(RESEARCH ARTICLE)

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Assessment of energy status in people living with HIV/AIDS under antiretroviral treatment in Lubumbashi city, DR Congo

Ndibualonji Badibanga Bualufu Victor [1, *], Manya Tsheko Dona [2], Koya Mawazo Kaya [3], Tshibumbu Kabeya Edouard [4] and Kilinda Mufwaya Florence [1]

[1] Department of Biochemistry, Faculty of Veterinary Medicine, University of Lubumbashi, DR Congo.
[2] Laboratory Department, Higher Institute of Medical Techniques of Lubumbashi, DR Congo.
[3] University of Kalemie, School of Public Health, DR Congo.
[4] Department of Biomedical Sciences, Faculty of Medicine, University of Lubumbashi, DR Congo.

Abstract

Introduction: Human immunodeficiency virus (HIV) infection constitutes a major public health and development problem in sub-Saharan African countries in general and in Democratic Republic of Congo (DR Congo) in particular. In these countries, people living with HIV have increased energy needs in part because of prevailing malnutrition and food insecurity.

Objective: To assess energy status in people living with HIV/AIDS (PLWH) under antiretroviral treatment (ART) in the city of Lubumbashi in DR Congo.

Methods: We selected 60 individuals received for consultation at the university clinics of Lubumbashi, among whom 20 were PLWH under ART, 20 were PLWH not yet undergoing treatment and 20 healthy individuals who we considered as controls. Venous blood samples were taken from the 60 individuals and, after centrifugation, the serum obtained was used for glucose and triglycerides measurements by enzymatic and colorimetric methods. The average results obtained in PLWH under treatment or not and in controls were compared using the Student's t test.

Results: The mean serum concentrations of glucose and triglycerides obtained in PLWH under ART, in PLWH without treatment and in controls were 76.0 ± 10.67 mg/dl and 89.6 ± 37.49 mg/dl; 71.5 ± 9.85 mg/dl and 96.5 ± 23.25 mg/dl; 78.1 ± 8.41 mg/dl and 68.1 ± 26.86 mg/dl, respectively.

The average glycemia obtained in PLWH not yet treated was significantly lower ($P < 0.05$) than that obtained in PLWH under ART and in controls, while the average triglyceridemia observed in PLWH under ART or not was significantly higher ($P < 0.05$) than that observed in controls.

Conclusion: The study showed that in the precarious socio-economic conditions of DR Congo, HIV/AIDS infection is accompanied by an increase in energy needs and the body of PLWH faces this by mobilizing reserves, lipids, represented by triglycerides. This mobilization is more important in PLWH without ART.

Keywords: Evaluation; energy status; HIV/AIDS; Lubumbashi; DR Congo

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* Corresponding author: Ndibualonji Badibanga Bualufu Victor

1. Introduction

Human immunodeficiency virus (HIV) infection constitutes a major public health and development problem in sub-Saharan African countries (1, 2, 3). Towards the end of 2016, the World Health Organization (WHO) estimated that around 36.7 million people were living with HIV, including 25.6 million in Africa (4).

The Democratic Republic of Congo is among the most affected countries in Africa. With a population of more than 80 million inhabitants, the DR Congo had in 2011 a prevalence of HIV/AIDS estimated at 3.5% among pregnant women and 2.57% in the general population (4,5). At the same time, the country faces endemic malnutrition, a situation which is further aggravated by the HIV/AIDS pandemic. Indeed, this pandemic is often associated with malnutrition and household food insecurity due to the reduction in family income and the increase in the share of the budget allocated to medical care (6). In addition, due to opportunistic infections following HIV, PLWH have increased energy needs and difficulties in ingestion and digestion of food (3). This is why the main objective of our study is to evaluate the energy status among PLWH under ART in the city of Lubumbashi.

2. Material and methods

2.1. Site of research

The study was carried out at the Lubumbashi university clinics, an institution managed by the University of Lubumbashi and which constitutes the second largest hospital center in the city of Lubumbashi after the Jason SENDWE general reference hospital. Lubumbashi, the second city in DR Congo after the capital Kinshasa, is located at 27° 28'32" east longitude, 11°44' 33" south latitude and at an altitude of 1230 m.

2.2. Study population

Our study was carried out on 60 individuals received for consultation at the university clinics of Lubumbashi, among whom 20 were PLWH under ART, 20 were PLWH not yet subject to treatment and 20 healthy individuals whom we considered as controls because they lived in the same socio-economic conditions than PLWH.

2.3. Inclusion and exclusion criteria

We included in our study any PLWH subject to ART or not, received in consultation at the university clinics of Lubumbashi and who gave his informed consent to participate in the study. We excluded from our study any individual who did not meet a single one of our inclusion criteria. For controls, we included in our study any individual declared healthy after medical consultation at the university clinics of Lubumbashi and who freely consented to participate in the study.

2.4. Variables studied

Qualitative variable: Sex

Quantitative variables: Age, glycemia, triglyceridemia

2.5. Materials used

- Spectrophotometer (CYAN SMART);
- Centrifuge (HORIZON);
- Fridge (SHARP);
- Agitator (CYAN CL008);
- Micropipettes (EPPENDORF);
- Stopwatch;
- Test tubes;
- Tube racks;
- Tips;
- 5 ml syringes and needles;
- Tourniquet;
- Wadding;
- Denatured alcohol.

2.6. Methods

2.6.1. Type of study

We conducted a cross-sectional descriptive study with analytical aims.

2.6.2. Collection and processing of blood samples

Blood samples (4 ml) were collected from the superficial veins of the elbow crease, placed in test tubes without anticoagulant and centrifuged at 3000 rpm for 10 minutes. The serum obtained was used for glycemia and triglyceridemia measurements in the laboratory of the university clinics of Lubumbashi.

2.6.3. Laboratory assay

Glycemia measurement

Blood glucose levels were measured using an enzymatic and colorimetric method using glucose oxidase. The principle of this method is as follows: under the action of glucose oxidase, glucose is oxidized into gluconic acid and hydrogen peroxide. The latter, in the presence of 4-aminoantipyrine and under the action of peroxidase, gives hydrogen chloride and a chromogen (quinone imine) colored red. The intensity of this coloring is proportional to the concentration of glycose in the sample (7).

Triglyceridemia measurement

Triglyceridemia was measured using an enzymatic and colorimetric method using lipoprotein lipase. The principle of this method is as follows: under the action of lipoprotein lipase, triglycerides are hydrolyzed into fatty acids and glycerol. The latter, under the action of glycerol kinase, is transformed into glycerol-3-phosphate which undergoes the action of glycerol-3-phosphate oxidase to give dihydroxyacetone phosphate and hydrogen peroxide. Finally, under the action of peroxidase, hydrogen peroxide is transformed into a red colored derivative whose coloring intensity is proportional to the concentration of triglycerides in the sample (8).

2.6.4. Statistical analysis

The mean serum concentrations of glucose and triglycerides obtained in PLWH under ART or not and in healthy individuals (controls) were compared using the Student's t test (9). Statistical significance was declared at the threshold of $P < 0.05$.

3. Results

3.1. Distribution of repodents acconding to age and sex

In the 20 PLWH under ART, the number of male individuals was 11 (55%) and that of female individuals was 9 (45%). The average age was 47±10 years. In the 20 PLWH not yet under ART, the number of male individuals was 10 (50%) and that of female individuals was also 10 (50%). The average age was 39±9.6 years. In the 20 controls, the number of male individuals was 10 (50%) and that of female individuals was also 10 (50%). The average age was 36 ±6.6 years.

3.2. Mean serum glucose and triglycerides concentrations

The average serum concentrations of glucose and triglycerides obtained in PLWH under ART or not and in controls are presented in table 1.

Table 1 Mean serum glucose and triglycerides concentrations

Status	Glycemia (mg/dl)	Triglyceridemia (mg/dl)
PLWH under ART	76.0±10.67	89.6±37.49
PLWH without ART	71.5±9.85	96.5±23.25
Controls	78.1±8.44	68.1±26.86

3.3. Statistical comparisons of mean blood glucose and triglycerides concentrations between PLWH under ART, PLWH without ART and controls

Statistical comparisons of mean blood glucose and triglycerides concentrations between PLWH under ART, PLWH without ART, and controls are presented in tables 2 and 3.

Table 2 Statistical comparisons of mean blood glucose between PLWH under ART, PLWH without ART and controls

Groups compared	Numbers	Means	DOF	Tcal	Tth	Interpretation
PLWH under ART	20	76.0	38	1.71	1.68	S*
PLWH without ART	20	71.5				
PLWH under ART	20	76.0	38	0.67	1.68	NS
Controls	20	78.1				
PLWH without ART	20	71.5	38	2.26	1.68	S*
Controls	20	78.1				

DOF: degree of freedom; Tcal: calculated T; Tth: theoretical T; NS: non-significant difference; S: significant difference at the threshold of $P < 0.05$.

Examination of table 2 shows that the average blood glucose level obtained in PLWH without ART is significantly lower (Tcal>Tth) than that obtained in PLWH under ART and in controls. There is no significant difference in mean glycemia (Tcal<Tth) between PLWH under ART and controls.

Table 3 Statistical comparisons of mean triglyceridemia between PLWH under ART, PLWH without ART and controls

Groups compared	Numbers	Means	DOF	Tcal	Tth	Interpretation
PLWH under ART	20	89.6	38	0.69	1.68	NS
PLWH without ART	20	96.5				
PLWH under ART	20	89.6	38	2.09	1.68	S*
Controls	20	68.1				
PLWH without ART	20	96.5	38	3.55	1.68	S*
Controls	20	68.1				

DOF: degree of freedom; Tcal: calculated T; Tth: theoretical T; NS: non-significant difference; S*: significant difference at the threshold of $P < 0.05$.

Examination of table 3 shows that the mean triglyceridemia obtained in PLWH under ART and in PLWH without ART are significantly higher (Tcal >Tth) than that obtained in controls. There is no significant difference (Tcal < Tth) in mean triglyceridemia between PLWH under ART and PLWH without ART.

4. Discussion

In our study, the average age of PLWH under ART was 47 ± 10 years while that of PLWH without ART was 39 ± 9.6 years. These results are close to those of Sohounme (10) and Akotegnon (11) who respectively found an average age of 39.7±10.56 years and 40±12 years.

Concerning gender, we observed that among PLWH under ART, 55% of them were male compared to 45% female. These results contradict those of Séibo (12) who observed that among PLWH, 68% were female compared to 32% male. This difference in results may be due to the difference in sample sizes because in our study, there were 20 PLWH under ART while in the Séibo study, there were 44.

The mean serum glucose concentrations that we obtained in PLWH under ART, in PLWH without ART and in controls were 76.0 ± 10.67 mg/dl; 71.5±9.85mg/dl and 78.1±8.41, respectively. Mean serum triglycerides concentrations were 89.6 ± 37.49 mg/dl; 96.5± 23.25 mg/dl and 68.1± 26.86 mg/dl, respectively.

Statistical analysis showed that the average blood glucose observed in PLWH without treatment was significantly lower (P<0.05) than that observed in PLWH under ART and in controls. These results are in agreement with those of Sohounme(10) who observed a higher average blood sugar level in PLWH under ART than in PLWH without ART.

These observations indicate that ART corrects disturbances in carbohydrate metabolism during HIV infection because we observed no significant difference in mean blood glucose between PLWH under ART and controls. In our study, the mean triglyceridemia obtained in PLWH under ART or not was significantly higher (P<0.05) than that obtained in controls. The increase in triglyceridemia in PLWH has also been observed in other studies carried out in Africa (12, 13, 14) and indicates that HIV infection is accompanied by a significant energy deficit which could be due to a reduction in food consumption (malabsorption, mouth lesions, anorexia) and the side effects of ART (nausea, vomiting) without forgetting the malnutrition and food insecurity which prevail in most African countries (1, 2, 3).

The patient's body tries to cope by mobilizing the lipid reserves represented by triglycerides (15).

5. Conclusion

The study showed that energy status is greatly disrupted during HIV infection and that the body of PLWH copes with this by mobilizing reserve lipids represented by triglycerides. This lipid mobilization is greater in PLWH without ART than in PLWH under ART.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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