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Assessment of lipid profile in patients with human immunodeficiency virus (HIV/AIDS) without antiretroviral therapy

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ABSTRACT

Objective: To assess lipid profile in patients with HIV positive infection and to correlate the variation in lipid profile with the $CD4^+$ and $CD8^+$ cell count and establish the relationship between the variables. **Methods:** Ninety-one participants were enrolled for the present study of which forty seven patients were HIV positive patients and forty four were controls. The study was carried out at College of Medicine & JNM Hospital, Kalyani. Ten mL of blood samples were collected from the participants. The CD4 and CD8 lymphocyte count was estimated by Fluoresence Activated Cell Sorter (FACS) count system (Becton Dickinson). Lipid profiles were analyzed enzymatically using kit obtained from Randox Laboratories Limited, Crumlin, UK. **Results:** The changes in total cholesterol (TC), HDL-C, TC/HDL-C and age were not significant when compared between cases and controls. Significantly higher levels of triglycerides, low-density lipoprotein-cholesterol (LDL-C), LDL /HDL-C, TG/HDL-C and CD4/CD8 ratio were observed along with decline in CD-4 cells/ μ L, CD-8 cells/ μ L (P=0.0001). Furthermore there was a strong correlation between CD-4 cells/ μ L and TG, LDL-C. Also triglycerides and LDL-C level increased proportional to the increase in CD-4 cells/ μ L. **Conclusions:** It can be concluded that the changes in lipid profile can be a good index of disease progression in HIV infection.

1. Introduction

Human immunodeficiency Virus (HIV) infection is pandemic world wide[1]. Among Indians currently there are about 3.7 million HIV positive cases which are further predicted to rise in future if successful prevention programs are not implemented[2]. Another factor which makes HIV positive patients ostracized is the social stigma and very often has difficulty in findings physicians who come forward to treat them[3-5]. Human immunodeficiency virus patients are often associated with aberration of biochemical parameters like renal profile, liver profile, thyroid profile, thrombocytopenia and severe anemia with high erythrocyte sedimentation rate (ESR). Patients with HIV infection were reported to have hypocholesterolaemia with or without hypertriglyceridemia however the mechanism of decrease in cholesterol levels is not known[6]. Studies have been observed when HIV patients are treated with protease inhibitors. They tend to exhibit hyperlipidaemia with increase in total cholesterol, triglycerides, low-density lipoproteins and concomitant decrease in high-density cholesterol[7]. Infections can increase serum triglycerides levels by decreasing clearance of circulating lipoprotein levels as process seems to inhibit the lipoprotein lipase activity or stimulating hepatic lipid synthesis through increase in either hepatic fatty acid synthesis or reesterification of fatty acids derived from lipolysis.

Keeping in view of the various biochemical abnormalities associated with lipid metabolism, our research was inclined to assess the lipid profile in HIV positive cases, with an attempt to further elucidate more features of HIV disease which erupts as acquired immunodeficiency syndrome (AIDS) linking any possible involvement of lipid profile in disease progression of AIDS. The current study is an attempt to examine whether any changes in lipid profile do take in HIV positive patients and whether those changes which are involved could be linked to the development of clinical AIDS with HIV infection. Thus the current study was undertaken to address whether HIV infection can affect lipid profile status in patients.

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2. Materials and methods

2.1. Participants

Ninety-one participants (49 males; 42 females) were enrolled for the present study with ages ranging from 21 to 45 years. Forty seven patients were HIV positive patients (26 men and 21 women, 21-45 years of age) and 44 healthy controls (23 men and 21 women, 21-45 years of age) were recruited for the study. The study was carried out at College of Medicine & JNM Hospital, Kalyani for a period of one year from January 2010 till December 2010 which was pre-approved by the Ethical Committee of this Institution Review Board. For diagnosis and confirmation of HIV infection we followed the National AIDS Control Organization (NACO) recommendation for HIV testing (NACO 2003). All the patients were subjected to detail history taking and clinical examination. The informed consent was obtained from the patients before enrolling them for the study. The inclusion criteria was that patients with confirmed cases of HIV infection without anti-retroviral therapy were included. And the exclusion criteria was that subjects who were smokers, obese and on anti-hypertensive drugs for more than three months and patients on lipid lowering drugs and antioxidant vitamin supplements were excluded.

2.2. Sample collection

Twelve hours fasting blood samples were collected from healthy volunteers and patients with insulin resistance. The patients selected for the study were registered in Out Patients Department (OPD) of College of Medicine & JNM Hospital, Kalyani. Ten mL of blood samples were collected from the participants, of which 5 mL of blood was collected in a sterile test tube, allowed to clot and then carefully centrifuged at 3 000 rpm for 10 minutes. Serum samples obtained were used for analysis of lipid profile.

2.3. Cell count

The CD4 and CD8 lymphocyte count was estimated by Fluoresence Activated Cell Sorter (FACS) count system (Becton Dickinson).

2.4. Lipid profile

Total cholesterol (TC), triglycerides and high density lioprotein-cholesterol (HDL-C) were analyzed enzymatically using kit obtained from Randox Laboratories Limited, Crumlin, UK. Plasma low density-cholesterol (LDL-C) was determined from the values of total cholesterol and HDL-cholesterol using the following formula[8]:

$$\text{LDL-cholesterol} = \text{TC} - \frac{\text{TG}}{5} - \text{HDL-cholesterol (mg/dL)}$$

2.5. Statistical analysis

The data from patients and controls were compared by Student's t-test. Values are expressed as mean±standard deviation (SD). Microsoft Excel for Windows 2003 was used for statistical analysis. P-value <0.05 was considered to indicate statistical significance.

3. Results

The changes in TC, HDL-C, TC/HDL-C and age were not significant when compared between cases and controls (Table 1). Significantly higher levels of triglycerides, low-density lipoproteins, LDL/HDL-C, TG/HDL-C and CD4/CD8 ratio were observed along with decline in CD-4 cells/μL, CD-8 cells/μL (P=0.0001). Furthermore there was a strong correlation between CD-4 cells/μL and TG, LDL-C. Also triglycerides and LDL-C level increased proportional to the increase in CD-4 cells/μL. TG level increases proportional to the increase in CD-4 cells/μL and one unit increase in CD-4 cells/μL ratio will result in 0.45 (confidence interval 0.26 to 0.64) units increase in TG level (R^2=0.34, P=0.0001) (Figure 1). LDL-C level increases proportional to the increase in CD-4cells/μL and one unit increase in CD-4 cells/μL will result in 0.54 (confidence interval 0.44 to 0.64) units increase in LDL-C level (R^2= 0.744, P=0.000 1) (Figure 2).

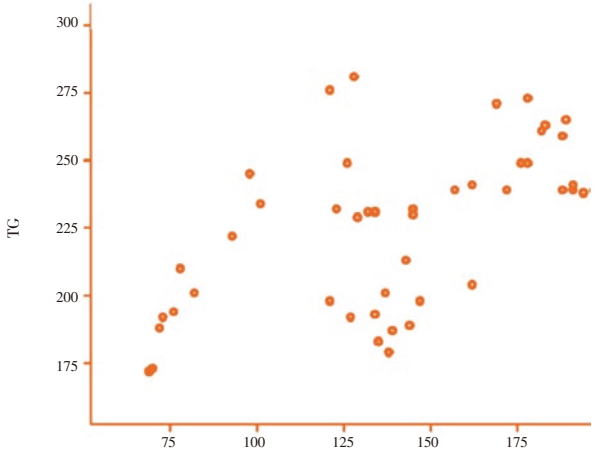

Figure 1. Correlation and regression analysis for CD-4 cells/μL and TG.

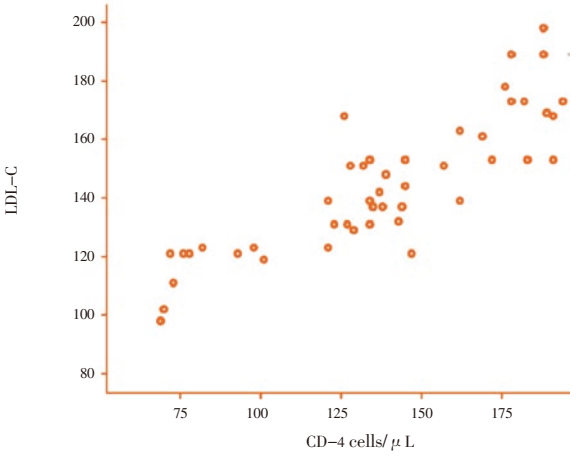

Figure 2. Correlation and regression analysis for CD-4 cells/μL and LDL-C.

Table 1
Lipid profile of HIV positive patients and controls.

	Cases	*n*	Mean±SD
TC	Controls	44	171.50±10.67
	HIV	47	168.55±23.18
TG*	Controls	44	135.89±26.10
	HIV	47	225.43±29.80
HDL-C	Controls	44	51.59±6.48
	HIV	47	51.45±5.91
LDL-C*	Controls	44	107.80±26.14
	HIV	47	145.30±23.89
TC/HDL-C	Controls	44	3.38±0.48
	HIV	47	3.33±0.65
LDL/HDL-C*	Controls	44	2.13±0.61
	HIV	47	2.87±0.60
TG/HDL-C*	Controls	44	2.67±0.58
	HIV	47	4.43±0.76
CD-4 cells/μL*	Controls	44	840.27±62.92
	HIV	47	139.38±38.19
CD-8 cells/μL*	Controls	44	547.23±47.77
	HIV	47	66.55±17.15
CD4/CD8 ratio*	Controls	44	1.54±0.10
	HIV	47	2.10±0.30
Age	Controls	44	31.41±4.73
	HIV	47	31.38±5.63

*: $P<0.05$.

4. Discussion

This study included data on 47 HIV positive patients and 44 HIV negative controls. The study observed no changes in TC, HDL-C and TC/HDL-C ratio. Significantly higher levels of triglycerides, LDL-C, LDL-C/HDL-C and CD4/CD8 ratio with decline in CD4 and CD8 cells in HIV positive patients were observed. Further more the TG and LDL-C levels increased proportional to the increase in CD4 cells.

Study conducted by Pashupati *et al*[9] observed significant reduction of $CD4^+$ cells in HIV/AIDS compared to controls. Their study observed significantly decreased levels of TC, HDL-C and LDL-C in AIDS cases compared to controls which did not conform to the findings of the current study as we observed no changes in TC, HDL-C but significantly higher levels of LDL-C compared to controls.

Further study conducted by Khiangte *et al*[10] on correlation between the changes in lipid profile and the progression of HIV infection also observed significant decrease in TC, HDL-C, LDL-C with concomitant increase in VLDL-C along with significant reduction in $CD4^+$ cell count as the disease progressed gradually. The serum level of TG was found to be lastly affected. The observations made in this study did not conforms to our study as we observed no changes in TC and HDL-C levels in cases when compared to controls.

Study conducted by Adewole *et al*[11] on the effect of antiretroviral therapy on lipid profile in HIV patients in Nigeria, observed significantly higher levels of LDL-C and lower levels of HDL-C in patients compared to controls, when the patients were on antiretroviral therapy. This conformed to the changes in lipid profile on administration of antiretroviral therapy.

Contrary to this report, study based on evaluation of lipid profile in AIDS patients with and without HAART therapy[10] observed mean TC, HDL-C and TG were significantly higher in HAART group compared to no-HAART group subjects. Another study conducted[13] on lipid profile assessment in Thai adult with HIV infection receiving protease inhibitors. They observed mean serum TC, LDL-C, TC/HDL-C and TG levels higher and lower HDL-C levels in cases when compared to controls.

In another study conducted by Obirikorang *et al*[14], serum TG showed significant increase in the subjects compared to control group, serum total cholesterol ($P<0.001$), HDL-C ($P<0.001$) and HDL-C ($P<0.001$) and LDL-C ($P<0.001$) showed significant decreases compared to the control group. HDL-C in subjects' with CD4 cells between 200-499 mm^3 and CD4 $\geqslant$500 showed no statistically significant difference in comparison to control group.

Yet another study conducted on assessment of lipid profile in Switzerland by Young *et al*[15] on HIV patients subjected to anti-retroviral therapies and comparing their efficacies and advantages, also observed a better lipid profiles after commencement of protease inhibitors. They observed drastic increase in HDL-C levels and decline in TG levels with increasing exposure to NNRTI-based therapy, whereas triglyceride levels increase with increasing exposure to PI-based therapy. In another study focused on determination of the effect of HIV infection on lipid metabolism in Cameroon[16] also observed HIV patients with CD4 counts <50 cells/μL had significantly lower TC ($P<0.000\ 1$) and LDL-C ($P<0.000\ 1$) but significantly higher triglyceride values ($P<0.001$) and a higher atherogenicity

index for TC/HDL-C (P<0.01) and HDL-C/LDL-C (P=0.02); patients with CD4 counts of 50-199 cells/μL had significantly lower TC (P<0.001) and significantly higher TG values (P<0.001); patients with CD4 counts of 200-350 cells/μL had significantly higher TG (P=0.003) and a higher atherogenicity index for TC/HDLC (P<0.000 2) and HDLC/LDLC (P=0.04); and those with CD4 counts >350 cells/μL had a higher atherogenicity index for TC/HDL-C (P<0.000 1) and HDL-C/LDL-C (P<0.001). HDL-C was significantly lower in HIV-positive patients irrespective of the CD4 cell count. Lipid parameters were also influenced by the presence of opportunistic infections (OIs) and concluded HIV infection is associated with dyslipidaemia, and becomes increasingly debilitating as immunodeficiency progresses. HDL-C was found to be lower than in controls in the early stages of HIV infection, while TG and the atherogenicity index increased and TC and LDL-C decreased in the advanced stages of immunodeficiency. In another study conducted to evaluate the lipid profile of asymptomatic and untreated HIV patients, also observed significant differences in means (controls *vs.* cases) were found in: HDL-cholesterol (52 mg/dL *vs.* 38 mg/dL, P>0.000 2); LDL-triglycerides (41 mg/dL *vs.* 63 mg/dL, P>0.012); total cholesterol/HDL-cholesterol (3.4 mg/dL *vs.* 4.5 mg/dL, P>0.006); apoA (158 mg/dL *vs.* 127 mg/dL, P>0.000 1); apoB100 (96 mg/dL *vs.* 86 mg/dL, P>0.05), haematocrit (45% *vs.* 42%, P>0.05) and total lymphocytes (2 450/mL *vs.* 1 668/mL, P>0.004). In the case group LDL-cholesterol correlated to immune activation markers (beta-2-microglobulin, P>0.05 and viral load, P>0.01). Their study concluded HIV-positive patients have a significant lower serum HDL-C and a change in LDL composition pattern, with lower cholesterol and apoB100 content and higher triglyceride content, suggestive of altered synthesis of LDL in the liver. In a study conducted by Palaniswamy *et al*[9] established the changes in $CD4^+$ cell count and lipid profile in HIV infection and AIDS patients. The study observed a significant reduction in $CD4^+$ cell count in HIV/AIDS patients when compared to control subjects. Serum levels of total cholesterol, HDL-C and LDL-C were found to be decreased significantly in HIV/AIDS patients when compared with normal counterparts. On the other hand, the levels of triglyceride and very low-density lipoprotein cholesterol (VLDL-C) were markedly elevated in HIV/AIDS patients compared to normal subjects. Hence, it may be justified that $CD4^+$ cell count and lipid profile can be a good index of disease progression in HIV infection and AIDS patients.

The study is limited by low participation rate of HIV positive patients thus lowering the sample size of the study. Future directions of the study: In future a multicentre study should be carried out encouraging HIV positive patients to participate in the study so that concrete findings would come up pertaining to lipid profile in HIV patients without antiretroviral therapy and explaining the basis of alternations in lipid profile.

The study could predict the stage of HIV infection by measuring the changes in lipid profile as the current study observed changes in lipid profile in these HIV positive patients. Further we can establish the association of lipid profile with HIV infection.

Conflict of interest statement

We declare that we have no conflict of interest.

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