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EVALUATION OF TOTAL PROTEIN, ALBUMIN AND GLOBULIN CONCENTRATIONS IN FUEL PUMP ATTENDANTS IN PORT HARCOURT METROPOLIS, NIGERIA

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ABSTRACT

This study was carried out to determine Total protein, Albumin and Globulin concentrations in fuel pump attendants exposed to petroleum pollutant in Port Harcourt metropolis Rivers State, Nigeria. A total of 44 subjects consisting of 22 fuel pump attendants and 22 control subjects were recruited. 5mL of blood was collected from ante cubita vein of subjects for analysis. Bromocresol Green method was used to determine albumin concentration while biuret method was used to determine total protein concentrations. The result showed that mean± standard deviation for Total protein was 60.19 ± 8.16g/l, Albumin 35.30± 3.30g/l and Globulin was 24.89 ± 4.86g/l in fuel pump attendants exposed to petroleum pollutant while in the control, the values are Total protein 73.32 ± 1.41g/l, Albumin 44.17 ± 0.23g/l and Globulin 29.15 ± 1.18g/l respectively. All parameters were significantly lower in fuel pump attendants than in control. Thus, revealed that exposure to petroleum pollutant is associated with decreased Total protein, Albumin and Globulin. Statistical analysis also confirmed this significance decrease of Total protein ($P<0.05$) and Globulin ($p<0.05$) in pump attendants than in control. This implies that exposure to petroleum pollutants have adverse effect on Total protein of those who work in petroleum stations. Hence, raising the need for public awareness about the health hazard, in order to enable petroleum attendants to take necessary precautionary measures.

KEYWORDS: Fuel pump attenants, Occupational exposure, Petroleum polluants, Total protein,

INTRODUCTION

A pollutant is a substance or energy introduced into the environment that has undesired effect or adversely affects the usefulness of a resource. Pollutants can cause long or short term damage by changing growth rate of plant or animal species or by interfering with human amenities, comfort and health.[1]

Petroleum is an organic compound formed when large quantities of dead organisms usually zoo plankton and algae are buried underneath sedimentary rock and subject to intense heat and pressure.[2] It consists of hydrocarbons of various molecular weights such as cycloalkanes and aromatic compounds. Liquid organic compounds containing nitrogen, oxygen, sulfur and trace amounts of metals (iron, nickel, copper and vanadium) also make up its constituents. The exact molecular weight composition varies widely from formation to formation.

Petrol is distilled from crude petroleum. During its evaporation, petrol fumes are produce as vapor. The volatile nature makes petrol fumes easily available in the atmosphere any time it is dispended, especially at petrol filling stations and depots. Petrol contains mixture of volatile hydrocarbon and so inhalation is the most common form of exposure.[3] Volatile organic compounds belong to a very heterogeneous group of chemical characterized by their relatively high vapor pressure. Exposure to these compounds can bring about variety of adverse health effects such asthma, Headache and mucosal symptoms.[4]

Petrol vapor can reach supra-lateral concentration in confined or poorly ventilated areas, although such exposures are rare.[5] At low dose, petrol vapor is irritating to the eyes, respiratory tract and skin. Exposure to higher concentration of petrol vapor may produce central nervous system effects such as staggered gait, slurred speech and confusion. Very high concentration may result in rapid unconsciousness and death due to respiratory failure.[6]

Total protein comprises two classes of proteins found in liquid portion of blood, namely Albumin and Globulin. Albumin helps prevent fluid from leaking out of blood vessels.[7] Albumin also helps to regulate colloidal osmotic pressure of blood and it constitutes 50% of human plasma proteins, acting as a molecular “taxi” by serving as carriers for lipid soluble hormones, bile salts and unconjugated bilirubins, calcium and free fatty acids.[8] Decrease

albumin may result from direct inhibition of synthesis by toxins,[9] malabsorption and protein loosing enteropathy.[10]

Globulins serve as important parts of the immune system. Total protein in serum is a measure of total immunoglobulin concentration and helps to diagnose nutritional problems, kidney diseases or liver diseases.[7]

Studies have shown that petroleum pollutant cause blood disorder, hepatic dysfunction and serious psychotic problem because their metabolites binds to proteins and nucleic acid.

This study sought to determine Total protein, Albumin and Globulin concentrations in fuel pump attendants exposed to petroleum pollutants and this will be achieved through the following objectives (i) to determine Total protein, Albumin and Globulin concentrations in fuel pump attendants and control(ii) to determine Total protein, Albumin and Globulin in male and female fuel pump attendants(iii) to determine Total protein, Albumin and Globulin in fuel pump attendants in relation with number of years of exposure to petroleum pollutants and to ascertain if there is any statistically significant differences in years of exposure.

MATERIALS AND METHOD

Study area

The study was conducted within Port Harcourt metropolis in Rivers State of Southern Nigeria. Rivers state is an oil producing state in Nigeria. Port Harcourt hosts both petroleum and allied industries.

Subjects and study design

The study comprised of a total of 44 subjects (aged between 19 and 40 years with mean age as 26.5), consisting of 22 fuel pump attendants from different petrol stations within Port Harcourt that have been directly exposed to petrol vapor and pollutant in the course of their duties and 22 apparently healthy individuals who work in an office setting away from petrol stations in Port Harcourt metropolis, Nigeria with no known chemical exposure.

Out of twenty two fuel pump attendants, 11 (50%) were male and 11(50%) were female. Age range of participants was between 19 – 40 years of age. Test subjects have been exposed to petroleum pollutants in the course of their duty as fuel pump attendants. Years of exposure ranged between 1-7 years. Participants gave informed, written and well understood consent in accordance with Helsinki declaration of 1964 as amended in 1983.[11]

Sample collection

5ml of blood samples were collected from ante –cubital vein of subjects into well labeled Lithium heparin anticoagulant bottles. The samples were centrifuged at 5000 rpm for 5 minutes to obtain plasma samples for analysis.

Test methods

Total Protein was estimated using Biuret method [12] while Albumin was estimated using Bromocresol Green method,[13] Globulin was calculated using the formula below:

Globulin =Total Protein Concentration– Albumin concentration

Analysis of variance (ANOVA) was used to find significances of study parameters between groups of study patterns while student T test two tailed independent was used to find significance of study parameters between two groups. Value less than 0.05 was considered to be statistically significant.

RESULT

The study was conducted to determine the concentration of Total protein, Albumin and Globulin in twenty two fuel pump attendants exposed to petroleum pollutants and twenty two individuals not exposed to petroleum pollutants. Data are presented in (tables 1-4).

Table 1: Total protein, albumin and globulin concentration with statistical evaluation (n = 22) for fuel pump attendants and (n = 22) for control

Parameter	FuelPump Attendants N=22	Control N=22	T value	P value	Significance
Totalprotein (g/l)	60.19 ± 8.16	73.32 ± 1.41	7.4370	0.0001	S
Albumin (g/l)	35.30± 3.30	44.17 ± 0.23	12.5768	0.0001	S
Globulin (g/l)	24.89 ± 4.86	29.15 ± 1.18	3.9953	0.0003	S

At 95% interval, P <0.05 is considered significant. (S) significant.(NS) not significant.

Table 1 reveals that mean ± SD for Total protein (g/l), Albumin (g/l) and Globulin were 60.19 ± 8.16 g/l, 35.30 ± 3.30g/l and 24.89±7.94g/l respectively in fuel pump attendants while in control the values were 73.32 ± 1.41g/l, 44.17 ± 0.23g/l and 29.15 ± 1.38g/l. All three parameters were reduced in fuel pump attendants than in control subjects.

Table 2: Total protein, albumin and globulin concentration of male and female fuel pump attendants with statistical evaluation (n = 11) for male and (n = 11) for female

Parameter	Fuel pump attendants (male) N=11	Fuel pump attendants (females) N=11	T value	P value	significance
Total protein(g/l)	55.73 ± 7.48	64.47 ± 6.57	2.9116	0.0008	S
Albumin (g/l)	35.05 ± 2.53	35.56 ± 3.90	0.3639	0.7198	NS
Globulin (g/l)	20.68 ± 4.95	28.91 ± 2.67	4.8533	0.0001	S

At 95% interval, P <0.05 is considered significant .(S) significant.(NS) not significant.

In Table 2 showing concentration of test parameters in male and female fuel pump attendants, there were significant differences ($p<0.05$) in Total protein and Globulin between male and female fuel pump attendants.

Table 3: anova table for total protein, albumin and globulin concentration in fuel pump attendants expose to petroleum pollutants between 1-3years

Sources of variation	SS	DF	MS	F(MSR)	P value	F crit
Between Groups	6974.0891	2	3487.0446	80.2002	9.158E18	3.3158
Within groups	1304.3782	30	43.4793			
Total	8278.4673	32				

Table 4: anova table for total protein, albumin and globulin concentration in fuel pump attendants expose to petroleum pollutants between 4-7years

Sources of variation	SS	DF	MS	F(MSR)	P value	F crit
Between Groups	8305.5109	2	4152.7555	68.0129	7.148E12	3.3158
Within groups	1831.7509	30	61.0584			
Total	10137.2618	32				

Table 3-4 shows Anova table for Total protein, Albumin and Globulin in fuel pump attendants exposed between 1-3years and 4-7years.

Figure 1 shows that Total protein, Albumin and Globulin increased as years of exposure increased.1-3 years had lower values of test parameters

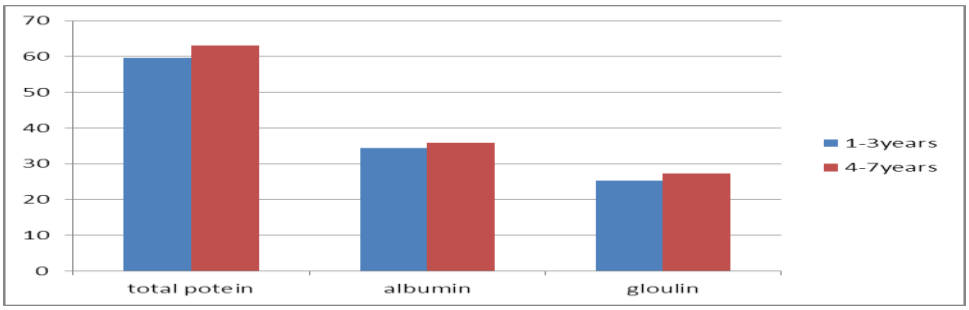

figure 1: result of total protein, albumin and globulin concentration in relation with number of years of exposure to fuel pollutant with statistical evaluation n=11

DISCUSSION

Table 1, revealed that Total protein, Albumin and Globulin was more reduced in fuel pump attendants than in control subjects. Total protein in Serum is a measure of total immune globulin concentration. This study is in agreement with the work of,[14, 15] who observed a significant decrease in Total protein in petrol attendants exposed to petroleum fumes. Estimation of Total protein is of less clinical importance as a result of compensation between Albumin and Globulin fraction. However, the result obtained for Albumin concentration of fuel pump attendants was at variance with the works of.[16, 17] who observed that Albumin levels in petrol attendants did not change significantly when compared with controls. Albumin helps to regulate colloidal osmotic pressure of blood. It constitutes 50% of human plasma protein.[8] It acts as a molecular taxi by serving as carriers for free fatty acids and hormones in plasma. Albumin possess cysteine residue which enhances its capacity to neutralize peroxyl radicals.[18]

Exposure to petroleum pollutants could occur during spillage which could cause skin burns while dispensing petrol, this could account for low albumin as loss may be due to Albumin binding fractions and protein losing enteropathy. Albumin deficiency may be caused by a decreased rate of synthesis or increased membrane permeability and loss from the body.[19]

Table 2 revealed that there is significant difference in Total protein and Globulin concentrations, while there is none in Albumin concentration in male and female fuel pump attendants. This could be attributed to the aforementioned reasons and the ability of the hydrophobic part of protein and globulin to be metalated with petrol metabolites.[17]

The anova tables 3 and 4 revealed that Total protein, Albumin and Globulin concentrations increased as the number of years of exposure increased. To ascertain if there is statistical difference in the level of exposure to petroleum pollutants in fuel pump attendants, analysis of variance for single factors experiment using F-distribution was carried out on Total protein, Albumin and Globulin. At 95% confidence level (0.05), the MSR (F) calculated for fuel attendants who have been exposed between 1-3years is 80.2002, while the MSR (F) critical or tabulated is 3.3158. Similarly, the MSR (F) calculated for those exposed between 4-7years is 68.0129, while the MSR (F) tabulated is the same as 3.3158. Since in both cases, the MSR (F) calculated is greater than the MSR (F) tabulated, the levels of total protein, albumin and globulin differ significantly due to duration of exposure.

The increase in total protein as years of exposure increased as observed in this study could be attributed to the fact that fuel pump attendants handle petroleum products in filling station without proper protection either out of ignorance or unavailability of protective gear. These petroleum products could be inhaled during dispensing into cars. Inhaled petroleum products are absorbed into the pulmonary routes and in plasma are transported initially bound to proteins and albumin. However, protein molecules during binding can form complexes with long chains thereby reducing the total protein concentrations of exposed individuals.[17] Long time exposures to petroleum pollutants can cause respiratory disease during which time Total protein concentration is elevated.[6]

Again, raised plasma protein concentration may be due to a major increase in concentration of one or more of the immunoglobulin including para proteins.[19]

CONCLUSION

The study revealed that Total protein content of fuel pump attendants are significantly affected by exposure and that as the period of exposure increased so also the Total protein content is reduced. This can cause adverse health implication to the immune system of humans or other health hazards. It will therefore be wise to draw public attention to this silent environmental hazard and advise that personal protective equipment be provided for such workers.

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