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Profile of Discordant Couples for Human Immunodeficiency Virus Infection Followed in Kinshasa: Case of Monkole Medical Center

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Abstract

Background: Programs targeting serodiscordant couples in Africa are not a priority in efforts to prevent Human Immunodeficiency Virus (HIV) infection, although a large proportion of these occur in stable relationships, of which serodiscordance accounts for about two-thirds with a high risk of seroconversion of the seronegative partner. **Objective**: The objective of this study was to describe the profile of HIV serodiscordant couples followed in Kinshasa, DRC. **Methods**: Descriptive cross-sectional study to describe the profile of different heterosexual HIV serodiscordant couples followed at the Monkole Medical Center in Kinshasa, DRC, from November 2021 to June 2022. The data were collected from the information sheets elaborated by the research team as well as from the information provided by the computerized files of the patients managed at the Infectious Diseases Unit of the Monkole Medical Center after the signature of the informed consent. An average of 8 cc of blood was taken from a peripheral vein in the patient's forearm, and was stored in EDTA tubes at −20˚C, of which at least 6 mL were used for biochemical analyses, 2 spots of 200 µL for each partner were stored on filter paper at −20˚C and were used for DNA extraction. Nested PCR confirmed the serological diagnosis. **Results**: Out of a total of 482 heterosexual couples followed for HIV at the Monkole Medical Center, 28 (5.8%) were HIV serodiscordant, of which 14 (2.9%) couples agreed to participate in the present study. The mean age was 43.39 ± 10 years with extremes ranging from 24 to 62 years. The patients were mainly from the informal sector (53.6%) and

weighed between 61 and 71 kg (46.4%). Sexual intercourse continued in all couples, without condom use (85.7%) for desire of procreation (82.1%); although the great majority of HIV-negative partners (85.7%) were not under ARV prophylaxis. Leukopenia was found in 42.9% of HIV-negative partners compared to 21% of HIV-positive partners; all partners had a predominantly lymphocytic white blood cell count. 21.4% of HIV-negative partners had high HDL, 14.3% of HIV-positive partners had low HDL, and 14.3% of HIV-negative partners had high LDL. Chi-square and Pearson correlation tests showed no relationship between the biochemical parameters performed and the couples' serodiscordance for HIV. **Conclusion**: The frequency of HIV discordant couples in Kinshasa is significant. Serodiscordance is encountered in young intellectual and entrepreneurial couples with a desire to procreate. It is desirable to carry out further analyses for better management of these couples.

Keywords

Discordant Couple, Profile, HIV, Kinshasa

1. Introduction

Nowadays, approximately 37.7 million people are living with the Human Immunodeficiency Virus (HIV) worldwide, including 1.5 million new infections, of which nearly two-thirds occurred in sub-Saharan Africa in 2020 [1]. Since the advent of Human Immunodeficiency Virus (HIV) in Africa, efforts to stop its spread have focused primarily on preventing "risky" sexual behavior, involving more sex workers and casual partners in the general population [2] [3]. About two-thirds of couples with at least one HIV-positive partner have been shown to be serodiscordant for HIV; seropositivity is equally distributed between men and women [2]. A study predicting the annual risk of HIV transmission from HIV-positive to HIV-negative partners in a serodiscordant couple for 23 countries south of the Sahara found it to be high, hovering around 10 (range 4 - 20) per 100 persons/year in the majority of countries; with a median of 11.1 per 100 persons/year in all countries [4]. Facts highlighting the global failure to slow the spread of the epidemic, the need to implement and scale up effective HIV prevention strategies, and to find new prevention approaches [5].

It has been shown that each individual's genetic heritage modifies his or her susceptibility to infection and subsequent progression to the disease [6]. The phenomenon of discordance in HIV-infected couples remains a mirage and a concept that needs to be unraveled [7].

Discordant couples are those where one partner is HIV-infected while the other is not [8]. Discordance among infected couples is a common phenomenon in sub-Saharan Africa and has always been a challenge in the fight to prevent and cure HIV in the population [9] [10]. In addition to the innate HIV resistance of one of the partners, initial non-disclosure before marriage or relation-

ship, traditional marriages without premarital counseling and testing, latency in case of infection before marriage and accidental infection of a partner during marriage or sexual relationship, are the other factors explaining the occurrence of HIV discordance [11].

Programs targeting serodiscordant couples have not been widely implemented and are rarely a priority in prevention efforts because these couples are not among the "key populations" to be targeted by prevention programs. Most men and women who are in an HIV-positive relationship do not know their own HIV status. In addition, the lack of HIV prevention for couples is partly due to misperception and denial of the possibility of HIV serodiscordance [12]. This calls for the urgent implementation of feasible and acceptable strategies to promote the prevention of HIV transmission in serodiscordant couples, and to make this a key strategy in our HIV programs [13].

Serodiscordant couples are not often the focus of research in our community. Hence the objective of this study was to describe the different parameters of HIV serodiscordant couples followed in Kinshasa, Democratic Republic of Congo.

2. Methods

2.1. Setting, Type and Time Period of the Study

The present study is a cross-sectional study with a descriptive aim. It presents the profile of different serodiscordant couples for HIV infection followed in Kinshasa, Democratic Republic of Congo. The Monkole Medical Center was selected on the basis of record keeping, couple management and accessibility. The inclusion period was from November 2021 to June 2022, or 8 months.

2.2. Study Populations

All HIV discordant heterosexual couples followed at Monkole Medical Center were included in the present study after reading and signing an informed consent. Couples were retained in pairs for data compliance.

2.3. Sample

Our sampling was based on convenience. We considered all serodiscordant couples identified during the study period, followed up at the Monkole Mother and Child Hospital, and who met the inclusion criteria.

Inclusion criteria

- All discordant couples after reading and signing an informed consent form;
- Couples must be paired for data conformity;
- Have a file containing all our parameters of interest.

Non-inclusion criteria

- All seropositive couples;
- All PLHIV or seronegatives not living in couples;
- All sero-negative couples.

2.4. Parameters of Interest

Apart from the couples' serology, the parameters retained for this study were divided into two groups: sociodemographic and anthropometric parameters on the one hand, and clinical, para-clinical and therapeutic parameters on the other.

For the sociodemographic and anthropometric parameters, age, weight, height, level of education, profession and religion were selected.

For clinical parameters, frequency of sexual intercourse, number of children, desire to procreate, previous exposure to ARVs, rational use of condoms and clinical stage were selected.

For the para-clinical parameters, total protein, white blood cells (WBC), white blood cell count (WBC), CRP, hemoglobin (Hb), transaminases (AST or SGOT and ALT or SGPT), HDL and LDL were selected.

Regarding the treatment, the therapeutic regimen and the duration of ARV treatment were retained.

2.5. Collection and Storage

We collected from each person subject to our study an average of 8 cc of blood from a peripheral vein of the forearm which we stored in EDTA tubes at −20˚C. We then subtracted at least 6 mL for biochemical analyses; the 1 mL aliquot kept on eppendorf tubes at −20˚C, and 4 spots of blood per couple due to 2 spots of 200 µL for each partner were deposited on filter paper and dried in the open air. The well-labeled dried filter paper is placed in the individual zyploc bag with silica gel and stored at −20˚C for bio-molecular analyzes (PCR). After DNA extraction on filter paper, nested PCR was performed and confirmed the serological diagnosis of the couples.

2.6. Data Collection and Analysis

The data were collected from the information sheets prepared by the research team and from the computerized records of the patients followed at the Infectious Diseases Unit of the Monkole Medical Center, as well as from the results of the biochemical analyses from the pharmacy laboratory of the Faculty of Medicine of the University of Kinshasa.

A database was created using Excel (Microsoft 2016) and then exported to SPSS version 25.0 for descriptive analyses. Quantitative variables were presented as proportions, means and standard deviations; qualitative variables were presented as proportions (%). Our results are presented in tables (containing absolute values and percentages) and charts (bar and pie charts). Chi-square and Pearson correlation tests were used to investigate associations between the variables studied and serostatus, and relationships between different variables.

2.7. Ethical Considerations

The present study was approved by the ethics and research committee of the School of Public Health, Faculty of Medicine, University of Kinshasa (Ref: ESP/E/115/2021). Authorization to access the Monkole Medical Center was ob-

tained from the competent authority of the Center. Prior to inclusion, informed consent was obtained from each patient. Blood samples for the couples were taken by the technical teams of the institution. The results of the different analyses were returned to the Monkole Medical Center at the end of the study.

3. Results

3.1. Frequency

Out of a total of 482 couples followed for HIV at the Monkole Medical Center, 28 couples (5.8%) were HIV serodiscordant of which 14 couples (2.9%) consented to participate in the present study. Of these 14 couples, 89.3% were tested at the Monkole Medical Center; and all couples were followed up at this institution.

3.2. Sociodemographic Characteristics

The mean age of all partners was 43.39 ± 10 years with extremes ranging from 24 to 62 years; this mean was 42.64 ± 10 years for HIV-positive partners with extremes ranging from 24 to 62 years; and 44.14 ± 10 years for HIV-negative partners with extremes ranging from 32 to 60 years. The 36 - 45 age group was the most affected by HIV with 71.4% of cases, and the over 45 age group was the most representative (50.0%) of HIV-negative individuals. The Chi-square test (0.043) showed that age was associated with HIV status. The mean age of women was 39.71 ± 10 years with extremes ranging from 24 to 51 years; that of men was 47.07 ± 10 years with extremes ranging from 37 to 62 years (**Table 1**). The majority of partners had a secondary education (56.0%). The informal sector was the most represented among the couples (53.6%) (**Table 2**). Catholic and revivalist church couples were the most prevalent, at 35.7% each (**Table 3**).

3.3. Clinical Characteristics

The majority of partners in the couples (46.4%) weighed between 61 and 71 kg; for those who were HIV positive, 57.1% weighed between 61 and 71 kg; while for those who were HIV negative, 42.9% weighed between 72 and 82 kg. Only the HIV-negative partners, *i.e.* 7.1% of all couples, weighed more than 83 kg. The majority of patients were between 1.61 and 1.71 m tall, and over 1.72 m tall, *i.e.* 48.1% and 44.4% respectively (**Table 1**). All couples had sexual desire and had sexual intercourse at a frequency of 1 to 3 times and 4 to 6 times per month in the majority of cases (42.9% each), during the last 12 months. 64.3% of couples had between 4 and 6 children (**Table 3**), and 82.1% had a desire to procreate 85.7% of HIV-negative partners were not on ARV prophylaxis; and one serodiscordant couple was not exposed to ARVs. 92.9% of PLWH received ARV treatment. The chi-square test (<0.001) showed that prior exposure to ARVs was highly associated with the patient's HIV status. The vast majority of serodiscordant couples (85.7%) did not use condoms, and 57.1% of PLWH were at WHO stage 2 (**Figure 1**).

Table 1. Distribution of serodiscordant couples by sex, age, weight and height.

Variables	HIV− n (%)	HIV+ n (%)	Total n (%)
Sex			
Men	7 (50.0%)	7 (50.0%)	14 (50.0%)
Women	7 (50.0%)	7 (50.0%)	14 (50.0%)
Total	14 (100.0%)	14 (100.0%)	28 (100.0%)
Age			
15 to 25 years	0 (0.0%)	1 (7.1%)	1 (3.6%)
26 to 35 years	3 (21.4%)	0 (0.0%)	3 (10.7%)
36 to 45 years	4 (28.6%)	**10 (71.4%)**	14 (50%)
Over 45 years	**7 (50.0%)**	3 (21.4%)	10 (35.7%)
Total	14 (100.0%)	14 (100.0%)	28 (100.0%)
Weight			
≤60 Kg	1 (7.1 %)	4 (28.6%)	5 (17.9%)
61 to 71 Kg	5 (35.7%)	8 (57.1%)	**13 (46.4%)**
72 to 82 Kg	6 (42.9%)	2 (14.3%)	**8 (28.6%)**
≥83 Kg	2 (14.3%)	0 (0.0%)	2 (7.1%)
Total	14 (100.0%)	14 (100.0%)	28 (100.0%)
Height			
≤1.60 m	0 (0.0%)	2 (15.4%)	2 (7.4%)
1.61 - 1.71 m	5 (35.7%)	8 (61.5%)	**13 (48.1%)**
≥1.72 m	9 (64.3%)	3 (23.1%)	**12 (44.4%)**
Total	14 (100.0%)	13 (100.0%)	27 (100.0%)

n = number, % = percentage.

Table 2. Distribution of patients according to level of education, profession, municipality of residence.

Variables	HIV− n (%)	HIV+ n (%)	Total
Level of education			
Primary	1 (8.3%)	2 (15.4%)	3 (12.0%)
Secondary	7 (58.3%)	7 (53.8%)	**14 (56.0%)**
University	4 (33.3%)	4 (30.8%)	8 (32.0%)
Total	12 (100.0%)	13 (100.0%)	25 (100.0%)

Continued

Profession			
Informal	7 (50.0%)	8 (57.1%)	**15 (53.6%)**
Driver	0 (0.0%)	2 (14.3%)	2 (7.1%)
Teacher	3 (21.4%)	0 (0.0%)	3 (10.7%)
Engineer	0 (0.0%)	1 (7.1%)	1 (3.6%)
Journalist	1 (7.1%)	0 (0.0%)	1 (3.6%)
Housewife	1 (7.1%)	0 (0.0%)	1 (3.6%)
Military	0 (0.0%)	1 (7.1%)	1 (3.6%)
Technician	2 (14.3%)	1 (7.1%)	3 (10.7%)
Unemployed	0 (0.0%)	1 (7.1%)	1 (3.6%)
Total	14 (100.0%)	14 (100.0%)	28 (100.0%)
Municipality of residence			
Selembao	3 (21.4%)	3 (21.4%)	6 (21.4%)
Ngaliema	5 (35.7%)	5 (35.7%)	**10 (35.7%)**
Masina	2 (14.3%)	2 (14.3%)	4 (14.3%)
Kimbaseke	1 (7.1%)	1 (7.1%)	2 (7.1%)
Mont Ngafula	3 (21.4%)	3 (21.4%)	6 (21.4%)
Total	14 (100.0%)	14 (100.0%)	28 (100.0%)

n = number, % = percentage.

Table 3. Distribution of serodiscordant couples by religion, province of origin and number of children.

Variables	HIV− n (%)	HIV+ n (%)	Total
Religion			
Catholic	5 (35.7%)	5 (35.7%)	**10 (35.7%)**
New Apostolic	0 (0.0%)	2 (14.3%)	2 (7.1%)
Protestant	3 (21.4%)	3 (21.4%)	6 (21.4%)
Revival	6 (42.8%)	4 (28.6%)	**10 (35.7%)**
Total	14 (100.0%)	14 (100.0%)	28 (100.0%)
Province of origin			
Bandundu	6 (42.9%)	5 (35.7%)	11 (39.3%)
Congo-Central	3 (21.4%)	2 (14.3%)	5 (17.9%)
Equateur	1 (7.1%)	1 (7.1%)	2 (7.1%)
Kasaï-Oriental	0 (0.0%)	2 (14.3%)	2 (7.1%)
Kasaï-Occidental	1 (7.1%)	2 (14.3%)	3 (10.7%)

Continued

Katanga	2 (14.3%)	0 (0.0%)	2 (7.1%)
Nord-Kivu	0 (0.0%)	1 (7.1%)	1 (3.6%)
Sud-Kivu	1 (7.1%)	1 (7.1%)	2 (7.1%)
Total	14 (100.0%)	14 (100.0%)	28 (100.0%)

Number of children	**Number of discordant pairs n (%)**
≤3	4 (28.6%)
4 - 6	**9 (64.3%)**
≥7	1 (7.1%)
Total	14 (100.0%)

n = number, % = percentage.

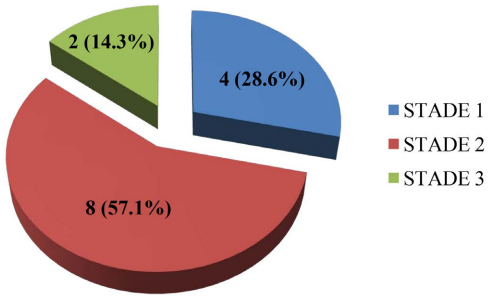

Figure 1. Distribution of PLHIV by clinical stage.

3.4. Biochemical Parameters

The majority (92.9%) of couples were screened with an indirect method. Most partners had normal and slightly above normal hemoglobin levels, 46.4% and 50.0% of partners respectively. 42.9% of HIV-negative partners out of 21% of HIV-positive partners had leukopenia. Overall, the majority of partners, 67.9%, had a normal white blood cell count. All serodiscordant couples had a predominantly lymphocytic WBC count. 89.3% of the partners had a normal CRP; and a significant proportion of the seropositive partners (14.3%) had an increased CRP. The majority of patients (85.7%) had normal total protein levels; and a significant proportion of HIV-negative partners (14.3%) had low total protein levels compared to 7.1% of HIV-positive partners; in addition, 7.1% of HIV-negative partners had high total protein levels. 78.6% of partners had normal SGOT levels; and a significant proportion of HIV-positive partners (28.6%) had high SGOT levels. The majority of patients (92.9%) had normal SGPT levels. The majority of patients (75.0%) had normal HDL levels; and a significant proportion of HIV-negative partners (21.4%) had above-normal HDL levels, and 14.3% of HIV-positive partners had low HDL levels. The majority of patients, 89.3%, had normal LDL levels, and a significant proportion of HIV-negative partners, 14.3%, had high LDL levels (Table 4). Referring to the Chi-square test, no biochemical parameters were associated with the patient's serological status.

Table 4. Biochemical parameters of HIV+ and HIV− patients.

Variables	HIV− n (%)	HIV+ n (%)	Total
Hb			
≤10 g/dL	1 (7.1%)	0 (0.0%)	1 (7.1%)
>10 - 13 g/dL	7 (50.0%)	6 (42.9%)	13 (46.4%)
>13 g/dL	6 (42.9%)	8 (57.1%)	14 (50.0%)
Total	14 (100.0%)	14 (100.0%)	28 (100.0%)
WBC			
<4000 elts/mm^3	6 (42.9%)	3 (21.4%)	9 (32.1%)
4000 - 10,000 elts/mm^3	8 (57.1%)	11 (78.6%)	19 (67.9%)
Total	14 (100%)	14 (100%)	28 (100%)
WBC differential			
Predominantly lymphocytic	14 (100.0%)	14 (100.0%)	28 (100.0%)
Total	14 (100.0%)	14 (100.0%)	28 (100.0%)
CRP			
0 - 6 mg/dL	13 (92.9%)	12 (85.7%)	25 (89.3%)
>6 mg/dL	1 (7.1%)	2 (14.3%)	3 (10.7%)
Total	14 (100.0%)	14 (100.0%)	28 (100.0%)
GOT			
0 - 31 UI/L	12 (85.7%)	10 (71.4%)	22 (78.6%)
>31 UI/L	2 (14.3%)	4 (28.6%)	6 (21.4%)
Total	14 (100.0%)	14 (100.0%)	28 (100.0%)
GPT			
0 - 41 UI/L	13 (92.9%)	13 (92.9%)	26 (92.9%)
>41 UI/L	1 (7.1%)	1 (7.1%)	2 (7.1%)
Total	14 (100.0%)	14 (100.0%)	28 (100.0%)
HDL			
<30 mg/dL	1 (7.1%)	2 (14.3%)	3 (10.7%)
30 - 60 mg/dL	10 (71.4%)	11 (78.6%)	21 (75.0%)
>60 mg/Dl	3 (21.4%)	1 (7.1%)	4 (14.3%)
Total	14 (100.0%)	14 (100.0%)	28 (100.0%)
LDL			
<160 mg/dL	12 (85.7%)	13 (92.9%)	25 (89.3%)
>160 mg/dL	2 (14.3%)	1 (7.1%)	3 (10.7%)
Total	14 (100.0%)	14 (100.0%)	28 (100.0%)

Continued

TOTAL PROTEINS			
<6.6 g/dL	2 (14.3%)	1 (7.1%)	3 (10.7%)
6.6 - 8.2 g/dL	11 (78.6%)	13 (92.9%)	24 (85.7%)
>8.2 g/dL	1 (7.1%)	0 (0.0%)	1 (3.6%)
Total	14 (100.0%)	14 (100.0%)	28 (100.0%)

n = number, % = percentage.

3.5. Treatment Management

No HIV-negative partners were not on ART, and all HIV-positive partners received ART according to national program recommendations (TDF + 3TC + DTG). The chi-square test (<0.001) revealed that the TDF + 3TC + DTG regimen was highly associated with the patient's HIV status. A good number of patients or 28.6% started ART less than 1 year ago. The median duration of ART for HIV + patients was 3 years (Table 5).

3.6. Correlation Test

Strong correlations were observed between gender and age (R = −0.518; P = 0.005), previous ARV exposure and serostatus (R = −0.788; P = 0.000), number of children and desire to procreate (R = 0.510; P = 0.007), number of children and clinical stage (R = −0.721; P = 0.005), Hb level and anemia (R = 1.000; P = 0.000), and SGOT and SGPT (R = 0.531; P = 0.004) (Table 6).

There was a correlation between gender and height (R = −0.458; P = 0.016), gender and weight (R = −0.388; P = 0.042), gender and level of education (R = −0.456; P = 0.022), age and height (R = 0.478; P = 0.012), age and number of children (R = 0.432; P = 0.024), age and desire for childbearing (R = 0.382; P = 0.045), weight and height (R = 0.456; P = 0.017), weight and serostatus (R = −0.474; P = 0.011), height and previous ARV exposure (R = 0.382; P = 0.049), height and serostatus (R = −0.458; P = 0.011), province of origin and number of children (R = −0.461; P = 0.016), rational condom use and duration of treatment (R = 0.656; P = 0.011), GB and prior ARV exposure (R = −0.433; P = 0.021), HDL and height (R = 0.429; P = 0.026), HDL and rational condom use (R = 0.380; P = 0.046), CRP and SGOT (R = 0.382; P = 0.045) (Table 6).

4. Discussion

This study evaluated the sociodemographic, clinical, biochemical and therapeutic aspects of HIV serodiscordant couples in Kinshasa. Fourteen (14) couples out of 28 responded to inclusion at Monkole Medical Center.

4.1. Hospital Frequency of HIV Discordant Couples

In the present study, the frequency of serodiscordant couples was 5.8% of all couples followed for HIV at Monkole Medical Center during the study period, of

Table 5. Distribution of PLHIV by duration of ARV treatment.

Duration of ARV treatment	n	%
Médiane	3 (1 - 4) years	
<1 year	4	**28.6**
1 - 4 years	4	**28.6**
5 - 9 years	1	7.1
10 - 14 years	4	**28.6**
>14 years	1	7.1
Total	14	100.0

n = number, % = percentage.

Table 6. Correlation test.

	Sex	Age	Weight	Number of children	HIV status	Hb level	WBC	CRP	SGPT	HDL	Duration of treatment	Previous ARV exposure
Age	**(R = −0.518; P = 0.005)**	(R = 1)	(R = 0.327; P = 0.090)	**(R = 0.432; P = 0.024)**	(R = −0.141; P = 0.473)	(R = 0.223; P = 0.254)	(R = −0.140; P = 0.476)	(R = −0.234; P = 0.231)	(R = 0.118; P = 0.551)	(R = 0.078; P = 0.695)	(R = −0.096; P = 0.627)	(R = −0.030; P = 0.878)
Weight	**(R = −0.388; P = 0.042)**	(R = 0.327; P = 0.090)	(R = 1)	(R = 0.091; P = 0.653)	**(R = −0.474; P = 0.011)**	(R = 0.285; P = 0.141)	(R = 0.023; P = 0.907)	(R = −0.244; P = 0.211)	(R = −0.084; P = 0.672)	(R = 0.151; P = 0.443)	(R = 0.380; P = 0.180)	(R = 0.324; P = 0.093)
Height	**(R = −0.458; P = 0.016)**	**(R = 0.478; P = 0.012)**	**(R = 0.456; P = 0.017)**	(R = −0.030; P = 0.884)	**(R = −0.458; P = 0.011)**	(R = −0.047; P = 0.816)	(R = −0.212; P = 0.288)	(R = −0.212; P = 0.288)	(R = 0.059; P = 0.769)	**(R = 0.429; P = 0.026)**	(R = 0.553; P = 0.050)	**(R = 0.382; P = 0.049)**
Education	**(R = −0.456; P = 0.022)**	(R = 0.364; P = 0.074)	(R = 0.116; P = 0.581)	(R = −0.219; P = 0.303)	(R = −0.076; P = 0.718)	(R = 0.044; P = 0.834)	(R = 0.081; P = 0.699)	(R = −0.311; P = 0.130)	(R = −0.093; P = 0.658)	(R = −0.170; P = 0.415)	(R = 0.360; P = 0.227)	(R = 0.102; P = 0.628)
Province of origin	(R = −0.114; P = 0.565)	(R = −0.107; P = 0.588)	(R = 0.257; P = 0.187)	**(R = −0.461; P = 0.016)**	(R = 0.085; P = 0.667)	(R = 0.104; P = 0.599)	(R = 0.161; P = 0.414)	(R = −0.249; P = 0.201)	(R = −0.236; P = 0.226)	(R = 0.053; P = 0.789)	(R = 0.323; P = 0.261)	(R = −0.024; P = 0.902)

Continued

Desire for childbearing	(R = −0.093; P = 0.637)	**(R = 0.382; P = 0.045)**	(R = −0.028; P = 0.887)	**(R = 0.510; P = 0.007)**	(R = 0.093; P = 0.637)	(R = −0.218; P = 0.266)	(R = −0.278; P = 0.152)	(R = −0.162; P = 0.412)	(R = −0.129; P = 0.512)	(R = −0.033; P = 0.866)	(R = 0.296; P = 0.304)	(R = −0.060; P = 0.761)
Clinical stage	(R = 0.000; P = 1.000)	(R = −0.295; P = 0.306)	(R = −0.225; P = 0.439)	**(R = −0.721; P = 0.005)**	(R = .c; P = 0.000)	(R = 0.032; P = 0.913)	(R = −0.389; P = 0.169)	(R = 0.091; P = 0.756)	(R = 0.062; P = 0.833)	(R = −0.035; P = 0.906)	(R = −0.211; P = 0.468)	(R = 0.496; P = 0.071)
Anemia	(R = 0.063; P = 0.750)	(R = 0.223; P = 0.254)	(R = 0.285; P = 0.141)	(R = 0.266; P = 0.180)	(R = 0.189; P = 0.335)	**(R = 1.000; P < 0.001)**	(R = 0.294; P = 0.128)	(R = −0.080; P = 0.685)	(R = 0.018; P = 0.930)	(R = 0.068; P = 0.732)	(R = 0.055; P = 0.853)	(R = −0.258; P = 0.186)
SGOT	(R = 0.000; P = 1.000)	(R = −0.008; P = 0.967)	(R = −0.262; P = 0.177)	(R = −0.145; P = 0.471)	(R = 0.174; P = 0.376)	(R = −0.121; P = 0.540)	(R = −0.013; P = 0.946)	**(R = 0.382; P = 0.045)**	**(R = 0.531; P = 0.004)**	(R = −0.212; P = 0.279)	(R = 0.090; P = 0.761)	(R = −0.312; P = 0.106)
Previous ARV exposure	(R = 0.072; P = 0.717)	(R = −0.030; P = 0.878)	(R = 0.324; P = 0.093)	(R = −0.216; P = 0.279)	**(R = −0.788; P < 0.001)**	(R = −0.258; P = 0.186)	**(R = −0.433; P = 0.021)**	(R = −0.091; P = 0.645)	(R = −0.258; P = 0.185)	(R = 0.077; P = 0.697)	(R = −0.262; P = 0.365)	(R = 1)
Rational condom use	(R = 0.000; P = 1.000)	(R = −0.096; P = 0.627)	(R = 0.123; P = 0.533)	(R = −0.096; P = 0.635)	(R = 0.000; P = 1.000)	(R = 0.206; P = 0.293)	(R = 0.066; P = 0.823)	(R = −0.141; P = 0.473)	(R = −0.113; P = 0.566)	**(R = 0.380; P = 0.046)**	**(R = 0.656; P = 0.011)**	(R = 0.029; P = 0.883)

.c : Calcul impossible, car au moins une des variables est une constante.

which 2.9% consented to participate. This high frequency corroborates the 5.8% and 5.9% found in Kenya in 2007 [14] and Ethiopia in 2011 [15], respectively. This frequency, although significant, is also low compared to data that estimate a serodiscordance prevalence rate of 20% to 30% in sub-Saharan African countries [16].

In Africa, the recorded frequency of HIV serodiscordance is highly variable. In Central Africa, it was estimated at 5% in the Republic of Congo [17]; in East Africa it was 8.4% in Ethiopia [18], 12% in Rwanda [19], 14% in Tanzania and 13.6 in Kenya [20]; in West Africa it was estimated at 21.6% in Togo [21] and

20% in Burkina Faso [22]; in Southern Africa it was 27% in South Africa, 14.2% and 20.1% in Zambia and Botswana respectively [20]. These divergent results could be attributed to the difficulties in the sub-region, the permeability of borders, socio-economic problems, level of knowledge or education, but also to the lack of acceptance of one's HIV status and stigmatization.

4.2. Socio-Demographic Characteristics

In the present study, there was a gender balance in relation to sero-discordance, *i.e.* 50% men and women. This result is similar to those found in some studies [3] [17]. Women fear being infected by their spouse/regular partner, while men fear HIV infection by external partners [23]. Regarding HIV infection in couples, some studies have shown a female predominance [3] [16] [18] [22]. Indeed, women have a higher risk of contracting HIV infection than men [24], particularly in regular couples, probably because of their greater biological sensitivity and the infidelity of men [13]. Other studies have shown a male predominance [16] [25]. In the present study the Chi-square test did not show an association between gender and serostatus. One explanation for the discordance may be that partners may not have been primarily susceptible to HIV [19]. Indeed, with respect to the risk of HIV transmission during heterosexual sex, the infectiousness of the infected partner and the susceptibility of the uninfected partner are critical [26]. This demonstrates the existence of some innate factors of HIV resistance.

The mean age of all patients was 43.39 ± 10 years with the extremes ranging from 24 to 62 years. The mean age of the HBV + patients was 42.64 ± 10 years with the extremes ranging from 24 to 62 years; and 44.14 ± 10 years in HBV- with the extremes ranging from 32 to 60 years. The age group 36 - 45 years was the most affected by HIV with 71.4%, and the age group over 45 years was the most representative of HIV-negative persons with 50.0%. The Chi-square test (0.043) showed that age was associated with HIV status. The mean age of women was 39.71 ± 10 years with extremes ranging from 24 to 51 years; and the mean age of men was 47.07 ± 10 years with extremes ranging from 37 to 62 years. These results are thought to be related to the vulnerability of the younger, more sexually active population to HIV [27].

4.3. Clinical Characteristics

The majority of patients, 46.4% and 28.6%, weighed between 61 and 71 Kg and 72 to 82 Kg respectively. A good number of HIV-positive partners (57.1%) weighed between 61 and 71 Kg; while HIV-negative partners (42.9%) weighed between 72 and 82 Kg. Only the HIV-negative partners, *i.e.* 7.1% of all couples, weighed more than 83 kg. These results are interesting because the Pearson correlation test showed a significant negative association between weight and serostatus ($R = -0.474$; $P = 0.011$) (**Table 6**), and 4/5 of those who weighed more than 71 kg were seronegative.

All serodiscordant couples had regular sex per month for the past 12 months, the vast majority of whom (85.7%) did not use condoms, although the vast majority of HIV-negative partners of HIV discordant couples (85.7%) were not on ARV prophylaxis (pre- or post-exposure). These results show that the majority of patients had frequent unprotected sex, probably because of a desire to procreate, as 82.1% had a desire to procreate. A very strong positive correlation was observed between the number of children and the desire to procreate ($R = 0.510$; $P = 0.007$) (**Table 6**).

ART was previously administered in 92.9% of PLWH; and one of the serodiscordant couples was not exposed to ART. We found a highly significant association (Chi-square < 0.001) and a strong negatively significant correlation ($R = -0.788$; $P < 0.001$) between prior ARV exposure and HIV status (**Table 6**). Although we did not take into account the duration of the relationship, these results seem promising in suggesting that there may be some innate factors that have favored the maintenance of this discordance in couples.

A review of published studies of discordant couples in sub-Saharan African countries, which was undertaken to determine factors that may explain the high rates of HIV discordance and why some individuals remain uninfected despite repeated exposure to HIV, identified a number of correlates of transmission, including condom use [28], however, rational condom use was not the case among couples in our study; this lends support to the idea of innate HIV resistance. In our study, the majority of PLHIV were at WHO stage 2, or 57.1%. Like us, Ermias Habte et al, found that WHO clinical stage, and immunological factors such as CD4 count had no relationship with serodiscordance, and thought that this result made the question of discordance more difficult and suggested the need for more studies in this area of interest [18]. Indeed, discordant couples who have received Voluntary Counseling and Testing and other interventions have lower rates of seroconversion; however, the incidence among these couples remains high, ranging from 3% to 8% per year [29].

4.4. Biochemical Parameters

Chi-square and Pearson correlation tests showed no relationship between biochemical parameters and HIV serostatus of discordant couples. This could be due to the small size of our sample.

During this study, the following were considered Hb values for men and women: normal from >10 to 13 g/dL anemia at ≤10 g/dL, moderate anemia from <10 to 7 g/dL, and severe anemia < 7 g/dL. Poor socioeconomic conditions, poor food quality, undernutrition, and inadequate nutrient intake may account for these low hemoglobin levels in Kinshasa.

According to WHO, anemia is defined in men as Hb < 13 g/dL and Hb < 12 g/dL in non-pregnant women, at sea level; and mild anemia in men at 11.0 - 12.9 g/dL, and in women at 11.0 - 11.9 g/dL, in men and women, moderate anemia at 8.0 - 10.9 g/dL and severe anemia at <8.0 g/dL [30] [31] [32].

Gender, age, race, pregnancy, and altitude are the factors causing variation in Hb level. A moderate decrease in hemoglobin, clinically and hematologically isolated (no change in erythrocyte constants or reticulocyte count and no abnormalities in other lineages), exists in black patients. It is well established that mean hemoglobin levels are 0.8 to 1 g/dL lower in black patients, and the adoption of the same thresholds used in Caucasian patients for the diagnosis of anemia leads to overdiagnosis [30].

42.9% of HIV-negative partners compared to 21% of HIV-positive partners had leukopenia. This leukopenia in HIV-negative partners is thought to be due to increased exposure to the virus by HIV-positive partners and as a defense mechanism. Indeed, some studies have suggested a potentially protective role for Th1-type cytokines, associated with the development of a T-cell immune response against HIV-1 [33]; others, on the contrary, carried out on populations with a high prevalence of helminthic infections, which present a Th2-type immune activation, have suggested that this activation is a factor favoring the transmission of HIV-1 and the rapid evolution to AIDS in Africa [34]. The study by Jennes WIM *et al.* published in 2003, analyzing a number of immunological parameters in a population of exposed and uninfected female sex workers (ESN) in Abidjan, Côte d'Ivoire, in comparison with HIV-negative female voluntary blood donors, in order to identify markers of HIV protection, found significantly decreased levels of CXCR4 expression and significantly increased levels of CD8 + T-cell activation in the ESN [35]. Similarly a decrease in CXCR4 was correlated with a decrease in the proportion of naive lymphocytes, which preferentially express CXCR4 in Vietnamese ESN drug users [36]. An increased proportion of CD8 T cells, including memory subpopulations and subpopulations expressing activation markers, in ESN has been documented by various studies [37] [38]. These data show that coordinated production and secretion of immune cells and factors is required to control HIV viral replication. We believe that the high number of HIV + partners (78.6% of cases) with normal WBC levels is due to the use of ARVs and other treatments.

We found a significantly negative correlation between WBC count and prior ARV exposure ($R = -0.433$; $P = 0.021$) (**Table 6**). Although ARVs are very effective when properly followed: decrease in viral load, increase in TCD4 lymphocytes in the first 6 months, HIV is still present in the body (memory TCD4 lymphocytes and infected macrophages, sperm) as reservoirs harboring HIV-1 proviruses that are totally transcriptionally inactive, but capable of low-level replication [39]-[44]; ARVs cannot reach these already constituted reservoirs [43] [44]. This may be evidenced by the fact that all partners (HIV positive and negative) in the present study had a predominantly lymphocytic White Blood Cells differential, supporting the role of the lymphocyte cellular immune response during HIV infection (contamination).

Overall, 89.3% of partners had normal CRP; and a significant proportion of HIV-positive partners (14.3%) had increased CRP, probably due to opportunistic infections.

The majority of patients, 85.7%, had normal total protein levels; and a significant proportion of HIV-negative partners, 14.3%, had low total protein levels compared with 7.1% of HIV-positive partners; in addition, 7.1% of HIV-negative partners had high total protein levels. The normal protein level in PLHIV would be due to adherence to ARV treatment.

We found that 78.6% of the partners had a normal SGOT level; and a significant proportion of the HIV-positive partners, 28.6%, had an elevated SGOT level. The majority of patients (92.9%) had a normal SGPT level. In fact, the action of ARVs allows the liver to fully carry out its metabolic activity [45].

We noted a significant proportion of HIV-negative partners (21.4%) who had an HDL level above normal, and 14.3% of HIV-positive partners had a low HDL level. We also observed a significant proportion of HIV-negative partners (14.3%) with high LDL. These facts are very interesting as LDL and HDL are made up of Apo lipoproteins (Apo) which also have a role in metabolic regulation (activator/inhibitor of plasma enzymes or membrane receptor ligands) [46]. Particularly truncated Apo lipoprotein B (apoB-48), present on the surface of LDL [46], whose Apo lipoprotein B catalytic polypeptide-like mRNA editing enzymes 3 (APOBEC3) have been shown to be potent inhibitors of HIV-1 infection [47] [48]. The low HDL level in some PLWH may be explained by the fact that ARV treatment, especially with PIs (protease inhibitors), and the chronicity of the disease (HIV) itself may be responsible for the frequent occurrence of dyslipidemia, which is sometimes severe [49].

4.5. Treatment Management

During the follow-up of couples at Monkole Medical Center, not all HIV-negative partners were on ARV prophylaxis, and all HIV-positive partners received triple therapy (TDF + 3TC + DTG), of which a good number of patients (28.6%) started ART less than 1 year ago, between 1 and 4 years ago and between 10 and 14 years ago respectively, for a median duration of ART for HIV-positive patients of 3 years. The chi-square test (<0.001) revealed that the TDF + 3TC + DTG treatment regimen was highly associated with the patient's HIV status; also a positive correlation was found between rational use of condoms and duration of treatment (R = 0.656; P = 0.011) (**Table 6**). We noted 57.1% of PLWH in WHO stage 2 and a significant proportion in stage 3. Indeed, infectiousness and the risk of sexual transmission of HIV must be understood in a broader context of behavioral problems [50] [51] and vulnerability since several psychosocial factors interfere with adherence to ART and its effectiveness [52] [53].

5. Study Limitation

Due to the rare nature of the study, it was difficult to enroll a large number of couples. The exclusion of people with multiple sexual partners had an influence on obtaining a sufficient number of couples. Therefore, the small sample size is a limitation for this study, not allowing conclusions to be drawn about the general

population.

In addition, cross-sectional studies do not allow for determination of the sequence of cause and effect, which complicates interpretation of associations. Because of the cross-sectional design, some factors associated with HIV acquisition (correct knowledge of status, evolution of viral load, etc.) or some data (duration of relationship in the couple, adherence to treatment, etc.) could not be included.

6. Conclusions

The frequency of HIV discordant couples is significant. Serodiscordance is found in young, intellectual, entrepreneurial couples with a desire to procreate.

Referring to the identified risky sexual behavior, as well as the low frequency of HIV discordant couples compared to HIV concordant couples in the present study, the prevention of sexual transmission of HIV in serodiscordant couples is a major challenge. Our analyses demonstrate the need for specific patient follow-up and adjustment of communication strategies, ideally in a couple counseling setting. Also, large-scale studies on biochemical parameters, in particular LDL and HDL levels, in discordant couples are important to better understand the issue of HIV discordance.

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Conflicts of Interest

The authors declare no conflicts of interest in this study.

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List of Abbreviations and Acronyms

ALAT: Alanine Aminotransferase,
ARV: Antirétrovirals,
ASAT: Aspartate Aminotransferase,
BMI: Body Mass Index,
CHME: Centre Hospitalier Mère et Enfant (Mother and Child Hospital),
CRP: C-Reactive Protein,
DRC: Democratic Republic of Congo,
ESN: Exposed Seronegative,
Hb: Hemoglobin,
HDL: High-Density Lipoprotein,
HIV: Human Immunodeficiency Virus,
LDL: Low-Density Lipoprotein,
PLHIV: People Living with Human Immunodeficiency Virus,
UNIKIN: University of Kinshasa,
WBC: White Blood Cells,
WBC differential: White Blood Cell differential,
WHO: World Health Organization