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HIV and *Helicobacter pylori* Coinfections among HIV-Infected Patients in Calabar, Nigeria

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ABSTRACT
This study was carried out to detect anti-HIV and anti-*Helicobacter pylori* coinfection among 191 patients attending the ART clinic in Calabar, Nigeria. Blood samples were collected from 191 subjects and processed using standard laboratory procedures. One Step Anti-HP Rapid detection test kit was used stepwise to detect *H. pylori* antibodies in the blood samples. Commercial ELISA by Dia Pro (Italy) was also used to assay for *H. pylori* among these patients. The overall prevalence of HIV/*H. pylori* coinfection was 26.2%. A higher prevalence occurred in age-group 26-30years (40.0%), females (27.0%), the married (27.8%), those with secondary education (27.7%), teachers (42.1%), CD4 counts 350-499 cells/µl (32.6%) and < 200 cells/µl (32.4%) and viral loads ≥10, 000 copies (43.1%). However, none of the variables evaluated in this study were statistically significant, except for viral loads. The study further confirms the presence of HIV/*Helicobacter pylori* among patients in Calabar, Nigeria. This result emphasizes the need for regular blood testing for *H. pylori* and HIV to reduce transmission among the general population. Extensive health education is required to inform the public about infection risk factors and potential preventative actions. To characterize the function of *H. pylori* coinfection and eradication in immunological reconstitution in HAART-treated HIV-1 patients, more research with more significant numbers of HIV-1 patients with and without *H. pylori* coinfection for an extended period is required.

Keywords: Coinfections, *Helicobacter pylori*, HIV-1, Prevalence, Nigeria

I. INTRODUCTION

A global calamity, the most extensive plaque, and the deadliest tsunami in human history are HIV and AIDS. The most catastrophic diseases that humanity has ever experienced, according to the United Nations, are HIV and AIDS.[1-4] The majority of HIV infections are contracted through unprotected sexual activity, sex work,[5] sharing of sharp objects, contaminated hypodermic needles, injection drug use, mother-to-child contact during pregnancy, childbirth, or breastfeeding,[6] having multiple sexual partners and having STIs,[7] or other exposure to one of the risks as mentioned above factors.[8-9]

From the commencement of the epidemic, 84.2 million individuals worldwide have contracted HIV, and 40.1 million have passed away from AIDS-related illnesses. At the same time, there were 38.4 million HIV-positive individuals worldwide in 2021.[10] The HIV epidemic still burdens the world and poses significant public health issues in developing nations, particularly Nigeria.[2-4,11]

Given the ongoing HIV epidemic, it is still a significant public health concern in developing nations, particularly Nigeria.[4] Nigeria has just lately begun to understand the devastating impact that HIV/AIDS has had on its population, social, economic, and health advancement.[3,12] Furthermore, 1.9 million persons in Nigeria were HIV-positive in 2021.[13] In 2020, the prevalence rate of HIV was 1.3 per cent, with female adults having the most significant prevalence at 1.6 per cent. In 2020, the male adults' prevalence rate was 1.0%[14]. The 103,404 new HIV infections in 2019 were followed by 92,323 in 2021.[15] However, according to the most recent National Sentinel survey, Cross River State ranked 7th out of States with an HIV prevalence of 2.0%.[16]

Undoubtedly, HIV and AIDS are among the most significant infectious disease threats in history, threatening the very fabric of society and increasingly focusing on the poor and downtrodden.[2]

Helicobacter pylori (H. pylori) is a gram-negative, microaerophilic rod with a spiral form and flagella. Although the duodenum also contains it, the stomach mucosa is its natural habitat.[17-19] Tests for oxidase, catalase, and urease indicate that the organism is present.[18] The organism, which has two to six flagella and is classified as a class one carcinogen, has chronically infected more than half of the world's population.[17] The stomach lining's extensive infection, which causes ulcers, is attributed to *Helicobacter pylori*. Furthermore, 80.0% of the infected persons are asymptomatic, although more than 50.0% of the world's population is afflicted. The bacteria are the most common infection in the world, affecting at least half of the population.[20]

The most common aetiology of chronic gastritis and peptic ulcers in the general population is infected with *Helicobacter pylori*. Patients with acquired immunodeficiency syndrome (AIDS) and human immunodeficiency virus (HIV) frequently experience gastrointestinal (GI) symptoms (AIDS). There have been reports of *Helicobacter pylori* infections in HIV-positive people.[21-25] Nevertheless, it is unclear what impact H. pylori infection plays in the GI tract mucosa of HIV patients.[26] The humoral immunity of those who are infected with both *Helicobacter pylori* and HIV can be weakened, which raises their risk of illness and fatality over a short period. People with HIV infection and/or low CD4+ T cell counts would lose the protective mechanism that *H. pylori* use to maintain colonization, and the severity of the illness would decline with effective antibiotic treatment and a reduction in gastric acidity.[27] However, for any effort targeted at its treatment and control to be successful, it is imperative to determine the prevalence rate of *H. pylori* infection.

The prevalence of HIV/*H. pylori* antibodies among HIV-1 patients in Calabar, Cross River State, Nigeria, and the extent and severity of HIV coinfections with *Helicobacter pylori* have received much attention from researchers worldwide. However, there is a dearth of literature and data on these topics, particularly in Nigeria. To the best of our knowledge, few studies compare HIV/*H. pylori* coinfection among HIV-1 patients, particularly in Nigeria. As a result, people with HIV and *H. pylori* coinfections have impaired humoral immunity, making them vulnerable to other opportunistic infections. We started this study to assess the prevalence of coinfection with HIV and *Helicobacter pylori* antibodies among patients in Calabar, Cross River State, Nigeria, and to assess some of the sociodemographic and clinical factors related to the patients' seropositivity to both *H. pylori* and HIV.

II. MATERIALS AND METHOD

2.1 Study Area

The study was conducted in the ART clinic of the University of Calabar Teaching Hospital (UCTH), Calabar, Cross Rivers State, South-South of Nigeria. Cross River State is located in the Niger Delta region of Nigeria. Cross River State, known for its tourism potential and made up of 18 Local Governments Areas (LGAs), shares boundaries with Benue, Ebonyi, Abia, Akwa-Ibom States, the Cameroun Republic and the Atlantic Ocean. At the same time, with 31 LGAs, Akwa Ibom State is bordered by Cross River, Rivers, Abia States and the Atlantic Ocean.

2.2 Study Population

Blood samples were collected from 191 patients patronizing the University of Calabar Teaching Hospital (UCTH) at Calabar, Cross River State. Blood samples were collected randomly from patients and carried to the Virus Research Unit, Department of Microbiology, University of Port Harcourt, Nigeria, for serological analysis. Data was collected from consenting volunteers after obtaining due ethical permits from the relevant bodies. All experiments have been examined and approved by the Research Ethics committees of the University of Calabar Teaching Hospital (UCTH), Calabar, Cross River State, Nigeria. Therefore, the study was performed following the ethical standards laid down in the 1964 Declaration of Helsinki.

2.3 Sample Collection and Preparation

The method of sample collection was the venepuncture technique. The blood was collected and transferred into an EDTA bottle, which was centrifuged, and the plasma was then pipetted.

2.4 Serological Analysis

The HIV test kits used to re-test the participants were the Determine® manufactured by Alere Medical Co Ltd, Japan). Each strip HIV-1 & -2 recombinant antigen and synthetic peptide coated test card. A parallel test was carried out for the *Helicobacter pylori* antibody using One step ANTI-FTP. The tests were performed according to the instruction of the kit manufacturers.

2.5. Data Analysis

Data were analyzed using the Statistical Package for Social Sciences (SPSS) version 16.0. The seroprevalence for *H. pylori* was expressed as a percentage for the entire study group.

III. RESULTS

3.1. PATIENT CHARACTERISTICS

The age range of the 191 HIV-infected patients who participated in the study was 4-67 years, with an average of 38.2 years. About 21.5% were in the 36-40 age range, and comparisons of the seven age groups were recorded as non-significantly different (P>0.05). The median age of the participants was 40 years (4 - 67). Most (75.4%) of the HIV-1 infected individuals were females, and 24.6% were males (Table 1). In this study, 58(30.4%) were single, 133(69.6%) were married, and no divorced and widowed patients. Twelve (6.3%) had a primary education, 65(34.0%) had a secondary school education, 114(59.7%) had a tertiary education, and none had no formal education. Thirty-one (16.2%) were traders, 4(2.1%) were retired, 41(24.5%) were businessmen/women, 32(16.8%) were civil servants, 12(6.3%) were artisans, 4(2.1%) were farmers, 19(10.0%) were teachers, 32(16.8%) were students and 16(8.4%) were unemployed (Table 1).

3.2. Immunological and Virological Markers of HIV-1 Patients in Calabar, Nigeria

This study's CD4 count ranges from 5-2,139 cells/µl (average = 447.3 cells/µl). Thirty-seven (19.4%) HIV-infected patients had a CD4 count of ≤200 cells/µl, and 41(21.5%) had a CD4 count of 201-349 cells/µl. Those with a CD4 count within 350-499 cells/µl were 43(22.5%) while 70(36.6%) had a CD4 count above 500 cells/µl. The percentage of individuals with CD4 cell counts <200 cells/µl indicates advanced disease. The percentage of individuals diagnosed with CD4 cell counts ≥500 cells/µl, indicating a recent acquisition of HIV infection, has remained relatively stable (Table 2). In terms of viral load, it ranges from <20-3,675,901 copies/mL (average = 202,302 copies/mL). Forty-nine (25.6%) HIV-infected individuals had a viral load of ≤20 copies/mL, 21(11.0%) had a viral load within 21-150 copies/mL, 49(25.7%) had a viral load of 151-9999 copies/mL while 72(37.7%) had a viral load ≥ 10,000 copies/mL (Table 2).

3.3 HIV/*H. pylori* Coinfection

Table 1 shows the HIV/*H. pylori* coinfection amongst HIV-1 infected persons with their sociodemographic variables. The seropositivity of HIV/*H. pylori* coinfection among the HIV-1 infected persons in this study was 26.2% (n=50/191).

3.4 Age-Specific Coinfections

Figure 1 shows the prevalence of HIV/*H. pylori* coinfection with age groups. The age-specific prevalence showed that HIV/*H. pylori* coinfections were highest in age-group 26-30years (40.0%), followed by age groups 41-45 years (38.7 %), ≤25 years and 51 years and above (23.8%), 31-35 years (21.4%), and 46–50 years (16.7 %) while age groups 36-40 years (2.4%) had the least seropositivity (5.7%). These differences were not statistically associated ($P > 0.05$) as indicated in Table 1.

3.5 Sex-Specific HIV/*H. pylori* Coinfections

The sex-specific prevalence showed that females had a higher prevalence of HIV/*H. pylori* coinfection (27.0%) than their male counterparts (23.4%) as indicated in Figure 2. The study showed no significant difference ($P > 0.05$) between sex and HIV/*H. pylori* coinfections amongst subjects (Table 1).

3.6 Marital Status-specific HIV/*H. pylori* Coinfection

Figure 3 shows the distribution of HIV/*H. pylori* coinfection among the subjects in terms of their marital status. Higher prevalence of HIV/*H. pylori* coinfection was observed among the married (27.8%) than in singles (22.4%). These differences were not statistically associated ($P > 0.05$) as indicated in Table 1.

3.7 Distribution of HIV/*H. pylori* coinfection with educational background

Figure 4 shows the distribution of HIV/*H. pylori* coinfection among subjects based on their educational status. Higher prevalence of HIV/*H. pylori* coinfection was recorded among those with secondary education (27.7%), followed by those with tertiary education (26.3%) and those with primary education (16.7%) the least. This difference was not statistically associated (P >0.05) as indicated in Table 1.

3.8 Distribution of HIV/*H. pylori* coinfection with occupation

Figure 5 shows the distribution of HIV/*H. pylori* coinfection among subjects based on their occupational status. Higher prevalence of HIV/*H. pylori* coinfection was recorded among teachers (42.1%),

followed by students (31.2%), retired workers (25.0%) and farmers (25.0%), businessmen/women (24.0%), traders (22.6%), unemployed (12.5%), and artisans (8.3%) while civil servants (3.1%) had the least prevalence. This difference was not statistically associated (P>0.05) as shown in Table 1.

3.9 Distribution of HIV/*H. pylori* coinfection with CD4 counts

Figure 6 shows the prevalence of HIV/*H. pylori* coinfection among subjects with their CD4 counts. Higher prevalence of HIV/*H. pylori* coinfection occurred among the subjects with a CD4 count of 350-499 cells/µl (32.6%), followed by those with a CD4 count < 200 cells/µl (32.4%) and 200-349 cells/µl (24.4%) while those with CD4 count $\geq$ 500 cells/µl (20.0%) had the least prevalence of HIV/*H. pylori* coinfection. These differences were not statistically associated (P>0.05) as shown in Table 2.

3.10 Distribution of HIV/*H. pylori* coinfection with Viral load

Figure 7 shows the prevalence of HIV/*H. pylori* coinfection among subjects based on their viral load. Higher prevalence of HIV/*H. pylori* coinfection occurred among the subjects with a viral load 10, 000 copies and above (43.1%), followed by those with a viral load of 151-9999 copies/mL (20.4%) and 21-150 copies/mL (19.0%) while subjects with a viral load of <20 copies/mL (10.2%) had the least prevalence of HIV/*H. pylori* coinfection. These differences were statistically associated (P>0.05) as shown in Table 2.

IV. DISCUSSION

Because untreated infection can result in stomach cancer, *Helicobacter pylori* infection remains a serious global health concern.[28] Nigeria has a high frequency of *H. pylori* infection (87.7%), with the northern section having a higher incidence than other parts of the country.[28] The study concentrated on HIV-infected patients in Calabar, Cross River State, Nigeria, who also had specific antibodies against *Helicobacter pylori*. Infection with *H. pylori* is prevalent in underdeveloped nations.[27] Throughout and even within a single country, there are notable variations in the frequency of illness. Overcrowding and socioeconomic status are intimately tied to this.[29] According to reports, the incidence rate is higher in developing countries because most of the population is from a poor or middle socioeconomic level,[30] even though *H. pylori* is frequently linked to coinfections with other illnesses and infections, including HIV, dyspepsia, and anaemia.[31-32] The study primarily focused on HIV patients who visited health facilities in Calabar, Nigeria, according to age, sex, marital status, level of education, and occupation.

The findings of this study showed that the infection was present in 26.2% of the population under investigation, which is consistent with the high prevalence rate previously reported in other developing nations.[27] Comparable figures include 23.5% reported in Ogun State, South-West, Nigeria[33] and 29.7% reported in Uyo, Akwa Ibom State, Nigeria.[34]

This finding contrasts with the 42.1% previously reported in Calabar, Cross River State,[35] the 72.1% overall prevalence of *H. pylori* infection reported by Chen et al.,[36] the 44.0% reported by Okonko et al. in Port Harcourt, Nigeria, [23] and the 38.0% reported by Ahaotu et al. also in Port Harcourt, Nigeria.[25] In Keffi, Nasarawa State, North Central Nigeria, studies by Ishaleku and Ihiabe, and Oti et al. revealed high prevalence rates of (56.3%) and (56.3%), respectively. [37,38] In a study in Kano, North-west Nigeria, Kumurya found a remarkably high infection incidence of 96.0%.[39] Etukudo et al. reported similar results of 30.9% seroprevalence of *H. pylori* infection in Uyo, Akwa Ibom State, Nigeria.[40]

Moreover, a greater prevalence rate (80.0%) was noted in Lagos, South West, Nigeria.[41] Jidda et al. reported a 78.9% prevalence of *H. pylori* infection in Gwadabawa in Sokoto, North-West, Nigeria.[42] In addition, Saidu et al. found that adults in Sokoto Metropolis had a 56.8% prevalence of *H. pylori* infection.[43] A comparable study by Gide et al. in Damaturu, Yobe, North East, Nigeria, found a high (51.96%) overall prevalence of *H. pylori* infection.[44] Omosor et al. found a 52.0% *H. pylori* infection rate in Delta State, Nigeria, in South-South Nigeria.[45] A significant seroprevalence of *H. pylori* (68.7%) occurred in the Lagos, South-West Nigeria study conducted by Olufemi et al.[46]

In Port Harcourt, Nigeria, it is higher than the 2.0% prevalence reported by Okonko and Barine,[24] the 6.0% prevalence recorded by Okosigha,[22] and the 20.0% prevalence reported by Ahaotu et al.[47] In their study in Karu, North-Central Nigeria, Kolawole et al. found a relatively low seroprevalence of *H. pylori* infection (5.5%).[48]

The prevalence of *H. pylori* infection in Nigeria has been documented in numerous studies over time, with variations in the country's demography, age groups, occupations, gender, marital status, level of education, and disease conditions depending on the region[28]. Geographical differences in *H. pylori* prevalence are significant.[49] According to studies, *H. pylori* prevalence in industrialized nations typically hovers at about 40.0% and is much lower in children and adolescents than in adults and the elderly.[20,49] Even at young ages, *H. pylori* infection affects more than 80.0% of the population in several developing nations.[41, 49-50]

This study reported an age-specific prevalence that was not statistically linked. It was shown that the age groups 36-40 years (2.4%) had the lowest seropositivity (5.7%), whereas age groups 41-45 years (38.7%), 25 years, and 51 years and above (23.8%), 31-35 years (21.4%), and 46-50 years (16.7%) had the highest rates of HIV/*H. pylori* coinfections. This result contrasts Okosigha's findings in Port Harcourt, Nigeria, which found that *H. pylori* infection was more common among certain age groups.[22] This observation also corroborates some previous studies in Nigeria. In Karu, North-Central Nigeria, Kolawole et al. found no correlation between age and *H. pylori* infection among the respondents.[48]

This outcome conflicts with the findings of Joav et al., who discovered a comparable circumstance.[51] In Uyo, Akwa Ibom State, Nigeria, the 6-to-10-year age group had the highest prevalence.[40] Compared to other age groups, 30-39-year-olds had the most significant rate of *H. pylori* infection in Port Harcourt, Nigeria.[24] According to Zhu et al., children and adolescents were not co-infected, indicating a substantial difference in the patients with both illnesses.[52] According to a study conducted in Anambra, South-East Nigeria, age was revealed to be a risk factor for *H. pylori* infection among people.[54] The age group 24-35 years had the highest seroprevalence of *H. pylori*. In Calabar, Cross River State, Nigeria, Kooffreh-Ada et al. found a significant prevalence of *H. pylori* infection among people aged 40 to 60.[35]

Ishaleku and Ihiabe[37] and Oti et al.[38] observed an association between *H. pylori* infection and age among patients in Keffi, Nasarawa State, North Central Nigeria, on the same topic of age-specific prevalence.[37,38] In Kano, North-west Nigeria, Kumurya found a noticeably high infection rate in people between 40 and 50 years.[39] At Damaturu, Yobe, North East, Nigeria, Gide et al. found that patients between 50 and 59 had the highest infection rates.[44] Omosor et al. found no connection between age and *H. pylori* infection in Delta State, Nigeria.[45] Previous research by Enitan et al. in Ogun State, South-West, Nigeria, suggested a correlation between infection age and disease.[33] In Uyo, Akwa Ibom State, Nigeria, Owowo et al. also noted a greater frequency of *H. pylori* infection among children between the ages of 5 and 14 years.[34] In Aba, Abia State, South East, Nigeria, Ibebuike et al. discovered a concurrent connection between the subjects' ages and *H. pylori* infection.[54]

The study also included sex-specific prevalence data, which revealed that females were more likely to have HIV/*H. pylori* coinfection (27.0%) than males (23.4%). No significant relationship between sex and HIV/*H. pylori* coinfections occurred in the study. This result also corroborates Okosigha, who claimed that *H. pylori* infection affects both sexes equally and is not specific to the male or female sex.[22] This situation is comparable to one in Bangladesh, where Lee et al. observed no discernible difference in the infection concerning sex.[27] Just those who are susceptible to the sickness would matter.[27] The genders did not appear to differ significantly, according to Chen et al.[36] In a study conducted at Anambra, South-East Nigeria, Chukwuma et al. found that *H. pylori* seroprevalence was primarily female,[53] while no correlation occurred between gender and *H. pylori*. in Karu in North-Central Nigeria,[53] Kolawole et al. found no correlation between *H. pylori* infection and gender.[48] In Kano, North-west Nigeria, Kumurya found no appreciable variation in seropositivity to *H. pylori* between men and women.[39] In Delta State, Nigeria, Omosor et al. showed no correlation between gender and *H. pylori* infection.[45] Kooffreh-Ada et al. showed no relationship between *H. pylori* infection with the sex of the patients in Calabar, Cross River State, Nigeria.[35]

The results of this study, however, contradicts Zhu et al. claim that there was a significant gender gap and that women had a greater infection rate than men.[52] In Keffi, Nasarawa State, North Central Nigeria, research by Ishaleku and Ihiabe and Oti et al. also discovered a link between *H. pylori* infection and gender among patients.[37-38]

On the exact sex-related prevalence, Jidda et al. and Saidu et al. identified a greater incidence of infection in females compared to males in Sokoto, North-West, Nigeria.[42-43] At Damaturu, Yobe, North East, Nigeria, Gide et al. found that patients of the male gender had the highest infection rates.[44] Enitan et al. earlier research in Ogun State, South-West, Nigeria, suggested a link between infection and gender.[33] In Uyo, Akwa Ibom State, Nigeria, Owowo et al. also noted a greater frequency of *H. pylori* infection among females.[34]

In this study, married people (27.8%) had a greater rate of HIV/*H. pylori* coinfection than single people (22.4%). According to the study, *H. pylori* infection and marital status were not significantly related. This observation can be attributed, among other things, to stress and to have a family. Our result, however, contradict other studies in Nigeria and overseas. Marital status and *H. pylori* infection were linked, according to Chen et al.[36] According to Brenner et al., a person's time living with an infected spouse increased their likelihood of contracting *H. pylori* infection.[55] According to Marshall, a patient who married into a family with gastric ulcers later experienced duodenal ulceration.[56] According to Chen et al., the marital transmission of *H. pylori* to a partner who does not have the disease may also be a way for it to spread later in life.[36] At Sokoto, North-West, Nigeria, Jidda et al. and Saidu et al. noted an even higher prevalence in married participants than in singles.[42-43]

Socioeconomic level, home crowdedness, ethnicity, migration from high prevalence locations, and family member infection status are the risk and susceptibility variables for *H. pylori* infection.[29] This found this otherwise as no significant difference exist between *H. pylori* and educational level. Secondary education (27.7%) had the highest frequency of HIV/*H. pylori* coinfection, followed by tertiary education (26.3%), while elementary education (16.7%) had the lowest prevalence. The level of education was not related to *H. pylori* infection in the Smith et al. investigation.[57] The present observation opposed that of some previous studies. In Aba, Abia State, Nigeria, Ibebuike et al. revealed a concurrent connection between parental education and *H. pylori* infection.[54] In Karu, North-Central Nigeria, Kolawole et al. ascribed the study subjects' strong understanding of *H. pylori* infection to the low prevalence of *H. pylori* infection.[48]

This study also discovered that teachers (42.1%) had a higher prevalence of HIV/*H. pylori* coinfection than students (31.2%), farmers (25.0%), retired workers (25.0%), businessmen/women (24.0%), traders (22.6%), the unemployed (12.5%), and artisans (8.3%), while civil servants (3.1%) had the lowest prevalence. However, similar to that of Smith et al. who indicated that occupation was not linked to *H. pylori* infection,[57] these differences were not statistically associated which contradicts that of some previous studies. In Aba, Abia State, Nigeria, Ibebuike et al. revealed a concurrent connection between socioeconomic class and *H. pylori* infection.[54] At Karu, North-Central Nigeria, Kolawole et al. linked the study subjects' high standard of living to the low prevalence of *H. pylori* infection.[48] In Uyo, Akwa Ibom State, Nigeria, Owowo et al. also identified occupation as a risk factor for *H. pylori* infection.[34]

Regarding CD4 counts, subjects with a CD4 count of 350-499 cells/l (32.6%) had a higher prevalence of HIV/*H. pylori* coinfection, followed by those with a CD4 count of 200 cells or less (32.4%) and 200-349 cells/l (24.4%). Subjects with a CD4 count of >500 cells/l (20.0%) had the lowest prevalence of HIV/*H. pylori* coinfection. However, these differences were not statistically associated. Additionally, this study revealed results similar to those reported by Ali et al., who concluded that there was a decrease in HIV-positive subjects with decreasing CD4+ cell counts and no significant difference in *H. pylori* prevalence between HIV-positive and HIV-negative subjects.[58]

According to viral load, participants with viral loads of 10,000 or more copies/mL had a greater prevalence of HIV/*H. pylori* coinfection (43.1%), followed by those with viral loads of 151–9,999 copies/mL (20.4%), 21–150 copies/mL (19.0%), and subjects with viral loads of 20 copies/mL (10.2%). These differences were statistically associated. *H. pylori* are classified as a Class I carcinogen, according to the International Agency for Research on Cancer (IARC).[29,32] Based on epidemiological data, this report was created. Some claim that *H. pylori* are just a danger factor in certain areas. The study focused on patients with HIV in Calabar, Cross River State, Nigeria, who also had *Helicobacter pylori* infections. There have been reports of widespread distribution of *H. pylori* in poorer nations.[51,59-61]

Serological approaches are primarily used on individuals from endemic regions to gather reported data on HIV/*H. pylori* coinfection. With various detection methods, there are inconsistent *H. pylori* prevalence patterns in HIV-infected patients.[49,62-63] Nonetheless, globally, there have been noticeable variations in prevalences ($p < 0.05$). This study further supported the occurrence of both illnesses and their coexistence in Nigeria by revealing a coinfection rate of 26.2% for HIV/*H. pylori*. Olmos et al. reported a coinfection rate of 41.1%.[64] They stated that the prevalence of *H. pylori* in gastric mucosa in HIV and non-HIV patients were comparable in their study, which somewhat agrees with this. Nonetheless, several studies have reported findings that diverge from the current study's findings. According to earlier research, HIV patients had a lower prevalence of *H. pylori* than the general population's healthy people.[31, 65]

This study found a significant prevalence of HIV/*H. pylori* coinfection, and of all the risk factors examined, they seemed to be linked to seropositivity. In conclusion, this study has added to the body of

knowledge regarding the prevalence of HIV/*H. pylori* coinfection among HIV-positive patients in Calabar, Cross River State, Nigeria. According to Ajayi et al., factors such as a low standard of living, poor personal cleanliness, overcrowding, amount of education attained, way of life, and poverty may contribute to variations in the prevalence of *H. pylori* infection.[41] However, none of the variables evaluated in this study were statistically significant, except for viral loads.

V. CONCLUSION

This study provides evidence of the coinfection of people in Calabar, Cross River State, Nigeria, with HIV and *Helicobacter pylori*. According to the study, *H. pylori* infection is a widespread public health issue in Calabar, Cross River State, Nigeria. More research on the underlying mechanisms is required. This finding emphasizes the need for routine blood testing for *H. pylori* and HIV coinfection to reduce their spread among the general population. Extensive health education is required to inform the public about infection risk factors and potential preventative actions. To characterize the function of *H. pylori* coinfection and eradication in immunological reconstitution in HAART-treated HIV-1 patients, more research with more significant numbers of HIV-1 patients with and without *H. pylori* coinfection for an extended period is required.

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Disclosure of conflict of interest

The authors have declared that no competing interests exist.

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