

## Effect of Benzene on Some haematological Parameters of Oil Station Workers

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### Abstract

Benzene is a hydrocarbon chemical consisting of six atoms arranged in a ring structure. At normal ambient temperatures; it is a liquid, which evaporates rapidly at room temperature and is highly flammable. It has a characteristic of aromatic odor and is slightly soluble in water (1.5 g/liter at 20°C) but miscible with most other organic solvents [1].

Long-term inhalation of benzene causes blood disorders. It specifically affects bone marrow [2]. And it may cause anemia, excessive bleeding, damage to the immune system and DNA [3, 4]. Increased incidence of leukemia (cancer of the tissues that form white blood cells) has been observed in people occupationally exposed to benzene; so (EPA) Environmental Protection Agency has classified benzene as a known human carcinogen [5].

The present study was conducted to evaluate the effect of benzene on some hematological parameters on 60 males working in different oil stations that provide benzene products for people at Waset governorate with a mean year for work duration 1 to 20 years, 8 hours of work as a mean per day.

A haemoglobin (Hb) concentrations as well as white blood cells count (W.B.Cs) and platelets count (Plt) were well observed to evaluate the effect of benzene on these parameters. Results showed that workers in oil stations indicated normal values for haemoglobin 13.2 and white blood cells (5640 cell/cmm) and platelets 261000 during the first 10 years of work.

As the duration of work progresses, results indicated that there was a gradually reduction in all parameters.

### Introduction

Air toxicants are generally defined as air pollutants known or suspected to cause serious health problems, serious health effects including cancer, birth defects, lung damage and nerve damage [2].

Although benzene is a naturally-occurring chemical, found in crude petroleum at levels of up to 4 g/liter, almost all the benzene found at ground level comes from human activities. It is produced in extremely large quantities worldwide (14.8 million tons) and emissions arise during the processing of petroleum products, in the coking of coal, during the production of toluene, xylene and other aromatic compounds, and from its usage as a component of petrol and in other consumer products as a chemical intermediate. The distribution to fatty tissue is reflected in the toxic effects of benzene, extremely high concentrations which may cause narcotic or anesthetic effects and deaths of workers, have been recorded after exposures to concentrations of several

thousand ppm. Very high levels of exposure (over 5000 ppm) on repeated occasions have led to the development of severe and sometimes fatal damage to the blood-forming elements of the bone marrow, preventing the manufacture of essential blood cells [6,7]. Such serious consequences are not a risk associated with exposure to the concentration of benzene observed in ambient air and will not occur in workers except as a result of unforeseen and accidental exposure to very high concentrations. Benzene is a hematopoietic toxin (benzene is toxic to the blood and blood forming organs) leukemia is of most concern for human health [8], in particular, several types of leukemia known collectively as non-lymphocytic leukemia's (or myeloid leukemia's). Also benzene or its derivatives cause chromosomal aberrations in humans and laboratory animals and such chromosomal re-arrangements are relevant steps in the carcinogenic process.

Several types of neoplasm have been reported to be associated with benzene exposure in rats and mice after oral dosing or inhalation exposures. These tumors were primarily of epithelial origin (e.g. liver, mammary gland, nasal cavity) Lymphomas and leukemia's were observed less frequently in rats and mice [5].

The earliest report for toxic effects of benzene was frank blood disease; this is resulted from heavy occupational exposure to benzene. The reported diseases included leucopenia (decrease in white blood cells count), anemia (decrease in red blood cells count), thrombocytopenia (decrease in platelets count), and pancytopenia (decrease in all blood contents counts) and a plastic anemia [9].

The studies also showed that females which had been occupationally exposed to benzene suffered from a decrease in the size of the ovaries as well as menstrual problems. Some studies, although not yet conclusive, had also suggested that the high level exposure to the chemicals like benzene could also affect the fertility of women; some women who breathed high levels of benzene for many months had irregular menstrual periods and a decrease in the size of their ovaries. It is not known yet whether benzene exposure affects the developing fetus in pregnant women or fertility in men [10].

The studies on animals had shown a low birth weights, delayed in bone formation, and bone marrow damage when pregnant animals breathed benzene. In animal tests; pregnant animals that were exposed to benzene via inhalation sustained fetus damage including low birth weight, bone marrow problems, and problems with bone formation. Breathing very high levels of benzene can result in death, while high levels can cause drowsiness, dizziness, rapid heart rate, headaches, tremors, confusion, and unconsciousness. Also Eating or drinking foods containing high levels of benzene can cause vomiting, irritation of the stomach, dizziness, sleepiness, convulsions, rapid heart rate, and sometimes death [6]. Additionally, [11] showed that exposing of peoples worked within 1.5 to 72 months consequently (average: 14 months ) have different types of disorders such as leukopenia, agranulocytosis, anemia, pancytopenia, aplastic anemia (AA), myelodysplastic syndrome (MDS), and leukemia

## Material and Methods

### - Samples

Sixty males working in different oil stations that provide benzene product for people in Waset governorate with a mean years of work durations 1-20 years , working 8 hours / day as a mean . on the other hand 60 males were used as a controls from the same governorate who never work in this field

### - blood analysis :

#### a- Hb

This test is based on the reaction between haemoglobin in RBCs with Drabkins solution. It acts by converting haemoglobin to cyanomethmoglobin and then measured by haemoglobin meter [12].

#### **b-White blood cells count**

0.02 ml of blood is mixed with 0.4 ml glacial acetic acid that causes RBCs and platelets break down, keeps white blood cells intact, then transfers to Neubour chamber and left it for 1-2 min for the WBCs to settle down, then counts the WBCs on the four square under low power objective lenses [13].

#### **c- Platelets count**

Blood is mixed with diluents which has the ability to haemolyze red corpuscles and preserve platelets in proportion sufficient to the relatively large number of platelets to be countable.[13]

- statistical analysis

statistical analysis was performed to compare two different groups by using ANOVA-test [14]

## **Results and Discussion**

Table (1) shows that workers in oil stations indicated normal value for the haemoglobin concentration 13.2 g% and white blood cells 5640 count / cmm and for the platelet was 261000 count / cmm at the first 10 years from work.

And as the duration of the work progresses; results indicate that there was a decrease in the haemoglobin concentrations (11.7), white blood cells (2910) and in the platelet count (1333000).

As the work duration progresses up to 20 years of work, result indicated a decrease in the haemoglobin concentrations (9.9), also there was a decrease in the value of WBCs (2840); as well as the platelets count (132600).

It is well known that Phenol, hydroquinone, catechol, and benzene oxide are the major derivative of benzene [15]. The metabolism of benzene initially involves the formation of hydroxylated benzenes. Only small amounts of ring-opened metabolites are formed due to the stability of the aromatic ring. The enzymes catalyzing these hydroxylations are the mixed function cytochrome monooxygenase enzymes, which are found predominantly in the liver, but also in the bone marrow, which is the putative target organ of benzene toxicity. The oxidizing moieties produced by the enzymes probably involve a cascade of reactive oxygen species, including free radicals. These reactive oxygen species may contribute to benzene-induced cell damage. The substitution of hydroxyl groups onto the benzene ring proceeds by at least two pathways: an indirect pathway through an epoxide intermediate and a direct pathway involving direct insertion of hydroxyl groups. Both pathways appear to proceed through an enone intermediate. The hydroxylated benzenes can undergo conjugation reactions to form glucuronides and sulfate esters [15,16], or can be further oxidized to benzoquinones. The benzoquinones are probably the electrophilic species which covalently bind to macromolecules including DNA, and therefore may be the ultimate carcinogenic forms of benzene [17]. Also research indicated that DNA damage (as examined with the single-cell gel assay for single-strand breaks) was detected in peripheral blood cells, bone marrow and liver in mice exposed to benzene at 900 mg/m<sup>3</sup> [18,19].

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**Table (1): the relationship between duration of works and haemoglobin concentration for oil stations workers**

Duration of work ( years )	Hb concentration (g%) mean $\pm$ SD	
	Workers	Control
1_10	13.2 $\pm$ 1.398	14.4 $\pm$ 0.894
11_20	11.7 $\pm$ 0.949	14.4 $\pm$ 0.894
20_	9.9 $\pm$ 0.994	14.4 $\pm$ 0.894

**Table (2): the relationship between duration of works and white blood cells count for oil stations workers**

Duration of work ( years )	WBCs count/cmm mean $\pm$ SD	
	Workers	Control
1_10	5640 $\pm$ 884.685	5980 $\pm$ 807.465
11_20	2910 $\pm$ 703.088	5980 $\pm$ 807.465
20_	2840 $\pm$ 1863.807	5980 $\pm$ 807.465

**Table (3): the relationship between duration of works and total platelets count for oil stations workers**

Duration of work ( years )	Platelets count / cmm mean ± SD	
	Workers	Control
1_10	261000± 73249.953	189000 ± 34351.12807
11_20	133000± 30568.684	189000 ± 4351.12807
20_	132600± 37500.222	189000 ± 34351.12807

## تأثير مادة البنزين المستعمل في محطات الوقود في نسب بعض المعايير الدمية للعاملين فيها

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### الخلاصة

تعد مادة البنزين من المواد الكيميائية الهيدروكربونية السائلة في درجات الحرارة الاعتيادية وهي سريعة الانتشار والتبخر والاحتراق ولها قابلية ذوبان في الماء بمعدل 1.5 غرام باللتر في 20 درجة مئوية ، كما ان لها قابلية الذوبان في بعض المذيبات العضوية .

ان الاستنشاق طويل الامد لمادة البنزين يعد مسببا رئيسا لامراض الدم بسبب تأثيره على نخاع العظم مسببا فقر الدم والنزف ، كما انه يسبب دمارا في الجهاز المناعي و الوراثة ، وهو من المسببات الرئيسية لسرطان الدم (اللوكيميا) الذي لوحظت اعراضه في العاملين بتماس مباشر مع هذه المادة [5] حسب تقرير منظمة حماية لبيئة لذلك تمت هذه الدراسة لمعرفة تأثير هذه المادة على بعض مكونات الدم ( تركيز الهيموكلوبين و كريات الدم البيض والصفائح الدموية).

تضمنت الدراسة عاملأ في محطات لوقود في محافظة واسط ، قسم العمال الى ثلاث فئات حسب سنوات الخدمة ، وبمعدل 8 ساعات عمل يوميا .

اظهرت النتائج ان قيم تركيز الهيموغلوبين وكريات الدم البيضاء و اعداد الصفائح الدموية كانت طبيعية في الاشخاص التي تراوحت فترة عملهم بين 1-10 سنوات ، في حين اظهرت النتائج انخفاضا في القيم كلما زادت سنوات لخدمة .