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Original article

Prevalence of hepatitis B virus and its associated factors among pregnant women attending antenatal care in Ambo town, Central Ethiopia: A cross-sectional study

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ABSTRACT

Background: Hepatitis B virus is the most common major hepatic infection. During pregnancy, the hepatitis B virus has an elevated rate of vertical transmission. Fetal hepatitis acquired during pregnancy leading to an impairment of cognitive and physical development in the future lives of children.
Purpose: This study was to assess the prevalence of the hepatitis B virus and its associated factors among pregnant women receiving antenatal care at public health facilities in Ambo town, Central Ethiopia, 2019.
Materials and methods: A cross-sectional facility-based study was conducted among 361 systematically selected pregnant women who received antenatal care from March 25 and May 10, 2019. Data were gathered through face-to-face interviews and blood samples were taken. The data has been cleaned and checked, entered into Epi Data 3.1, and exported into SPSS version 25 for further analysis. Bivariable and multiple logistic regressions were used. The level of statistical significance was reported to be < 0.05.
Results: Prevalence of hepatitis B virus infection was 4.99%. Admission history (AOR = 5.55, 955CI:(1.06, 29.03)], had history tattoo [AOR = 5.31, 95%: CI (1.45, 19.44)], having multiple sexual partners (AOR = 7.22, 95%CI:(1.47, 35.45)], drinking alcohols [AOR = 7.97, 95% CI:(2.39, 26.52)], had history of abortion (AOR = 6.303, 95%CI:(1.45, 27.39) and had history of contact with liver disease person (AOR = 20.64, 95% CI:(2.23, 19.82)] were factors significantly associated with Hepatitis B virus infection.
Conclusions: In this study, the prevalence of the hepatitis B virus was intermediate. Having an admission history, tattoo, multiple sexual partners, drinking alcohol, having a history of abortion, and a having history of contact with family had liver diseases were should be prioritized for interventions aiming at addressing Hepatitis B virus among pregnant women.

1. Introduction

Hepatitis B virus (HBV) infection can result in chronic hepatic infection.[1] Globally, approximately 65 million women of reproductive age groups are infected with hepatitis B virus and 9 in every 10 mothers with hepatitis B infection transmit the diseases to their at the time of birth. Approximately 257 million people were living with chronic hepatitis B virus infection, including 2.7 million co-infected with human papilloma virus.[2,3]

Children born to hepatitis B surface antigen-positive and hepatitis B envelope antigen-positive women have a 70–90% more chance of prenatal acquisition of hepatitis B virus and about 85–90% will become the chronic carrier of the diseases. The World health organization (WHO) recommends screening pregnant mothers for hepatitis B virus infection, providing its vaccine and hepatitis B immune globulin to neonates within the first day of childbirth.[1,4]

The prevalence of hepatitis B virus in Ethiopia, was ranged from 2.40% to 8.40% in pregnant mothers.[5,6] According to world health organization; the prevalence of hepatitis B virus infection is categorized as high (≥8%), intermediate (2–7%), and low if < 2%.[7] Globally, hepatitis B virus infection is a severe public health problem. According to world health organization revealed in 2015, around 257 million persons were living with hepatitis B virus infection.[8] Global burden of disease, the report estimates that around 1.45 million persons died yearly from

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hepatitis B virus infection.[9]

In pregnant women, HBV infection is spread primarily from mother to child during childbirth. Over 90% of vertical transmission was caused by the lack of neonatal prophylaxis. The world health organization result revealed that Ethiopia is categorized as a country with intermediate to hyper endemic hepatitis B virus infections, but it has no national strategy available for its surveillance, prevention and control of hepatitis B virus infections.[10,11]

In Ethiopia, there are more than 5 million people living with hepatitis B in the general population. The prevalence of hepatitis B virus in pregnant women was 4.7%, 3.7%, 4.9%, 8.1% and 3.5% in the Addis Ababa, Jimma, Dessie, Mekelle and Dawuro areas, respectively.[12–17]

Despite the problems, routinely hepatitis B virus screening of pregnant mothers is not given as routine antenatal care services at public health facilities in Ethiopia. Therefore, finding of this study was important for the local health facilities authorities to know the prevalence of HBV among pregnant women and take necessary measures to reduce risk. The findings were also serves as baseline information for future study and serves as a bridge to close the gap of associated factors with HBV infection. Hepatitis B virus infections during pregnancy is associated with a high risk of maternal and infant complications.[18,19] However, the prevalence of hepatitis B virus infections among pregnant women is not known and rare information was available on its factors associating with hepatitis B virus in Ambo town, Ethiopia. Thus, this study was aimed to assess prevalence of hepatitis B virus and its associated factors among pregnant women attending antenatal care in health facilities found in Ambo town, Central Ethiopia.

2. Methods and materials

2.1. Study area, design and period

The study was conducted in the town of Ambo, in the regional state of Oromia, 114 km from Addis Ababa, the capital of Ethiopia. The town of Ambo has a population of 94,153, including 47,058 men and 47,095 women. The estimated numbers of childbearing age (15–49 years old) and pregnant women had 20836 and 3267 respectively. Ambo town has 1 general hospital, 1 referral hospital, and 2 government health centers. A cross-sectional institutional study was conducted among pregnant women who received antenatal care in public health settings between March 25, 2019 and May 5, 2019.

2.2. Study populations

All pregnant women who follow antenatal care (ANC) in public health facilities in Ambo town where source population, while pregnant women who randomly selected from all pregnant women attending antenatal care (ANC) at public health facilities in Ambo Town were taken as the study population.

3. Inclusion and exclusion criteria

3.1. Inclusion criteria

Pregnant women attending ANC at public health institutions during the data collection period.

3.2. Exclusion criteria

Pregnant women who visit more than one public health institutions and have been vaccinated against hepatitis B virus were excluded from the study.

3.3. Sample size determination

The sample size was determined based on a one-population proportion formula. n= (Zα/2)2 p (1−p)/d2 with the assumptions: the (p) prevalence of hepatitis B virus that was taken from the study done from Dire Dawa, Ethiopia which was 8.4%.[20] The significant level at α = 0.05, Z = Level of confidence interval 95% = 1.96, d = Degree of precession (the margin of sampling error to be used = 0.03 with 95% confidence interval, and 10% non-response rate = 33 were used to obtain 361 pregnant mothers.

3.4. Sampling techniques

Four public health facilities located in the town of Ambo offered prenatal care services, namely Ambo General Hospital, Ambo University Hospital and Ambo Health Centers. Study subjects were selected proportionally from each public health facilities by using systematic random sampling techniques depending on the previous two months average flow of pregnant mothers for antenatal care in each health facility (Fig. 1).

3.5. Operational definitions

Hospitalization history: refers to the subject's prior hospital admission history for any disease in the past. History of blood transfusion: relates to the patient's history of blood transfusion for any problem. Sociocultural risk factors: refers to some of the social and cultural activities carried out by the subject under study. Behavioral Risk Factors: refers to some of the occupational misconduct of subjects who have exposed them to the risk of HBV infection from different sources.

3.6. Data collection tools

The data were gathered using a pre-tested questionnaire structured by in-person interview with pregnant women. An English version tool was developed by looking at different literacies[21–25] and then translated into the local language (Oromiffa). The questionnaire was reinterpreted in English by language experts. Three BSc midwives were hired based on their experience in data collection and one MSc supervisor was assigned to supervise. Socio-demographic data, health-related factors, health-related behavioral factors and practices were included on the questionnaire.

4. Variables

4.1. Independent variable

Serostatus of hepatitis B virus.

4.2. Independent variables

The explanatory variables were socio-demographic characteristics such as: age, educational level, income level, occupation, and marital status. History of surgical procedure, blood transfusion and history of dental procedure were taken as health related variables. Body tattooing, ear piercing and abortion, history of Contact with family having Liver disease and multiple sexual partners were taken as risky behaviors and practice variables.

4.3. HBsAg measurement

Approximately 5 mL (ml) of venous blood were collected from an ordinary tube by experienced laboratory technologists of pregnant women. The serum was separated from the whole blood after clotting the samples taken, and a rapid hepatitis B surface antigen test was conducted to obtain the result on the same day and informed their result status. The remaining serum samples were separated and stored at a temperature of −20 °C at the University of Ambo Reference Hospital laboratory. Frozen serum samples were then transported to a Nekemte

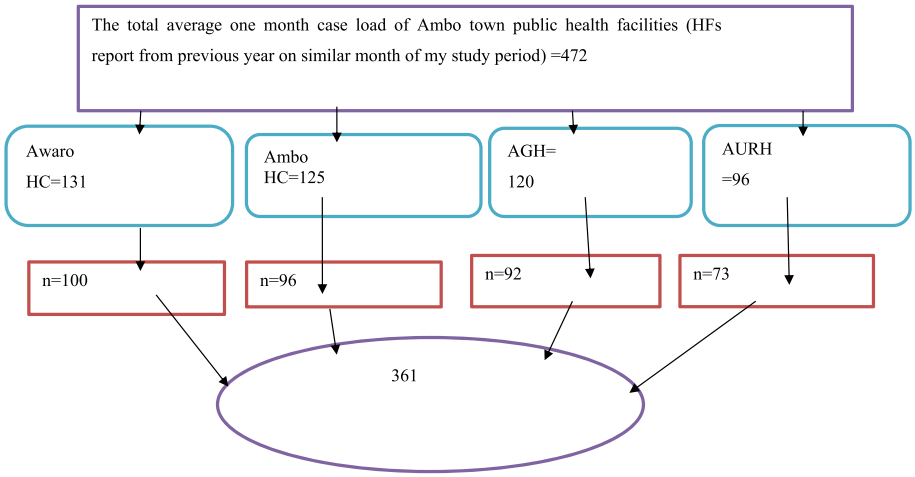

Fig. 1. Schematic presentation of sampling procedure for the selection of study participants in Ambo town public health facilities, West Shoa zone, Ethiopia, 2019.

blood bank using a cold box for the Sorbent Immunoenzyme Test (ELISA) and then retested. All samples were subjected to rapid diagnostic tests based on the principle of immunity chromatography (SD Bioline, Yongin, Korea).

4.4. Data quality management

In order to check the quality of the data, the questionnaire was pretested among the 5% of pregnant women living in a neighboring town of Guder and the necessary modifications were considered accordingly. Two-day training was provided to the supervisor and data collection personnel. The data collection process was overseen and the data collected were examined and verified by the principal investigator. Subsequent data collection was verified to ensure consistency and accuracy. Standard operating procedures were rigorously followed during the collection, storage and testing of blood samples. Storage conditions and expiry date of reagents have been verified. Both positive and negative control serums were used in accordance with the manufacturer's recommendations.

4.5. Data processing and analysis

The collected data were checked for completeness, captured in Epi Data version 3.1 and exported to SPSS version 25 for analysis. Descriptive statistics were also compiled. Binary logistic regression was used to verify the association between the outcome variable and the independent variables. Variables that gave a p-value of less than 0.25 in bivariate analysis were considered candidates for multiple logistic regression analysis. The model was tested for suitability by the Hosmer Lemeshow suitability test. Standard errors were used to identify multicollinearity between the predictor variables. Odds ratio with 95% confidence intervals was used to see the strength of association between each independent variable and outcome variable. Finally, the statistical significance was declared at $p < 0.05$.

4.6. Ethical considerations

Ethical approval to conduct this study was obtained from the ethical clearance committee of Ambo University, College of Medicine and Health Science (Ref. No: AU/PGC/29/2019). The award/grant number for the study was N/A. Then the formal letter was submitted to the Town of Ambo Health Unit, and the letter of support was obtained. The written consent of the study participants was obtained after informing the objective and significance of the study for each participant. To keep participant information confidential, codes were used to indicate that the participant's name and any participant identifiers were not on the questionnaire. Participants were interviewed individually to maintain confidentiality. No participants paid for the test. Voluntary participation was made clear that they could choose to participate or not; and they could still receive all the services they normally do if they chose not to participate. Test results were given to clinicians working at the prenatal clinic and medical and psychological management was given to pregnant women who become positive for the test. The clinical sample taken during the study period was used solely for the stated purposes.

5. Results

5.1. Socio-demographic characteristics' of study participants

Out of 361 expectant mothers receiving antenatal care, the study was carried out. Respondents ranged in age from 18 to 38 years with an average age of 25.05 years (SD 4937). One hundred and fifty-three (42.4%) of participants were found in age groups between 20 and 24. The majority of respondents 343 (95.0%) were married, and 18 (5%) were single. One hundred and eighteen (32.7%) of pregnant women had elementary school (Table 1).

5.2. Prevalence of HBV infected

The overall prevalence of HBV positive was 4.99% [95% CI: (3.0%–7.0%)]. Of the study participants, 20 (5.5%) pregnant mothers were

Table 1
Socio-demographic characteristics of pregnant mothers attending antenatal care in public health facilities in Ambo town, Central Ethiopia, 2019.

Variables	Categories	Number	Percent (%)
Age of respondent in years	≤19	25	6.9
	20–24	153	42.4
	25–30	135	37.4
	≥31	48	13.3
Marital status	Single	18	5.0
	Married	343	95.0
Educational level	Illiterate	48	13.3
	Elementary	118	32.7
	Secondary	100	27.7
	Diploma and above	95	26.3
Occupation	Housewife	192	53.2
	Government employee	66	18.3
	Laborer	95	26.3
	Private employee	8	2.2
Monthly income	≤1634	282	78.1
	≥1634	79	21.9
Gravidity	≤3	306	84.8
	≥4	55	15.2

previously hospitalized, and 4 (20%) were HBsAg reactive. Only 11 pregnant women (3.0%) had a history of blood transfusion, and none were responsive to HBsAg. In terms of sociocultural risk behaviors 43 (11.9%) pregnant mothers who had tattoos on their body parts, 6 (13.95%) of which were considered HBsAg positive. (Table 2).

5.3. Factors associated with hepatitis B viral infection

In bivariable analysis, those who have a hospital admission history, tattoo, multiple sexual partners, had a history of dental procedure, drinking alcohols, abortion and a history of contact with liver disease person showed significant association with sero-positivity of HBsAg. In multivariable logistic regression analysis, only admission history (AOR = 5.55, 955CI:(1.06, 29.03)], tattoo [AOR = 5.31, 95%: CI (1.45, 19.44)], Multiple sexual partners (AOR = 7.22, 95%CI:(1.47, 35.45)], drinking alcohols [AOR = 7.97, 95% CI:(2.39, 26.52)], abortion (AOR = 6.303, 95%CI:(1.45, 27.39) and had history of contact with liver disease person (AOR = 20.64, 95% CI:(2.23, 19.82)] had statistically significant with sero-positivity of HBsAg (Table 3).

6. Discussion

In this study, we assessed the prevalence of hepatitis B virus and related factors among pregnant women receiving antenatal care in public health facilities in Ambo town, Central Ethiopia. We found that the prevalence of HBV was 4.99%. Admission history, tattoos, multiple sex partners, liquor, abortion and contact history with a person with liver disease have revealed statistically significant associations with hepatitis B virus seropositivity. This finding was in line with previous study from Addis Ababa and Dessie that revealed the prevalence of hepatitis B virus was 4.7% and 4.9% respectively,[13,15] but lower than studies conducted in Juba Teaching Hospital, South Sudan, in Nigeria and in Ghana, Mekelle, and Dire Dawa with prevalence of 11%, 16.6%, 9.5% 8.1% and 8.4% respectively.[16,20,27–29] Such discrepancy could be due to the differences in study design, difference in sample size of the study, geographical setting of study populations, and sociocultural factors. In contrast, higher seroprevalence of HBV was observed in similar study in similar study populations in different parts of the world. The present study finding was considerably higher than other previous studies such as: 2.26% from Bulgaria,[30] 2.78% from Pakistan,[31] 2.04% from India.[32] These differences in the seroprevalence might be due to differences in cultural and behavioral characteristics of the pregnant women.

In this study, pregnant mothers with a history of hospital admission were more likely to be seropositive to HBsAg than their counterparts. This finding implies that those pregnant mothers with history of hospitalization are six times more likely to have HBsAg than those without history of hospitalization, which is consistent with study done in Saudi Arabia that reported pregnant women with a history of hospitalization revealed that a significant association with HBV sero-positivity.[26] In the present study history of mothers with multiples sexual partners were around seven times more risk of having sero-positivity of HBsAg compared to those who had no multiples sexual partners. This is similar to a study conducted in the hospital in Dadar, Ethiopia.[24]

In this study, women with a history of abortion had six times the risk compared to women without a history of abortion. This result was in line with previous finding from Jimma, Ethiopia,[14] and Arba Minch, Ethiopia.[5] Abortion could be due to the sexual transmission of hepatitis B virus and instrumentation during an abortion procedure could also contribute to the transmission of hepatitis B virus. In this study having a history of contact with family having liver diseases also was found significantly associated with Hepatitis B virus. Women with a history of contact with family had liver disease history been about twenty one times more risk of having hepatitis B virus than those with no having a history of contact with family having Liver diseases history (AOR = 20.636, 95% CI: 2.23–19.82) but insignificant results were reported in the Goba General Hospital, South East Ethiopia.[26]

Table 2
HBV sero-status by exposure to the hospital associated factors and sociocultural behaviors among pregnant women attending antenatal care at public health facilities in Ambo town, Central Ethiopia, 2019.

Variables	Categories	HBsAg positive (%)	HBsAg negative (%)	Total (%)
Admission history	Yes	4 (22.2%)	16 (4.7%)	20 (5.5%)
	No	14 (77.8%)	327 (95.3%)	341 (94.5%)
Tattoo	Yes	6 (33.3%)	37 (10.8%)	43 (11.9%)
	No	12 (66.7%)	306 (89.2%)	318 (88.1%)
Surgical history	Yes	1 (5.6%)	17 (5.0%)	18 (5%)
	No	17 (94.4%)	326 (95.0%)	343 (95%)
Multiple sexual partners	Yes	4 (22.2%)	10 (2.9%)	14 (3.9%)
	No	14 (77.8%)	333 (97.1%)	347 (96.1%)
Ear piercing	Yes	18 (100.0%)	339 (98.8%)	357 (98.9%)
	No	0 (0.0%)	4 (1.2%)	4 (1.1%)
History of Dental Procedure	Yes	7 (38.9%)	46 (13.4%)	53 (14.7%)
	No	11 (61.1%)	297 (86.6%)	308 (85.3%)
Blood transfusion	Yes	0 (0.0%)	11 (3.2%)	11 (3%)
	No	18 (100.0%)	332 (96.8%)	350 (97%)
Drinking Alcohols	Yes	9 (50.0%)	43 (12.5%)	52 (14.4%)
	No	9 (50.0%)	300 (87.5%)	309 (85.6%)
Abortion	Yes	4 (22.2%)	15 (4.4%)	19 (5.3%)
	No	14 (77.8%)	328 (95.6%)	342 (94.0%)
History of contact with liver disease person	Yes No	2 (11.1%) 340 (99.1%)	3 (0.9% 16 (88.9%)	5 (1.4%) 356 (98.6%)

Table 3
Factors associated with HBV positive among pregnant women attending antenatal care at public health facilities in Ambo town, Central Ethiopia, 2019.

Variables	Categories	COR (95%CI)	AOR (95%CI)
Admission history	Yes	5.84 (1.73–19.76)	5.55 (1.06–29.03)*
	No	1	1
Tattoo	Yes	4.14 (1.47–11.67)	5.31 (1.45–19.44)*
	No	1	1.00
Multiple sexual partners	Yes	9.51 (2.65–34.11)	7.22 (1.47–35.45)*
	No	1	1.00
History of Dental Procedure	Yes	4.11 (1.52–11.14)	3.34 (0.85–13.11)
	No	1	1
Drinking Alcohols	Yes	6.97 (2.63–18.55)	7.97 (2.39–26.52)*
	No	1	1
Abortion	Yes	6.25 (1.83–21.29)	6.30 (1.45–27.39)*
	No	1	1
History of contact with liver disease person	Yes	14.17 (2.21–9.83)	20.67 (2.2–19.8)*
	No	1	1

6.1. Strengths of the study

The blood samples were collected Sorbent Immunoenzyme Test (ELISA) diagnostic method. The study also used prestested standaridized questionnaires to collect information from the study participants.

6.2. Limitations

The study was conducted in public health facilities in the town of Ambo and therefore the research results may not be representative of all pregnant women in the West Shewa area. The interview was conducted in health facilities, such that the study could be subject to socially desirable biases.

7. Conclusion

Hepatitis B virus prevalence was intermediate in the study area. The sero-prevalence of hepatitis B virus was significantly associated among pregnant mothers had an admission history, tattoo, multiple sexual partners, drinking alcohols, abortion and a history of contact with family having liver diseases. Efforts should be made to improve the quality of service in healthcare institutions, in particular to improve aseptic technique in the various procedures. In addition, there should be routine screening of all pregnant mothers for hepatitis B virus infection for early childhood immunization. Health education for the community to prevent tattoo related problems.

Authors' contributions

MG conceptualized the idea, and MG, MRT, and JD analyzed the data. MW wrote the original draft. JD and HO supervised the overall study. MRT prepared the manuscript. All authors contributed to data analysis, drafting the articles, gave final approval of the version to be published, and agree to be accountable for all aspects of the work.

Declaration of interest/Competing interest of statement

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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References

1 Organization WH. *Hepatitis B*; 2019. Available from https://www.who.int/news-room/fact-sheets/detail/hepatitis-b.
2 Global WHO. *Health Sector Strategy on Viral Hepatitis 2016–2021: Towards Ending Viral Hepatitis*. World Health Organization; 2018. Available from: http://www.who.int/hepatitis/.
3 Liu J, Liang W, Jing W, Liu M. Countdown to 2030: eliminating hepatitis B disease, China. *Bull World Health Organ*. 2019;97(3):230–238. https://doi.org/10.2471/BLT.18.219469.
4 Bender TJ, et al. Outbreak of hepatitis B virus infections associated with assisted monitoring of blood glucose in an assisted living facility–Virginia. *PLoS One*. 2010;7(12), e50012, 2012.
5 Yohanes T, Zerdo Z, Chufamo N. *Seroprevalence and Predictors of Hepatitis B Virus Infection Among Pregnant Women Attending Routine Antenatal Care in Arba Minch Hospital, South Ethiopia. Hepatitis research and treatment*. 2016, 2016.
6 Metaferia Y, et al. Seroprevalence and associated risk factors of hepatitis B virus among pregnant women in southern Ethiopia: a hospital-based cross-sectional study. *Epidemiol Health*. 2016;38.
7 Öner S, et al. Hepatitis B, hepatitis C, HIV, and VDRL seroprevalence of blood donors in Mersin, Turkey. *Turk J Med Sci*. 2011;41(2):335–341.
8 Gilbert M, et al. Get checked… where? the development of a comprehensive, integrated internet-based testing program for sexually transmitted and blood-borne infections in British Columbia, Canada. *JMIR Res Protoc*. 2016;5(3), e186.
9 Souza MT, et al. Prevalence of hepatitis B among pregnant women assisted at the public maternity hospitals of São Luís, Maranhão, Brazil. *Braz J Infect Dis*. 2012;16(6):517–520.
10 Gasim GI, Murad IA, Adam I. Hepatitis B and C virus infections among pregnant women in Arab and African countries. *J Infect Dev Countries*. 2013;7:566–578, 08.
11 Lazarus J. *Global Policy Report on the Prevention and Control of Viral Hepatitis in WHO Member States*. 2014.
12 Schweitzer A, et al. Estimations of worldwide prevalence of chronic hepatitis B virus infection: a systematic review of data published between 1965 and 2013. *Lancet*. 2015;386(10003):1546–1555.
13 Bayuh F. *Prevalence of Hepatitis B Surface Antigen and KAP towards HBV Infection, Among Pregnant Women Attending Selected Antenatal Clinics in Addis Ababa, Ethiopia*. Addis Ababa; 2014.
14 Awole M, Gebre-Selassie S. Seroprevalence of HBsAg and its risk factors amoung pregnant women in Jimma, Southwest Ethiopia. *Ethiop J Health Dev*. 2005;19(1):45–50.
15 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. *Adv Life Sci Health*. 2014;1(2):109–120.
16 Semaw A, Awet H, Yohannes M. Sero-prevalence of hepatitis B surface antigen and associated factors among pregnant mothers attending antenatal care service, Mekelle, Ethiopia: evidence from institutional based quantitative cross-sectional study. *World Acad Sci, Eng Technol: Med Health Sci*. 2015;2(9).
17 Chernet A, Yesuf A, Alagaw A. Seroprevalence of hepatitis B virus surface antigen and factors associated among pregnant women in Dawuro zone, SNNPR, Southwest Ethiopia: a cross sectional study. *BMC Res Notes*. 2017;10(1):418.
18 Ethiopia FDRo. *National Expanded Programme on Immunization Comprehensive Multi-Year Plan 2011–2015*. Fedral Ministry of Health Addis Ababa; 2010.
19 Eyong EM, et al. The prevalence of HBsAg, knowledge and practice of hepatitis B prevention among pregnant women in the Limbe and Muyuka Health Districts of the South West region of Cameroon: a three-year retrospective study. *Pan Afr Med J*. 2019;32.
20 Mekonnen, et al. SeroPrevalence of hepatitis B virus and associated factors among pregnant mothers attending antenatal care in public health facilities, Dire Dawa. *J Med Microbiol Diagn*. 2018;3(7).
21 Cho Y, et al. The prevalence and risk factors for hepatitis B surface Ag positivity in pregnant women in eastern region of Ghana. *Gut Liver*. 2012;6(2):235.
22 Walle F, et al. Prevalence of hepatitis B surface antigen among pregnant women attending antenatal care service at Debre-Tabor Hospital, Northwest Ethiopia. *Ethiop J Health Sci*. 2008;17(17):13–20.
23 Ndako JA, et al. Hepatitis B virus sero-prevalence among pregnant females in Northern Nigeria. *Res J Med Sci*. 2012;6(3).
24 Umare A, et al. Hepatitis B virus infections and associated factors among pregnant women attending antenatal care clinic at Deder Hospital, Eastern Ethiopia. *PLoS One*. 2016;11(11).
25 Desalegn Z, et al. Hepatitis B and human immunodeficiency virus co-infection among pregnant women in resource-limited high endemic setting, Addis Ababa, Ethiopia: implications for prevention and control measures. *Eur J Med Res*. 2016;21(1):16.
26 Erena AN, Tefera TB. Prevalence of hepatitis B surface antigen (HBsAg) and its risk factors among individuals visiting Goba General Hospital, South East Ethiopia, 2012. *BMC Res Notes*. 2014;7(1):833.
27 Kirbak ALS, Ng'ang'a Z, Omolo J, Idris H, Usman A, Mbabazi WB. Sero-prevalence for Hepatitis B virus among pregnant women attending antenatal clinic in Juba Teaching Hospital, Republic of South Sudan. *Pan Afr Med J*. 2017;26. https://doi.org/10.11604/pamj.2017.26.72.11410.
28 Kolawole. Seroprevalence of hepatitis B surface antigenemia and its effects on hematological parameters in pregnant women in Osogbo, Nigeria. *Virol J*. 2012;9:317. https://doi.org/10.1186/1743-422X-9-317.
29 Richard E, Isaac D, Samuel A, Joyce A, Hope A. Seroprevalence and risk factors of Hepatitis B and Hepatitis C infections among pregnant women in the Asante Akim North Municipality of the Ashanti region, Ghana; a cross sectional study. *Afr Health Sci*. 2015;15:3.
30 Tsankova G, Kostadinova T, Todorova T. Seroprevalence of hepatitis B among pregnant women in Varna region, Bulgaria. *J Med Virol*. 2016;4(1):25–28. https://doi.org/10.1002/jmv.
31 Jamil A, Hamid S, Aziz Q. Prevalence of Hepatitis B amongst pregnant women. *JIMDC*. 2018;7(2):195.
32 Ruchika G, Asha N, Saroj S, Richa S, Shikha S, Rekha R. Seroprevalence of hepatitis B surface antigen among pregnant women in a tertiary care health center of North India. *J South Asian Fed Obstetr Gynecol*. 2017;9(2):164–168. https://doi.org/10.5005/jp-journals-10006-1484.