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Erythrocyte Glutathione Peroxidase, Serum Selenium, Lipids and Lipoproteins in Human Immunodeficiency Virus Positive Blood Donors

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Abstract: The study was designed to assess the relationship between red cell glutathione peroxidase and serum selenium as well as lipids and lipoprotein in HIV positive blood donors. Thirty five subjects consisting of twenty HIV positive blood donors with a mean age of 34±2.18 years and fifteen HIV negative blood donors with a mean age of 43±2.18 years controls were selected for this study. Erythrocyte glutathione peroxidase, lipids and lipoprotein were estimated using colorimetric methods. Serum selenium was determined by atomic absorption spectrophotometer. The anthropometric indices were determined using standard techniques. The mean body mass index was significantly reduced in HIV patients when compared with the controls. Significant decreased mean value was obtained in the erthrocyte glutathione peroxidase ($p<0.01$) while significant increases were observed in serum triglycerides ($p<0.01$) and total cholesterol ($p<0.05$) compared with the control values. Erythrocyte glutathione peroxidase was significantly correlated with total cholesterol ($r = 0.603$, $p<0.05$) and low density lipoprotein cholesterol ($r = 0.605$, $p<0.05$). Decreased cellular antioxidant such as erythrocyte glutathione peroxidase, increased TC and TG were observed in HIV positive blood donors in the present study.

Keywords: Gluthathione, HIV lipids, peroxidase, selenuim

INTRODUCTION

It is known that free radical mediated tissue injury is a final common pathway of damage and integral component of a wide variety of pathophysiological processes. This concept led to the suggestion that pathological alterations in a number of diseases may be associated with biochemical changes at the early stages of their aetiology (Preedy *et al*., 1998). Several studies (Peace and Leaf,1995; Kelly, 1998) have suggested the use of antioxidants as prophylactic agents with the aim of reducing the incidence of chronic diseases like cancer and Acquired Immunodeficiency Syndrome.

Glutathione peroxidase plays a major role in red cell metabolism (Mills, 1957; Slater, 1987). The activity of glutathione peroxidase has been shown to be directly related to the availability of dietary selenium (Rotruck *et al*., 1973).

Human Immunodeficiency Virus is retrovirus that has been found to have a worldwide distribution (Cheesbrough, 2002; Mitchel and Kumar, 2004). It induces a wide array of immunologic alterations resulting in the progressive development of opportunistic infections and malignancy; which results in Acquired Immunodeficiency Syndrome (Allard *et al*., 1998).

Oxygen radicals are known to disrupt cellular integrity and thus causing disruption in the normal metabolic function. Peroxidation of lipids and low density lipoprotein cholesterol cause disruption of the architecture of the cell membrane and subsequent loss of metabolic control which has been suggested to be the origin of biochemical changes and pathology of selenium in part. (Diplock, 1985). Available studies (Taylor, 1997; Friis *et al*., 2002) have shown that there is a direct relationship between decreased plasma selenium concentration and the risk of developing Acquired Immunodeficiency Syndrome in Human Immunodeficiency Virus infected individuals.

There is very little information on the role between serum selenium and red cell glutathione peroxidase in Human Immunodeficiency Virus infected individuals in Nigeria. This study was designed to assess the relationship of red cell glutathione peroxidase and serum selenium as well as lipids and lipoprotein in HIV positive blood donors.

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MATERIALS AND METHODS

Subjects*:* Twenty voluntary blood donors with mean age of 34±2.18 years who were positive for Human Immunodeficiency Virus were recruited from the blood bank of the University College Hospital Ibadan Nigeria for this study. Fifteen HIV negative blood donors with mean age of 43.87±2.18 years were included as controls. An institutional Ethical approval was obtained from the Ethical Committee. All participants gave Informed consent. All who had ailments that could alter the outcome of this study were excluded. This study was conducted about a year ago.

Anthropometric measurement: The weight was measured using Seca weighing scale with each subject in little clothing. The height of each subject was measured using a calibrated meter rule for height. The body mass index (BMI) of each subject was calculated using the formula:

$$\text{BMI} = \text{Weight (kg) kg/m}^2$$
$$\text{height}^2 \text{ (m}^2\text{) (Quetelet, 1842).}$$

Blood sample collection: Over night fasting (10-12 h) 5 mL of venous blood samples was collected from all subjects into plain bottles; these were allowed to clot. The serum was separated using MSE centrifuge and red blood cell was extracted carefully and analyzed for glutathione peroxidase. An aliquot of the serum sample was stored at -20ºC until analyzed for selenium, lipids and lipoprotein.

Method of Analysis*:* Glutathione peroxidase was estimated using Paglia and Valentine (1967) Method. Selenium in serum was determined with standard atomic absorption spectrophotometric method of Jacobson and Lockith (1998). Serum total cholesterol was determined. spectrophotometrically using the method of Allain *et al*. (1974). Triglyceride was determined after enzymatic hydrolysis with lipase using 4-aminophenazone and 4-chlorophenol under the catalytic influence of peroxidase (Buccolo and David, 1973). Total cholesterol was dtermined using the enzymatic methods of Allian *et al*, (1974). High density lipoprotein cholesterol was determined using precipitation method of Warnick *et al*. (1983) and the resulting supernant was estimated for HDLC using the methid of Allian *et al*, (1974). Low density lipoprotein cholesterol was calculate dusing formula Friedwald *et al*. (1972):

$$\text{LDL} = \text{TC} - (\text{TG}/5) - \text{HDLC}$$

Accuracy and precision of biochemical tests were monitored by including commercial quality control samples within each batch of test assay.

Table 1: Physical Parameters in HIV Positive and Non Positive Blood Donors (Mean ± SEM)

Variables	HIV+ve blood donors N = 20	Controls N = 15	t-value	p-value
Age (years)	34.00±2.18	43.97±2.18	3.15	<0.01
Weight (kg)	66.89±3.30	78.00±2.63	3.19	<0.01
Height (m)	66.89±3.30	1.71±0.002	1.27	ns
BMI (kg/m^2)	23.87±1.00	26.70±0.99	2.02	ns

N = number; SEM = standard error of means; P = level of significance; Ns = non significant

Table 2: Biochemical Parameters in HIV Positive and Negative Blood Donors (Mean ± SEM)

Variables	HIV positive n = 20	Controls n = 15	t-value	p-value
GPX (u/L)	79.95±8.66	113.94±8.37	2.79	<0.01
Selenium (µg/dL)	65.20±4.90	69.50±3.30	0.92	NS
TG (mg/dL)	130.30±18.97	71.40±10.80	2.80	<0.01
TC (mg/dL)	203.20±14.20	160.00±10.20	2.35	<0.05
HDLC (mg/dL)	24.40±4.50	33.40±5.20	0.58	NS
LDLC (mg/dL)	147.70±13.50	112.20±11.60	1.93	NS

N = Number; P = level of significance; GPX = Glutahione perioxidase; TC = Total cholesterol; TG = Triglycerides; HDLC = High density lipoprotein; LDLC = Low density lipoprotein; NS = Not significant

Statistical analysis*:* All data were subjected to statistical analysis using Statistical Package of Social Sciences (SPSS). The results were expressed as mean ±SE. Differences between means were assessed using Student *t*-test for independent samples. Post Hoc test was also performed. Pearson's correlation coefficient was used to assess association between biochemical and physical parameters. Differences were regarded as significant at $p<0.05$.

RESULTS

Table 1 Shows mean and standard error of the mean of all biophysical parameters in HIV positive blood donors and controls. The HIV positive blood donors were younger than the corresponding controls ($p<0.01$). The body weight was significantly reduced in the HIV positive blood donors when compared with the control value ($p<0.01$). The height and body mass index were not significantly different from the control values.

Table 2 Shows biochemical parameters of HIV positive blood donors and controls. There were significant decreases in the serum total cholesterol ($p<0.05$),glutathione peroxidase and triglycerides ($p<0.01$) when compared with the control values. Although the serum LDLC was slightly higher in the HIV positive blood donors, this increase was however not statistically significant when compared with the control value. The mean serum HDLC was decreased in the HIV positive blood donors, this difference was however not statistically

Table 3: Pearson's Correlation Coefficient of Physical and Biochemical Parameters in HIV Positive Blood Donors

Variables	Age (years)	Weight (kg)	Height (m)	BMI (kg/m^2)	GPX (u/L)	Selenium (u/L)	TC (mg/dl)	TG (mg/dl)	HDLC (mg/dl)	LDLC (mg/dl)
Age (years)										
Weight (kg)										
Height (m)			-							
BMI (kg/m^2)		0.880**	0.588**							
GPX (u/L)							0.603**			0.605**
Selenium (u/L)										
TC (mg/dl)					0.603**					0.911**
TG (mg/dl)										
HDLC (mg/dl)										
LDLC (mg/dl)					0.605**		0.911**			

** = Significant at the 0.01 level; BMI = Body mass index; GPX = Glutathione peroxidas; TC = Total cholesteroll; TC = Total cholesterol; TG = Triglycerid; HDLC = High density lipoprotein; LDLC = Low density lipoprotein

significant when compared with the control value. The serum selenium was not significantly different from the control value.

Table 3 Shows Pearson's correlation coefficient (r) of all parameters in HIV positive blood donors. Red cell glutathione peroxidase shows a significant correlation with serum TC ($r = 0.603$, $p<0.01$) and LDLC ($r = 0.605$, $p<0.01$), respectively. There was a significant correlation between LDLC and TC ($r = 0.911$, $p<0.01$). A significant correlation was observed between the BMI and body weight ($r = 0.880$, $p<0.01$). While a significant inverse correlation was obtained between the BMI and height ($r = -0.588$, $p<0.01$). No significant correlations were obtained in other parameters

DISCUSSION

The subjects studied were apparently healthy free living n dividuals who volunteered to donate blood to the hospital blood bank. Most of them had little or no formal education.

The HIV positive blood donors were relatively younger than the control group. Available evidence showed that HIV infection is commoner among relatively young people (Allard *et al*., 1998). The body weight and BMI were significantly reduced in the HIV positive blood donors. These changes could be attributed to the degree of virus load in part. A report from earlier study Behrens *et al*. (2000) showed an apparent reduction in body weight and BMI in HIV positive patients due to loss of subcutaneous fat.

The erythrocyte glutathione peroxidase was markedly reduced compared with the controls, this decrease may suggest a gradual depletion of cellular antioxidant nutrients in these patients. Cellular antioxidants in part regulate the free radicals generated during oxidative stress. With increase demand on the antioxidant defense system as a result of HIV infection coupled with the normal metabolic processes, the HIV infected individual is likely to have reduced antioxidant defense mechanism. This may have accounted for the reduced erythrocyte glutathione peroxidase in HIV positive blood donors. A similar finding was reported in an earlier study (Allard *et al*., 1998). The LDLC was not significantly different from the controls; however, significant correlations were observed between TC, LDLC and glutathione peroxidase. This suggests that depletion in erythrocyte glutathione peroxides is most likely due in part to lipid peroxidation, thus indicating interplay between TC, LDLC and glutathione peroxidase. The reason for this is not clear.

Serum selenium was not significantly different from the control, a finding contrary to a report from a previous study (Taylor, 1997) which showed a significant reduction in serum selenium level in HIV positive patients. Nutritional factors may have accounted for this observation. The decrease in the serum HDLC in HIV positive blood donors though not stastically significant, suggests that they are tending towards the risk of developing cardiovascular disease event in which reduced serum HDLC is a hallmark. Reduced serum HDLC has been reported to be useful predictor of coronary disease in different populations (Tanne *et al*. (1997).

The mean TG, a known independent risk factor for cardiovascular disease was significantly increased in all HIV positive blood donors. The hypertriglyceridaemia obtained in this study could be as a result of the disease process. An earlier study has shown that hypertriglyceridaemia is an independent risk factor for premature cardiovascular disease process (Garber and Avins, 1994).

CONCLUSION

This study has demonstrated interrelationship between serum erythrocyte glutathione peroxidase TC and LDLCin HIV positive blood.

However, early supplementation of antioxidants to reduce the effect of the infection on the immune system is essential and this could help limit the rate of progression into Acquired Immunodeficiency Syndrome (AIDS).

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