

Evaluation of Operational Workplace and Occupational Musculoskeletal Disorders among Workers in Ethiopian Shoe Manufacturing Company

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Abstract— Musculoskeletal disorders in developing countries are considered as main cause of occupational disorders and disability and highly associated with socioeconomic burden to individual, organization and society in general view. The purpose of this study was to determine the prevalence of musculoskeletal disorders and associated risk factors among shoe manufacturing workers. In a cross-sectional study, 47 questionnaires were provided from 247 randomly selected workers of production department of one of the Ethiopian shoe manufacturing company. Data of musculoskeletal disorders was gathered by means of structured questionnaire. Demographic and work related data were collected into the check list. Out of 47 individuals, 47 questionnaires returned and mean age of study workers was 32.2 years old. Leg pains, work postures discomforts are most common musculoskeletal disorders and environmental problem due chemical substances and dehydration are also found more. Musculoskeletal disorders in Ethiopian shoe manufacturing companies happened in high rate. Ergonomic interventions strategies into the workplaces must be focused to eliminate environmental hazards. Proper ergonomic workplace design is necessary to prevent repetitive strain injuries and other musculoskeletal disorders, which can develop over time and can lead to long-term disability. Musculoskeletal disorders had significant association with the job time of work. Improvements in ergonomics improve quality and operators productivity.

Index Terms— Ergonomic workplace, musculoskeletal disorders, Footwear, Safety and health of workers, Occupational hazards.

I. INTRODUCTION

Modern shoe making in Ethiopia started at the onset of the tanning industry. The art of shoemaking is introduced to Ethiopians in the mid-1920s. The leather product industry in Ethiopia includes the manufacture of the leather shoes, shoe uppers, leather garments, bags and stitched upholstery. The

producers belong to the formal and the informal sectors of the economy.

The growing demand that exists both locally and abroad for leather footwear has contributed to the growth of the Ethiopian footwear company. Currently, there are more than 16 mechanized operational medium and large footwear companies in the formal sector. Most of these companies produce primarily shoes for men, women, and children.

Musculoskeletal disorders (MSDs) are a major cause of occupational injury in the developed and industrially developing countries [1-4]. Risk factors have been found to include workplace activities such as heavy lifting, repetitive tasks and awkward working postures [5, 6], while demographic characteristics (i.e., age, gender, job tenure, etc.) and psychosocial factors are also known to be important predictive variables [7-12]. In industrially developing countries, the problems of workplace injuries are serious [4]. Poor working conditions and no effective work injury prevention programs in these countries have resulted in very high rates of MSDs [13].

In the case of Ethiopia, ergonomic considerations have not been taken into account yet and no statistics exist, implying ergonomic disorders' prevalence and productivity deficiencies caused by neglecting workplace ergonomics.

The objective of this study was to investigate the prevalence of musculoskeletal disorders among shoe manufacturing company workers. We believed that the results of the current study could be an appropriate base for planning interventional ergonomics programs in the workplace and improving worker's health in the Ethiopian shoe manufacturing company.

II. MATERIALS AND METHODS

In this study an attempt was made to assess the current situation of operational workplace (local and export production department) and occupational musculoskeletal disorders status of workers in case shoe manufacturing company in Addis Ababa city, Ethiopia. This was conducted through interviews, personnel visits and randomly distributed the designed questionnaire (five point Likert scale based) to the operational workers who have direct relation to the work/machine and interview them while working. Data was collected from age groups of the subjects ranged between 20-56 years (mean of 32 years). The survey questionnaire also investigated pain, discomfort, limitations of motion and affection of daily activities.

In this study an attempt were made random selecting 47 from 247 footwear manufacturing workers of local and export production department. These workers performed various

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jobs of shoe manufacturing namely measuring, cutting, applying adhesives, fitting job and finishing. A questionnaire was performed to know the occupational musculoskeletal disorders status of all the subjects. The questionnaire included questions about their present, previous history of any kinds of pains and discomforts. The investigation was done by using descriptive statistics such as standard deviations, means and percentage analyzed statistically. All the subjects included in this study resided outside company. 24 operational workers of them are reached by walking and the remaining 23 of them are reached by using service bus and taxi in company (Table I).

Table I
Personal And Job Related Characteristics Of The Workers Who Participated In The Questionnaire Survey

Variables	Respon ses	Percenta ge	Mea n	Stand ard deviati on
Gender:				
Male	22	46.8%	--	--
Female	25	53.2%	--	--
Number of years in to the job:	47	--	8.98	9.256
Working hours in a week:	47	--	49.89	4.202
Education status:				
Primary	10	21.3%	--	--
Secondary	20	42.5%	--	--
Higher school	9	19.2%	--	--
TVET/College	8	17.0%	--	--
Marital status:				
Single	27	57.5%	--	--
Married	20	42.5%	--	--
Type of transport to reach company:				
Walking	24	51.1%	--	--
Company bus	10	21.3%	--	--
Private local taxi	13	27.6%	--	--

III. RESULTS AND DISCUSSION

Table I show the personal and job related characteristics of the workers who participated in the questionnaire survey. Among the 47 workers randomly selected, 53.2% were females while 46.8% were males. Majority of them were single (57.45%), 42.55% were married and mean of 32.2 years old indicating a relatively young working population. 42.55% were secondary school level, followed by workers who were primary school level (21.28%), 19.15% of the workers were high-school graduates, and 17.02% workers who graduated from TVET/College. The temperature inside the production department was 19°C at the time of research study were conducted.

Operational workplace cause-and-effect diagram (Fig. 1) identifies the root causes and effects of physical and ergonomic problems in the production department of footwear manufacturing company.

Table II shows Likert scaling tabulations and mean value intervals used for questionnaire design and data calculation.

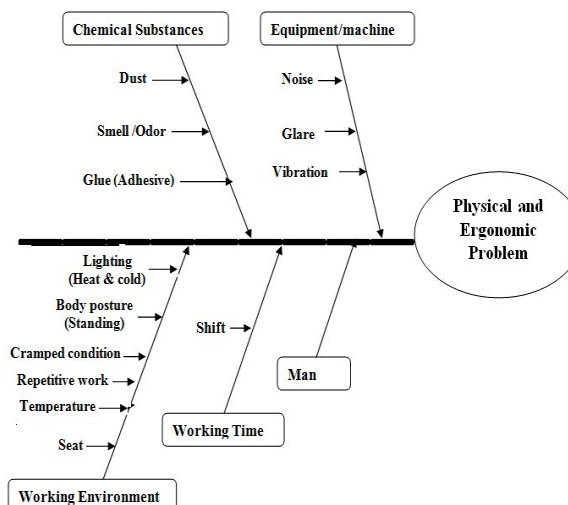


Figure 1: Cause-and-effect for the production department of footwear manufacturing company

Table II
Likert Scale Used [8]

Mean value intervals	Likert scale	Scale
1.0-1.8	Strongly Disagree	1
1.81-2.6	Disagree	2
2.61-3.40	Neutral	3
3.41-4.20	Agree	4
4.21-5.0	Strongly Agree	5

Many establishments and industries have yet to recognize the importance of ergonomics in the workplace. Since most of production operations are conducted in a standing work posture, (93.64%=72.37% strongly agree+21.27% agree) of these workers complained of working posture discomforts and dehydration due to overwork and heat (82.97%=46.8 strongly agree+36.17 agree) (Table III).

In this study, similar problems were noted among the respondents. The top musculoskeletal disorders and hazards identified were poor posture leading to backache (68.07%=29.78(SA)+17.02(A) lower back ache+38.29(SA)+12.77(A) upper back ache), hand fingers pain (53.18%=25.53(SA)+27.65(A)), leg ache (51.05%=27.65 (SA)+23.4(A) right leg pain+23.4(SA)+29.78(A) left leg pain), shoulder pain (29.79%=17.03(SA)+6.38(A) right shoulder pain+12.77(SA)+4.25(A) left shoulder pain), chemical exposure (61.7%) (Table II), due to temperature (51% heat+6.38% cold) (Table II), and machine and room lighting (29%) (Table II).

Exposure to indoor air pollutants has been associated with serious health hazards such as acute respiratory infection (ARI), chronic bronchitis, lung cancer, asthma strongly (4.27%) and stink strongly (29.78%) as per Table III.

Tables II and III shows the comparative frequencies of symptoms with respect to the different body areas investigated through data collection (questionnaire). Pain was the most commonly reported symptom across all body areas, followed by discomfort and limitation of motion.

Table III
Occurrence Of Work-Related Problems (Percentage)

SA	A	N	D	SD	Avg. (Std. Dev.)	Lo R
Right shoulder pain:						
No. 8	No. 3	No.1 6	No. 9	No.1 1	2.74 (1.82)	N
17.03	6.38	34.04	19.15	23.4		
Left shoulder pain:						
No. 6	No. 2	No.1 5	No.1 2	No.1 2	2.53 (2.49)	D
12.77	4.25	31.91	25.55	25.52		
Headache while working:						
No. 7	No. 4	No. 22	No. 6	No. 8	2.91 (2.53)	N
14.89	8.53	46.8	12.76	17.02		
Neck pain:						
No. 8	No. 14	No.1 0	No. 6	No. 7	3.08 (3.54)	N
17.02	14.89	29.78	12.78	25.53		
Lower back bone pain:						
No. 14	No. 8	No. 8	No. 6	No.1 1	3.17 (2.66)	N
29.78	17.02	17.04	12.76	23.4		
Upper back bone pain:						
No. 18	No. 6	No. 6	No. 5	No.1 2	3.27 (5.41)	N
38.29	12.77	12.76	10.63	25.53		
Wrist pain(s):						
No. 7	No. 17	No. 9	No. 8	No. 6	3.23 (3.46)	N
14.89	36.17	19.14	17.02	12.76		
Hand fingers pain:						
No.1 2	No.1 3	No.1 2	No. 4	No. 6	3.45 (1.97)	A
25.53	27.65	25.53	8.51	12.76		
Elbows pain:						
No. 6	No.1 0	No. 9	No. 9	No.1 3	2.72 (6.15)	N
12.78	21.27	19.15	19.14	27.65		
Visual discomforts:						
No. 6	No. 4	No. 5	No.1 0	No. 22	2.19 (3.71)	D
12.77	8.53	10.63	21.27	46.8		
Carpal tunnel syndrome:						
No. 7	No. 6	No. 21	No. 6	No. 7	3.04 (4.57)	N
14.90	12.76	44.69	12.76	14.89		
Right leg pain:						
No.1 3	No.1 1	No. 12	No. 8	No. 3	3.48 (2.35)	S A
27.65	23.4	25.53	17.02	6.38		
Left leg pain:						
No. 11	No. 14	No. 12	No. 6	No. 4	3.46 (4.24)	S A
23.4	29.78	25.53	12.76	8.51		
Numbness (asleep):						
No. 5	No. 3	No. 7	No. 9	No. 23	2.10 (6.64)	D
10.66	6.38	14.89	19.14	48.93		

Boredom:						
No. 8	No. 6	No. 9	No. 10	No. 14	2.65 (1.46)	N
6.39	8.51	17.02	23.4	44.68		
Stink:						
No. 7	No. 7	No. 8	No. 12	No. 13	2.64 (3.40)	N
14.89	14.89	17.02	25.53	27.65		
Dust:						
No. 6	No. 5	No. 8	No. 6	No. 22	2.30 (3.66)	D
12.78	10.6	17.02	12.77	46.8		
Suffering from asthma:						
No. 2	No. 1	No. 1	No. 15	No. 28	1.60 (3.97)	S D
4.27	2.12	2.12	25.43	59.57		
Regular cough:						
No. 4	No. 2	No. 16	No. 8	No. 17	2.31 (4.62)	D
8.51	4.27	34.04	17.02	36.17		
Hypertension:						
No. 1	No. 1	No. 2	No. 15	No. 28	1.55 (3.41)	S D
2.25	2.12	4.25	31.81	59.57		
Suffocation:						
No. 4	No. 3	No. 4	No. 10	No. 26	1.91 (5.68)	D
8.53	6.38	8.51	21.27	55.31		
Nausea:						
No. 12	No. 8	No. 7	No. 9	No. 11	3.02 (2.79)	N
25.53	17.02	14.89	19.14	23.40		
Dizziness:						
No. 9	No. 7	No. 18	No. 3	No. 10	3.04 (7.31)	N
19.14	14.89	38.29	6.38	21.27		
Dehydration:						
No. 22	No. 17	No. 5	No. 2	No. 1	4.21 (1.89)	S A
46.8	36.17	10.63	4.27	2.12		
Vibration:						
No. 6	No. 3	No. 9	No. 13	No. 16	2.36 (4.26)	D
12.79	6.38	19.14	27.65	34.04		
Work posture discomforts:						
No. 34	No. 10	No. 1	No. 1	No. 1	4.59 (23.8 1)	S A
72.37	21.27	2.12	2.12	2.12		

Note: SA: Strongly Agree; A: Agree; N: Neutral; D: Disagree; SD: Strongly Disagree; Avg.: Average; Std. Dev.: Standard Deviation; LoR: Level of Responses; No.: Number of Respondents'

Table IV
Occurrence Of Work-Related Physical And Ergonomic Problems (Percentage)

Work related problems	Responses	Percentage
Due to chemical substances, materials	29	61.7
Due to workplace layout	11	23
Due to space (e.g. cramped	9	19

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conditions)		
Due to working posture	13	27.65
Due to repetitive work	11	23
Due to equipment/machine noise	22	46
Due to machine and room lighting	14	29
Due to heat	24	51
Due to cold	3	6.38
Due to draughts	7	14.89
Due to smell/odor	8	17.02
Due to safety precautions	2	4.25

Shoe-making is a labor-intensive process that involves exposure to a number of hazardous compounds, such as shoe dust (leather), volatile organic compound, adhesives, shoe polish, hydrocarbons and different gases. The chemical exposures to chemicals in footwear manufacturing company can have adverse health effect on the operational workers. The greatest risk for chemical exposures occurs in the gluing process, leather dust during cutting, grinding and polishing processes. This causes pulmonary toxicity and nasal carcinoma (42.55% Nausea-25.53 (SA)+17.02(A)), 27.66% carpal tunnel syndrome symptom-(14.90 (SA)+12.76 (A)) as per Table III.

The data gathered in this study can be applied in the improvement of workplace design/layout and posture. The use of ergonomics in design systems can reduce human error in system performance, minimize hazards to individuals in the work environment, reduce adverse health effects/musculoskeletal disorders and improve system efficiency.

CONCLUSION

From the present study it may be concluded that the operational workers who are engaged in footwear manufacturing activities, which involve exposure to leather dust and various toxic adhesives in the working environment and have higher chance of occupational musculoskeletal disorders due to poor working conditions. The current results of data collected showed that most of workers had musculoskeletal disorders problems; legs, backbone, shoulder problems and dehydration were the most common ones among the workers.

The study brought to light many issues which were ergonomic in nature which were affecting the operational workers health. It was also observed that ergonomic awareness was very less in the company. The information gained on the work place design and its effect on workers through the ergonomic analysis added to the state of knowledge of these workplaces and focused our attention on areas where work condition improvements are needed. Also it is observed that there ample scope of improvement in work design, machine layout and working conditions with the objective of providing maximum comfort to workers to enhance their health and well being. Hence footwear manufacturing company must address ergonomics as equally to as their other core processes.

MSDs are common among shoe manufacturing workers from Ethiopia. Preventive programmes on musculoskeletal disorders among shoe manufacturing workers are recommended in order to reduce the rate of MSDs among them and to promote efficiency in workers care. Further

studies on job factors associated with MSDs among the shoe manufacturing workers are warranted.

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