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Assessment of the immuno-nutritional status of malnoutrished people living with HIV at ‘‘Notre Dame des Apôtres’’ hospital in Sarh/Chad

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ABSTRACT

Human immunodeficiency virus (HIV) infection leads to immune deficiency, reduced nutrient absorption, and malnutrition. Malnutrition also affects the immune system and contributes to the progression of HIV. The objective of the present study was to evaluate the immuno-nutritional state of malnourished people living with HIV/AIDS followed at the Notre Dame des Apôtres Hospital in Sarh/Chad. For this we performed the assay of biochemical parameters including total proteins, transaminases (ALT, AST), alkaline phosphatase and immunoglobulin E (IgE) was done 36 malnourished subjects living with HIV/AIDS aged at least 18 years at the People Living with HIV (PLHIV) service were identified during this study. The sample population was dominated by the female sex with 75% of cases, i.e. a sex ratio of 0.33. The most represented age group was 18 to 40 years old with 47.22%. The results obtained showed that 52.94% of the samples had a level below the standard in total proteins, 100% of the samples analyzed showed a level extremely higher than the standard in ASAT, ALT and alkaline phosphatase and 60% of individuals presented a higher level of IgE. From these results it could be concluded that malnutrition and HIV lead to an immuno-nutritional deficit giving way to other opportunistic infections.

Keywords: Biochemical, immunological analysis, malnourished, HIV immuno-nutritional status and Sarh/Chad.

INTRODUCTION

The Human Immunodeficiency Virus (HIV) was isolated in 1983 by the research team of Professor Luc Montagnier, it is at the origin of Acquired Immunodeficiency Syndrome (AIDS) (Krones et al., 2012). Due to the growing number of people infected, AIDS remains a major public health problem today (Rodenbach et al., 2002). Thus in 2020, according to UN/AIDS, an estimated 37.6 million people are living with HIV. UN/AIDS also estimated that HIV is the cause of 35.8 million deaths since the start of the epidemic worldwide, of which 740,000 people have died from AIDS-related illnesses in 2020 (UN/AIDS, 2021).

In Africa, despite the advent of triple therapy, the situation is particularly worrying

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because AIDS remains the leading cause of death in adults (UN/SIDA.WHO, 2007). UN/AIDS estimated in 2020 that 3.5 million people were living with HIV in West and Central Africa (UN/AIDS, 2021).

Malnutrition is a set of disorders or pathological conditions resulting from the deficiency or relative excess of one or more essential nutrients. This state can be detected by biochemical, anthropometric or physiological analyzes (UNICEF WHO MSP-Benin, 2011). HIV and malnutrition form a vicious circle that contributes to the deterioration of immune functions and nutritional status (Sicotte, 2014). Despite access to treatment, malnutrition persists as a determinant of disease progression and mortality among people living with HIV (Sicotte, 2014). HIV weakens nutritional status by compromising the immune system as well as nutrient consumption, absorption and enhancement (WFP, WHO, UNAIDS, 2008). Malnutrition can worsen the effects of HIV and accelerate the progression of HIV-related illnesses in people living with the virus. Adults living with HIV have 10 to 30% higher energy requirements than a healthy adult uninfected with HIV, and children living with HIV have 50 to 100% higher energy requirements than those of a healthy adult uninfected with HIV. normal needs (WHO, 2003). Food availability and good nutrition are therefore crucial to keeping people living with HIV healthy for longer (WFP, WHO, UNAIDS, 2008). A stronger, healthier body can better resist opportunistic infections that affect people living with HIV, especially in resource-poor settings, where preventive health services are not always available (WFP, WHO. UNAIDS, 2008). The impact of HIV/AIDS-related mortality and morbidity has significant repercussions on the economy of households and the country. By reducing the ability of individuals to meet their needs and reducing the available labor force, HIV helps support poverty and food insecurity at the individual and community level (Sicotte, 2014).

In Chad, malnutrition and HIV/AIDS are the evils that undermine its future and the food situation continues to deteriorate. UN/AIDS estimated in 2019 that 120,000 people were living with HIV/AIDS of which 5,200 were newly infected and 3,200 died of AIDS (UN/AIDS, 2019). However, few data exist concerning the trajectories and determinants of nutritional and immunological status in patients living with HIV/AIDS, it is therefore with a view to participating in the improvement of the health status of the populations of Chad that the present study aimed to assess the immuno-nutritional status of malnourished people living with HIV/AIDS followed at ‘‘Notre Dame des Apôtres’’ hospital in Sarh/Chad.

MATERIALS AND METHODS

Study framework

The present study took place in the Municipality of Sarh, Department of Barh-Koh, Region of Moyen-Chari, health district of Sarh and specifically at the Hospital Notre Dame des Apôtres de Maïngara (Figure 1). This hospital is located in the southwest of the commune of Sarh, of religious denomination, created on February 24, 2004 and non-profit. It is entirely managed by the Sisters of Our Lady of the Apostles of Sarh but under the supervision of the Health District of Sarh. This study ran from June 2020 to February 2021.

Study population

The present study population consisted of subjects of both sexes over the age of 18, living in the city of Sarh, infected with HIV. Their HIV status is pre-established when they enter the HNDA and is subsequently confirmed when they are included in our study. Thus, 36 patients were part of the study. They included HIV-positive patients aged 18 and over, with deficiency malnutrition with a BMI less than 18.40.

The following were excluded from this study:

• Patients under 18 years of age and over with associated pathologies (heart disease, cancer) or having violated the protocol.

• Pregnant women and people who have refused to participate or who have withdrawn voluntarily; finally, there are those excluded by

decision of the doctor for reasons of safety and/or the well-being of the patient.

Parameters studied and blood collection and processing of blood samples

The following parameters were studied:

- Biochemical parameters (total proteins, ALAT, ASAT, PAL)
- Immunological parameters (IgE).

The blood sample was taken according to the experimental protocol used by WHO.

Blood was collected from all study participants in dry vacuum tubes using the vacutainer system. This sample was taken to the biomedical analysis laboratory of ‘‘Notre Dame des Apôtres’’ hospital in Maïngara Sarh (Chad) and analyzed in the pharmacology and improved traditional medicines laboratory (Benin). Then the blood tubes are left to sediment at room temperature and then centrifuged at 3000 revolutions / min for 5 min. After centrifugation, the sera and plasma are aliquoted in sterile micro tubes under a laminar flow hood. They are then stored at -08°C further use.

Determination of biochemical parameters

Total protein

The colorimetric method is described by Gornall et al. (1949). The peptide bonds of proteins react with Cu^{2+} in alkaline solution to form a color complex whose absorbance, proportional to the protein concentration in the specimen, is measured at 550 nm. The Biuret reagent contains sodium potassium tartrate which complexes copper ions and maintains their solubility in alkaline solution.

Alanine aminotransferase: ALAT / GPT

Alanine aminotransferase (ALT) initially called pyruvic glutamic transaminase (GPT) catalyzes the reversible transfer of an amino group from alanine to glutamate-pyruvate-forming alpha-ketoglutarate. The pyruvate produced is reduced to lactate in the presence of lactate dehydrogenase (LDH) and NADH:

$$\text{Alanine} + \alpha\text{-Cetoglutarate} \xrightleftharpoons{\text{ALAT}} \text{pyruvate} + \text{gutamate}$$

$$\text{Pyruvate} + \text{NADH} + \text{H} \xrightleftharpoons{\text{LDH}} \text{L-Lactate} + \text{NAD}^+$$

The rate of reduction of the central NADH concentration, determined photometrically, is proportional to the catalytic concentration of ALT in the sample.

Aspartate Aminotransferase: ASAT / GOT

This was done according to the method developed by Drachtman et al. (2002), optimized by Henry et al. (2003). Aspartate aminotransferase (AST), originally called glutamate oxaloacetic transaminase (GOT) catalyzes the reversible transfer of an amino group from aspartate to glutamate-oxaloacetate-forming alpha-ketoglutarate. The oxaloacetate produced is reduced to malate in the presence of malate deshydrogenase (MDH) and NADH:

$$\text{Aspartate} + \alpha\text{-Cetoglutarate} \xrightleftharpoons{\text{ASAT}} \text{Oxaloacetate} + \text{gutamate}$$

$$\text{Oxaloacetate} + \text{NADH} + \xrightleftharpoons{\text{MDH}} \text{Malate} + \text{NAD}^+$$

The reaction was then measured kinetically at 340 nm by the decrease in absorbance resulting from the oxidation of NADH to NAD^+. The rate of appearance of p-nitrophenol, proportional to PAL activity is measured at 405nm.

Immunological assays (IgE)

Immunoglobulin E (IgE) is an immunoglobulin that is normally present in low amounts in healthy subjects. In allergic patients, IgE is present in serum and is also firmly attached to the surface of basophils and mast cells. Screening for total IgE levels is used for diagnosis in non-allergic asthma, rhinitis and eczema. Other pathologies are the cause of the high serum IgE level: these are parasitic infections, bronchopulmonary aspergillosis and certain dermatitis.

IgE assay procedure

• Dosage of controls:

Wait 15 minutes after which the lyophilisate had dissolved, the required volume (25 µL) was added with a precision pipette (disposable tips) to the sample well of the cassette then sent rest of the procedure was carried out same as for a patient sample;

The concentration levels in (IU/mL) have been indicated on the label of the vial and the results obtained must correspond to the specified level. Concentration levels may vary from batch to batch. The reconstituted vial was stored at +2°C to +2°C and used within two weeks of reconstitution.

• Assay of samples:

Follow the samples below

Allow the samples and components of the IgE-Check-1 test to come to room temperature before performing the test;

Take the reagent box out of its protective bag by tearing along the notches;

Write the patient's name or an identification number on the test;

Fill the pipette with the sample (Serum, plasma or whole blood) and hold it vertically.

Place a drop (25 µL) in the sample well for a serum or plasma sample. If using whole blood, place two drops (50 µL) in the sample well and wait until the blood sample is completely absorbed before adding the diluent;

Add exactly 4 drops of diluents (150 µL) to the sample.

Read the result in (IU/ml) after 10 minutes, with a VEDA.LAB EASY Reader + Brand reader.

Table 1 : Mode opératoire de dosage de ASAT/GOT.

	Automate	**Manual technique**
Reagent	200 µL	1000 µL
Standard, control or specimen	20 µL	100 µL
Mix. After 1 minute, read the initial absorbance at 340 nm then every minute for 3 minutes		
Calculate the average of the absorbance variations per minute.		

Table 2: Alkaline phosphatase (DEA) procedure.

Induce in a thermo-stated tank with an optical path of 1cm :	
Reagent	1ml
Let the temperature equilibrate to 37° then add :	
Specimen	10µl
Mix. After 1 minute, read the absorbance at 405 nm then every minute for 3 minutes	
Calculate the average of the absorbance variations per minute.	

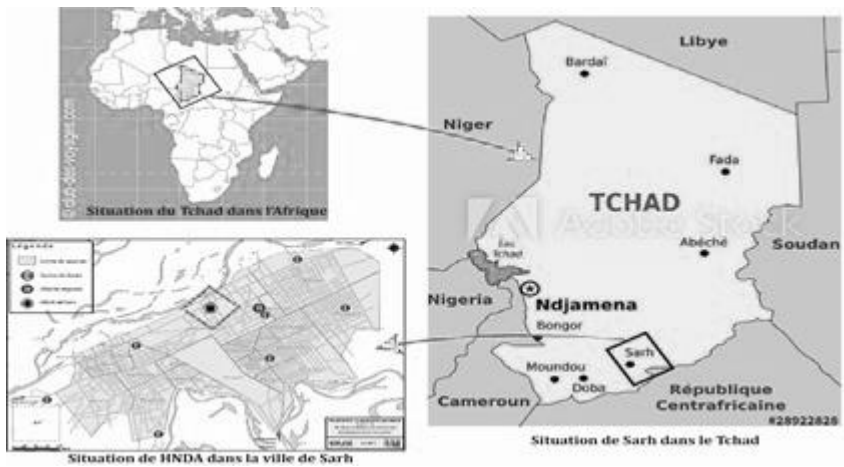

Figure 1 : Geographical location of the HNDA of Sarh

Source : wwwClub des voyages.com

RESULTS

The results of our work are presented in the following figures:

Results revealed that 75% of patients were female and 25% were male. The sex ratio was 0.33 in favor of females. The following figure shows the distribution of patients by age group. It appears that elderly patients (18-40 years) were more represented with 47.22%.

Total protein content in the blood of PLHIV/AI

The figure below shows the concentration of total protein in the blood.

It emerges from this figure of total protein that: 52.94% of the samples total protein content below the standard (2,3,4,10,11,12,13,14,19,20,21,22,23, 25,26,28,30,31) and 47,05% were in the norm (1,5,6,7,8,9,15,16,17,18,24,27,29,32,33, 34).

Transaminases

ASAT

The following figure shows the pattern of the concentration of ASAT in the blood of patients.

The ASAT figure shows us that 100% of the samples analyzed show an extremely higher rate than the standard (13-31 IU/L).

Alkaline phosphatase content in the blood

The figure below shows the level of PAL concentration in the blood:

It emerges from this figure of alkaline phosphatase that 100% of the samples show an extremely higher level than the standard (70-460 IU/L).

Immunoglobin E

The figure presented below summarizes the data of the immunological parameters. Analysis of the IgE figure showed that 60% of individuals had a higher level of IgE while 40% had a normal level of IgE.

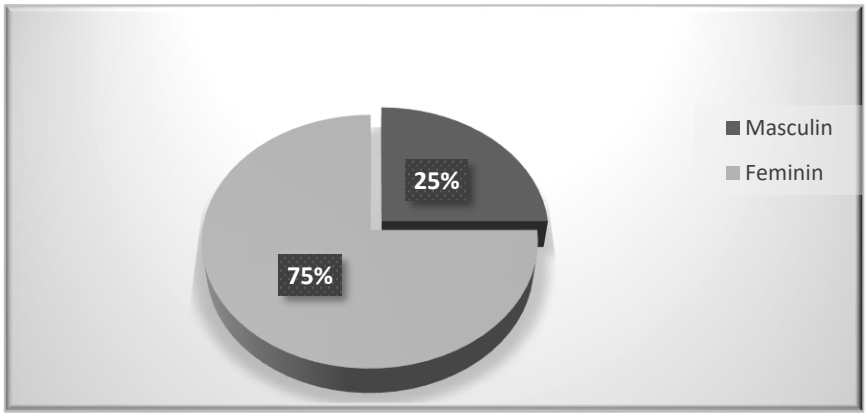

Figure 2: The distribution of patients by sex.

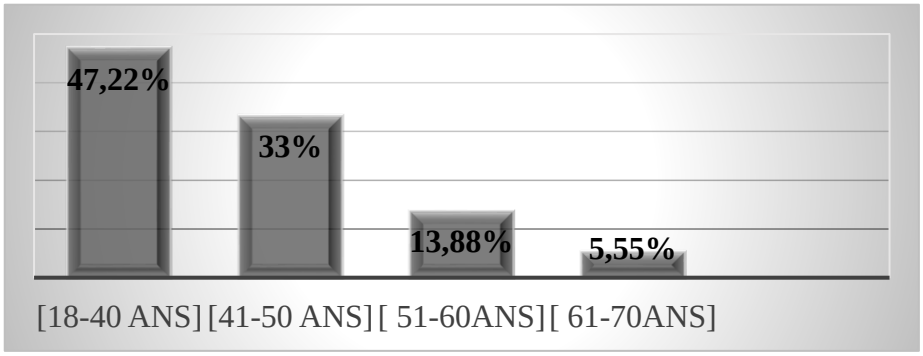

Figure 3: The distribution of patients according to age groups.

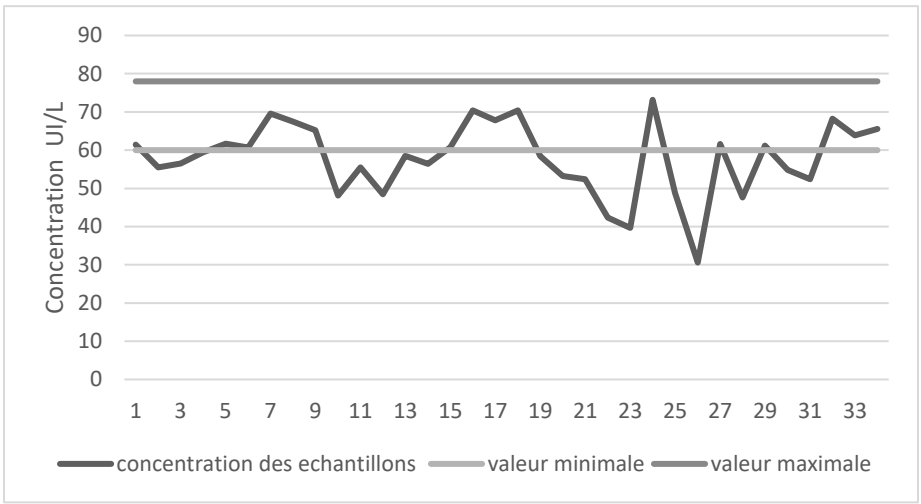

Figure 4: Total protein content.

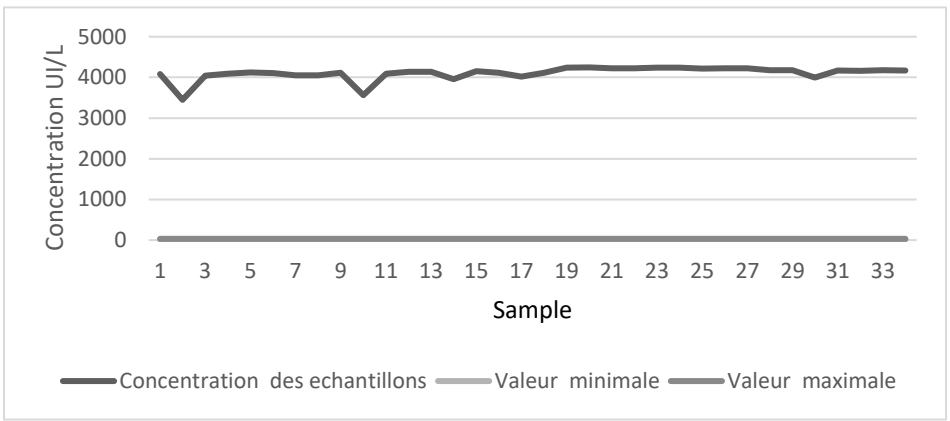

Figure 5: Concentration of ASAT.

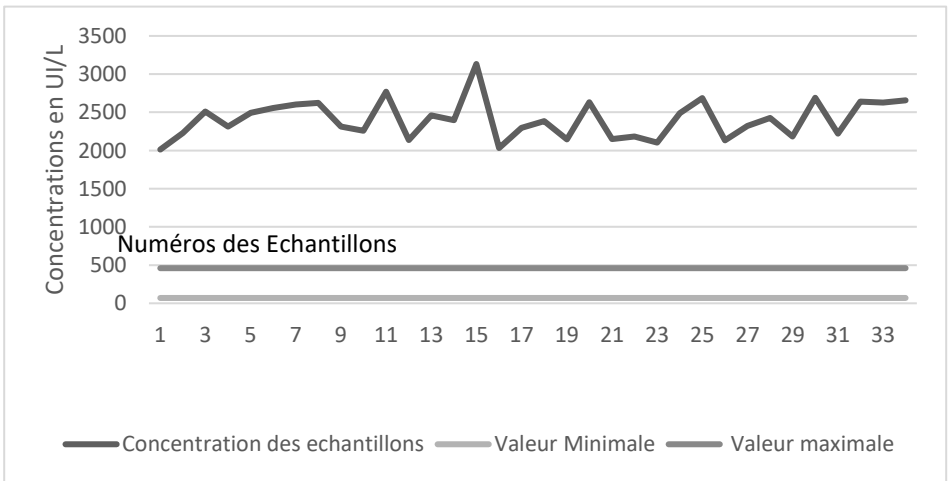

Figure 6: Concentration of ALAT.

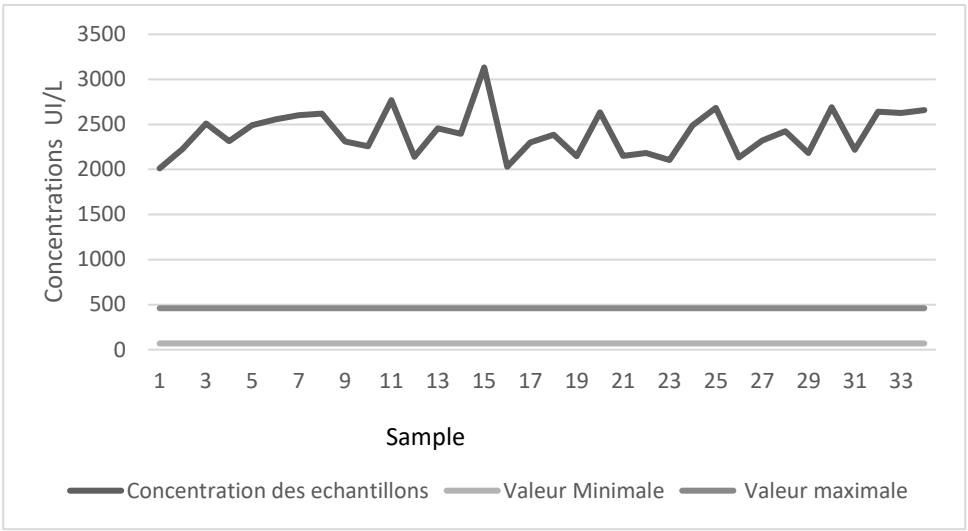

Figure 7: Alkaline phosphatase concentration.

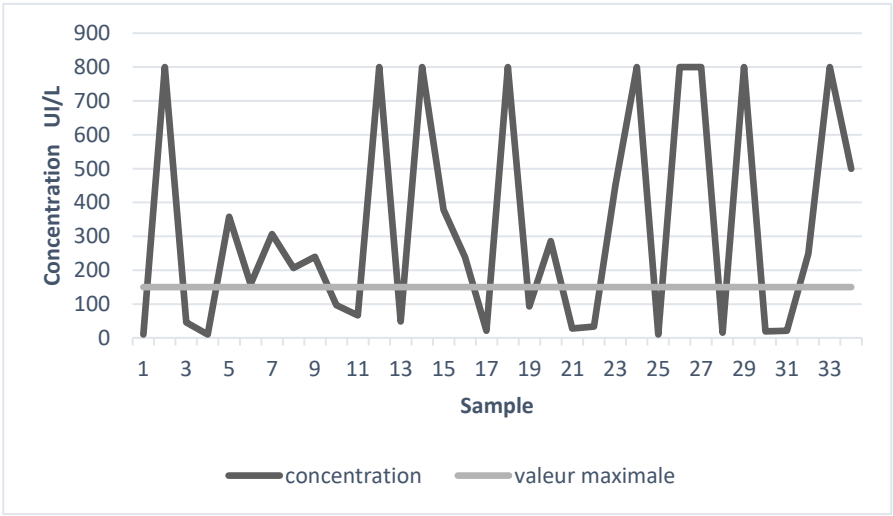

Figure 8 : IgE Assay Trace.

DISCUSSION

In the present study, the sample population was dominated by the female sex with 75% of cases, a sex ratio of 0.33. This female predominance has been found in most of the studies conducted on HIV, in particular that of Issou (2007) and Hamou (2010), which respectively found a sex ratio of 1.38 and 3.38 in favor of women. This could be explained by the fact that women go to health facilities more than men or by the fact that the large surface of genital contact and recurrent infections make women vulnerable to this infection.

The most represented age group was 18 - 40 years with 47.22%. This result is more or less the same as that of Saliou (2004) with 46%. This period corresponds to that of maximum sexual activity at risk of transmission of sexually transmitted infections.

With regard to the dosage of the Biochemical and Immunological parameters, it should be remembered that HIV/AIDS

infection and nutritional deficiencies lead to immunodeficiency and severe malnutrition in living beings.

Samples taken at T0 showed that 47.05% of the samples show a normal level of protein and 52.94% have a level below the standard (60-78) in protein which exposes these individuals to protein malnutrition, energetic and accentuates HIV/AIDS effect on the immune system.

Glutamo-pyruvic transaminases (TGP) or alanine amino-transferase (ALAT) and glutamo-oxaloacetic (TGO) also called aspartate amino-transferase (ASAT) is found mainly in decreasing order in the following organs: liver, kidneys, heart, skeletal muscles. Their increases in the blood indicate cytolysis, which is cell destruction, mainly in the heart or liver. Their activity rises during myocardial infarction and very significantly during all hepatitis (viral, drug or toxic). Their activity is also elevated in disease affecting the bile ducts and in liver cancer.

Thus, 100% of the samples present an extremely higher rate than the standard in ALAT, ASAT and Alkaline Phosphatase this could be explained by the advanced stage of the infection with HIV/AIDS, causing cellular and muscular lesions at the level of the liver, heart and muscles. This result contrasts with that of Nikiéma et al. (2018) who found 11.11% and 13.9% low rate in ALT and ASAT.

Food allergy is a condition that affects genetically predisposed individuals who develop an inappropriate immune response against certain dietary proteins. The causes of the development of this pathology are multifactorial. According to CIAO in 2012, the search for IgE directed against a particular substance can determine whether the person is tolerant or allergic. During our work, it appeared that 60% of individuals had a higher level of IgE, this confirms the presence of food allergy and infections in these individuals. This result is lower than those of Roubenoff et al. (2002) which is 86.3%.

Conclusion

This study made it possible to evaluate the biochemical and immunological parameters of malnourished people living with HIV/AIDS at ‘‘Notre Dame des Apôtres’’ hospital in Sarh/Chad. The results of the Samples carried out have made it possible to note some metabolic dysfunctions at the level of the biochemical parameters (total proteins. ALAT, ASAT, PAL) and immunological (IgE). Thus 52.94% of the samples have presented a rate lower than the standard in total protein, 100% of the samples have a rate extremely higher than the standard in ALAT, ASAT and Alkaline Phosphatase and 60% of individuals had a higher rate in IgE. From these results we can conclude that malnutrition and HIV form a vicious circle leading to an immuno-nutritional deficiency giving way to other opportunistic infections in infected people. It is also important to note that our results (IgE assay) showed that HIV infection coupled with malnutrition increases the risk for patients of developing food allergies.

COMPETING INTERESTS

The authors declare no competing interest relating to the content of this article.

AUTHORS’ CONTRIBUTIONS

IS and OS were involved in data collection among malnourished patients living with HIV while establishing an interaction of trust. JMA and AS set in motion bioethics procedures for the protection of colleagues in data collection and sample handling. LK and PYA decoded and compiled information obtained during the study.

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