WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 7.523
Volume 6, Issue 2, 571-578. Research Article ISSN 2277– 7105

"STUDY OF ELECTROLYTE CONCENTRATION IN PETROL PUMP WORKERS OF WESTERN MAHARASTRA."

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Article Received on
16 Dec. 2016,
Revised on 06 Jan. 2017,
Accepted on 26 Jan. 2017
DOI: 10.20959/wjpr20172-7564

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ABSTRACT

Background Long term exposure to solvents and air pollutants can lead to hazardous effects on respiratory, cellular and kidney Functions. **Objective-** The aim of this study is to investigate Electrolyte Concentration in petrol pump workers and also to check the electrolyte concentration with duration of exposure. **Materials and Methods: -** The study was conducted on 45 male petrol pump attendants between age group of 20- 40 years who were working as petrol filling attendant for more than one year from western Maharashtra. 45 normal healthy male with same socioeconomic status was chosen as control to find out the effect of occupational exposure to petroleum product on electrolyte concentration. Petrol pump attendants are divided into three groups based on their duration of exposure i.e. 1-5 yrs, 6- 10 yrs and more than 11 years. Electrolyte Concentration ($Na^+$and K^+) of petrol pump attendants and control was measured by using a flame photometer. Comparisons were performed using unpaired t-test for 2 group and one

way ANOVA (Analysis Of Variance) for multiple groups of exposures. **Results:** Petrol pump workers shows significant ($P<0.05$) increase in serum potassium and sodium ion concentrations compared with the control group. As year of exposure increases mean value of serum potassium and sodium ion was significantly increases from 137.86, 145.83, 156.12 for Na^+ and 3.818, 5.004, 6.230 for K^+ respectively. **Conclusion:** The study suggests that long term inhalation of petrol fumes is associated with adverse effect on electrolyte concentration and kidney.

KEYWORDS: Occupational exposure, Petrol pump workers, Potassium ion, Sodium ion.

INTRODUCTION

Petrol (gasoline) is a volatile and inflammable petroleum derived liquid mixture primarily used for internal combustion of engines.[1] It consists of aromatic, saturated and unsaturated hydrocarbons and non hydrocarbons like Nitrogen, Sulphur, Oxygen, Vanadium and Nickel.[1,2] There is no alternative has been found in Indian automobile industry for petrol and diesel. So millions of automobiles on Indian roads run on petrol or diesel fuel. Petrol pump workers are exposed to various petroleum products (petrol, diesel).These petroleum products (petrol, diesel) contain various organic compounds such as benzene, toluene, ethylbenzene and xylene (BTEX compound). Petrol pump workers are coming in contact with these BTEX compounds through inhalation, ingestion and dermal contacts.

The volatile nature of petrol and diesel increases its concentration in air at petrol filling stations, automobile garages and depots.

Exposure to various fractionated products of crude petroleum has reported to cause impairment of the renal functions evident by the derangement of serum electrolytes.[3]

Electrolytes are compound which when dissolved or melted will conduct electricity. These electrolytes help to maintain the stability of body fluids. The electrolytes found in the body include; major cations like sodium (Na+), Potassium (K+), magnesium (Mg+) and Calcium (Ca+) while the anions are chloride (Cl-), bicarbonate (HCO-), phosphate.[4] Sodium and potassium are useful for heart and other muscle activities where sodium keep the correct water balance in the body, that perform other numerous physiological functions in the body. Electrolyte in the body fluid has clinical significance of hyponatremia (low sodium), hypernatremia (high sodium), hypokalemia (low potassium) hyperkalemia (high

potassium).[4] electrolyte homeostasis is regulated by hormone such as antidiuretic hormones, aldosterone and parathyroid hormone.

Pollutants from petroleum vapour transformed into various metabolites in the body. Some of these metabolites are very reactive, interacting in various ways with the metabolizing, transporting and excreting tissues to elicit toxic effects. And these interaction may cause cellular injury, hence, damaged the overall functionality of the kidney. And this damaged may be accessed through analysis of some electrolyte in the body (Such as, Na+, K+, Cl- and HCO3-).[5]

Hence, this study conducted to determine the concentration of electrolyte in petrol pump workers of western Maharashtra, also this type of study has not been carried out in our area.

MATERIAL AND METHODS

After the approval by institutional ethics committee, a case control comparative study was carried out on randomly selected 45 petrol pump attendants of Western Maharashtra (Sangli, Satara and Kolhapur Dist). They were further divided in to three groups depending on their duration of exposure as Group I (1-5 years), II (5-10 years) and Group III (more than 10 years). 45 control subjects were chosen from paramedical staff of same socioeconomic status from Bharati Vidyapeeth Medical and Dental College and Hospital Sangli. Written informed consent was obtained from subjects. Subject with history of Kidney diseases were excluded from the study, only nonsmoker & non alcoholic workers were enrolled. With prior appointment, petrol pump workers were interviewed with the help of pretested questionnaire. Workers were evaluated as per standard proforma, which included questionnaire regarding health status.

Sample Collection

Blood sample was collected by venepuncture from the antecubital vein. The skin was cleaned with 70% alcohol and allowed it to air dry, a tourniquet was tightened on the hand above the site of the puncture and 21swg disposable needle and syringe was used to collect 5ml of blood and it was dispensed into a plane bottle without anticoagulant. The container was well labeled with the patients name, sex, and age.

PROCEDURES FOR ANALYSIS

Flame photometric determination of serum sodium and potassium ions concentration

The concentration of sodium and potassium ions in the serum was determined by flame photometric estimation of sodium and potassium, using compressed air. Dilute serum was sprayed as a fine mist of droplets (nebulised) into a non-luminous gas flame which emits the characteristic golden or lilac colour. Light of a wavelength corresponding to metal being measured (sodium or potassium) was selected by a light filter and allowed to fall on a photo sensitive detector. The amount of light emitted is proportional to the concentration of metallic ions present.

In brief, 1:200 dilutions each of the sample and the standard for sodium and potassium were made in a universal container by diluting them with deionised water on the flame photometer and allowed to warm for 15 minutes. The photometer reading was set at zero by using deionised water as blank. The equipment was calibrated with the diluted solutions of the standards to give 140 mmol/L for sodium and 5.0 mmol/L for potassium. The various test sample concentrations were then read on the digital read-out.[6]

STATISTICAL ANALYSIS

Results were presented as Mean ± SD. Unpaired t-test and ANOVA test was used to find the significance of study parameters by using SPSS 16.0 version. $P < 0.001$ was considered as statistically significant.

RESULTS

Table 1 indicates that age wise distribution of Na+ and K+ concentration in petrol pump attendant and in control group. The serum concentration (mmol/L) in the petrol pump workers for sodium ion, Na+ (143.00 ± 6.81) and potassium ion, K+ (4.533 ± 0.79) respectively were relatively higher than that in the control as shown in table No. II. An observed value of electrolyte concentration**(Na^+, K^+)** according to sex and duration of exposure shown in Table 3 and 4.

Table 1 Age Wise Distribution of electrolyte concentration in petrol pump attendant and Control Group

Groups	Age	n	Na ion conc. Mean ± S.D	K ion conc. Mean ± S.D
Petrol Pump Workers	20 - 30 years	19	143.37 ± 6.751	4.455 ±1.0150
	30 – 40 years	26	146.50 ± 8.373	5.144 ± **0**.9986
Control Group	20 - 30 years	28	139.21 ± 3.862	3.471 ± 0.4180
	30 – 40 years	17	137.29 ± 3.820	3.382 ±0.4683

Table No. 2 Showing Mean and SD of Electrolyte (Na+, K+) concentration in Petrol Pump attendant and Control Group

Parameters	Groups	Mean ± S.D	t test	P value
Sodium Na+(mmol/L)	Petrol pump workers (n=40)	143.00 ± 6.81	3.854	0.001*
	Control group (n= 30)	138.49 ± 3.92		
Potassium K+(mmol/L)	Petrol pump workers (n=40)	4.533 ± 0.79	8.228	0.001*
	Control group (n= 30)	3.416 ± 0.45		

** = Significant, NS= Not significant*

In table 2, sodium and chloride is more significantly increased in petrol pump attendants as compared to control.

Table No.3 Electrolyte (Na+, K+) concentration according to years of exposure among Petrol Pump Workers.

Parameters	Mean± SD **1-5 yr exposure** (n= 14)	Mean± SD **6-10 yr exposure** (n= 23)	Mean± SD **>11 yr exposure** (n= 8)	F value	P value
Sodium Na+(mmol/L)	137.86±4.400	145.83 ± 5.015	156.12 ± 4.734	37.52	0.001 *
Potassium K+(mmol/L)	3.818 ±0.5921	5.004±0.6990	6.230 ± 0.6181	35.84	0.001 *

*Pearson correlation test. * = Significant, NS= Not significant*

DISCUSSION

The kidney plays main role in maintaining a constant extracellular environment required for normal functioning of the cells. It is achieved by excretion of waste products of metabolism and urinary excretion of water and electrolytes. However, a deviation from the normal levels of these waste products/electrolytes in blood, due to several factors, indicates renal impairment.[7, 8, 9] Electrolytes are the smallest chemicals that are important for the cells to carry out normal functions of the body and allow the body to work effectively. Electrolyte status provides an indication of the renal integrity and cellular functions in animals.[10]

In this study, the concentration of electrolyte (Na+, K+) is significantly increases in petrol pump attendants than in control as shown in table No. 1. Findings of our study coincides with findings of Emeji Roseline et al., Anthony Cemaluk C. et al., Ogunneye A.L et al.[5,6,11]

The serum electrolytes were higher in the petrol pump attendants than in the control, indicating decreased excretion of these electrolytes (due perhaps to kidney and cellular dysfunctions) that may result in pathological conditions. The higher Na+ and Cl- concentration in the exposed group of this study could be due to the higher concentration of,

and longer exposure to, the petroleum products.[12] that could adversely alter the electrolyte balance of the unprotected petrol pump attendants .

The concentration of electrolyte in the body is controlled by a variety of hormones, most of which are manufactured in the kidney and the adrenal gland. According to Uboh et al.[13] he reported that exposure to petroleum pollutants (such as, fuel fume, kerosene vapours and gasoline) is a predisposing factors to the impairment of the kidney functions while carrying out studies on rats exposed to petrol fumes.

Electrolytes are important for regulating our nerve and muscle functions, our body hydration, blood pH, blood pressure and the rebuilding of damaged tissues.[14] An increase or decrease concentration of body electrolytes cause or can result to biochemical dysfunction which can lead to kidney diseases, heart failure, damaged of tissues.

Also it was observed that, the depletion in the electrolyte concentration among the fuel pump attendants exposed to petroleum pollutants is dependents on the number of years of exposure as shown in Table no 3 which means that the more in the number of years of exposure causes more effect on the electrolytes concentration which causes diverse body biochemical dysfunction which can result to kidney disease, heart failure, damaged in tissue cells etc.

These results suggest that the absorbed constituents of petrol vapour might have reacted with the renal tissues to cause injury to the glomerulus, the tubules, or both. As such, nephrons are lost leading to kidney function impairment.

Thus, exposure to petrol should be considered as a predisposing factor for renal function impairment in humans

CONCLUSION

Prolonged exposure to petroleum pollutants are predisposing factor to the impairment of the kidney function and it causes a wide variety of toxicological effects on body tissues as well as biochemical dysfunction that constitute serious health hazard to humanity. It is therefore advised that petrol pump attendants should wear protective or safety wears during work to avoid direct inhalation of the petrol fumes.

Conflict of interests

There is no conflict of interest for this study.

ACKNOWLEDGMENT

We thanks to Dr. Anand Shigali , Dr. R. B. Kulkarni , Dr. Mote , Dr. Ulhas Mali for their help at different stages of research. Also thankful to Lab Technician Mohite for his help in the project.and thanks to all the participants of the study.

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