

Occupational Exposure and Awareness of Occupational Safety and Health Among Cloth Dyeing Workers in Jaipur India

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ABSTRACT

The objective of the study was to assess the health risk factors and awareness of Occupational safety and health of workers in cloth dyeing industry of Jaipur.

A pretested questionnaire was used to evaluate the health problems and awareness of occupational safety and health among workers.

The majority of these workers were suffering from eye irritation, back pain, allergies, general weakness, with most workers having three to five of these health problems. Back pain was found in 20%, 14.4%, 40.4%, of the workers in the age group of 20-35, 36-50, 51-65 years respectively, during the study period. Occupational contact dermatitis reaction was observed in 51.1%, 26.5%, 51.0%, of the workers in the age group of 20-35, 36-50, 51-65, years respectively.

A large number of diseases in different age groups are an indication that this industry exposes workers to many health hazards and lack of awareness and non availability of PPE in this industry is aggravating the health problems of the workers.

Keywords: Health Risks, Awareness, Workers, Dyes, Occupational Health, Jaipur

INTRODUCTION

The textile industry is one of the rapidly growing sectors of Jaipur's economy as this industry provides employment to a large number of people in Rajasthan [1]. Jaipur, the State capital that has a population of more than two million people and most of the textile industries of Sanganer are concentrated in the urban area. Their textile industries are estimated to be around 500 block and screen-printing units in Jaipur and near about 10,000 workers are working in this industry that get exposed to a large number of chemicals and become the victims of different types of diseases.

The origin of synthetic materials used in the textile industry has produced many new types of dyes have been developed and put into regular use. The different dyes that are used in this industry include acid dyes, premetalized acid dyes, chrome dyes (mordant dyes), cationic dyes (basic dyes), direct dyes (substantive dyes), direct developed dyes, disperse dyes, naphthol dyes, reactive dyes, sulfur dyes, and vat dyes [2]. On the other hand, workers are exposed to an increasing number of chemicals and occupational hazards in the textile dye industry. The exposure of workers to different types of

chemicals causes different types of diseases like skin allergies, respiratory diseases and musculoskeletal disorders. Skin allergies i.e., occupational dermatoses contribute a large number of occupational diseases and could even surpass all other industrial diseases put together [3]. Other organs such as the eyes, lungs, liver and urinary bladder may also be involved [4]. The common factors that predispose to the development of contact dermatitis are existing dermatoses, pressure, friction, sweating and prolonged immersion in water [5]. Genetic influences also play an important role [6]. Respiratory diseases may cause dry or productive cough of chronic or non-chronic nature, asthma and other respiratory symptoms.

Globally, Musculo Skeletal Diseases (MSD) are the largest single cause of work-related illness, accounting for over 33% of all newly reported occupational illnesses in the general population and 77% in construction workers. MSD is also the largest cause of sick absenteeism, days of work lost and disability. It affects productivity at work, causes increased economic burden due to costs of workers' compensation, healthcare and insurance [7]. Work patterns associated with MSD include heavy

workloads or exertion of force concentrated on specific parts of the body, fixed or constrained body positions, awkward posturing, and continual repetition of movements, exposure to vibrating tools or material, and most importantly, a pace of work that does not allow sufficient recovery between movements. The risks of MSD can increase with low job satisfaction, high job demands, job stress and lack of support from peers and supervisors. Further, the workers are not aware of health and safety is poor management that does not promote OHS in Textile industry (8).

A number of studies have been carried out all over the world to enumerate and evaluate the health effects workers working in the dyeing and printing industry. However, such studies carried out in other parts of the world and this is the first study carried out in Jaipur city that simultaneously studied the respiratory, skin and musculoskeletal disorders among the workers working in the dyeing industry of Jaipur. Hence, this study was initiated to explore occupational health status of the exposed workers in Jaipur, Rajasthan.

MATERIALS AND METHODS

Study Area

Jaipur is situated in the eastern part of Rajasthan, surrounded on three sides by the rugged Aravali hills. Jaipur is located at 26°55'N 75°49'E (26.92°N 75.82°E). Besides other products Jaipur is famous for cloth dyeing industry. Sober, low toned colors and delicate lines, creating finer designs like the poppy, rose and lotus, usually against a white background, is well known characteristic of fabrics that are printed at Jaipur. The main rivers and tributaries that are a source of irrigation and drinking water and in the Jaipur district are Banas, Banganga, Bandi, Dhund and Sabi which are polluted by the cloth dyeing industries. Different types of dyes from the cloth dyeing industry may find their way in this water body and may change the quality and quantity of water.

The study area selected was textile cluster units of Jaipur region. These clusters units at Jaipur use lot of water during dye processing and then the untreated waste water from these units is directly discharged into the small nalla going from their houses which are then ultimately drained into bigger nalla. This water is used in irrigating agricultural fields located inside or nearby the bigger nalla. It certainly makes the part of the food chain. Human beings in and around Jaipur village in Jaipur district consume these vegetables and products of other crop plants. In the present context of study, particular emphasis is made to find out the physical and chemical characteristic of water.

Study groups

Cross sectional study design was employed in the study. Ten units located in Jaipur city were randomly selected so that a proportional representative sample of dyeing units is covered in the study. List of dyeing units in the city was taken and random number Tables used for selection. All the 153 male workers and 22 female subjects employed in dyeing units were included as the exposed group. Those who did not give consent for the study in the exposed group were excluded.

None of the study subjects was suffering from any chronic disease like tuberculosis, diabetes, thyroid malfunction or malignancy during clinical examination. No study subject suffered from a major health problem which required hospitalization of more than a week.

A total of 153 male workers and 22 female workers were drawn from various cloths dyeing units of Jaipur. The questionnaire which was a modified version of earlier studies (9-10) was used that consisted of two parts:

a). Personal details are i.e age, gender, job tenure, daily working hours, marital status, number of children, educational level, smoker or non smoker and medical background.

b). The second part of the questionnaire was subdivided into different types of diseases viz., respiratory disease, musculoskeletal diseases, physical disorders, and general disease. The target group was the workers of the age between 20–65 years and the experimental subjects were divided into three groups according to their age (i.e., 20-35, 36-50, 51-65 years).

Recording occupational and personal histories of exposed workers A complete history of the workers was recorded with respect to the duration and nature of occupation, respiratory symptoms, smoking and family on a pre structured performa.

Health Hazards

The health hazards of the workers in the selected small scale industries were evaluated with the help of Medical evaluation schedule developed by OSHA with slight modifications wherever necessary. The questionnaire is requiring signature covering age, occupational carrier, working days in a week and daily working hours were filled personally by translating the questionnaire in the local language (Hindi). The present illness, general subjective symptoms, musculoskeletal symptoms, respiratory problems and injuries were also included in the questionnaire. The participants were asked about symptoms of illness during the last six months.

Evaluation of awareness of occupational health and safety hazards

A separate questionnaire was distributed among the workers of the industry to study the awareness of workers towards occupational health and safety.

The questionnaire containing the following questions were administered to the workers and the response was noted:

- 1) Has any Vaccination of workers against infectious Diseases conducted during the last 12 months?
- 2) Do you have SHE (Safety Health & Environment) Manger in your industry?
- 3) Has any medical checkup conducted at the time of recruitment/selection?
- 4) Does the OHS policy and arrangement for its implementation were communicated to all employees, contractors and other potentially affected groups?
- 5) Do you provide suitable information, instruction and training in PPE use and maintenance to your employees?
- 6) Are basic concepts of occupational health and safety protection included in the induction courses for new employees?
- 7) Do you have any waste treatment plant (solid, air, water) at your facility?

RESULTS

The data described in Fig.1 illustrate that the majority (47%) of workers were middle aged (35-50), while one-fourth (26%) were young (35-50 years) and (27%) of the workers belonged to old age (50- 65 years).

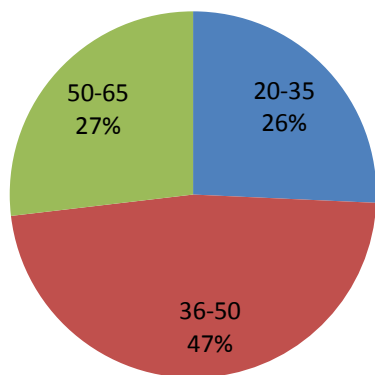


Fig 1. Distribution of the respondents according to their age *Gender*

The respondents were asked about their gender and responses are offered in Table 4 which shows that a vast majority (87%) of the respondents were male and only 13% were female workers. This shows that

the dye industry prefers male workers rather than female (Fig. 2).

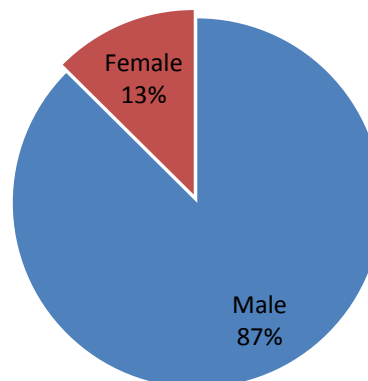


Fig 2: Distribution of the respondents according to the gender

Smoking Habit

The respondents were asked to tell about the smoking habit and their answers are presented in Table 12 which specifies that majority (70.29%) of the respondents smoke a cigarette and only (29.71%) of the respondents do not smoke cigarette. Among those who smoke, 91.86 percent reported that they smoke up to 2 cigarettes daily and half of the respondents were smoking 5 cigarettes daily. The respondents who smoke were further asked where they used to smoke, 93.50 percent of them argued that they smoke at their work place and 6.50 percent smokes in Canteen of the industry.

Table. 1: Distribution of the respondents according to their smoking habits and frequency of smoke

Smoking Habit	Frequency	%
Yes	123	70.29
No	52	29.71
Total	175	100.0
If yes than how many cigarettes you take daily?		
Up to two (2)	113	91.86
> 3-5	7	5.70
> 6-10	3	2.44
Total	123	100.0
Where do you smoke at your facility?		
At canteen	115	93.50
At the work place	8	6.50
Total	123	100.0

Physical health of the workers

The respondents were asked about their physical health and the responses are presented in Fig 3, which disclose that about one-fourth (54.29%) of the respondents were suffered from chronic diseases and 30.29 percent were hospitalized.

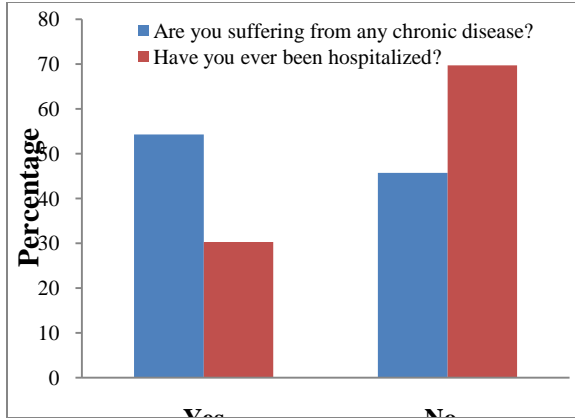


Fig. 3. Distribution of the respondents according to their physical health

Disease and their frequency

The respondents were asked about the frequency of suffering from different diseases from the last six months and the responses are presented in Table 2-5. The highest prevalence of different physical and ergonomic diseases was found in the workers having the age group of 50-65 years followed by the age group of 36-50 years (Table 2). Back pain was found in 20%, 14.4%, 40.4%, of the workers in the age group of 20-35, 36-50, 51-65 years respectively, during the study period (Table 3). Shortness of breath was found in 28.9%, 27.7%, 38.3%, of the workers in the age group of 20-35, 36-50, 51-65 years respectively. Coughing was found in 8.9%, 7.2%, 29.7%, of the workers in the age group of 20-35, 36-50, 51-65 years respectively (Table 5).

Table 2: Prevalence of Physical disorder among cloth dyeing workers

Complaints	Age (20- 35) N= 45 (%)	Ag (36-50yr) N= 83 (%)	Age (51-65 yr) N= 47 (%)
Numbness	4(8.9)	1 (1.2)	4(8.5)
Injuries	05(11.1)	02(2.4)	11(23.4)
General weakness and fatigue	20(44.4)	19(22.8)	44(93.6)
Weakness in any of your arms	19(42.2)	47(56.6)	35(74.5)
Headache	20 (44.4)	10 (12.0)	26(55.3)
Depression	03(6.7)	21(25.3)	31(65.9)

Table3: Prevalence of Musculoskeletal diseases among cloth dyeing workers

Complaints	Age (20- 35) N= 45 (%)	Age (36-50yr) N= 83 (%)	Age (51-65 yr) N= 47 (%)
Pain in fingers	27(60)	51(61.4)	17(36.2)
Swelling tonsils	4(8.8)	16(19.3)	23(48.9)
Swelling in your legs and feet	12(26.6)	29(34.9)	22(46.8)
Pain in wrist	24(53.3)	37(44.6)	31(65.6)
Back pain	9(20)	21(14.4)	19(40.4)
Difficulty in fully moving the your arms and legs	16(35.5)	13(15.7)	21(44.7)
Joint pain	18(40)	42 (21.7)	22(46.8)

Table 4: Prevalence of allergic reactions among cloth dyeing workers

Complaints	Age (20- 35) N= 45 (%)	Age (36-50yr) N= 83 (%)	Age (51-65 yr) N= 47 (%)
Occupational contact dermatitis	23(51.1)	22(26.5)	24 (51.0)
Pruritus	8(17.7)	1(1.2)	9(19.1)
Eye irritation	21(46.6)	21(25.3)	23(48.9)

Table 5: Prevalence of respiratory symptoms among cloth dyeing workers

Complaints	Age (20- 35) N= 45	Age (36-50yr) N= 83	Age (51-65 yr) N= 47
Chronic bronchitis	0	05 (6.0)	3(6.4)
Shortness of breath	13(28.9)	23(27.7)	18(38.3)
Shortness of breath when walking fast and slow	25(55.6)	23(27.7)	41(87.2)
Coughing	4(8.9)	6(7.2)	14(29.7)
Chest pain when you breathe deeply	0	1(1.2)	07(14.9)

OHS Measure and Awareness

The respondents were asked about the awareness of occupational health and safety and the responses are presented in Fig 4, which shows that majority (56%) of the respondents do not have awareness about occupational health and safety and one-third (32%) of the respondents reported their awareness to great extent. However, only 12 percent of the respondents are aware of occupational health and safety to great extent (Table. 6).

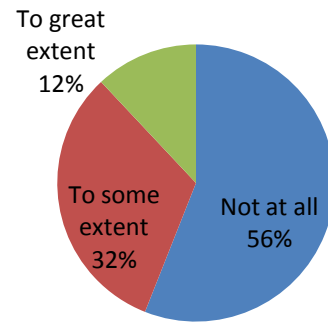


Fig. 4: Awareness about the occupational health and safety About 82.9% of the managers reported that they included the basic concept of OHS protection in the induction courses of new employees. 100% workers reported that they had no vaccination of workers against infectious Diseases conducted during the last 12 months and no medical checkup was carried out before their recruitment in this industry. A simple majority (57.5%) had no effective inspection system and the same number of the managers had no formal system. More than one-third (37.5%) of managers described that they had adequate numbers of competent personnel to carry out OHS programme.

The same number of managers also had the facilities of the ambulance in case of emergency. All managers

reported that their enterprises have the waste treatment plant.

Table 6: Distribution and proportion of general information about OHS management.

Statements	Yes		No	
	Frequency	%	Frequency	%
Has any medical checkup of workers conducted during the last 12 months?	112	64	63	36
Has any Vaccination of workers against infectious Diseases conducted during the last 12 months?	0	0	175	100
Do you have SHE (Safety Health & Environment) Manger in your industry?	145	82.9	30	17.1
Has any medical checkup conducted at the time of recruitment/selection?	0	0	175	100
Do the OHS policy and arrangement for its implementation been communicated to all employees, contractors and other potentially affected groups?	73	41.8	102	58.2
Do you provide suitable information, instruction and training in PPE use and maintenance to your employees?	127	72.6	48	27.4
Are basic concepts of occupational health and safety protection included in the induction courses for new employees?	5	2.8	170	97.2
Do you have any waste treatment plant (solid, air, water) at your facility?	0	0	175	100

DISCUSSION

The present study revealed that the workers in the dyeing industry of Jaipur are exposed to an increasing number of chemicals and occupational hazards over the years. One of the major causes of concern is occupational dermatoses that account for a large number of occupational diseases and could even exceed all other industrial diseases put together in Jaipur city. Most of the time it was reported by workers working in Jaipur dyeing industry those other vital organs such as the eyes, lungs, liver and urinary bladder are also involved. The reason for occupational dermatoses among the workers of cloth dyeing industry in Jaipur is the constant immersion of hands for prolonged periods in water. Pressure, friction, sweating and also plays an important role for the development of dermatoses among the workers.

It was observed that the workers in this industry are also exposed to various types of respiratory symptoms like asthma, chronic bronchitis, cough and chest pain. Moreover, non-specific respiratory symptoms in isolation or in combination with respiratory functional impairments with or without symptoms have also been reported by workers at the study site. The presence of organic dyes produced chest tightness, chest pain, angina, that kept the workers away from the work most of the time, which not only deteriorates the living standard of people but may reduce the productivity of this industry as well. Organic dyes exposure produces symptoms like chest tightness mostly on resuming work after an absence, altered pulmonary functions findings, etc. The exclusive design of making saris by the textile

workers in Jaipur is recognized as traditional art all over India. The records of the Dyeing and Printing Association revealed that, there are around 50 small scale units employing more than 1000 employees directly and many are indirectly involved including the women and children. This industry is mainly dominated by the Muslim community in the city of Jaipur. The process of making clothes involves many stages and the whole process is labor intensive which can be broadly divided into printing and dyeing of fabrics. Printing may be either screen printing or batik printing. The fabric is stretched along a long table and the selected design is printed using a screen which has the selected motif engraved in it during screen printing. However, this process exposes the workers to many types of ergonomic disorders that are mostly overlooked by the owners of the units and the workers who are engaged in this profession. The dye is applied on the screen at regular intervals without using any type of personnel protective equipment by the workers that aggravate the problems of the workers in the city of Jaipur. Depending upon the design requirements wax is melted on fabrics using either a block or a brush in batik printing. In the dyeing process, thick rope is used first and is dyed first and then rinsed in water and later sundried to complete the process.

The process of tying and dyeing is a manual procedure that directly exposes various workers of cloth dyeing industry of Jaipur to various dyes and chemicals used for bleaching, printing and finishing. The most common skin diseases, such as allergic contact dermatitis, irritant dermatitis and inflammation of mucous membranes, result from

contact with dyes and chemicals, particularly acids, alkalis, oxidizing and reducing agents, detergents and solvents. In the present investigation, the prevalence of contact dermatitis in the 'tie and dye' industries of Jaipur has been reported by the workers was found to be very high as compared to other studies.

It was observed that all the family members including the children participated in the 'tie and dye' work that is done manually in the courtyard of small residential houses, with poor ventilation, light and working conditions using wood as a fuel. The solution for dyeing is prepared in one corner of the house and washing and rinsing is done in another. The drainage system is very poor, open and highly unhygienic in all the units that were under investigation.

From the observations of the textile dye industry of Jaipur, it was evident that the dye workers have to work in a congested and poorly illuminated conditions because most of the work areas were inside the shops where the light intensity is very poor. The study revealed that dye workers suffered from discomfort in various parts of the body, especially in lower back, knees and upper extremities due to kneel, squatting and awkward working postures for longer periods of time. Furthermore, in order to see things clearly the workers have to take several harmful postures that render them to various types of muscular skeletal disorders. According to Wani and Jaiswal [9], severe discomforts or pain in the workers is due to heavy spinal loading and repetitive movement of the body parts over an extended period. The feeling of discomfort (pain) in different parts of the body among the workers may be due to their prolonged working hours and repetitiveness of the work without sufficient rest, which may lead to severe musculoskeletal disorders. Joshi et al. has obtained a 59.4% prevalence of MSD in their study on industrial workers in Delhi and have recommended that due to the high prevalence of MSDs in workers, the condition needs urgent attention from the health and labor sectors [11].

Although all the workers strongly believe that there should be safe methods of to handle and dispose contaminated packaging in an ecofriendly manner, only 20% of the workers had been instructed on safe methods of handling dyes. The rest of the workers did not receive any instructions on handling of dyes, because in every unit only few people had been identified to prepare the dye solution. The workers reported that using PPE cause them one or the other type of discomfort that interfere with their work practice and lack of awareness on the health hazards of working with dyes may be the other cause for not using the PPE by the workers in these units. This might also be one of the reasons for the high level of

knowledge that dyeing and printing workers will develop dermatological problems.

The different methods are utilized by the workers of cloth dyeing industry to remove the stains due to dyes on the hands and legs depend on the availability, ease of access, perception of workers for stain removal. Workers engaged in dyeing mostly used bleaching powder to remove irritants while dish washing powder and soap was used by workers engaged in screen printing, and water was used by hand printers and batik printers. Our study clearly indicated that although workers had knowledge regarding the occupational hazards irrespective of the nature of the occupation they are engaged in, their attitudinal approach toward the betterment of the work environment is positive. But because of lack of provision in the work site, they are unable to practice. Making workers aware of the occupational hazards and motivating them to use PPE while at work is the need of the hour.

The experimental data suggest a need to implement common objectives, compatible policies and programmes for improvement in the industrial waste water treatment methods. It also suggests a need of consistent, internationally recognized data driven strategy to assess the quality of waste water effluent and generation of international standards for evaluation of contamination levels. The existing situation if mishandled can cause irreparable ecological harm in the long-term well masked by short term economic prosperity in India with special reference to the city of Jaipur.

The harmful effects of dyestuffs on human health have been reported worldwide for several decades. Poor health, safety, and waste management practices may pose several health hazards to textile workers as they are exposed to such conditions with no control over the length and frequency of exposure. Occupational health authorities around the world have established safety regulations and/or guidelines to limit workers' exposures to solvents at the work site, both by controlling the air concentrations of solvents in the work environment and by helping workers to avoid unnecessary exposures through safe practices and personal protective equipment (PPE). Theoretically, safe practices depend on having an appropriate attitude toward the health risks associated with exposure to dyes, which in turn depend on knowledge about the danger and harmful effects of dyes. Millions of workers are occupationally exposed to dyes in the world, but little is known about their knowledge of and attitudes toward the effects of dyes. Fabric dyers' and printers' knowledge, attitude, and practice toward the health hazard of dyes has not been well assessed in India. There is a great concern that workers should be aware of the adverse effects of

dyes if not handled properly as they are exposed to the same with no control over the length and frequency of exposure. Though a number of studies have been carried out on Jaipur of workers in various fields, this is the first attempt to study the physicochemical properties of water along with health hazards of dyes on the workers keeping the working conditions into consideration as well.

CONCLUSION

The workers in cloth dyeing industry of Jaipur are exposed to different types of health hazards due to poor working conditions and lack of awareness among working community. There must be established policies binding the owners of cloth dyeing industry to keep conditions favourable for weaving. Most diseases and health problems found in carpet units can be avoided with proper precautions and care. Some protective equipment must be provided, e.g., face masks and first-aid facilities, to protect workers from the adverse effects environment. The owners, with the co-operation of the government, must also provide health insurance.

ETHICAL ISSUES

All the participants were informed about the purpose of study and their willingness was noted in the questionnaire.

CONFLICT OF INTEREST

Authors did not have any conflict of interest.

AUTHORS CONTRIBUTION

Authors have equal contribution.

FINDING/ SUPPORTING

Authors done this investigation by their buget.

REFERENCES

- [1] Babu BR, Parande SR, Kumar TP., Cotton Textile Processing: Waste Generation and Effluent Treatment. *J. Cotton Sci.* 2007. 11: 141-53.
- [2] Price, A., Cohen, A., & Johnson, I. J.J. Pizzuto's fabric science, Fairchild Publications, New York 2005.
- [3]Farner LM. Rehabilitation in industrial dermatosis, *AMA Arch Dermatol syphilol* 1954;69(4):428-34.
- [4] Hunter D. The disease of occupation, 6th edn. Hodder and Stoughton, London, 1978.
- [5] Calnan CD. The climate of contact dermatitis. *Acta Derm Venereol* 1964;44:34.
- [6] Hoh J, Ott J. Genetic dissection of diseases: design and methods. *Current Opinion in Genetics & Development.* 2004;14(3):229-32.
- [7] Joshi TK, Menon KK, Kishore J. Musculoskeletal disorders in industrial workers of Delhi. *Int J Occup Environ Health* 2001;7(3):217-21.
- [8] Praveen Kumar M, Mugundhan.K, Visagavel K..., Occupational health & safety in textile industry. *International Journal of Research in Engineering and Technology.* 2014;03(11); 168-72.
- [9] Wani KA, Jaiswal YK., Health risk factors in carpet industries of Kashmir, India. *JOSE.* 2012; 18(4): 451-56.
- [10] Reese CD, Edison JU. Handbook of OSHA construction safety and health. Boca Raton, FL, CRC, USA; 1999
- [11] Punnett L, Wegman DH., Work-related musculoskeletal disorders: The epidemiologic evidence and the debate. *J Electromyogr Kinesiol* 2004;14(1):13-23.