

Assessment of Occupational Health Hazards among Leather Tannery Workers at Minia and Assuit city

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Abstract

Background: More than 5000,000 people are working in tanneries around the world. Work related accidents and diseases continue to have serious consequence, with an estimated 2.3 million fatalities per year and economic losses of 4% of global gross domestic product. Aim of the study: To assess occupational health hazards among leather tannery workers at Minia and Assuit city. Research design: Across –sectional descriptive study was utilized in this study. Subjects: comprised 50 workers in leather tannery whose age ranged between 17 to 58 years. Setting: This study was carried out at leather tannery in Minia and Assuit city. Tools of data collection: Two tools were utilized to measure the variables of the study included socio demographic part & workers knowledge about occupational health safety ,knowledge score this section contain 7 questions with a total score of 7 divided to :scoring 5-7 indicates good knowledge ,scoring 1-4 indicates poor level of knowledge. (Aliyu and Ibrahim, 2015). Results: The majority of the workers were single (48%) followed by married (44%). More than half of them were from rural areas. More than one third of them were illiterate. 72% of the participants were workers. Workers working in tanning represent 44% followed by 30% working in salting .Conclusion: The prevalence of occupational hazards is high in the studied tannery workers. Workers working in tanning and Beam house or salting phase affected more than others. Personal protective equipment not available enough in tanneries. This high prevalence of occupational skin diseases could result from: lack of occupational safety training, and poor concepts on utilization of PPE in working environment. Recommendation: Government should enforce compliance to health and safety measures in industries so as to minimize to minimum the level of occupational risks and hazards. In the same light government and supervising institutions should enforce compliance to occupational health and safety measures in the industries.

Key Words: Leather Tannery, Occupational Health, Hazards, Personnel Protective Equipment

Introduction

Occupational health is an area concerned with protecting the safety, health and welfare of people engaged in work. It plays a vital role in helping employers care and understand the need of their employees to create enabling businesses with reduced sickness, absence level and optimized staff performance and productivity. Occupational health remains neglected in developing countries because of competing social, economic, and political challenges (Tawhidur Rahman, 2012).

Occupational health is a multidisciplinary activity aimed at protection and promotion of the health of workers by preventing and controlling occupational disease and accidents and by eliminating occupational factors and conditions hazards to health and safety at work (Geneva international, 2010). Developing countries generally have fewer adequately effective occupational health programs and fewer adequately developed and enforced laws and regulations than those in the developed countries (Azom et al., 2012).

A healthy, productive and well-motivated workforce is the key agent for overall socioeconomic development. Moreover, high-quality and productive work can ensure healthy production of materials, goods and services, and the consideration and practical implementation of the principles of sustainable development (WHO, 2000).

Occupational diseases are adverse health conditions in the human being. The occurrence or severity of which is related to exposure to factors in the work environment .These factors may be: physical (e.g. heat, noise, radiation), chemical (e.g. solvents, pesticides, heavy metals, dust),biologic (e.g. HIV, tuberculosis, hepatitis), Ergonomic (e.g. improperly designed tool or work areas), mechanicals (e.g. these mainly cause work accidents and injuries rather than occupational disease). (WHO, 2000). Hazards is defined as the presence of a material or condition

that has the potential for causing loss or harm .work related hazards are brought about by unsafe work conditions and unsafe work behaviors.(Salaudun and Rahman , 2014) .

The workplace should be periodically reassessed for any changes in conditions, equipment or operating procedures that could affect occupational hazards. This periodic reassessment should also include a review of injury and illness records to spot any trends or areas of concern and taking appropriate corrective action. The suitability of existing Personal protective equipment, including an evaluation of its condition and age, should be included in the reassessment (Charles, 2009).

Leather is exclusively vast, multi-dimensional and mutually dependent material all over the world. Currently more than 5000,000 people are working in this sector and the number of workers is increasing from day to day all over the world, The growth rate of tanning materials is increasing in developing countries

(Tawhidur Rahman, 2012) Working in the leather industry is fraught with potential risks and hazards which are categorized into occupational, environmental and public hazard,(Salaudun and Rahman , 2014) .

Tanning processes involve several chemicals and some of them are known to be potentially carcinogenic as well as having other adverse health effects, (Apte et al., 2005).Tannery workers are mainly exposed to Cr in the inorganic or protein-bound form leather dust Occupational exposure to Cr is generally through inhalation, as well as dermal absorption, although ingestions also possible (Febriana et al., 2012).

Chromium exists in two oxidation states, namely the trivalent (III) and hexavalent (VI) forms. Hexavalent Cr is more toxic than trivalent Cr and the toxicological impact is due to its oxidizing ability and high solubility. Chromium (VI) is capable of damaging the skin due to its high

penetration power and ability to form free radicals (Khan et al., 2013) (Stern, 2010).

The chemical used in the leather industry can be divided into three broad categories: pre-tanning chemicals, tanning chemicals, and finishing chemicals. Pre-tanning chemicals are used to clean and prepare skin for tanning process and they are mostly washed away with waste water. Chrome Sulphate is the basic tanning chemical which is expensive and also series pollutant. Finishing chemicals are used to impart certain properties of leather like softness, color, appearance etc. like tanning chemicals finishing chemicals also get discharged in wastewater (Zewdie et al., 2011)

Aim of the study

The aim of the present study is to assess occupational health hazards among leather tannery workers at Minia and Assuit city.

Specific objective:

- Assessing knowledge of leather tannery workers about occupational health hazards.
- Assessing leather tannery workers practice towards safety measures of protection from occupational health hazards related to leather tannery.

Research Questions:

- What is the occupational health hazards related to leather tannery and its prevention?

Significance of the study:

More than 5,000,000 people are working in tanneries around the world Work related accidents and diseases continue to have series consequences, with an estimated 2.3 million fatalities per year and economic losses of 4% of global gross domestic product, In the Egyptian economy leather tanning representing about 5% of the total industrial production of the country. The labor force is made up of about 250,000 workers and has 300 leather tanners. The 300 leather tanners and much of the industry are located in the old Cairo. There is a paucity of local data regarding leather tanneries in Egypt and no study has been done in Upper Egypt. So study of occupational health effect among workers in tanneries is useful in the development of occupational epidemiology (Marina et al., 2012).

Subjects and Methods Research Design:

A cross-sectional descriptive study was used in this study.

Setting:

The current study was carried out at Minia Governorate (Malawi district) beside Mobark zoo and Assuit Governorate in Arab Elmadabegh . Every leather tannery consists of one floor; each one contains 4-5 Ponds for salting.

Sample

Recruitment sample included 50 workers in two leather tannery, Data was collected over a period of 5 months from October 2017 to February 2018 (2-3 days per week).

Inclusion Criteria:

All workers present in two leather tanneries in Minia and Assuit city.

Tools and technique of data collection:

Two tools were utilized to collect data pertinent for this current study. These tools are standard, and then reviewed by a panel of five experts, these tools are:

Tool I: Structured Interview questionnaire It was developed by the researcher in Arabic language after reviewing the literature it covered the following three parts:

Part I: demographic Characteristics: which included age, educational level, marital status, work hours, living conditions, work experience. etc....

Part II: Medical history regarding to Past history and current history which include previous and current disease, complication and follow up.

Part III: Health habits and life style which include smoking, exercise, nutrition, rest ,sleep and personal hygiene.

Tool 2: Occupational health hazards questionnaire.

Part I: It included chemical hazards such as (dermatitis, ulcer, stones formation), physical such as (fatigue, increase rate of accident, irritation of eye, skin cancer, lung cancer), respiratory health problems (cough, shortness of breath, wheezes), mental hazards such as (inability to take decisions, inability to solve problem, insomnia, feeling of depression, loss of self-esteem, loss of concentration), biological hazards as (nephritis, T.B, hepatitis) etc

Part II: Work environment including health and safety information, health and safety training, workplace supervision, work section, PPE, utilization, ventilation, illumination.

Validity of tools:

Validity is the accuracy and meaningfulness of inferences, which are based on the research results. The tool was tested for content validity by a Jury of five experts (Minia University, Assiut University, Community health Nursing Department) All jury members (100%) agree that current study tools were valid and relevant with the aim of the study. A pilot study was carried out on 10 workers (5%) of the total sample to test Feasibility, objectivity, and applicability of the tools. Results of the pilot study illustrated that no any refinements and modifications needed so the subjects were included to the actual sample.

Also, the tool was tested for internal reliability (reliability referred to the consistency of measurement and was frequently assessed using the test-retest reliability method). To achieve reliability of the questionnaire, the instrument was designed with great care matching questions with objectives for the study.

Ethical Consideration:

- Approval was sought from the Provincial and District ethical committee before undertaking the research.
- The purpose of the study was explained to all participants.
- The participant had ethical rights to agree or refuse to participate in the study.
- Oral consent was obtained from every participant.

- Every participant was informed that the information and data obtained was confidential and used only for the purpose of the study through coding of all data and protecting the obtained data.

Study Procedure:

An official permission was granted from the manager of leather tannery, in addition obtaining formal agreement which obtained one month before conducting the study. Data was collected over a period of 5 months (2-3 days per week). Selected sample was admitted to the manager of leather tannery, then the nature and purpose of the study were explained. Written informed consent was obtained from those who accepted to participate in this study.

The researcher has started collection of data from all workers by using the questionnaire and some workers were illiterate, so the questionnaire was filled by the researcher. Health education message about how and when to use PPE was given.

Limitation of the study:

- The number of workers was limited per day.
- Interruption during interview was occurred from other workers so researcher made an effort and spent a lot of useless time to complete the questionnaire.
- Place of tannery was far away and beside Cemeteries in Assuit city.
- The leather tanneries in this area (Cemeteries) were limited

Statistical analysis of data

Statistical Package for the Social Sciences Version 21 was used for data entry and analysis, and Microsoft Excel (Microsoft Corp., Redmond, WA, USA) was used for graphics. Quantitative data were presented as mean and standard deviation, and qualitative data were presented as a frequency distribution. Chi-squared test and Student's t test were used. P < 0.05 was considered to indicate significance.

Result:

Table 1: Demographic characteristics of studied workers N= (50).

Characteristics	N	%
Age range (mean ±SD)	17-58(34.6±12.5)	
Marital status		
Single	24	48
Married	22	44
Divorced	2	4
Widowed	2	4
Residence		
Urban	24	48
Rural	26	52
Educational level		
Illiterate	18	36
Read and write	15	30
Diplom or institute	17	34

Table (1): it shows that the studied workers were 50 males. The age of study subjects ranged from 17 to 58 years old with a mean age and SD of 34.6±12.5. Majority of the worker were single (48%) followed by married (44%). More than half of them were from rural areas. More than one third of them were illiterate.

Table 2: work characteristics of studied workers N= (50).

Work characteristics	N	%
Job		
Worker	36	72
Administrative	4	8
Supervisor	8	16
Accountant	2	4
Stage of work		
Salting stage	15	30
Tanning stage	22	44
Finishing stage	7	24
Hours of work		
Weekly work hours range (mean ±SD)	45-50 (47.4±1.5)	
Experience		
0-5years	20	40
6-10years	11	22
More than 10 years	19	38

Table (2): it was found that 72% of the participants were workers. Workers working in tanning represent 44% followed by 30% working in salting. The average weekly working hours in the tannery was 47.4±1.5. Forty percent of the workers had experience from 0 to 5 years and 38% of the workers had more than 10 years' experience.

Table 3: Medical history of studied workers N= (50).

Medical history	N	%
Diseases		
Hypertension	6	12
Respiratory disorder	4	8
Diabetic	3	6
Dermatitis	3	6
Wounds and scratches	12	24
More than one disease	2	4
Investigations		
RBS	14	28
CBC	22	44
Others (chest x-ray)	14	28

Table (3): it shows that 12% of workers suffered from hypertension and 24% had a history of injuries resulting in wounds and scratches. 44% and 28% of them had been subjected to routine investigation by CBC and chest x ray respectively.

Table 4: Frequency distribution of tannery workers according to using of personal protective equipment (PPE) of studied workers N= (50).

Personal Protective Equipment(PPE)	Yes		No		Some Times	
	N	%	N	%	N	%
Gloves	35	70	8	16	7	14
Mask	10	20	27	54	13	26
Apron	16	32	26	52	8	16
Safety boots	40	80	7	14	3	6
Goggles	2	4	40	80	8	16

Table (4): shows that 70% of tannery workers always wear gloves and 80% of them put on boot shoes. More than half of the workers did wear neither mask nor apron. 80% of workers did not wear goggles during work.

Table 5: Occupational risks and hazards of leather tanning of studied workers N= (50).

Hazards	N	%
Medical hazards		
Chemical hazards	5	10
Physical hazards	16	32
Mental hazards	1	2
Respiratory hazards	12	24
Biological hazards	6	10
Indirect risks of extreme heat exposure		
Increase fatigue	12	24
Decrease concentration	8	16
Increase accident rate	3	6
Burn the skin	3	6
Others	24	48
Effect of noise		
Hearing problems	2	4
Hearing loss	3	6
Lack of ability to concentrate	26	52
Other	19	38
Light problem		
Eye diseases	2	4
Eye strain	10	20
Lack of concentration	14	28
Others	24	48
Information about PPE		

Hazards	N	%
Yes	40	80
No/ incomplete answers	10	20
Prevention of the disease resulting from leather tannery		
Use PPE	5	10
Low hours of working	8	16
Decrease exposure to hazards	8	16
More than one answer	16	32

Table (5): shows that 32% and about one quarter of workers had knowledge about physical and respiratory hazards respectively. 24% of them knew that increased fatigue is one of indirect risks of extreme heat exposure. More than half of the workers had a knowledge that lack of concentration is one of the side effects of noise. 80% of tannery workers knew different methods of personal protection during their work.

Table 6: Relation between knowledge score and demographic characteristics of studied workers N= (50).

Demographic characteristics	Not knowledgeable 19 (100%)	Knowledgeable 31 (100%)	Total 50 (100%)	X2 P value
	N (%)	N (%)	N (%)	
Age group				
17-27 years	11 (57.9)	9 (29)	20 (40)	4.3
28-38 years	3 (15.8)	6 (19.4)	9 (18)	0.1
More than 39 years	5 (26.3)	16 (51.6)	21 (42)	
Marital status				
Single	11 (57.9)	13 (41.9)	24 (48)	3.1
Married	8 (42.1)	14 (45.1)	22 (44)	0.4
Divorced/widowed	0 (0)	4 (13)	4 (8)	
Residence				
Urban	9 (47.4)	15 (48.4)	24 (48)	0.005
Rural	10 (52.6)	16 (51.6)	26 (52)	0.9
Qualification				
Not read and write	8 (42.1)	10 (32.3)	18 (36)	12.9
Read and write	10 (52.6)	5 (16.1)	15 (30)	0.002*
Diplom /institute	1 (5.3)	16 (51.6)	17 (34)	

Table (6): it was shows that there is a significant difference was observed in the level of knowledge of occupational health and safety practice among workers of different educational level (p=0.002). About 52% of knowledgeable workers had attended institute or with diplom (51.6%) compared to (42.1%) of not knowledgeable workers who could not read and write.

Table 7 Relation between respiratory complications and using of mask of studied workers N= (50).

Using of mask	Respiratory complications		Total	X2 P value
	No N (%)	Yes N (%)	N (%)	
Yes	8 (80)	2 (20)	10 (100)	9.4
No/sometimes	11 (27.5)	29 (72.5)	40 (100)	0.002*
Total	19 (38)	31 (62)	50 (100)	

Table (7): shows that there is a significant difference between those who used to wear mask and those who did not as regards respiratory complications. 80% of workers who used to wear mask did not complain from any respiratory complications versus 20% of them.

Table 8: Relation between skin complications and using of gloves, apron and boot of studied workers N= (50).

	Skin complications		Total	X2 P value
	Yes N (%)	No N (%)	N (%)	
Using of gloves				
Yes				8.2
No/ sometimes	20 (57.1)	15 (42.9)	35 (100)	0.004*
	2 (13.3)	13 (86.7)	15 (100)	
Using of boot				
Yes	15 (37.5)	25 (62.5)	40 (100)	3.4
No/ sometimes	7 (70)	3 (30)	10 (100)	0.06
Using of apron				
Yes	3 (18.8)	13 (81.2)	16 (100)	6.1
No/ sometimes	19 (55.9)	15 (44.1)	34 (100)	0.01*
Total	22 (44)	28 (56)	50 (100)	

Table (8): shows that there is a significant difference between those who used to wear gloves or put on apron and those who did not as regards skin complications. About 81% of those who put on apron did not complain from skin problems versus 18.8% of them.

Discussion

Governments in developing countries have apathy to occupational health and safety issues (Khan et al., 2012), and all the stakeholders, ranging from the management, workers and government do not appreciate the problems that can be solved or mitigated through occupational safety and health (WHA, 2007). Accidents can cause various forms of disabilities; loss of man-power leading to decreased productivity and in severe cases may lead to death (Lakhan .,et al2010).

Since hundreds of years ago, the Egyptian leather has been well known for its unique texture due to Egypt's warm climate. Thus, the leather industry in Egypt has been considered one of the most important industrial sectors in the Egyptian economy representing about 5% of the total industrial production of the country. (MENA, 2012). Leather production includes many operations with different exposures, which can be harmful for the health of the workers, and particularly be carcinogenic. Some compounds in the tanning process are considered as probably being carcinogenic to humans (some benzene-based dyes and formaldehyde chromium may enter the body by inhalation, ingestion and by direct cutaneous contact. (Muhammad et al., 2012)

Current study was aimed to assess occupational health hazards among leather tannery workers at Minia and Assuit city. A total sample of 50 males' participants was selected by a-cross sectional descriptive design as subject for the present study and their age ranged from 17 to 58 years with a mean age of 34.6 ± 12.5 . Majority of the participants were single (48%) followed by married (44%). More than half of them were from rural areas. More than one third of them were illiterate.

In this study, it was found that the most of the participants 72% of the participants were workers. Workers working in tanning represent 44% followed by 30% working in salting. The average weekly working hours in the tannery was 47.4 ± 1.5 . Forty percent of the workers had experience from 0 to 5 years and 38% of the workers had more than 10 years' experience.

In the current study, it was found that 12% of workers suffered from hypertension and 24% had a history of injuries resulting in wounds and scratches. 44% and 28% of them had been subjected to routine investigation by CBC and chest x ray respectively. These percentages approximate the results of study conducted by Mokhlesur et al., (2012) who found that some of the respondents are suffered from skin disease 26.2%, and 2.3 of them suffered from hypertension.

The current study found that 34% of leather tanners suffered from chest infection. The prevalence of low back pain was found as 22%. Occupational dermatitis affected 46% of the workers. These percentages slightly lower to what found in study by Dejene Seyoum et al., (2014) who reported that nearly (34%) of leather tanners reported dermatological diseases such as eczema, rashes, burning sensation, papules along with complaints of itching. Studies done in Turkey, India, UK and Bangladesh on tannery workers (29.3%), (23%), (22%) and (31%) respectively showed that workers had slightly less occupational skin diseases. The difference could be explained by different

sample size, and variation in working conditions that might not expose the workers to different determinant factors.

In this current study, it was found that there is a significant difference was observed in the level of knowledge of occupational health and safety practice among workers of different educational level ($p=0.002$). About 52% of knowledgeable workers had attended institute or with diplom (51.6%) compared to (42.1%) of not knowledgeable workers who could not read and write. This is in coherence with (Amabye , 2016) who observed a significant difference in the level of knowledge of occupational health and safety practice among workers of different educational level ($p<0.01$).

Conclusion:

This study showed that more than one quarter of workers had knowledge about physical and respiratory hazards and 80% of tannery workers knew different methods of personal protection during their work. A significant difference was observed in the level of knowledge of occupational health and safety practice among workers of different educational level ($p=0.002$). More than a quarter of these workers are highly exposed to occupational risks and hazards in the leather tannery. Significant relation between knowledge level and type of work was observed. The percentage of workers who had knowledge increased by increasing the years of experience. Significant relation between using mask and respiratory complication was detected. Workers working in tanning and Beam house or salting phase were affected more than others. PPE not available enough in tanneries. About 81% of workers not use apron and complain from skin problem. This high prevalence of occupational skin diseases could result from: lack of occupational safety training, and poor concepts on utilization of PPE in working environment

Recommendation

Based on the findings of the study the following recommendations are being suggested:

1. The study recommends that the bio-monitoring of the chromium levels in the biological fluids can serve as a useful tool for qualifying the health hazards and risk factors in the tannery workers
2. There is need for providing awareness and training programs on sustainable leather production.)
3. This will need prudent chemical management practices in the leather-tannery industry to help minimize the quantities and risks of the chemicals being used
4. Each tannery management/ administration should provide full personal protective devices and enforce its usage.
5. The tannery should arrange periodic occupational health and safety training and full annual health checkup.
6. Comparative or longitudinal studies are recommended to examine the real cause and effect relationship of the determinant.

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References

1. TawhidurRahman. (2012) :The Effect of Working Place on Worker's Health in a Tannery in Bangladesh SalauddinBiswas, Heidelberg, Germany Center for Sustainable Development (CSD), University of Liberal Arts Bangladesh, Dhaka, Bangladesh December 16th,.
2. Economically active population (2010):4th ed. on diskette Geneva international labour organization.
3. Azom MR, Mahmud K, Yahya SM, Himon SB (2012): Environmental Impac Assessment of Tanneries: A Case Study of Hazaribag in Bangladesh. *Int J Environ Sci Develop* 3: 152-156
4. Report of a WHO (2000): Young Peoples health:a challenge for society . for All by the Geneva ,WHO (Technical Report Series No731.
5. Charles D.Reese (2009):Industrial Safety and Health For People Oriented Services Charles D.Reese P326 Cited by <https://books.google.com> .eg.
6. Salauddin Biswas, Tawhidur Rahman (2014): The Effect of Working Place on Worker's Health in a Tannery in Bangladesh'. *Advances in Anthropology*. PP. 46-53doi: 10.4236/aa.2013.31007.Available at: <http://www.jourlib.org/paper/286256#.Vb4ITNWqqkp>
7. Febriana SA, Jungbauer F, Soebono H,Coenraads PJ (2012). Inventory of the chemicals and the exposure of the workers' skin to these at two leather factories in Indonesia. *Int Arch Occup Environ Health* [Internet]. 2012 Jul [cited 2014 Jun 4];85(5):517–26. Available from: <http://download.springer.com/static/>
8. Apte AD, Verma S, Tare V, Bose P(2005). Oxidation of Cr (III) in tannery sludge to Cr (VI): field observations and theoretical assessment. *J Hazard Mater* [Internet]. 2005 May 20 [cited 2014 Jun 4]:121(1-3):215-22. Available from: <http://www.sciencedirect.com/science/article/pii/>
9. Stern AH.(2010) A quantitative assessment of the carcinogenicity of hexavalent chromium by the oral route and its relevance to human exposure. *Environ Res* [Internet]. 2010 Nov Available from:<http://www.sciencedirect.com/science/article/pii/>
10. Khan D, Mushtaq AS, Khan FA, Khan MQ.(2013) Toxic effects of chromium on tannery workers at Sialkot (Pakistan). *Toxicol Ind Health* [Internet]. 2013Mar [cited 2014 Sep 20];29(2): 209-15. Available from: <http://tih.sagepub.com/content/29/2/209.long> Subscription required to view
11. ZewdieAderaw, DagneEngdaw, and TakeleTadesse (2011): Determinants of Occupational Injury (2011): A Case Control Study among Textile Factory Workers in Amhara Regional State, Ethiopia. November 2011
12. 12-Marina, A. and S. Noha, K. Seven, (2012). Strategy Development. *The MENA Journal of Business Case Studies*.ID 270660, 23 pages.
13. Khan M, Manderson L (2012): Focus groups in tropical diseases research. *Health Policy Plan* 7(1): 56-66.
14. World Health Assembly.WHA(2007):. 60.26. Agenda item, p. 12-13. Global plan of action on workers' health: 2008-2017:60.26. Agenda item, p. 12-13.
15. Lakhan R, Sharma M (2010): A study of knowledge, attitudes and practices (KAP) survey of families to-ward their children with intellectual disability in Barwani, India. *Asia Pacific Disability Rehabilitation Journal* 21(2): 101-117
16. Muhammad Md. And Ariful Haque(2012): Physical and Mental Health of Tannery Workers and Residential People of Hazaribag Area in Dhaka City By Noor, December, 2012
17. Bhuiyan, et al. (2013), 'Investigation of the Possible Sources of Heavy Metal Contamination in Lagoon and Canal Water in the Tannery Industrial Area in Dhaka', Bangladesh. *Environmental Monitoring and Assessment*. Available at: http://www.worstpolluted.org/projects_reports/display/88 [Accessed 16 July, 2015
18. F. G. Öry, F. U. Rahman, V. Katagade , A. Shukla& A. Burdorf(2011): Assessment of Exposure to Chemical Agents and Ergonomic Stressors in Tanneries in Kanpur, India. Published online, *American Industrial Hygiene Association Journal*: 01 Jun 2011.
19. Dejene seyoum et al.,(2014).assessment of occupational skin disease and associated factors among tannery workers ,of selected tanneries ADDIS ABABA Ethiopia
20. Amabye TG.(2016) Occupational risks and hazards exposure, knowledge of occupational health and safety practice and safety measures among workers of sheba leather plc, wukro, tigray Ethiopia. *MOJ Public Health*. 2016;4(2):39–45. DOI: 10.15406/jpcpy.2016.09.0051