Prevalence of Hepatitis B virus Infection and Associated Risk Factors Among Pregnant Women Attending Antenatal Care Clinics in Kofele Town, Oromia Region, Ethiopia

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Abstract

Hepatitis B virus (HBV) infection is one of the major public health problems affecting many people worldwide. This cross-sectional study was conducted to assess the prevalence and associated factors of HBsAg carriage among pregnant women attending antenatal care clinics in Kofele Town, Oromia Region, Ethiopia from January to April, 2016. A total of 270 pregnant women were recruited using systematic random sampling method. Structured questionnaires were used to collect data on socio-demography and risk factors for HBsAg carriage. Moreover, venous blood samples were collected from all study participants and sera were analyzed for HBsAg marker using SD BIOLINEHBsAg strip test. The prevalence of HBsAg among pregnant women was 5.9%. The age of the women varied from 17–41 years (mean age 24.5 years) and 40.0% were in the age category of 20–24 years. Participants with no formal education (AOR= 6.2; 95% CI= 1.35-28.74, P= 0.019) and had a history of abortion were at higher odds of being HBsAg carrier (AOR= 6.23; 95% CI= 1.74-22.5, P= 0.005). The study showed an intimidate prevalence of HBV infection on the basis of the World Health Organization HBV endemic definition (5-7% HBsAg prevalence). Therefore, screening pregnant women for HBV infection and making the vaccine available to exposed babies need to be emphasized.

Key words: Hepatitis B virus, HBsAg, pregnant women

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INTRODUCTION

Hepatitis B virus (HBV) infection is a challenging global health problem (Liaw and Chu, 2009). There have been more than 2 billion HBV infected people globally; 240 million of which are chronically infected. In the absence of expanded and accelerated response, the number of people living with HBV is projected to remain high for the next 40–50 years, with a cumulative 20 million deaths occurring until 2030 (WHO, 2016). An estimated 57% of cases of liver cirrhosis and 78% of cases of primary liver cancer result from HBV infection (Perz et al., 2006). Chronic viral hepatitis also results in loss of productivity (Su et al., 2010).

The prevalence of chronic HBV infection varies widely according to geographical area, and predominant routes of transmission (Maddrey, 2000). The global prevalence of chronic HBV infection varies widely, from high (≥8 %, e.g. Africa and Asia) to intermediate (2-7%) e.g. Southern and Eastern Europe) and low (<2%, e.g. Western Europe, North America and Australia) (World Health Organization, 1990). A medium to high endemicity of HBV was reported in Ethiopia (Tsega, 2000).

Perinatal transmission is the major route of HBV transmission in many parts of the world, and an important factor in maintaining the reservoir of infection (Franco et al., 2012). In the absence of prophylaxis, a large proportion of viraemic mothers, especially those who are seropositive for HBeAg, transmit the infection to their infants at the time of, or shortly after birth (Franco et al., 2012). The risk of perinatal infection increased if the mother has acute hepatitis B in the second or third trimester of pregnancy or within two months of delivery. The risk of developing chronic infection is about 90% following perinatal infection (up to 6 months of age) but decreases to 20–60% between the ages of 6 months and 5 years(Ranger-Rogezand Denis, 2004).

HBV infection in pregnancy can cause coagulation defects, postpartum hemorrhage, organ failure, high maternal mortality and poor outcomes of their newborns such as stillbirths, neonatal deaths, acute and chronic liver disease, hepatocellular carcinoma and increased premature delivery (Elsheikhet et al., 2007). Globally, perinatal HBV transmission accounts for an estimated 21% of HBV related deaths in neonates. It ranges from 13% in the Eastern Mediterranean region to 26% in the Western Pacific region (Sookoian , 2006).

In Ethiopia, HBV screening is not recognized as an essential component of a quality antenatal care service package and the infection is often left undiagnosed among pregnant women. Thus, infected mothers may pass the infection on to their babies. In the absence of a large country data on HBV prevalence among pregnant women, small scale studies in various localities may generate valuable information to plan interventions. This study aimed to determine the prevalence and risk factors of HBsAg carriage among pregnant women in Ethiopian

settings where HBV screening is not a part of antenatal care (ANC) services.

MATERIALS AND METHODS

A facility based cross- sectional study was conducted in two health centers (Kofele and Roba health centers) in Kofele District of the West Arsi Zone, Oromia Region from January to April, 2016. The majority of the population in the area belongs to Oromo ethnic group (97%) and Muslim religion (93.7%). The health centers provide antenatal care services including HIV and syphilis screening.

The study population consisted of all pregnant women who attended the antenatal care (ANC) clinics of the health centers during the study period. However, those women who were mentally and physically incapable of being interviewed or refused to consent were excluded. The sample size was estimated using a single population proportion formula, with the assumption of HBV prevalence among pregnant women to be 6.1 % (Ramos et al., 2011) and level of confidence 95%. A precision of 3 % was taken considering the suggestion that one half of the estimated prevalence would be appropriate incases prevalence is lower than 10% or higher than 90% (Nainget al., 2006). Thus, the sample size was calculated to be 270. ANC attendees were recruited into the study using a systematic random sampling method. On the basis of the health center's plan and a prior three-month performance document review, a total of 562 pregnant women were estimated to visit the ANC clinics of the health centers. This estimate was divided by the sample size to determine sample interval (k value), which would be two. The 1stserved pregnant woman and every 2nd woman thereafter were invited to participate in the study until the required sample size was obtained.

A pre-tested and structured questionnaire was used to collect information on socio-demography, risky sexual behavior, history of hospital admission, history of abortion and contact with HBV infected individuals. Nurses or health officers working in the ANC clinics of the health centers interviewed the study participants. Trained laboratory personnel drawn 5 ml of venous blood from each study participant, and sera were tested for HBsAg marker using SD BIOLINE Strip Test (Standard Diagnostic Inc, Korea) according to the manufacturer's instruction. The sensitivity and specificity of the kit was >99.9%.

Data were summarized and analyzed using SPSS version 23 software. Multivariable logistic regression analysis was performed for those socio-demographic and risk behavior factors found to be significantly associated with HBsAgsero status in bivariate logistic regression analysis. Odds ratio (OR) and its corresponding 95% confidence interval (CI) were calculated to measure the strength of association. In all cases p-value less than 0.05 was considered statistically significant.

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Ethical approval was obtained from the Institutional Review Board of College of Medicine and Health Sciences, Hawassa University. Permission to conduct the study was also obtained from Oromia Health Bureau, West Arsi Zone Health Department and respective health centers administrations. All participants were given adequate information regarding the purpose, risk, benefit, and confidentiality of the study. Participation was fully voluntary based on informed consent. Code numbers were used in place of identifiers to maintain the confidentiality of participant's information. The study incurred no cost to the study participants and HBsAg testing was performed free of charge. Participants who tested HBsAg positive were managed by responsible health care workers.

RESULTS

In the study period, a total of 270 women who attended the antenatal clinics, 170 in Kofele and 100 in Roba Health Centers, were included. Thus, 62.6% of the participants were from Kofele Health Center and 37.4% from Roba Health Center. The mean age was 24.5 years (standard deviation of 4.59; range 17–41years), and 40.0% were in the age category of 20–24 years. Urban residents accounted for 50.4%, and most participants (95.2%) were married. The majority (85.2%) of the respondents was housewives, and 40.0% had completed a secondary school level education (Table 1).

Table 1: Socio-demographic characteristics of pregnant women attending antenatal clinics at Kofele town, Oromia Region, Ethiopia, 2016

Variable	Category	Kofele Health Center (N=170) (%)	Roba Health Center (N=100) (%)	Total (N=270) (%)
Age (in years)	15-24	54.7	43.0	50.4
	25-34	43.5	53.0	47.0
	35 and above	1.8	4.0	2.6
Residence	Urban	79.4	1.0	50.4
	Rural	20.6	99.0	49.6
Marital status	Single	2.9	1.0	2.2
	Married	95.3	95.0	95.2
	divorced	1.8	3.0	2.2
	Widowed	0.0	1.0	0.8
Educational status	No formal education	18.2	28.0	21.9
	Primary education	30.6	51.0	38.1
	Secondary and above	51.2	21.0	40.0
Occupation	Employed	8.2	0.0	5.2
	Housewife	78.2	97.0	85.2
	Merchant	10.0	0.0	6.3
	Others	3.5	3.0	3.3

Out of the 270 pregnant women tested for HBsAg, 16 were found to be positive, making the sero-prevalence 5.9% (Table 2). The highest sero prevalence of HBsAg was observed among pregnant women in the age range of 35 years and above (28.6 %), followed by those aged 25-34 years (7.1%). Concerning site of residence, 5.9 % of urban dwellers were sero-positive for HBsAg compared to 6%in rural dwellers. The sero-positivity rate was 16.7% among women who never married. It seems that HBsAgsero-positivity was higher among merchants (11.8%) and in those pregnant women with no formal education (16.9%), although difference was not found to be statistically significant (P > 0.05). Moreover, there was no statistically significant association between HBsAg and residence, marital status, or occupational status.

In bivariate analysis, the prevalence of HBsAg positivity increased with age, with the highest risk at 35 years of age and above compared with those in the age range 15-24 years (COR 10.48; 95% CI 1.62-67.8, P = 0.014). Similarly, the educational status was significantly associated with HBsAg (COR 7.14; 95% CI 1.88-27.11).

Further analysis, after adjustment for those significantly associated variables, using multivariable logistic regression showed that educational status of the study participant influenced the rate of HBV infection and those with no formal education had 6.2 times higher risk of acquiring HBV infection (AOR= 6.2; 95% CI= 1.35-28.74, P= 0.019) compared to women who had completed secondary school and above level. However, the association between HBsAg and age did not remain statistically significant in the multivariable analysis.

Table 2: Distribution of HBsAg by socio-demographic characteristics of pregnant women attending the antenatal care clinics of KofeleTown, Oromia Region, Ethiopia, 2016

Socio-demographic variables	Categories	Total N (%)	Positive for HBsAg N (%)	Crude OR (95% CI)	Adjusted OR(95%CI)	P-value
Age(in years)	15-24	136(50.4)	5(3.7)	1	1	
	25-34	127(47.0)	9(7.1)	1.99(0.65-6.13)	1.55(0.39-6.08)	0.527
	35 and above	7(2.6)	2(28.6)	10.48(1.62-67.8)	6.72(0.36-124.2)	0.200
Residence	Urban	136(50.4)	8(5.9)	0.98(0.35-2.7)		
	Rural	134(49.6)	8(6.0)	1		
Marital Status	Single	6(2.2)	1(16.7)	3.47(0.38-31.76)		
	Married	257(95.2)	14(5.4)	1		
	Divorced	6(2.2)	1(16.7)	3.47(0.38-31.76)		
	Widowed	1(0.4)	0(0.0)			
Educational Status	No formal education	59(21.9)	10(16.9)	7.14(1.88-27.11)	6.2(1.35-28.74)	0.019
	Primary education	103(38.1)	3(2.9)	1.05(0.20-5.32)	1.36(0.25-7.37)	0.723
	Secondary and above	108(40.0)	3(2.8)	1	1	
Occupation	Employed	14(5.2)	1(7.1)	1.39(0.16-11.59)		
	Housewife	230(85.2)	12(5.2)	1		
	Merchant	17(6.3)	2(11.8)	2.42(0.49-11.83)		
	Others	9(3.3)	1(11.1)	2.27(0.26-19.66)		

NB: *Candidate variable for multivariate analysis at P<0.25 *variable significant at P<0.05,1: reference

HBsAg sero positivity was not significantly higher in pregnant women who had ear piercing (6.3%) than who did not have this practice (3.3%) (Table 3). Among pregnant women that reported a history of abortion, 22.6% were positive for HBsAg compared to those with no history of abortion (3.8%). The bivariate logistic regression analysis showed that a history of abortion was significantly associated with HBsAg (COR 7.45; 95% CI 2.54-21.80; P <0.001). The association of HBsAg sero-positivity with previous contact with patients having history of liver disease was marginally non-significant (COR 4.39; 95% CI 0.85-22.65; P = 0.077). In multivariable logistic regression analysis, a history of abortion was also found to be a significant predictor of HBV infection (AOR 6.23; 95% CI 1.74-22.5, P= 0.005). However, there was no statistically significant association between HBV infection and body tattooing, history of surgical procedures, gestational age, gravidity, previous place of birth, hospital admission, history of multiple sexual partners, and history of blood transfusion.

Table 3.Bivariate and multivariate analyses of factors associated with HBV infection of pregnant women attending the antenatal care clinics of Kofele town, Oromia Region, Ethiopia, 2016

Socio-demographic variables	Categories	Total N (%)	positive for HBsAg N (%)	Crude OR (95% CI)	AOR (95%CI)	P-value
Ear piercing	Yes	240(88.9)	15(6.3)	1.9(0.24-15.18)		
	No	30(11.1)	1(3.3)	1		
History of multiple sexual practice	Yes	16(5.9)	1(6.3)	1.06(0.13-8.59)		
	No	254(94.1)	15(5.9)	1		
History of surgical Procedure	Yes	7(2.6)	1(14.3)	2.75(0.31-24.38)		
	No	263(97.4)	15(5.7)	1		
History of blood transfusion	Yes	2(0.7)	0(0)			
	No	268(99.3)	16(6)			
Gravidity	Primigravida	83(30.7)	4(4.8)	1		
	Multi gravida	187(69.3)	12(6.4)	1.35(0.42-4.33)		
History of abortion	Yes	31(11.5)	7(22.6)	7.45(2.54-21.80)	6.23(1.74-22.5)	0.005*
	No	239(88.5)	9(3.8)	1	1	
Previous place of delivery	No birth	83(30.7)	4(4.8)	1	1	
	Home	93(34.4)	10(10.8)	2.38(0.71-7.89)	0.85(0.18-3.90)	0.832
	Health institution	94(34.8)	2(2.1)	0.43(0.07-2.40)	0.15(0.02-1.16)	0.69
Gestational age	1st trimester	19(7)	1(5.3)	0.95(0.11-8.05)		
	2nd trimester	145(53.7)	8(5.5)	1		
	3rd trimester	106(39.3)	7(6.6)	1.21(0.42-3.45)		
Pervious contact with liver disease	Yes	10(3.7)	2(20)	4.39(0.85-22.65)	2.23(0.22-22.0)	0.494
	No	260(96.3)	14(5.4)	1	1	
Hospital admission	Yes	20(7.4)	3(15)	3.22(0.83-12.39)	2.99(0.53-6.89)	0.214
	No	250(92.6)	13(5.2)	1	1	
Tattooing	Yes	86(31.9)	8(9.3)	2.26(0.81-6.23)	0.8(0.22-2.87)	0.733
	No	184(68.1)	8(4.3)	1	1	

NB: *Candidate variable for multivariate analysis at P<0.25 *variable significant at P<0.05, 1: reference

DISCUSSION

In this study, the overall sero-prevalence of HBsAg among pregnant women was (5.9 %) which is an intermediate endemicity of HBV infection according to the classification criteria of (World Health Organization, 1990). The prevalence we reported is similar with results in various localities in Ethiopia: 6.1% in south Ethiopia (Ramos et al., 2011),3% in Addis Ababa (central Ethiopia) (Tegegne et al., 2014),4.9 % in Dessie (northeast Ethiopia) (Seid et al., 2014)and 3.8%in Bahir Dar (Zenebe et al., 2014).This highlights that pregnant women in Ethiopia may have similar risk of exposure to and/or rate of HBsAg clearance.

The current finding is also similar to the reported rates of HBsAg among pregnant women in different African countries: 8% in Mali (MacLean et al., 2012), 4.2% in Nigeria (Ezechi et al., 2014), and 6.3% in Tanzania (Hasegawa et al., 2006). However, contrasting the result of this study, higher prevalence rates were also reported from high endemic African countries: 12.5% in Benin (Lai and Yuen, 2007) and 16% in Ghana (Andernach et al., 2009). The difference in the rate of HBsAg may be due to diverse risk factors involved in various geographical regions and different diagnostic methods employed. There are studies that used more sensitive laboratory methods (ELISA and PCR) compared to the rapid diagnostic test employed in the present study.

Regarding socio-demographic status of the study participants, educational status had significant association with HBV infection where pregnant women with no formal education had 6.2 times higher risk of having HBsAg compared to those who completed a secondary school level education and above. This finding was also supported by other reports from Dessie in Ethiopia (Seid et al., 2014), Cameroon (Ezegbudo et al., 2004) and Nigeria (Scott et al., 1997).The possible cause for this higher prevalence of HBV infection among pregnant women with no formal education may be related to a low level of awareness about the transmission and methods of prevention.

This study showed a significant association between HBsAg positivity and history of abortion. Those who had history of abortion were 6.23 times more likely to have HBsAg marker than their counter parts. A similar study, which was conducted in Dessie (Seid et al., 2014) identified this variable as significant associated factor for HBsAg prevalence. Abortion may be related to unprotected sexual intercourse resulting in unplanned pregnancies. Thus, HBV infection might be contracted as a result of unprotected sexual contact or due to abortion with inadequately sterilized instruments since most induced abortion in Ethiopia remains predominantly unsafe and clandestine (Sundaram et al., 2010).

Although the difference was not significant, a higher rate of HBsAg among pregnant women in the age range of 35 years and above in the current study agrees with a similar study done in Nigeria (Alegbeleye et al., 2013). An increasing HBsAg carriage rate with this age group may be explained by the cumulative effect phenomena in which an exposure to HBV infection increase with time (Mansour et al., 2012).

The current study showed a history of blood transfusion was not associated with rate of HBsAg carriage, which is also in line with the result in Jimma (Awole and Gebre-Selassie, 2005). However, in contrast to this finding, blood transfusion was significantly associated with sero-prevalence of HBV in other studies in Ethiopia (Walle et al., 2008; Zenebe et al., 2014). In fact, the small number of pregnant women with a history of blood transfusion in the current study may result in weaker statistical power to be able to assess the rate difference. Similar to a finding reported from Sana'a, Yemen (Murad et al., 2013), we also observed no difference in seropositivity of HBsAg between urban and rural pregnant mothers. However, a study from Eastern Sudan has shown a significantly higher prevalence of HBsAg among pregnant mothers from urban areas than the rural counterparts (Abdallah and Mohamed, 2013). The observed similar distribution in seropositivity in our context may highlight no difference in rate of HBV transmission and/ or HBsAg clearance rate by residence site.

Our study has some limitations in light of which results need to be interpreted. We used rapid diagnostic tests, which are less sensitive than ELISA or PCR tests and may underestimate the prevalence. We investigated HBV prevalence based on HBsAg marker and did not use other markers such as HBeAg, anti-HBe antibodies. Furthermore, the smaller sample size used resulted in a widened confidence interval for some of the variables. Despite these shortcomings, this study generated valuable information on HBV infection among pregnant women in a setting of very limited epidemiological data

CONCLUSION

In conclusion, the prevalence of HBsAg among pregnant mothers attending ANC clinics in Kofele town was intermediate. Pregnant women with no formal education and those with a history of abortion were at higher odds of being HBsAg carrier. Therefore, screening pregnant women for HBV infection and making the vaccine available to exposed babies has to be emphasized. In addition, Oromia Regional Health Bureau and health facilities in the region need to work on preventive measures against unwanted pregnancies and unsafe abortion to child bearing age women. Moreover, Kofele and RobaHealth Centers should give health information on transmission and prevention of HBV to child bearing age women.

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Conflict of interest

The authors have no conflict of interest to declare for this study.

REFERENCES

Abdallah T.M., Mohamed M.H. and Ali A.A. 2013. Seroprevalence and epidemiological factors of hepatitis B virus infection in Eastern Sudan. *Int. J. Med. Med. Sci*. (7): 239-241.

Alegbeleye J.O., Nyengidik T.K. and Ikimal J.I. 2013. Maternal and neonatal seroprevalence of hepatitis B surface antigen in a hospital based population in

South-South, Nigeria. *Int. J. Med. Med. Sci*. 5(5): 241-246.

Andernach I.E., Hübschen J.M. and Muller C.P. 2009. Hepatitis B virus. The genotype E puzzle. *Rev. Med. Virol*. 19 (1): 231-240.

Awole M. and Gebre-Selassie S. 2005. Sero-prevalence of HBsAg and its risk factors among pregnant women in Jimma, Southwest Ethiopia. *Ethiop. J. Health Dev.* 19(1): 45-50.

Elsheikh R.M., Daak A.A., Elsheikh M.A., Karsany M.S. and Adam I. 2007. Hepatitis B virus and hepatitis C virus in pregnant Sudanese women. *Virol. J*. 4(1): 104.

Ezechi O.C., Kalejaiye O.O., Gab-Okafor C.V., Oladele D.A., Oke B.O., Musa Z.A., et al. 2014. Sero-prevalence and factors associated with Hepatitis B and C co-infection in pregnant Nigerian women living with HIV Infection. *Pan Afr. Med. J.* 17: 197.

Ezegbudo C.N., Agbonlahor D.E., Nwobu G.O., Igwe C.U., Agba M.I., Okpala H.O. et al, 2004. The seroprevalence of hepatitis B surface antigen and human immune deficiency virus among pregnant women in Anambra State, Nigeria. *Shiraz E-Med. J.* 5(2): 4-8.

Franco E., Bagnato B., Marino M.G., Meleleo C., Serino L. and Zaratti L. 2012. Hepatitis B: Epidemiology and prevention in developing countries. *World J. Hepatol*. 4(3): 74-80.

Hasegawa I., Tanaka Y., Kurbanov F., Yoshihara N., E.l.-Gohary A., Lyamuya E., et al. 2006. Molecular epidemiology of hepatitis B virus in the United Republic of Tanzania. *J. Med. Virol*. 78: 10.

Lai C.L. and Yuen M.F, 2007. The natural history and treatment of chronic hepatitis B: a critical evaluation of standard treatment criteria and end points. *Ann. Int. Med*. 147(1): 58-61.

Liaw Y.F. and Chu C.M. 2009. Hepatitis B virus infection. *The lancet* 373(9663): 582-592.

Linear Chemicals S.L. Joaquim Costa 18 2ª planta. 08390 Montgat, Barcelona, SPAIN. Website www.linear.es.

MacLean B., Hess R.F., Bonvillain E., Kamate J., Dao D., Cosimano A. and Hoy S. 2012. Seroprevalence of hepatitis B surface antigen among pregnant women attending the Hospital for Women and Children in Koutiala, Mali. *South Afr. Med. J.* 102(1): 47-49.

Maddrey W.C. 2000. Hepatitis B: an important public health issue. *J. Med. Virol*. 61(3): 362-366.

Mansour W., Malick F.Z., Sidiya A., Ishagh E., Chekaraou M.A., Veillon P. et al. 2012. Prevalence, risk factors, and molecularepidemiology of hepatitis B and hepatitis delta virus in pregnant women and in patients in Mauritania. *J. Med. Virol*. 84: 1186-1198.

Mast E.E., Margolis H.S., Fiore A.E., Brink E.W., Goldstein S.T., Wang S.A., et al, 2005. A comprehensive immunization strategy to eliminate transmission of hepatitis B virus infection in the United States. *MMWR* 54(16): 1-32.

Murad E.A., Babiker S.M., Gasim G.I., Rayis D.A., and Adam I. 2013. Epidemiology of hepatitis B and hepatitis C virus infections in pregnant women in Sana'a, Yemen. *BMC Pregnancy Childbirth* 13(1): 1.

Naing, L., Winn, T. and Rusli, B.N. 2006. Practical issues in calculating the sample size for prevalence studies. *Arch. Orofac. Sci.* 1(1): 9-14.

Perz J.F., Armstrong G.L., Farrington L.A., Hutin Y.J. and Bell B.P. 2006. . The contributions of hepatitis B virus and hepatitis C virus infections to cirrhosis and primary liver cancer worldwide. *J. Hepatol.* 45(4): 529-538.

Ramos J.M., Toro C., Reyes F., Amor A., Gutiérrez F., 2011. Seroprevalence of HIV-1, HBV, HTLV-1 and Treponema pallidum among pregnant women in a rural hospital in Southern Ethiopia. *J. Clin. Virol.* 51(1): 83-85.

Ranger-Rogez S. and Denis F.O, 2004. Hepatitis B mother-to-child transmission. *Expert. Rev. Anti. Infect. Ther.* 2(1): 133-145.

Scott-Wright A., Hakre S., Bryan J.P., Jaramillo R., Reyes L.G., Cruess D. et al. 1997. Hepatitis B virus, human immunodeficiency virus type-1, and syphilis among women attending prenatal clinics in Belize, Central America. *Am. J. Trop. Med. Hyg*. 56(3): 285-290.

Seid M., Gelaw B. and Assefa A. 2014. Sero-prevalence of HBV and HCV infections among pregnant women attending antenatal care clinic at Dessie Referral Hospital, Ethiopia. *Adv. Life Sci. Health.* 1(2): 109-120.

Sookoian S. 2006. Liver disease during pregnancy: acute viral hepatitis. *Ann. Hepatol.* 5(3): 231-236.

Su J., Brook R.A., Kleinman N.L. and Corey-Lisle P. 2010. The impact of hepatitis C virus infection on work absence, productivity, and healthcare benefit costs. *Hepatol*. 52(2): 436-442.

Sundaram A., Vlassoff M., Bankole A., Remez L. and Gebrehiwot Y. 2010. Bernstein HBS. Benefits of meeting the contraceptive needs of Ethiopian women. New York: Guttmacher Institute 2(1):34-37.

Tegegne D., Desta K., Tegbaru B. and Tilahun T. 2014. Seroprevalence and transmission of Hepatitis B virus among delivering women and their new born in selected health facilities, Addis Ababa, Ethiopia: a cross sectional study. *BMC Res. Notes* 7(1): 239.

Tsega E. 2000. Epidemiology, prevention and treatment of viral hepatitis with emphasis on new developments. *Ethiop. Med. J.* 38(2): 131-141.

Walle F., Asrat D., Alem A., Tadesse E. and Desta K, 2008. Prevalence of hepatitis B surface antigen among pregnant women attending antenatal care

service at Debre-Tabor Hospital, Northwest Ethiopia. *Ethiop. J. Health. Sci.* 17(1): 13.

Weinbaum C.M., Mast E.E. and Ward J.W. 2009. Recommendations for identification and public health management of persons with chronic hepatitis B virus infection. *Hepatol*. 49(5): S34-44.

World Health Organization. Global health sector strategy on viral hepatitis 2016-2021. Towards ending viral hepatitis.7-9.

World Health Organization, 1990. Protocol for assessing prevalence of Hepatitis B infection in antenatal patients. In Protocol for assessing prevalence of hepatitis B infection in antenatal patients. World Health Organization.

Zenebe Y., Mulu W., Yimer M. and Abera B. 2014. Sero-prevalence and risk factors of hepatitis B virus and human immunodeficiency virus infection among pregnant women in Bahir-Dar City, Northwest Ethiopia. *BMC Infect. Dis.* 118: 2-7