

# Nutritional Status in Patients with HIV Infection and Aids in a Tertiary Health Centre in Nigeria

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## **ABSTRACT**

**Background:** Nutritional status may be an important factor in the prognosis of morbidity and mortality in Human Immunodeficiency Virus (HIV)-seropositive individuals. HIV-positive individuals are prone to malnutrition due to inadequate dietary intake, especially in under developed countries like Nigeria where 70 % of the population is estimated to be living on or below the poverty line. In addition, stigmatization and discrimination results in a lack of support for HIV-positive individuals, ultimately contributing to further reduced food availability and inadequate dietary intake. The aim of the present study was to evaluate the nutritional status using laboratory parameters and body mass index (BMI) in HIV-seropositive patients in Zaria, Nigeria.

**Methodology:** Serum total cholesterol, glucose, total protein, albumin, total calcium and phosphorus in a cross sectional study of 150 HIV- positive patients (100 on antiretroviral (ARV) therapy and 50 ARV naive) and 50 controls were assessed. BMI of all the volunteers was calculated. The data obtained were analyzed using SPSS 15.0. Two-tailed student's t-test for matched samples, analysis of variance (ANOVA) and Pearson's linear correlation were employed for the analysis. A p < 0.05 was considered as statistically significant.

**Results:** Significantly lower ( $p < 0.05$ ) values of serum total cholesterol, glucose, total protein, albumin and BMI were observed among ARV naive patients. Hypoalbuminaemia was recorded in 30 % and 34 % of patients on treatment and naive respectively. Also 20 % and 12 % of ARV naive patients had hypocholesterolaemia and hypoglycaemia respectively. Based on BMI, 7 % of patients on treatment and 32 % of ARV naive were malnourished.

**Conclusion:** Malnutrition is common among HIV-positive patients in Zaria, Nigeria.

**Keywords:** HIV, BMI, Antiretroviral, Malnutrition

## **Introduction**

Human Immunodeficiency Virus (HIV) infection is a major global health problem, and nutritional disorders are often present in HIV/

AIDS patients.<sup>1</sup> The virus has the capability to affect every organ system in the body by direct damage or by rendering the host susceptible to opportunistic infections.<sup>2</sup>

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Malnutrition is frequent and a marker for poor prognosis and can also itself induce immune-depression and worsen HIV-related immune-depression among HIV-infected subjects.<sup>3</sup> HIV-positive individuals are prone to malnutrition due to inadequate dietary intake, nutritional losses, metabolic changes and increased requirements for both macro- and micro-nutrients.<sup>4</sup>

The importance of good nutrition in HIV management in Nigeria is not diminished by the advent of antiretroviral (ARV) drugs, whose metabolic effects on underprivileged, malnourished subjects are yet to be carefully characterized.<sup>5</sup> It is estimated that 24 % of sub-Saharan Africans live on less than US \$1.00 daily.<sup>6</sup> For Nigeria, 70 % of the population is estimated to be living on or below the poverty line<sup>5</sup>, and also with stigmatization and discrimination results in a lack of support for HIV-positive patients, ultimately contributing to further reduced food availability and inadequate dietary intake.<sup>4</sup> The American Diabetic Association has also emphasized that nutrition intervention and education should be part of the health care provided to individuals infected with HIV, and they should be implemented at all stages of the disease.<sup>7</sup> This is not available in this group of patients in most of our treatment centres.

This study was aimed at evaluating the nutritional status of HIV-seropositive patients in Zaria, Nigeria, using some commonly assayed biochemical parameters and body mass index (BMI). The study could help in improving the management and subsequently prognosis of HIV-seropositive patients in our treatment centres.

### Subjects and Methods

This cross sectional study was conducted between January, 2010 and April, 2010 among HIV-seropositive subjects aged 16-50 years attending ARV clinic in Ahmadu Bello University Teaching Hospital (ABUTH), Zaria in Northern Nigeria. The study was approved

by the ethical committee of the hospital. Informed written consent was obtained from all participants.

One hundred (100) HIV-seropositive subjects on ARV therapy (combination of zidovudine, lamivudine and nevirapine), fifty (50) patients who were ARV naive confirmed with western blot attending ARV clinic in ABUTH, Zaria (patients in both groups were randomly selected) and also fifty (50) HIV-negative controls were assessed for nutritional status. The subjects with features suggestive of tuberculosis and malignancies were excluded from the study to rule out other factor(s) that could affect or worsen nutritional status.

Weight (kg) and height (m) of the studied subjects were recorded with subjects wearing light clotting and BMI calculated. Blood sample was collected into plain bottles and serum obtained from the clotted blood samples after centrifuging. Serum total cholesterol, glucose, total protein, albumin, total calcium and phosphorus were assayed using SELECTRA XL automated chemistry analyser.

Data obtained were analysed using SPSS 15.0 for window (Chicago, USA). The analysis of variance (ANOVA) and student's t-test were used to compare mean values of variables. Also Pearson's linear correlation analysis to test significance of association was carried out. A p-value of less than or equal to 0.05 ( $p \leq 0.05$ ) was considered statistically significant.

### Results

For the patients receiving ARV therapy, the mean duration on ARV drugs was  $19.88 \pm 1.71$  months. The mean age of patients on ARV therapy, ARV naive patients and controls were  $32.66 \pm 0.68$ ,  $38.10 \pm 0.68$  and  $36.04 \pm 0.57$  years respectively ( $p > 0.05$ ). The mean weight of patients on treatment, ARV therapy naive patients and controls were  $62.17 \pm 1.29$ ,  $51.11 \pm 0.85$  and  $66.42 \pm 0.92$  kg respectively.

**Table 1:** Laboratory parameters and BMI (Mean  $\pm$  SEM) in study population

Subject	n	TP (g/L)	Alb (g/L)	Chol (mmol/L)	Glu (mmol/L)	Ca <sup>2+</sup> (mmo/L)	PO <sub>4</sub> <sup>2-</sup> (mmol/L)	BMI (kg/m <sup>2</sup> )
HIV patient on ARV	100	94.88 $\pm$ 1.71	49.52 $\pm$ 0.94	6.96 $\pm$ 0.20	4.30 $\pm$ 0.13	2.62 $\pm$ 0.03	1.21 $\pm$ 0.03	24.41 $\pm$ 0.46
HIV patient ARV naive	50	71.84 $\pm$ 1.09	31.82 $\pm$ 0.64	3.15 $\pm$ 0.12	2.86 $\pm$ 0.04	2.58 $\pm$ 0.04	1.18 $\pm$ 0.04	1.18 $\pm$ 0.46
Control	50	77.08 $\pm$ 1.90	52.44 $\pm$ 1.69	4.80 $\pm$ 0.26	3.50 $\pm$ 0.26	2.31 $\pm$ 0.03	1.22 $\pm$ 0.03	23.47 $\pm$ 0.46
p-value		*<0.001 **<0.001 ***<0.05	*<0.001 **>0.05 ***<0.001	*<0.001 **<0.001 ***<0.001	*<0.001 **<0.001 ***<0.001	*>0.05 **<0.001 ***<0.001	>0.05	*<0.001 **>0.05 ***<0.001

*SEM*, standard error of mean; *n*, sample size; *TP*, total protein; *Alb*, albumin; *Chol*, cholesterol; *Glu*, glucose; *Ca<sup>2+</sup>*, calcium; *PO<sub>4</sub><sup>2-</sup>*, phosphorus; *BMI*, body mass index

Key: \* = p-value between HIV patients on ARV and ARV naive

\*\* = p-value between HIV on ARV therapy and controls

\*\*\* = p-value between ARV naive patients and controls

The mean values of laboratory parameters showed a significantly higher total protein and total cholesterol ( $p < 0.001$ ) in HIV-positive patients on ARV therapy compared with ARV naive patients and controls. There was a statistically significant lower serum total protein, albumin and total cholesterol ( $p < 0.001$ ) in ARV naive patients. There was no statistically significant difference in BMI ( $p > 0.05$ ) between

patients on ARV therapy and controls but significantly higher than in ARV naive patients ( $p < 0.001$ ) as shown in table 1. There was a statistically significant positive correlation between duration on ARV therapy and BMI ( $r = 0.205$ ,  $p = 0.039$ ) in patients on therapy.

Hypoalbuminaemia was found in 30 % and 34 % of HIV-positive patients on ARV therapy and

**Table 2:** Percentage of low concentration of laboratory parameters in study population

Analytes	HIV patients on ARV therapy	HIV patients ARV naive	Controls
Hypoproteinaemia	-	-	-
Hypoalbuminaemia	30 %	34 %	-
Hypocholesterolaemia	-	20 %	2 %
Hypoglycaemia	6 %	12 %	-
Hypocalcaemia	8 %	12 %	2 %
Hypophosphataemia	9 %	14 %	1 %

patients who are ARV naïve respectively as against none of the controls. Hypocholesterolaemia was present in 20 % and 2 % of ARV naïve patients and controls respectively, while 59 % of patients on ARV therapy had hypercholesterolaemia. Hypoglycaemia was present in 6 % and 12 % of patients on ARV therapy and ARV naïve patients respectively as against none of the controls. In ARV naïve patients there was hypocalcaemia and hypophosphataemia in 12 % and 14 % respectively as shown in table 2.

Based on BMI, 7 % and 32 % of HIV-positive patients on ARV therapy and those who are ARV therapy naïve were malnourished as against none of the controls. Mild to moderate obesity was found in 48 % of patients on

This study demonstrated significantly higher concentrations of serum total protein in HIV patients on ARV therapy and significantly lowers serum total protein and albumin concentrations in ARV naïve patients compared with controls. There was no subject in all the three groups with hypoproteinaemia but a significant number of patients on ARV therapy (30%) and ARV naïve patients (34%) had hypoalbuminaemia. The increased serum total protein could be accounted for by the increased synthesis of globulin in response to the presence of HIV as found by other studies<sup>10,11,12</sup> especially in patients on ARV therapy. The lower serum total protein found in HIV infected ARV naïve patients may be due to suppression of immune system and inability of the patients to mount enough immunity

**Table 3:** Nutritional status as measured by BMI

Nutritional status by BMI	HIV patients on ARV therapy	HIV patients ARV naïve	Controls
Malnutrition	7 %	32 %	-
No malnutrition	45 %	62 %	78 %
Mild obesity	34 %	4 %	16 %
Moderate obesity	14 %	2 %	4 %
Severe obesity	-	-	2 %
Total	100 %	100 %	100 %

therapy as against 6 % and 20 % of ARV naïve patients and controls respectively as shown in table 3.

### Discussion

HIV infection induces several metabolic alterations including changes in whole body protein turnover, increased urinary nitrogen loss, elevated hepatic protein synthesis (especially globulins), decreased peripheral lipoprotein lipase activity, insulin resistance and increased gluconeogenesis.<sup>8</sup> Also, depression of nutritional status has been reported to begin in the first stages of HIV-1 infection, which can contribute to the progression of the disease.<sup>9</sup>

against the virus leading to decreased globulin level and subsequently decreased total protein concentration. The decreased total protein is further worsened by significantly lower serum albumin concentration which is synthesized by the liver and a better marker of nutritional assessment compared with total protein concentration. Significantly lower albumin concentration was also found in previous studies.<sup>10,11,12</sup> The decreased albumin concentration in ARV naïve patients is expected to increase with initiation and progression on ARV therapy as shown in study by Serpa *et al*<sup>13</sup> and this is probably as a result of improvement in appetite and alleviation of

other complications of HIV infection such as diarrhea and vomiting.

In the present study, serum cholesterol concentrations were significantly lower in ARV naïve patients and controls than in patients on ARV therapy. This finding could be attributed to lipodystrophic (fat accumulation and atrophy) effects of some antiretroviral drugs, the reverse transcriptase inhibitors (NRTIs) especially zidovudine which are included in the drug combinations patients on therapy were taking leading to weight gain and subsequently increased BMI which was found to be significantly higher than in ARV naïve patients. This is in agreement with previous study by Morten *et al*<sup>14</sup> who also found higher BMI in HIV-infected patients on ARV therapy in their study. This is further supported by the finding of a positive and significant correlation between duration on ARV therapy and BMI in the patients on therapy studied. In agreement with the study by van Staden *et al*<sup>12</sup> hypocholesterolaemia was present in 20 % of ARV naïve patients and 2 % of controls as against none of patients on therapy who have more of hypercholesterolaemia. This suggests that serum cholesterol concentration is a poor marker of assessing nutritional status in patients on ARV therapy.

The present study showed a significantly higher mean concentration of fasting serum glucose among HIV-infected patients on ARV therapy compared with ARV naïve patients and controls. This could be due to abnormal carbohydrate metabolism caused by the ARV drugs, as insulin resistance and diabetes mellitus have been reported as possible complication of use of highly active antiretroviral therapy (HAART).<sup>15</sup> Hypoglycaemia was found in 6 % and 12 % of patients on ARV therapy and ARV naïve patients respectively as against the controls. This could result from reduced nutrient availability and malabsorption.<sup>5</sup>

The findings of hypocalcaemia and hypophosphataemia in both HIV patients on

ARV therapy and ARV naïve could be as a result of deficiency of calcitriol which is involved in calcium and phosphorus metabolism.<sup>16,17</sup>

### **Conclusion**

From the findings of the present study it could be concluded that malnutrition is common among HIV-infected patients in Zaria, Nigeria. The outcome of this study would encourage an early evaluation of the nutritional status in these groups of patients to prevent, treat and monitor malnutrition from the time of presentation in the clinic. This would aim at delaying the evolution of the disease, and might improve the prospects of survival and quality of life of these patients.

### **Recommendation**

It could be recommended that all HIV patients be evaluated for nutritional status from the time of presentation in the clinic. Serum albumin rather than total protein are used to assess nutritional status especially in patients with active infection and that serum cholesterol result is interpreted with caution in patients on ARV therapy.

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