <20, 40+ respectively, where majority of the respondents were men. About 280 respondents did work 10 to 12 hours sometimes according to their working pressure.

Table 1: Demographics of footwear industry workers

Sl.No.	Characteristics	Categories	Number	Percentage (%)
1	Age	>20	22	5.5
		20-24	176	44
		25-29	122	30.5
		30-40	60	15
		40+	20	5
2	Sex	Male	218	54.5
		Female	182	45.5
3	Working Hours	Always Eight Hours	120	30
		Sometimes More than Eight Hours	280	70
4	No. working days in a week		6	85.71

Figure 2 shows the appearance of symptoms reported by the workers before joining and after joining at the 20 footwear industries combined. Without exception, all the symptoms percentage after being joined was found higher than the symptoms before being joined. The percentage of symptoms before beginning the job ranged from 0 to 6.5 percent. Highest percentages of symptoms after being joined were frequent headache, stomach ache, eye problem, pain in joints. The percentage of symptoms after starting the job ranged from 0.5 to 48 percent.

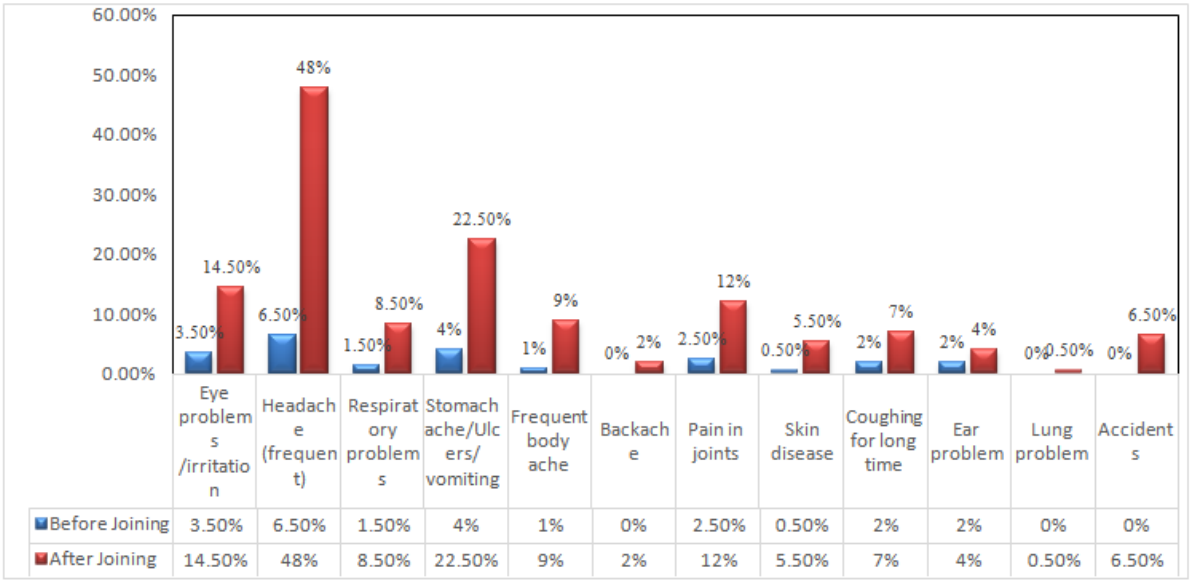

Figure 2: Appearance of symptoms reported before and after joining at the footwear industry

Table 2: Comparison of problem faces before and after joining cases for indirect and direct exposed in the footwear industries.

Problems	Before Joining		After Joining	
	Indirect Exposed	Direct Exposed	Indirect Exposed	Direct Exposed
Eye problems /irritation	4	10	33	25
Headache (frequent)	14	12	134	58
Respiratory problems	2	4	22	12
Stomach ache/Ulcers/vomiting	14	2	56	34
Frequent body ache	0	4	28	8
Backache	0	0	5	3
Pain in joints	3	7	30	18
Skin disease	2	0	7	15
Coughing for long time	4	4	20	8
Ear problem	6	2	12	4
Lung problem	0	0	0	2
Accidents	0	0	26	0

About 41.5% workers were found to suffer frequent headache problem after beginning the work which was the highest number among those diseases. Stomach ache, eye problem and pain in joints were found at greater percentages which were 18.5, 11 and 9.5% respectively. For the twenty footwear industries, direct exposure and indirect exposure groups were compared to before and after joining in table 2. In most cases, the number of workers experienced in ergonomics hazards is higher than the workers who are direct exposed to chemicals.

Table 3: Percentage of using personal protective equipment and safe drinking water

Name	Yes (%)	No (%)	Sometimes (%)
Personal protective equipment	10	59	31
Safe drinking water	80	5	15

Table 3 shows that about 90% workers did not always use personal protective equipment during their work. Some of them used it sometimes due to management pressure. On the other hand, all industry provides either filtered or deep tube well water. But about 20% workers always take unsafe supply water from basin or washroom tap instead of filtered or deep tube well water.

IV. Discussion

This research found adverse health effect among the workers. Most of the workers who did not directly expose to chemicals were in close proximity to workers who were directly exposed to chemicals. Indirect exposed group was involved in some operations which generated repetitive motion and awkward working position. Workers who were very sensitive to chemicals exposure or ergonomics hazard left the job more quickly than the workers who were insensitive. In summer, workers especially women, suffered more diseases just like fall on the floor due to high room temperature or dizziness, food poisoning than in winter season. A recent study shows that the average room temperature was found ranging from 32.8 to 34.9℃inside the footwear industries [19].

4.1. Eye, headache, respiratory, stomach ache, skin, coughing, lung problem

Workers from cutting, sewing and quality control department were seen with visual problems related to watery eyes, dimension of vision, tired eyes. This is relevant with findings because many chemicals, VOCs were used in the manufacturing process that can cause irritation. Poor lighting was also found in some industries that may raise these visual problems which ultimately lead to another problem named frequent headache. Workers of almost all sections reported this common problem where most of them were involved in gluing, priming or heavy machineries operations which generated high level of noise. A number of workers of the few industries used water-based adhesive that contained hexa-methylene di-iso-cyanate. Iso-cyanate can cause irritation in respiratory, skin, lung, through dermal absorption, inhalation or skin contact. The workers applied adhesive using different kinds of brushes without using hand gloves. Many workers suffered stomachache problem due to taking unhealthy food, unsafe drinking water and the operations related to dust, chemicals. The mechanical operation like roughing and scouring released a greater amount of dusts. Many workers did this type of operation without using mask and suffered lung problem, coughing for long time and pain in deep breath.

4.2. Pain in joints, back ache, frequent body ache, ear problem, accident

Pain or stiffness in hand, fingers, different joints, waist, and legs were found among the workers at considerable level. Standing or sitting for a long time, continuous work with vibrating substances gave back ache and frequent body ache to the workers. Most of the workers had job operation involving fixed position beside or in front of the conveyor belts. These workers sat on an unbalanced bench according to their height or standing on a hard surface. Many job tasks involve awkward body positioning, repetitive motions (such as cutting, sewing, cementing etc.) of hand and arm. Sometimes accidents occurred due to lack of concentration or unconsciousness during their works such as needle passes through the finger in sewing machine.

4.3. Controls at the industries

Filtered or deep tube well water, known as safe drinking water was provided by all selected industries. But many workers, who were unconscious about their health life, did not take that water. Instead of taking safe drinking water, they were taking unsafe supply water. In this study, the percentage of using personal protective equipment was found terrible. Some workers, who were involved in roughing, gluing, printing and priming operation, did not use any mask or gloves. On the other hand, no worker was found who used earplugs or ear muffs. Every industry provides first aid for any small kind of accident. In case of big accident, the injured workers are taken to the nearest hospital. Each footwear industry was sufficiently neat and clean. The dirt and refugees had been removed daily by sweeping in a suitable manner from floors, workstation and passages of the establishment. But in some industries, both working area and passages were filled with products which are ready for shipment due to lack of storage room. However, the toilet facilities were found to be quite adequate in these industries, but their maintenance was inadequate. There were also inadequacies in the supply of soaps and towels however management complained that toiletries are often stolen by the workers. Almost all industry provides health and safety training in irregular basis.

V. Conclusion

The current study reveals that the workers who are directly exposed to chemicals or ergonomics hazards experience in adverse health effects. Frequent headache, stomachache, eye problems and pain in joints are most prevalence symptoms suffered by the workers due to mainly VOCs, adhesive, poor lighting, high noise and repetitive motion. On the other hand, compliance issues are now getting priority at higher level to the whole world. There is no scope to take worker's health issue lightly to sustain in the world market. More well-targeted intervention studies should be conducted to find out which controlling measures will be most effective to decrease these health problems. Particularly, new application methods of chemicals and working process need to be developed along with the raise of awareness to use personal protective equipment according to rules and regulations to eliminate these health problems.

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