



# International Journal of Advanced Community Medicine

E-ISSN: 2616-3594  
P-ISSN: 2616-3586  
<https://www.comedjournal.com>  
IJACM 2023; 6(4): 41-46  
Received: 26-09-2023  
Accepted: 05-11-2023

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## Occupational respiratory and auditory disorders among workers of agricultural equipment factory in Tanta city, Gharbia governorate

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DOI: <https://doi.org/10.33545/comed.2023.v6.i4a.278>

### Abstract

**Background:** Metal equipment industry is consistently identified as having a high rate of serious health problems over the years within the broader Manufacturing industry.

**Objectives:** The aim of this study was to identify occupational respiratory and auditory disorders among workers, and to assess the level of safety measures applied in Tanta Motors Factory in Tanta City, Gharbia governorate.

**Subjects and Methods:** The study was a cross-sectional study, started from October 2021 up to June 2022 in Tanta Motors company. The study included 120 male workers. An interview questionnaire was filled to collect required data. The Occupational Safety and Health Inspection Checklist (2016) was used and filled out by the researcher to check safety measures available and applied in the workplace environment.

**Results:** The most used PPE among study group workers were overshoes (100%) followed by aprons (85%). Also, more than half of them were using gloves (58.3%). The most prevalent respiratory symptoms among workers were cough (41.7%), Dyspnea (31.7%), wheeze (25%) sputum (14.2%). The most prevalent nasal symptom was sneezing among more than half of exposed group workers (54.2%) auditory symptoms with the most prevalent symptom among exposed group was hearing difficulty (66.7%).

**Conclusion:** Working in agricultural equipment metal industries was associated with high prevalence of chest manifestations and hearing impairment.

**Recommendations:** Regular inquiry of workers about arising hazards in work environment, and barriers or difficulties regarding use of PPE as earmuff or plug and any arising problem from its use. Well established accurate health records of workers, so those at risk can be monitored.

**Keywords:** Metal industry, risk assessment, respiratory disorder

### Introduction

In agricultural equipment, metalworking involves forming and connecting metal to shape it. The metal components are additionally polished, painted, or coated <sup>[1]</sup>. A vast range of instruments utilized throughout the agricultural value chain are included in the agricultural equipment market. Large machinery is used in the organized manufacturing sectors to create complex products including tractors, power tillers, post-harvest and processing equipment, and dairy equipment <sup>[2]</sup>.

Metal agricultural equipment production employs a substantial labor force <sup>[3]</sup>. Metal fabricators are susceptible to both acute and long-term health issues because of the noise, vibration, and pollutants from welding. These industries have a high risk of accidents and injuries to workers because of the fast-moving machinery, jagged metal edges, and hot, flying molten metal fragments <sup>[2, 5]</sup>.

Workers who join or cut metal components using flame, electric arc, or other types of heat are known as welders, according to the International Standard Classification of Occupations <sup>[4]</sup>.

Welders are individuals who join and cut metal components using flame, electric arc, or other heat sources, according to the international standard classification of occupations. There are 200 different kinds of welding techniques, some of which are metal arc, electron beam, plasma arc, electric, and oxy-fuel gas welding. These days, oxy-fuel gas welding and

electric arc welding are the most widely used welding technologies in industries, especially small-scale industries [5].

Aerosol welding exposure at work is linked to pulmonary and systemic health consequences. These include bronchitis, fibrosis, lung cancer, elevated risk of respiratory infections, decreased lung function, increased airway hyper responsiveness, and metal fume fever [6].

One of the main risk factors for noise-induced hearing loss is noise exposure, which is calculated as the sum of exposure duration and decibel level (NIHL). Hearing threshold shifts that are repeated and do not return to baseline are known as noise-induced hearing loss (NIHL) [7].

To our best of knowledge, the metal manufacturing industry is economically and occupationally important. Data about occupational disorders among workers in metal forming processes are insufficient in Egypt.

## Aim of the study

### Objectives

#### The present study aimed at

1. Identifying occupational respiratory and auditory disorders among workers in agricultural equipment factory), and
2. Assessing the level of safety measures applied in agricultural equipment factory (Tanta Motors Factory) in Tanta City, Gharbia governorate.

## Subjects and Methods

### Study design, setting and time

It was a cross-sectional study.

it was started from October 2021 up to June 2022 in Tanta Motors company which is a leading Egyptian joint stock company in the field of trading and manufacturing agricultural equipment and machinery.

### The study subjects

- All workers in the factory who were available during the period of the study.

### Exclusion criteria

Workers with duration of work less than one year, and any worker who had history of respiratory and auditory disorders before engagement into work in factory.

### Data collection and tools of the study

#### Interview questionnaire with study participants during their break time included the following items

1. **Sociodemographic traits**, such as age, sex, marital status, education level, and habits
2. **Current job history**: length of time spent in the workplace, department at work.
3. Prior work experience, encompassing the number of years worked at prior employment.
4. **Past medical history**: Both related to an unrelated to work-related illnesses.
5. **Symptoms of health issues associated to various occupational exposures through**: An international commission on occupational health (ICOH) questionnaire that has been standardized [8].

## The questionnaire includes symptoms such as

### Respiratory manifestations

- Presence of cough and its duration.
- Shortness of breath.
- Chest tightness.
- Wheezing or whistling in chest.

### Nasal symptoms as

(Sneezing, runny nose.....).

### Auditory symptoms

- Hearing problems
- Tinnitus
- Dizziness
- Vertigo

## Occupational Health and Safety Inspection Checklist [9]

Using the most recent version of the Occupational Safety and Health Inspection Checklist (2016), the researcher verified the existence and implementation of safety measures at the workplace. The OSH Inspection Checklist was developed in compliance with Egyptian Work Law No. 12 for 2003 and international labour office standards. The International Labour Organization (ILO) and the Egyptian Ministry of Manpower worked together to test the checklist. It was welcomed by all Egyptian inspectors since it facilitated the collection and use of data. Consequently, there was a standardization of the labour and occupational safety and health (OSH) inspection process.

It includes thorough information on the mechanical, chemical, and physical dangers that are the main workplace hazards as well as safety requirements.

### Statistical Analysis and data management

- Data entry was done in Excel spread sheet then the data were exported to Statistical Package for Social Sciences (SPSS) program version 21 for Sorting, tabulation, and analysis of data.
- For quantitative data, the range, mean, and standard deviation were calculated. For qualitative data, which describes a categorical set of data by frequency and percentage of each category. And significance was tested whenever needed.
- The level of significance was adopted at 5%, and P value was set at  $\leq 0.05$ .

### Ethical consideration

- The study was authorized in the September 2021 meeting of Tanta University's Faculty of Medicine's Ethical Committee. A formal letter of authorization was acquired.
- The Tanta Faculty of Medicine's research ethics guidelines were taken into account when this study was being conducted.
- Before every worker was examined, formal permission was obtained.
- Each participant received an explanation of the study's objectives.
- The data was obtained with confidentiality in mind and was only utilized for scientific studies.

## Results

**Table 1:** Distribution of socio-demographic characteristics and smoking habits of the studied groups

Sociodemographic characteristics	Exposed group (N=120)	
	N	%
<b>Age (years)</b>		
(Mean ± SD)	44.9± 8.9	
Range	27-69	
<b>Residence</b>		
Rural	78	65
Urban	42	35
<b>Education</b>		
Illiterate	16	13.3
Read and write.	27	22.5
Intermediate education	71	59.2
High education	6	5
<b>Smoking habit:</b>		
Nonsmokers	69	57.5
Ex-Smokers	5	4.2
Smokers	46	38.3
<b>Type of smoking</b> N= 51		
Cigarettes	39	76.5
Shisha	12	23.5
<b>Cigarettes Smoking index</b> (N=39)		
(Mean ± SD)	434±223	
Median	400	
<b>Work duration (In years)</b>		
Mean ± S.D	15.57± 10.19	
Range	5 - 42	

Table (1) shows the socio-demographic characteristics and smoking habits of the study group. It revealed that all workers were males with the mean age of (44.9±8.9). Regarding their educational level (59.2%) respectively were intermediate education. More than half (65%) were from rural areas. Regarding exposed and control group marital

status, the majority of workers (90%) were married. More than third of both groups (38.3%) were smokers, Majority of them were cigarettes smokers (76.5%) with median of cigarettes smoking index 400 cigarettes among workers. Also about half of workers (45%) worked for less than 10 years with a mean duration of work was (15.57± 10.19).

**Table 2:** Distribution of personal protective equipment usage among the exposed group workers

PPE usage	Exposed group (n=120)							
	Rarely (once/week)		Sometimes (2-3times/week)		Mostly (4times/week)		Always (5-6 times/week)	
	N	%	N	%	N	%	N	%
Eye goggles	44	36.7	18	15	13	10.8	45	37.5
Face cover	31	25.8	46	38.3	6	5	37	30.8
Gloves	7	5.8	23	19.2	20	16.7	70	58.3
Apron	0	0	12	10	6	5	102	85
Over shoes	0	0	0	0	0	0	120	100
Ear plugs	33	27.5	41	34.2	26	21.7	20	16.7
Head gear	98	81.7	17	14.2	4	3.3	1	0.8
Mask	51	42.5	39	32.5	15	12.5	15	12.5
Instructions for the right using	N				%			
Regularly	111				92.5			
Irregularly	9				7.5			
PPE supervision								
Yes	107				89.2			
No	13				10.8			

Table (2) clarifies distribution of PPE usage among exposed group, all workers were using PPE with different percent's. The most used PPE among exposed workers were overshoes (100%) followed by aprons (85%). Also, more than half of them were always using gloves (58.3%). Eye goggles and

face cover were used (37.5%-30.8% respectively). While earplugs, mask, and head gear were used less (16.7%-12.5%-0.8%) respectively. Most of the exposed group took the right instructions of use of PPE, also the majority of the exposed group had PPE supervision.

**Table 3:** Distribution of respiratory manifestations among exposed and control group

Respiratory manifestations	Exposed group (n=120)	
	N	%
<b>Cough</b>		
Yes	50	41.7

No	70	58.3
<b>Sputum</b>		
Yes	17	14.2
No	103	85.8
<b>Wheeze</b>		
Yes	30	25
No	90	75
<b>Dyspnea</b>		
Yes	38	31.7
No	82	68.3

Table (3) shows that the highest prevalence respiratory symptoms is cough 41.7%, followed by dyspnea in 31.7% of workers. Also, wheeze and sputum were detected among (25%-14.2%) of workers respectively.

**Table 4:** Distribution of respiratory symptoms of the exposed group workers in relation to work duration

Work duration (In years)	Respiratory symptoms								
	Cough		Sputum		Wheezing		Dyspnea		
	No	%	No	%	No	%	No	%	
10> (n=54)	5	9.3	2	3.7	1	1.9	2	3.7	
-1019 (n=34)	19	55.9	3	8.8	9	26.5	16	47.1	
-2029 (n=18)	14	77.8	4	22.2	12	66.7	10	55.6	
30≤ (n=14)	12	85.7	8	57.1	8	57.1	10	71.4	
Significance	χ <sup>2</sup>	46.888		27.885		39.852		38.212	
	P value	0.001*		0.001*		0.001*		0.001*	

χ<sup>2</sup> for Chi squared test. \*: Statistically significant at P ≤ 0.05.

Table (4) shows that respiratory symptoms increased with increasing work duration. More than three fourths of workers who worked more than 30 years (85.7%) suffered from cough, more than half (57.1%) suffered from sputum and wheeze, also (71.4%) suffered from dyspnea. The least

frequency of respiratory symptoms was among workers who worked less than 10 years. A significant association was found between work duration and respiratory symptoms p<0.05.

**Table 5:** Distribution of nasal and auditory problems among the studied workers

Auditory Symptoms	Exposed group (n=120)	
	N	%
Difficulty in hearing	80	66.7
Tinnitus	48	40
Vertigo	48	40
Dizziness	21	17.5
Wear aids	6	5

Table (5) this table clarifies highly prevalent auditory symptoms among workers was hearing difficulty (66.7%)

followed by equal percent (40%) for tinnitus and vertigo.

**Table 6:** The percentages of fulfilled items of the Occupational Safety and Health Inspection Checklist

Main domains of OSH Inspection Checklist	Total No. of items in each domain	No. of fulfilled items in each domain	%
Physical hazards	13	7	53.8
Mechanical hazards	5	3	60
Chemical hazards	4	3	75
Storage and warehouses	6	2	33.3
Negative (indirect) risks	5	1	20
Fire hazards	7	4	57.1
Electrical hazards	7	6	85.7
Emergency plans, disaster, industrial and natural crises management	4	3	75
	7	6	85.7
Occupational Safety and Health Management System	3	3	100
Training and awareness	6	5	83.3
Medical examinations	4	3	75

Table (6) shows the percentages of fulfilled items of the Occupational Safety and Health Inspection Checklist. It was found that training and awareness measures were the most domain to be covered (100%) followed by the same percentage (85.7%) for both of electrical hazards and occupational safety and health management system followed by (83.3%) for medical examinations.

The most prevalent non-controlled hazards in the workplace were negative risks as it was found that only 20% of its items were covered followed by storage and warehouses (33.3%).

**Discussion**

**PPE usage and safety measures**

Regarding PPE usage a higher percentage was detected by

Tadesse *et al.*, (2016) <sup>[1]</sup>, According to their statement, 93.2% of the workers wore personal protection equipment (PPE) at least once in their line of work. The majority of them, 91.8%, 85.4%, and 61.3%, respectively, were wearing coveralls, goggles, and safety shoes <sup>[1]</sup>, this because of better awareness of workers by safety measures and importance of wearing PPE. Islam *et al.*, (2022) <sup>[10]</sup>, Regarding PPE use, they found that 76.1% of the workers said they wore goggles, and 18.5% said they wore masks. At least 2.4% of those surveyed mentioned using safety shoes <sup>[10]</sup>. Mamat *et al.*, (2014), showed that 30% of employees regularly wore earmuffs and earplugs, while just 6% of workers never used hearing protection equipment <sup>[11]</sup>.

In the study of Reinhold *et al.*, in 2014, the findings show that just 41% of welders utilised respiratory protection against hazardous welding fumes <sup>[12]</sup>. The way personal protective equipment (PPE) is used varies throughout factories based on factors including exposure levels, worker understanding of the significance of adhering to safety protocols, PPE availability, and wear.

### Respiratory manifestations

Regarding respiratory symptoms nearly similar result was found by Singh *et al.*, in 2013, They found that although just 7% of the employees said they had asthma, around 49% of them said they coughed, 38% wheezed, and 40% had dyspnea. These workers were from the departments of nickel plating, painting, welding, grinding, and gas cutting <sup>[13]</sup>. Also, in accordance with the current study results by Gomes *et al.*, in 2001, discovered that those who had been exposed reported experiencing repeated and prolonged cough, phlegm, wheeze, and dyspnea far more frequently than those who had not. Those in fabrication had a much higher incidence of respiratory problems than those in mechanical fields (30%, 30%, 20%, and 30%), including coughing (68%), phlegm (50%), wheezing (33%), and dyspnea (42%) <sup>[14]</sup>.

Also, Hamzah *et al.*, (2015), found that the cause of their respiratory issues was rooted in the events of the preceding year. Chest tightness (27.2%), shortness of breath (25.0%), and persistent cough (35.3%) were the most common complaints among the employees <sup>[15]</sup>. Also, in study by Girma., (2019), 25% of study participants had breathing difficulties, 32% reported wheezing regularly, and 38% reported sneezing. 86% of the workers said that they began having respiratory problems after working at the steel factory <sup>[16]</sup>. The fact that the exposure circumstances of these individuals are the similar in all metal businesses may help to partially explain the very same percentages of respiratory symptoms shown in all these investigations. In fact, many workers lacked any kind of respiratory protection gear.

Another study showed lower percentage of respiratory symptoms by Ahmad *et al.*, (2020), 13.6% of workers reported wheezing, and 22.7% said they had discomfort in their throats or noses. 18.2% of employees reported sneezing regularly. Thirteen percent of employees said they had phlegm, thirteen percent said they were short of breath, and nine percent said they were coughing <sup>[17]</sup>. This could be because exposed workers are wearing personal protective equipment (PPE), but it also depends on the type of workplace and how safe it is.

### Auditory manifestations

Auditory manifestations go hand by hand with Mamat *et al* (2014), they found that 30% of the workers had ear ringing

and 42% of them periodically had difficulty carrying on a regular conversation. Just 8% of the workers often notified others that they were speaking too loudly, compared to nearly 50% of those who asked others to repeat things during talks. Of the staff, twenty-six percent are turning the television volume up too high <sup>[11]</sup>. Lower percentages were reported by study of Worede *et al.*, (2022), They reported that the total percentage of hearing problems among metalworkers and woodworkers was 20.7%. Of the research participants, 26.4% and 32.9% reported having communication issues and tinnitus, respectively <sup>[18]</sup>. The factory's use of engineering, administrative, and control PPE measures may be the cause of this lower proportion.

### Inspection checklist

Regarding safety in workplace environment Kifle *et al.*, (2014) Despite the dearth of first aid supplies in the locations being examined, the plant had small nurse-run clinics providing therapeutic therapy <sup>[19]</sup>. Also as seen in Benti *et al.*, (2019). Of those surveyed, 45.8% said they often received supervision at work, but 75.8% said they had never attended any kind of occupational safety training. While safety standards were posted on the walls of each work area in two metal plants, three manufacturers had no warning signs at all. Health and safety regulations were not documented in any of the five metal industries <sup>[3]</sup>.

Lower percentages were recorded by Habtu *et al.*, (2014), Regarding workplace environmental factors, 66.9% of participants reported never having attended training on safety and health. Respondents said that there were 27.6% functioning hazard warnings and 40.2% of goods that were kept property <sup>[20]</sup>.

Also, about workers awareness and knowledge Islam *et al.*, (2022) <sup>[10]</sup>, 92.7% of respondents were aware of the health dangers connected to metal cutting sounds, and the majority of respondents (99%) were aware of the detrimental consequences of metal dust. To protect one's health at work, 99% of participants nearly unanimously agreed that one must wear shoes, masks, safety goggles, or glasses. PPE was worn by a significant majority of participants (77.1%), and nearly all workshops lacked a clear policy or process for operations. Of the personnel surveyed, just 2.9% had completed safety awareness and training programmes <sup>[10]</sup>.

Moreover, occupational health treatments are inaccessible to the majority of workers globally. In wealthy nations, occupational health treatments are available to just 20–50% of workers. The ratio is just 5–10% for emerging nations <sup>[21]</sup>.

### Conclusion

Working in agricultural equipment metal industries associated with higher prevalence of chest manifestations and hearing impairment. There was obvious shortage of personal protective equipment usage among workers.

### Recommendations

**Based on the findings of the present study; one may recommend the following**

- Ensure regular periodic environmental monitoring for light, noise, heat, humidity, and dust to ensure their values are within the permissible level with Periodic workplace survey using the national inspection checklist to ensure the presence, application of safety measures and to specify proper preventive and control measures.

- Well established accurate health records of workers, so those at risk can be monitored.

Regular inquiry of workers about arising hazards in work environment, and barriers or difficulties regarding use of PPE as earmuff or plug and any arising problem from its use.

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### How to Cite This Article

Elgendy AR, Elkafas EAE, Salem MEA, Elsallamy RM. Occupational respiratory and auditory disorders among workers of agricultural equipment factory in Tanta city, gharbia governorate. *International Journal of Advanced Community Medicine* 2023; 6(4): 41-46.

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