Nutritional Indices of Human Immuno Deficiency Virus (HIV) and Tuberculosis (TB) Positive Pregnant Women

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DOI: 10.29322/IJSRP.10.05.2020.p10120
http://dx.doi.org/10.29322/IJSRP.10.05.2020.p10120

ABSTRACT

Malnutrition remains a significant but intriguing consequence of HIV and TB infections. This study was set to evaluate the Nutritional Indices of Human Immuno Deficiency Virus and Tuberculosis positive pregnant Women. A total of four hundred (400) subjects were recruited for this study which comprised of 150 HIV positive pregnant women, 150 TB positive pregnant women and 100 apparently healthy women which served as the control. Whole blood samples (6mls) were collected using standard procedures and were distributed; 2ml into fluoride oxalate vacoutainer for glucose estimation and 4ml into plain tube for Biochemical tests. The results of this study showed that the mean values of Glucose for HIV positive pregnant women (93.40±8.41mg/dl) and TB positive pregnant women (93.90±7.02 mg/dl), were significantly higher ($p<0.05$) as compared to the control (88.43±7.22 mg/dl). Total Protein values of HIV (8.44±1.39 g/dl) and TB (8.44±0.54 g/dl) subjects was significantly higher ($p<0.05$) as compared to the control (7.37±1.16 g/dl), while the albumin values of HIV (4.59±0.78 g/dl) and TB (5.06±0.38 g/dl) subjects was significantly higher ($p<0.05$) as compared to the control (3.75±0.55 g/dl). The mean values of Globulin for both HIV and TB pregnant subjects was statistically not significant ($p>0.05$) as compared to the control. Similarly, Calcium was significantly reduced ($p<0.05$) in HIV positive subjects (7.49±1.36 mg/dl), while being significantly higher for TB positive pregnant subjects (9.69±0.49 mg/dl) as compared to the control (9.19±0.64 mg/dl). Therefore, this study revealed significant alterations in the nutritional indices of HIV and TB positive pregnant women revealing the various nutritional deficiencies associated with HIV and TB; hence will serve as basis for continuous monitoring and follow-up for these patients.

Keywords: Nutrition, Pregnancy, Nutrition, Infections

I. INTRODUCTION

Pregnancy has been described as the stage for the development of offspring inside a woman after sexual activity or the use of assisted reproductive technology (Abman and Steven 2011; Wylie, 2015). The time of childbirth usually occur within the 40th week of pregnancy tracing from the last menstrual cycle of woman (Abman and Steven 2011). The offspring that develops during the first eight weeks after conceptions is described as the embryo and at this point the fetus starts to develop to the delivery period (Abman and Steven 2011). Pregnancy is typically divided into three trimesters. The first trimester runs from the first week to the twelfth week with conception included. The second trimester is from week 13 through 28 (WHO 2015). The third trimester is from 29 weeks through 40 weeks (WHO 2015). Pregnancy is greatly improved by prenatal care which involves the use of folic acid, drug and alcohol avoidance, consistent exercise, blood examinations and regular physical examinations.

Human Immunodeficiency Virus and tuberculosis infections have reached epidemic proportions in Nigeria, where increasing numbers of people now die from these diseases. Malnutrition remains a significant but intriguing consequence of HIV and TB infections. It is estimated that about one-third population of the world is infected with *Mycobacterium Tuberculosis*, the Bacillus that causes tuberculosis (TB). Coupled with the pandemic of Human Immunodeficiency Virus (HIV), TB is an important cause of morbidity and mortality worldwide (Corbett *et al*., 2003). It was also estimated by the World Health Organization that there were over 40 million people living with HIV/AIDS in the world in 2003 (UNIAIDS/WHO, 2003). According to UNAIDS, approximately 17 million women worldwide that are aged between 15 and 49 years are HIV positive. Most (55%) live in sub-Saharan Africa. Despite the fact that many women of reproductive age are HIV positive, few studies have investigated the relationship between HIV infection during pregnancy or lactation with a focus on maternal nutritional status and health. In most trials in HIV-positive pregnant women, the primary focus has been the effect on the infant rather than the HIV-positive mother (Saadeh, 2004). Among the people who are dually infected with *Mycobacterium tuberculosis* and HIV, more than 70% live in sub Saharan Africa, a region with the highest TB incidence rate (290 per 100,000 population) (Corbett *et al*.,2003). It has been known for many years that nutritional deficiencies can lead to increase susceptibility to infectious diseases (King, 2000). TB and HIV infection frequently occur together and can result in muscle wasting (Lettow Van *et al*., 2004). The wasting in turn affect the inflammatory response, suppresses cellular immunity, and aggravates the severity and outcome of disease (Failla, 2003).

Furthermore, the best markers of better health in pregnancy reside on the level of good nutrition by the pregnant mother. Nutrient intake and proper planning of the dietary intake determines the nutritional level during pregnancy **(**ACOG, 2010). Most organs and systems of the fetus develop during conception; therefore these systems and organs are maintained from the energy acquired through nutrients by the mother during circulation and metabolism. It therefore becomes essential that adequate nutrients be taken by the pregnant mother to maintain a healthy living **(**ACOG, 2010). The development and growth of a baby however is improved as a result of increased intake of nutrients by the mother and consequently assist the mother to be well acclimatized with changes which will improve the health of the baby. In addition, it is well established that proper dietary habits will likely reduce in the incidence of pregnancy complications; and hence tend to make more healthy babies **(**Huston *et al.,* 2000). Various medical anomalies experienced by pregnant mothers ensue as a result of poor nutrition and protein energy malnutrition. However, a good number of chronic ailments such as arthrosclerosis, diabetes mellitus, cancers and hypertension have been reported to have likely increased as a result of improper dietary inclusions (Crawley, 2004). Furthermore, malaria anaemia has been seriously implicated in lieu with poor nutrition which affects mostly rural areas with serious socio-economic burden. People in such areas are constantly faced with persistent malaria parasite and infestations with helminths (Crawley, 2004). In addition, pregnant mothers who are exposed to HIV virus have compromised immune system and as such are implicated to great severity and burden of malaria parasitaemia and consequently mortality and morbidity. Fetal growth and survival depends majorly on the nutritional status of pregnant mothers **(**Fawzi, 2007). Little or no attention has been placed on pregnant mothers who reside in rural areas considering the fact that their urban counterpart is well acclimatized with the consequences improper nutrition on pregnancy **(**Saxena *et al*., 2000). Moreover, there is paucity of knowledge and information about the need for proper balanced diet for pregnant mothers. In addition, this paucity of knowledge has led to serious pregnancy complications such as still births, spontaneous abortions and low birth weight (Sharma *et al*., 1999).

II. MATERIALS AND METHODS

A. Study Area

This study was carried in Esan land, Edo Central Senatorial District of Edo State in South Southern Nigeria. This area is located between latitude '6º 10 and 6º 45' north of the equator and between longitudes 6º 10' and 6º 30' east of the Greenwich Meridian (Akinbode, 1983).The 2006 national census put the population of the study area at 591,534 people Projected to 2014 at 2.8 percent national growth rate, the 2014 population of the study area is 734,583 (World Gazetteer, 2007).

B. Study Design

This study was designed as prospective cross-sectional study to determine the nutritional indices of HIV and TB positive pregnant women attending ANC in Irrua Specialist Hospital, Central Hospital Uromi and ANC Clinics within Esan Land, Edo State, Nigeria. After obtaining verbal informed consent to be enrolled into the study, two sets of blood samples, 2ml and 4ml each were collected into Fluoride Oxalate and plain vacutainer tubes for Glucose estimation and Biochemical tests respectively. The height and weight of the subjects were measured using approved standard techniques to calculate the BMI.

C. Anthropometric Measurement

The data collected were age, number of pregnancies (gravidity) and the age (trimester) of the pregnancy. Weight and height were measured by pre-defined procedure to evaluate the Body Mass Index (BMI) which indicates the usual health and nutritional status of individual (WHO, 1995).

D. Ethical Considerations

Ethical approval was sought from the Ethics and Research committees of Ambrose Alli University, Edo State. Also, informed consent was sought from the subjects after explaining the purpose of the study to them.

E. Study Population

A total of One hundred subjects were recruited for this study which comprised of forty (40) pregnant women without HIV and TB (controls), Forty (40) HIV positive pregnant women and twenty (20) TB positive pregnant mothers. The subjects were pregnant women attending Antenatal Clinics (ANC) in Irrua Specialist Hospitals Irrua, Central Hospital Uromi and ST. Camillus Hospital Uromi, Edo State.

F. Informed Consent

A verbal informed consent was sought for from each pregnant woman and control subjects, assuring them of the confidentiality of the information provided and results beyond the context of the study purpose.

G. Inclusion Criterion

Only HIV and TB positive and negative pregnant women attending ANC at Irrua Specialist Hospital Irrua, Central Hospital Uromi and ST. Camillus Hospital Uromi who gave verbal informed consent were included in the study.

H. Exclusion Criterion

All women who refused to give an informed consent and those pregnant women with serious complications attending ANC and ART Clinic in Irrua Specialist Hospital, Central Hospital Uromi and ST. Camillus Hospital Uromi were excluded from this study.

I. Sample Collection and Processing

Whole blood samples (6mls) were collected using standard procedures and were distributed; 2ml into fluoride oxalate container for glucose tests and 4ml into plain tubes for Biochemical tests. The sample in the plain tubes were allowed to clot and centrifuged at 3000 rpm to obtain the serum. The samples were analyzed using standard laboratory methods at the Medical Laboratory Department of St. Camillus Hospital Uromi, Edo State, Nigeria.

J. Sample Analysis

Glucose, Total protein, Albumin, Globulin and Calcium were assayed using RANDOX – kit (Abell Kendell method) by automation method as described by RANDOX Laboratories, (2010a). Body Mass Index was calculated as Weight (kg)/ h (m^2). Underweight = <18.5kg/m^2, Normal/healthy weight = 18.5 – 24.5kg/m^2, Overweight 25 – 29.9kg/$m^2$and Obesity = 30kg/m^2 and above (WHO, 1995).

III. RESULTS

A total of one hundred (100) pregnant women at different trimesters were recruited in this study, among these were 40 HIV positive pregnant women, 20 TB positive pregnant women and 40 HIV and TB negative pregnant women that served as the control group. The age group 20 – 29 years had the highest number with 65% (26), this was followed by 30 – 40 years with 35% (14). According to the number or occurrence of pregnancy (Parity/Gravidity) in the study groups, for No or one (±1) pregnancy; control amounted to 22.5% (9), HIV amounted to 22.5% (9) and TB 77.5% (5), while for 2 – 4 pregnancies; control amounted to 77% (31), HIV amounted to 77.5% (31) and TB amounted to 75% (15). According to their BMI categorization, none had BMI less than 18.5kg/m^2 for all subjects, those within 18.5 – 24.9kg/m^2 were 47.5% (19), 32.5% (13) and 60% (12) for control, HIV and TB groups respectively, while those with BMI between 25.0 – 29.9kg/m^2 were 45% (18), 60% (24) and 40% (8) for control, HIV and TB groups respectively. 7.5% (3) of both the control group and HIV group had BMIs of 30.0kg/m^2 and above (Table 1).

The mean values of Glucose for HIV positive pregnant women (93.40±8.41mg/dl) and TB positive pregnant women (93.90±7.02 mg/dl), were significantly higher ($p<0.05$) as compared to the control (88.43±7.22 mg/dl). Total Protein values of HIV (8.44±1.39 g/dl) and TB (8.44±0.54 g/dl) subjects was significantly higher ($p<0.05$) as compared to the control (7.37±1.16 g/dl), while the albumin values of HIV (4.59±0.78 g/dl) and TB (5.06±0.38 g/dl) subjects was significantly higher ($p<0.05$) as compared to the control (3.75±0.55 g/dl). The mean values of Globulin for both HIV and TB pregnant subjects was statistically not significant ($p>0.05$) as compared to the control. Similarly, Calcium was significantly reduced ($p<0.05$) in HIV positive subjects (7.49±1.36 mg/dl), while being significantly higher for TB positive pregnant subjects (9.69±0.49 mg/dl) as compared to the control (9.19±0.64 mg/dl) (Table 2).

The mean values for glucose, total protein, albumin, globulin and calcium of the HIV infected pregnant women in the different trimesters were not statistically significant ($p>0.05$) as compared to the controls (Table 3).

The mean values for glucose, total protein, albumin, globulin and calcium of the TB infected pregnant women in the different trimesters were not statistically significant ($p>0.05$) as compared to the controls (Table 4).

Table 1: Demographic Characteristics of the Study Population

Variables	Pregnant women Control (n = 40)	HIV pregnant women (n = 40)	TB pregnant women (n = 20)
Age groups (years)			
20 – 29	26 (65%)	14 (35%)	13 (65%)
30 –39	13 (32.5%)	25 (62.5%)	7 (35%)
40+	1 (2.5%)	1 (2.5%)	0 (0%)
Gravidity			
±1	9 (22.5%)	9 (22.5%)	5 (25%)
2 – 4	31 (77.5%)	31 (77.5)	15 (75%)
BMI (kg/m^2)			
<18.5	0 (0%)	0 (0%)	0 (0%)
18.5 – 24.9	19 (47.5%)	13 (32.5%)	12 (60%)
25.0 – 29.9	18 (45%)	24 (60%)	8 (40%)
30+	3 (7.5%)	3 (7.5%)	0 (0%)

KEY: n= Number of subjects, Gravidity = Number of pregnancies. Underweight = <18.5kg/m^2, Normal/healthy weight = 18.5 – 24.5kg/m^2, Overweight = 25 – 29.9kg/m^{2}and Obesity = 30kg/m^2 and above.

Table 2: Nutritional Indices of HIV and TB Positive Pregnant Women in comparison with the control

Parameter	Control (n=40	HIV (n=40)	TB (n=20)	F-value	P-value	Sig
Glucose (mg/dl)	88.43±7.22^a	93.40±8.41^b	93.90±7.02^b	5.399	0.006	S
TP (g/dl)	7.37 ±1.16^a	8.44±1.39^b	8.44 ±0.54^c	9.955	0.000*	S
Albumin (g/dl)	3.75 ±0.55^a	4.59 ±0.78^b	5.06 ±0.38^c	34.108	0.000*	S
Globulin (g/dl)	3.65 ±0.80^a	3.85 ±0.10^a	0.59 ±0.76^a	0.77.0	0.466	NS
Calcium (mg/dl)	9.19 ±0.64^a	7.49 ±1.36^b	9.69±0.49^b	45.414	0.000*	S

Key: NS= Not significant, S= Significant. *= Statistically significant at $p\leq0.05$, HIV= HIV positive pregnant women, TB= TB positive pregnant women. Mg/dl= Milligrams per Decilitre, n= Number of subjects, g/dl= grams per deciliter, TP=Total Protein

Table 3: Nutritional Indices of HIV-Infected Pregnant Women Based on Trimesters

Parameter	First Trimester n=8	Second Trimester n=22	Third Trimester n=10	F-value	P-value	Sig
Glucose (mg/dl)	94.25±8.83	93.32±7.64	92.90±10.42	0.057	0.945	NS
TP(g/dl)	8.10±0.96	8.62±1.52	8.31±1.44	0.460	0.635	NS
Albumin (g/dl)	4.71±0.54	4.65±0.76	4.38±0.99	0.502	0.609	NS
Globulin (g/dl)	3.39±0.85	3.99±1.09	3.89±0.88	1.087	0.348	NS
Calcium (mg/dl)	7.76±1.21	7.43±1.31	7.54±1.69	0.040	0.960	NS

Key: *Statistically significant difference between pregnant and non-pregnant women at $p \leq 0.05$, Sig = Significance, NS= Not significant, S= Significant. *= Statistically significant at $p \leq 0.05$, HIV= HIV positive pregnant women, TB= TB positive pregnant women, mg/dl= Milligrams per Decilitre, g/dl= Grams per Decilitre, n= Number of subjects.

Table 4: Nutritional Indices of TB-Infected Pregnant Women based on Trimesters

Parameter	First Trimester (n=7)	Second Trimester (n=11)	Third Trimester (n=2)	F-VALUE	P-VALUE	Sig
Glucose (mg/dl)	93.14±8.03	95.00±6.96	90.50±4.95	0.384	0.687	NS
TP(g/dl)	8.01±0.40	8.67±0.49	8.65±0.49	4.591	0.250	NS
Albumin (g/dl)	5.00±0.29	5.17±0.40	4.60±0.28	2.269	0.134	NS
Globulin (g/dl)	3.23±0.78	3.65±0.66	4.55±0.78	2.956	0.079	NS
Calcium (mg/dl)	9.73±0.36	9.76±0.54	9.10±0.28	1.704	0.212	NS

Key: Sig = Significance, NS= Not significant, S= Significant, *=Statistically significant at $p \leq 0.05$, Mg/dl= Milligrams per Decilitre, n= Number of subjects, TP=Total Protein

IV. DISCUSSION

Pregnancy causes significant changes in metabolism, fluid balance, organ function and blood circulation which are driven by estrogen and the presence of feto-placental unit (Mahmoud *et al*., 2013). These dramatic changes coupled with other illness like HIV and TB influence a wide variety of parameters. Therefore, acknowledging these changes is essential when interpreting the result of investigations to diagnose or monitor illness in pregnant women (Mahmoud *et al*., 2013). Furthermore, Pregnancy is a normal physiological process that results in increased plasma volume and decreased concentration of circulating nutrient – binding proteins and other micronutrients (Ladipo, 2000). Adaptation to pregnancy in humans involves anatomic, physiologic and metabolic changes in the mother to support and provide her nutritional and metabolic needs and that of the growing fetus (Kalhan, 2000). Several concerns have been raised as a result of ART usage during pregnancy which includes potential risk for the exposed and uninfected newborn (Floridia *et al.*, 2006). This study was set to evaluate the nutritional indices of HIV and TB positive pregnant women in Esan Land, Edo State.

Disorders of glucose metabolism have been reported in individuals infected with HIV and Borderline diabetes mellitus (DM) has been reported with TB causes (Karachunski *et al.*, 1993) and DM has been considered a risk factor for TB (Karachunski *et al.*, 1993). In this present study, level of glucose increased significantly in both HIV pregnant women and TB pregnant women as compared to controls but there was no significant different between the two subject groups. The increase in blood glucose level of the two group as being attributed to the effects of drugs use to manage these diseases. For example drugs such as Megestrol acetate and corticosteroids seem to be responsible for severe hyperglycemia in HIV infected persons (Dube *et al.*, 2000) while Takasu *et al.*, (1982) observed that rifampicin induce an early phase hyperglycemia which he attributed to augmented intestinal

absorption. An over dose of isoniazid (INH) may cause hyperglycemia (Mandell and Sande, 1980), while in rare circumstances diabetes may become difficult to control in patients on pyrazinamide (Girling, 1982).

Serum total proteins perform many functions in the body. Due to their various kinds of functions, metabolism and site of origin, serum albumin and globulin are subjected to different influences and hence their concentrations vary, which is independent of one another. Alterations have been described in hepatic, renal, acute, and chronic infectious diseases like tuberculosis and HIV (Aziz *et al.,* 1988). The level of serum protein and albumin increased significantly in HIV seropositive pregnant and pregnant women with tuberculosis as compared to control individuals. While there was a significant difference in albumin level, there was no significant difference in serum protein between the two subject groups (HIV and TB). The hyperproteinaemia observed in this study among HIV sero-positive pregnant women is in agreement with the findings of Ikekpeazu *et al.,* (2012) and Akinpelu *et al.,* (2012). But in contrast with the study of Okpa *et al.,* (2015), who observed decrease in total protein level in HIV patients. The increased total protein level obtained in our study may be due to increased immunoglobulins as stated by various authors (Arinola and Igbi, 1998, Lyamuya *et al.,* 1999, Arinola *et al.,* 2005). Also the significant increase observed in pregnant women with TB when compared to the control individual was in agreement with works of Sasaki *et al.,* (1999), Yamanaka *et al.,* (2001), Nnodim *et al.,* (2012) and Jemikalajah *et al.,* (2014), but at variance with the studies of Adedapo *et al.,* (2006) and Akiibinu *et al.,* (2007) who reported decreased total proteins in tuberculosis patients. The increase recorded has been attributed to dehydration and influence of isoniazid and rifampicin employed in the treatment of *Mycobacterium tuberculosis* (Nnodim *et al.,* 2012).

Calcium performs a structural role by providing rigidity to skeleton and is also most common mineral in the body and makes up 1.9% of the body by weight (Nordin, 1997). From the results of this study, the level of calcium was significantly reduced in pregnant women with HIV when compared with controls. This finding agrees with works of Kuehn *et al.,* (1999) and Obum-Nnadi *et al.,* (2013) who also reported hypocalcemia in this group of individuals. Drugs such as foscarnet, ketoconazole, aminoglycosides and pentamidine have been reported to be related to hypocalcaemia in HIV subjects (Perazella and Brown, 1994). Kuehn *et al.,* (1999) also concluded that the decrease may be as a result of reduction in vitamin D and potentially, a lack of adequate parathyroid hormone secretion as low Bone Mineral Density (BMD) and is prevalent in subjects infected with Human Immunodeficiency Virus. Also, there was no significant difference in calcium level of TB pregnant women when compare to the control individuals although a slight increase was observed. It has been reported that hypercalcemia is more often encountered during the first weeks of antituberculous treatment, when hypercalcemia may be found in approximately 30–50 % of the patients (Kitrou *et al,* 1983). According to Kitrou *et al.,* (1983) hypercalcaemia in patients with PTB seems to be triggered by chemotherapy although the mechanism(s) by which anti-tuberculosis treatment affects calcium metabolism remains uncertain.

ACKNOWLEDGMENT

Thanks to all who contributed to the success of this research and the presentation of this manuscript. Special appreciation goes to Mr. Iyevhobu Kenneth Oshiokhayamhe and Mr. Obodo Basil Nnaemeka, Chief Researchers in St Kenny Consult, Ekpoma, Edo State, Nigeria for taking their time to prepare, arrange and make the required corrections in this work.

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