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Identification of Occupational Health Hazards and Protective Measures among Workers in Welding Workshops at Beni Suf City

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Abstract

Welding is a common industrial process associated with various health hazards. **This study aimed to** identify the prevalence of the occupational health hazards & to observe the using of protective measures among workers in welding workshops. **Subjects & Methods** : A cross-section descriptive study was conducted with this study. The Convenience sample of workshops included 257 workers. **Two tools** were used for data collection, the first one included two parts. **part I**: for socio demographic data, **part II**: about knowledge of occupational hazards and safety. **Tool II**: included checklist of personal protective equipment. **Results of the study**: the using of personal protective equipment, it was observed that 88% of workers were used eye goggles as personal protective equipment. Also 56.0% of them used the respiratory mask **Conclusion**: the vast majority of workers were exposed to all type of occupational hazards. Eye goggle is the most common used of personal protective equipment. **Recommendations**: provide educational training programs regularly special for use of personal protective equipment and first aid.

Keywords: *Welding, Welders, Occupational Hazards & Personal Protective Equipment.*

Introduction

Welding is an ancient art that has been practiced since man begun to extract and refine iron (Z'gambo, 2015) Workers represent half of the world's population and 70% of this global workforce lives in developing countries (WHO, 2014) Welding is a process that involves the joining of metal pieces by means of a molten flux produced by heat, pressure or both (Z'gambo, 2015) The welding joins materials together by melting work pieces along with filler metal from strong joint, the welding is a common industrial process associated with various health hazards (Sabit et al., 2009). Welding processes can be classified on the basis of following technological criteria: Welding with or without filler material, Source of energy for welding, Arc & non-arc welding also Fusion & pressure welding. The welding has received a lot of attention worldwide since it is one of the methods used for joining materials in the most efficient & economical way (Welding & Cutting Journal, 2017).

The health risks associated with welding gases & fumes are also determined by the length of time one is exposed to them, type of welding engaged in the work environment & the protection employed, hence, it is pertinent to keep exposure to harmful gases & fumes below recommended occupational exposure limits, also for limited duration to curb sick effects on health (Chauhan et al., 2014) The welding education & training group have introduced several pedagogical solutions such as virtual welding machines to assist smart learning & familiarization with welding processes & techniques. Thus replacing

the skill of welding into a preferred state of the art manufacturing process (Small Bone & Kocally, 2012).

According Occupational hazard it may be defined as a source or situation with a potential for harm in terms of injury or ill health, damage to property, damage to the workplace environment, or a combination of these. Occupational hazards occur in all sectors of employment such as agriculture, construction, manufacturing, and service industry. (Sarok & Susil 2012) There are many types of Occupational Health Hazards as Physical, Chemical, Mechanical and Psychosocial. The National Association for Occupational Health Nurses, refer to professionals who perform tasks related to occupational hygiene, medicine and safety, and integrate study groups to protect workers' health and safety. Occupational Health Nurses responsibilities, also according to the association, include tasks that range from first aid to health promotion and prevention of occupational injuries and diseases. They have a unique role between the workforce and management and as such can support the improvement of health in the workplace and improve health, social wellbeing and quality of working lives. (Rossi, et al., 2010) Occupational health nurses have direct access to all employees and are often the first point of contact for many health-related questions and problems. (Lancaster & Stanhope 2014).

Significance of the study

Health impact and morbidity data about occupational hazards among welders No studies have been conducted thus far in Egypt regarding exposure and

health effects among welders, according to the information available. (Ekram, et al., 2014).

We expect that the welders in Egypt were exposed to occupational health hazards because they exposed to fumes, gases and burn during welding process.

Aim of the study

- Measure the prevalence of the occupational health hazards among
- Workers in welding workshops at Beni- Suef City.
- Observe the using of protective measures among workers in welding workshops at Beni- Suef City.

Research Questions:

- Are the welders having knowledge about occupational health hazards?
- How can the welders protect themselves?

Subjects & Method

Research design: A cross-section descriptive study was conducted by this study

Setting: The study was conducted in all welding workshops at Beni -Suef city.

Sample & sampling: Convenience sample all workers were available in 106 workshops according to work office craftsmen Beni - Suef council .

Name of workshop	Type of work	No of workshops	No of welders
Welding and plumbing	Samkarat	28	79
Turning	Kharatat	37	87
Iron	Hidaduh	32	75
Carburetters	Carburetters	9	16
Total	4	106	257

obtain the address of these workshops from (office of craftsmen- Beni Suef city council).

Tools of data collection. The study has two tools, (Tool I, interview questionnaire) form developed by (Ibrahim, 2014) it modified by the research team. It consisted of two parts .

Part I : It was included socio-demographic characteristics such as age of workers , educational level , marital status , experience , history of occupational hazard & present health problems .

Part II: designated to assess worker's knowledge about health services, types of occupational hazards, occupational safety. It included four basic items (physical chemical, mechanical and psychological hazards), formed 36 sub- items.

Tool II: observational Check list about using personal protective equipment) It includes seven items (overall uniform, head cover, eye goggles, gloves, protective apron, safety boots & respiratory mask).

1-Knowledge Score: For knowledge' items, a correct response was scored 1 grade & incorrect zero grade. The score of each item summed –up and converted into percent score.

Poor score <60%, fair < 65 % & good ≥65%. (kayoed, et al., 2013).

Validity: These tools were reviewed by 5 experts in the field of community health nursing.

Reliability of tool: Reliability was assessed for the tool one interview questionnaire sheet by cronbach's coefficients to be (0.833) & tool of check lists about personal protective equipment (0.720) for all samples.

Methodology

Operational Design: The study was passed through different phases, the preparatory phase, then the pilot study and lastly the fieldwork phase.

Preparatory Phase: Review of the current local and international related literature using books, articles and scientific magazines was made by the research team. This helped them to be acquainted with the problem, & guided them in the process of tools' designing. The tools were then presented to experts for review and validation.

Pilot Study

Aim were evaluated the clarity, of the tools. It also helped in the estimation of the time needed to fill in the forms. According to the results of the pilot study, no modifications were done, so Pilot study was involved in the sample.

Data Collection

Ethical Consideration

An official approval was obtained from the community nursing department counsels & the scientific research ethics committee those were approved by the Faculty of Nursing, Assiut University Counsel. The aim of the study was explained to each worker of welding before applying the tools to gain his confidence and trust. An oral consent was obtained from each worker to participate in the study, after ensuring that data collected will be treated confidentially.

Field work

Data was collected in the period from 1st of January 2016 until the end of April 2016. The researchers interviewed each person individually according to his work circumstances to obtain the necessary information after introduced herself and explained the purpose of study. The average time taken to complete each questionnaire was around 10-20 minutes depending on the person's response to questions. Observation checklist was done by the researchers themselves, it took from 10- 15 minute .all of these activities done at the work places (welder workshops) 3days/week, the number of persons ranged from 4-5 person / day.

Statistical analysis

Date entry and data analysis were done using SPSS version 19 (Statistical Package for Social Science). Data were presented as mean & ±standard deviation.

Chi-square was used to compare between qualitative variables. P-value considered statistically significant when $P < 0.05$.

Results

Table (1): Frequency distribution of the studied welders according to their socio- demographic characteristics at Beni Suf City 2016. (n=257).

Personal Characteristics	No.	%
Age: (years)		
< 20	64	24.9
20 - < 30	82	31.9
30 - < 40	68	26.5
≥ 40	43	16.7
Mean \pm SD (Range)	29.11 \pm 11.01 (12.0 – 60.0)	
Educational level		
Illiterate	74	28.8
Read & write	106	41.2
Primary	44	17.1
Preparatory	24	9.4
Technical Secondary	9	3.5
Marital status		
Single	75	29.2
Married	162	63.0
Divorced	17	6.6
Widow	3	1.2
Years of experience		
< 10	100	38.9
10 - < 20	77	30.0
≥ 20	80	31.1
Mean \pm SD (Range)	14.08 \pm 10.82 (less than 1 year – 47 years)	

Table (2): Frequency distribution of the studied welders regarding to their physical hazards and its problems at Beni Suf City 2016.(n=257).

Physical hazards #	No.	%
Noise	219	85.2
High temperature	218	84.8
Vibrations	7	2.7
Radiation	6	2.3
Electricity	239	93.0
Reich	234	91.1
Problems related to physical hazards#		
Hearing problems	73	28.4
Headache	212	82.5
Sleep disturbance	14	5.4
Electric shocks	206	80.2
Burns	232	90.3
Nervous	14	5.4

answer are not mutually exclusive

Table (3): Frequency distribution of the studied welders regarding to their chemical hazards and its problems at Beni Suf City 2016. (n= 257).

Chemical hazards	No.	%
Gases & vapors	210	81.7
Chemical substances	47	18.3
Problems related to chemical hazards:#		
Respiratory problems	98	38.1
Allergy in (chest – eye – nose- skin)	143	55.6
No problems	43	16.7

answer are not mutually exclusive

Table (4): Frequency distribution of the studied welders regarding to their mechanical hazards and its problems at Beni Suf City 2016. (n= 257).

Mechanical hazards:#	No.	%
Carrying heavy things	216	84.0
Standing for a long time	255	99.2
Setting for a long time	29	11.3
Curving for a long time	199	77.4
Falling	6	2.3
Problems related to mechanical hazards:#		
Varicose veins	18	7.0
Backache	251	97.7
Torsion	9	3.5
Fractures	4	1.6
Neck pain	117	45.5
Tearing ligaments	12	4.7
No problems	3	1.2

answer are not mutually exclusive

Table (5): Frequency distribution of the studied welders regarding to their psychological hazards and its problems at Beni Suf City 2016. (n= 257).

Psychological hazards:#	No.	%
Verbal abuse	175	68.1
Long work period	216	84.0
Lack of cooperation	50	19.5
No positive motivation	157	61.1
Work overload	209	81.3
Customers	7	2.7
No hazards	10	3.9
Problems related to psychological hazards:#		
Stress	151	58.8
Frequent absenteeism	49	19.1
Job dissatisfaction	50	19.5
Family problems	22	8.6
No problems	62	24.1

answer are not mutually exclusive

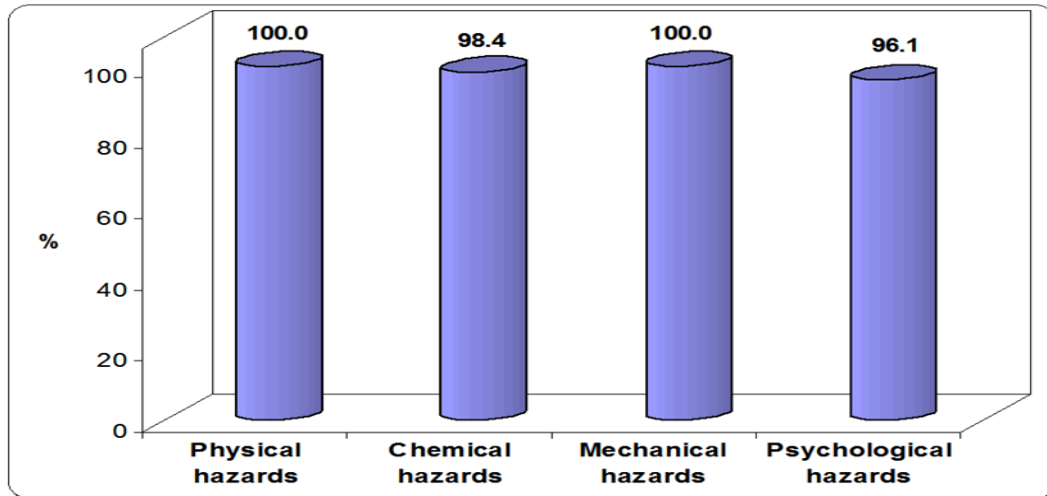


Figure (1): The prevalence of occupational hazards among the studied welders at Beni Suef City (n=257).

Table (6): Frequency distribution of the studied welders regarding to their the using of personal protective equipment at Beni Suef City 2016. (n=257).

Personal protective equipment.	Used		Not used		Not available	
	No.	%	No.	%	No.	%
Overall uniform	6	2.3	0	0.0	251	97.7
Head cover	1	0.4	3	1.2	253	98.4
Eye goggles	227	88.3	3	1.2	27	10.5
Gloves	9	3.5	79	30.7	169	65.8
Protective apron	17	6.6	1	0.4	239	93.0
Safety boots	3	1.2	0	0.0	254	98.8
Respiratory mask	144	56.0	34	13.3	79	30.7

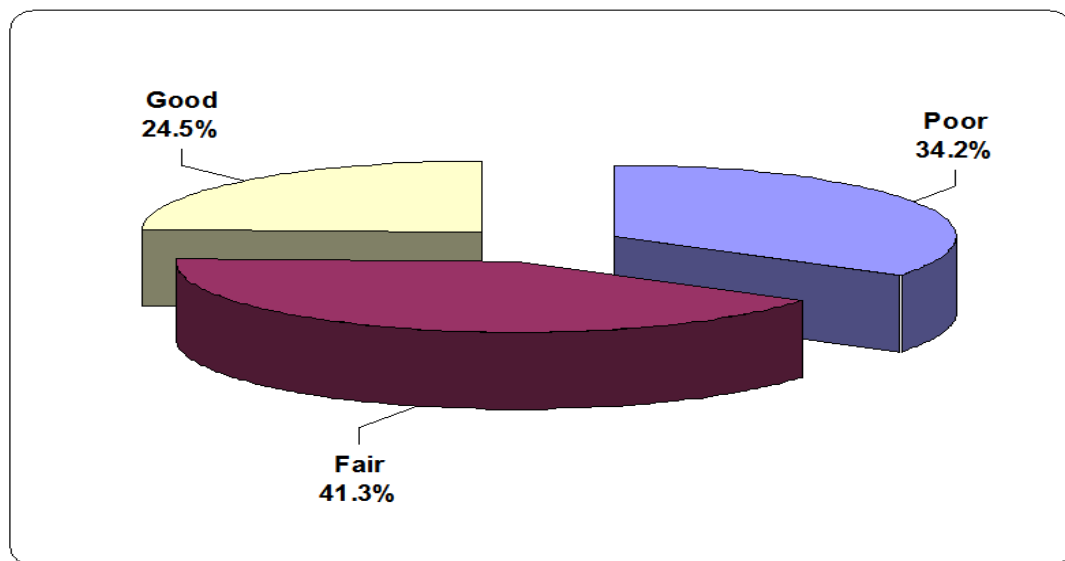


Figure (2): distribution of the studied welder's total score knowledge regarding to the causes of occupational hazards during work at Beni Suef City 2016. (n= 257).

Table (7): Relation between total score of knowledge among studied welders and their personal demographic characteristics at Beni Suef City 2016.(257).

Socio demographic characteristics	Level of knowledge						P-value
	Poor		Fair		Good		
	No.	%	No.	%	No.	%	
Age: (years)							0.894
< 20	20	31.3	26	40.6	18	28.1	
20 - < 30	25	30.5	36	43.9	21	25.6	
30 - < 40	27	39.7	27	39.7	14	20.6	
≥ 40	16	37.2	17	39.5	10	23.3	
Educational level							0.160
Illiterate	20	27.1	30	40.5	24	32.4	
Read & write	36	34.0	49	46.2	21	19.8	
Basic education or more	32	41.6	27	35.1	18	23.3	
Marital status							0.957
Single	25	33.3	32	42.7	18	24.0	
Ever married	63	34.6	74	40.7	45	24.7	
Years of experience							0.523
< 10	31	31.0	39	39.0	30	30.0	
10 - < 20	27	35.1	35	45.5	15	19.4	
≥ 20	30	37.5	32	40.0	18	22.5	

Table (8): The relation between educational levels of the studied welder regarding their to occupational health hazards at Beni Suef City 2016.(n=257).

Occupational hazards	Educational level						P-value
	Basic education or more n=77		Read & write n=106		Illiterate n=74		
	No.	%	No.	%	No.	%	
Physical hazards:#							
Noise	71	92.2	88	83.0	60	81.1	0.111
High temperature	66	85.7	85	80.2	67	90.5	0.158
Vibrations	4	5.2	2	1.9	1	1.4	0.275
Radiation	5	6.5	0	0.0	1	1.4	0.013*
Electricity	72	93.5	102	96.2	65	87.8	0.093
Reich	70	90.9	98	92.5	66	89.2	0.751
Chemical hazards							0.002*
Gases & vapors	73	94.8	81	76.4	56	75.7	
Gases & vapors and chemical substances	4	5.2	25	23.6	18	24.3	
Mechanical hazards:#							
Carrying heavy things	67	87.0	90	84.9	59	79.7	0.451
Standing for a long time	77	100.0	105	99.1	73	98.6	0.620
Setting for a long time	1	1.3	13	12.3	15	20.3	0.001*
Curving for a long time	59	76.6	84	79.2	56	75.7	0.836
Falling	3	3.9	0	0.0	3	4.1	0.116
Psychological hazards#							
Verbal abuse	58	75.3	78	73.6	39	52.7	0.003*
Long work period	66	85.7	95	89.6	55	74.3	0.020*
Lack of cooperation	21	27.3	15	14.2	14	18.9	0.085
No positive motivation	56	72.7	58	54.7	43	58.1	0.039*
Work overload	65	84.4	88	83.0	56	75.7	0.326
Customers	2	2.6	0	0.0	5	6.8	0.023*
No hazards	4	5.2	1	0.9	5	6.8	0.109

answer are not mutually exclusive

* Statically Significant. ($p \leq 0.05$).

Table (1): Showed distribution of studied welders according to their personal characteristics that less than one third of workers (31.9%) were in the age group $20 < 30$ years while only 16.7% were in the age group ≥ 40 years. The mean age was 29.11 ± 11.0 . The slight more than two fifth (41.2%) of the studied group were able to read & write, while only 3.5% of them were having technical secondary school. According to marital status it was observed that 63.0% were married. Concerning years of experience there were slight less than two fifth of workers (38.9%) had years of experience < 10 years.

Table (2): Illustrated distribution of studied welders regarding to physical hazards & its problems, it cleared that the vast majority of participants (93.0%) exposed to electricity as physical hazard & only 2.3% exposed to radiation. Regarding to the problems of physical hazards it was noticed that the majority of them (90.3%) were complaining from a burn, & only 5.4% had sleep disturbance and nervous.

Table (3): Illustrated distribution of studied welders regarding to chemical hazards, the majority of chemical hazards (81.7%) were gassed & vapours. Also the table illustrated that more than half (55.6%) were complaining from Allergy in (chest – eye – nose- skin).

Table (4): Showed distribution of studied welders regarding to mechanical hazards & its problems the vast majority of the studied group (99.2%) were standing for a long time, there were more than four fifth (84.0%) carrying heavies things & more than three quarters (77.4%) were curving for a long time. The most of them 97.7% were complained from backache & less than half of the sample (45.5%) had neck pain.

Table (5): Revealed distribution of studied welders regarding to psychological hazards and its problems, that more than four fifth (84%) had risk working for a long period, slightly more than four fifth (81.3%) had wok overload. While more than two third (68.1%) had verbal abuse & slight more than three fifth (61.1%) no positive motivation.

Figure (1): illustrated that the vast majority of studied participants exposed to all types of occupational hazards.

Table (6): Revealed distribution of studied welders regarding to the using of personal protective equipment, it was observed that more than four fifth (88.3%) of workers were used eye goggles as personal protective equipment. Also there were more than half (56.0%) used the respiratory mask. According to gloves, it was noticed that there were more than one quarter (30.7%) not used, although it was available. It was cleared that the majority of personal protective equipment were not available like

98.8% of safety boots 98.4% of head cover, 97.7% of overall uniform & 93.0% of protective apron.

Figure (2): Illustrated distribution of studied welder's total score knowledge regarding to causes of occupational hazards during work .It revealed that slightly more than two fifth (41.3%) had fair knowledge . Also slightly more than one third (34.2%) had poor knowledge & about one quarter (24.5%) had good knowledge

Table (7): Revealed that relation between total score knowledge among studied welders according to their socio demographic characteristics, it shown that were no statistical significant difference between their total score knowledge and their demographic characteristics.

Table (8): Showed that the relation between the educational level of studied welders regarding to occupational health hazards of workers, it cleared that there was statistical significance difference between their level of education & radiation as physical hazards $p < 0.013$, chemical hazards $p < 0.002$, setting for long period time as mechanical hazards $p < 0.001$ and psychological hazards (verbal abuse, no positive motivation, long work period & Customers) P values (< 0.003 , < 0.039 , < 0.020 & < 0.023).

Discussion

Welding is associated with various inherent occupational Hazards which may result in severe consequences on health of workers performing this task. Very little information exists regarding health hazards & how they are controlled among welders in developing countries. For instance, there is limited information on use of personal protective equipment or work related health problems within this occupational group. Little information is published concerning welders in Egypt, although the number of welders is increasing, especially in small scale enterprises (**Z'gambo, 2015**). Thus, the present study aimed to identify the prevalence of the occupational health hazards among workers in welding workshops at Beni- Suef city& to observe the using of protective measures workers in welding workshops at Beni-Suef city.

The current study findings revealed that the mean age of welders was (29.11 ± 11.01) & their were less than one third of them their age group ranged from $20 \leq 30$ years. It was noticed that the minority of welders 16.7% were at age group ≥ 40 years.

There was study conducted by (**Z'gambo, 2015**) who carried out for in Lusaka, Zambia, about occupational hazards & use of personal protective equipment among small scale welders, it's findings were in the same line with the present study who found that more than one third of welders were at

age group of 28 – 36 years & the mean age of welders was (33.0 ± 10.0). Also, study conducted by **Sabitu et al., (2009)** who carried out for in Kaduna Metropolis, in North Nigeria, about awareness of occupational hazards and utilization of safety measures among welders, it was found that the minority of welders at age group of >40 years or more .

In relation to the marital status, the current study findings showed that more than three fifth of welders were married. The result supported by **Z'gambo, (2015)** who reported that less than four fifth of welders were married.

The result was contrast with **Sabitu et al., (2009)** who found that more than three fifth of welders were single & there was one third only of welders married. As regards to their level of education, more than one quarter were illiterate, more than two fifth could read & write .Also, less than one fifth of them had primary educational level. This result was in the same line with **Sabitu et al., (2009)** who found that less than one fifth of them were illiterate & more than one quarter of welders had primary educational level. The study by, **Z'gambo, (2015)** encourage this result & stated that only 4.0% illiterate & more than half of welders had basic educational level.

Concerning to their experience, it was noticed that the mean years of experience were (14.08 ± 10.83), while **Z'gambo, (2015)** noticed that the mean years of experience were (9.0 ± 8.0). These differences may be due to the variations of participant ages.

The current study findings revealed that the most common used protective personal equipment were eye goggles as more than four fifth& respiratory masks more than half. The study findings were agreed with **Budhathoki et al., (2013)** who carried out in Easter Nepal , about Awareness of occupational health hazards and use of safety measures among welders , they found the same results about eye goggles, & mask.

Also, the findings of the present study were agreed with **Monica, (2011)** who carried out in Jinja, about Awareness of occupational health hazards & use of safety measures among road-side welders, he stated that the majority of welders had goggles. The current study findings were in the same line with **Z'gambo, (2015)** who reported that more than two third of welders used eye goggles. Also The current study findings were agreed with **Sabitu et al., (2009)** who found that the utilization rate of protective personal equipment as eye Goggles more than three fifth. The current study findings revealed that other personal protective equipment were less used as apron, gloves, head cover, & safety boots. These results may be related to lack of awareness &

training .also, this because the majority of welders had basic educational level and illiterate.

The current study findings were in agreement with **Monica (2011)**, who mentioned that, only 12.8% used gloves, overalls & boots. The present study finding was contrast with **Budhathoki et al., (2013)** who stated that most of welders were used personal protective equipment includes gloves, foot wear & apron. The current study findings were not in the same line with **Z'gambo, (2015)**, who reported that the majority of welders were aware a safety shoes, suit/coveralls & glove .The current study findings were in conflict with **Sabitu et al., (2009)** who found that the welders were used protective personal equipment as apron slight less than one quarter , slight more than half were used gloves & more than one third were used boots .The present study findings illustrated that majority of the welders were exposed to physical hazards such as, noise, high temperature & electricity.

The current study findings were in disagreement with **Z'gambo, (2015)**, who notice that minor of welders were exposed to physical hazards as noise , high temperature & electricity. As shown by the present study findings nearly the most of welders reported that they were complained from burn. The current study findings were in accordance with **Monica, (2011)**, who observed that more than two third of welders complained from burn.

The current study findings revealed that more than one quarter of welders had hearing problems. The current study findings were in harmony with **Monica, (2011)**, who cleared that only 6.0% of them suffered from hearing and vision problems. In relation to chemical hazards the current study findings showed that most of welders were exposed to gases, vapors & chemical substance. This finding were contrast with **Chauhan et al., (2014)** who carried out in North Delhi , about occupational hazard exposure and general health profile of welders ,who reported that the chemical exposure was only 5.5% . Regarding to their health problems related to chemical hazards more than three fifth of welder reported they had allergy in chest, eye, and nose. The results of current study were in the same line with **Chauhan et al., (2014)** who found that eye symptoms were the most commonly reported Symptoms. In the present study the majority of welders were exposed to mechanical hazards such as carrying heavy things, standing for a long time and curving for a long time. The current study findings were in accordance with **Chauhan et al., (2014)** who reported that more than half of the welders were reported that their work physically hard Involve much lifting of weight & carrying heavy things.

The current study findings were conflicted with **Z'gambo, (2015)** who mentioned that little numbers of welders reported uncomfortable position. According to relation between level of education & welders exposure to occupational hazards, it was noticed that there were significant in chemical, psychological & sitting for a long time as mechanical hazards and radiation as physical hazards. The current study disagree with **Amabya, (2016)** who carried out occupation risk & hazards exposure, knowledge of occupational health, safety practice & safety at measures among workers in Ethiopia, they were no significance difference. The finding of the present study noticed that only one quarter of workshops had adequate safety environment & more than one third of welders had poor total score of knowledge about occupational hazards, so, the welders were complained from more than one type of occupational health hazards.

Conclusion

Based on the results of the present study, it can be concluded that

Welders in this study worked under inadequate environmental conditions. Also, about two third of them were knowledgeable about causes of occupational hazards and personal protective equipment for their work. But their knowledge wasn't translated into used of personal protective equipment. So most of them exposed to all types of occupational hazards.

Recommendations

Based on the results of the present study, it recommended that:

- Provide education & training programs should be carried out regularly, special for using of personal protective equipment by community health nurse.
- Proper use & maintenance of personal protective equipment.
- Periodic medical examination should be performed to all workers in workshops periodically.
- Further research is recommended to investigate sustainable preventive strategies to control and reduce exposure to welding related safety and health hazards in order to preserve the health of welders in the small and informal enterprises.

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