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Liver function indicators in Nigerian gasoline attendants

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ABSTRACT

Excessive and prolonged exposure to petrol fumes has been shown to cause a significant health hazard which may be multisystemic. Data on liver involvement is highly inconclusive and scanty in this environment hence this study. The present study investigated Alanine aminotransferase (ALT), Aspartate aminotransferase (AST), Alkaline phosphatase (ALP), Total bilirubin (T-BIL), Conjugated bilirubin (C-BIL) and Albumin (ALB) as liver function indicators. A total number of ninety (90) subjects, comprising of sixty (60) gasoline attendants (35 males and 25 females) and thirty (30) apparently healthy non gasoline attendants as control (18males and 12 females) were recruited for the study. Analysis of the analytes was carried out using standard spectrophotometric methods. The mean values of ALT, AST, ALP, T-BIL, C-BIL and ALB obtained from gasoline attendants were not significantly different when compared with the controls ($p>0.05$) although slightly higher. Conclusively, liver function indicators were within normal range in Nigerian gasoline attendants studied.

Key words: Liver function, gasoline, liver enzymes

INTRODUCTION

Petroleum is one of the most widely utilized natural resources in most oil producing economies like Nigeria. It forms the mainstay of the economy and brings an alarming increase in industrial activities which have contributed immensely to the disruption of the natural ecological setting of the oil producing area. An example of such ecological disruption is pollution as well as alteration of the ozone layer [1].

Petroleum is a flammable and volatile liquid. The volatile nature of gasoline makes it readily available in the atmosphere [2]. The populace is directly or indirectly exposed to pollutant of petroleum in their environment. However, the oil workers and gas station attendants are more at risk by virtue of their occupational exposure [1]. It has been documented by Ueng et al [3]. " that exposure of rat to gasoline exhaust and organic extracts of exhaust particles caused a dose and time dependent increase in oxygenase and glutathione-5[1]-transferase in liver, kidney, lungs microsomes as well as pulmonary dysfunction and parechymal damage among dogs ".

Exposure to high levels of unleaded gasoline vapour caused an increase of kidney tumour in male rats and liver tumours in female mice [4]. The humans are believed not to be at risk to kidney tumours due this exposure because, the kidney tumour is as a result of interaction between the components of unleaded gasoline and a kidney protein

found in male rats but not humans. However the underlying mechanism for the special sensitivity of female mice to liver tumours caused changes in the uterus, which suggests that the increase in liver tumour might be related to changes in the sex hormones status.

Like other known xenobiotic, the chemical pollutant from gasoline vapour may be metabolically transformed into various metabolites in the body [5]. Some of these metabolites may be very reactive, interacting in various ways with the metabolizing, transporting and excreting tissues to elicit toxic effects [4]. The interaction of these metabolites with the hepatocytes and other liver tissues may cause cellular injury, bile duct obstruction which subsequently results in liver dysfunction.

An atmospheric concentration of gasoline vapour (of approximately 2000 PPM) is not safe when inhaled even for a brief period of time. During fuelling of vehicles, the concentration of gasoline vapour in the air is between 20-200 PPM [1].The atmospheric concentration becomes high when there is a long queue of cars to be fuelled which usually occurs during fuel scarcity causing both environmental and health hazards. Despite, the occupational risk that gasoline attendants are faced with, little or no emphasis have been made on the assessment of the health condition of attendants as well as provide remedy to reduce their exposure to these toxic substance.

The liver function may be assessed from the level of some liver enzymes (ALP, AST, ALT, and GGT) and metabolites (protein, albumin, globulin, bilirubin etc.) [5]. Hence this study assessed the liver function in Nigerian gasoline attendants using the above named indicators.

MATERIALS AND METHODS

Study Population:
The subjects used for this study were 60 gasoline attendants (35 male and 25 female) from Edo central senatorial district who were in a steady state of health as test subjects and 30 apparently healthy non- gasoline attendants who were selected from the academic community of the Ambrose Alli University, Ekpoma, Edo State served as control subjects.

Sample Collection:
5mls of venous blood samples were collected from each subject by venipuncture of the anticubital vein. The samples were transferred into plain containers. The serum was separated after clot retraction and centrifugation at 4000rpm for 5minutes and stored frozen until the time for analysis.

Sample Analysis:
The ALT and AST activity in the sample was determined using the method described by Retiman and Frankiel, (1957) [6]. Alkaline phosphatase was determined using phenolphthalein monophosphate method as described by Klein and Babson [7]. The total and conjugated bilirubin were estimated using the method described by Jendrassik and Grof, (1938) [8], while the measurement of serum albumin was carried out based on the method described by Doumas *et al.*,(2003) [9].

Statistical Analysis
The results were presented in mean ± standard deviation (m±SD). Students' T- test was used to test for statistical significant. $P<0.05$ was significant.

RESULTS

Table 1 showed the mean $\pm$ SD of the concentration/activities of ALT, AST, AIP, T-BIL, C-BIL and ALB of gasoline attendants and control. The mean $\pm$ SD of the concentration/activities of gasoline attendants were, 12.16 $\pm$ 5.83IU/L(ALT), 11.26 $\pm$ 2.60 IU/L (AST), 24.93 $\pm$ 8.82 IU/L(ALP), 1.16 $\pm$0.37 mg/dl (T-BIL), 0.23 $\pm$0.31mg/dl(C-BIL) and 37.7$\pm$4.22g/L(ALB) while the mean $\pm$ SD of the concentration/activities for controls were, 11.52$\pm$0.72IU/L(ALT), 11.21$\pm$1.93IU/L(AST), 23.97$\pm$ 7.68IU/L(ALP), 1.18 $\pm$0.39mg/dl(T-BIL), 0.22$\pm$ 0.21mg/dl(C-BIL) and 38.77 $\pm$ 5.29g/L(ALB). The serum activities of ALT, AST, ALP, T-BIL, C-BIL and ALB of gasoline attendant when compared with control were not statistically significant ($p>0.05$).

Table 2 compared the mean ± SD values of the serum activity/concentration of ALT, AST, ALP, T-BIL, C-BIL and ALB in male gasoline attendants and controls.
The mean value obtained from the male gasoline attendants were 12.31 ± 2.39IU/L (ALT), 11.02± 2.88IU/L (AST), 25 ± 8.82IU/L (ALP), 2.09 ± 0.25mg/dl (T-BIL), 0.35 ± 0.12mg/dl (C-BIL) and 37.9 ± 3.1g/L (ALB) and the corresponding values for control subjects were, 11.44± 1.72IU/L (ALT),10.85+2.36IU/L (AST), 23+7.75IU/L (ALP), 1.86+0.19mg/dl(T-BIL), 0.28+0.18mg/dl (C-BIL) and 39.3±5.1g/L (ALB). There was no significant difference (p>0.05) in values obtained in male subject when compared with male controls

Table 3 presents the mean ±SD activity/ concentration of ALT, AST, ALP, T-BIL C-BIL and ALB in female gasoline attendants and control subjects. The mean values obtained from the female gasoline attendants were 11.94± 2.33 IU/L (ALT), 11.82 ± 1.99IU/L (AST), 22 ± 8.34IU/L (ALP), 1.58±0.18mg/dl (T-BIL), 0.47±0.15mg/dl (C-BIL) and 37.6 ± 8.2g/L (ALB) while the mean values for controls were 11.75 ±0.91 IU/L (ALT), 11.52± 0.85IU/L (AST), 21± 8.96IU/L (ALP), 1.16± 0.35mg/dl(T-BIL), 0.56± 0.19mg/dl (C-BIL) and 37.9± 5.1g/L (ALB). The T-BIL, C-BIL, ALB, ALT, AST, and ALP of female test subjects were not statistically significant (p>0.05) when compared with the female control.

Table 1 the concentration/activities in m ±SD of AST, ALT, AST, ALP, T-BIL, C-BIL and ALB of gasoline attendants compared with control subjects

Parameter	Gasoline attendants subjects (n=60)	Control subjects (n-30)	T value	p Value	Remark
ALT (IU/L)	12.16 ± 5.83	11.52 ± 0.71	1.92	>0.05	NS
AST (IU/L)	11.26 ± 2.60	11.21 ± 1.93	0.45	>0.05	NS
ALP (IU/L)	24.93 ± 8.82	23.97 ± 7. 68	-1.43	>0.05	NS
T-BIL (mg/dl)	1.18 ± 0.37	1.18 ± 0. 39	0.40	>0.05	NS
C-BIL (mg/dl)	0.23 ± 0.31	0.22 ± 0.21	1.00	>0.05	NS
ALB (g/L)	37.7 ± 4.22	38.77 ± 5.29	1.29	>0.05	NS

p>0.05 is not significant (NS)

Table 2 the concentration/ activities in m± SD of AST, ALT, ALP, T-BIL, C-BIL and ALB in male gasoline attendants compared with male control subjects.

Parameter	Male gasoline attendants subjects (n=35)	Control subjects (n-18)	T value	p Value	REMARK
ALT (IU/L)	12.31 ± 2.39	11.44± 1.72	1.67	>0.05	NS
AST (IU/L)	11.02 ± 2.88	10.85 ± 2.36	2.46	>0.05	NS
ALP (IU/L)	25 ± 8.82	23 ± 7.75	1.79	>0.05	NS
T-BIL (mg/dl)	2.09 ± 0.25	1.86 ± 0. 19	0.64	>0.05	NS
C-BIL (mg/dl)	0.35 ± 0.12	0.28 ± 0. 18	1.66	>0.05	NS
ALB (g/L)	37.9 ± 3.1	39.3± 5.1	1.33	>0.05	NS

p>0.05 is not significant (NS)

Table 3 the activity/ concentration in m±SD of ALT, AST, ALP, T-BIL C-BIL and ALB in female gasoline attendants compared with female control subjects.

Parameter	Female gasoline attendants subjects (n=25)	Control subjects (n-12)	T value	p Value	REMARK
ALT (IU/L)	11.94 ± 0.91	11.75 ±2.33	2.20	>0.05	NS
AST (IU/L)	11.82 ± 1.99	11.52± 0.85	2.02	>0.05	NS
ALP (IU/L)	22 ± 8.96	21± 8.34	1.53	>0.05	NS
T-BIL (mg/dl)	1.58±0.18	1.16± 0.35	1.03	>0.05	NS
C-BIL (mg/dl)	0.47±0.15	0.56± 0.19	0.67	>0.05	NS
ALB (g/L)	37.6 ± 8.2	37.9± 5.1	0.43	>0.05	NS

p>0.05 is not significant (NS)

DISCUSSION

Previous studies on adverse effects of xenobiotics on organs and tissues in experimental animals and few humans have shown that many experimental chemicals suppress the immune response [10]. The reports on liver function in humans exposed to various agents as part of occupational hazards are scarce. There is need for the use of biological

markers to detect early stage of disease due to occupational exposure to toxic chemical substances. This study evaluates the effect of gasoline fume that is constantly inhaled by gasoline attendants on the liver function.

The liver is one of the most important organ of the body which is involved in detoxification and excretion of toxin from the body as well as synthesis of some proteins. Liver function tests are group of laboratory tests which are used to ascertain the state of the liver. Most liver disease cause mild symptoms initially; therefore it's vital that these diseases are detected early. The regular liver function tests include alanine amino transferase (ALT), asparatate amino transferase (AST), alkaline phosphatatase (ALP), total bilirubin (T-BIL), conjugated bilirubin (C-BIL) and albumin (ALB) [11]. The result of this study showed that these tests were slightly higher (except albumin which is slightly lower) in the gasoline attendants compared with control although within normal reference range and not significant.

ALT is an enzyme present in the hepatocyte (liver cells) and it leaks into blood when liver cells are damaged. ALT rises dramatically in acute liver damage (viral hepatitis and paracetamol over dose) and during liver inflammation. There was a similarity in levels of ALT in gasoline attendants and control in this study. These results were in agreement with those reported by Akinosun *et al., (*2006) [12] which states that the ALT activities of gasoline attendants in Nigeria were within the normal reference range.

AST is another enzyme associated with liver cell. It is raised in acute liver damage and also present in red cells and cardiac muscle. The AST of gasoline attendants was not statistically significant ($p>0.05$) when compared with control. Normal AST values in gasoline attendants indicate the absence of any of the above abnormalities. These results were in agreement with those reported by Akinosun *et al., (*2006) [12] which states that the AST of gasoline attendants in Nigeria are within the normal reference range.

ALP is an enzyme in the cell lining the billary duct of the liver. If there is an obstruction in the bile ducts, ALP levels in plasma rises. ALP is also present in the placental tissue and in growing children for bone remoldelling [11]. The ALP values of gasoline attendants were not significantly ($p>0.05$) increased when compared with control.

Bilirubin is a tetrapyrole pigment derived from red blood cell break down, it is of two types, unconjugated and conjugated bilirubin. The liver plays a role in conjugating bilirubin with uridine diphosphoglucoronic acid. Bilirubin measurement is used to diagnose liver diseases such as Hepatitis, gall stone, cirrhosis etc. Usually jaundice results from high level of bilirubin. The levels of total bilirubin in petrol attendants when compared with control were not significantly ($p>0.05$) increased. This is an indication that there was no abnormal haemolysis or liver damage in the petrol attendants. These results were in agreement with those reported by Akinosun *et al., (*2006) [12] and Ghali et al, 2012 [13].

Albumin was slightly reduced in petrol attendant reduced in petrol attendants when compared with the control although not significant. Albumin is decreased in chronic liver disease, nephritic syndrome and poor nutrition. The mean level of albumin in petrol attendants (37.7 ± 0.8g/L) was lower than in the normal controls (38.8 ± 0.09g/L) but within normal reference range (3.0-5.0 g/dl). This showed that the gasoline attendants considered for this study may not have any liver diseases.

CONCLUSION

From this study, it may be concluded that the serum activity and concentrations of Alanine amino transferase, Aspartate amino transferase, Alkaline phosphatase, Albumin, Total Bilirubin, Conjugated bilirubin of gasoline attendants are within normal reference range.

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