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Effects of Gasoline on Blood, Kidney and Liver Parameters of Unregulated Gasoline Traders

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ABSTRACT

Environmental and occupational studies are necessary for managing risk in exposed humans. Although hazardous effects of gasoline were initially considered in occupational settings, the current study aimed to explore the effects of gasoline on blood, kidney and liver indices in unregulated gasoline traders. The case group was gasoline traders who directly exposed to the gasoline compounds. The data were collected through a medical assessment and obtaining a 10 ml venous blood sample. Complete blood count, blood urea nitrogen (BUN), creatinine (Cr), aspartate aminotransferase (AST), alanine aminotransferase (ALT), and alkaline phosphatase (AP) were tested. The hemoglobin, hematocrit, mean corpuscular hemoglobin concentration, BUN, AST, ALT, AP levels were higher in the exposed group. However, the Cr level was significantly lower in the exposed group compared to the non-exposed ones. Most of parameters were significantly different between two groups. Proper controlling and training may limit the burden of future chronic disorders costs at risk populations.

Keywords: Adverse effects; Blood parameters; Liver function; Petrol

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INTRODUCTION

The most common routes of gasoline or petrol human exposure are through inhalation and ingestion. A variety of local or systemic problems occurs through exposure to gasoline contamination. Skin and eye irritation, narcosis, pneumonitis, atelectasis, abdomen pain, renal failure, cardiac arrhythmias, cardiac arrest, disseminated intravascular coagulation, convulsions, coma and sudden death may occur after an acute exposure [1]. In addition, leukemia, aplastic anemia, and chromosomal aberrations are reported in chronic exposure [2]. Gasoline components are known as carcinogen [3,4]. Nevertheless, no risk of cancer reported from short-term or occasional exposures [1].

The blood, liver, and kidneys are the major organs, which are affected by gasoline compounds. Anemia, liver cancer, and renal failure related to the gasoline component exposure have been reported in a number of studies [5,6]. However, some studies did not find a significant association between liver cancer and gasoline exposure [7].

Exposing to gasoline components is increasing in the border of some of the Middle East countries such as Iran, Pakistan, Afghanistan, and Iraq where people collect and trade gasoline as an unregulated job. They directly exposed to gasoline components through inhalation, skin contamination and occasionally accidental ingestion when sucking on a pipe to remove gasoline from vehicle fuel tanks. They are unaware of long-term risk exposure. Therefore, environmental and occupational studies are necessary for managing risk in exposed humans [7]. Although hazardous effects of gasoline were initially considered in occupational settings, the current study screens the changes in blood, liver, and kidney parameters in unregulated gasoline traders who had direct inhalation, ingestion and dermal exposure.

MATERIALS AND METHODS

Study design and participants

This case-control study was conducted in Zabol, Iran from January to April 2012. A purposeful sampling method was applied to collect the data from the study populations. The researchers visited the samples along the streets, where they traded gasoline, and invited them to a laboratory center for data collection. The total sample size was 300 men. Of them, 150 were included as case group. They were unregulated gasoline traders in the streets or roads around the gas stations. The traders sucked at a pipe to remove the gasoline from the vehicle fuel tanks and collect it in an unsafe plastic container without tight seal. They usually transported the collected gasoline with their own cars, and restored them at homes. The main direct sources of exposure were included inhalation, accidental ingestion, and skin contact, which were of gasoline evaporation from the fuel tank of cars and the loose seals of plastic containers. The control group, 150 people, did trade neither gasoline nor work in the oil industry. The inclusion criteria were no past medical history of chronic diseases, including diabetes, hepatitis, renal failure, and blood disorders, no using a specific medicine, no smoker, and no alcohol consumptions. The case group must also be involved in the job at least 6 hours a day for 6 months. Besides, gas station workers, oil workers, and mechanics were excluded from the study.

Study variables

Demographic data, including age, job duration (year) and working time (hour/day) were collected through a physical assessment. Ten ml venous blood was taken for the laboratory tests in the mornings. The complete blood count (CBC), creatinine (Cr), blood urea nitrogen (BUN), aspartate aminotransferase (AST), alanine aminotransferase (ALT), and alkaline phosphatase (AP) levels were tested using Sysmex KX-21N hematologic analyzer, made in Japan, and GT 3500, made in Italy. In order to confirm the reliability of the tests, some of the samples were double-checked in another laboratory.

Ethical approval

The ethical approval was obtained from the Ethics Committee of the university. The purpose of the study was explained to the participants and an oral & written consent was achieved before data collection.

Data analysis

A logistic regression was applied using the SPSS 22 to calculate the odds ratio for the study parameters. The p-value was set at 0.05 and the confidence interval at 95%.

RESULTS

Of 300 men who participated in the current study, 150 were exposed directly to the gasoline and the remaining 150 were non-exposed. Of the exposed group, three persons were excluded because of hepatic problems prior to trading gasoline. There was no significant difference in the average age of exposed and non-exposed groups (32.83 ± 8.17 Vs. 30.74 ± 8.54; *P* =.992). The average exposure time was 6.81 ± 1.83 years with an average of 10.90 ± 2.08 hours/day.

The most common symptoms in the exposed group were coughing (71.1%), throat problems (57.1%), and skin itching (22.4%). However, nobody complained of any notable symptoms in the case group.

Table 1 shows the level of RBCs (Odds Ratio: *OR*= 1.30, 95% Confidence Interval: *CI* (1.30, 16.67); *P*=.018), Hb (*OR*: 9.51; 95% *CI*: 1.19, 76.03; *P*=.034), HCT (*OR*: 8.22; 95% *CI*: 1.85, 36.62; *P*=.006), and MCHC (*OR*: 1.93; 95% *CI*: 1.26, 2.95; *P*=.003) indices were significantly higher in the case group compared to the control ones. In addition, the level of BUN (*OR*: 2.98; 95% *CI*: 1.34, 6.66; *P*=.008), AST (*OR*: 3.65; 95% *CI*: 2.27, 5.85; *P* <. 001), ALT (*OR*: 4.49; 95% *CI*: 2.70, 7.48; *P* <. 001), and AP (*OR*: 15.64; 95% *CI*: 7.43, 32.94; *P* <. 001) were higher in the exposed group. However, the WBC (*OR*; 85; 95% *CI*: .75, .95; *P*=.005), and Cr (*OR*: .36; 95% *CI*: .22, .59; *P* <. 001) levels were significantly lower in the exposed group compared to the control ones.

DISCUSSION

The current study investigated exposure to gasoline vapor for a long time. The people, who traded gasoline as an unregulated job, were directly exposed to gasoline through inhalation, skin contamination and occasionally accidental ingestion when sucking on a pipe to remove gasoline from car fuel tanks. This unregulated job is currently being common in the border of less-developed areas of the Middle East countries such as Iran, Iraq, Pakistan, and Afghanistan or in regions with internal war.

The medical history and physical assessment showed that coughing, throat problems, and skin itching were the most common symptoms in the exposed group. The long-term exposure to gasoline vapors could be a potential risk factor that can trigger the mouth and oropharyngeal cancers. The prevalence of complaining symptoms was in line with the previous studies of human and animal samples [8].

Table 1. The odds ratio, mean (standard deviation) of laboratory tests in case and control groups

Variable	OR (95%CI)	P-value	Case (n=150) Mean (SD)	Control (n=150) Mean (SD)	P-value	95%CI
$WBC_{cells/\mu L/cu\ mm}$	.85 (.75, .95)	.005	6.37 (1.89)	7.02 (2.07)	.005	-1.09, -.19
$RBC_{million/\mu L/cu\ mm}$	1.30 (1.30, 16.67)	.018	4.99 (.73)	4.82 (.64)	.031	.02, .33
$Hgb_{g/dl}$	9.51 (1.19, 76.03)	.034	15.17 (2.04)	14.33 (1.47)	$\leq$ .001	.42, 1.23
$HCT_{\%}$	8.22 (1.85, 36.62)	.006	44.03 (7.57)	41.90 (4.10)	.003	.74, 3.48
$PLT_{/mL}$	1.00 (.37, 2.66)	1.00	247.54 (75.69)	250.73 (60.48)	.688	-18.45, 12.69
MCV_{Cuum}	.94 (.48, 1.84	.865	87.58 (8.09)	90.77 (27.79)	.182	-7.87, 1.42
$MCH_{Pg/cell}$	1.69 (.91, 3.13)	.097	30.59 (3.22)	30.14 (2.45)	.177	-.23, 1.07
$MCHC_{g/dl}$	1.93 (1.26, 2.95)	.003	34.89 (1.33)	36.37 (25.25)	.477	-5.57, 2.56
$BUN_{mg/dL}$	.36 (.22, .59)	<.001	12.18 (3.39)	10.97 (3.55)	.003	.41, 1.98
$Cr_{mg/dL}$	2.98 (1.34, 6.66)	.008	.51 (.21)	.65 (.24)	$\leq$.001	-.18, -.08
$AP_{IU/L}$	15.64 (7.43, 32.94)	<.001	389.87 (280.35)	223.64 (49.41)	$\leq$.001	120.27, 211.03
$AST_{IU/L}$	3.65 (2.27, 5.85)	<.001	42.52 (39.38)	22.02 (8.05)	$\leq$.001	13.82, 26.63
$ALT_{IU/L}$	4.49 (2.70, 7.48	<.001	32.42 (47.75)	19.33 (10.41)	.001	5.00, 20.57

The changes in the blood cell count, kidney and liver parameters were the other important findings in the exposed group. The RBCs, Hb, and MCHC indices were significantly higher in the exposed group compared to the control ones. Although the findings were statistically different in the exposed and non-exposed groups, they were in normal ranges and did not show any other severe sign and symptoms. This may indicate a need for a longitudinal follow up at risk populations because the gasoline compounds affect bone marrow and blood components, which resulting in an acute leukemia in the exposed people [1,2].

Investigating the renal function indices, the levels of Cr and BUN were significantly different between the exposed and non-exposed groups. The Cr was lower, but the BUN was higher in the case group in comparison with the control ones. The BUN and Cr levels fluctuate in exposed to gasoline vapors [9], but renal failure is inevitable lately [6]. Gasoline inhalation and ingestion increase the kidney weight of the rates in a short period and pathological changes occur in a long-term exposure [9]. However, Lohi [10] did not find a significant association between estimated occupational exposure to gasoline and solvents and risk of Renal Cell Cancer. Although, there is not a consensus in previous studies on the effects of gasoline component of renal diseases, the Cr level may designate a possible onset of renal disorder in the exposed group. The higher level of BUN in the exposed group signified a higher intake of exogenous proteins.

Liver tests, including AST, ALT and AP were significantly higher in the exposed group compared to the non-exposed ones. The risk of gasoline vapors is controversial, some researchers reported that pathological changes in liver tissue and an increased risk for cancer [8,12], whereas Lindbohm did not find a relationship between gasoline vapor exposure and liver cancer [13]. We also did not find evidence of severe problems in the current study group.

Although the findings of the current study are not clinically significant, they indicate important changes that require a longitudinal study to find the impacts of prolonged exposure to gasoline vapors at risk populations. The findings of current study could be a basis for investigating the risk effects of gasoline components in societies where unregulated gasoline trade is prevalent and people are unaware of the long-term effects of the hazard. The message must be transferred to occupational health professions, trades, and people. The governments must be banned this unhealthy trade in the cities and controls should all be addressed. However, the results of the present study are limited to the blood, kidney and liver tests through a blood sample. Exposure assessment was based on participants' reports, which is inaccurate. Further relevant assessment and diagnostic approaches such as ultrasonography, histopathological evaluation, and measurement of gasoline components, i.e., benzene recommended to find out changes in the body systems as needed.

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