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THE EFFECTS OF PETROLEUM PRODUCTS ON RENAL FUNCTION AMONG PETROLEUM FILLING WORKERS STATIONS IN EL-OBIED CITY

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ABSTRACT

Background: Petrol (or gasoline) is a volatile and inflammable petroleum-derived liquid mixture primarily used for internal combustion of machines. **Objective**: To assess the renal function of individuals who are occupationally exposed to 'petrol' product. **Patients, material & methods**: a cross sectional study of sixty seven individuals comprising thirty seven 'petrol station' attendants (test group) in El-obeyed, North Kordofan State, Sudan, and thirty apparently healthy individuals who are 'non-petrol station' attendants (control group) age and sex matched during the period from December 2015 to August 2016. Venous blood samples were collected for the analysis of plasma Creatinine, urea, uric acid, Na^{+}, K^{+}, and Ca^{+2} using standard laboratory procedures. **Results**: The plasma levels of Creatinine, urea, uric acid and Na^{+} were significantly elevated among the test group when compared with control group, while there was no significant different of the plasma level of Ca^{+2} and K^{+} among the study population. Also this study reveal that there is significant positive correlation of urea, calcium and sodium levels with the duration of exposures in (years) among filling station workers P. value $\leq$ 0.05.**Conclusion**: The prolonged exposure to the petroleum product affect on renal function of the filling station workers; therefore upgrading and development of the worker environment is recommended to minimize the progression of renal insufficiency among them.

KEYWORDS: North Kordofan State, Filling Station, Petroleum.

INTRODUCTION

Petrol or else gas is a unstable and ignitable petroleum-derived liquid assortment primarily used for internal incineration of machinery.[1] Certain peoples have a greater risk of exposure to gasoline vapors; these include filling-station workers, service station attendants, drivers of gasoline trucks and refinery workers.[2] The volatile nature of petrol products makes them readily available in the atmosphere any time it is dispensed, especially at petrol filling stations and depots.[3] People are exposed to gasoline fumes during fuelling and refueling at gas stations, but the filling station workers are more at risk by virtue of their occupational exposure.[4] Many of the harmful effects seen after exposure to gasoline are due to the individual chemicals in the gasoline mixture, such as benzene, lead and oxygenates.[5] Breathing small amounts of gasoline vapors can lead to nose and throat irritation, headaches, dizziness, nausea, vomiting, confusion and breathing difficulties. Some effects of skin contact with gasoline include rashes, redness, and swelling. Allergic reactions (hypersensitivity) have been reported but these are rare occurrences.[6]

PATIENTS, MATERIALS & METHODS

This is Quantitative descriptive, cross sectional study. Samples was collected from different petrol filling station in El-obied City the capital of the North Kordofan state during the period from December 2015–May 2016. Thirty seven Petrol filling station workers were enrolled in this study as test group in contrast, thirty healthy volunteers (age and sex matched) were involved as control group. Interview with the workers was done to obtain clinical data and to provide health education. Also questionnaire sheet recorded by the participants. After informed consent, and use of antiseptic alcohol swab for the skin (70 % ethanol), 5ml of venous blood was collected from each volunteer included in this study. Plasma was separated after centrifugation at 3000rpm for 5minutes at room temperature. The supernatant plasma was collected by means of micropipette in tightly sealed plain container and kept at (4 to 8) C° till used later. The

plasma then allowed to warm at room temperature and investigated of study variables by using spectrophotometer and flame photometer. The precision and accuracy of all methods used in this study were checked in each patch analyzed by including commercially prepared control sera. The result was analyzed by SPSS (version 20). The mean and SD obtained and "t" test was used for comparison. Linear regression also used for comparison. P.value was obtained to assess the significance. P.value < 0.05 is considered significant and P.value < 0.01 is highly significant.

RESULTS

Table 1 Shows comparison of the mean levels of plasma urea, creatinine and uric acid of tested group compared with that of the control group. Mean levels were significantly elevated (P<0.05)

Table 2 illustrate comparison of the mean levels of plasma Na^+, K^+ and Ca^{+2} of tested group compared with that of the control group. (mean levels of plasma Na^+ and Ca^{+2} concentrations amongst 'petrol station' attendants tend to be significantly elevated (P<0.05) when compared control; whereas no significant different on the mean of the plasma K^+.

Figure 1 explain a significant positive correlation between the duration of exposures in (years) with the plasma levels of urea (mg/dl) among filling station workers (r =0.2, P =0.003).

Figure 2 Shows a significant positive correlation between the duration of exposures in (years) with the plasma levels of sodium (mmol/l) among filling station workers (r =0.2, P =0.04).

Figure 3 Shows correlation between the duration of exposures in (years) with the plasma levels of Calcium (mg/dl) among filling station workers (r =0.3, P =0.02).

Table. 1: Comparison of means of the plasma levels of urea, creatinine and uric acid of the test group and control group.

Variables	Test group n= 37	Control group n= 30	P. value
Urea (mg/dl)	25.5 ± 7.0	21 ± 5.2	0.007
Range	(15 - 44)	(11 - 31)	
Creatinine (mg/dl)	1.0 ± 0.2	.9 ± 0.1	0.001
Range	(0.5 - 1.5)	(1.1 - 0.8)	
Uric acid (mg/dl)	5.3 ± 1.0	4.8 ± 0.9	
Range	(3.4 – 7.5)	(3.4 – 7.4)	0.01

- The table shows the mean ± SD, range in brackets () and probability (P. value).
- T-test was used for comparison.
- P. value ≤ 0.05 is considered significant.

Table. 2: Comparison of means of the plasma levels of sodium, potassium and calcium of the test group and control group.

Variables	Test group n= 37	Control group n= 30	P. value
Sodium (mmol/l)	140 ± 4.8	137 ± 6.2	
Range	(128 - 146)	(128 - 149)	0.03
Potassium (mmol/l)	3.8 ± 0.8	3.8 ± 0.7	
Range	(2.9 – 5.7)	(2.7 – 5.3)	0.5
Calcium (mg/dl)	7.7 ± 1.7	8.9 ± 1.1	
Range	(4.9 – 11.2)	(7 - 11)	0.004

- The table shows the mean ± SD, range in brackets () and probability (P. value).
- T-test was used for comparison.
- P. value ≤ 0.05 is considered significant.

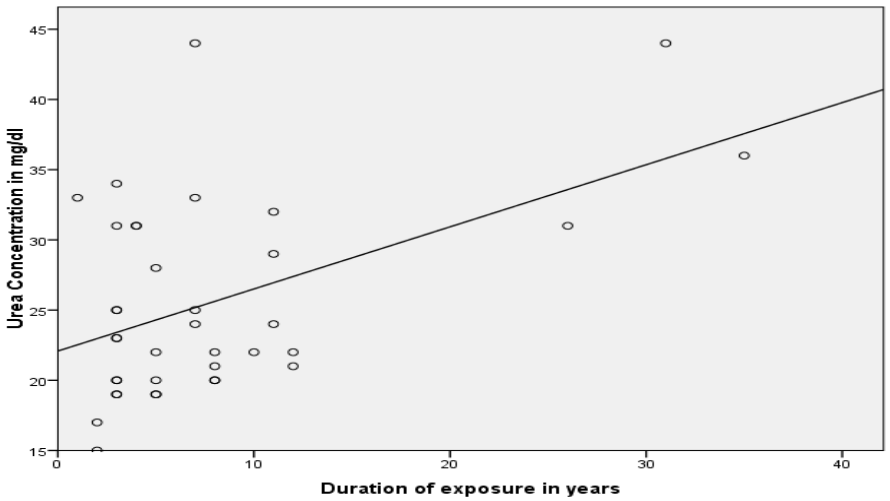

Figure. 1: The relationship between the duration of exposures in (years) and the plasma levels of Urea (mg/dl) among filling station workers (r =0.2, P =0.003).

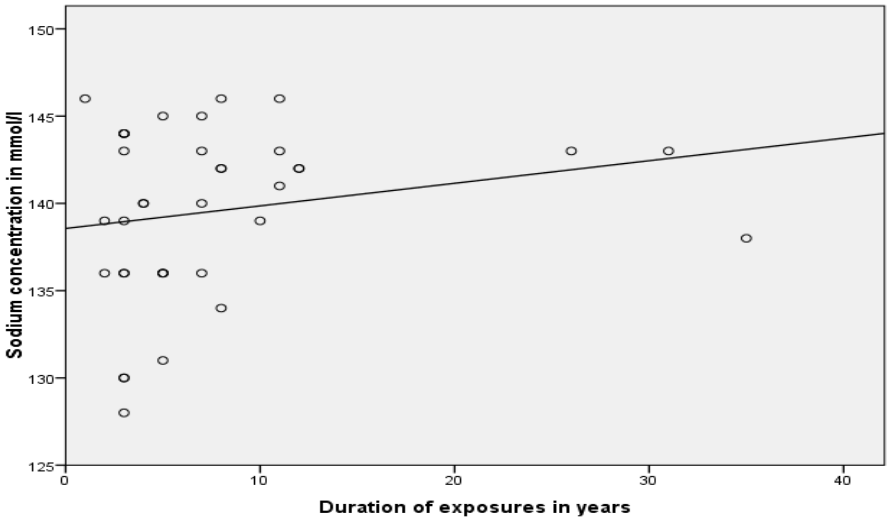

Figure. 2: The relationship between the duration of exposures in (years) and the plasma levels of sodium (mmol/l) among filling station workers (r =0.2, P =0.04).

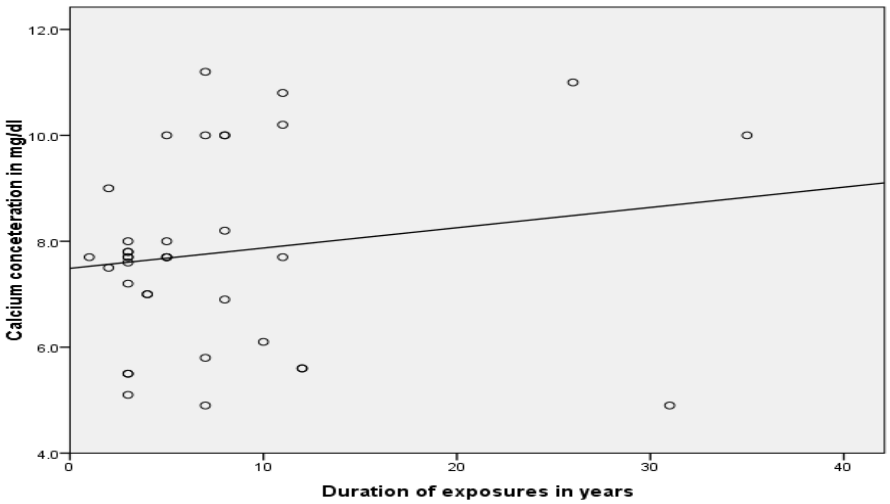

Figure. 3: The relationship between the duration of exposures in (years) and the plasma levels of calcium (mg/dl) among filling station workers (r = 0.3, P =0.02).

DISCUSSION

The kidney is vital organ that perform a variety of important function. The most prominent are removal of unwanted substances from plasma, homeostasis of body water electrolyte and acid base status, and hormonal regulation.

In the current study there is a significant difference between the mean of the urea level in the tested group when compared with control group, the mean of the test group is significantly elevated (P< 0.05) (Table 1) and this elevation in urea levels may be as a result of the fall in glomerular filtration rate as a result of exposure to petroleum products and also this urea elevation may be attributable to the damage of the nephrons structural integrity. This finding consent with previous studies

Also in this study there was a significant positive correlation between the urea levels with the duration of exposures in (years) among filling station workers (r =0.2, P =0.003) (Figure1) and this may be down to the progression on renal dysfunctions. This agrees with previous study.[7] Creatinine retention in the blood is a significant indicator for kidney impairment.[8] in this study there was a significant increase in Creatinine level among petrol filling station workers when compared with control group (P<0.05), (Table 1) and this may be due to Creatinine retention as result of petroleum product inhaled, ingested or absorbed through skin by workers .furthermore impairment of the kidney functions caused by introduction to nephrotoxic substance such as petroleum product. The above result consistence with previous study.[9,10]

In the existing study there is a significant diversity between the mean of the uric acid concentration in the test group when compared with that of the control group, the mean of the test group is significantly elevated (P < 0.05) (Table 1) and this may be due to response of uric acid as antioxidant to protect against the prooxidant effect of petrolium products. This agrees with previous study[11] who reported that; occupational exposure of human subjects to lead in petrol increases the concentrations of uric acid in exposed subjects compared with unexposed subjects.

In the current study there is highly significant difference between the mean of the sodium concentration in the test group when compared with that of the control group, the mean of the test group is significantly elevated as shown in (Table 2) (P. value = 0.03) and this may be due to renal tubular reabsorption defect in different parts of nephrons. According to that elevation on sodium levels among the test group this may be considered as a predisposing factor for renal impairment. This agree with previous study.[13]

Also study showed significant weak positive correlation between sodium concentration and the duration work in petrol filling station as shown figure 2 (r = 0.2, P = 0.04) and this reflected that sodium concentration tended to be increase as the duration of exposures elongated and may be attributed to progressive renal tubular defect.

In the current study there is a significant difference between the mean of the calcium concentration in the test group when compared with that of the control group, the mean of the test group is significantly decrease as shown in (Table 2) (P. value = 0.004) and this may be due to that calcium reabsorption, regulation and excretion by kidney is defected give rising to kidney insufficiency. This agrees with previous study[12] who reported that; calcium readily mobilized in bone deposits causing its level to be decreased under effect by petrol metabolite.

This study showed a significant weak positive correlation between calcium concentration and the duration work in petrol filling station as shown figure 3 (r = 0.3, P = 0.02) and this reflected that calcium concentration tended to be decrease as the duration of work continuous and this may be due to progressive renal dysfunctions as a result of long exposure to petroleum products either through skin contact or lung inhalation.

CONCLUSION

Prolong exposure to petroleum products might be the likely cause of the kidney dysfunction of petroleum station filling personnel and it causes a wide variety of toxicological effects on body tissues as well as biochemical changes as a result constitute serious health hazard to humanity.

RECOMMENDATIONS

1. It is therefore advised that petrol pump attendants should wear protective or safety wears during work to avoid direct inhalation of the petrol fumes; proper cleaning/washing of hands in work shop environment should be practiced before eating and drinking.

2. Petrol pump attendants should use nose mask, protective clothing during work and good health education should be carried out by the primary health care board to sensitize the petrol pump attendants on how to develop the habit of using nose mask and protective clothing during work and also supply it to them. To enable them escape health challenges associated with petroleum fume pollutants.

3. Regular check for renal function investigations for prognosis of early minor renal function deterioration.

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