ESJ Natural/Life/Medical Sciences

Thyroid check-up of people over 18 living with Human Immunodeficiency Virus (HIV), malnourished followed at Notre Dame des Apôtres Hospital in Sarh / Chad

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Doi:10.19044/esj.2022.v18n11p331

Submitted: 10 October 2021
Accepted: 22 November 2022
Published: 31 March 2022

Cite As:
Behanzin, J.G., Soudonou O., Sogan C., Agbo E., & Sezan A.,(2022). *Thyroid check-up of people over 18 living with Human Immunodeficiency Virus (HIV), malnourished followed at Notre Dame des Apôtres Hospital in Sarh / Chad* European Scientific Journal, ESJ, 18 (11), 331.
https://doi.org/10.19044/esj.2022.v18n11p331

Abstract

Malnutrition and Human Immunodeficiency Virus/Acquire Immunodeciency Syndrome (HIV/AIDS) are public health problems. HIV/AIDS continues to have severe consequences for the nutrition, food security, and other socioeconomic aspects of HIV-infected individuals. The objective of our study is to evaluate the correlation between HIV infection, malnutrition, and thyroid disorders in malnourished people living with HIV/AIDS followed at Notre Dame des Apôtres Hospital in Sarh/Chad. The study included 36 malnourished people living with HIV/AIDS over 18 years of age, followed at the People Living with Human Immunodeficiency Virus (PLWHIV) ward. Our study population consisted of females with 75 percent of cases with a sex ratio (M/F) of 0.33. The most represented age group was between 32 and 59 years. We performed a thyroid assessment of each patient by measuring biochemical parameters such as Thyroid Stimulating Hormone (TSH), Tri-iodothyronin (T3) and Tetra-iodothyronin (T4). The results obtained showed 61.76 percent of thyroid dysfunction prevalence with 11.76 percent primary hypothyroidism, 2.94 percent subclinical hypothyroidism, 5.88 percent TSH-mediated hyperthyroidism, and 41.18 percent central hypothyroidism. As a result, the cases of thyroid dysfunction were high noticed in the age group between 32 and 45 years. Furthermore, the assessment showed that 67 percent of the cases were women. From these results, we can conclude that the combination of the two conditions, malnutrition and HIV infection, weakens the immune system, thus giving way to other opportunistic diseases.

Keywords: Malnutrition, HIV/AIDS, Hypothyroidism, Hyperthyroidism, Chad

Introduction

Malnutrition remains a significant health problem in developing countries. According to statistics, 815 million people worldwide were undernourished, as determined by the 2016 Committee on Food Security (2017). It is caused by the lack of food security and poor nutritional status and can accelerate the progression of diseases such as HIV/AIDS. In 2020, worldwide, 37.6 million people were living with HIV. Of these, 35.9 million were adults (UNAIDS, 2021). HIV infection undermines food security and nutrition by reducing work capacity and productivity, which compromises household lives. HIV alters nutritional status by weakening the immune system reducing nutrient intake, absorption, and utilization. Malnutrition can worsen the effects of HIV and accelerate opportunistic infections in people living with HIV. Indeed, HIV/AIDS continues to claim many lives, especially in sub-Saharan Africa. With a prevalence of 1.6 percent, Chad has a generalized epidemic with 110,000 People Living with HIV, according to the Spectrum projection in 2018 (Nguezoumka 2019). Among them, 61,352 are on ARVs, i.e., 55.7 percent, including 2,587 children under 14 years old, i.e., 4.2 percent of the active file. It should be noted that adolescents and young people also face risks and vulnerabilities that hinder their health development (Nguezoumka, 2019). Adults living with HIV have energy needs that are 10-30 percent higher than uninfected adults; children living with HIV have needs that are 50-100 percent higher than usual. Adequate nutrition allows PLWHIV on ART to resist HIV infection, maintain their weight and improve their quality of life (Kelem, 2008). Two new elements have emerged since the introduction of highly active antiretroviral therapy (HAART). On the one hand, thyroid complications related to interferon treatment of hepatitis C are very often observed. Secondly, more rarely and more recently, dysthyroidism associated with the immune restoration phenomenon has also been monitored. These dysthyroids often manifest themselves at a distance from the immune restoration, since they are often diagnosed one to two years after the end of the episode (Feve, 2005). Despite all the efforts made, AIDS remains a significant public health problem in developing countries due to the number of deaths it causes and the cost of its management (Daou, 2018).

Goiter is defined as any thyroid gland enlargement (Daou, 2018). Several clinical and subclinical adrenal, gonadal, and thyroid dysfunction have been reported in HIV infection before the introduction of HAART (Erika, 2014). The latter causes viral and opportunistic Infections, plastic neo-infiltration of the gland, and systemic effects resulting from HIV infection that causes these abnormalities (Beltran, 2003). The population at risk of Iodine Deficiency Disorders (IDD) is estimated to be around 6 million, or 80 percent of the total population, with a predominance of women and puberty. Undernutrition and AIDS have an even more significant deleterious effect on immune competence as they potentiate each other. Identifying nutritional deficiencies and implementing nutritional support strategies are necessary from diagnosis and throughout the infection. A direct relationship has been found between deficiencies in specific micronutrients (vitamin A, vitamin B12) and a decrease in CD4 count. The goitreous endemic is the first worldwide endemic. It affects 1.5 billion people spread across the globe (Samake, 2015).

In Chad, few studies have been conducted on the thyroid status of people living with HIV. With this in mind, we set our overall objective to assess the correlation between HIV infection, malnutrition, and thyroid disorders in malnourished people living with HIV. We precisely characterized the study population, perform their thyroid workup and establish the prevalence of thyroid disorders.

1. Methods

2.1 Sampling

Our study concerns 36 malnourished people living with HIV in the commune of Sarh, at the Notre Dame des Apôtres hospital in Maïngara. This center was chosen because its objective at the time of its creation was to welcome people living with HIV/AIDS, but now Maïngara has opened its doors to all patients.

2.2 Socio-demographic parameters,

Age and sex were recorded from the patients' identity documents such as the National Identity Card or birth certificate. The data was entered into Excel and word software as the study progressed. These data were analyzed using Excel 2013 and Microsoft Word 2013 software. The results were presented in tables, histograms, and graphs using Excel 2013. Furthermore, patients were included in the study only after signing an informed consent form. Anonymity was respected, and the patients’ names were not mentioned, and a unique number represented each case.

2.3 Biochemical or biological parameters

2.3.1 Blood collection and processing of blood samples

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Blood was collected from all study participants in EDTA tubes and dry vacuum tubes using the vacutainer system. The blood was collected at the biomedical analysis laboratory of the Notre Dame des Apôtres Hospital in Maïngara Sarh. After that, the samples were transported to the Laboratory of Biomembrane and Cellular Signalling (Faculty of Science and Technology of the University of Abomey-Calavi/Benin), where the different assays were performed. After centrifugation, the sera and plasma are put in aliquots in sterile micro-tubes under a laminar flow hood. They are then stored at -08°C and transported to Benin for analysis.

2.3.2 Thyroid workup data

Several methods are often used to quantify thyroid hormones in biological fluids. In our study, we used the CHECK method with the EASY READER. It is a relatively easy, simple, and inexpensive way, whose specificity and sensitivity allowed us to make a good reading of the concentrations.

2.3.2.1 Sample collection and preparation

- TSH-CHECK-1, T3-CHECK-1, and T4-CHECK-1 tests are performed on the serum of PLWHIV.
- Samples are collected under standard collection conditions (aseptically and in such a way as to avoid hemolysis).
- Each piece is treated as if it is potentially infected.
- The samples were stored in a freezer until the day of the assays. Before testing, the samples were thawed and gradually brought to room temperature.

1.3.2.2 Dosing of controls

This operation consisted in calibrating the EASY READER device. First, after switching on and setting up, we took a cassette on which we poured four drops of Reactive White for TSH, 50µL for T3 and inserted the device. Then, the reading on the device’s dial is made after 15 minutes.

1.3.2.3 Determination of samples

For this dosage, you need :

- Ensure that all models and TSH-CHECK-1 for TSH, T3-CHECK-1 for T3, and T4-CHECK-1 for T4 reagent boxes are at room temperature before starting the test.
- Remove the reaction cell from its protective bag by tearing along the notches.
- Indicate the patient identification number on the test
- Fill the pipette with the sample (serum) and hold it vertically.

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- Place one drop of sera (25 µL) for TSH 2 drops (50 µL) for T3 and T4 in the sample well.
- Wait until the sample is completely absorbed before adding the diluent
- Hold the dropper bottle upright and gently add precisely four drops (150 µL) for TSH, three drops (100 µL) for T3 and T4 into the sample well, with an interval of 2 to 3 seconds between drops.
- Read TSH results in (mIU/L), T3 results in (ng/mL) and T4 results in (µg/dL) after 15 minutes as an immediate or delayed reading

Summary of reference values for thyroid hormone assays
Source: VEDA.LAB, 2020; PALARDY, 2018

Biological element	Reference value
TSH	0.2 - 4mUI/L
T3	1.08 - 3.08nmol/L
T4	51.52 -141.68 nmol/L or 0.59 - 1.33ng/dL
Indication	
Screening for thyroid pathology : ❖ a decrease in T4 and T3 levels and a rise in TSH levels, indicating hypothyroidism ❖ an increase in T4 and T3 and a reduction in TSH, indicating hyperthyroidism ❖ Primary hypothyroidism: TSH high T4 low T3 normal or low ❖ Subclinical hypothyroidism: TSH high - T4 normal - T3 normal ❖ Primary hyperthyroidism: TSH low - T4 high - T3 high ❖ Subclinical hyperthyroidism: low TSH - normal T4 - normal T3 ❖ TSH-mediated hyperthyroidism: TSH normal or low - T4 increased - T3 increased ❖ Central hypothyroidism: TSH normal or low - T4 low or borderline low - T3 normal or low	

2.4 Ethical considerations

The Notre Dame des Apôtres Hospital staff in Sarh / Chad was contacted and informed before our arrival. Free and informed consent to participate in the survey was requested from each head of household or representative. To ensure the confidentiality of the data collected, the interview with the participants took place behind closed doors. Participants were reassured that all the data collected would be kept confidential throughout the process until the results were revealed.

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2. Results

3.1 Patient characteristics

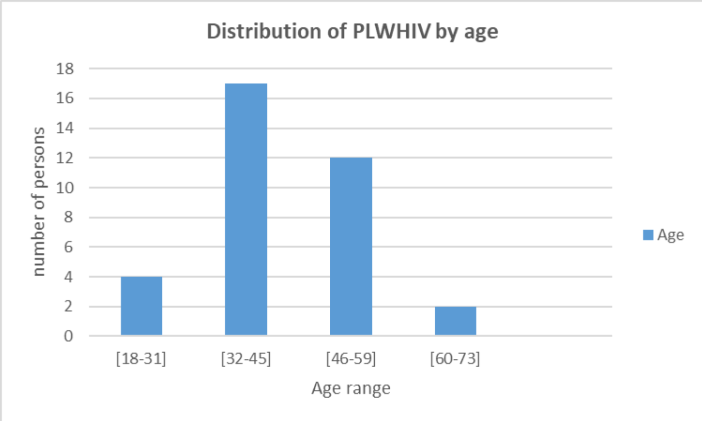

Figure 1: ***Age distribution of PLWHIV***

The figure shows that our study's age groups [32-45] and [46-59] are the most represented, with 48.75 percent and 34.29 percent, respectively. The age group of 32-59 years represents 83.04 percent of the study population.

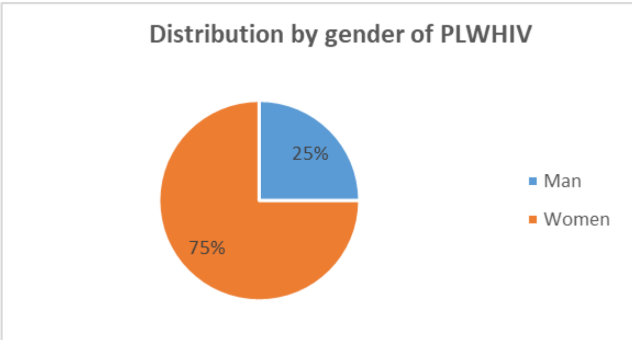

Figure 2: Distribution of PLWHIV by gender

From this diagram, the patients received are 75 percent of females and 25 percent of males with a sex ratio of 0.33 (M/F).

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3.2 Thyroid Assessment Result

3.2.1 Result of TSH

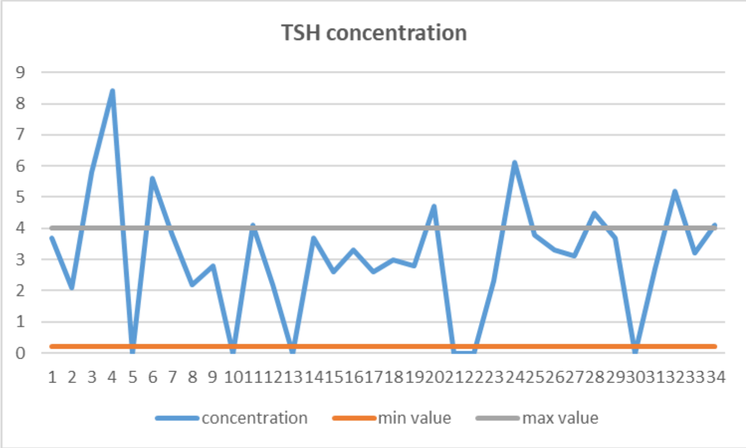

Figure 3: **TSH concentration**

From this figure, in our study population, 52.94 percent have a normal TSH, while 17.67 percent have a decreasing TSH and 29.41 percent have a high TSH.

3.2.2 Result of T3 Concentration

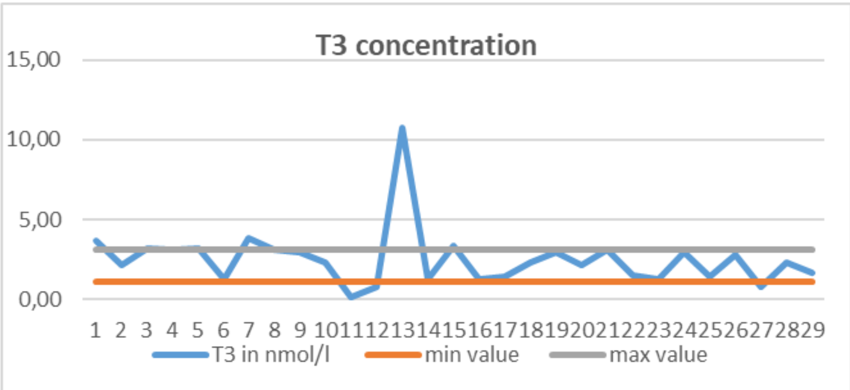

Figure 4: **T3 concentration**

From this figure, 65.52 percent have a standard T3, while 10.34 percent have a low T3 and 24.14 percent have a high T3.

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3.2.3 Result of T4 Concentration

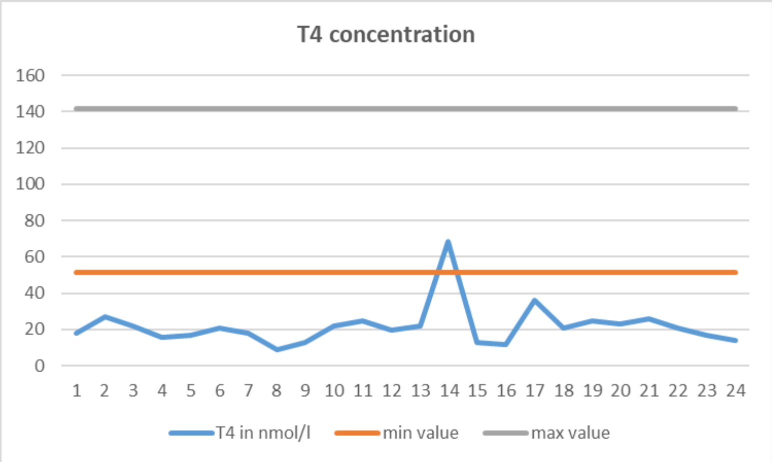

Figure 5: T4 concentration

From this figure, only 4.17 percent have a normal T4 while 95.83 percent have a low rate, and we have not noted any rate higher than the standard T4.

3.2.4 Frequency distribution of thyroid hormone dysfunction

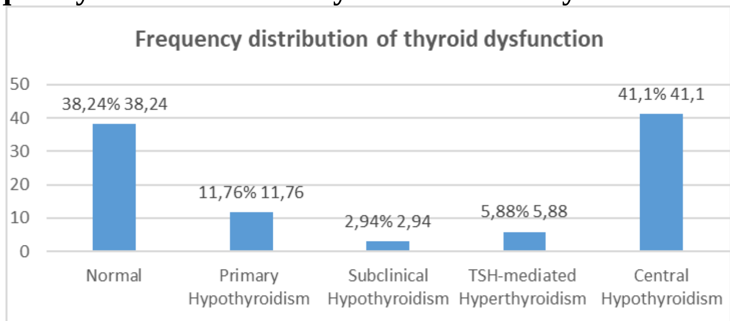

Figure 6: Frequency distribution of thyroid dysfunction

The figure shows the results of the thyroid assessment carried out on people living with HIV and malnutrition. From this figure, 38.24 percent of the study population had normal thyroid hormone status, 61.76 percent had abnormal thyroid hormone status, i.e., 11.76 percent had primary hypothyroidism, 2.94 percent had subclinical hypothyroidism, 5.88 percent had TSH-mediated hyperthyroidism, and 41.18 percent had central hypothyroidism.

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3.2.5 Frequency of thyroid dysfunction by gender

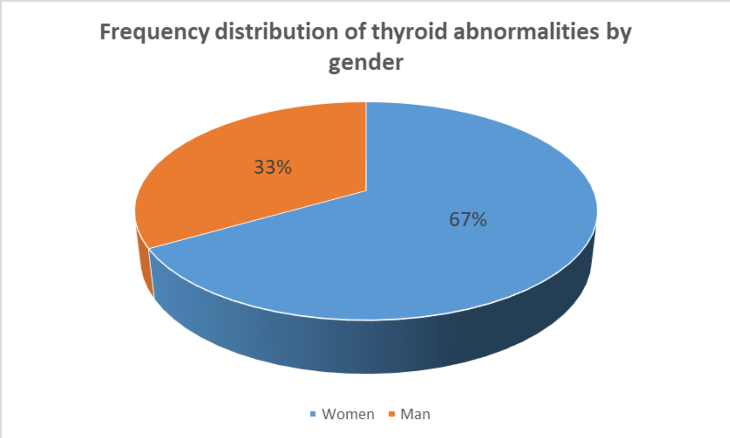

Figure 7: Frequency of thyroid abnormalities by gender

The chart shows that women are the most affected by thyroid dysfunction, with a rate of 67 percent compared to 33 percent for men.

3.2.6 Frequency of thyroid dysfunction by age and gender

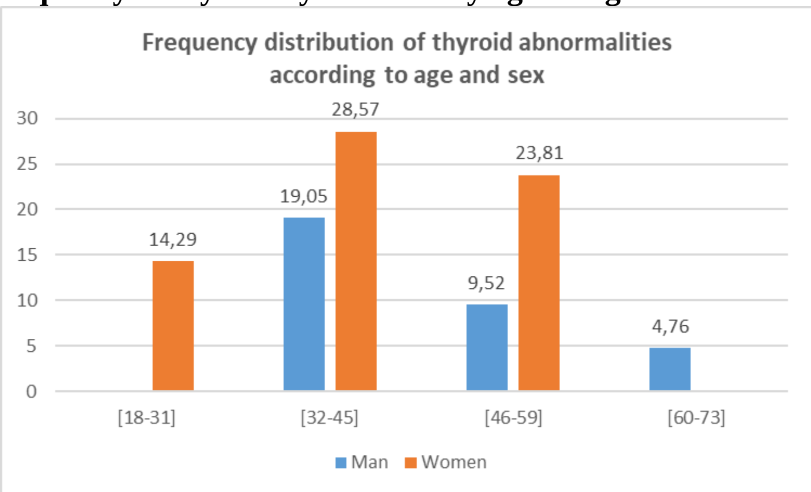

Figure 8: Frequency of thyroid dysfunction by age and gender

The figure shows that adults between 32 and 45 years are the most represented. This same age group has a higher frequency of thyroid dysfunction in women than in men with a percentage of 28.57 percent and 19.05 percent, respectively.

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3. Discussion

In the present study, the female sex is the most represented in the overall population, with 75 percent or a sex ratio of 0.33. This female predominance has been found in most studies conducted on HIV, including (Maiga, 2015) in Burkina Faso and (Barkat, 2019) in Algeria, who reported 71.3 percent and 65.29 percent of women against 28.7 percent and 34.71 percent of men. This high representation of women could be explained by the fact that women attend health centers the most and are the most exposed to infection. The most represented age group is 32 to 59 years with 83.04 percent. This result is more or less the same as that of (Mbopi-Keou, 2012) in Cameroon, with 66.6 percent in the 31 to 50 age group. This period corresponds to that of maximum sexual activity, exposing the risk of transmission of sexually transmitted infections. To determine biochemical parameters, it is good to remember that HIV/AIDS infection and nutritional deficiencies lead to malnutrition due to iodine deficiency. The samples taken allowed us to see that 52.94 percent of the pieces had a normal TSH level, and 47.06 percent had a level below the TSH norm. This could be explained by the fact that PLWHA often has a problem of poor absorption of nutrients or micronutrients necessary for the proper functioning of the body (CAMES, 2004). The case of iodine exposes its individuals to thyroid hormone dysfunction and accentuates the infection of HIV/AIDS on the immune system. The assays performed on the samples showed that 65.52 percent have normal T3 while 10.34 percent have low T3 and 24.14 percent have high T3. This could be explained by the low level of T4 which makes the mechanism of deiodination of T4 to obtain T3 defective. As for T4 assays, which in association with TSH allows defining whether patients have dysfunction or not and to orientate the diagnosis shows that only 4.17 percent have a normal T4 level while 95.83 percent have a low level and there is no high T4 level because the patients are both malnourished and on anti-retroviral drugs. Research by (Erika, 2014) in Argentina showed that even before introducing antiretroviral therapy, several studies reported alterations in thyroid function following sequences of opportunistic infections caused by HIV. Regarding the prevalence of thyroid dysfunction, 38.24 percent of the study population had normal thyroid hormone status, and 61.76 percent had abnormal rate, i.e., 11.76 percent primary hypothyroidism, 2.94 percent subclinical 5.88 percent TSH mediated hyperthyroidism, and 41.18 percent central hypothyroidism. These results are comparable to (Emokpae, 2018) in Nigeria, who found that 52 percent of the study population on antiretrovirals had thyroid dysfunction.

Moreover, according to the distribution of thyroid dysfunction according to sex, women are the most affected, with 67 percent against 33 percent. These results are different from those of (Sezan, 2009) in Benin, who

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

found 46.15 percent of women and 53.85 percent of men in a population not infected by HIV. This difference could be explained by our patients being malnourished, on antiretroviral drugs, and living with HIV/AIDS. The frequency of thyroid dysfunction according to age and sex shows that adults aged between 32 and 45 years are the most represented. This same age group has the highest frequency of thyroid dysfunction in both women and men, with 28.57 19.05 percent. This result is close to that of (Mba, 2019) in Mali, which found 26.4 percent in the age group of 31 to 40 years.

4. Conclusion

This study assessed the thyroid status of malnourished people living with HIV/AIDS at Notre Dame des Apôtres Hospital in Sarh/Chad. Thyroid hormone measurements (TSH, T4, and T3) on blood samples allowed us to establish a correlation between HIV infection, malnutrition, and thyroid disorders. From these results, we can conclude that malnutrition and HIV form is a vicious circle leading to further opportunistic infections and thus creating thyroid dysfunction in infected individuals. However, this dysfunction's actual causes and mechanisms are not yet clearly understood.

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