Co-Relation between Oxidative Stress and Socioeconomic Status in HIV Pregnant Women at Grant Government Medical College and JJ Group of Hospital Byculla Mumbai

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Introduction

Human immunodeficiency virus (HIV), since its discovery, is still a great challenge on the health care delivery system worldwide. Several attempts have been made to find a cure but none has been able to see the light of the day. The presence of this virus in the body system poses a stress on body metabolism. Free radicals are generated and they affect cellular organelles, this may worsen the damage HIV has on the body system. Pregnancy also is a stressful physiological condition. This has been associated with an increased free radical injury and lowered antioxidant status. Lipid peroxidation is an oxidative process which occurs at low levels in all cells and tissues. Under normal conditions, a variety of antioxidant mechanisms serve to control this peroxidative process [1]. The generation of free radicals is a normal physiological process, but increased production of free radicals can act on lipids causing lipid peroxidation. The cells have evolved a number of counter acting antioxidant defenses. Free radical scavenging mechanisms includes enzymatic like GR, GPx, SOD, MDA and total antioxidant and nonenzymatic antioxidants i.e. vitamins, minerals which limit the cellular concentration of free radical and prevent excessive oxidative stress.

Pregnancy is a stressful condition in which many physiological and metabolic functions are altered to a considerable extent. Consequently, remarkable and dramatic events occur during this period [2]. Moreover, pregnancy is a physiological state, accompanied by a high-energy demand and an increased oxygen utilization, both of which may lead to increased oxidative stress. Oxidative stress occurs when there is an imbalance between free-radical production and the radical scavenging capacity of antioxidant systems [3]. Recently, Leal et al. [4] showed that there was a change in the prooxidant and antioxidant defenses that are inherent to pregnancy process.

HIV stands for human immunodeficiency virus. HIV attacks the body's immune system, gradually destroying its ability to fight infections and certain cancers. Left untreated, HIV can develop into acquired immunodeficiency syndrome (AIDS). This is the most severe stage of HIV and is usually fatal. There's currently no cure for HIV. However, medication can slow the progression of HIV and delay the onset of AIDS. Many people diagnosed with HIV today stay healthy for many years and have a nearly normal life span. In 1981, the first cases of atypical skin lesions and an aggressive disease of Kaposi's sarcoma appeared in homosexual men [5]. These

accounts marked the initial onset of a condition that became known as Acquired Immune Deficiency Syndrome (AIDS). Within twenty years, AIDS became a global epidemic; an estimated 20 million people died, and an additional 36 million people were living with its causative agent –human immunodeficiency virus (HIV) [6]. India has the third largest HIV epidemic in the world. Some people have no symptoms when they first become infected with HIV. Others develop temporary flu-like symptoms in the first few weeks after being exposed to the virus. These include fever, headache, sore throat, achiness, fatigue, and swollen glands. These symptoms may not seem significant at first because they're similar to flu and generally get better without treatment.

It can take as long as 10 years after infection to develop more severe symptoms. During this time, most people experience a gradual reduction in the number of CD4 cells in their blood.

Healthy adults have between 500 and 1,200 CD4 cells in every cubic millimeter (mm^3) of blood. A person with fewer than 200 cells per mm^3 starts to develop serious infections called opportunistic illnesses and has progressed to AIDS.

The Symptoms of AIDS includes:

- swollen lymph glands
- rapid weight loss
- frequent fevers and sweating
- persistent or frequent sores in the mouth or vagina
- extreme and unexplained tiredness

In 2015, HIV prevalence in India was an estimated 0.26%. This figure is small compared to most other middle-income countries but because of India's huge population (1.2 billion) this equates to 2.1 million people living with HIV. In the same year, an estimated 68,000 people died from AIDS-related illnesses [7]. Overall, India's HIV epidemic is slowing down, with a 32% decline in new HIV infections 86,000 in 2015, and a 54% decline in AIDS-related deaths between 2007 and 2015 [8]. India has the third largest HIV epidemic in the world. The HIV epidemic in India is driven by heterosexual sex, which accounted for 87% of new infections in 2015. However, the epidemic is concentrated among key affected populations such as sex workers. The vulnerabilities that drive the epidemic are different in different parts of the country. The five states with the highest HIV prevalence (Manipur, Mizoram, Nagaland, Andhra Pradesh and Karnataka) are in the south or east of the country. Some states in the north and northeast of the country have also reported rising HIV prevalence [9]. A large majority of those infected lived in non-industrialized countries with inadequate financial support to handle the pandemic.

The socio economic status (SES) is an important determinant of health, nutritional status, mortality and morbidity of an individual. SES also influences the accessibility, affordability, acceptability and actual utilization of available health facilities. There has been a lot of discussion of late in the country regarding the number of people living below the poverty line (BPL families). They vary from 42% and 26% in rural and urban India [10]. They also differ based on the different committees that had been formed to look into the problem. There is a need to identify the actual beneficiaries who will be benefitted by the government programs. One of the tools available to measure the problem is the identification of SES of the family by applying the SES scales.

Income, education and employment status are important determinants of HIV risk, and are clearly closely related insofar as they determine an individual's SES. Each of these factors is discussed separately below. It should be noted that there are considerable complications in measuring factors such as income and employment status. Income can be defined in terms of individual income or

household income. In the analysis that follows, there is no attempt to distinguish between the two, although clearly a high household income does not necessarily imply a high individual income. Different definitions of unemployment are possible, and these are briefly discussed. The effect of income and employment status on HIV risk can also be examined at both individual and community levels.

Usually the relationship between SES and health is such that an improvement in health status is seen with every increase in SES with this relationship being termed a gradient [11]. The important components of SES are income, education and occupation, and globally there is a strong inverse relationship between HIV infection rates and all three components. It is no surprise therefore that researchers like Gilbert and Walker suggest that "for 1/4thof the world's population absolute poverty remains the principal determinant of their health status, exposure to HIV/AIDS, and high levels of fertility" [12].

Furthermore, the presence of HIV pregnancy and SES may cause worse oxidative stress injury, that is, imbalance in oxidant and antioxidant in excess of oxidant. In the present study, our aim was to investigate oxidative stress as an indicator of oxygen radical activity and antioxidant defenses in HIV or AIDS pregnant women and socioeconomic status, compare with normal healthy pregnant women at Grant Government Medical College and JJ group of hospital byculla Mumbai.

Material and Methods

I. Selection of Patients

The study was conducted in the Dept. of Biochemistry and in collaboration with Obstetrics and Gynecology Dept. at Grant Government Medical College and JJ group of hospital byculla Mumbai. (MS)**.** Investigation was carried out in 100 pregnant women suffering from HIV or AIDS and compared with 100 normal control group composed of age matched healthy pregnant women and find out

relation between socioeconomic status and oxidative stress.

II. Collection of blood samples

Overnight fasting 5ml blood samples were collected from HIV or AIDS and normal healthy pregnant women in plain bulb and EDTA bulb. The plasma was separated from plain vacuum tube, aliquoted and stored at -4°C - 17°C and used for the estimate glutathione reductase (GR), glutathione peroxidase (GPx), Superoxide dismutase (SOD), Malondialdehyde (MDA), total antioxidant and compare oxidative stress with socioeconomic status. Socioeconomic status was calculated by **KUPPUSWAMY'S** socio-economic status scale [13]. Serum GR, GPx, SOD and total antioxidant activity were measured by using ELISA and reagents kits will purchased from **RANDOX** Laboratories Ltd. [14-17].

Table no 1:- Shows Age wise distribution of Control group and HIV Pregnant women

Age Group	Pregnant Women (n=100)	HIV Pregnant Women (n=100)
23-24 yrs	12	8
25-26 yrs	34	23
27-28 yrs	29	27
29-30 yrs	15	31
Above 31	10	11

Table 1 shows the age wise HIV pregnant women and normal subject group distribution. In first group, second group, third group, fourth group and in fifth group 8, 23, 27, 31 and 11 respectively HIV pregnant women's were studied.

Table -2: Socio-Economic Classes of Pregnant and HIV-Pregnant women's

Socio-Economic Group	Pregnant females	HIV-Pregnant Females	Total
upper class	20	20	40
upper middle class	20	20	40
lower middle	20	20	40
upper lower	20	20	40
lower	20	20	40
Total	100	100	200

Table 2 shows the socio-economic classes of normal pregnant women's and HIV pregnant women. It contains 20 normal and HIV pregnant women in each class. Total 100 normal and 100 HIV pregnant women's selected for study

III. Data Analysis

Data were expressed as mean ±SD. Mean values were assessed for significance by paired student –t test. A statistical analysis was performed using the Stastical Package for the Social Science program (SPSS, 23.0). Frequencies and percentages were used for the categorical measures. Probability values $p < 0.05$ were considered statistically significant.

IV. Ethical committee Clearance

The protocol study was approved by the institutional ethics committee (No.IEC/ Pharm / 902/ 2013) and National AIDS Control Organisation Delhi, India (T-11020/74/2014-NACO).

Results and Discussion

Table3 shows the activity of Biochemical parameters in normal pregnant and HIV pregnant women– based on socio-economic status.

Parameters	Females (All classes)	N	Min	Max	Mean	SD	'p' value
GR (Ug/HB)	Pregnant	100	3.00	6.00	4.3780	0.7928	<0.001
	HIV Pregnant	100	1.90	6.00	3.5150	1.1548	
GPx (Ug/HB)	Pregnant	100	20.00	31.00	27.1700	2.7627	<0.001
	HIV Pregnant	100	13.00	23.50	19.5400	2.5103	
SOD (Ug/HB)	Pregnant	100	600.00	1302.00	944.9400	193.1878	<0.001
	HIV Pregnant	100	400.00	908.00	675.3800	125.9321	
MDA (nmol/L)	Pregnant	100	4.00	5.20	4.5040	0.3210	<0.001
	HIV Pregnant	100	4.50	6.30	5.4690	0.5530	
Total Antioxidant (mmol/L)	Pregnant	100	.90	1.60	1.1918	0.2004	<0.001
	HIV Pregnant	100	.50	1.00	.8820	0.1507	

Table 3 shows the activity of antioxidant in normal pregnant and HIV positive pregnant women. The activity

in normal pregnant women were 4.37 ± 0.79, 27.17 ± 2.76, 944.9 ± 193.1, 4.50 ± 0.32, 1.19 ± 0.20 and the activity were 3.51 ± 1.15, 19.54 ± 2.51, 675.3 ± 125.9, 5.46 ± 0.55, and 0.88 ± 0.15 found in HIV pregnant women. It shows that the level of antioxidant in HIV pregnant women was significantly decreased. The MDA activity was slightly increased found compare to normal pregnant women as compared to HIV pregnant women; similar observation was made by Kodliwadmath et al [18]. The present study revealed a decrease in the level of SOD in serum of HIV/ AIDS patients than control group but this decrease was statistically insignificant [19,20]. The SES score in normal pregnant women was in normal and in HIV positive pregnant women was significantly decreased found. It shows low socio-economic profile is associated with a slightly lower HIV risk than is apparent in communities with a 'medium' socio-economic profile, but communities with high socio-economic status appear also to have low levels of HIV prevalence.

SOD and MDA is a decisive antioxidant enzyme in aerobic cells, which is responsible for the elimination of superoxide radicals and it converts two toxic species: Superoxide and hydrogen peroxide (H_2O_2) into water. This diminishes the toxic effects of superoxide radical and other radicals formed by secondary reactions. GR and GPx is a selenocysteine – dependent enzyme. GPx in cells is the most important hydrogen peroxide (H_2O_2) scavenging enzyme [21].

Table – 4 : Activity of Biochemical parameters in upper class normal pregnant and HIV pregnant women– based on socio-economic status

Parameters	Females (upper class)	N	Min	Max	Mean	SD	'p" value
GR (Ug/HB)	Pregnant	20	3.00	6.00	4.40	0.87	0.002
	HIV Pregnant	20	1.90	6.00	3.32	1.15	
GPx (Ug/HB)	Pregnant	20	20.00	31.00	26.70	3.11	<0.001
	HIV Pregnant	20	13.00	22.00	19.00	2.29	
SOD (Ug/HB)	Pregnant	20	600.00	1300.00	920.95	178.77	<0.001
	HIV Pregnant	20	450.00	908.00	708.60	131.91	
MDA (nmol/L)	Pregnant	20	4.00	5.00	4.49	0.32	<0.001
	HIV Pregnant	20	4.50	6.30	5.49	0.57	
Total Antioxidant (mmol/L)	Pregnant	20	0.90	1.50	1.17	0.18	<0.001
	HIV Pregnant	20	0.50	1.00	0.86	0.18	

Table – 5: Activity of Biochemical parameters in upper middle class normal pregnant and HIV pregnant women– based on socio-economic status

Parameters	Females (upper middle class)	N	Min	Max	Mean	SD	'p" value
GR (Ug/HB)	Pregnant	20	3.60	6.00	4.56	0.71	0.071
	HIV Pregnant	20	2.00	6.00	3.79	1.18	
GPx (Ug/HB)	Pregnant	20	23.50	31.00	27.63	2.13	<0.001
	HIV Pregnant	20	13.00	23.50	19.53	2.76	
SOD (Ug/HB)	Pregnant	20	600.00	1302.00	914.85	216.84	<0.001
	HIV Pregnant	20	400.00	850.00	670.00	118.55	
MDA (nmol/L)	Pregnant	20	4.10	5.20	4.51	0.32	<0.001
	HIV Pregnant	20	5.00	6.30	5.48	0.55	
Total Antioxidant (mmol/L)	Pregnant	20	0.90	1.60	1.21	0.21	<0.001
	HIV Pregnant	20	0.60	1.00	0.90	0.13	

Table – 6 : Activity of Biochemical parameters in lower middle class normal pregnant and HIV pregnant women– based on socio-economic status

Parameters	Females (lower middle class)	N	Min	Max	Mean	SD	'p" value
GR (Ug/HB)	Pregnant	20	3.00	6.00	4.41	0.88	0.021
	HIV Pregnant	20	2.00	6.00	3.59	1.25	
GPx (Ug/HB)	Pregnant	20	20.00	31.00	26.13	2.96	<0.001
	HIV Pregnant	20	13.00	23.50	19.43	2.68	
SOD (Ug/HB)	Pregnant	20	700.00	1302.00	988.90	182.43	<0.001
	HIV Pregnant	20	400.00	890.00	664.80	114.14	
MDA (nmol/L)	Pregnant	20	4.00	5.20	4.58	0.35	<0.001
	HIV Pregnant	20	5.00	6.30	5.48	0.55	
Total Antioxidant (mmol/L)	Pregnant	20	0.90	1.60	1.20	0.23	<0.001
	HIV Pregnant	20	0.60	1.00	0.91	0.12	

Table – 7 : Activity of Biochemical parameters in upper lower class normal pregnant and HIV pregnant women– based on socio-economic status

Parameters	Females (upper lower class)	N	Min	Max	Mean	SD	'p" value
GR (Ug/HB)	Pregnant	20	3.00	6.00	4.17	0.80	<0.001
	HIV Pregnant	20	1.90	4.90	3.09	0.95	
GPx (Ug/HB)	Pregnant	20	20.00	31.00	27.15	2.66	<0.001
	HIV Pregnant	20	15.00	23.50	20.23	2.08	
SOD (Ug/HB)	Pregnant	20	600.00	1300.00	916.65	207.37	<0.001
	HIV Pregnant	20	400.00	908.00	661.60	150.26	
MDA (nmol/L)	Pregnant	20	4.00	5.00	4.46	0.33	<0.001
	HIV Pregnant	20	4.50	6.30	5.42	0.60	
Total Antioxidant (mmol/L)	Pregnant	20	1.00	1.40	1.19	0.15	<0.001
	HIV Pregnant	20	0.50	1.00	0.84	0.18	

Table – 8 : Activity of Biochemical parameters in lower class normal pregnant and HIV pregnant women– based on socio-economic status

Parameters	Females (lower class)	N	Min	Max	Mean	SD	'p" value
GR (Ug/HB)	Pregnant	20	3.00	6.00	4.35	0.72	0.078
	HIV Pregnant	20	2.00	6.00	3.79	1.18	
GPx (Ug/HB)	Pregnant	20	20.00	31.00	28.25	2.61	<0.001
	HIV Pregnant	20	13.00	23.50	19.53	2.76	
SOD (Ug/HB)	Pregnant	20	789.00	1302.00	983.35	182.26	<0.001
	HIV Pregnant	20	400.00	850.00	670.00	118.55	
MDA (nmol/L)	Pregnant	20	4.00	5.00	4.49	0.31	<0.001
	HIV Pregnant	20	5.00	6.30	5.48	0.55	
Total Antioxidant (mmol/L)	Pregnant	20	0.90	1.60	1.19	0.23	<0.001
	HIV Pregnant	20	0.60	1.00	0.90	0.13	

Table no 4, 5, 6, 7 and 8 shows the level of antioxidants in normal and HIV pregnant women based on socio-economic status. In all class the level of antioxidant were stastically significantly lower in HIV pregnant women compare to normal pregnant women.

Socioeconomic status (SES) encompasses not just income but also educational attainment, financial security, and subjective perceptions of social status and social class. Socioeconomic status can encompass quality of life attributes as well as the opportunities and privileges afforded to people within society. Poverty, specifically, is not a single factor but rather is characterized by multiple physical and psychosocial stressors. Further, SES is a consistent and reliable predictor of a vast array of outcomes across the life span, including physical and psychological health. Thus, SES is relevant to all realms of behavioral and social science, including research, practice, education, and advocacy.

A similar findings was observed by Nobubelo Ngandu [22] and he showed in the 7th South African AIDS conference they shows that there was a significant difference in the proportion of infants that were HIV-exposed (infants born to HIV-positive women), according to socio-economic status. Infant exposure occurred in 37.9% (95% CI: 34.4 – 41.4) in the lowest 10% of the socio-economic status ranking, compared to 23.5% (95% CI: 20.5 – 26.8) in the highest 10% and 33.2% (95% CI: 32.1 – 34.3) in the sample average. In the highest-status 10%, only 18.7% (95% CI: 16.0 – 21.7) self-initiated HIV testing before enrolling into antenatal care, compared to 23.8% (95% CI: 20.9 – 27.0) in the lowest-status 10% and 22.4% (95% CI: 21.4 – 23.4) in the sample average. However, this difference was not significant. Socio-economic status is an important determinant of healthcare uptake. Studies have illustrated examples of wealth-related inequalities in maternal and child health care in low and middle-income countries, such as access to skilled birth attendance and antenatal care and early uptake of HIV testing. As wealth-related inequality is generally very high in South Africa, this study sought to understand if this was affecting the PMTCT programme. When wealth-related inequality was measured using the concentration index to compare the cumulative proportion of a health outcome and individuals ranked by socio-economic status, it was found that uptake of early HIV testing is slower and that infant HIV exposure increases faster among the lower socio-economic status groups. However, the wealth-related inequality is underestimated by this sample, as the data is only relevant to communities using accessible public health facilities.

In this study found that higher socio-economic status was associated with the likelihood of HIV testing through VCT; that lower socio-economic status was associated with the likelihood of testing at integrated facilities; and that PMTCT and integrated testers were similar to non-testers and had lower levels of educational attainment compared with VCT testers. These results have implications for the implementation of programmes designed to ensure access to testing in low-resource settings [23]. They suggest that provider-initiated modes of testing can increase uptake among socio-economically disadvantaged strata to a greater extent than traditional VCT at stand-alone facilities. Secondly, the lack of socio-economic differentials for PMTCT is consistent with the notion that expanding testing through PMTCT has reduced socio-economic obstacles for women [24]. It is important to develop comparable ways to reach men and address the gender dimension of HIV testing, which has been recognized in global documents. Thirdly, given low levels of testing worldwide and the persistence of socio-economic obstacles to the uptake of testing, continued efforts are needed to encourage testing among the less affluent through multiple means.

Conclusion

The relationship between oxidative stress and socio-economic markers such as GR, GPx, DOS, MDA, total antioxidant, income, education and employment status, is highly complex, and is likely to be obscured by a variety of other demographic factors. The crucial point is that the individual's risk of HIV infection is determined by both her socio-economic status, and the socio-economic profile of the community in which she is situated. Both factors are 'non-linear' in terms of the effect they have on HIV risk.

"At a community level, low socio-economic profile is associated with a slightly lower HIV risk than is apparent in communities with a 'medium' socio-economic profile, but communities with high socio-economic status appear also to have low levels of HIV prevalence".

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