

Original Research Article

Seroprevalence and associated risk factors of human immunodeficiency virus, hepatitis B virus and syphilis among pregnant women attending Dessie referral hospital, Northeast Ethiopia

Hussen Nuru¹, Negash Nurahmed^{2*}, Yeabkal D. Teka², Fewzia Mohammed²,
Getachew Ferede¹, Wondwossen Abebe¹

¹University of Gondar, Gondar, Ethiopia

²Ethiopian Public Health Institute, Addis Ababa, Ethiopia

Received: 01 August 2020

Accepted: 08 September 2020

***Correspondence:**

Negash Nurahmed,

E-mail: nurahmednegash@gmail.com

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Background: Globally the burden of human immunodeficiency virus (HIV), hepatitis B virus (HBV) and syphilis infections are a common problem of pregnant women where the complications are transmitted to their new born infants. These infections, often silent and without symptoms, can result in serious and fatal health consequences.

Methods: Cross-sectional study was conducted on 384 pregnant women attending Dessie referral hospital from February to April 2019 by using convenience sampling techniques. Data were collected by assigned nurses with face to face interview using a pre-tested questionnaire. Samples were screened by rapid serological tests for HIV and *T. pallidum* antibodies as well as HBsAg. Data was analysed using SPSS. Logistic regression was used to see the association between dependent and independent variables. P values <0.05 was considered as statistically significant.

Results: The overall seroprevalence rates of HIV, HBsAg, syphilis and HIV/HBV coinfections were 6.5%, 4.7% and 0.8%, and 0.5% respectively. The history of sexual transmitted infections (STIs), multiple partners and using sharp materials were significantly associated to HIV with an adjusted odd ratio (AOR) of 8.35, 9.6 and 3.097 respectively. Likewise, the habit of ear/nose piercing and partner's STIs exposure were associated with hepatitis B infection with an AOR 8.24 and 14.11 respectively.

Conclusions: HIV and HBV infections are still critical public health concerns among pregnant women in the study area. History of multiple sexual partners, sharing of sharp materials, history of STIs exposure, habits of ear/nose piercing were significantly associated with infections.

Keywords: HBV, HIV, Pregnant women, Seroprevalence, Syphilis

INTRODUCTION

The term STIs (sexually transmitted diseases) includes a group of infectious diseases that are caused by pathogens and can be acquired and transmitted through unprotected sexual activity.¹ They are among the major causes of illnesses throughout the world, particularly in developing countries. Globally, the burden of the HIV, HBV, and *Treponema pallidum* infections are a common problem of

pregnant women where the complications are transmitted to their new born infants.²

HIV is an enveloped single stranded ribonucleic acid (RNA) virus which is found in the family *Retroviridae* subfamily Lenti virus genus retroviruses. The envelope contains viral glycoproteins. The envelope surrounds a capsid that contains two identical copies of the positive-strand RNA genome inside an electron-dense core. The

virion also contains reverse transcriptase and integrase enzymes and two cellular transfer RNAs.³

HBV is the main representative of the family *Hepadnaviridae*; genus *Orthohepadnavirus*. It is an enveloped virion containing partial double-stranded circular DNA genome.^{3,4} Most HBV in developing settings is transmitted from mother to child at birth, followed by parenteral transmission. Depending on the epidemiological pattern within a geographic area, the main ways of transmission are sexual intercourse, parenteral transmission of the baby at birth from an infected mother.⁵

Syphilis a chronic, infectious, genital ulcerative disease which is caused by a spirochete bacterium called *T. pallidum* subspecies *pallidum*. *Treponema pallidum* is slender spiral measuring about 5-15 µm in length 0.25 µm in diameter. The organisms are actively motile, rotating steadily along its longitudinal axis even after attaching to cells by their tapered ends. The spirals are so thin that they are not readily seen unless immunofluorescent stain or dark-field illumination is used. They are gram negative even if they do not stain well with routine staining dyes.^{6,7}

A pregnant woman with syphilis can transmit *T. pallidum* to the fetus through the placenta beginning in the 10th-15th weeks of gestation which results fetus's death, miscarriages or stillbirth. Others are born live but develop the signs of congenital syphilis in childhood, including interstitial keratitis, Hutchinson's teeth, saddle nose, periostitis, and a variety of central nervous system anomalies. Adequate treatment of the mother during pregnancy prevents congenital syphilis.⁶

HIV, HBV and *T. pallidum* remain the main public health problems in sub-Saharan countries where access to adequate diagnostic and treatment facilities are very limited. Individuals with untreated STIs that cause genital ulceration (like syphilis) have an increased risk of acquiring or sexual transmission of HIV through the broken skin or membrane. Since a high proportion of these infections are asymptomatic, control and prevention depend on screening and treatment of populations at risk, as well as the provision of effective treatment for those with symptoms.¹ These infections, often silent and without symptoms, can result in serious and fatal health consequences.⁸

Diagnosing and treating these devastating etiologic agents at an early stage may result in preventing the spread of such infections and complications for pregnant women as well as for their new born infants.⁹

Ethiopia is among the countries where HIV, HBV, and *T. pallidum* infections are highly prevalent.¹⁰ However, in Ethiopia, antenatal screening and intervention strategies against HBV are not yet practiced routinely and in all

health service centers. The risk of transmission is related to the maternal treponemal load.⁶ In addition, there is also inconsistency of data available about the prevalence of these infections especially in the study area. Therefore, the aim of this study was to assess the seroprevalence and associated risk factors of HIV, HBV and syphilis among pregnant women attending Dessie referral hospital, Northeast Ethiopia.

METHODS

A cross-sectional study was conducted from February to April 2019. The study population was pregnant women attending antenatal care clinic (ANC) clinic of Dessie referral hospital.

Inclusion criteria included all pregnant women able to give a complete data and sufficient amount of bloods were included. Exclusion criteria excluded pregnant women who were unable to provide a complete data and give sufficient amount of blood, may be due to severe health problems were excluded.

During their visit in ANC as part of routine medical purposes, ten millilitres of blood was drawn from each study participant into a labelled plain vacutainer tube (Becton-Dickinson, USA). Then, the blood was allowed to clot & sample was centrifuged at 4000 rpm for 10 min to separate serum. The serum was screened for the HBsAg, as well as HIV and *T. pallidum* antibodies using rapid tests.

For the quality control the questionnaire preparation was checked and pre-tested before the detailed work was started. Standard operating procedures (SOPs) were strictly followed and internal quality control materials were included from the test kit. To assure the controlled performance of the testing procedure and storage condition of reagents primarily we have also found out in house known control for both negative and positive control samples in addition to controls provided from manufacturers.

The data collection and analysis were entered into Epi info 7.2.1.0 software and double checked before analysis and were exported to statistical package social sciences (SPSS) version 20 for analysis. The descriptive statistics (means, percentages or frequency) were calculated and the bi-variant logistic regression analysis used to see the relationship between dependent and independent variables. Variables that have a p<0.2 were selected for further analysis using multiple logistic regression models. The strength of the association measured using an odd ratio and interpreted by considering the 95% confidence interval and p<0.05 statistically significant. Finally, the results were presented using texts, graph, and tables accordingly.

RESULTS

Socio-demographic characteristics of study participants

A total of 384 pregnant women were included in the study. Their mean age and standard deviation of the study participant was 27.05±6.12 ranged from 18 to 45 years. Two hundred twenty (57.3%) of them were between 20 and 29 years old. Most of the study participants were married, 290 (75.5%), 109 (28.4%) did not attend formal education, 183 (47.7%) were not employed and 278 (72.4%) were lived in urban areas (Table 1).

Prevalence of HIV, HBV and syphilis among pregnant women

The overall seroprevalence of HIV, HBV and syphilis infections were 25/384 (6.5%, (95% CI, 4.2-8.9%)), 18/384 (4.7%, (95% CI, 2.6-6.9%)) and 3/384 (0.8%, (95% CI, 0-1.9%)), respectively. Among these, 2/384 (0.5%) had HIV/HBV co-infection, but there was no HIV/syphilis and HBV/syphilis co-infection (Figure 1).

Among the different age groups, the highest prevalence of HIV and HBV infections were observed in the age group of 20-29 years, but both HIV and HBV infection have no statistical significance with the age of participants (Table 2).

Risk factors for the acquisition of HIV, HBV, and syphilis

The multivariable analysis results showed that a history of multiple sexual partners (AOR 9.62; 95% CI 4.05-22.85, p=0.001), sharing of sharp materials (AOR 3.097; 95% CI 1.3-7.53, p=0.013) and history of STIs exposure (AOR 8.35; 95% CI 2.8-24.66, p=0.001) have a statistically significant association with HIV infection. History of ear/nose piercing (AOR 8.24; 95% CI 1.97-34.46, p=0.004) and STIs exposure of sexual partner (AOR 14.11; 95% CI 2.8-71.6, p=0.001) were significantly associated with HBV infection (Table 3).

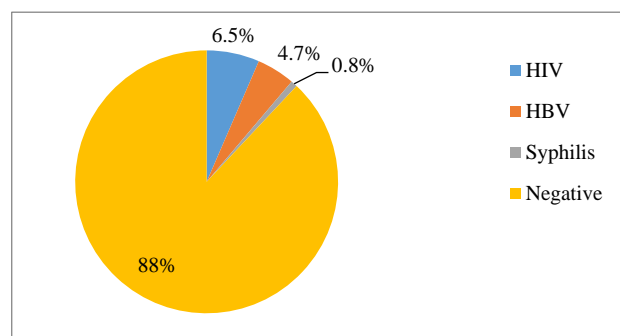


Figure 1: Prevalence of HIV, HBV and syphilis among pregnant women (n=384).

Table 1: Socio-demographic characteristics of pregnant women (n=384).

| Characteristics | Frequency | Percentage (%) |
|----------------------------|-----------|----------------|
| Age (years) | | |
| 18-19 | 40 | 10.4 |
| 20-29 | 220 | 57.3 |
| 30-39 | 104 | 27.1 |
| 40-45 | 20 | 5.2 |
| Marital status | | |
| Married | 290 | 75.5 |
| Single | 33 | 8.5 |
| Separated* | 61 | 16 |
| Educational level | | |
| No formal education | 109 | 28.4 |
| Primary school | 94 | 24.5 |
| Secondary school | 97 | 25.2 |
| Above secondary school | 84 | 21.9 |
| Occupational status | | |
| Employed** | 89 | 33.3 |
| Farmer | 40 | 17.2 |
| Daily laborer | 72 | 18.8 |
| unemployed | 183 | 30.7 |
| Residence | | |
| Urban | 278 | 72.4 |
| Rural | 106 | 27.6 |

Employed**= government or private, Separated*=divorced or widowed

Table 2: Seroprevalence of HIV, HBV and syphilis infections in relation to socio-demographic characteristics among pregnant women.

| Variables | HIV Positive | | | | | HBV Positive | | | | | Syphilis | |
|----------------------------|--------------|---------|-------------------|-------|------------------|--------------|---------|-------------------|-------|--------------------|----------|-----|
| | Total | Pos (%) | COR (95% CI) | P | AOR (95%CI) | p | Pos (%) | COR (95% CI) | P | AOR (95% CI) | P | Pos |
| <20 | 40 | 2 (5) | 1 | | | | 2 (5) | 1 | | | | 0 |
| 20-29 | 220 | 15(7) | 1.124 (0.31-4.08) | 0.858 | | | 12 (6) | 0.41 (0.05-3.211) | 0.395 | | | 2 |
| 30-39 | 104 | 6 (6) | 1.32 (0.315-5.57) | 0.702 | | | 3 (3) | 0.508 (0.06-4.55) | 0.542 | | | 1 |
| 40-49 | 20 | 2 (1) | 1.3 (0.12-13.44) | 0.827 | | | 1 (1) | 0.49 (0.03-8.22) | 0.618 | | | 0 |
| Marital status | | | | | | | | | | | | |
| Married | 290 | 18 (6) | 1 | | | | 15 (5) | 1 | | | | 2 |
| Unmarried/ single | 33 | 4 (12) | 1.03 (0.23-4.63) | 0.974 | | | 2 (6) | 1.87 (0.24-14.5) | 0.551 | | | 0 |
| Separated * | 61 | 3 (5) | 0.74 (0.26-2.08) | 0.569 | | | 1 (3) | 1.13 (0.32-4.00) | 0.851 | | | 1 |
| Education level | | | | | | | | | | | | |
| No formal | 109 | 4 (4) | 0.52 (0.18-1.48) | 0.22 | | | 6 (6) | 1.09(0.31-3.84) | 0.893 | | | 1 |
| Primary | 94 | 4 (4) | 1.014 (0.3-4.07) | 0.985 | | | 2 (2) | 1.55 (0.31-7.70) | 0.593 | | | 0 |
| Secondary | 97 | 11 (11) | 0.92 (0.3-2.70) | 0.877 | | | 5 (5) | 0.918 (0.3-4.27) | 0.876 | | | 1 |
| Above secondary | 84 | 6 (7) | 1 | | | | 5 (6) | 1 | | | | 1 |
| Occupational status | | | | | | | | | | | | |
| Employed** | 89 | 5 (4) | 1 | | 1 | | 4 (3) | 1 | | 1 | | 1 |
| Daily laborer | 72 | 4 (6) | 0.384(0.09-1.6) | 0.187 | 0.585 (0.13-2.5) | 0.481 | 6 (8) | 0.355 (0.1-1.3) | 0.118 | 0.209 (0.041-1.09) | 0.06 | 1 |
| Farmer | 40 | 5 (8) | 1.36 (0.14-13.5) | 0.793 | 1.046 (0.21-5.2) | 0.956 | 1 (2) | 2.1 (0.23.19) | 0.512 | 3.43 (0.3-39.261) | 0.322 | 0 |
| Not employ*** | 183 | 11 (9) | 0.39 (0.11-1.39) | 0.146 | 0.245 (0.07-1.4) | 0.121 | 7 (6) | 0.89 (0.157-5.1) | 0.295 | 0.228 (0.05-1.04) | 0.06 | 1 |
| Residence | | | | | | | | | | | | |
| Urban | 278 | 17 (6) | 1.2 (0.5-2.997) | 0.612 | | | 15 (3) | 0.504 (0.1-1.78) | 0.286 | | | 1 |
| Rural | 106 | 8 (8) | 1 | | | | 3 (3) | 1 | | | | 2 |
| Total | 384 | 25 | | | | | 18 | | | | | 3 |

CI=Confidence Interval, COR= Crude Odd Ratio, Employed**= government or private sector, not employed***= students, housewife and others, Pos=number of positive values, P=-p-value, Separated*= divorced or widowed

Table 3: Association of possible risk factors related to HIV, HBV and syphilis in pregnant women.

| Factors | | HIV infection | | | | HBV infection | | | | Syphilis | | | |
|------------------------------------|----------------------------------|---------------|-----------|------------------|-------|-------------------|-------|----------|------------------|----------|---------------------|-------|-----|
| | | Total | Pos (%) | COR (95% CI) | P | AOR (95% CI) | P | Pos (%) | COR (95% CI) | P | AOR (95% CI) | P | Pos |
| Multiple sexual partners | Yes | 115 | 14 (12) | 3.251 (1-7.4) | 0.005 | 9.6 (4.05-22.8) | 0.001 | 4 (4) | 0.7 (0.2-2.1) | 0.48 | - | -- | 3 |
| | No | 269 | 11 (4) | 1 | | | | 14 (5) | 1 | | | | 0 |
| Use of sharp material | Yes | 80 | 11(14) | 3.302 (1.44-7.6) | 0.005 | 3.1 (1.27-7.5) | 0.003 | 3 (4) | 0.8 (0.2-2.7) | 0.657 | - | -- | 0 |
| | No | 304 | 14 (5) | 1 | | | | 15 (5) | 1 | | | | 3 |
| Ear/nose piercing | Yes | 116 | 4 (3) | 0.42 (0.1-1.3) | 0.120 | 0.38 (0.11-1.3) | 0.127 | 11(10) | 3.9 (1.4-10.35) | 0.006 | 8.2 (1.9-34.5) 1 | 0.004 | 3 |
| | No | 268 | 21(6) | 1 | | | | 7 (3) | 1 | | | | 0 |
| Tattooing | Yes | 63 | 4 (7) | 1.031 (0.3-2.9) | 0.955 | --- | -- | 2 (3) | 0.7 (0.2-0.97) | 0.591 | -- | -- | 0 |
| | No | 321 | 21 (7) | 1 | | | | 16 (5) | 1 | | | | 3 |
| Blood transfusion | Yes | 19 | 4 (21) | 4.37 (1.3-14.3) | 0.015 | 1.596 (0.39-6.6) | 0.517 | 2 (11) | 2.57 (0.5-12.1) | 0.233 | -- | -- | 2 |
| | No | 365 | 21(6) | 1 | | | | 16 (4) | 1 | | | | 1 |
| Hospital admission | Yes | 44 | 3 (7) | 1.058 (0.3-3.7) | 0.93 | -- | -- | 2 (5) | 0.96 (0.2-4.3) | 0.962 | -- | -- | 0 |
| | No | 340 | 22 (6) | 1 | | | | 16 (5) | 1 | | | | 3 |
| Tooth extraction | Yes | 58 | 3 (5) | 0.754 (0.2-2.66) | 0.68 | -- | -- | 5 (9) | 2.27 (0.78-6.6) | 0.134 | 2.11 (0.58-7.7) 1 | 0.256 | 0 |
| | No | 326 | 22 (7) | 1 | | | | 13 (4) | 1 | | | | 3 |
| Surgery | Yes | 62 | 5 (8) | 1.33 (0.5-3.7) | 0.589 | -- | -- | 2 (3) | 0.64 (0.1-2.85) | 0.555 | -- | -- | 2 |
| | No | 322 | 20 (6) | 1 | | | | 16 (3) | 1 | | | | 1 |
| Catheterization | Yes | 18 | 1 (6) | 0.838 (0,11-6,6) | 0.867 | -- | -- | 1 (6) | 1.21 (0.2-9.6) | 0.859 | -- | -- | 0 |
| | No | 366 | 24 (7) | 1 | | | | 17 (5) | 1 | | | | 3 |
| History of STIs | Yes | 82 | 16 (19.5) | 7.892 (3.3-18.6) | 0.001 | 8.35 (28.-24.66) | 0.001 | 8 (9.75) | 3.16 (1.2-8.278) | 0.019 | 1.197 (0.36-3.98) 1 | 0.769 | 3 |
| | No | 302 | 9 (3) | 1 | | | | 10 (3.3) | 1 | | | | 0 |
| Pregnancy related problems* | Yes | 165 | 11(7) | 1.046 (0.41-2.1) | 0.836 | -- | -- | 10 (6) | 1.26 (0.5-3.3) | 0.63 | -- | -- | 2 |
| | No | 219 | 14 (6) | 1 | | | | 8 (4) | 1 | | | | 1 |
| Pregnancy status | 1 st ,2 nd | 126 | 9 (7) | 1 | 0.73 | -- | -- | 6 (5) | 1 | 0.962 | -- | -- | 0 |
| | /more | 258 | 16 (6) | 0.859 (0.5-2.7) | | | | 12 (5) | 1.025 (0.38-2.8) | | | | 3 |
| STIs of partner | Yes | 65 | 9 (14) | 3.044 (1.3-7.2) | 0.012 | 0.549 (0.18-1.61) | 0.277 | 12(18) | 11.811 (4-32.8) | 0.001 | 14.(2.78-71.6) 1 | 0.001 | 2 |
| | No | 319 | 16 (5) | 1 | | | | 6 (2) | 1 | | | | 1 |

Pregnant related problems* include abortion, CS/vacuum extraction, still birth, edema, AOR=Adjusted odd Ratio, CI=Confidence Interval, COR=Crude Odd Ratio, Pos=number of positive values

DISCUSSION

In the present study seroprevalence of HIV among pregnant women was 6.5%, which is in line with studies done in Berhan (7.2%), Dar (6.6%), Ababa (5.2%), Cameroon (6%), Tanzania (6.9%), Nigeria (7.5) and India (5.5%).^{7,8,11-15} This finding was higher than the previous study in Southern Ethiopia (1.8%), the national HIV prevalence on adult women (4%), Republic of Congo (3.6%), Nigeria (4.1%), and Tanzania (2%). However, it is lower than results done in Gondar (10.3%), Dessie (13.8) as well as South Africa (14%).^{9,10,16,17-20}

The variations might be reflection of the differences in sexual practices and behavior, difference in sample size, awareness of HIV infection and testing, socio-cultural practices and accessibility to healthcare.

The present study demonstrated that study participants with a history of STIs exposure were nine times (AOR 9.3; 95% CI 3.9-22.4) more infected with HIV than those without previous STIs. This finding was supported by a research done in Ababa in which the history of STIs was associated with HIV infection.⁸ This might be due to the creation of ulcers on the skin and mucous membrane which in turn facilitate the acquisition of HIV. Pregnant women with a history of multiple sexual partners had also eight times chance (AOR 8.35; 95% CI 2.8-24.66) to acquire HIV infection compared to their counterpart. Studies conducted in Ababa, India and Nigeria revealed that the habit of multiple sexual practices was associated with HIV infection.^{8,9,15}

Pregnant women shared sharp material were 3 times (AOR 3.1; 95% CI 1.27-7.5) more exposed to HIV as compared to those without sharing of sharp materials. The studies carried out in Dar and Ababa also indicated that previous history of piercing with sharp materials have a statistical association with HIV infection.^{8,11} This may be because of traditional body tattooing, a tooth removal or other home activities which were practiced by using the same sharp materials that make them vulnerable for HIV infections.

In this study, the overall seroprevalence of HBV infection was (4.7% 95% CI, 2.6-6.9%). The prevalence of HBV found in the current study can be graded as intermediate prevalence according to WHO criteria. The prevalence of HBV infection can be divided into three main categories namely: high when the prevalence is >8%, intermediate when the prevalence is between 2-8% and low when <2%.²²

This result is consistent with a study done in Dessie (4.9%), South Ethiopia (6.1%), Addis Ababa (5%), Indonesia (2.8%) and India (6.3%).^{8,10,15,20,23} Conversely, this finding was lower than the results of a study conducted in Dawa (8.4%) and Nigeria (10.3%).^{14,24} However, it is higher than the reported prevalence by

other studies in India (2.4%), Afghanistan (1.5%), Peru (2.11%), Brazil (0.4%) and Guatemala (0.16%).²⁵⁻²⁹ The discrepancies observed in the magnitude of HBV prevalence across a different geographical location might be attributed by differences in socio-demographic characteristics of the study population such as socio-cultural environment, traditional operation, tribal activities, sexual practices, and medical exposure as well as the difference in hepatitis epidemiology.

In the present study, pregnant women who had the history of ear/nose piercing were 8 times (AOR 8.2; 95% CI 1.97-34.5) more infected than the reverse phenomenon. Similarly, studies conducted in Ababa, Dessie and Dawa revealed that ear/nose piercing was significantly associated with HBV infection.^{8,20,24} Study participants with STIs exposed partner were found to be 14 times (AOR 14; 95% CI 2.78-71.6) more infected than their counterparts. A study conducted in Nigeria sought that infected partner and unfaithful sexual relationship were associated risk factors for the HBV infection.⁹ Home care giving mechanisms of infected individuals might play an important role in the transmission of the virus. In addition, because of this ear and/or nose piercing activities were performed at home in traditional ways where there was a chance of using common sharp materials.

This study found low prevalence of syphilis infection, 0.8% (95% CI, 0-1.9%), which was in-line with similar study conducted in Berhan (1.8%), Ababa (0), Cameroon (1.7%), Nigeria (1.1%), India (1.7%), Peru (1.6%) and Guatemala (0.66%).^{7,8,12,14,15,27,29} However; the finding was lower than compared to studies conducted in Gondar (3.7%), Republic of Congo (3.9%), Niger Delta (5%), Tanzania (5%), South Africa (5%) and Brazil (2.8%).^{9,17-19,21,28} The variation might be the result of differences in culture, socioeconomic status, risk factors, level of awareness, and methods used for diagnosis.

CONCLUSION

History of multiple sexual partners, sharing of sharp materials and habits of ear/nose piercing were significantly associated with HIV infection. To halt the spread of these infections, awareness should be created among parents to avoid identified risk factors like sharing of needles for invasive procedures (e.g. ear/nose piercing).

Limitation of the study

One of the limitations of the present study is the use of serological rapid tests only for the diagnosis, which may lead to false positivity and negativity and, as a result, underestimate or overestimate the results of the study. In addition, other seromarker like hepatitis B antigen were not detected.

ACKNOWLEDGEMENTS

Author would like to express deepest gratitude to university of Gondar who allowed to conduct the research. The study participants deserve duly acknowledgement for their willingness to participate in the study.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

- World Bank. Sexually Transmitted Infections In Developing Countries; Current concepts and strategies on improving STI prevention, treatment, and control. <http://www.cddegov/std/program>. 2008;1. Accessed on 01 July 2020.
- Workowski KA, Bolan GA. Sexually transmitted diseases treatment guidelines. *MMWR. Recommendations and reports: Morbidity and mortality weekly report. Recommendations and reports.* 2015;64(RR3);1-137.
- Murray KRMPP. *Medical Microbiology.* 2013 ES. China. Available at: <https://www.elsevier.com/books/medical-microbiology/murray/978-0-323-08692-9>. Accessed on 01 July 2020.
- Khayota Grace N. Prevalence of HSV-2, syphilis and HBV in HIV-1 individuals in selected health facilities in Nairobi, Kenya. *Kenyatta University, Kenya.* 2012: 1-67.
- Kayser T. *Virology; Medical Microbiology.* Ehringer Ingelheim International GmbH Dr Karl Thomae GmbH. 2005: 376-474.
- Jawetz M, Adelberg's. *Medical Microbiology.* The McGraw-Hill Companies. 2010;26th edi.
- Zinabie S, Belachew E, Yidenek T, Lewetegn M, Asfaw T. Sero-prevalence of syphilis and HIV and associated factors in pregnant women attending antenatal care clinics in Debre Berhan Public Health Institutions, Ethiopia. *Am J of Biomed Life Sci.* 2018;6(3):56-62.
- Fissehatsion K, Ali Ibrahim, Ashebir G. Seroprevalence and risk factors of sexually transmitted infections (HIV, HBV and syphilis) among pregnant women provided health care services, Addis Ababa, Ethiopia. *Am J Health Res.* 2017;5(5):154-61.
- Buseri FI SE, Jeremiah ZA. Surveying infections among pregnant women in the Niger Delta, Nigeria. *J Global infectious dise.* 2010;2(3):203.
- Ramos JM, Toro C, Reyes F, Amor A, Gutiérrez F. Seroprevalence of HIV-1, HBV, HTLV-1 and *Treponema pallidum* among pregnant women in a rural hospital in Southern Ethiopia. *J clin virol.* 2011;51(1):83-5.
- Zenebe Y, Mulu W, Yimer M, Abera B. Seroprevalence and risk factors of hepatitis B virus and human immunodeficiency virus infection among pregnant women in Bahir Dar city, Northwest Ethiopia: a cross sectional study. *BMC Infectious Diseases.* 2014;14(1):118.
- Dionne-Odom JM, Rembert R, Tancho NJ, Ekane SH, Enah GH, et al. Hepatitis B, HIV, and syphilis seroprevalence in pregnant women and blood donors in Cameroon. *Infect Dis Obstetr Gynecol.* 2016;2016:4359401.
- Msuya Sia EUJ, Akhtar H, Elizabeth MM, Stig J, Sam Noel E, Stray-Pedersen et al. Prevalence of sexually transmitted infections among pregnant women with known HIV status in northern Tanzania. *Reproductive Health.* 2009;6(1):1.
- Ogundeji AA. Seroprevalence of Human Immunodeficiency Virus, Hepatitis B, Hepatitis C, Syphilis and Co-Infections among Antenatal Women: A Retrospective Case Study at National Hospital Abuja, Federal Capital Territory (FCT), Nigeria. *Texila Intl J Public Health.* 2018;6(2).
- Kaur Paramjit BR, Rupinder S, Bhopal Surinder K, Amandev S. Sociodemographic and seroprevalence profile of sexually transmitted infections (HIV, Hepatitis B, Hepatitis C and Syphilis) in asymptomatic pregnant females. *Int J Reprod, Contra, Obstetr Gynecol.* 2017;6(10):4636-41.
- Ethiopia P. Ethiopia Population-Based HIV Impact Assessment EPHIA 2017-2018. Summary Sheet: Preliminary. December 2018;1:4.
- Niama RF, Bongolo NCL, Kombo ESB, Yengo R, Mayengue PI, Kosso E-BM et al. Syphilis and HIV infections among pregnant women attending antenatal clinics in Republic of Congo. *Pan African Medi J.* 2017;28(1).
- Yahya-Malima KI, Evjen-Olsen B, Matee MI, Fylkesnes K, Haarr L. HIV-1, HSV-2 and syphilis among pregnant women in a rural area of Tanzania: prevalence and risk factors. *BMC Infect Dis.* 2008;8(1):75.
- Melku Mulugeta KA, Zelalem A. Magnitude of HIV and syphilis seroprevalence among pregnant women in gondar, northwest ethiopia: a cross-sectional study. *HIV/AIDS - Research and Palliative Care.* 2015;7:175.
- Seid M, Gelaw B, Assefa A. Sero-prevalence of HBV and HCV infections among pregnant women attending antenatal care clinic at Dessie Referral Hospital, Ethiopia. *Adva Life Sci Health.* 2014;1(2):109-20.
- Thu-Ha Dinh MLK, Msimang V, Likibi M, Molebatsi Y, Goldman T, Lewis DA. Integration of preventing mother-to-child transmission of HIV and syphilis testing and treatment in antenatal care services in the Northern Cape and Gauteng provinces, South Africa. *Sexually Transmitted Dis.* 2013;40(11):846-51.
- Franco Elisabetta BB, Giulia MM, Cristina M, Laura S, Laura Z. Hepatitis B: Epidemiology and prevention in developing countries. *World J hepatol.* 2012;4(3):74.

23. Sari SYI, Rachmawati A, Alisjahbana B, Susanto H. Seroprevalence of HIV, HBV, HCV and syphilis in obstetrics and gynaecology patients in West Java, Indonesia. *Int J Infect Contr.* 2015;11(3).
24. Mekonnen R AD, Belete M. Sero-Prevalence of Hepatitis B Virus and Associated Factors Among Pregnant Mothers Attending Antenatal Care in Public Health Facilities, Dire Dawa. *J Medi Microbiol Diagnosis.* 2018;7(281):2161-0703.
25. Jindal Neerja AU, Sukhwinder S, Bimla D. Prevalence of sexually transmitted infections (HIV, hepatitis B, herpes simplex type 2 and syphilis) among asymptomatic pregnant women. *J Obstetr Gynecol of India.* 2012;62(2):158-61.
26. Todd CS, Ahmadzai M, Atiqzai F, Miller S, Smith JM, Ghazanfar SAS et al. Seroprevalence and correlates of HIV, syphilis, and hepatitis B and C virus among intrapartum patients in Kabul, Afghanistan. *BMC Infect Dis.* 2008;8(1):119.
27. Ormaeche M, Whittembury A, Pun M, Suárez-Ognio L. Hepatitis B virus, syphilis, and HIV seroprevalence in pregnant women and their male partners from six indigenous populations of the Peruvian Amazon Basin, 2007-2008. *Int J Infect Dis.* 2012;16(10):e724-e30.
28. Moura AAdM, Maria Júlia Gonçalves Correia, Jailson B. Prevalence of syphilis, human immunodeficiency virus, hepatitis B virus, and human T-lymphotropic virus infections and coinfections during prenatal screening in an urban Northeastern Brazilian population. *Int J Infect Dis.* 2015;39:10-5.
29. Samayoa B, Anderson MR, Alonso Pacheco KP, Lee C, Pittard A, Soltren A et al. Seroprevalence of HIV, hepatitis B, and syphilis among pregnant women at the general hospital, Guatemala City, 2005-2009. *J Int Associat Physicians in AIDS Care.* 2010;9(5):313-7.

Cite this article as: Nuru H, Nurahmed N, Teka YD, Mohammed F, Ferede G, Abebe W. Seroprevalence and associated risk factors of human immunodeficiency virus, hepatitis B virus and syphilis among pregnant women attending Dessie referral hospital, Northeast Ethiopia. *Int J Sci Rep* 2020;6(11):434-41.