

Original Research Article

Early Renal Dysfunction is Associated with Exposure to Petroleum Products in Petroleum Stations Workers at Khartoum State –Sudan

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Abstract: Petrol and its derivatives are the most important sources of energy in the world, and they have many benefits and uses however they have hematological and biochemical adverse effects on human health. The primary purpose of this study is to determine the effect of petroleum products exposure on renal function. This study carried out at Khartoum state on petroleum stations workers during the period from March to May 2016. Spot urine samples were collected from 50 individuals exposed to petroleum products at petroleum stations and 50 non exposed individuals as control. The urine Albumin and urine creatinine was estimated by using cobas Integra 400 analyzer and then the albumin/creatinine ratio was calculated. The mean of albumin/creatinine ratio was higher in exposed group (43.56 ± 43.00 mg/g) compared to non exposed group (19.58 ± 3.9 mg/g); p -value < 0.05 and there was no correlation of albumin/creatinine ratio (ACR) results with age, body mass index (BMI) and duration of exposure to petroleum products at petroleum stations per year. The exposure to petroleum products at petroleum stations has risk of renal dysfunction, but the severity of renal damage was not correlated with duration of exposure to petroleum products. That indicates increase the probability of chronic kidney disease in petroleum stations workers in the area of study.

Keywords: petroleum stations petroleum products , workers, albumin/creatinine ratio (ACR), kidney disease.

INTRODUCTION

Petroleum products are used for various reasons by human beings at homes, in manufacturing and petrochemical industries [1].

Petrol and its derivatives especially the benzene contains significant amount of aromatic hydrocarbons [2]. It consists of hydrocarbons (aromatic, saturated and unsaturated) and non-hydrocarbons (N, S, O₂, Vanadium and Nickel) [3].

Despite the variety of derivatives of petrol; only few of them are designated as hazardous compounds to human health. These compounds are mainly light chain volatile aromatic compound such as benzene, toluene, ethylbenzene and xylene, (BTEX) [4]. Benzene is a colorless, flammable liquid with a strong odor. It evaporates quickly when exposed to air [5]. It is highly volatile, and exposure occurs mostly through inhalation. Public health precautions are needed to reduce the exposure of both workers and the general population to petroleum product especially benzene [6].

The risk of acute or chronic toxicity in humans exists during production, distribution, and usage of petrol [2]. Acute exposure to petroleum products has been associated with skin and sensory irritation, central nervous system depression and effects on the respiratory system, whereas prolonged chronic exposures to these compounds affects these organs as well as kidney, liver and blood circulation systems. Of these, particularly the benzene is considered to be the most hematotoxic [1]. The Workers are exposed to emission of benzene volatile aromatic hydro-carbons (VAHs) [7].

In 2013 Naza *et al* evaluate the alteration in B.urea and S.creatinine was significantly elevated in gasoline filling station workers [3]. In 2015 Masoad Neghab *et al* found that there significant elevated in B. urea and S. creatinine [2].

The kidneys are vital organs that perform a variety of important functions for the body. One of The most predominant functions is the removal of waste and surplus from plasma [8]. It is playing the central role in

the homeostatic mechanisms of the human body. Reducing renal function strongly correlates with increasing morbidity and mortality [9].

Estimation of renal functions is important in a number of clinical situations, including assessing renal damage and monitoring the progression of renal diseases [10]. Chronic kidney disease is worldwide public health problem [11]. And associated with increased risk of adverse results, including death, cardiovascular events, and the development of end stage renal disease [12].

The urine albumin test or (ACR) was used to screen people with chronic condition that put them at an increased risk of developing kidney disease. The American diabetes association has state a preference for ACR as most accurate test for screening of albuminuria indicating early kidney disease [13].

The present study was designed to evaluate the effects of exposure to petroleum products (benzene and gasoline) in petroleum stations on the kidney function.

MATERIALS AND METHODS

This is population based Case - control study carried out among Petroleum Stations Workers. The study included 100 Individuals, 50 of them were exposed to petroleum products (benzene and gasoline) and 50 were non exposed, the two groups were matched in term of body mass index (BMI) and age (age from 20-50). This study was conducted in Khartoum state during the period from March to May, 2016.

The selection of the subjects and controls was based on questionnaire which includes questions on demographic, medical, lifestyle and occupational status. Spot urine samples were collected. The urine albumin and urine creatinine in the collected samples were

estimated by immiunoturbidometric assay using cobas Integra 400 analyzer following the manufacture guidance, and accordingly the albumin/creatinine ratio was calculated.

The data obtained analyzed using the statistical package for social science (SPSS), student t-test was used to compared the albumin/creatinine ratio between exposed to and non exposed groups P. value <0.05 considered significant. pair test was used to correlate the albumin/creatinine ratio with age, body mass index and the duration of exposure to petroleum product per years. And then used ANOVA to determine the effect of exposure duration on ACR.

RESULTS

The mean of age and body mass index (BMI) for exposed group were 35.14±8.67 years, and 24.54±1.77 Kg m²; and the corresponding value for the non exposed group were 34.61± 8.58 years and 24.00±1.89 Kg m² respectively.

As demonstrated in (table 1) there was no significant difference in age, BMI between two groups (p.value>0.05). The mean of albumin/creatinine ratio in exposed (cases) group was 43.56±43.00 mg/g compared to 19.58±3.9 mg/g (N.R <30mg/g for non exposed group. There was significant increase in ACR in exposed group (cases) compared and non exposed control groups. P.value <0.05.

As shown in(table 2) there was no correlation of albumin/creatinine ratio with body mass index, age and duration of exposure to petroleum products per years (p > 0.05). When cases grouped according to duration of working per year, there was no effect of duration exposure to benzene in benzene filling stations workers on albumin /creatinine ratio (ANOVA, P .value >0.05). (Figure 1).

Table 1: Comparisons of BMI, Age and ACR between study group and control

Parameter	Control N= 50	Cases N= 50	P value
BMI	24.0± 1.8	24.53± 1.77	0.193
Age	34.61±8.58	35.14±8.67	0.145
ACR	19.58±3.9	43.56±43	0.00

Significant p value <0.05 level

Table 2: the Correlation of albumin/creatinine ratio with duration, age and body mass index of workers (per/year)

	R	P
ACR with duration	0.89	0.53
ACR with age	0.208	0.146
ACR with BMI	0.161	0.262

P=P value

R= coefficient of correlation

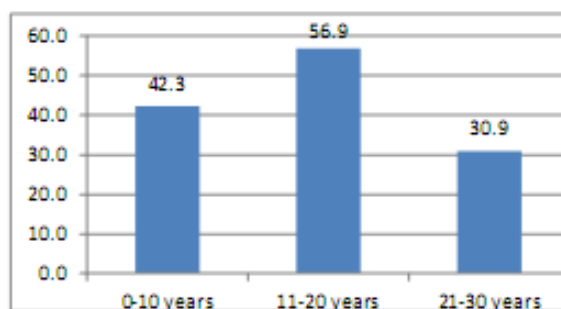


Fig-1: The effect of Duration exposure (per/year) of benzene on ACR levels

DISCUSSION

Albumin is a protein that is normally not present in the urine if the kidney is well functioning. The concentration of albumin in the urine is varying throughout the day; and the production of creatinine depends on muscle mass metabolism which release into the urine in constant rate. Urine albumin and creatinine are measured in random urine sample and ACR was calculated [13].

The result of this study found that the mean of albumin/creatinine ratio in exposed group was significantly higher than comparison group. (43.56 ± 43.00 mg/g VS 19.58 ± 3.9 mg/g, P.value <0.05).

The association between exposure to petroleum products or benzene containing solvents and renal damage has been shown in previous studies in different countries [1, 3, 14-16].

The previous studies [1, 3, 14, 16] showed that the levels of S. creatinine, B. urea and uric acid were significantly higher in workers group compared to control group. And Viau *et al* [15] found that there was a significant effect on renal function markers of refinery workers who were occupationally exposed to volatile aromatic hydro-carbons (VAHs)

Petroleum products are mixtures of aliphatic and volatile aromatic hydrocarbons; most of the products are toxic to the renal system. This may be attributed to an increase in liberating toxic metabolites as reactive oxygen species (ROS). Some experiments with rats indicate that exposure by inhalation to aromatic hydrocarbons can cause nephrotoxic. Furthermore human and experimental studies suggest that some of chemicals can affect the renal system. Since petroleum products (benzene) are chemicals it can be a cause of the renal impairment [14].

There were some limitations of this study included that there were no baseline and periodic medical checks for workers to determine the change in their health if it could be attributed to benzene exposure or not, and the amount of benzene in workers blood and local environment was not determined.

It is recommended assessing the medical status of workers before joining the jobs to check their fitness then periodic medical checkup for determines if the workers have probability to develop chronic renal disease. And it is also recommended to use the personal protective equipment that could minimize the hazards of exposure to petroleum products.

CONCLUSION

The exposure to petroleum products at petroleum stations workers has risk of renal dysfunction, but the severity of renal damage was is not correlated with duration of exposure to these products. That indicates increase the probability of chronic kidney disease among petroleum stations workers in the area of study.

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