ejpmr, 2015,2(7), 110-114

SJIF Impact Factor 2.026

EUROPEAN JOURNAL OF PHARMACEUTICAL AND MEDICAL RESEARCH

www.ejpmr.com

Research Article

ISSN 3294-3211

EJPMR

ELECTROYLE CONCENTRATION IN FUEL PUMP ATTENDANTS WITHIN PORT HARCOURT METROPOLIS

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Article Received on 16/10/2015 **Article Revised on 06/11/2015** **Article Accepted on 26/11/2015**

ABSTRACT
This study was carried out to determine the electrolyte concentration in fuel pump attendants exposed to petroleum pollutants in Port Harcourt metropolis, Rivers state. Plasma electrolyte concentrations of twenty fuel pump attendants were compared with ten apparently healthy individuals as control. The result showed that mean ± standard deviation of potassium 4.3± 1.8,sodium 151±3.7,chloride115±14.6,bicarbonate 26±3.3 in fuel pump attendants while the control is potassium 3.5±0.2, sodium137±2.5, chloride101±0.3,bicarbonate21±1.3 respectively. The Result shows that electrolyte concentration is more significantly increase in fuel pump attendants, except potassium that do not show not quite difference in statistical significance than in control ($P < 0.05$).This changes can be attributed to prolong exposure. And inhalation of petrol fumes into the lungs. Which serves as a predisosing factor to the impairment of the kidney function and it can cause a wide variety of toxicological effects as well as biochemical dysfunction that constitute serious health hazard to humanity. This study here by recommend that 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 protective. Clothing (especially nose mask) during work, to prevent direct inhalation of petroleum fumes.

KEYWORDS: Sodium ion, Potassium ion, Chloride, Bicarbonate, Fuel pump attendants.

INTRODUCTION
Pollutants are substances or energy introduced into the environment that has undesired effects or adversely affects the usefulness of a resource. A pollutant may cause long-or short term damage by changing the growth rate of plants or animals species or by interfering with human communities, comfort, health or property values (Tietenberg, 2006).

There are several types of pollutants which include chemical such as petroleum hydrocarbon, carbon monoxide, lead, smoke, and pesticides e.t.c. which are very devastating to human health as a result of chronic or prolonged exposure (Garshrick et al., 2008).

Petroleum is a mixture of different hydrocarbons and metals, and the chemical composition of petroleum varies between geologic formation (Edwards et al., 1989).

It may be refined into fractions of kerosene, petrol, diesel, heavy gas oil, lubricating oils, as well as residual and heavy fuel among others; however kerosene, petrol and diesel are the commonly used fractionated crude petroleum product (Kato et al., 1996).

These fractions contain aliphatic, aromatic and a variety of other branched saturated and unsaturated hydrocarbons at variable concentration (Uboh et al., 2009).

Domestic and industrial use of petroleum either in the crude or refined forms, has increased tremendously leading to increased exposure to users to it various constituents hydrocarbons.

The common forms of exposure are inhalation, dermal contact and ingestion of petroleum contaminated food, and water. Studies have documented the adverse environmental and health effects of petroleum hydrocarbons over the years. Previous studies reported the cardiotoxic, nephrotoxic, haematotoxic,and hepatotoxic effect of hydrocarbon.

Exposure to various fractionated products of crude petroleum has reported to cause impairment of the renal functions evident by the derangement of serum electrolytes (Ovuru et al., 2004).

However, the most set of persons affected are those who are occupationally exposed to fume emanated from petroleum product (Smith et al., 1993).

Patrick-Iwuanyawu et al. (2011) also reported that frequent exposure to petrol fume could possibly cause adverse effects on the kidney and impair liver functions.

Electrolytes are compound which when dissolved or melted will conduct electricity. They form positively and negatively charged ions which are known as the cations and anions. These electrolytes help to maintain the stability of body fluids. The electrolytes found in the body include; major cations sodium (Na+), Potassium (K+), magnesium (Mg+) and Calcium (Ca+) while the anions are chloride (Cl-), bicarbonate (HCO-), phosphate (Ochei et al., 2000). Sodium and potassium are useful for heart and other muscle activities where sodium keep the correct water balance in the body fluid as well as bicarbonate, chloride, etc. 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) (Ochei et al., 2000).

Electroyte balance is maintained by oral or in emergencies, intravenous intake of electrolyte containing substance and is regulated by hormones, in general with kidney flushing out excess levels in humans, electrolyte homeostasis is regulated by hormone such as antidiuretic hormones, aldosterone and parathyroid hormone. Serious electrolyte disturbance such as dehydration and over hydration may lead to cardiac and neurological complication and unless they are rapidly resolved will result in a medical emergency (Stanley et al., 2011). Petroleum product contain a number of toxic chemical component which are considered to be carcinogenic and can also lead to liver damage and disturb some normal biochemical process such as electrolyte concentration in the body system (Carballo et al., 1995).

According to Uong et al. (1998), he documented that exposure of rat to petroleum fumes causes kidney dysfunction as well as pulmonary dysfunction and parenchymal damage among dogs. The adverse effect associated with exposure to petroleum vapour has been reported in both the experimental animals and humans. Pollutants from petroleum vapour may be metabolically transformed into various metabolites in the body. Some of these metabolites may be 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-) and metabolites (such as urea, creatinine in the plasma (Hu et al., 1994; Nwankwo et al., 2006).

However the most affected with these disorders are those who are occupationally exposed to the petrol fume (Smith et al., 1993; and Rothman et al., 1996). This study suggest to determine the concentration of electrolyte in petrol pump attendants expose to petroleum pollutants in Port Harcourt metropolis which may aid in establishing some biological and health consequences of petrol vapour on petrol attendants in the area.

Aim

The aim of this study is to estimate the concentration of electrolyte among fuel pump attendants expose to petroleum pollutants in Port Harcourt Metropolis.

Objective of Study

- This is carried out in order to determine the level of distribution of electrolyte among fuel pump attendants.
- To know the extent to which electrolyte elevates or decline among fuel pump attendants.
- To make a link between year of exposure to petroleum pollutants and the concentration of electrolytes on petrol pump attendants.

MATERIALS AND METHOD

Study Area

This research study was conducted on the evaluation of electrolyte among petrol pump (fuel filling station) attendants in Port Harcourt metropolis, Rivers State, Nigeria. Port Harcourt is an urban area with a population of 1,382,592 peoples according to the 2006 Nigeria census.

The occupations of the correspondent were strictly on petrol pump attendants and they comprise people from different parts of the country and different ethnic groups.

Study Population

A total number of twenty (20) human volunteers petrol station attendants were used for the study (12 males and 8 females) were drawn from various filling station attendants in Port Harcourt metropolis. All the subjects have been directly exposed to petrol vapour in course of their duties. And ten (10) apparently healthy individuals who work within an office setting away from petrol station were used as control for the study.

Sample Collection

Blood sample were collected by venepuncture from the antecubital vein. The skin was cleaned with 70% alcohol and allowed 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. The sample containers was arranged in a rack. And it was sent to the laboratory for the estimation of electrolyte level.

PROCEDURES FOR ANALYSIS

Estimation of serum/plasma Sodium /Potassium

Principle: (flame photometer). (Ochei et al., 2000)

Using compressed air, diluted serum or plasma is sprayed as fine duplets into a non-luminous gas flame which becomes coloured by the characteristic emission of sodium/potassium metallic ions in the sample using a light filter or prism system, the light of wavelength corresponding to the metal being estimated, is selected. The amount of light emitted depends on the concentration of metallic ions present in the sample.

Procedure for Sodium/Potassium Estimation

- Ensure the reagent was properly mixed
- Switch on the air compressor and adjust the air pressure
- Introduce deionized water through the atomizer.
- Turn on the gas and adjust the flame to give fine sharp cones.
- Place appropriate filters for simultaneous sodium and potassium estimation
- Set the zero with deionized water
- Introduce standard 1(120/2) and adjust 120.0 for sodium and 2.0 for potassium
- Check that the standards 2 and 3 display the exact concentrations for both sodium and potassium.
- Introduce the diluted test serum and note the readings for sodium and potassium.

Precaution

Blood sample left to stand for more than 4 hours prior to plasma a serum separation is unsuitable for estimation of electrolytes due to a leakage of electrolytes, especially potassium from red cells.

Estimation of Serum/Plasma Chlorides by the use of Chloride Meter (Ochei et al., 2000)

Principle

This is an electrometric titration (colometry) where silver ions are released from electrode through electrolysis. The specimen is place in an electrochemical cell. The electricity generates silver ions from the silver anode which are attracted toward the cathode. AS the silver ions travel through the diluted specimen, they come in contact with the chloride ions and form silver chloride. The silver chloride is precipitated. This process continues till all the chloride ion are removed from the specimen. When free silver ions are released in the solution, they reach the cathode and bring about a sudden change in the conductivity of the solution. This increased in the potential shuts-off the instrument. Thus, with a constant current, the time taken till this point is the measure of concentration of plasma chloride.

Procedure for Chloride Estimation

- Mix 0.1ml of serum with 10ml of diluting fluid in a beaker
- Add 2-3 chips of the indicator solution
- Immerse the electrodes and switch on the machine
- The digital display starts
- The concentration of chloride in mmol/L is indicated when the digital display stops.

Precaution

Repeat the same procedure with 0.1ml of standard to confirm the accuracy of the result.

Estimation of Serum/Plasma Bicarbonate (Ochei et al., 2000)

Principle

When serum is mixed with 0.01N hydrochloride acid, there is a loss of acidity due to the bicarbonate in the serum. This decrease in acidity can be determined by titrating against standard 0.01N sodium hydroxide.

Procedure for Bicarbonate Estimation

- Prepare control tube as follows: Add 0.1ml of serum to 5.0ml of 1% saline and add 2-drops of phenol red indicator. Mix well.
- Pipette 4.0ml of 1% saline in another tube.
- Add 1.0ml of 0.01N HCl
- Add 0.1ml of serum and 2-drops of phenol red indicator
- Titrate against 0.01N NaOH till the colour changes from yellow to red. Compare the colour of the end point with the control tube. Note the reading (XML).

CALCULATION

Serum bicarbonate (mmol/L) = (1-xml of 0.01N NaOH required X 100

RESULT

A total of thirty (30) subjects were used for this study. Twenty (20) petrol pump attendants who were exposed to petrol pollutant and ten (10) apparently healthy individual who work in office settings always from petroleum pollutants exposure were used as control. Summary of the result obtained from this study are shown in the tables below.

Table 4.1: **Showing electrolyte (K^+, Na^+, Cl^- and HCO_3^-) concentration in fuel pump attendants and control with statistical evaluation. (n = 20) for fuel pump attendants and (n =10) for control.**

Parameter	Fuel Pump Attendants mean ± S.D	Control Mean ± S.D	P. value
Potassium K+(mmol/L)	4.3 ± 1.8	3.5 ± 0.2	0.0532
Sodium Na+(mmol/L	151 ± 3.7	137 ± 2.5	0.0001
Chloride Cl- (mmol/L)	115 ± 146	101 ± 0.3	0.0055
Bicarbonate HCO3-(mmol/L)	26 ± 3.3	21 ± 1.3	0.0001

In table 1 above, sodium chloride and bicarbonate is more significantly increased in petrol pump attendants exposed to petrol pollutants (P<0.05). Except potassium that show not quite difference in statistical significance between test and the control.

Table 4.2: Showing electrolyte (K+, Na+, Cl- and HCO3-) Concentration in male and female fuel pump attendants expose to petroleum pollutants with statistical evaluation (n =12) for males and (n = 8) for females.

Parameters	Males Mean ± S.D	Female Mean ± S.D	P-value
Potassium K+ (mmol/L)	4.4 ± 0.2	4.3 ± 0.1	0.1495
Sodium Na+ (mmol/L)	159 ± 4.1	139 ± 5.7	0.0001
Chloride Cl- (mmol/L)	115 ± 8.6	109 ± 3.9	0.0044
Bicarbonate (HCO3-(mmol/L)	28 ± 0.7	26 ± 3.5	0.0186

In table 2 above, potassium (K+) and bicarbonate (HCO3-) level in male and female did not show statistical significant different in petrol fuel attendants exposed to petrol pollutants, while sodium and chloride shows more increase in male than female petrol pump attendants exposed to petrol pollutants(P<0.05).

Table 4.3: Showing Electrolyte Concentration in Fuel Pump Attendants Exposed to Petrol Pollutants in Relationship with Number of Years of Exposure to Petrol Pollutants with Statistical Random Selection Using n = 5.

Parameter	N = 17+ 1-5yrs Mean±S.D	n = 1 6-10yrs mean±S.D	n=2 11yrs & above Mean±S.D	P-value
Potassium K+(mmol/L)	43±0.2	47±1.08	4.8±1.00	0.006
Sodium Na+ (mmol/L)	139±20.5	170±1.00	177±1.00	0.034
Chloride Cl-(mmol/L)	114±9.4	115±1.00	199±1.00	0.001
Bicarbonate HCO3-(mmol/L)	25±4.4	26±1.00	28±1.00	0.643

In table 4.3 above, the concentration of electrolyte with statistical random selection using n=5 was found to increase in the number of years of exposure.

DISCUSSION

In this study, the concentration of electrolyte is significantly increase in petrol pump attendants than in control (apparently healthy individuals working in an office setting away from petroleum pollutant). Electrolytes are the smallest of chemicals that are important for the cells in the body to function and allow the body to work effectively.

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 (Thomas, 2013). According to Uboh et al.(2005), 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. According to the study, potassium level increase as well as decrease in the level of serum sodium and chloride ions in rats following exposure to petroleum pollutant. This result indicates that the absorbed constituents of these vapour and/or their metabolites might have reacted and interacted with the renal tissues to impair the kidney function. Electrolyte is of great important in regulating our nerve and muscle function, our body hydration, blood pH, blood pressure and the rebuilding of damaged tissues (Clayten et al., 2006). 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 in the body, which constitute serious health threat to humanity (Stanley et al., 2011). Osudolar et al., 2010 also documented an increase in potassium, bicarbonate and decrease in sodium and chloride ions concentration of laboratory rabbits models fed on groundnuts grown in Kutchalli Waste pit materials (KINPM) in Nigeria National Petroleum cooperation (NNPC) exploration sites in Borno State Nigeria.

In cause of the is study on concentration of electrolyte in fuel pump attendants expose to petroleum pollutants in Port Harcourt metropolis; The concentration of sodium, chloride and bicarbonate was found to increase in petrol pump attendant exposed to petroleum pollutants. The concentration of potassium was fond to be not quite increased when compared to the control sample (people working always from petrol station and it pollutants). 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 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.

CONCLUSION

Prolong exposure to petroleum pollutants is a 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.

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.

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