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Changes in the levels of some enzymes associated with tumours among Nigerian automobile workers

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ABSTRACT: Environmental and occupational carcinogens when introduced into human cause abnormal degenerative or proliferative cellular turnover hence remain one of the major causes of cancer especially in developing countries. Activities of some serum enzymes which had been implicated in metastasis, specifically gamma-glutamyltransaminase, alkaline phosphates, total and postatic acid phosphatase were estimated in 50 automobile workers recruited from some selected workshops in Ibadan metropolis. 25 apparently healthy individuals, majorities of which are civil servants with minimal exposure to hydrochemicals and similar age range were recruited as control.

Automobile workers had significantly increased serum activities of both total and prostatic acid phosphatase compared with non-automobile workers ($P < 0.05$). This difference was more pronounced in spray-painters and welders ($P < 0.01$), followed by vulcanizer and motor mechanic ($P < 0.05$). There were however no significant differences with auto-electrician and panel beaters compared with controls ($P > 0.05$). It was also observed that the elevated values of both total and prostatic acid phosphatase in autoworkers are linearly increased with years of exposure but not with age. No significant difference was observed in the activities of gamma glutany transaminase (GGT) and alkaline phosphates(ALP) of automobile workers compared with control ($P > 0.05$).

The within group significant elevated activity of prostatic acid phosphatase activities in welder, vulcanizer and spray painters are most probably due to the hazardous effect of some noxious substances such as hydrocarbons, petrochemicals, toxic metals etc. peculiar to their line of occupation. This indicate a high risk of prostatic cancer in this group of automobile worker and necessitate a regular routine screening test with more specific biomarkers such as prostate specific antigen (PSA).

Key words: Tumour biomarkers; Automobile workers; Prostatic cancer.

Introduction

Environmental and occupational carcinogens initiate appropriate 75 – 80% of cancers causing changes in deoxyribonucleic acid (DNA), chromosomes and gene (1,2). Hydrocarbons and heavy metals are sources of environmental pollution and hazards where present, but their contact with human beings by vocations is unavoidable. In Nigeria, crude oil and its by-product or distillates are the major sources of these substances.

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Over 100 million people are exposed to petroleum products and heavy metals in the course of their occupation and environmental exposure (3). Available information in general population exposure is either incomplete or inconsistent with other data (4). Although several epidemiological studies had implicated specific industries and occupation with the risk of liver, neurological, bone and prostate cancer (2), little information is available in this environment.

The biochemical method used for screening and diagnosis of various types of cancer (bone, liver, prostatic, etc.) had been adopted for mass screening because of their sensitivity and practicability (5,6,7). Importantly, enzymes were one of the first groups of tumour markers identified, their elevated activities were used to screen for cancer in general population and in differential diagnosis of symptomatic cancer (8). In this study, we screened some Nigerian automobile workers for possible risk of cancer using enzyme biomarkers.

Material and Methods

Subjects

Seventy-five consenting men between the age of 15-50 were recruited into the study. Fifty of them (study group) were automobile workers recruited from some automobile workshops in Ibadan. The professional classes include motor mechanics, panel beaters, spray painters, welders, vulcanizer and automobile electricians, with at least 3 years of practice. Similarly, twenty-five healthy males that had minimal exposure to automobile pollution being a non-automobile worker majority of which are clerics, were recruited to serve as controls.

Sample collections

Venous blood was collected through anti-cubital vein into clean plain tubes. The samples were allowed to clot and serum prepared by centrifugation for 10 mins at 3000g in an MSE bench centrifuge. The clear supernatant was used for the estimation of serum enzymes.

Assay

The activity of gamma glutamyltransferase was determined by kinetic method (9). Alkaline phosphatase activity was determined by optimised standard method of Hausamen *et al* (10). Total and prostatic acid phosphatase activities were determined by two points assay method of King and Jegathewsan (11).

Statistical Analysis

Statistical Package for Social Sciences Software (SPSS) was used for statistical data analysis of the results. The results were expressed in mean ± SEM. The paired sample student 't' test was used to determine the area of significant difference between tests and control subjects. Statistical significant level was put at $P < 0.05$.

Results

The specific occupation of automobile workers and selected demographic characteristic of both automobile workers and non-automobile workers investigated in this study were presented in Table 1. Table 2 shows the mean ± SEM of serum enzymes investigated in both test and control subjects.

The serum total phosphatase and serum prostatic acid phosphostase was significant increased automobile subject compared with non-automobile subjects ($t = 2.08$ and 2.06 respectively ($P < 0.05$).

There was however no significant difference in gamma glutamyl transferaseand alkaline phosphatase activity in automobile workers compared with non-automobile workers ($P > 0.05$) Table 3.

Within group elevation of total and prostatic acid phosphatase in automobile workers compared with non-automobile workers shows significant difference in spray painter and welders ($P < 0.01$), vulcanizers and motor mechanic ($P < 0.05$) and no significant difference with auto-electricians and panel beaters ($P > 0.05$) Table 4.

Table 1: Mean ± SEM of age and period of exposure of investigated subjects (automobile and non-automobile workers).

Occupation	Number (n)	Age (Years)	Range	Period of exposure	Range
Automobile workers					
Mechanics	31	26.0 ± 4.7	17 – 42	8.7 ± 0.7	3- 12
Spray painters	9	31.3 ± 2.6	16 – 50	12.5 ± 2.8	5 –13
Auto-electricians	5	25.6 ± 1.8	18 – 41	11.5 ± 1.5	10 – 13
Panel beaters	5	26.6 ± 2.5	18 – 32	11.3 ± 1.0	10 – 12
Vulcanizers	10	31.2 ± 1.8	21 – 45	12.5 ± 2.5	10 – 15
Welders	5	29.8 ± 3.2	15 – 45	8.8 ± 2.4	5 – 15
Non-automobile Workers	25	26.1 ± 1.19	19 - 45	-	-

Table 2: Mean ± SEM of serum enzymes level of automobile and non-automobile workers.

Occupations	Serum	Enzymes	(IU/l)
		Acid	Phosphatase
	GGT	ALP	Total	Postatic
Automobile workers				
Mechanics	20.55 ± 12.9	120.77 ± 72.2	10.30 ± 2.8	7.22 ± 2.2
Spray painters	23.44 ± 10.61	129.13 ± 74.6	11.78 ± 2.15	8.23 ± 2.2
Auto-electricians	14.51 ± 4.9	72.36 ± 0.4	9.17 ± 0.1	5.52 ± 0.7
Panel beaters	14.73 ±10.6	82.57 ± 19.1	7.65 ± 0.1	5.15 ± 0.6
Vulcanizers	16.55 ± 6.4	77.53 ± 13.5	12.03 ± 4.2	8.52 ± 2.4
Welders	26.25 ± 7.7	147.75 ± 45.9	15.75 ± 2.9	10.43 ± 2.3
Non-automobile Workers	21.92 ± 15.3	121.53 ± 47.8	9.44 ± 2.2	6.19 ± 2.4

Table 3: Comparison of enzymelevelss between automobile and non-automobile workers.

Enzymes level (I.U.L.)	Non-automobile workers (n = 25)	Automobile workers (n = 50)	"t"	P-value
GGT	21.92 ± 15.3	20.88 ± 11.6	2.03	P > 0.05
ALP	121.53 ± 47.8	120.01 ± 67.3	0.56	P > 0.05
TACP	9.44 ± 2.2	10.94 ± 3.1*	2.08	P < 0.05
PACP	6.19 ± 2.4	7.54 ± 2.4*	2.06	P < 0.05

Values expressed as Mean ± SEM
*Significantly difference from non-automobile workers.

Table 4: Comparison of acid phosphotase levels between automobile workers group and normal subject.

	Total Acid Phosphatase		Prostatic acid Phosphatase	
	"t"	P-value	"t"	P-value
Non-automobile worker vs				
Spray printers	0.613*	P < 0.01	0.805*	P < 0.05
Welders	0.453*	P < 0.01	0.770*	P < 0.01
Vulcanizers	0.142	P > 0.05	0.875*	P < 0.05
Mechanics	0.608*	P < 0.05	0.272	P > 0.05
Auto-electricians	0.045	P > 0.05	0.210	P > 0.05
Panel beaters	0.039	P > 0.05	0.195	P > 0.05

*Significantly different from non-automobile workers.

Discussion

Occupational and environmental pollution in filling station attendants, petroleum tanker drivers and automobile workers has been reported as the major sources of exposure to petroleum products and heavy metals (12). These compounds have been reported to have powerful carcinogenic effects on experimental animals such as mice (13). Various researcher have reported that long time contact with petroleum product and heavy metals in working place may result in thrombocytopenia, porphuria, lymphatic and haematopoietic cancer, suppression or inactivation of erythropoietic activity in the bone marrow and kidney (12). The biochemical method used for screening and diagnosing of various types of cancer (bone, liver, prostate etc.) has been adopted for mass screening because of their sensitivity and practicability (7). Importantly, enzymes are the first groups of tumour makers identified, and their elevated activities were used to screen for cancer in general population and in differential diagnosis of symptomatic cancer (8).

In this study, an elevated total acid phosphatase and prostatic acid phosphatase was observed in the automobile workers compared with control subjects. Schwanz (1973) reported elevation in total acid

phosphatase prior to metatases (8). The use of tartrate inhibition of prostate fraction technique in the enzyme sensitivity and specificity has improved or rather supplies information helpful in the diagnosis of carcinoma of the prostate before metastasis occur (11, 14). Thus the elevation in prostatic acid phosphate observed in the autoworkers in this study as compared to the non-autoworkers is indication that exposure to petroleum product and metals is possible risk of prostate cancer. It was also observed in this study that the elevated values of both total acid phosphatase and prostatic acid phosphatase in autoworker linearly increased with years of exposure but not with age. This was in support of the observation of Di-Paola *et al* (15) who reported development of carcinoma with increasing period of exposure to associated carcinogen. This may therefore be an indication that automobile workers are likely to develop metastasis disturbances or prone to develop cancer of the prostate with increase year of exposure. The period of save maximal exposure is however not yet determined.

The within group significantly elevated activity of these enzymes in vulcanizers, spray painters, welders and mechanics are due possibly to the hazardous effect of some noxious substances such as hydrocarbon, petrochemical and toxic heavy metals present in petrol, diesel, engine oil and lubricant peculiar to their line of occupation, to which auto-electricians and panel beaters are less exposed. The significant increase in prostatic acid phosphatase level in vulcanizers, spray painters and welders compared to controls is an indication that this professional groups are at higher risk of prostate cancer compared to auto-electricians and panel beaters who showed no significant differences in their enzymes levels compared to controls.

There was no significant difference in the gamma glutamyltransfere (GGT) and alkaline phosphatase (ALP) levels in automobile workers and non-automobile workers in this study. This is an indication that exposure to petroleum product and their toxic metals do not affect the serum levels of this enzyme. GGT and ALP estimation have significant importance in the evaluation of liver and bone damage or metastasis. The result from this study shows that petroleum product and heavy metals peculiar to this occupational group may not have significant effect on liver and oesteogenesis.

It could therefore be concluded from this study that automobile workers especially vulcanizers, spray painters and welders are at higher risk of cancer of the prostate. It is therefore necessary to carry out routine screening tests for these occupational groups, possibly with a more specific biomarker such as prostate specific antigen (PSA) detection (16), and also to encourage protective measures that will minimise long-term exposure to this occupational risk.

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