

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ



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**The Effect of welding fume in hematological
parameters in Atbara locality , March 2018**

*A thesis submitted for partial fulfillment for BSc. degree in medical
laboratory Science (Honor)*

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قال تعالى:

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

وَلَقَدْ خَلَقْنَا الْإِنْسَانَ مِنْ سُلَالَةٍ مِنْ طِينٍ ﴿١٢﴾ ثُمَّ جَعَلْنَاهُ نُطْفَةً فِي قَرَارٍ
مَكِينٍ ﴿١٣﴾ ثُمَّ خَلَقْنَا النُّطْفَةَ عَلَقَةً فَخَلَقْنَا الْعَلَقَةَ مُضْغَةً فَخَلَقْنَا الْمُضْغَةَ
عِظَامًا فَكَسَوْنَا الْعِظَامَ لَحْمًا ثُمَّ أَنشَأْنَاهُ خَلْقًا آخَرَ فَتَبَارَكَ اللَّهُ أَحْسَنُ
الْخَالِقِينَ ﴿١٤﴾

صدق الله العظيم

سورة المؤمنون الآية 12-14

Dedication

We dedicate this research to:

Our fathers

Our mothers

For their support and kindness

Our friends and our colleagues

Everyone from whom we learned

Acknowledgments

Firstly we are great fully thanks to Allah for guiding me to the straightway in our life.

To our supervisor Marwa Fatahalrhman Suliman for his valuable advice and endless efforts to make this work came into reality

We wish to thank the management and the workers at the Atbara industrial area where this study was conducted for this cooperation.

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List of Abbreviations

| Abbreviations | Means |
|----------------------|---|
| CBC | Complete blood count |
| CI | Confidence interval |
| DC | Diffusion capacity |
| EDTA | Ethylene diamine tetra acetic acid |
| HB | Hemoglobin |
| HCT | Hematocrit |
| MCH | Mean corpuscular hemoglobin |
| MCHC | Mean corpuscular hemoglobin concentration |
| MCV | Mean corpuscular volume |
| PCV | Packed cell volume |
| RBCs | Red blood cells |
| RI | Reference interval |
| SD | Standard deviation |
| SPSS | Statistical package for social sciences |
| WBCs | White blood cells |

Abstract

Welding fume is most frequently used in routine life in different application for that this is a descriptive cross sectional study conducted in Atbara located aimed to measurement the hematological parameters values in the industrial area to welding fume exposure and it is effect on complete blood count among workers . A total 80 exposure worker and 40 non exposure as (control). with age ranging between <20 - 60 years of life were participated in this study according to inclusion criteria and standard questionnaire . Venous blood 2.5ml were collected in to EDTA containers, Complete Blood Count was measured within 6hours after collection using SysmexKX-21N analyzer the data was analyzed by SPSS software. from results of some studies done in some countries found that exposure to welding fume cause heart disease and respiratory disease such as lung cancer which lead to change in hematological parameters, in this study found that the welding fume slightly effected on hematological parameters on workers and significant in neutropeina and lymphocytosis , So that the workers must be used the protective equipment .

مستخلص البحث

يتم استخدام اللحام بكثرة في حياتنا اليومية في عدة مجالات ونظرا لذلك هدفت دراستنا الي قياس التغيير في قيم المعلمات الدموية للأشخاص المعرضين إلي دخان اللحام وهي دراسة مقطعية وصفية أجريت في المنطقة الصناعية بمدينة عطبرة لتفسير التشخيص لنتائج الأشخاص المعرضين لدخان اللحام وتأثيره علي تعداد الدم الكامل . شارك في هذه الدراسة 80 عامل معرض و40 غير معرض، وكانت أعمارهم تتراوح بين >20 - 60 سنة وفقا لمعايير الاشتغال والاستبيان المعياري.

وتم قياس تعداد الدم الكامل في غضون 6ساعات بجمع 2.5 مل من الدم الوريدي في حاوية [EDTA] بعد الجمع باستخدام جهاز تحليل اختبار الدم Sysmexkx-21N وتم إجراء التحليل الإحصائي بواسطة SPSS

ومن نتائج الدراسات التي أجريت في بعض الدول وجد أن التعرض لغاز اللحام يسبب بعض أمراض القلب والجهاز التنفسي كسرطان الرئة مما أدى إلي التغيير في معلمات الدم وخلصت دراستنا إلي أن هناك تأثير بسيط لغازات اللحام علي تعداد الدم الكامل للعاملين بالمنطقة ويتمثل تأثيره بصورة واضحة علي خلايا العدلات والخلايا الليمفاوية ونسبة لهذا التأثير نوصي العاملين في مجال اللحام باستخدام معدات الحماية الشخصية .

Chapter one

1.1 Introduction

The process of welding involves joining metal parts by heating the pieces to melting temperature.

Welding generates high levels of metal fume, which is comprised primarily of fine and ultra-fine particles, Epidemiological studies have shown that exposure to welding fumes is associated with metal fume fever, Welders are exposed to a wide range of metals and non-metals with varying and sometimes additive toxic effects. In addition, welders are commonly exposed to physical hazards including heat, electrical current, noise, vibration and light (visible, infrared, ultraviolet) and It has been proposed that inhaled particulates from air pollution may cause systemic alterations by the release of (inflammatory cytokines) subsequent to pulmonary inflammation, which plays an important role in the pathogenesis of atherosclerosis and coronary diseases. Indeed, elevated ambient particulate levels have been shown to be associated with increased levels of inflammatory markers, such as white blood cell counts (WBCs)⁽¹⁾.

1.2 Health Hazards of Welding

Welding “smoke” is a mixture of very fine particles (fumes) and gases. Many of the substances in welding smoke, such as chromium, nickel, arsenic, asbestos, manganese, silica, beryllium, cadmium, nitrogen oxides, phosgene, acrolein, fluorine compounds, carbon monoxide, cobalt, copper, lead, ozone, selenium and zinc, can be extremely toxic.⁽²⁾

Generally, welding fumes and gases come from:

- the base material being welded or the filler material that is used;
- coatings and paints on the metal being welded, or coatings covering the electrode;
- chemical reactions which result by the action of ultraviolet light from the arc and heat;
- process and consumables used; and
- contaminants in the air, for example vapors from cleaners and degreasers. The

health effects of welding exposures are difficult to list, because the fumes may contain so many different substances that are known to be harmful. The individual components of welding smoke can affect any part of the body, including the lungs, heart, kidneys and central nervous system.⁽²⁾

Welders who smoke may be at greater risk of health impairment than welders who do not smoke, although all welders are at risk.⁽²⁾

Exposure to welding smoke may have short-term and long-term health effects. These effects are described below:

1.2.1 Short Term (Acute) Health Effects

Exposure to metal fumes (such as zinc, magnesium, copper, and copper oxide) can cause metal fume fever, Symptoms of metal fume fever may occur 4 to 12 hours after exposure, and include chills, thirst, fever, muscle ache, chest soreness, coughing, wheezing, fatigue, nausea and a metallic taste in the mouth.

Welding smoke can also irritate the eyes, nose, chest, and respiratory tract, and cause coughing, wheezing, shortness of breath, bronchitis, pulmonary edema (fluid in the lungs) and pneumonitis (inflammation of the lungs). Gastrointestinal effects, such as nausea, loss of appetite, vomiting, cramps, and slow digestion, have also been associated with welding.⁽²⁾

Some components of welding fume, for example cadmium, can be fatal in a short time. Gases given off by the welding process can also be extremely dangerous. For example, ultraviolet radiation given off by welding reacts with oxygen and nitrogen in the air to form ozone and nitrogen oxides. these gases are deadly at high doses and can also cause irritation of the nose and throat and serious lung disease.⁽²⁾ Ultraviolet rays given off by welding can react with chlorinated hydrocarbon solvents, such as 1,1,1-trichloroethane, trichloroethylene, methylene chloride, and perchloroethylene, to form phosgene gas. Even a very small amount of phosgene may be deadly, although early symptoms of exposure dizziness, chills, and cough- usually take 5 or 6 hours to appear. Arc welding should never be performed within 200 feet of degreasing equipment or solvents.⁽²⁾

1.2.2 Long Term (Chronic) Health Effects

Studies of welders, flame cutters, and burners have shown that welders have an increased risk of lung cancer, and, possibly cancer of the larynx (voice box) and urinary tract.⁽²⁾ These findings are not surprising in view of the large quantity of toxic substances in welding smoke, including cancer-causing agents such as cadmium, nickel, beryllium, and arsenic.⁽²⁾ Welders may also experience a variety of chronic respiratory (lung) problems, including bronchitis, asthma, pneumonia, emphysema, pneumoconiosis (refers to dust-related diseases), decreased lung capacity, silicosis (caused by silica exposure) and siderosis (a dust-related disease caused by iron oxide dust in the lungs).⁽²⁾ Other health problems that appear to be related to welding include: heart disease, skin diseases, hearing loss and chronic gastritis (inflammation of the stomach), gastroduodenitis (inflammation of the stomach and small intestine) and ulcers of the stomach and small intestine.

Welders exposed to heavy metals such as chromium and nickel have also experienced kidney damage.⁽²⁾ Welding also poses reproductive risks to welders. A recent study found that welders, and especially welders who worked with stainless steel, had poorer sperm quality than men in other types of work. Several studies have shown an increase in either miscarriages or delayed conception among welders or their spouses. Possible causes include exposure to: Metals such as aluminum, chromium, nickel, cadmium, iron, manganese, and copper, gases, such as nitrous gases and ozone, heat and ionizing radiation (used to check the welding seams). Welders who perform welding or cutting on surfaces covered with asbestos insulation are at risk of asbestosis, lung cancer, mesothelioma and other asbestos related diseases. Employees should be trained and provided with the proper equipment before welding near materials that contain asbestos.⁽²⁾

1.3 Complete Blood Count (CBC)

A complete blood count (CBC) is a blood test used to evaluate the overall health and diagnose a wide range of disorders, including anemia, infection, leukemia etc. CBC test measures several components and features of your blood, including: Red

blood cells- which carry oxygen, White blood cells-which fight infection, Hemoglobin - the oxygen-carrying protein in red blood cells, Haematocrit- the proportion of red blood cells to the fluid component, and Platelets- which help with blood clotting. Abnormal increases or decreases in cell counts in CBC may indicate that you have an underlying medical condition that calls for further evaluation ⁽³⁾.

1.3.1 Whitebloodcells

The white blood cells (leucocytes) may be divided into two broad groups: the phagocytes and the immunocytes. Granulocytes, which include three types of cell – neutrophils (polymorphs), eosinophils , basophils , together with monocytes and lymphocytes are found in normal peripheral blood.(N.R:4.00–11.0×10⁹/L*)⁽⁴⁾

1.3.1.1 Neutrophil (Polymorph)

This cell has a characteristic dense nucleus consisting of between two and five lobes, and a pale cytoplasm with an irregular outline containing many fine pink – blue (azurophilic) or grey – blue granules. .The granules are divided into primary ,which appear at the promyelocyte stage, and secondary (specific) which appear at the myelocytstage and predominate in the mature neutrophil .Both types of granule are lysosomal in origin .The lifespan of neutrophils in the blood is only 6–10 hours (N.R 2.5–7.5×10⁹/L*).⁽⁴⁾

1.3.1.2 Monocytes

These are usually larger than other peripheral blood leucocytes and possess a large central oval or indented nucleus with clumped chromatin .The abundant cytoplasm stains blue and contains many fine vacuoles giving a ground – glass appearance. Cytoplasmic granules are also often present. The monocyte precursors in the marrow (monoblasts and promonocytes) are difficult to distinguish from myeloblasts and monocytes (N.R: 0.2 – 0.8 × 10⁹ /L).⁽⁴⁾

1.3.1.3 Eosinophils

These cells are similar to neutrophils, except that the cytoplasmic granules are coarser and more deeply red staining and there are rarely more than three nuclear

lobes. Eosinophil myelocytes can be recognized but earlier stages are indistinguishable from neutrophil precursors. The blood transit time for eosinophils is longer than for neutrophils. They enter inflammatory exudates and have a special role in allergic responses, defence against parasites and removal of fibrin formed during inflammation. (N.R: $0.04 - 0.4 \times 10^9 /L$).⁽⁴⁾

1.3.1.4 Basophile

These are only occasionally seen in normal peripheral blood. They have many dark cytoplasmic granules which overlie the nucleus and contain heparin and histamine. In the tissues they become mast cells. They have immunoglobulin E (IgE) attachment sites and their degranulation is associated with histamine release (N.R $0.01 - 0.1 \times 10^9 /L$).⁽⁴⁾

1.3.2 Red Cell Components

There is considerable variation in the red blood cell count (RBC) and hemoglobin concentration (Hb) at different periods of life and there are also transient fluctuations, the significance of which is often difficult to assess. At birth the Hb is higher than at any period subsequently (N.R : Women $4.3 - 0.5 \times 10^{12}/l$, Men $5.0 - 0.5 \times 10^{12}/l$)

1.3.3 Platelet Count

There is a slight diurnal variation in the platelet count of about 5%;⁽⁵⁾ this occurs during the course of a day as well as from day-to-day. Within the wide normal reference range, there are some ethnic differences and in healthy West Indians and Africans platelet counts may on average be 10–20% lower than those in Europeans living in the same environment.⁽⁶⁾ There may be a sex difference; thus, in women, the platelet count has been reported to be about 20% higher than in men.⁽⁷⁾ A decrease in the platelet count may occur in women at about the time of menstruation. There are no obvious age differences; however, in the 1st year after birth the platelet count tends to be at the higher level of the adult normal reference range. Strenuous exercise causes a 30–40% increase in platelet count;⁽⁸⁾ the

mechanism is similar to that which occurs with leucocytes. (N.R: $150 - 400 \times 10^9$ /L).⁽⁴⁾

1.3.4 Hemoglobin and Packed cell volume

HB and PCV are the most common performed tests worldwide and essential component of many health systems. They are also assisting in detection and diagnosis of hematological diseases such as anemia and polycythemia; they provide public health data such as nutritional status and assessment of erythropoietic status of reticuloendothelial system⁽⁹⁾. PCV is measure of the ratio of the volume occupied by red cells to the volume of whole blood. It is measure after appropriate centrifugation and expressed as decimal fraction⁽¹⁰⁾. A screening test for anemia, method for calibrating automated blood count system, rough guide to the accuracy of hemoglobin measurement (HCT $\times 1000$ is about three times of hemoglobin expressed in g/L) and calculation of red cell indices⁽⁹⁾. Hemoglobin is the protein contained in red blood cells that is responsible for delivery of oxygen to tissues. To ensure adequate tissue oxygenation, sufficient hemoglobin level must be maintained. The amount of hemoglobin in whole blood express in gram per deciliter. the molecular weight of hemoglobin is approximately 64,500 Daltons. HB is composed of two pairs of dissimilar chains, α and β , each defined by a specific amino acid sequence and incorporating an iron-containing heme group⁽¹¹⁾. Hb and PCV are used in conjunction with total red blood cell count in calculating the red cell indices, which includes MCV, MCH and MCHC⁽¹²⁾. Both hemoglobin and the haematocrit are based on whole blood, and are therefore dependent on plasma volume. If a patient is severely dehydrated, the hemoglobin and haematocrit will appear higher than if the patient were normovolemic; if the patient is fluid overloaded, they will be lower than their actual level. To assess true red cell mass, independent radionuclide evaluation of the red cells and plasma (by ^{51}Cr and ^{131}I respectively) must be performed⁽¹¹⁾.

1.4 Rationale (Justification)

Welding fume effect on healthy individual workers there is limited or non-published data in Sudan regarding the study welding fumes effect on hematological parameters of workers.

1.5 Objectives

1.5.1 General objective

To determine the hematological parameter in welding human workers.

1.5.2 Specific objectives

1-To determine hematological Parameters in workers welding fume and normal control by Sysmex KX 21 analyzer.

2-To determine hematological Parameters to effect of welding fumes among long duration and short duration exposures.

3-To determine hematological Parameters according to welding fume technique.

1-6 Hypothesis:

Suspect of effect or not effect of welding fume on the hematological parameters.

Chapter Two

2. Materials and Methods

2.1. Instrument

2-1-1-1 Principle of Sysmex KX-21 hematology analyzer

Sysmex KX-21 employs two basic technologies to achieve precise measurements at the micro liter level. these are sheath flow DC detection in which a constant electric current is passed through a solution; this method measures the changes in electrical resistance that occur when blood cells pass through detection aperture⁽¹²⁾.



Figure (2.1) Sysmex KX-21

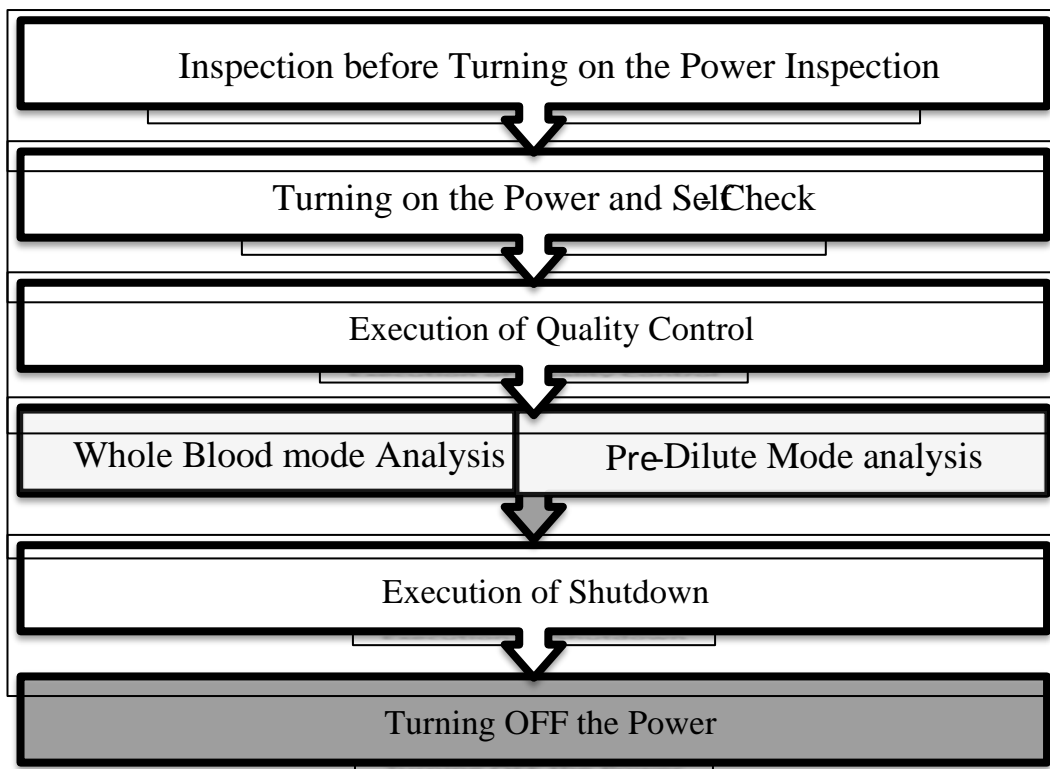


Figure (2.2): Show The Analysis Procedure Flow Chart

2.1.2 Materials

2.1.3 Consumables

Show the Consumables and Manufacturer:

| | |
|---------------------|----------------------------------|
| Syringes | Shandong zinbo shanthyuan- china |
| EDTA container..... | MingboMs LAB-china |
| Cotton..... | Egypt |
| Doctor aid..... | Pharma plast -Egypt |
| Alcohol..... | ..Germany |
| Gloves..... | Malaysia |

2.2 Methods

2.2.1 Study Design

Cross sectional study.

2.2.2 Study Area

Atbara locality.

2.2.3 Study Duration

From October 2017 to July 2018.

2.2.4 Study population

Apparently healthy adult Sudanese males there age ranging from < 20-60 years.

2.2.5 Ethical consideration

The individuals included in the study were notified well about the objective and the need of this study and they accept to give blood samples before the start of the collection process.

2.2.6 Criteria of selection

2.2.6.1 Inclusion criteria:

1. Atbara city apparently healthy males.
2. From <20 -60 years old.

2.2.6.2 Exclusion criteria

1. Any male have hematological disease.
2. Any male his age above of 60 years old.
3. +ve screening for HIV, HBV, and HCV.

2.2.7 Data Collection

The primary data was collected by a standard questionnaire and the secondary data was analyzed.

2.2.8 Data Analysis

Data was analyzed by SPSS to get the mean.

2.2.9 Blood sample collection

First, the donor identity has been checked, and found that it correspond to the details on request form .Recommended that skin must be cleaned by 70% alcohol or by 0.5% chlorhexidine and allowed to dry before being punctured .Blood best withdrawn from antecubital vein or other visible vein in the forearm by either an evacuated tube or a syringe. The tourniquet has been applied just above the venopuncture site and released as soon as the blood has been flown into syringe or evacuated tube. If a syringe was used for blood collection the piston of syringe should be withdrawn slowly, ant coagulated specimen was mixed by harvesting the containers several times. after the blood was obtained and released the tourniquet, the needle was removed and then pressed applying pressure on the swab, then the punctured site was covered with a small adhesive dressing ⁽⁸⁾.

2.2.10 Test procedure

Small sample of the blood was aspirated into chamber and diluted with an isotonic saline solution. the analyzer prepares two dilution: on lysed and other un lysed. After the first dilution is measure WBCs and hemoglobin Hb, the analyzer measure the second dilution which measure RBCs, HCT, mean corpuscular volume MCV and platelet count. the hemoglobin concentration was measured optically using the solution in the WBCs bath. The lysing agent contains potassium cyanide that reacts with hemoglobin to form cyanmethemoglobin. the color intensity measured in separate cuvette, read spectrophotometric ally at 540 nm⁽¹³⁾. It is preferable to use different terms to distinguish the manual and automated test, for this reason the ICSH suggested that term (haematocrit) rather than PCV should be used for automated measurement. the passage of cell through the beam of light of a light -

scattering instrument leads to generation of an electrical pulse the height of which is proportional to cell volume. the number of pulses determine RBCs, pulse height analysis allow either MCV or PCV to be determined. If the average pulse height was computed, this is indicative of MCV and PCV can be derived by multiplying the MCV by RBCs. calibration of the PCV can be base on manual PCV determination⁽⁸⁾.

2.2.11 Expected outcome of the study

Variation of the results because the variation of genetics and environmental factors.

Chapter three

3. Results

Total of (80) apparently healthy adult Sudanese males were selected according to inclusion criteria for this study.

Table (3-1) show distribution of study group according to age group

| Age | Frequency | Percentage |
|---------------|-----------|-------------|
| < 20 years | 7 | 14% |
| 20 – 29 years | 13 | 26% |
| 30 – 39 years | 8 | 16% |
| 40 – 49 years | 10 | 20% |
| ≥ 50 years | 12 | 24% |
| Total | 50 | 100% |

The table showed that above the quarter (26%) of welder worker age between 20-29 year, less than quarter (24%) of welder worker age more than 50 year, less than quarter (20%) of welder worker age between 40-49 year, less than quarter (16%) of welder worker age between 30-39 year ,and less than quarter (14%) of welder worker age less than 20 year.

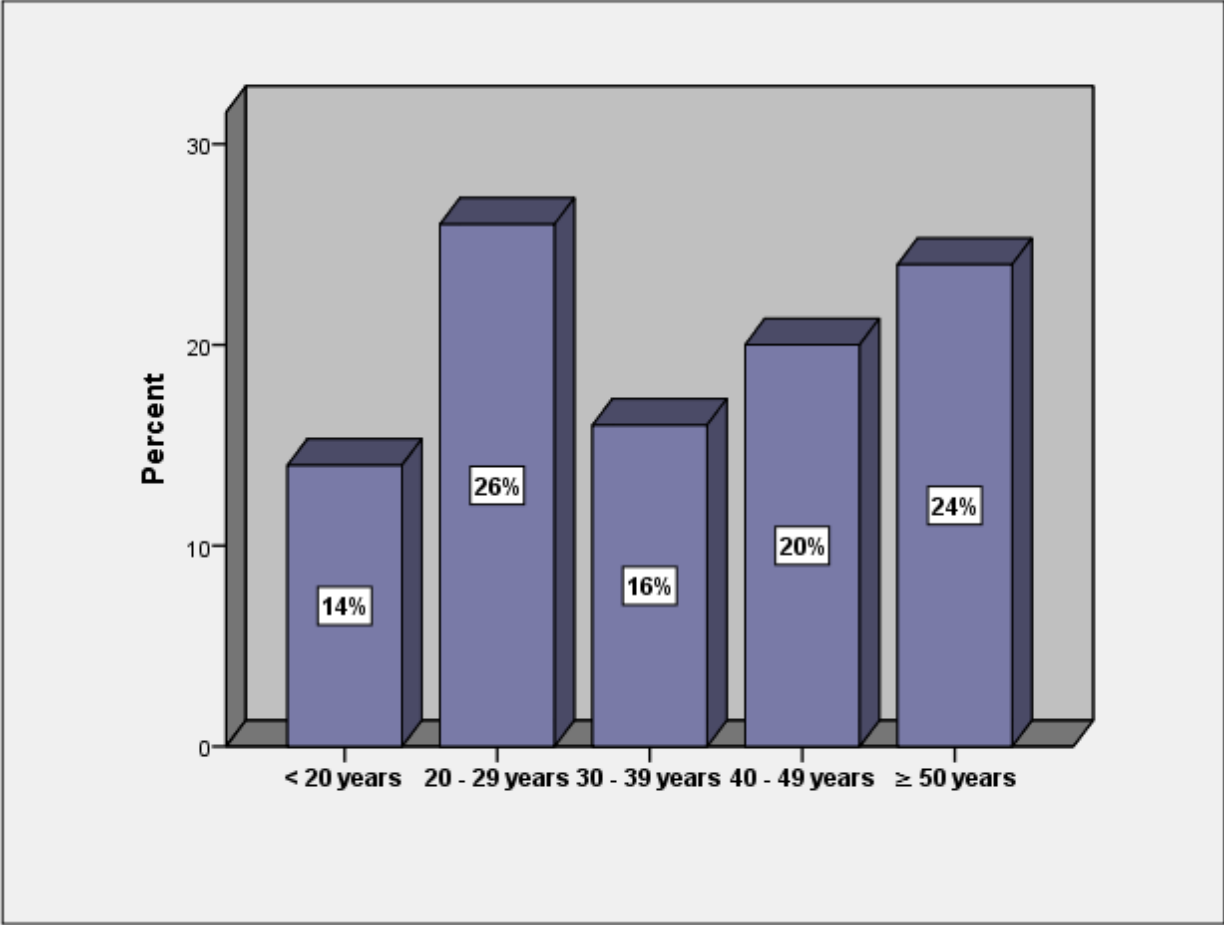


Figure (3-1) distribution of study group according to age group

Table (3-2) show distribution of study group according to welding methods

| Welding methods | Frequency | Percentage |
|------------------------|------------------|-------------------|
| Acetylene welding | 49 | 98% |
| Electrical welding | 1 | 2% |
| Total | 50 | 100% |

In above the result showed that near majority (98%) of welding method is acetylene welding ,and (2%) of welding method is electrical welding .

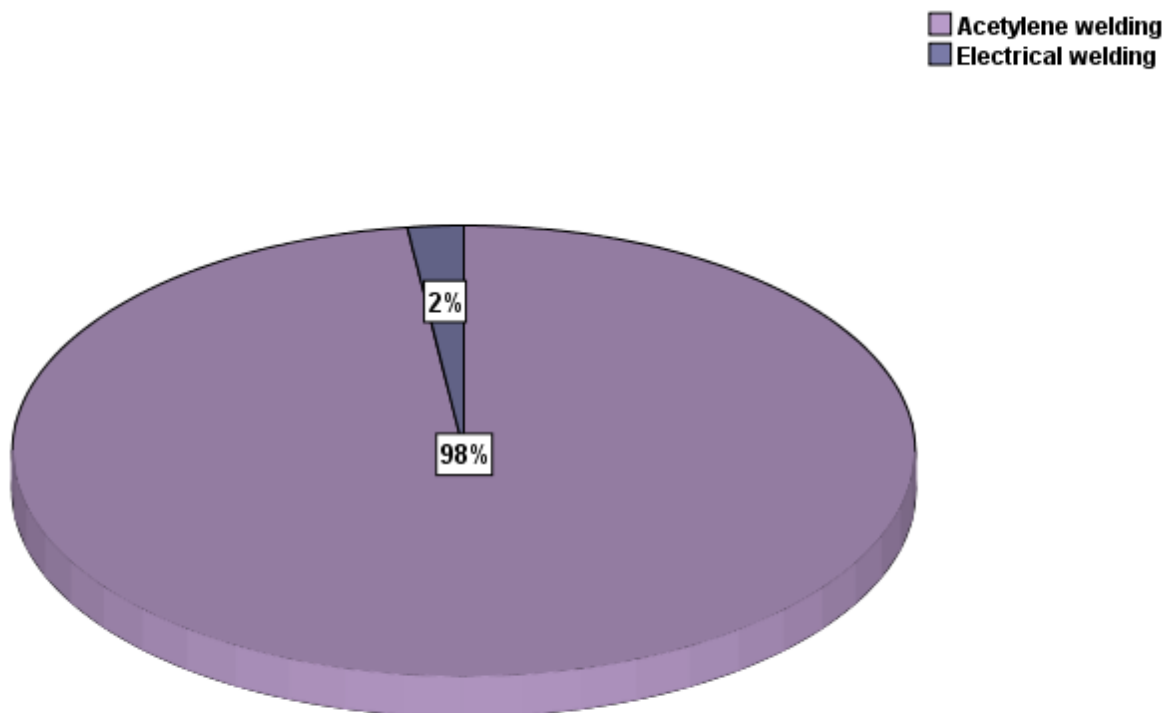


Figure (3-2) distribution of study group according to welding methods

Table (3-3) show distribution of study group according to types of gases used for welding

| Gas type | Frequency | Percentage |
|-----------------|------------------|-------------------|
| Carbon monoxide | 26 | 52% |
| Oxygen | 24 | 48% |
| Total | 50 | 100% |

In above the result showed that more than half (52%) of types of gases used for welding is carbon monoxide and less than half (48%) of type of gases used for welding is oxygen.

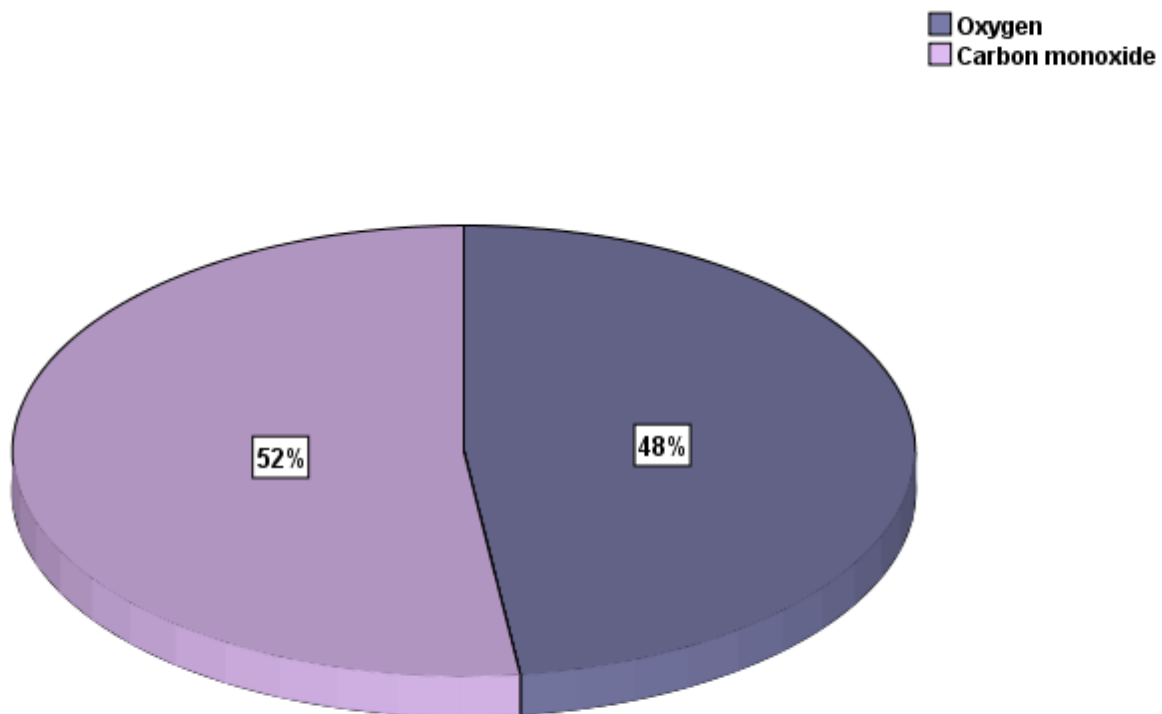


Figure (3-3) distribution of study group according to types of gases used for welding

Table (3-4) show distribution of study group according to working period in welding

| Working period | Frequency | Percentage |
|-----------------------|------------------|-------------------|
| Month – 1 year | 11 | 22% |
| 1 – 5 years | 4 | 8% |
| 5 – 10 years | 5 | 10% |
| More than 10 years | 30 | 60% |
| Total | 50 | 100% |

In above the result showed that above half (60%) of working period in welding more than 10 year ,less than quarter (22%) of working period in welding between month-1 year ,less than quarter (10%) of working period in welding between 5-10 year, and less than quarter (8%) of working period in welding between 1-5 year.

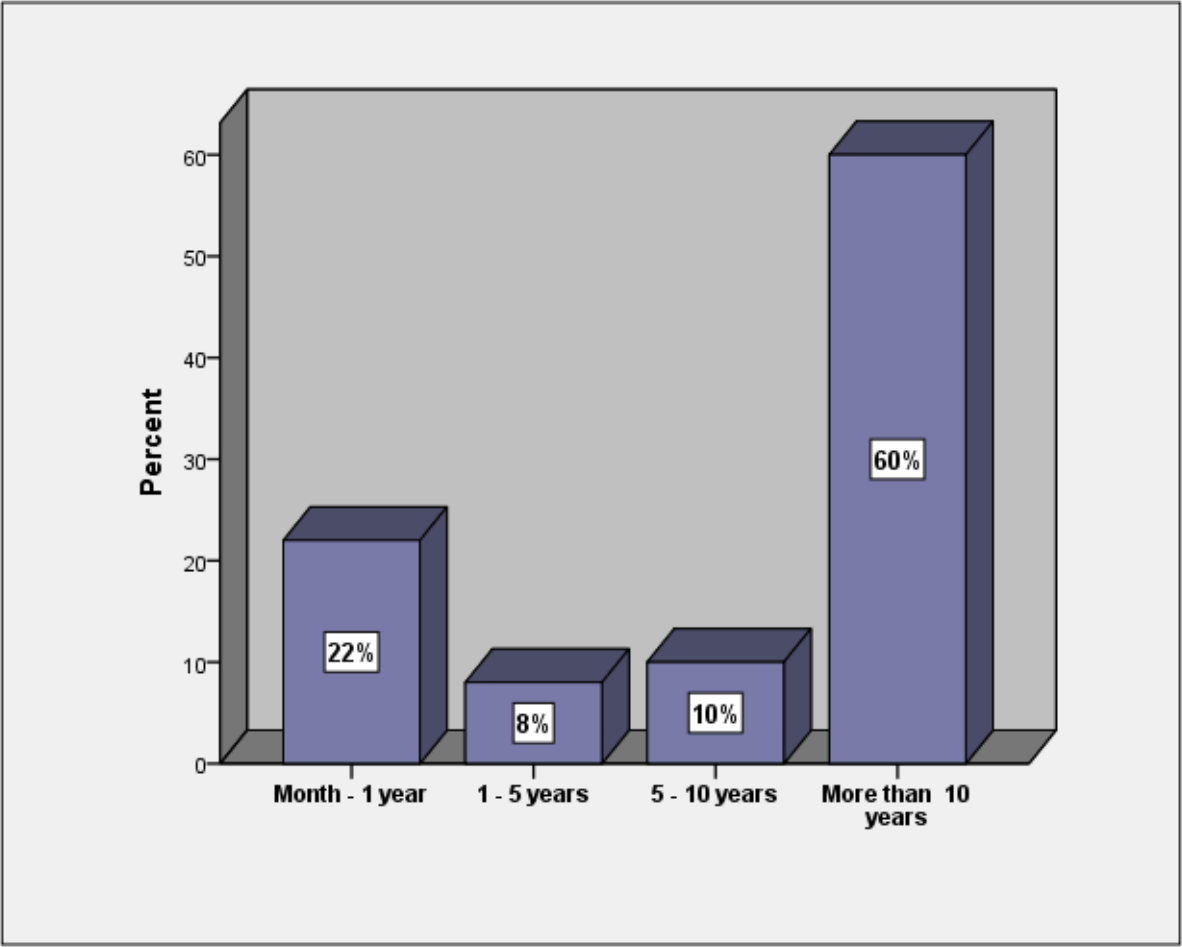


Figure (3-4) distribution of study group according to working period in welding

Table (3-5) show percentage of persons who suffer from chronic disease among study group

| Suffer from chronic disease | Frequency | Percentage |
|-----------------------------|-----------|-------------|
| Yes | 4 | 8% |
| No | 46 | 92% |
| Total | 50 | 100% |

In above the result showed that near majority(92%) of persons who suffer from chronic disease among study group is non found ,and less than quarter (8%) of persons who suffer from chronic disease among study group is found.

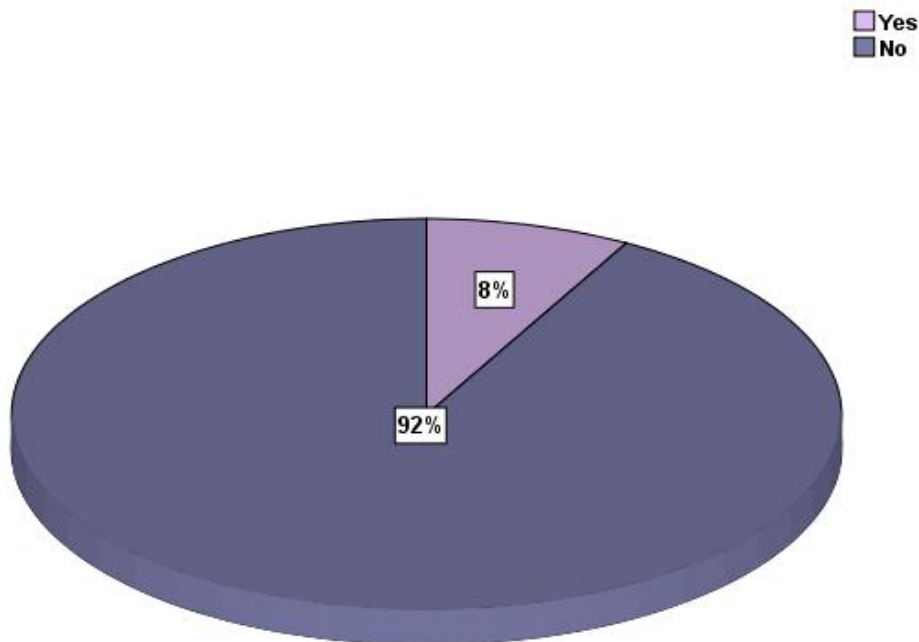


Figure (3-5) percentage of persons who suffer from chronic disease among study group

Table (3-6) show types of harmful habit person participated among study group

| Harmful habit | Frequency | Percentage |
|----------------------|------------------|-------------------|
| Smoking | 18 | 36% |
| Tobacco | 13 | 26% |
| Nothing | 19 | 38% |
| Total | 50 | 100% |

In above the result showed that more than half (38%) of type of harmful habit person participated among study group is nothing ,more than half (36%) of type of harmful habit person participated among study group is smoking ,and more than half (26%) of type of harmful habit person participated among study group is tobacco.

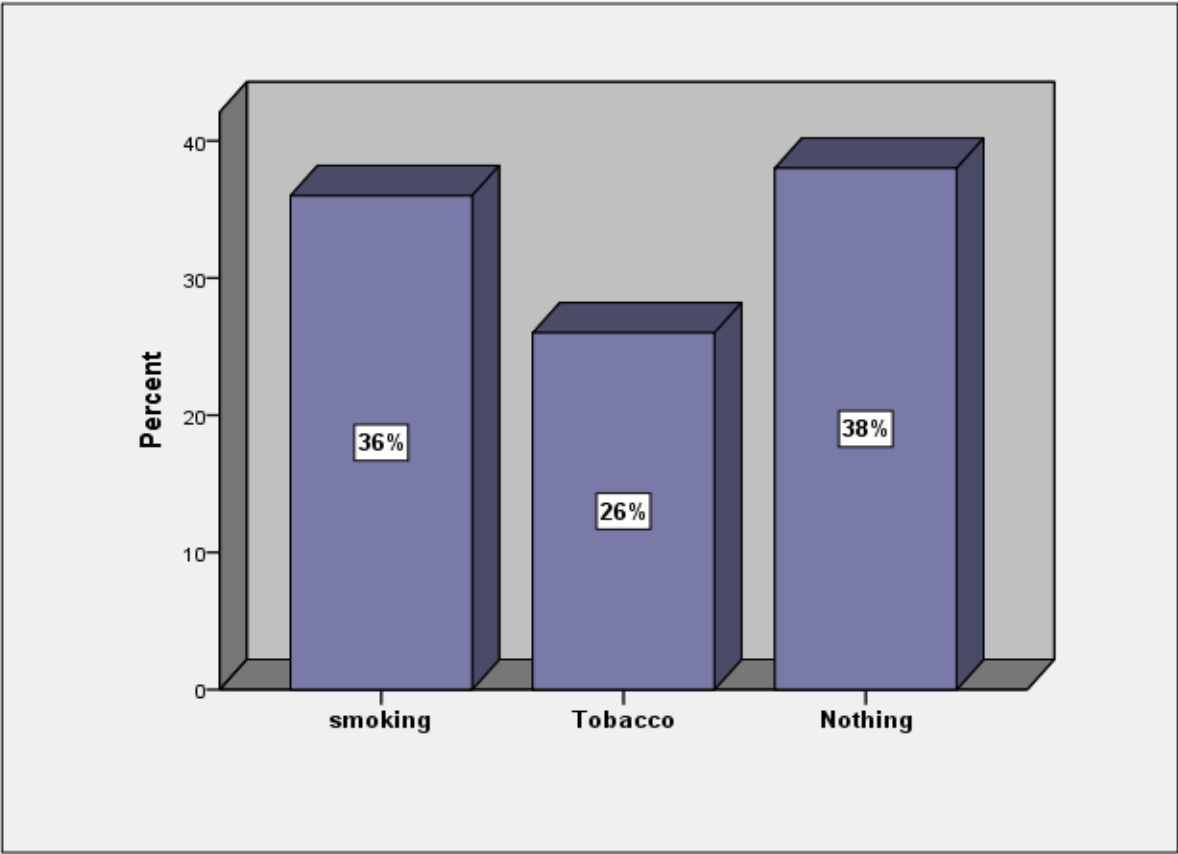


Figure (3-6)) types of harmful habit person participated among study group

Table (3-7) show types of respiratory diseases

| Respiratory diseases | Frequency | Percentage |
|-----------------------------|------------------|-------------------|
| Breath shortness | 5 | 10% |
| Chronic cough | 2 | 4% |
| Sputum | 2 | 4% |
| Pulmonary inflammation | 1 | 2% |
| Nothing | 40 | 80% |
| Total | 50 | 100% |

In above the result showed that near majority (80%) of type of respiratory disease is nothing ,less than quarter (10%) of type of respiratory disease is breath shortness (4%) of type of respiratory disease is chronic cough and sputum ,and (2%) of type of respiratory disease is pulmonary inflammation.

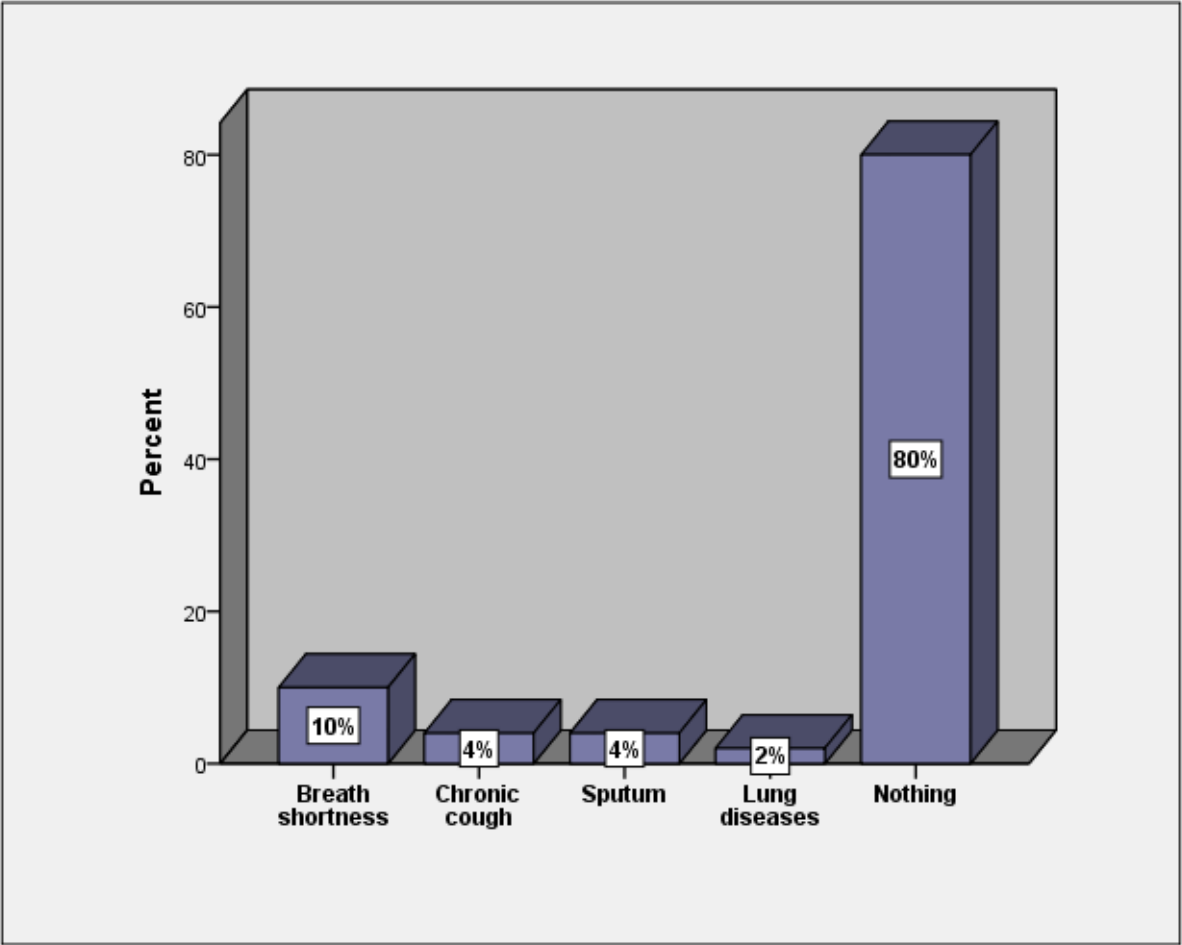


Figure (3-7) types of respiratory diseases

Table (3-8) show percentage of persons who suffer from night fever

| Night fever | Frequency | Percentage |
|--------------------|------------------|-------------------|
| Yes | 6 | 12% |
| No | 44 | 88% |
| Total | 50 | 100% |

In above the result showed that near majority (88%) of persons are not suffer from night fever and less than quarter (12%) of persons are suffer from night fever.

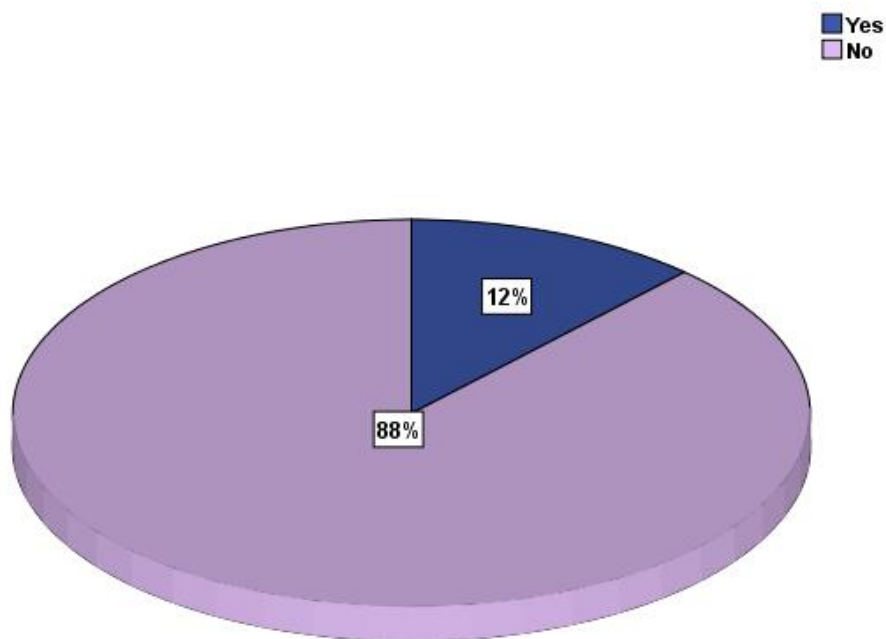


Figure (3-8) percentage of persons who suffer from night fever

Table (3-9) show percentage of persons who suffer from sensitivity in the eye or skin

| Suffer from sensitivity | Frequency | Percentage |
|--------------------------------|------------------|-------------------|
| Yes | 14 | 28% |
| No | 36 | 72% |
| Total | 50 | 100% |

In above the result showed more than half (72%) of persons are not suffer from sensitivity in eye or skin and more than half (28%) of persons are suffer from sensitivity in eye or skin.

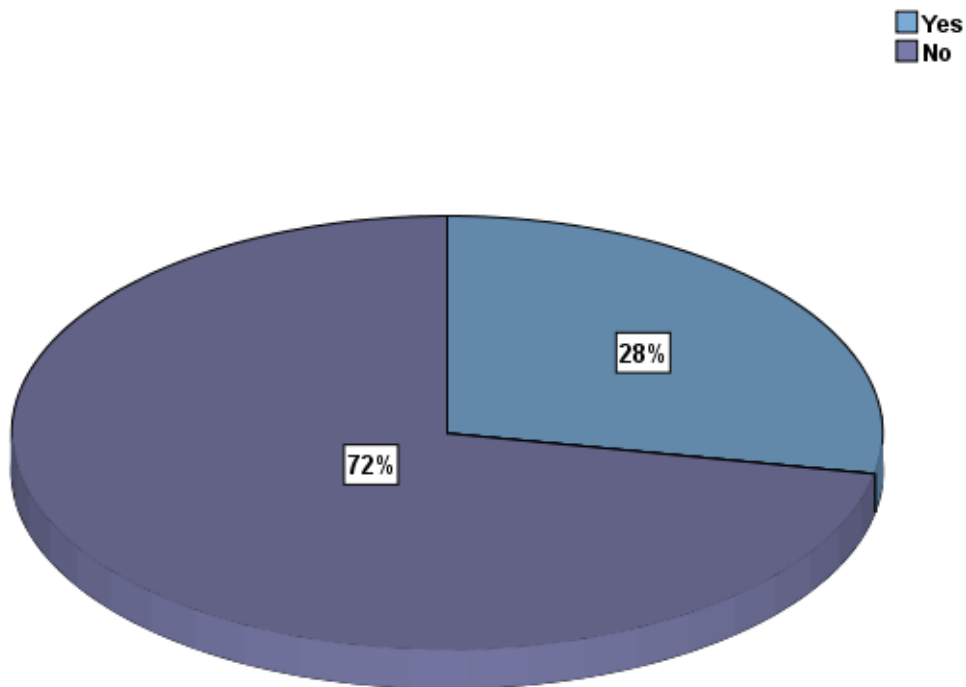


Figure (3-9) percentage of persons who suffer from sensitivity in the eye or skin

Table (3-10)show Comparison of mean (SD) and mean difference between case (n=50) and normal control (n=50)

| Group | Mean (SD) | MD | p-value |
|---------------|----------------|--------|---------|
| WBC case | 5.31(0.486) | 4.50 | 0.068 |
| WBC control | 4.52(0.339) | 4.45 | 0.059 |
| RBC case | 5.52(0.143) | 5.52 | 0.06 |
| RBC control | 5.41(0.137) | 5.47 | 0.049 |
| HGB case | 14.89(0.226) | 14.90 | 0.053 |
| HGB control | 14.60(0.283) | 14.45 | 0.013 |
| HCT case | 46.72(0.725) | 46.35 | 0.04 |
| HCT control | 45.94(0.672) | 46.25 | 0.038 |
| MCV case | 87.50(0.959) | 87.50 | 0.058 |
| MCV control | 85.61(1.811) | 87.14 | 0.010 |
| MCH case | 27.49(0.398) | 26.93 | 0.049 |
| MCH control | 27.13(0.721) | 27.25 | 0.05 |
| MCHC case | 32.08(0.273) | 31.60 | 0.023 |
| MCHC control | 31.77(0.280) | 31.75 | 0.05 |
| PLT case | 264.70(14.864) | 279.50 | 0.05 |
| PLT control | 264.20(17.91) | 251.0 | 0.06 |
| LYM% case | 44.54(4.279) | 44.65 | 0.049 |
| LYM% control | 41.66(1.299) | 41.45 | 0.064 |
| MXD% case | 10.91(1.308) | 11.30 | 0.001 |
| MXD% control | 13.05(1.771) | 11.75 | 0.00 |
| NEUT% case | 45.04(7.307) | 51.50 | 0.120 |
| NEUT% control | 45.29(2.710) | 46.10 | 0.09 |

| | | | |
|----------------|--------------|-------|-------|
| LYM# case | 2.18(0.162) | 2.30 | 0.19 |
| LYM# control | 1.87(0.142) | 1.85 | 0.064 |
| MXD# case | 0.61(0.108) | 0.55 | 0.052 |
| MXD# control | 0.55(0.060) | 0.58 | 0.050 |
| NEUT# case | 2.46(0.385) | 2.07 | 0.061 |
| NEUT# control | 2.10(2.33) | 1.90 | 0.051 |
| RDW-SD case | 43.39(0.777) | 43.7 | 0.055 |
| RDW-SD control | 43.03(0.717) | 42.77 | 0.049 |
| RDW-CV case | 13.48(0.266) | 13.20 | 0.11 |
| RDW-CV control | 13.04(0.346) | 12.70 | 0.08 |
| PDW case | 13.10(0.625) | 12.98 | 0.068 |
| PDW control | 14.75(0.803) | 14.0 | 0.059 |
| MPV case | 10.40(230) | 10.43 | 0.048 |
| MPV control | 11.08(0.352) | 10.80 | 0.023 |
| P-LCR case | 28.12(1.869) | 28.65 | 0.06 |
| P-LCR control | 33.23(2.532) | 31.25 | 0.055 |

Above table showed the association between hematological parameter and other variables (p value: significant ≤ 0.05).

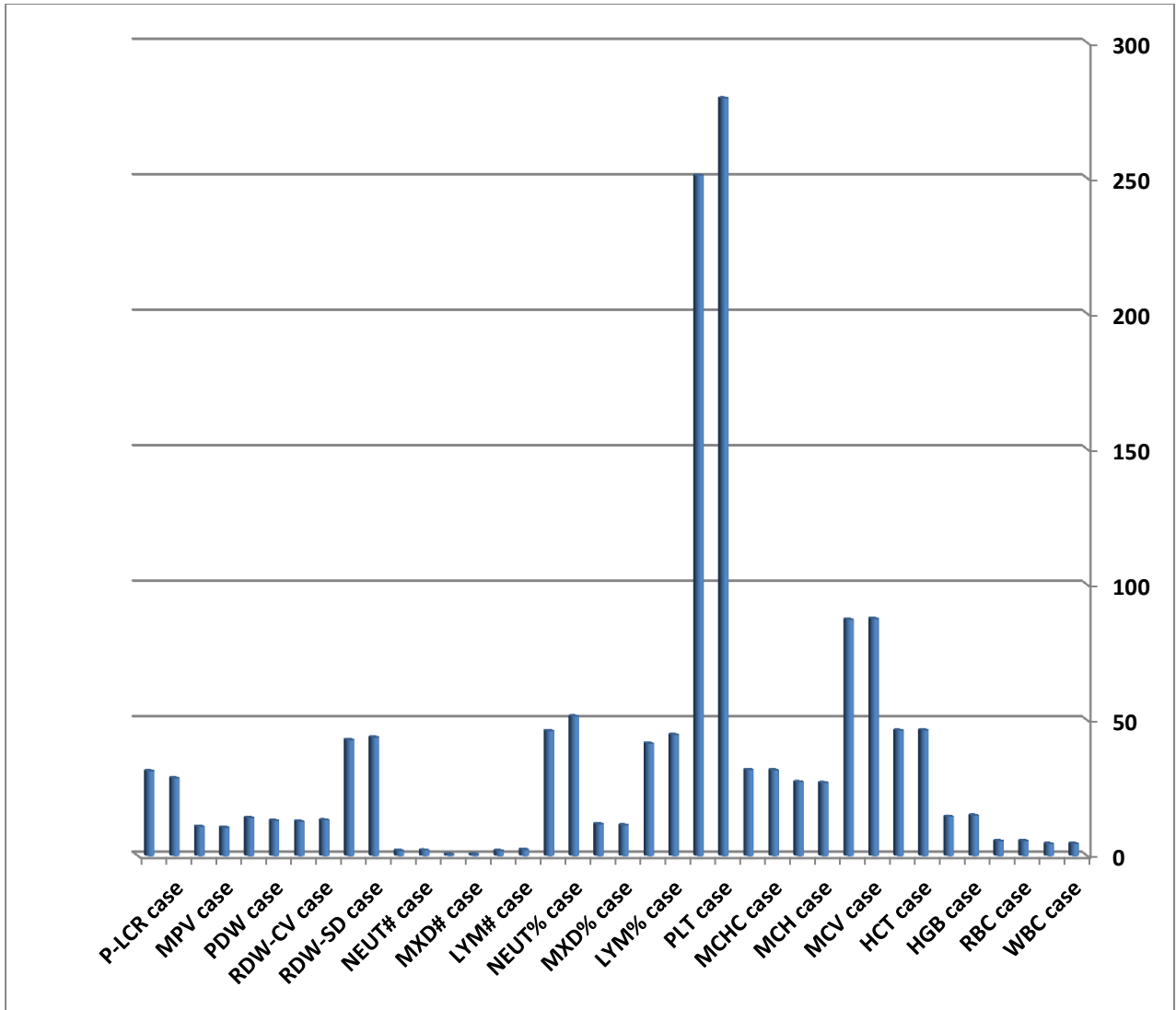


Figure (3-10) Comparison of mean (SD) and mean difference between case (n=50) and normal control (n=50)

Chapter Four

4.1 Discussion

This is cross sectional study based regarding effect of welding fume on the hematological parameter on welding worker in the industrial area in Atbara Locality ,from march to July 2018.

80 exposure worker and 40 non exposure as control ,with different in age of worker and Duration of exposure to welding fume.

A study performed by Margareta Littorin 1983 reported that the neutrophil mean was 3.70 and lymphocyte mean was 2.20 which was similar than this study .

Another study done by Paula Kauppi ^{a,b} 2015 the result showed that HB mean was 15.7 and hematocrit was 0.46 which is similar significant value when compared with this study .

A study done by Ceylan, Halil Erhan 2013 showed that elevation of lymphocytes and neutropenia which were agree result to other study performed in Turkey done at 2009 showed that agree to this study .

The discrepancies of the previous results might be related to genetic, geographical, nutritional ,environmental factors and types of harmful habit person.

Table (4.1) Comparison between mean and RI of HB and HCT in this study and other countries:

| Parameters | This Study | Done by paula kauppi ^{a,b} 2015 | Turkey Bozak university 2009 | Turkey By. Ceylan ,Halil Erhan 2013 | Done by Margareta Littorin . 1983 |
|-------------|------------|--|------------------------------|-------------------------------------|-----------------------------------|
| Mean HB | 14.98±2.02 | 15.7±2.02 | - | - | - |
| Mean HCT | 46.72±2.02 | 46.6±2.02 | - | - | - |
| Leukocyte | 5.6±2.02 | - | - | - | 6.5 ±2.02 |
| Erythrocyte | 5.52±2.02 | - | - | - | 5. 0±2.02 |
| Neutrophils | 2.46 | - Decrease | Decrease | Decrease | 3.70 |
| Lymphocyte | 2.18 | increase | increase | Increase | 2.20 |
| PLTs | 264.70 | - | - | - | 273.50 |

4.2 Conclusion

This study concluded that welding fumes slightly effected on hematological parameters of workers and high significant in nutropenia and lymphocytosis.

4.3 Recommendation

- Follow up regularly for hematological parameters on workers
- Further studies for all ages should be done.
- Smokers, tobacco etc.. should be established.
- Other study with large sample size should be done .

References

1. Reference ranges and what they mean .lab test online (USA). retrieved 22 June 2013.
2. IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans :Chromium ,Nickel and Welding .Lyon :International Agency for Research on Cancer:1990.
3. Vinutha H Reddy , Automatic Red blood cell and White blood cell counting for Telemedicine system .International journal of Research in Advent technology volume 2 , issue 1, January 2014 .EISSN :2321-9637.
4. *Essential Haematology*, 6th Edition. © A. V. Hoffbrand and P. A. H. Moss. Published 2011 by Blackwell Publishing Ltd.
5. Richardson Jones A, Twedt D, Swaim W, et al. Diurnal change of blood count analytes in normal subjects. *Am J Clin Pathol* 1996;106:723–727.
6. Bain BJ, Seed M. Platelet count and platelet size in healthy Africans and West Indians. *Clin Lab Haematol* 1986;8:43–48
7. Stevens RF, Alexander MK. A sex difference in the platelet count. *Br J Haematol*. 1977;37:295–300
8. Avloniti AA, Douda HT, Tokmakidis SP, et al. Acute effects of soccer training on white blood cell count in elite female players. *International Journal of Sports Physiology & Performance*. 2007;2: 239–249.
9. Amities Ramezani, Mandana Shams, Nader Zarinfar, Mohammed Banifazal Arezzo Aghakhani, Ali Eslamifar, Fatemeh- Al-Sadat Mahdavi et al. Hematological Reference values for healthy males in the central part of Iran. *Iranian journal of Pathology* 2014 volume 9 NO (1) , 50-55

10. Lewis SM, Bain BJ & Bates I, “Dacie and Lewis Practical Haematology” 10th ed., Philadelphia: Churchill Livingstone, 2006.
11. F j Baker, RE Silveston , R.Shannon, S.E gglestone , D.L Guthrie , J.C Mackenzie . introduction to medical technology 1985 P 335_ 342.
12. Henny H .Billet , clinical method : The history .Physical and laboratory examination .3 edition. 2005 .
13. MD. Reinold Munker, Erhard Hiller m Jonathon Glass ,Ronald Paquette . Modern Hematology , 2 edition , Humana Press Totowa New jersey .2007.
14. Tibebe Adinew, Performance Evaluation of Sysmex KX-21 and Cell-Dyn 1800 Hematology Analyzers at St. Paul’s Hospital Millennium Medical College, Addis Ababa, Ethiopia. June, 2015.
15. IWONA KAZNOWSKA -BYSTRYK , The automated hematology analyzers, Annals UniversitatisMariae Curie -Sklodowska Lublin -Polonia , Volume XXIV no 3,7 2011.

Appendix 1

Questionnaire:

date -----

Address:-----

Age: -----

Sex

Male

Female

1-Method used in welding?-----

2-Type of gas ?-----

3-The duration of working?

Month-5years

5-10 years

More than 10years

4-Are you complaining of any disease?

Yes -----

No -----

If yes identify please -----

5-Are you on any medication?

Yes -----

No -----

If yes identify please-----

6-Are you smoker? Yes -----

No-----

7-Are you in any condition bellow:

Dyspnea-----

chronic cough-----

Pulmonary disease-----

sputum-----

8-Are you suffering of night fever?

Yes -----

No -----

9-Are you suffering allergy in eye or in skin?

Yes -----

No -----

Appendix(2)

Informed Consent For Collection Of Blood Samples For Research

This sample is being collected solely for purpose of determine the effect of welding fume on hematological parameters .The research pertains reference of Hemoglobin and packed cell volume in Sudanese people. The procedure for sample collection involves only the withdrawal of 2-3 ml of blood. It is such a harmless process .The results of the study may not be of immediate benefit to the patient. complete confidentiality will be maintained in the handling and processing of samples.

The above statement has been read out or explained to me, and having understood the same, I put my signature or thumb impression. I hereby consent to collection of the blood sample of myself.

Participant name:

Phone number:

Signature

Address:

Date:

استمارة موافقه للأشخاص المشاركين في الدراسة

هذه الدراسة لغرض البحث العلمي فقط وهى بغرض تحديد مدى تأثير معلمات الدم علي العاملين باللحام وتتطلب اخذ 2-3 مل من الدم ولا يوجد أذى أو خطورة تنتج منها عليك وحال موافقتك على المشاركة في هذه الدراسة سيبقى اسمك قيد الكتمان كما لن يكون هنالك أي تعويض مالي. لقد اطلعت على استمارة الموافقة وادركت مضمونها واطلعتني الباحث عن فوائد بحثه وأهميته العلمية والعملية وبناء عليه فإني حراً مختاراً وبمحض إرادتي اوافق على المشاركة في هذه الدراسة كما اوضح بان مشاركتي فيها طوعاً مني ، وان باستطاعتي رفض المشاركة كما أن بإمكانني أن لا اجيب على أي سؤال لا أرب في اجابته، كما تم إعلامي بأن مشاركتي بالبحث لن تحملني اي نفقات أو مساءلة من شأنها الضرر بمهنتي أو شخصي . وأن المعلومات الناتجة عن مشاركتي سوف تعامل بسرية تامة ولن يطلع عليها أي شخص غير معني بالبحث وأن هذه المعلومات ونتائجها هي لأغراض علمية فقط ولن تكون هنالك إشارة إلى شخصي أو عائلتي في أي منشور عن هذه الدراسة ولأجل هذا فإني أوافق بمشاركتي في هذه الدراسة.

اسم المشارك: رقم التلفون:

التوقيع: العنوان:

التاريخ :