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Original Research Article

Trace elements disturbance and Liver toxicity in Sudanese Fuel Stations Workers

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Abstract: Workers in benzene stations are more susceptible to hepatotoxicity. This study was aimed to assess serum levels of trace elements and liver enzymes activity as indicator of hepatotoxicity in benzene station workers. In a matched case control study conducted in Khartoum State -Sudan during the period from October 2015 to January 2016. After signing written informed consent blood specimen was collected from 50 individual working in petrol station as case group and 20 healthy individuals not working in petrol station as control group aged from (20-50) years and serum levels of AST,ALT.GGT activity and Copper and Zink was measured using spectrophotometrical and atomic absorption methods. Data were collected using structural questionnaire. Data analysis was carried out by means of statistical package for social science (SPSS version 16). The mean level of Copper and Zinc was significantly decreased in comparison with control group ($p < .05$). There was no significant correlation of serum level of trace elements zinc and copper with duration, BMI, AST, ALT, and GGT activities. Working in petrol station is associated with decreased level of copper and Zink however the disturbance in these trace elements dose not correlated with abnormalities in liver enzymes.
Keywords: Fuel station, zinc, copper, liver enzymes, Sudanese

INTRODUCTION

Human in contact with petroleum products a ways in regular life needs as they are parts of many materials on consumption needs, the more affected individuals are those in direct contact with these products are individuals in work positions make easy direct exposure, as workers in petrol stations, petrol products enter the body though breathing from air; swallow in water, food, or through touching. Most components can enter the blood stream rapidly when inhaled. When touch petrol compounds, the absorption is more slowly and to a lesser extent than when breathe or swallow them. Most of petrol compounds leave the body through urine or when exhale air containing the compounds [1]. The aromatic hydrocarbons , such as benzene , that found in gasoline along with other additives are reported to be carcinogenic due to free radicals reactive oxygen species (ROS) and reactive nitrogen species (RNS) [2]. Trace elements are micro-nutrients present at very low concentrations in body fluids and they are essential to sustain life [3]. A number of trace elements have antioxidant effect and protect cells from damage [4, 5]. The balance between these antioxidant and rate of free radicals levels are reported to be essential factor in the degree of tissue damages [6, 7]. Zinc and Copper are essential trace elements that forms metalloprotiens enzymes and have antioxidant effect [8]. These metalloenzymes perform antioxidant activities are dependent on trace elements to function effectively. The copper and zinc forms Cu/zn forms dimmers of superoxide dismutases (Cu, Zn-SOD) which provide protection against uncontrolled free radicals reactions in different body tissues including hepatocytes [9].

Liver enzymes activities measurements are useful tests in the evaluation and treatment of patients with hepatic dysfunction [10]. Serum level of liver enzyme s increased according to the damage of the liver cell .these enzyme include transferase enzymes ,aspartate transferase (A ST), alanine transferase (ALT), alkaline phosphatase (ALP) and gamma-glutamyltranspeptidase (GGT). Alkaline phosphataseis most frequently measured indicator for liver bile ducts disease .AST and ALT enzymes frequently appear in the serum following liver cell injury or sometimes in smaller amounts from degraded cells. Gamma-glutamyltranspeptidase (GGT) is a common biomarker of liver injury. Elevated liver enzymes may indicate inflammation or damage to cell in the liver [11-14].

Recent studies about the relationship between exposure to petrol products and the trace metal status, liver toxicity in gasoline filling workers reported that liver enzymes and serum levels of Cu, and Zn are increased concluding that long term exposure to petroleum products may increases risk of liver toxicity [15]. Other studies performed about Total antioxidant status of copper and zinc levels in rats exposed to premium motor spirit fumes concluded that prolong exposure to PMS fumes might lead to hepatotoxicity, increase in plasma levels of copper and as well as decrease in plasma levels of zinc [2]. Another experimental also showed that frequent exposure to kerosene and petrol fumes may be highly deleterious to the liver cells [16].

This study designed to assess trace elements copper and zinc and liver enzymes, and to find correlation between trace elements levels and liver enzymes activities in gasoline station workers in Khartoum state-Sudan

MATERIALS AND METHODS

This study was done in Khartoum State during the period from March 2014 to October 2014. A total of 50 benzene workers individual as test group and 20 apparently healthy individuals not benzene workers as a control group were recruited for this study. Both groups were age matched. Those, individuals who take medications which can increase liver enzymes and hepatitis patient were excluded from the study. Permission of this study was obtained from to local authorities in the area of the study. An informed consent was obtained from each participant in the study after explaining objectives of the study. Interview and questionnaire was used to collect data. 5 ml of venous blood was collected from each participant. Serum was separated directly from the plain container by centrifugation at (300 rpm) for 5 minutes. Serum levels of Zink, Copper was measured using (atomic absorption spectrophotometer 210-VGP) and enzymes activity were determined using spectrohometrical methods

Statistical analysis was performed using statistical package for windows (SPSS v16). Fisher's exact test was used to assess the categorical variables and student *t*-test or kruskal Walis for continuous variables. Correlation between quantitative parameters was assessed with Pearson correlation test. Data are presented as mean ± standard deviation (SD). *P* value less than 0.05 was considered statistically significant.

RESULTS

Fifty benzene workers for more than three years act as study group and twenty healthy non benzene workers as control group aged from 20-50 years were enrolled in the study. The mean of age per year was (33.06 ± 1.1) and mean of BMI of working in benzene station was (26.03 ± 2.7)

There was significant decrease in serum copper level in benzene workers compared to control group (0.36 ± 0.09 Vs 0.97 ±0 .20 , p < .05) and there was significant decrease in serum zinc level in benzene workers compared with control group(0.22 ± 0.08 Vs 0.61 ±0 .12, p < .05) . However, the activity of the enzymes AST, ALT, and GGT in benzene workers showed no significance difference between two groups (Table 1).

There was no Correlation of serum trace elements zinc and copper with duration, BMI, AST, ALT, GGT in benzene station workers (Tables 2 and 3).

Table 1: comparison of trace elements and liver enzymes activity between benzene station workers and healthy non benzene workers

Parameter	Cases (N= 50)	Control (N= 20)	p. value
Copper (mg/L)	0.36 ± 0.09	0.97 ±0 .20	0.000
Zinc (mg/L)	0.22 ± 0.08	0.61 ±0 .12	0.000
AST (IU/L)	22.18 ±10 .75	20.0 ± 10.9	0.448
ALT (IU/L)	13.64 ±7 .2	13.30 ± 8.1	0.855
GGT (IU/L)	25.54 ± 8.1	23.0 ± 7.5	0.233
Age	33.06 ± 1.1	34.7 ± 1.7	0.433
BMI	26.03 ± 2.7	26.95 ± 3.2	0.225

Table 2: Correlation of serum level of Zinc in benzene station workers with some study variables

Variable	R	P. value
Duration	-0.022	0.877
BMI	0.036	0.805
AST	0.096	0.506
ALT	0.001	0.995
GGT	-0.122	0.400

Table 3: Correlation of serum level of capper in benzene station workers with some study variables

Variable	R	P. value
Duration	0.026	0.855
BMI	-0.119	0.412
AST	0.048	0.741
ALT	0.018	0.901
GGT	0.001	0.994

DISCUSSION

In this study, 50 benzene workers and 20 non benzene workers enrolled and the status of trace elements zinc, copper and liver toxicity was evaluated. Both trace elements were decreased in benzene workers but there were no signs of liver toxicity observed and no association between trace elements alterations and liver enzymes activities.

Previous studies reported that long term exposure to fuel products may causes skin irritations and impairment of lung functions [17, 18]. experimental studies in rats also demonstrated that fuels products may be a risk of hepatotoxicity [2]. The exact tissue damage causative component of fuel product is not determined, but it could be explained by the effect of free radicals reactive oxygen species (ROS) and reactive nitrogen species produced from aromatic hydrocarbons of benzene and gasoline [2] and release of pro inflammatory cytokines associated with many fuel products [19].

Findings of this study showed no signs of liver cells damage in Sudanese fuel service workers, indicated by normal levels of liver enzymes. In recent study [15], liver enzymes were found to be higher in petrol fuel crevice worker but still within accepted normal reference values and this is consistence with our findings. However, some occupational chemical hepatotoxicity due to inducing or inhibiting liver enzymes that play role in biotransformation may not change liver enzymes used to evaluate liver damages [20, 21].

In this study, both trace elements copper and zinc were significantly lower compared to peoples that are not exposed to fuels. These results are consistences with a recent study reported that long to moderate benzene exposed individuals under oxidative stress due to decrease levels of antioxidants, including copper and zinc, in the plasma and red blood cells [22]. In this study, copper and zinc were reduced by 51% and 56%, respectively, than lower limit of the accepted reference intervals and amounted 63% and 64% decrease to control individuals. Zinc and Copper are essential antioxidants in the human body [8]. These trace elements are essential component of many enzymes and proteins involved in protection against oxidative stress damage. Zinc deficiency associated with reduced immunity [23], DNA damage and increases other metals induced oxidative toxicity [24]. Copper is essential micronutrients for normal growth and protection of many organs and electron transport [25]. Copper deficiency increases risk of cellular oxidative damage due to decreased activity of superoxide dismutase (SOD) [26]. The balance between antioxidant, such as copper and zinc, and rate of free radicals levels are essential factor to prevent organs and tissue from oxidative damages [6, 7]. Although, oxidative stress markers were not assessed but the deficiency of copper and zinc antioxidants observed in petroleum fuel stations workers indicates the possibility of increasing oxidative stress in those populations.

In conclusion, from the finding of these results and above discussion, the decreased levels of antioxidants trace elements resulting from working at petroleum fuel stations for long period could be causes for serious health problems, liver toxicity and other organs and tissue damage. Regular examination of liver function tests and attention to use safety gloves and face mask is recommended for petroleum fuel stations workers.

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