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ASSESSMENT OF LIVER FUNCTION OF SELECTED AUTOMOBILE PROFESSIONALS IN SOUTH-SOUTH REGION OF NIGERIA

Adejumo B. I.,[1] Ajayi I. O., [1] Dimkpa U[2]., Emmanuel A. M.,[3] Uchuno G. A.,[4] Omosor K. I.,[5] Oke O. M.,[6] Ikenazor H. O.[7] and Oluwole M. M.[8]

1. Medical Laboratory Science Department, University of Benin, Benin City, Nigeria.
2. Physiology Department, Nnewi Campus, Nnamdi Azikiwe University, Awka, Nigeria
3. Medical Laboratory Science Department, College of Health Sciences and Technology, Idah, Kogi State, Nigeria.
4. External Quality Assurance Department, Medical Laboratory Science Council of Nigeria, Abuja, Nigeria.
5. Shalom Diagnostic Medical Laboratory, Warri, Delta State, Nigeria.
6. Department of Medical Laboratory Science, College of Health Sciences and Technology, Akure, Ondo State, Nigeria.
7. Department of Medical Laboratory Science, Madonna University, Elele, River state.
8. Department of Medical Laboratory Science, Nigerian Navy Hospital, Warri, Delta State.

ABSTRACT: *Aim: We assessed the liver function of automobile workers in Benin City, Edo state Nigeria. Methodology: A total of 89 male workers aged 20-45 years (33.2 ± 3.4) and 50 age-matched controls (32.8 ± 3.1) participated in the study. Blood samples of participants were collected and analyzed for total bilirubin (TB), conjugated bilirubin (CB), albumin (ALB), total protein (TP), alkaline phosphatase (ALP), aspartate aminotransferase (AST), alanineaminotransferase (ALT) and gamma glutamyl transferase levels.Results: Data indicated lack of significant differences in total bilirubin, conjugated bilirubin, serum albumin, total protein, alanine aminotransferase, aspartate aminotransferase and alkaline phosphatase activities between the auto workers and control. In contrast, the γ – glutamyltransferase activity significantly ($p < 0.05$) differed between the control and all the auto workers groups. Similarly, a significant ($p < 0.05$) decrease in serum albumin concentration was observed in spray painters compared with the control group. Conclusion: The present findings may suggest unimpaired liver function in automobile workers. The greater glutamyltransferase activity observed in the auto workers may be suggestive of lead induced toxicity in the autoworkers.*

KEYWORDS: Liver function, automobile workers, Benin City, enzyme activity

INTRODUCTION

Automobile workshop workers are a group of skilled workers who are routinely engaged in auto activities such as auto mechanics, spray painting, panel beating, welding, battery recycling,

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brazing and repairing of radiators and air conditioners. These automobile workshops are scattered all over major cities in Nigeria and have been identified as major sources of environmental pollution. Unfortunately, there are no workplace regulations for environmental pollutant exposure in Nigeria. It is reported that auto mechanics are regularly exposed to the dust, used auto lubricants, petroleum products, and exhaust fumes and prone to long-term lead toxicity, which are associated with cardiovascular, respiratory, urinary, brain and skin diseases [1, 2]. The used engine oil, for instance, contains ample amounts of heavy metals derived from 'wearing and tearing' of vehicle movable parts and benzene reported to result in cardiac abnormalities and heart attack among some other diseases [3]. Vehicles spray painters are occupationally exposed to health risk due to the constituents of materials used in spray paintings [4]. These toxicants may gain entrance into the body through inhalation, dermal contact and inadvertent ingestion [4] and distributed throughout the body, with the systemic effect occurring beyond the site of contact. Such exposures may pose great danger to the human body, particularly to organs associated with transport and blood circulation such as the liver.

The liver maintains a unique position within the circulatory system; this position aids the liver in its normal functions, which include carbohydrate storage and metabolism; metabolism of hormones, endogenous wastes and foreign chemicals, synthesis of blood proteins, urea formation, metabolism of fats , and bile formation [5]. Although many enzymes have been identified as useful in the assessment of liver function, the most clinically useful include the aminotransferases (alanine aminotransferase (ALT); aspartate aminotransferase (AST)), the phosphates (alkaline phosphatase (ALP); 5-neucleotidase), and γ – glutamyltransferase (GGT), and lactacte dehydrogenase [6].

There are limited studies on the effects of occupational exposures to pollutants associated with automobile activities on liver biomarkers among automobile workers. Unfortunately this 'at risk' population is not aware of the health hazards associated with exposure to the automobile pollutants. More pathetic is the lack of workplace regulations for environmental pollutant exposure and the utter disregard for workshop ethics and environmental protection laws by the auto workers. Similarly, precautionary measures such as maintenance of hygiene, use of face masks to minimize the inhalation of dust; wearing of recommended workshop garments and use of barrier creams to protect against dermatitis, are utterly disregarded.

The present study therefore aimed at assessing the adverse effects of automobile workshop environment on the liver function of the automotive workers in Benin City, Edo state, Nigeria.

METHODS

Study Area

This cross-sectional study was conducted in selected automobile workshops located in Benin City, Edo State, Nigeria. A preliminary close observation of these automobile workshop

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environments reveals very dusty, greasy and polluted environments resulting from exhaust fumes from many sources including heavy duty vehicles, power generating plants and other routine activities of mechanics, vehicle spray painters, welders, panel beaters, automobile battery recyclers, radiator and air conditioner repairers.

Subjects

A total of 89 male workers aged 20-45 years (33.2 ± 3.4 yrs) and 50 age-matched controls (32.8 ± 3.1 yrs) participated in the study. The test subjects included battery recyclers, auto mechanics and vehicle spray painters who have worked for more than two years in the auto workshop environment and prone to long term exposure to dust, polycyclic aromatic hydrocarbons, exhaust fumes and lead for at least 6-8 hours daily for five days in a week. The control subjects were adult males living in the same city but far away from auto workshops and who have reduced or no chance of exposure to automobile workshop pollutants. Subjects were administered with a structured health and life-style questionnaire adapted for the study population to obtain their past history of pulmonary diseases and other clinical abnormalities. Exclusion criteria included history of liver diseases, alcoholism, hypertension and other cardiovascular diseases. Each participant gave his or her individual informed consent to the study before participation. Ethical clearance was obtained from the ethical committee of Ministry of Health, Benin City, Edo State.

Sample Collection

The blood samples of participants were collected and analyzed at the Department of Medical Laboratory Science, University of Benin, Benin City. Five millilitres of blood was collected and dispensed into a plain container. The non anticoagulated blood was spun at 1500rpm for 10 minutes and the supernatant serum was separated into a separate tubes. The serum was stored at -20^0C for up to 2 weeks prior to analysis. Total bilirubin (TB), conjugated bilirubin (CB), albumin (ALB), total protein (TP), alkaline phosphatase (AP), aspartate aminotransferase (AST), alanineaminotransferase (ALT) were analysed using reagents from Randox Laboratories, (UK), while gamma glutammlytransferase was determined using kinetic method colorimetric technique.

Data Analysis

Data was expressed as mean and standard deviation. Comparative analysis was done using independent sample t-test. Statistical significance was set at $p < 0.05$. All statistics were done using IBM/SPSS software (version 20.0).

RESULTS

Table 1 shows the mean values of liver function tests of auto mechanics compared with those of control group. Data indicated that all liver function test values except those of AST and GGT were within the reference range of healthy individuals. There was lack of significant differences

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in T.Bil, C.Bil, ALB, TP, ALP, AST and ALT between the auto mechanics and the controls. In contrast, the mechanics indicated significantly ($p < 0.05$) greater GGT compared to the controls.

Table 2 shows the mean values of liver function tests of auto battery recyclers compared with those of control group. Data indicated that all liver function test values except those of AST and GGT were within the reference range of healthy individuals. There was lack of significant differences in T.Bil, C.Bil, ALB, TP, ALP, AST and ALT between the battery chargers and the controls. In contrast, the auto battery chargers indicated significantly ($p < 0.05$) greater GGT compared to the controls.

Table 3 shows the mean values of liver function tests of auto spray painters compared with those of control group. Data indicated that all liver function test values except that of GGT were within the reference range of healthy individuals. Data indicated lack of significant differences in T.Bil, C.Bil, TP, ALP, AST and ALT between the spray painters and the controls. In contrast, the spray painters indicated significantly ($p < 0.05$) greater ALB and GGT compared to the controls.

DISCUSSION

The principal findings of this study show lack of significant differences in serum bilirubin (total bilirubin and conjugated bilirubin), serum proteins (albumin and total protein) and liver enzymes (alanine aminotransferase, aspartate aminotransferase and alkaline phosphatase) activities between the auto workers and control. In contrast, the γ – glutamyltransferase activity differed between the control and all the auto workers. Similarly, a significant decrease in serum albumin concentration was observed in spray painters compared with the control group.

Bilirubin is a waste product resulting from the breakdown of red blood cells. It passes through the liver where it is processed by the liver before being excreted through the stool. An abnormally high level of bilirubin in the blood is an indication of damaged liver which cannot properly process bilirubin. Serum bilirubin test is therefore a test for liver's capacity to transport organic anions and to metabolize drugs [(7)]. The present study which indicated normal values of total and conjugated bilirubin levels in the auto workers as well as lack of significant differences in mean levels of these parameters between the control and auto workers, suggests uncompromised capacity of the liver to transport and metabolize bilirubin in auto workers. A previous study [(8)] involving automobile workers exposed to lead, reported significantly greater total bilirubin compared with the control. In another study [(9)] involving occupational lead exposed battery manufacturing workers and spray painters, bilirubin level was significantly increased only in battery workers but not the spray painters. Another study [(10)] reported significantly greater conjugated bilirubin levels in automobile workers compared to unexposed controls.

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The liver is the major site of synthesis of most of the serum proteins such as albumin, fibrinogen and other coagulation factors and most of the A and B globulins [11]. The serum protein tests are used to ascertain the liver's biosynthetic capacity [7]. Albumin, a protein made specifically by the liver, is the main constituent of total protein and a useful indicator of hepatic function [7]. The present findings, which indicated normal serum total protein and albumin levels in the automobile workers, but which did not differ significantly from those of controls, may suggest an intact liver biosynthetic capacity in the auto workers. The present finding agreed with a previous study [8] which reported lack of significant difference in serum total protein between the automobile workers and their control. In contrast, other studies [9, 12] reported significant decreases in serum total protein level in automobile workshop workers compared to control individuals, however, these values were within the reference range of healthy individuals. The present finding which showed lower, but normal albumin levels in spray painters compared with controls concurs with a previous study that reported a significant decrease in serum albumin concentration in spray painters [9].

Generally, serum enzyme tests are performed to test for injury to hepatocytes [7]. The aminotranferases (AST and ALT) are sensitive indicators of hepatocellular necrosis and are most necessary in recognizing hepatitis, while alkaline phosphatase is used to detect bile duct obstruction and interhepatic cholestasis [7]. The lack of significant differences in aminotransferases and alkaline phosphatase may suggest that occupationally exposed automobile workers may not be at greater risk of hepatic dysfunction compared with the non-exposed controls. Previous studies have indicated lack of significant enzyme activities between automobile workers and their control [13]. Similar results have also been reported in liver enzymes activities of Swedish paint industry workers with heavy exposure to organic solvents [14]. Another study by [9], showed that serum transaminase enzymes (AST, ALT) activities were significantly increased in spray painters but not in battery manufacturing workers [9]. In their study, [8] demonstrated that serum aspartate transaminase, alanine transaminas and alkaline phosphatase, were significantly increased in automobile workers as compared with the control group. Furthermore, significantly lower alkaline phosphatase activities and higher alanine aminotransferase and aspartate aminotransferase activities have been reported in occupationally exposed auto workers compared with unexposed subjects [15]. It is noteworthy that despite the lack of variations in serum aspartate aminotransferase enzymatic activities between the two groups, both auto mechanics and battery recyclers had values of AST above normal range. This may suggest increased risk of acute liver damage in these groups.

The gamma glutamyltransferase is a more sensitive marker for cholestatic damage than alkaline phosphatase, and may be elevated with even minor, subclinical levels of liver dysfunction and in drug, virus, chemical and alcohol induced hepatocellular damage [8]. In this study, gamma glutamyltransferase values were above normal range of healthy individuals and significantly greater in all the auto workers compared with the control subjects. A similar result has also been reported in a previous study [8]. It is however important that the interpretation of the present

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gamma glutamyltransferase findings with regards to liver function should be done with caution and in conjunction with other tests because of its lack of specificity [16]. An increase in GGT levels has been reported to be suggestive of lead induced toxicity in the autoworkers, since the effect of GGT seems to occur when GGT is expressed in the presence of transition metals [8]. In addition, a GGT mediated oxidative stress has been previously reported [17], and its activity has also been shown to represent a true marker of atherosclerotic cardiovascular disease [18]. The increase in GGT level therefore may be useful as a marker of oxidative stress and may have a prognostic importance for cardiovascular diseases.

In conclusion, the present study indicated lack of significant differences in serum bilirubin, serum proteins and some liver enzymes (alanine aminotransferase, aspartate aminotransferase and alkaline phosphatase) activities between the auto workers and control. This may suggest unimpaired liver function in automobile workers. The greater glutamyltransferase activity observed in the auto workers may be suggestive of lead induced toxicity in the autoworkers and may be useful as a marker of oxidative stress. Further studies may be required on larger population size to elucidate these facts.

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Table 1. Mean values of liver function tests of auto mechanics and control group.

Liver Function Tests	Controls (n =50)	Mechanics (n = 59)	t-stat	p-value
Serum Total Bilirubin (mg/dl)	0.52 ± 0.19	0.50± 0.18	0.40	0.684
Serum Conjugated Bilirubin (mg/dl)	0.26± 0.09	0.24 ± 0.07	1.28	0.203
Serum Albumin (g/dl)	4.07 ± 0.36	4.06 ± 0.46	0.08	0.938
Serum Total Protein (g/dl)	7.39 ± 0.39	7.40 ± 0.49	-0.22	0.827
Alkaline Phosphatase (U/L)	14.06 ± 3.39	14.81 ± 4.71	-0.94	0.348
Aspartate Aminotransferase (U/L)	35.56 ± 8.82	42.12 ± 26.84	-1.65	0.101
Alanine Aminotransferase (U/L)	43.02 ± 17.14	34.35 ± 27.68	1.92	0.057
Gamma Glutamyltransferase (U/L)	35.22 ± 19.13	77.80 ± 141.79	-2.10	0.038*

*Significant difference ($p < 0.05$)

Table 2. Mean values of liver function tests of auto battery recyclers and control group.

Liver Function Tests	Controls (n =50)	Battery Recyclers (n = 20)	t-stat	p-value
Serum Total Bilirubin (mg/dl)	0.52 ± 0.19	0.53 ± 0.18	-0.24	0.812
Serum Conjugated Bilirubin (mg/dl)	0.26± 0.09	0.28 ± 0.09	-0.89	0.377
Serum Albumin (g/dl)	4.07 ± 0.36	4.15 ± 0.51	-0.70	0.487
Serum Total Protein (g/dl)	7.39 ± 0.39	7.40 ± 0.52	-0.15	0.882
Alkaline Phosphatase (U/L)	14.06 ± 3.39	14.30 ± 3.81	-0.26	0.797
Aspartate Aminotransferase (U/L)	35.56 ± 8.82	43.65 ± 28.65	-1.81	0.075
Alanine Aminotransferase (U/L)	43.02 ± 17.14	40.75 ± 22.63	0.45	0.650
Gamma Glutamyltransferase (U/L)	35.22 ± 19.13	45.75 ± 15.82	-2.18	0.033*

*Significant difference ($p < 0.05$)

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Table 3. Mean values of liver function tests of spray painters and control group.

Liver Function Tests	Controls (n =50)	Spray Painters (n = 10)	t-stat	p-value
Serum Total Bilirubin (mg/dl)	0.52 ± 0.19	0.54 ± 0.13	-0.35	0.731
Serum Conjugated Bilirubin (mg/dl)	0.26± 0.09	0.24 ± 0.05	0.81	0.418
Serum Albumin (g/dl)	4.07 ± 0.36	3.75 ± 0.55	2.34	0.023*
Serum Total Protein (g/dl)	7.39 ± 0.39	7.36 ± 0.46	0.20	0.842
Alkaline Phosphatase (U/L)	114.06 ± 3.39	114.10 ± 2.08	-0.03	0.972
Aspartate Aminotransferase (U/L)	35.56 ± 8.82	40.0 ± 11.31	-1.38	0.171
Alanine Aminotransferase (U/L)	43.02 ± 17.14	40.30 ± 20.58	0.44	0.659
Gamma Glutamyltransferase (U/L)	35.22 ± 19.13	53.20 ± 30.15	-2.44	0.018*

*Significant difference ($p < 0.05$)

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