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Epidemiology and impact of HIV-HBV co-infection on haemato-biochemical parameters in patients at the Matam Community Medical Centre (City of Conakry)

Taliby Dos Camara[1+]
Abdoulaye Makanera[2]
Mariam Bailo Sy[1,3]
Fatimatou Diallo[1,3]

[1]*Laboratoiry of Biology, Biology Department, Faculty of Sciences, Gamal Abdel Nasser University, Conakry, Republic of Guinea.*
[1]*Email: talibycamara@gmail.com*
[2]*Laboratory of the Faculty of Health Sciences and Techniques, Gamal Abdel Nasser University, Conakry, Republic of Guinea.*
[2]*Email: abdmak@yahoo.fr*
[3]*Biomedical Analysis Laboratory Matam CMC, Republic of Guinea.*
[1,3]*Email: mariameahmadsy@gmail.com*
[1,3]*Email: Fatimatoudiallo199@gmail.com*


(+ Corresponding author)

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ABSTRACT

The human immunodeficiency virus (HIV) and hepatitis B virus (HBV) co-infection is a major public health problem wordlwide. The aim was to determine the impact of HIV/HBV co-infection on haemato-biochemical parameters in 400 patients, from July 1st to October 30th, 2022 at the Matam Medical communical center (MMC), in Conakry. The results showed that positivity was 12.5% for HIV, 12% for HBV and 4% for HIV/HBV coinfection. For hematological parameters, 81% (13/16) of HIV/HBV coinfected patients had low hemoglobin levels, with frustrated anaemia (54%), moderate anaemia (15%), severe anaemia (31%), microcytic anaemia (23%), normocytic anaemia (77%), hypochromic anaemia ‘8%), normochromic anaemia (92%), hyponeutrophilia (31%), red blood cell (19%). With monocyte values, 31% had hyperlymphocytosis, 19% had hypermonocytosis and 12% had hypereosinophilia. For biochemical parameters, 69% and 56% of coinfected patients had abnormal increased values of Alanine Aminotransferse (ALT) levels, Aspartate Aminotransferase (AST) levels. In relation to the epidemiological variables, Female was the most represented with 56%, all age groups are almost affected with the majority between 21-40 years, 56% followed by 41-60 years with 25% and ≤ 20 years with 19%. Married people are more represented by infections with 56% followed by Singles with 31% and Widows 13%. Almost all socio-professional categories are affected by infections with a high seroprevalence among Housewives, Commercial Agents and Workers with 25%, followed by Pupils/Students with 19% and Administrative Agents with 6%. These results showed that HIV/HBV co-infection had negative impact on hemato-biomedical parameters of the majority of patients in the present studies.

Contribution/Originality: The aim of this study was to determine the prevalence of HIV-HBV co-infection, the epidemiology of this co-infection and the organ damage, in particular haematological and biochemical parameters, in the study populations.

1. INTRODUCTION

The human immunodeficiency virus (HIV) is a retrovirus that infects humans and causes acquired immunodeficiency syndrome (AIDS), a weakened immune system that makes people vulnerable to a wide range of opportunistic infections such as tuberculosis, dermatosis, Kaposi's sarcoma and oral and anal candidiasis. HIV infection has become a major factor in morbidity and mortality in many countries [1]. Hepatitis B virus is one of

the major causes of viral hepatitis, and it can lead to acute or chronic illness [2]. HIV/HBV co-infection is a major public health problem in the world, particularly in Sub-Saharan Africa. Indeed, the prevalence of HIV/HBV co-infection is particularly high in Africa, varying between 8-15% [3]. In 2013, viral hepatitis was the seventh leading cause of death in the world. Viral hepatitis is also an increasingly important cause of death among people living with HIV. The frequency of HIV/HBV co-infection has been estimated at 21.5% in all in Mali, and 11.2% in Benin. In sub-Saharan Africa, transmission occurs during the perinatal period, in the first 5 weeks of life, through mother-to-child transmission or close family contact, as well as parenteral (including ritual scarification and tattooing) and sexual transmission [4]. Hepatotropic viruses share the same routes of transmission as HIV, hence the high frequency of co-infection with hepatitis B virus or hepatitis C virus in HIV-infected patients [5]. Anaemia remains one of the most frequent haematological complications of HIV, and its prevalence is clearly increasing in HIV-infected patients; the incidence of anaemia increases with the worsening of the immune deficiency. Anemia is usually normochromic-normocytic (61%), microcytic (31%) or macrocytic (6%) [6]. The aim of this studies was to determine the impact of HIV-HBV co-infection on haematological parameters in patients in the City of Conakry in order to improve their management and reduce their spread.

2. WORKING METHODS

This was a prospective, descriptive, cross-sectional study lasting four (4) months, from 1 July to 30 October 2022. Our survey covered all patients of both sexes and of all ages seen at the Matam Community Medical Centre during our study period. Sampling was simple random and the sample size (n=400) was obtained using the Schwartz formula. All patients seen at the laboratory for whom HIV, Hepatitis B virus antigen (HBsAg) and blood count tests were requested and who agreed to undergo the survey were included in our study. The HIV-1/2 determinate test, the bioline visual test for the detection of HIV infection, the Abbot Determine Hepatitis B surface antigen (HBsAg) test for hepatitis B, GeneXpert HIV-1 Viral Loa, Xpert HIV-1 viral load (HIV-1 VL), Sysmex xp-300 and Becton Dickinson flow cytometry system (BD FACS) Presto Near-patient CD4 counter, were used to analyse blood samples in our study.

Bio-material: Patient blood.

Study variables: The variables under study are :

Biological variables: SRV, HBsAg, viral load, CD4 co,TB, GMV, HDAC and CBC.

Epidemiological variables: Sex, Age, Marital status, Occupation and Residence.

Data collection and analysis: Our data were collected using registers, health diaries and examination bulletins, and were entered, processed and analysed using SPPS version 2021, Microsoft Word and Excel 2016 under Windows.

3. RESULTS

The application of the research methodology led to results in the form of tables, which were interpreted, commented on and discussed according to the available literature.

Table 1. Prevalence of HIV in patients seen at the laboratory.

N°	HIV serology	Number	Percentage
1	Positive	49	12.25
2	Negative	351	87.75
Total		400	100

Analysis of this Table 1 shows that of the 400 patients seen in the laboratory, 49 are carriers of HIV/AIDS, i.e. 12.25%, compared with 351 who are HIV-negative, i.e. 87.75%.

This prevalence remains very high compared with the national prevalence of 1.7%, perhaps due to the neglect of protective measures against this pandemic, which has been going on for 39 years since the identification of its causal virus, HIV.

Table 2. Prevalence of hepatitis B in patients seen at the laboratory.

No	HBs antigen	Number	Percentage
1	Positive	48	12
2	Negative	352	88
Total		400	100

In this Table 2 we note that out of the 400 patients received at the laboratory, 48 patients are HBs antigen carriers, i.e. 12%, compared with 352 serology-negative patients, i.e. 88%.

Table 3. Overall prevalence of HIV-HBV co-infection among patients.

No	Serology of HIV-HBV	Number	Percentage
1	Positive	16	4
2	Negative	384	96
Total		400	100

Analysis of this Table 3 shows that of the 400 patients received at the laboratory for testing for HIV and HBV co-infection, 16 patients (4%), were co-infected, compared with 384 patients (96%), in whom no co-infection was detected.

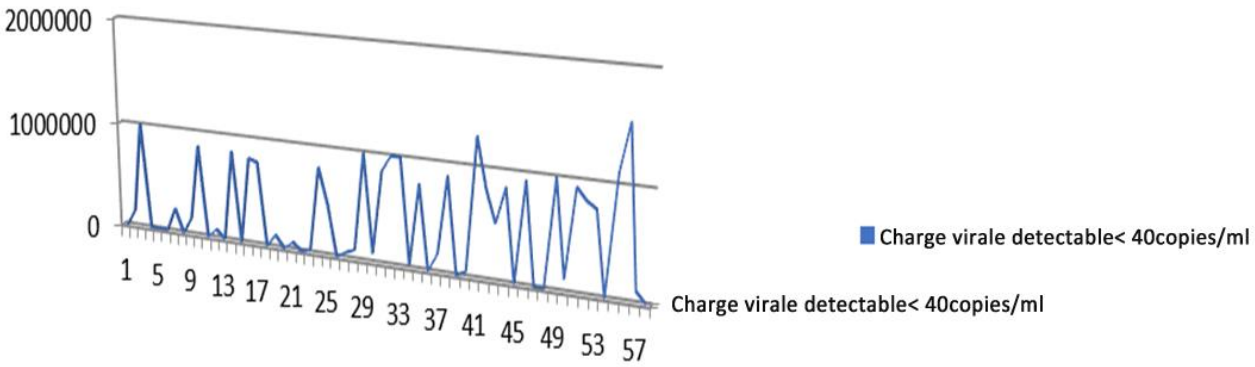

Figure 1. Determination of HIV/AIDS viral load and CD4 count in HIV-HBV co-infected patients.

This Figure 1 shows the variation in viral load in the 49 patients who tested positive for HIV. 70% of patients had a detectable viral load (CV≤40 copies /ml) with an average of (59277copies /ml) compared with 30% of patients with an undetectable viral load.

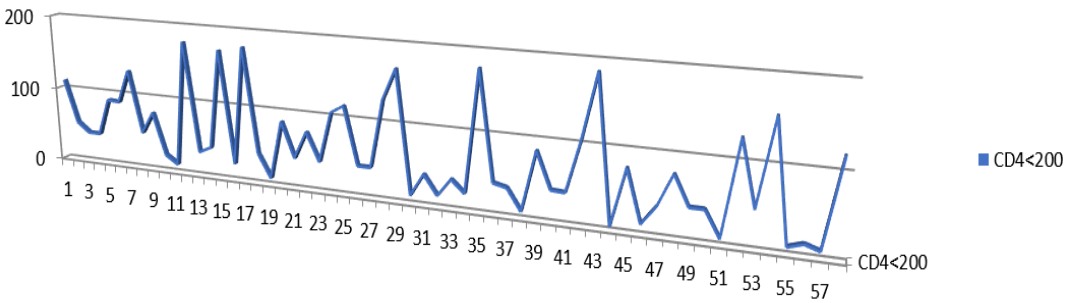

Figure 2. Distribution of HIV-HBV co-infected patients according to LTCD4+ rate.

This Figure 2 shows that immunosuppression was advanced overall, with the majority of patients in our study having an CD4+ T Lymphocyte (LTCD4+) level of less than 200 cells/µl. The mean LTCD4+ level was 124.52 cells/µl, with extremes ranging from 5 to 349 cells/µl. Patients with a mean LTCD4+ level ≥ 200 cells/µl represented 72% of cases (n=49).

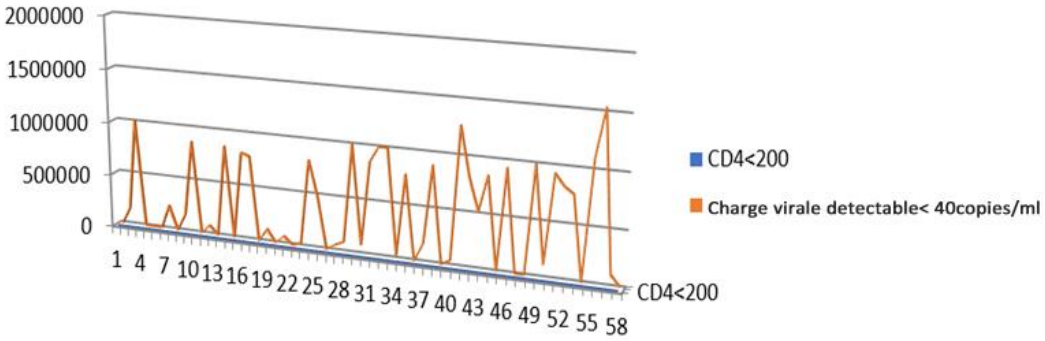

Figure 3. Variation in CD4 count and viral load in patients co-infected with HBV-HIV.

This Figure 3 shows the relationship between CD4 T lymphocyte load and viral load studied using correlation tests. These tests were applied after selecting patients who had both CD4 T lymphocyte load and viral load results under antiretroviral treatment. At the end of the study, it was found that when the CD4 T lymphocyte load increases, the viral load decreases (becomes undetectable), and when the CD4 T lymphocyte load decreases, the viral load increases (becomes detectable).

Table 4. Pathophysiological variations in hemoglobin levels in patients with HIV-HBV co-infection.

Total		Values					
		Low		Normal		High	
Number	%	Number	%	Number	%	Number	%
16	100	13	81%	3	19%	-	-

Analysis of this Table 4 shows that of the 16 HIV-HBV co-infected patients, 13 (81%) had haemoglobin levels below 12 g/dl (A sign of anaemia) and 3 (19%) had normal hemoglobin level (HBL).

Table 5. Typology of anaemia in HIV-HBV co-infected patients with anaemia.

Total		Values					
		Frustre		Moderate		Severe	
Number	%	Number	%	Number	%	Number	%
13	100	7	54%	2	15%	4	31

This Table 5 shows that of the 16 HIV-HBV co-infected patients, 13 had low haemoglobin levels, with the following anaemia typology: 7 patients had a HBL between 10-11 g/dl (sign of frustrated anaemia), i.e. 54%, 2 patients had a HBL between 8-9 g/dl (sign of moderate anaemia), i.e. 15%, and 4 patients had a HBL of ≤ 7 g/dl (sign of severe anaemia), i.e. 31%.

This high frequency of anaemia not only justifies the poor diet of these patients but also the presence of other infections. However, management of severe anaemia requires blood transfusion, increased monitoring and a good, rich, balanced diet.

Table 6. Pathophysiological variations in Mean corpuscular volume in anaemic patients with HIV-HBV co-infection.

Total		Values					
		Microcytic		Normocytic		Macrocytic	
Number	%	Number	%	Number	%	Number	%
13	100	3	23	10	77	-	-

Analysis of this Table 6 shows that of the 13 HIV-HBV co-infected patients with anaemia, 3 patients (23%) had microcytic anaemia and 10 patients (77%) had normocytic anaemia. The reduction of Mean corpuscular volume (MCV) consequently leads to microcytic anaemia due to a deficit in iron intake. This would explain the fall in haemoglobin levels.

Table 7. Pathophysiological variation of mean corpuscular concentration of red blood cells in anaemic patients with HIV-HBV co-infection.

Total		Values					
		Hypochromic		Normochromic		Hyperchromic	
Number	%	Number	%	Number	%	Number	%
13	100	1	8	12	92	-	-

In this Table 7 we see that of the 13 patients co-infected with HIV and HBV, 1 patient (8%) suffers from hypochromic anaemia and 12 patients (92%) suffer from normochromic anaemia. When the mean corpuscular hemoglobin cencentration (MCHC) is normochromic, this means that the red blood cells are of normal size and bright red in colour.

Table 8. Pathophysiological variation in leukocyte values in patients with HIV-HBV co-infection.

Total		Values					
		Low		Normal		High	
Number	%	Number	%	Number	%	Number	%
16	100	3	19%	12	75%	1	6%

Analysis of this Table 8 shows that of the 16 patients co-infected with HIV and HBV, 3 patients had low white blood cells (WBC) values, i.e. 19%, 12 patients had normal values, i.e. 75%, and 1 patient had high values, i.e. 6%. This increase in leucocyte content indicates the existence of an infection.

Table 9. Pathophysiological variation in neutrophil values in patients with HIV-HBV co-infection.

Total		Values					
		Low		Normal		High	
Number	%	Number	%	Number	%	Number	%
16	100	5	31%	10	63%	1	6%

Analysis of this Table 9 shows that of the 16 patients co-infected with HIV and HBV, 5 patients had low neutrophil values, i.e. 31%, 10 patients had normal values, i.e. 63%, and 1 patient had high values, i.e. 6%.

Table 10. Pathophysiological variation in eosinophil values in patients with HIV-HBV co-infection.

Total		Values					
		Low		Normal		High	
Number	%	Number	%	Number	%	Number	%
16	100	_	_	14	88%	2	12%

Analysis of this Table 10 shows that in the 16 HIV-HBV co-infected patients, 14 patients had normal eosinophil values, i.e. 88%, and 2 patients had elevated values, i.e. 12%.

Table 11. Pathophysiological variation in Basophil values in patients with HIV-HBV co-infection.

Total		Values					
		Low		Normal		High	
Number	%	Number	%	Number	%	Number	%
16	100	-	-	16	100%	-	-

Analysis of this Table 11 shows that all 16 HIV-HBV co-infected patients had normal Basophil values, i.e. 100%.

Table 12. Pathophysiological variation in lymphocyte values in patients with HIV-HBV co-infection.

Total		Values					
		Low		Normal		High	
Number	%	Number	%	Number	%	Number	%
16	100	-	-	11	69%	5	31%

Analysis of this Table 12 shows that in the 16 HIV-HBV co-infected patients, 11 patients had normal lymphocyte values, i.e. 69%, and 5 patients had high lymphocyte values, i.e. 31%.

Table 13. Pathophysiological variation in monocyte values in patients with HIV-HBV co-infection.

Total		Values					
		Low		Normal		High	
Number	%	Number	%	Number	%	Number	%
16	100	3	19%	10	62%	3	19%

Analysis of this Table 13 shows that of the 16 HIV-HBV co-infected patients, 3 patients had low monocyte values, i.e. 19%, 10 patients had normal values, i.e. 62%, and 3 had high values, i.e. 19%.

Table 14. Pathophysiological variation in Alanine aminotransferase in patients with HIV-HBV co-infection.

Total		Values					
		Low		Normal		High	
Number	%	Number	%	Number	%	Number	%
16	100	-	-	5	31	11	69

This Table 14 shows that of the 16 patients with HIV-HBV co-infection, there is a variation in transaminase levels: 11 patients have an increase in Alanine aminotransferase (ALT) levels, i.e. 69%, compared with 5 patients who have normal ALT levels, i.e. 31%.

In patients with HIV-HBV co-infection, transaminase results clearly show that infection with the hepatitis B virus leads to significant liver damage, characterised by elevated ALT levels in the blood.

Table 15. Pathophysiological variation in Aspartate aminotransferase in patients with HIV-HBV co-infection.

Total		Values					
		Low		Normal		High	
Number	%	Number	%	Number	%	Number	%
16	100	-	-	7	44	9	56

This Table 15 shows that of the 16 patients with HIV-HBV co-infection, 9 patients had increased Aspartate aminotransferase (ASAT) levels, i.e. 56%, compared with 7 patients who had normal ASAT levels, i.e. 44%.

In patients with HIV-HBV co-infection, the transaminase results clearly show that infections due to the hepatitis B virus cause disorders of biochemical parameters due to HBV.

This Figure 4 shows that of the 16 patients co-infected with HIV and HBV, females were the most represented in this series with 9 cases, representing a seroprevalence of 56%, compared with 7 cases of males, representing 44%. This female predominance could be explained by anatomical and physiological vulnerability: mucosal areas exposed during sexual intercourse are more extensive in women than in men.

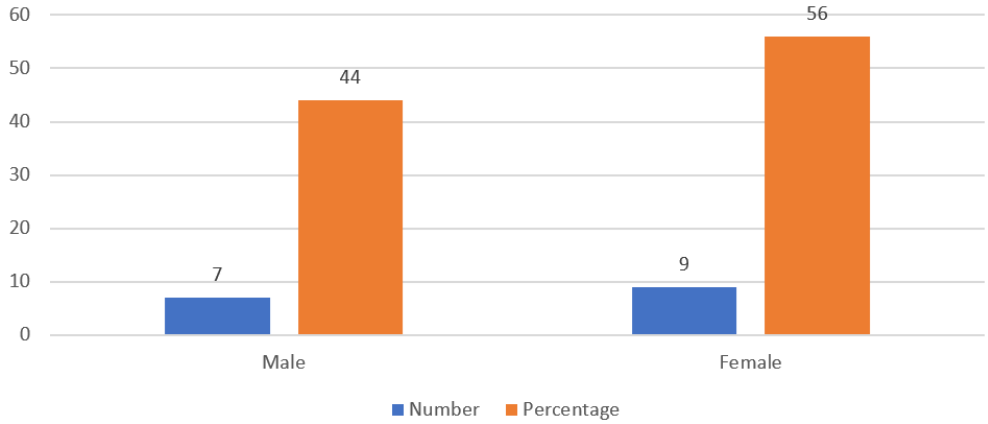

Figure 4. Breakdown of HIV-HBV co-infected patients by sex.

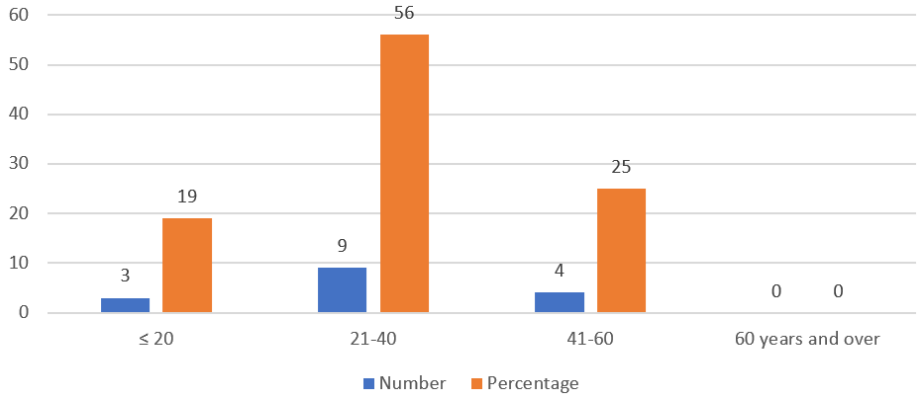

Figure 5. Breakdown of HIV-HBV co-infected patients by age group.

Analysis of this Figure 5 shows that of the 16 patients co-infected with HIV and HBV, almost all age groups are affected. However, the 21-40 age group is the most represented with 9 cases, i.e. 56%, followed by the 41-60 age group with 4 cases, i.e. 25%, and the ≤ 20 age group with 3 cases, i.e. 19%. The 60+ age group was not represented in this series. The high seroprevalence of HIV-HBV co-infection in the 21-40 age group could be explained by high levels of sexual activity, lack of use of protective measures and ignorance of the modes of HBV infection.

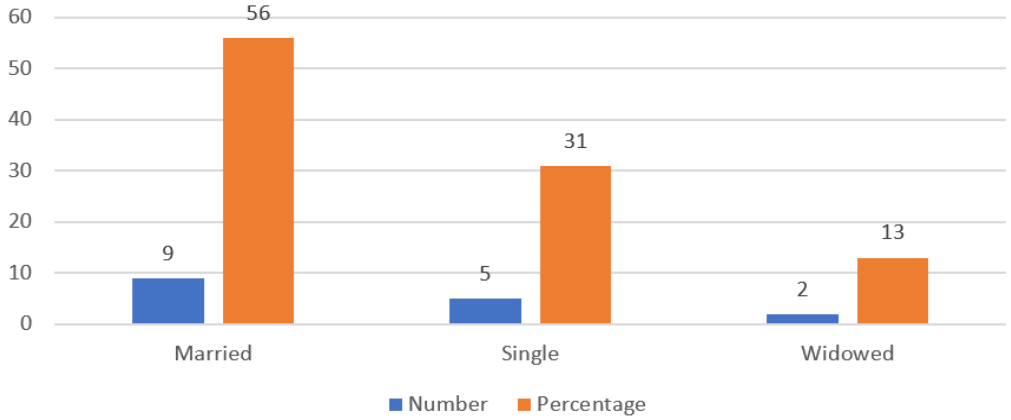

Figure 6. Breakdown of HIV-HBV co-infected patients by marital status.

The Figure 6 shows that, of the 16 patients co-infected with HIV and HBV, married people are more likely to be infected, with 9 cases (56%), followed by single people, with 5 cases (31%), and widows, with 2 cases (13%).

The high prevalence in the married population reflects the predominance of heterosexual transmission of HIV, which is the most common mode of transmission in sub-Saharan Africa, and the lack of responsibility (multiple partners through polygamy).

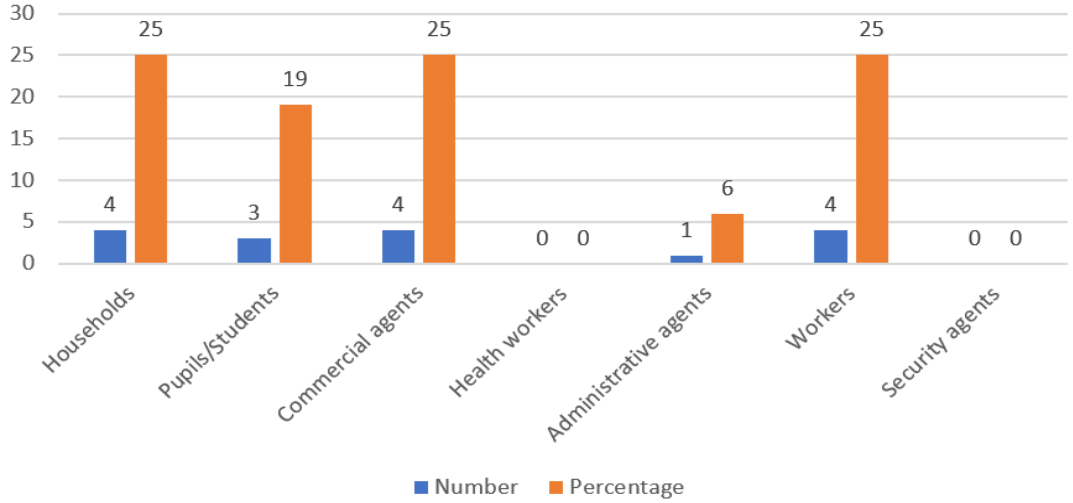

Figure 7. Breakdown of HIV-HBV co-infected patients by socio-professional category.

This Figure 7 shows that of the 16 patients co-infected with HIV and HBV, almost all socio-professional categories are affected by the infections, with a high seroprevalence among Housewives, Shopkeepers and Workers with 4 cases each, i.e. 25%, followed by Pupils/Students with 3 cases, i.e. 19% and Administrative Officers with 1 case, i.e. 6%. No co-infection was recorded among health and security workers in this study.

The predominance of co-infection among housewives, shop assistants and workers could be explained by their low level of education, lack of knowledge about modes of transmission and polygamy.

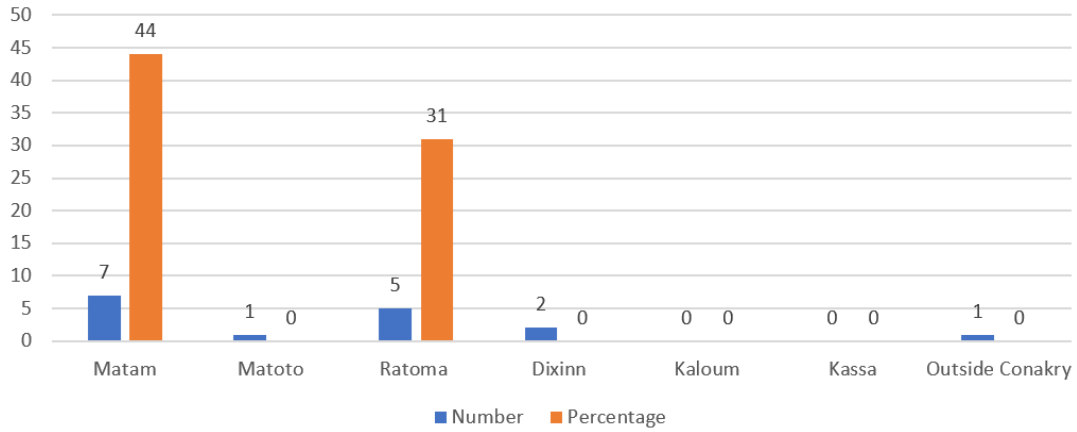

Figure 8. Breakdown of patients living with HIV by residence.

The Figure 8 shows that of the 16 HIV-HBV co-infected patients, Matam commune is the most represented with 7 cases, i.e. 44%, followed by Ratoma commune with 5 cases, i.e. 31%, and Dixinn commune with 2 cases, i.e. 12.5%. Patients co-infected with HIV and HBV from Matoto Commune and outside Conakry were the least represented in this series, with 1 case each, i.e. 6.25%.

The high prevalence in Matam Commune can be explained by the fact that it has a centre for the care of people living with HIV and is home to the health facility.

4. DISCUSSION OF RESULTS

This study made it possible to estimate the prevalence of HIV-HBV co-infection at the Matam Communal Medical Center (CMC), i.e. 4%, in 400 patients received at the laboratory. With regard to haematological parameters, 81% of patients had a low haemoglobin level, with 54% having frustrated anaemia, 15% moderate anaemia, 31% severe anaemia, 23% microcytic anaemia, 77% normocytic anaemia, 8% had hypochromic anaemia, 92% had normochromic anaemia, 31% had hyponeutrophilia, 19% had low red blood cell and monocyte counts, 31% had hyperlymphocytosis, 19% had hypermonocytosis and 12% had hypereosinophilia. In relation to the epidemiological variables, females were the most represented at 56%, with almost all age groups affected, with the majority aged between 21 and 40 years (56%), followed by 41 to 60 years (25%) and ≤ 20 years (19%). Married people are more represented by infections with 56% followed by Singles with 31% and Widowers with 13%. Almost all socio-professional categories are affected by infections, with a high seroprevalence among Housewives, Commercial workers and Manual workers (25%), followed by Pupils/Students (19%) and Administrative workers (6%).

This prevalence is lower than those reported by certain authors: Ba, et al. [7] in a study carried out in Dakar, reported a prevalence of HIV-HBV co-infection of 16.98% [6]. A study conducted at the University National Hospital Center by Hazoume [8] in Benin, reported a hospital prevalence of HBsAg carriage of 11.21% among people living with HIV (PLHIV) [9]. A predominance of women was observed, which is consistent with the feminisation of HIV infection in sub-Saharan Africa [10] but more pronounced than the prevalence estimates for the general population in Benin in 2012, which were 1.4% for women and 1.0% for men [11]. There is therefore an over-representation of women in the sample, which may be due to better access to healthcare or greater demand for healthcare among women. This is in line with trends previously observed in the same department for various pathologies [8, 12]. The subjects were mainly young (87% under 45), with an average age of 35.68 and extremes of 16 and 71. This distribution is comparable to the epidemiology of HIV in Benin and throughout Africa south of the Sahara [13-16] where the epidemic affects the productive force. People from Borgou/Alibori were the most represented, followed by Zou/Collines and Atacora/Donga, which border Borgou. This can be explained by the proximity and age-old ties between the peoples of these 3 departments, whose nationals are the most numerous in Parakou. As HIV infection is a long-term condition, the general tendency is to seek treatment in one's usual living environment, whereas an acute condition may require an emergency consultation, even away from home. In general, risky behaviour persists among this population of HIV-positive people, because although the majority live in couples, some are in polygamous households with no knowledge of their partner's status, and no sharing of positive results. It is therefore necessary to strengthen the integration of prevention programmes within care services for people with HIV, in order to reduce the risks of transmission of HIV Sexually Transmitted infections (STIs) to their partners on the one hand, and to reduce the risks of HIV superinfection and co-infection with other STIs for people with HIV themselves on the other. HBsAg carriage in the study population was 16.9%. HBV infection was diagnosed by testing for HBsAg. This method carries a risk of minimising prevalence because of occult hepatitis B, which is estimated to be 5% prevalent in PHAs [17].

However, although probably underestimated, the prevalence observed remains high and confirms the geographical distribution of HBV endemicity, according to which the prevalence of HBV is 8% in the Sub-Saharan region [18]. It is comparable to the prevalence found by Sehonou, et al. [16] and Diop-Ndiaye, et al. [15] in Cotonou in 2007 (11.2% [IC95% 7.21 - 15.21]), and to most estimates in sub-Saharan Africa [14, 19-22]. It is higher than that found in North Africa and on other continents (4.2 to 10.4%) [23-28]. This is in line with the findings of Makuwa, et al. [29] and Larsen, et al. [26] in the Congo, who showed that the absence of hepatitis B virus markers was correlated with the absence of HIV infection. However, the trends in Parakou need to be confirmed by a general population study. As in Cotonou in 2007 [15] no significant association was found between sex, age, marital status, level of education and HIV/HBV co-infection. It therefore affects both women and men.

However, it was associated with belonging to the Borgou/Alibori departments. It would therefore be interesting to investigate this observation further, to confirm it or not, and if necessary to explore the local socio-cultural variations that could explain this result in comparison with other departments. These could include cultural practices such as scarification, levirate, sororate, excision and circumcision, which were not explored in the present study. Indeed, Adewole, et al. [30] and Makuwa, et al. [29] observed in Nigeria that risk factors for co-infection included multiple sexual partnerships, scarification and repeated blood transfusions. Similarly, Sehonou, et al. [16] and Diop-Ndiaye, et al. [15] identified blood transfusion and acupuncture as significant risk factors for co-infection, while Koike, et al. [31] and Adewole, et al. [30] identified injecting drug use (IDU), blood transfusion and male homosexuality as risk factors. The latter factors could not be explored here because no cases of men who have sex with men (MSM) or IDU were reported. These two sub-populations are in fact few in number in Benin: in 2012, an exploratory survey counted 1,382 men who have sex with men in 13 major Beninese cities and 35 IDUs, mainly in Cotonou [31]. Although initiatives aimed at these target groups are being stepped up in Benin, their absence from the sample also reflects the social stigma that makes access to care difficult. WHO stage 4 HIV infection has been associated with a higher prevalence of co-infection. It could also be linked to the high probability of a person with advanced clinical HIV infection switching to chronic carriage rather than eliminating HBV after primary infection. This finding, also observed by Adewole, et al. [30] and Makuwa, et al. [29] in Nigeria, could also reflect a longer period of exposure of these subjects to the factors of transmission common to both viruses, thereby accumulating the risk of being infected by both. All of these results would provide a better understanding of HIV/HBV co-infection.

5. CONCLUSION

This study made it possible not only to estimate the carriage of HIV/HBV co-infection at the Matam Communal Medical Centre, which has a health care centre for patients living with HIV/AIDS that is 4%, but also to assess haemato-biochemical parameters, which showed significant variation. HIV/AIDS-HBV co-infection remains a real health problem, and improving its management requires the determination of haematological and biochemical parameters such as transaminase.

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Institutional Review Board Statement: The Ethical Committee of the Gamal Abdel Nasser University of Conakry, Guinea has granted approval for this study on 6 June 2022 (Ref. No. UGANC/RECT. 0027/06/2022).
Transparency: The authors state that the manuscript is honest, truthful, and transparent, that no key aspects of the investigation have been omitted, and that any differences from the study as planned have been clarified. This study followed all writing ethics.
Data Availability Statement: The corresponding author can provide the supporting data of this study upon a reasonable request.
Competing Interests: The authors declare that they have no competing interests.
Authors' Contributions: All authors contributed equally to the conception and design of the study. All authors have read and agreed to the published version of the manuscript.

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