# STATUS OF LIPID PROFILE, ANTIOXIDANTS AND LIPID PEROXIDATION IN CORONARY ARTERY DISEASED PATIENTS IN SOUTH WESTERN NIGERIA.

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## ABSTRACT

Cardiovascular disease is a major cause of death with coronary artery or heart disease being the single most important cause of death worldwide. Oxidative stress and inflammation are cooperative events involved in the development of atherosclerosis which is the underline factor in coronary artery disease progression. This study was designed to investigate plasma lipid profile namely total cholesterol (TC), low density lipoprotein cholesterol (LDLc), high density lipoprotein cholesterol (HDLc) and triglycerides (TG), plasma antioxidants; namely Vitamin C and E, Catalase, Superoxide dismutase and Glutathione peroxidise in coronary artery diseased patients. Plasma malondialdehyde(MDA) was also determined in these patients. A total of 200 angiographically diagnosed coronary artery duseased patients of both sexes attending various teaching hospitals, medical centers and general hospitals across Southwestern Nigeria were screened for this study. Significant risk factors such as cigarette and diabetes were excluded from the study. They were matched with equal number of normal

subjects. The result of the study shows a significant increase in the plasma level of both total cholesterol and LDL cholesterol in coronary artery diseased patients while the plasma level of high density lipoprotein cholesterol was significantly lowered in these patients when compared with the control subjects. Similarly the plasma level of MDA in these patients was significantly higher than the control subjects. The result also shows a significant decrease in the plasma level of the various antioxidants considered in these patients when compared with the control subjects.

**Conclusions**: This study revealed abnormal lipid level, and a high level of oxidative stress in these patients.

 **Keywords:**Lipid profile, Antioxidants, Lipid peroxidation,  Malondialdehyde. Coronary artery disease

**INTRODUCTION:**

Coronary artery disease is a condition in which fatty deposits build up in the lining of the wall of the coronary arteries resulting in obstruction to the flow of the coronary arteries which leads to the inability to provide adequate oxygen to the cardiac muscle, therefore an inability to meet demand. Coronary Artery Disease (CAD) is the major cause of mortality and morbidity in most countries (Krishnan, *et al.,* 2016). Atherosclerosis is the main cause of coronary artery disease. The process begins as disruption of endothelial function due to the accumulation of lipoprotein droplets in the intima of the coronary vessels. High concentrations of low density lipoprotein (LDL) can permeate an already disrupted or dysfunctional endothelium where it undergoes oxidation

Traditional risk factors for CAD development includes hypertension, hyperlipidemia, diabetes, age, sex, obesity, cigarette smoking and positive family history. There is an association between blood lipids levels and risk of cardiovascular disease, strong association has been found between high levels of serum cholesterol especially of low-density lipoprotein (LDL) cholesterol and the development of atherosclerosis. LDL cholesterol is believed to have a central role in atherogenesis (Boekholdt *et al.,* 2013). Oxidative stress and inflammation are now being considered as significant and novel risk factors, lipid peroxidation and inflammation are cooperative events involved in atherosclerosis development which is a major factor in coronary artery disease progression (Kutuk *et al.,* 2003).

The free radical-mediated peroxidation of lipids has received a great deal of attention in connection with oxidative stress in vivo. The oxidation hypothesis for artherosclerosis has stimulated extensive studies on the oxidative modification of low density lipoprotein cholesterol

Currently, lipid peroxidation is considered as the main molecular mechanisms involved in the oxidative damage to cell structures ((Dianzani & Barrera, 2008). Malondialdehyde (MDA), a carbonile group produced during lipid peroxidation, is used widely in determining oxidative stress.

Antioxidants are substances that, at low concentrations, prevent or retard the oxidation of biomolecules such as lipids, proteins and DNA, Becker *et al.,* (2004) and Ratnam *et al*., (2006) simply defined antioxidants as substances which counteract free radicals, thus preventing oxidative damage. Two major groups of antioxidants are recognised, namely; enzymatic and non-enzymatic antioxidants. Enzymatic antioxidants include the primary enzymes, superoxide dismutase, catalase and glutathione peroxidase, the secondary enzymes, glutathione reductase (Ratnam *et al.,* 2006).

This study investigate plasma lipid profile namely (TC, TG, LDLC, HDLC), antioxidants which includes (Vit C, Vit E, SOD, CAT, and GPx) and lipid peroxidation status in coronary artery diseased patients in Southwestern Nigeria with a view to providing informations that could be used in early diagnosis and management of the disease.

METHODOLOGY

This study included 200 freshly diagnosed coronary artery diseased patients who were currently attending the University Teaching Hospitals (in Ado, Ilesa, Ife, Ibadan, Lagos) and Federal Medical Centers (in Ido, Owo) Southwestern Nigeria and the same number of normal healthy subjects, without any known disease. Exclusion criteria includes smokers and patients having diabetes. Blood pressure was taken on the left arm after 5 minutes' relaxation, in a sitting position, using a standard mercury sphygmomanometer with appropriate cuff size; systolic (SBP) and diastolic (DBP) blood pressures corresponded to Korotkoff sounds 1 and V, respectively.

The average of three readings, taken at first visit, was used for further analysis. Height and body weight were measured with participants standing without shoes and heavy outer garments. 5mls of venous blood was collected into an heparin bottle and centrifuged. The plasma was collected and placed in another bottle containing no anticoagulant for analysis. Estimation of Triacyglyceride and total cholesterol was carried out using GPO-PAP method of Randox diagnostic kit (Trinder, 1988). HDLC in the sample was by precipitation through the procedure developed by Lopes-Virella(1977). LDL-Cholesterol concentration in the sample was determined using the relationship described by Friedewald, *et al.*,(1972). Vitamin C level was determined by the method of Lee *et al.,* (1988). Vitamin E level was estimated using the method described by Baker and Frank, (1968). Superoxide dismutase activity was determined by the method of Marklund and Marklund, (1974). Catalase activity was determined using the method of Beers and Sizer, (1952). Glutathione peroxidise activity was determined by the method described by Rotruck *et al.*,(1974). Total amount of lipid peroxidation products present in the samples was estimated by the thiobarbituric acid (TBA) method which measured the malondialdehyde (MDA) reactive products according to the method of Ohkawa *et al.,* (1979). All patients gave their informed consent, and this study was approved by the Institutional Review Board of the hospitals.

The data collected was analyzed using one –way Analysis of variance (ANOVA) and Duncan multiple range test to compare the data obtained from the text to those of the control (Zar, 1986).

# RESULTS

**Table 1**: Parameters showing: the anthropometric measurement of coronary artery diseased patients and control subjects.

| PARAMETERS | CONTROL | CAD PATIENTS |
|---|---|---|
| AGE(YRS) | $24.50\pm1.63^{b}$ | $69.1\pm13.53^{a}$ |
| WEIGHT(KG) | $53.66\pm22.6^{b}$ | $71.41\pm11.68^{a}$ |
| HEIGHT(M) | $1.48\pm0.2^{a}$ | $1.71\pm0.03^{a}$ |
| B/PSYS(mm/HG) | $116.6\pm2.2^{b}$ | $145.1\pm23.01^{a}$ |
| B/PDIA(mm/HG) | $68.6\pm2.73^{b}$ | $102.1\pm16.19^{a}$ |
| BMI(KG/M$^{2}$) | $24.5^{b}$ | $24.71^{b}$ |

Results are presented as means ± standard deviation. Values with different superscript are

significantly different.

**Table 2:** Parameters of blood plasma showing: the mean lipid profile and lipid peroxidation level of CAD patients and control subjects.

| PARAMETER | CONTROL | CAD PATIENTS |
|---|---|---|
| TG(mmol/L) | $0,53\pm0.16^b$ | $0.62\pm0.32^b$ |
| TC(mmol/L) | $3.79\pm1.27^b$ | $4.20\pm0.97^a$ |
| LDL(mmol/L) | $2.50\pm0.83^b$ | $3.10\pm0.82^a$ |
| HDL(mmol/L) | $1.14\pm0.24^a$ | $0.86\pm0.48^b$ |
| MDA(nmol/ml) | $1.98\pm0.42^b$ | $5.56\pm1.22^a$ |

Results are presented as means ± standard deviation. Values with different superscript are significantly different.

**Table 3:** Parameters of blood plasma showing: the mean antioxidant status of CAD patients and control subjects.

| PARAMETER | CONTROL | CAD PATIENTS |
|---|---|---|
| VIT C(mg/dL) | $4.61\pm1.07^a$ | $2.14\pm0.52^b$ |
| VIT E(mg/dL) | $10.85\pm3.34^a$ | $8.54\pm1.99^b$ |
| SOD(U/L) | $206.95\pm30.23^a$ | $166.2\pm26.8^b$ |
| GPx(pg/ml) | $533.3\pm180.69^a$ | $218.08\pm89.33^b$ |
| CAT(U/L) | $50.46\pm12.55^a$ | $29.67\pm16.94^b$ |

Results are presented as means ± standard deviation. Values with different superscript are significantly different.

## DISCUSSION

The rising incidence of cardiovascular diseases is currently a major cause of morbidity and mortality in Nigeria which has constituted a threat to her existence.   A good knowledge of the pattern of changes in the lipid profile, antioxidants level and lipid peroxidation of CAD patients considered in this study could provide useful information on the pathogenesis and management of the disease. The anthropometric indices of the patients and control subjects as shown in table 1 revealed a significant increase (p<0.05) in the mean age, weight and blood pressure of CAD patients when compared with that of the control subjects. This findings support the report that advancing age and overweight are important risk factors in developing cardiovascular or heart diseases (Finegold *et al*,2012), (Iloh *et al.,* 2013). Therefore as one advances in age good attention must be paid to these factors.

The result of the lipid profile as shown in table 2 revealed a significant increase (p<0.05) in the mean plasma TC, and LDL-c levels in CAD patients when compared with that of the control subjects. There was however a significant decrease (p<0.05) in the plasma level of HDL-c in these patients when compared with the control subjects. Abnormalities in plasma lipid and lipoprotein level observed in these patients may account for atherosclerosis and thus cardiovascular diseases.   Abnormalities in plasma lipid and lipoprotein level is a major modifiable cardiovascular disease risk factors. This agrees with the report of Oghagbon and Okesina, (2006), Ukoh and Oforofuo,(2007) and Pavithran *et al.,* (2007). Also the plasma level of MDA (which is a marker of lipid peroxidation) in CAD patients as shown in table 2 is significantly higher (p<0.05) than that of the control subjects. The accumulation of MDA in tissues or biological fluids is indicative of the extent of free radical generation, oxidative stress and tissue damage (Gutteridge, 1995). This is consistent with previous finding of Akila *et al.,*

(2007) and Abdulkaldar *et al.*, (2007).  Enhanced lipid peroxidation may occur as a result of the fact that naturally occurring scavenging mechanism are suppressed and the free radical generating mechanism are enhanced.

The plasma level of non-enzymatic antioxidants (Vit C and Vit E) and activities of enzymatic antioxidants ( SOD, CAT and GPx) in CAD patients as shown in table 3 was significantly (p<0.05) lowered when compared with the control subjects. The low level of antioxidants in these patients as revealed in this study could have resulted from increased free radical generation which may confirm the presence of oxidative stress in these patients and make these parameters important factors to be considered in the primary prevention and management of CAD. The outcome of this study agrees with the report of the study by Flore-Mateo *et al.*, (2009).

**CONCLUSION** This study reveals a possible presence of hyperlipidaemia, oxidative stress and high level of lipid peroxidation in CAD patients which are factors if properly monitored could help in early diagnosis and management of CAD.

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