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ORIGINAL ARTICLE

Screening of major endocrine disorders among stations of oil products distributions in Basrah city, Iraq.

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Abstract

Background: Gasoline poses a threat to the public health, in general, and gasoline station workers, in particular. Cardiometabolic syndrome is a very common health problem among gasoline station workers throughout the world. In spite of its significance, few health assessments studies (if any) are available exploring the health risk effects of gasoline in relation to occupational exposure in Iraq. Trying to fill this gap, the present study aimed to evaluate health risk effects of gasoline on gasoline station workers in Iraq.
Methods: The study population (N=134) was composed of randomly selected male gasoline pump workers (N=83) in Basrah, Iraq. Unexposed healthy individuals (N=51) without any systemic or mental illness were used as a control group. Body mass index (BMI), blood pressure, and blood glucose level were measured in both groups.
Results: The results indicated that the BMI, blood pressure, and blood glucose levels were significantly higher among gasoline station workers in comparison to those in the control group.
Conclusion: Based on the results, it can be claimed that exposure to gasoline could increase the potential risk of many disorders such as metabolic syndrome, high blood pressure, and elevated blood glucose level. It is highly recommended to consider preventive measures that protect gasoline station workers from such health threats. In addition, learning about the importance of wearing gloves, special coats, and face mask is believed to considerably reduce the risk of getting involved with such health problems.

Keywords: workers, gasoline, blood glucose level, blood pressure.

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INTRODUCTION

Gasoline is a liquid mixture composed of saturated and unsaturated hydrocarbons (1). More than 150 chemical substances are found in gasoline such as benzene, toluene, lead, oxygenates, ethylbenzene, and 3 isomers of xylene (1, 2). These compounds can bring about potentially hazardous effects on the environment and human being. Human exposure mostly occurs via airways and skin which causes a multiorgan intoxication, particularly in chronic occupational exposure with low concentrations. Various toxicological health problems including endocrine disorders, cancers, and neurological disorders are attributed to acute and/or chronic exposure to these compounds (3, 4). Acute benzene toxicity caused by occupational exposure could induce narcosis, dizziness, drowsiness, confusion, tremors and loss of consciousness, and irritation to the eye and skin (5-9). On the other hand, chronic exposure to gasoline compounds is associated with multiple pathologies like gastrointestinal diseases, liver disease, genitourinary tract diseases, endocrine diseases, and cardiovascular diseases (7). Several kinds of human cancers, including acute myeloid leukaemia, chronic myeloid leukaemia, and multiple myeloma are also reported with chronic exposure to gasoline. Likewise, aplastic anemia caused by reduced production of red/white blood cells from bone marrow has been noticed with benzene chronic toxicity(1).

Furthermore, cardiovascular and endocrine disorders are very common health problems associated with long-term exposure to gasoline, which could be related to carbon monoxide toxicity (10). in a similar manner, people with ischemic heart disease are at special risk of developing signs and symptoms of heart attack due to the decreased coronary artery blood flow (1, 10). The incidence of arterial hypertension is significantly higher in workers who are exposed to high levels of benzene and xylene in their workplaces (11). Chronic exposure to gasoline compounds causes serious damages to the homeostasis cardiovascular systems(1), leading to disturbances in blood pressure. On the other hand, obesity and diabetes beside other endocrine

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disorders are potentially induced by endocrine-disrupting chemicals found in gasoline. The most common endocrine-disrupting chemicals found in gasoline are Polychlorinated Biphenyls (PCBs), which are chlorinated compounds used as coolants and lubricants(12). PCBs are toxic to multiple organs including liver and thyroid and are linked to increased incidence of obesity and diabetes in people with long-term contact with these compounds (11, 13).

Basrah is the largest industrial city in Iraq of about 5 million inhabitants. Public vehicles are the most frequently used form transportation in this city and their numbers have significantly increased in the last ten years. In Iraq, vehicles are refueled with lead replacement petrol, unleaded petrol, or sulphur diesel. Everyday hundreds of people who work at Basrah's gasoline stations are in direct contact with gasoline, which noticeably increase the risk of exposure to the components of gasoline. Employees' exposure most likely happens during the pouring of gasoline(1). Although gasoline pump workers in Iraq are at a very high risk of developing adverse health effects, to the best of researcher's knowledge, there are no health risk assessment studies focusing on this group of workers. Motivated by this backdrop, this research study aimed to investigate the existence of a site-specific relationship between adverse health effects and exposure to gasoline in gasoline station workers in Iraq. More specifically, this study provides valuable insights about the potential risk of gasoline exposure and developing various health issues among employees working in gasoline station.

METHODS

Research Design and Subjects of the Study

The present study was carried out in a period that lasts from November 2017 to April 2018. The target subjects of study were composed of a randomly selected group of 83 male gasoline pump workers (exposed group) distributed over 19 gasoline stations in Basra city, Iraq. 51 unexposed healthy individuals without any systemic or mental illness whose age was above 15 years old together with sex matched groups were considered as control group. The exposed group included smokers and non-smokers, workers with or without disease and/or drug history with occupational experience of more than 6 months. It is also essential to note that the current study was approved by the local ethical committee in the pharmacy college, University of Basrah. Additionally, the aim of the study was explained to the participants and a written informed consent was obtained from them.

All the subjects in the study groups were given a questionnaire which included questions about age, sex, daily work times, routes of exposure, disease history, drug history, and smoking habits as shown in the table (1)

Table 1. Questionnaire of the Study

Name					
Number					
Work location					
Age	15-30	30-45		>45	
sex					
race					
weight					
height					
Possible routes of exposure	skin	inhalation		other	
Daily work times(hours)					
Exposure periods (years)					
Disease history	H.T.	D.M.	Thyroid disorder	Asthma	Others
time					
Drug history					
Current smoking habits					
Alcohol consumption					
Systolic blood pressure					
diastolic blood pressure					
Random blood glucose					
BMI					

Parameters Measured in the Study

BMI Measurement

The weight of each subject was measured by a regular spring weighing scale and the height was measured by a regular measuring tape. Body Mass Index (BMI) was measured depending on weight and height of each individual using the BMI equation:

BMI = weight / height(m)^ 2

Blood Pressure Measurement

Blood pressure was measured in mmHg by a cuff attached to the right arm and joined to an automatic sphygmomanometer (Citizen, Japan). A suitable sized cuff was fitted carefully around the upper arm so that the lower edge of cuff lies 2.5 cm above the antecubital fossa. Squeeze bulb was held in the right hand and the valve screw was closed with thumb and index finger. Then the cuff was inflated until 180 mmHg reading then the air was allowed to escape slowly from the cuff by partial opening of the valve. Once systolic and diastolic pressure readings were obtained the valve was opened to deflate the cuff completely.

Random Blood Glucose Measurement

Blood glucose (mg/dl) level was measured using a glucometer (ACCU-CHEK, Germany). Participants' fingertips were picked with sterilized lancets and fingers were squeezed to get a blood drop on the strip on the meter to be ready for testing and the result were displayed after 5 second

RESULTS

The demographic information of the participants along with the time of exposure to gasoline are reported as what follows: all the participants are males; their age is 15 years and older; the height is almost similar between groups; workers in the experimental group have a greater weight than those in the control group (Table 2).

Chronic exposure to gasoline compounds induces serious damages to the homeostasis of cardiovascular systems, resulting in elevated blood pressure. Cardiovascular disorders are relative signs of carbon monoxide toxicity (1). We were interested in examining blood pressure in gasoline stations workers to identify whether these workers are at higher risks of developing high blood pressure or not. We used an automatic sphygmomanometer for this purpose. In the end, we found that there is a significant increase in the systolic blood pressure (SBP) in the individual workers in the experimental group 130.8 ± 0.6427 compared to the control 123.6 ± 0.6489 (Figure 1). In contrast, no significant differences were identified in the diastolic blood pressure of station's workers 83.18 ± 0.5478 in comparison to the controls 82.02 ± 0.4808 (Figure 1). These data suggest that chronic exposure to gasoline and its components is a crucial risk factor in developing high blood pressure and, potentially, other cardiovascular diseases.

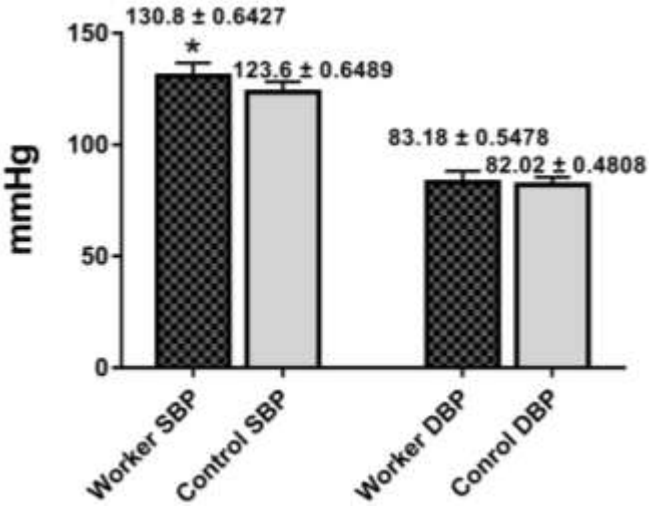

Figure 1. Systolic and Diastolic Blood Pressure in Workers and Control Groups (N=152). Analysis of Variance: * Significantly Difference Compared To Control Group (P<0.05). SBP: Systolic Blood Pressure; DBP: Diastolic Blood Pressure.

It has long been argued that endocrine-disrupting chemicals components of gasoline are toxic to the human being endocrine system, resulting in endocrine disorders such as obesity and diabetes. Chronic exposure to these chemicals is highly associated with increased incidence of obesity and diabetes(12). Therefore, we investigated blood glucose level and BMI in gasoline station workers and compared this to the participants in the control groups. Analyzing the obtained data, it was found that the blood glucose level is significantly higher in gasoline station workers (165 ± 1.945) compared to the control group (150.2 ± 2.889), as shown in Figure 2. Moreover, it was observed that there is a significant increase in BMI in the workers group (27.77 ± 0.3382) in comparison

Table 2. The Demographic Characteristics of Participants against the Status of Time of Exposure to Gasoline

Characteristics of participants	Workers (n=100)	Control (n=52)
15-30 years	60	29
30-45 years	36	18
>45 years	4	5
Height (Average)	174.7±5.98	174.9±6.63
Weight (Average)	85.88±9.46	74.58±10.09
Sex	Male	Male

to the non-workers group (24.29 ± 0.4163), as shown in Figure 3. Hence, the findings of the present research demonstrate that working in gasoline stations could represent a potential threat to the normal function of endocrine system, which in turn, puts workers in these places in a higher danger of susceptible metabolic disorders.

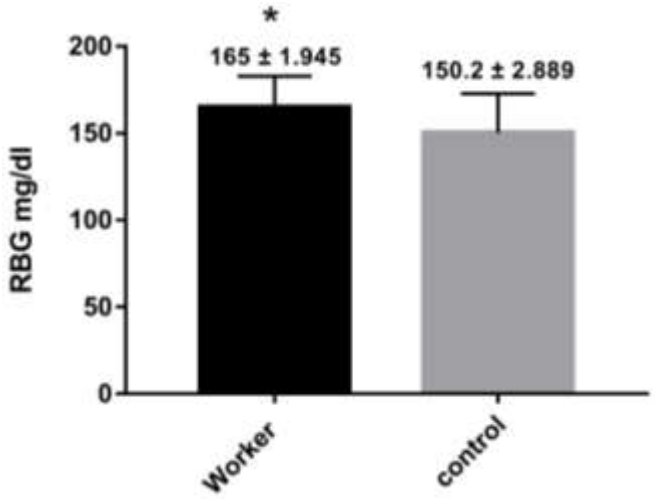

Figure 2. Random Blood Glucose (RBG) in Workers and Control Groups (N=152). Analysis of Variance: * Significantly Difference Compared to Control Group (P<0.05).

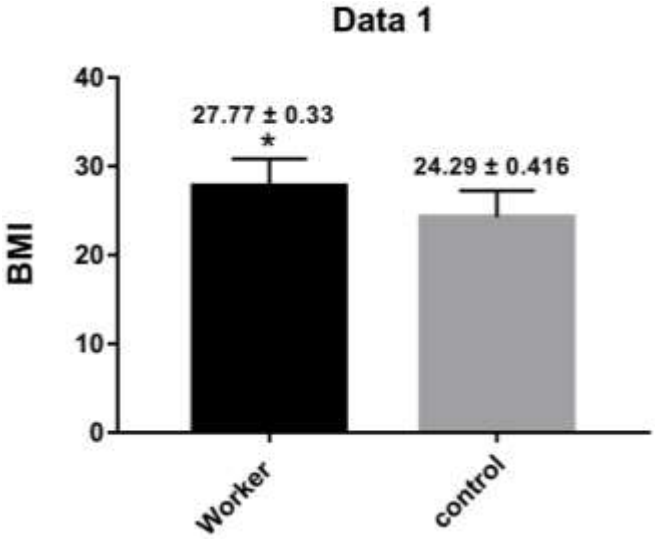

Figure 3. Body Mass Index (BMI) Levels in Both Workers and Control Group.
* Significantly Difference Compared to Control Group (P<0.05).

DISCUSSION

Automobile exposure represents a serious threat to the health, in particular, for people with direct and/or continuous exposure. Gasoline station workers are at a special risk for toxicity with gasoline and its composed components. The major health issues that such workers could face are cardiovascular disease and diabetes mellitus. In this study, we evaluated the body weight, blood pressure, and blood glucose level in gas station workers at Basrah city, Iraq. We observed that such workers are more prone to cardiometabolic disorders, an effect most likely related to continuous direct exposure to the benzene byproducts. Therefore, it is highly recommended to use more effective tools in order to protect those workers against such health issues. It was found that the risk of atherosclerosis and other cardiovascular diseases could be increased with increased exposure to gasoline vapors. High level of lead, xylene, toluene, and benzene in gasoline is the potential underlying cause of such health issues (14). Although the precise molecular mechanisms behind these effects is not entirely clear, research has suggested that bioactive gasoline metabolites could trigger an imbalance between oxidant and antioxidant states through generating more reactive oxygen species, which are known to induce lipid peroxidation and increased oxidative stress(15). These effects lead to the development of atherosclerosis and cardiovascular disease (16). In addition, lead enhances low density lipoprotein (LDL), peroxidation, and cardiovascular disease via inactivation of paraoxonase, an inhibitor of LDL oxidation (17). Moreover, in this study it was identified that the incidence of arterial hypertension was significantly increased in workers who were exposed to benzene and xylene in their workplace (11). Similarly, both preeclampsia and hypertension in pregnant women were highly related to solvent exposure (18). Here, we found that blood pressure is significantly raised in gas station workers in comparison to the healthy controls. This is in line with what has been previously reported by other researchers (19). As mentioned earlier, this health impact is probably associated with direct and continuous exposure to the organic components of gasoline that those workers experience in their workplace.

This study also revealed that gasoline station workers are at higher risks of developing diabetes mellitus. We found that incidence of diabetes mellitus is significantly higher in those workers in comparison with healthy controls. These findings are in tune with previous reports which showed that glucose values are markedly higher at this kind of workers (13). Moreover, we noticed that the BMI is significantly higher in gas station workers compared to healthy controls. Research has shown that there is a strong relationship between metabolic disease and insulin resistance, albeit the exact mechanism is not fully understood. The aetiology of metabolic syndrome is multifactorial and environment and genetic are important in the progression of this pathology (20). Occupational exposure to volatile petrochemical materials and organic solvents probably plays a significant role in inducing metabolic syndrome due to liver dysfunction (21, 22). Organic solvents cause triphasic response in insulin levels depending on the period of exposure (23). Research has also suggested that there is an inverted U-shaped relationship between the accumulated solvent exposure over lifetime and the blood glucose value (13).

Exposure to gasoline could increase the potential risk of many disorders such metabolic syndrome, high blood pressure, elevated blood glucose level, and obesity in addition to many other diseases. Although developing these health issues is affected by many other factors, gas station workers

are at a special risk due to their direct and continuous exposure. In this study, we found that the BMI, blood pressure, and blood glucose level are significantly higher at those workers in comparison with healthy controls, suggesting toxic effects induced by gasoline and its components.

LIMITATION

One of the limitations that the current study suffered from was that measuring blood concentrations of benzene or other toxic compounds in gasoline among station workers was a really difficult task for the researcher due to the limited sample of the study.

CONCLUSION

According to the obtained results, it can be concluded that exposure to gasoline could increase the potential risk of many disorders such metabolic syndrome, high blood pressure, elevated blood glucose level, and obesity in addition to many other diseases. Although developing these health issues is affected by many other intervening factors, gas station workers are at a special risk due to their direct and constant exposure. In this study, it was found that the BMI, blood pressure, and blood glucose level are significantly higher in gasoline station workers in comparison to healthy controls, suggesting toxic effects induced by gasoline and its components. Based on the findings and the data collected from different parts of the world, it is crucial to consider preventive measures that protect not only this kind of workers but also large public. Such measures may include training workers as to the importance of personal hygiene and the risks of exposure to gasoline and its components. Additionally, learning about the importance of wearing gloves, special coats, and face mask is expected to extremely reduce the risk of developing health issues.

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