

Effect of Antioxidant Nutraceuticals and Functional Foods on Blood Serum and Immune Activation of HIV Infected Patients in Abuja, Nigeria

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Abstract

ABSTRACT

Oxidative stress induced by free radicals (Reactive Oxygen species) during Human Immunodeficiency Virus (HIV) infection impairs immune functions through the destruction of cluster of differentiation antigen 4 (CD4+), causes more rapid disease progression, cell death e.g. blood cells, increase viral replication and increase requirements for dietary antioxidant such as B-carotene, Vitamin C and E respectively. These dietary requirements reduce oxidative stress and are very important especially in HIV/AIDS infected individuals. They can be found as finished antioxidants extracts called nutraceuticals (N) or as natural forms called functional foods (Fruits and Vegetables) (F). This study investigates the effects of antioxidants supplementation (both nutraceutical and functional food) on some hematological parameters (RBC, WBC, PLT, PCV, HB, etc) and the lipid of some HIV infected individuals. The result obtained showed that the dietary antioxidant supplementation brought about a significant increase ($p < 0.05$) in the hematological parameters and the lipid profile of the test groups compared to the control. This show that dietary antioxidant supplementation may reduce the progression of HIV through the reduction of oxidative stress as evident in the increased CD4 levels of the test groups.

Keywords: Human immunodeficiency virus, Oxidative Stress, Nutraceuticals, Antioxidant, Functional foods

Introduction

Human immunodeficiency virus (HIV) belongs to a class of virus called non-transforming retrovirus from the lentivirus family (cotran, et al., 1999). It is the virus that causes acquired immune deficiency syndrome (AIDS). (CDC, 2009) A syndrome is a collection of symptoms

and signs of a disease. HIV breaks down the body immune system invades and destroy certain white blood cells called cluster of differentiation antigen 4 (CD4+) cells initially and progressively lead to AIDS. (Pasupathi, et al., 2009). CD4 cells are responsible for the trigger of immune response to infections and diseases; HIV attacks them, uses them to make several copies of itself and destroys them. (U.S.Dhhs, 2012). HIV infection has been known to comprise the nutritional status of HIV-infected people and a poor nutritional status has been shown to accelerate the progression of HIV infection (Allard et al., 1998; Jiamton et al., 2003; Piwoz, 2004). HIV infection could affect the nutritional status of an infected person in different ways: via a reduction in food intake, reduction in nutrient absorption, gastrointestinal and oral pathology, increasing the utilization and excretion of proteins and micronutrients (Roy et al., 1994; Watson, 1994; Piwoz and Preble, 2000). It has been demonstrated that HIV infection increases the release of pro-oxidants, cytokines and ROS leading to increased utilization of antioxidant vitamins such as A, E, C, beta-carotene as well as micro minerals such as iron, zinc, selenium manganese and copper., this may lead to an imbalance between pro-oxidants and antioxidants which as a consequence may lead to oxidative stress which in turn may cause further damage to human cells, proteins and enzymes, thus accelerating HIV replication and ultimately death of the patient (Tang et al., 1997; Friis and Michaelson, 1998). Scientific reports support the view that vitamins and minerals are essential in reducing HIV disease progression and it has been shown that these micronutrients are required by the immune system and major organs to fight infectious pathogens (Tang et al., 1996; Chandra, 1997; Oguntibeju et al., 2003). Micronutrients and micronutrient supplementation have been shown to improve the effectiveness of the immune system and to reduce the severity and impact of opportunistic infections in people living with HIV/AIDS. (Tang et al.; Piwoz and Preble, 2000).

The paper is aimed

To investigate the antioxidant potentials of functional foods and Nutraceuticals on the immune system, blood parameters and lipid profile of HIV infected individuals. This study will be useful to the nation at large as functional foods and nutraceuticals can be used in the management of HIV infection

Material and Method

Patient treatment and biochemical investigation

A total of 180 HIV infected patients were divided into three (3) groups of 60 patients each. Group (A) patients were given functional foods (from fruits and vegetables) highly rich in antioxidants (vitamin C, E, A. and other carotene derivatives) in addition to their antiretroviral drugs. Group (B) patients were given nutraceuticals highly enriched in the afore-mentioned

antioxidants also in addition to their antiretroviral therapy and the third group (C) patients were give only antiretroviral drugs.

All patients range from age 25-50 years of age with considerable body mass index (BMI). After collection of clinical clearance (Ethical clearance) from the federal ministry of health F.C.T. Abuja, Nigeria. The study was carried out at the suleja clinic and feropod hospital both in Abuja for a period of three (3) months.

Red blood count, total white blood cell count, platelet count, total hemoglobin and packed cell volume (PCV) were determined using fully automated hematology analyzer (Pentra-XL 80, Horbia ABX, USA). The (CD4+) lymphocyte count was estimated by fluorescence Activated Cell Sorter (FACS) count system (Becton Dickson, USA).

Blood collection and erythrocyte lysate preparation

Blood samples were collected by venous puncture in heparinized tubes and the plasma was separated by centrifugation at 1000g for 15 minutes. After centrifugation, the Buffy coat was removed and the packed cells were washed three times with physiological saline. A known volume of the erythrocytes was lysed with hypotonic phosphate buffer (PH 7.4). The hemolysate was separated by centrifugation at 2500×g for 15min at 2°C. Capillary tubes were used for packed cell volume (PCV) while the turf solution was used for red bloods and white blood cells

Assay of Lipid Profile:

Component lipids were estimated using enzymatic colorimetric diagnostic kits obtained from Randox Laboratories, Antrium, United Kingdom BT 294 QY.

Total cholesterol estimation

The estimation of serum cholesterol was done by end point method of (Allain *et al*, 1974).

$$\text{Conc. of cholesterol in sample} = \frac{\Delta A \text{ sample} \times \text{conc. of standard}}{\Delta A \text{ standard}}$$

Where Δ = absorbance

Triacylglycerol Estimation (TG)

The estimation of triglycerides was done by end point method of McGowan *et al.*, (1983).

$$\text{Triglyceride concentration} = \frac{\text{Absorbance of Sample} \times 200}{\text{Absorbance of Standard}}$$

High density lipoprotein Estimation (HDL)

The estimation of serum HDL was done by precipitation method of Lopez-Virella *et al.* (1977).

$$\text{HDL-Cholesterol in mg/dl} = \frac{\text{Absorbance of Sample} \times 200}{\text{Absorbance of Standard}}$$

Factor of 200 was used instead of 50 for calculation due to serum dilution during precipitating step.

Low density lipoprotein-cholesterol Estimation (LDL-CHOL)

The estimation of LDL-cholesterol was determined by using formula of Friedwald *et al.* (1972).

$$\text{LDL-cholesterol} = \text{Total cholesterol} - (\text{TG}/5 + \text{HDL})$$

CD4 preparation

ELISA kits (Wernette, *et al.*, 2003) were used for the determination of cluster of differentiation cells (CD4) in blood serum.

Statistical analysis

Data collected were expressed as mean \pm standard deviation (SD) and the Statistical package for social sciences (SPSS) v15.0 was used for analysis. Values of $P < 0.05$ were regarded as significant.

Results and Discussions

Table 1: effects of functional foods and nutraceuticals on hematological parameters of the test groups compared to the control

S/N	HEMATOLOGICAL PARAMETERS	FUNCTIONAL FOODS	NEUTRACEUTICAL	CONTROL
1.	PCV (%)	43.4±5.758	36.1±2.923	23.15±4.761
2.	HB(g/dl)	14.82±1.827	11.59±0.3213	8.78±1.994
3	RBC(106/μl)	4.05±0.8631	5.10±0.5183	3.1±0.7196
4	MCV (%)	76.66±12.541	48.1±9.457	61.8±13.290
5	MHC (%)	23.88±5.814	26.2±7.021	24.9±4.383
6	MCHC (%)	30.1±3.900	29.4±2.914	27.2±7.115
7	PLT (cells/103μl)	124600±197600	124600±14968	700100±293190
8	WBC (106/μl)	5.22±1.962	11.59±0.3213	8.78±1.994
9	Differentials	53.09±4.875	44.4±3.565	35.6±10.002
10	BAS (%)	0.12±0.1398	0.12±0.1398	0.07±0.1059
11	EOS (%)	0.43±0.2946	0.54±0.1955	0.45±0.2953
12	LYMPH (%)	39.5±7.721	40.4±4.169	46.3±9.889
13	MON (%)	3.96±5.334	6.32±6.007	49±5.507
14	CD4 (cells/μl)	252.1±40.902	248.1±50.803	201±35.29

Values are given as mean ±S.D from ten subjects in each group

Table 2: effects of functional foods and nutraceuticals on the lipid profile of the test groups compared to the control.

GROUP	CD4+ COUNT	LDL	HDL	TG
Control	201±35.29	1.431±0.091	0.670±0.731	1.387±0.057
Functional Foods	252.3±40.90	1.137±0.019	1.130±0.128	1.651±0.068
Nutraceuticals	248.1±50.80	1.275±0.045	1.320±0.121	1.620±0.0821

Values are expressed as mean ±SD from ten subjects in each group.

Oxidative stress has been proposed in the immunologic defect observed in effector cells (Cd4) of the immune system, blood cell death and viral replication in human immunodeficiency virus (HIV) infected patient (Cayota, et.al.).pasupathi, et . al, 2009; Wu and Cederbaum,2003 also posit that lipid peroxidation subjects HIV-infected individuals to chronic oxidative stress. This study was designed to investigate the effect of antioxidant supplementation (nutraceuticals and functional foods) on hematological parameters (WBS, PCV, and MCHC e.t.c), lipid profile and the Cd4 levels of HIV infected individuals.

From the result, there was a significant increase ($p < 0.05$) in the hematological parameters of the test groups compared to the control, Also, from the result, there was a significant increase ($p < 0.05$) in the level of HDL and a significant decrease in the level of LDL, however there was no significant difference ($p < 0.05$) in the TG levels of both the test groups and the control. Also, antioxidant supplementation brought about a significant increase in the CD4+ count of the test group when compared to the control. This is not surprising, bearing the fact that oxidative stress produced through free radical generation is cardinal to the pathogenesis of HIV infection. Antioxidant supplementation brought about these remarkable observations by combating the free radicals generated through the course of HIV infection. Antioxidant supplementation brought about these remarkable observations by combating the free radicals generated through the course of HIV infection thereby increasing the life –expectancy of HIV infected individuals on antioxidant supplementation (Nutraceuticals and functional foods) in addition to their retroviral therapy. These findings are also in accordance with those conducted by other researchers (Jariwalla, et al, 2011; Muller, et al, 2000; Nat, 2007 and shen et al, 2000). It is therefore recommended that adequate dietary intake and nutrient supplement should be embraced in the management of HIV infection.

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