



## Seroprevalance of Hepatitis B among Pregnant Women and Neonates Born to HBsAg Positive Mothers in Batman

Batman'da Gebelerde ve HBsAg Pozitif Anneden Doğan Yenidoğanlarda HBsAg Seroprevalansı

Esin ÇEVİK<sup>1</sup>, Neşe İNAN<sup>2</sup>, Mehmet Baki ŞENTÜRK<sup>3</sup>, Aslıhan DEMİREL<sup>1</sup>, Hayat KUMBASAR<sup>4</sup>, Ayşe ARISOY<sup>2</sup>, Emine SÖNMEZ<sup>1</sup>

<sup>1</sup>Istanbul Bilim University Faculty of Medicine, Departments of Infectious Diseases and Clinical Microbiology, İstanbul, Turkey

<sup>2</sup>Istanbul Bilim University Faculty of Medicine, Department of Microbiology, İstanbul, Turkey

<sup>3</sup>Bakırköy Dr. Sadi Konuk Training and Research Hospital, Clinics of Obstetrics and Gynecology, İstanbul, Turkey

<sup>4</sup>Haseki Training and Research Hospital, Clinics of Infectious Diseases and Clinical Microbiology, İstanbul, Turkey

### ABSTRACT

**Objectives:** The aim of this study was to determine hepatitis B surface antigen (HBsAg) seroprevalance among pregnant women and neonates born to HBsAg-positive mothers admitted to Batman Gynecology, Obstetrics and Pediatrics Hospital located in Batman Province in, the Southeastern Anatolian Region of Turkey.

**Materials and Methods:** All pregnant women admitted to the obstetrics and gynecology unit between April 2008 and December 2010 were screened for HBsAg. Neonates born to HBsAg-positive mothers were also evaluated once for HBsAg seropositivity between 6 and 9 months of age. HBsAg presence was measured by the electrochemiluminescence immunoassay method using Modular analytics E170 analyser according to the manufacturer's recommendations.

**Results:** The mean age of the pregnant women was 30.13±6.58 years. 15585 consecutive pregnant women were screened for HBsAg, retrospectively. HBsAg positivity rate was found to be 4.2% (668/15585) in the pregnant women while it was 20.5% (137/668) in neonates born to HBsAg-positive mothers between 6 to 9 months of age.

**Conclusion:** These findings demonstrate the prevalence of HBsAg among pregnant women and neonates born to HBsAg-positive mothers in Batman. Although HBsAg seropositivity rate among the pregnant women was found to be similar to the rates that were reported in other studies from the Southeastern Anatolian Region of Turkey. The fact that this rate was high for the neonates born to HBsAg-positive mothers was attributed to the insufficient immunoprophylaxis of the neonates. The identification and close follow-up of HBsAg-positive mothers is essential to make the complete and appropriate immunoprophylaxis in all neonates born to HBsAg-positive mothers and to prevent transmission of HBV. (Viral Hepatitis Journal 2014; 20(3): 115-119)

**Key words:** HBsAg seroprevalance, hepatitis B, pregnancy

**Conflict of interest:** The authors reported no conflict of interest related to this article.

### ÖZET

**Amaç:** Bu çalışmanın amacı, Batman Kadın Doğum ve Çocuk Hastalıkları Hastanesi'ne başvuran gebe kadınlarda ve hepatit B yüzey antijenini (HBsAg) pozitif annelerden doğan yenidoğanlarda HBsAg seroprevalansının araştırılmasıdır.

**Gereç ve Yöntemler:** Nisan 2008-Aralık 2010 tarihleri arasında Kadın Doğum kliniğine başvuran gebe kadınlar HBsAg varlığı açısından taranmıştır. Ayrıca, HBsAg pozitif annelerden doğan bebekler 6-9 aylık dönemlerinde bir kez HBsAg pozitifliği açısından değerlendirilmiştir. HBsAg varlığı elektrokemilüminesans enzim immunoassay yöntemi ile Modular Analytics E170 analizöründe üretici firma önerileri doğrultusunda araştırılmıştır.

**Bulgular:** Çalışmaya alınan gebe hastaların yaş ortalaması 30,13±6,58 yıl idi. Çalışmaya HBsAg açısından ardışık olarak taranan 15585 gebe dahil edilmiş ve HBsAg sonuçları retrospektif olarak değerlendirilmiştir. Gebelerde HBsAg pozitiflik oranı %4,2 (668/15585) olarak saptanırken, HBsAg pozitif annelerden doğan yenidoğanların 6.-9. aylık dönemlerinde ölçüldüğünde bu oran %20,5 (137/668) olarak bulunmuştur.

**Sonuç:** Bu bulgular Batman'da gebe kadınlarda ve HBsAg pozitif annelerden doğan yenidoğanlarda seroprevalansını göstermektedir. HBsAg seropozitiflik oranı Türkiye'nin Güneydoğu Anadolu bölgesinde daha önce bildirilmiş çalışmalarla benzer oranda bulunmuş olmasına rağmen, HBsAg pozitif annelerden doğan yenidoğanlarda bu oran yüksek bulunmuştur ve bu durum yenidoğanlara immunoprofilaksinin yetersiz uygulanması ile açıklanabilir. HBsAg pozitif anneden doğan yenidoğanlara tam ve uygun immunoprofilaksinin yapılması ve HBV bulaşının önlenmesi için gereklidir. (Viral Hepatit Dergisi 2014; 20(3): 115-119)

**Anahtar kelimeler:** HBsAg seroprevalansı, hepatit B, gebe

**Çıkar çatışması:** Yazarlar bu makale ile ilgili olarak herhangi bir çıkar çatışması bildirmemişlerdir.

## Introduction

Hepatitis B virus (HBV) infection is a major public health problem in the world. It is estimated that more than 350 million people are chronic HBV carriers worldwide. About 25% of them will develop chronic hepatitis or cirrhosis and may develop hepatocellular carcinoma, eventually (1). In the previous decade, the prevalence of HBsAg positivity has declined from 4.19% to 2.10% in Turkey. Despite this reduction, Turkey is still located in the intermediate endemic areas of HBV infection. It is known that HBV seroprevalence increases from the western to eastern parts of Turkey (2-12.5%). The vertical transmission is still a very important mode of HBV transmission, especially in high endemic areas (2). The prevalence of HBsAg positivity in pregnant women has been found to be between 2.1% and 16.6% in many epidemiologic clinical trials in Turkey (3). Mother-to-child transmission occurs often, either in utero or through exposure to blood or blood-contaminated fluids at or around birth (4). Such prenatal transmission can be prevented with the identification of HBsAg-seropositive women and administration of immunoprophylaxis to their newborns (1). Women with hepatitis have an increased risk for adverse perinatal outcome and pregnancy-related complications, and careful surveillance is warranted (5,6). HBV infection early in life usually results in chronic infection and 25% of these infected persons will die prematurely from cirrhosis and liver cancer (7). Thus, screening for HBsAg during pregnancy has gained importance and, prevention of vertical transmission by vaccination and immunoprophylaxis is critical (8). The aims of this study were to determine the rate of HBsAg seropositivity among pregnant women and neonates born to HBsAg-positive mothers in Batman, to compare the results with the data previously reported from other regions of the country and to add the data to the national epidemiological data.

## Materials and Methods

We investigated the seroprevalence of HBsAg in 15585 pregnant women who were admitted to the obstetrics and gynecology unit between April 2008 and December 2010 in Batman Maternity Hospital. The mean age of participants was  $30.13 \pm 6.58$  years. HBsAg presence was measured from serum samples of pregnant women by an electrochemiluminescent immunoassay method using Modular Analytics E170 analyser (Roche Diagnostics GmbH, Mannheim, Germany) according to the manufacturer's recommendations. The results were evaluated retrospectively. Newborn infants of HBV-positive mothers received both recombinant vaccine and hepatitis B immunoglobulin (HBIG) within 72 hours after delivery while neonates born to HBsAg-negative mothers received just recombinant vaccine in accordance with the universal vaccination programme of the Ministry of Health if the labor occurred in this hospital. Vaccine schedule was 0, 1 and 6 months. Neonates born to HBsAg-positive mothers were followed up and they were also screened once for HBsAg seropositivity between their 6 and 9 months of age by the same method.

## Results

The mean age of the pregnant women was  $30.13 \pm 6.58$  years. 15585 consecutive pregnant women admitted to the Batman

Gynecology, Obstetric and Pediatrics Hospital located in Batman Province were screened for HBsAg, retrospectively. HBsAg positivity rate was found to be 4.2% (668/15585) in pregnant women and 20.5% (137/668) in neonates born to HBsAg-positive mothers between their 6 and 9 months of age.

## Discussion

HBV screening has been recommended by the Advisory Committee on Immunization Practices (AICP) for all pregnant women during an early prenatal visit in each pregnancy, even if they previously have been vaccinated or tested (9). HBV screening allows identification of infants requiring immunoprophylaxis with HBV vaccine and HBIG, antiviral treatment of pregnant carriers if indicated, and counseling of sexual and household contacts (10). Maternal screening programs and active and passive immunoprophylaxis have reduced transmission of HBV dramatically (11). However, 10-20% of children born to HBV carrier mothers, especially when the mother is highly viremic and HBeAg-positive, become HBsAg carriers, despite receiving active-passive immunoprophylaxis (9,10,11). It has been reported that

**Table 1.** HBsAg positivity rates of different cities from all over Turkey

Study	Year	City	Total sample	HBsAg (%)
Erdem et al. (16)	1994	Ankara	1224	4.33
Kuru et al. (17)	1996	İstanbul	5366	4.2
Kaleli et al. (18)	1997	Denizli	312	7.69
Kanadalı et al. (19)	1997	Erzurum	282	6.3
Gul et al. (20)	1998	Van	98	4.08
Şengür et al. (21)	1999	İstanbul	624	5.2
Sağsöz et al. (22)	2002	Kırkkale	157	4.9
Zeteroglu et al. (23)	2002	Van	1125	3.2
Tosun et al. (24)	2003	Manisa	760	4.2
Karaca et al. (25)	2003	İstanbul	460	4.7
Yılmaz et al. (26)	2004	Afyon	244	2.9
Kaynakgoz et al. (27)	2008	İstanbul	351	4.6
Atılğan et al. (28)	2009	Rize	1130	2.56
Dundar et al. (29)	2009	İstanbul	3503	2.2
Altınbaş et al. (2)	2010	Ankara	4700	2.8
Koksaldı et al. (30)	2010	Hatay	5410	1.5
Coskun et al. (33)	2011	İstanbul	795	3.65
Gonen et al. (31)	2011	Düzce	1028	3.3
Varol et al. (32)	2011	Edirne	1526	3.0
Karlıdag et al. (33)	2011	Elazığ	5120	1.9
Araz et al. (34)	2011	Gaziantep	11840	2.1
Cicek et al. (35)	2012	Şanlıurfa	56275	3.5
Kolgelier et al. (8)	2012	Adıyaman	9420	4.7
Yıldız et al. (36)	2012	Diyarbakır	2900	2.66
Ozlu et al. (37)	2013	Bolu	653	1.8

**Table 2.** HBsAg positivity rates of different cities from different countries

Study	Year	Country	Total sample	HBsAg (%)
Sami et al. (39)	1998	Pakistan	5902	4.6
Lin et al. (40)	1999	Taiwan	10327	15.5
Madzime et al. (41)	1999	Zimbabwe	984	25
El-Magrahe et al. (38)	2004	Libya	1500	1.5
Bertolini et al. (42)	2004	Brazil	3188	1.7
Denis et al. (43)	2006	France	22859	0.65
Stroffolini et al. (44)	2006	Italy	10881	1.7
Harder et al. (45)	2008	Denmark	140376	0.26
Okoth et al. (46)	2009	Kenya	2241	9.3
Papaevangelou et al. (1)	2009	Greece	3760	2.89
Gutiérrez-Zufiaurre et al. (47)	2010	Spain	2929	0.4
Rabiu et al. (48)	2010	Nigeria	1052	6.08
Zhang et al. (49)	2010	China	6398	6.71
Ramos et al. (50)	2011	Southern Ethiopia	165	6.1
Lobstein et al. (51)	2011	Germany	8193	0.48
Mehta et al. (52)	2013	India	1038	2.9
Murad et al. (53)	2013	Sudan	400	10.8

the failure rate of the immunoprophylaxis was up to 28% in babies born to HBeAg-positive mothers (12). In a prospective study, HBV transmission rates were 3% from HBV DNA-positive mothers, 7% from HBeAg-positive mothers and 9% from mothers with high HBV DNA levels (12). Dwivedi et al. reported that only 0.9% (37/4000) of pregnant women were HBsAg-positive (13). Vertical transmission rate was 65% (13/20) in neonates born to mothers positive for HBeAg and HBV DNA, conversely, it was only 9.1% when the mothers were HBeAg- and HBV DNA-negative. In this study, HBsAg seropositivity rate in the neonates was found to be 20.5% (137/668). However, we could not determine the factors that could contribute to the rate of HBV transmission such as HBeAg status and HBV DNA levels in the mothers. In addition, we did not know the exact number of deliveries outside the hospital that could explain the insufficient immunoprophylaxis in some cases and the HBsAg positivity ratio in those neonates.

Turkey is located in an intermediate endemic area for HBV infection, but the prevalence of HBV infection varies across various regions of the country (3). It has been shown that HBsAg positivity rate among pregnant women ranged between 1.9% and 8.4% with an average of 4.4% (14). The HBsAg prevalence in pregnant women has been found to be 4.2-4-9% in the cities of the western and central regions of Turkey; it was 4.7-12.3% in the Eastern and South-eastern regions of Turkey (15). According to our results, HBsAg positivity rate was 4.2% (668/15585) in pregnant women and this result is in accordance with other prevalence rates in this region of Turkey. HBsAg seroprevalence rates of pregnant women among different cities are shown in Table 1.

Geographical differences may explain the variation in seroprevalence rates of HBsAg among pregnant women from different countries (38). HBsAg seropositivity rates among pregnant women from different countries are shown in Table 2.

The prevalence rate of HBsAg in the present study (4.2%) was lower than the rate reported by Lin et al. (15.5%) from Taiwan, by Madzime et al. (25%) from Zimbabwe, by Okoth et al. (9.3%) from Kenya, Rabiu et al. (6%) from Nigeria, by Zhang et al. (6.7%) from China, by Ramos et al. (6.1%) from Ethiopia, and by Murad et al. (10.8%) from Sudan (40,41,46,48,49,50,53). On the other hand, HBsAg prevalence rate in this study was high when compared to the rates reported from developed countries such as Greece, France, Italy, Denmark, Spain, and Germany (1,43,44,45,47,51).

The prevalence may also vary with ethnicity and immigration patterns. Lobstein et al. found that 0.48% of pregnant women were HBsAg carriers, in line with other data showing lower rates in the Eastern parts of Germany compared to the Western part (51). Furthermore, the prevalence was much lower in German-born women (0.2%) in comparison to Asian-born women (9.1%).

The present study has some limitations. First, we did not know the HBeAg positivity and HBV DNA level in the HBsAg-positive women, since they were the most important risk factors for neonatal HBV transmission. Second, all pregnant women were screened for HBsAg positivity before delivery; all infants born to HBsAg-positive mother presumed vaccinated and received HBIG within 72 hours after birth. However, HBsAg positivity rate of 20.5% indicates that close follow-up and further improvement in universal implementation of immunoprophylaxis is also necessary.

## Conclusion

All pregnant women should be tested for HBsAg during each pregnancy, preferable in the first trimester. They should be retested at the time of admission for delivery if HBsAg test result is not available or if the mother was at the risk for infection during pregnancy. The infants of HBsAg-positive mothers

should receive vaccination and postexposure immunoprophylaxis to prevent perinatal transmission according to the WHO (World Health Organisation) and the CDC (Centers for Diseases Control and Prevention) recommendations. Although HBV vaccination has been the routine vaccination schedule for newborns in Turkey since 1998, screening of pregnant women in terms of HBV should be done. Our aim should be to control hepatitis B infection all over the country and to convert our intermediate endemic status into a low endemic region by continuing the HBV prenatal screening and hepatitis B immunization program in Turkey.

## References

- Papaevangelou V, Hadjichristodoulou C, Cassiomas D, Theodoridou M. Adherence to the screening program for HBV infection in pregnant women delivering in Greece. *BMC Infect Dis.* 2006; 6: 84.
- Altınbas S, Erdogan M, Danisman N. The Seroprevalence of HBsAg and Anti-HCV in pregnant women in Ankara. *Arch Gynecol Obstet.* 2010; 281(2): 371.
- Coskun El, Dincgez B, Koyucu RG, Ayanoglu YT, Yumru AE. Gebelerde HBsAg, AntiHBs ve Anti-HCV sıklığı. *Perinatal.* 2011; 19(2): 51-102.
- Lee C, Gong Y, Brok J, Boxall EH, Gluud C. Effect of hepatitis B immunisation in newborn infants of mothers positive for hepatitis B surface antigen: systematic review and meta-analysis. *BMJ.* 2006; 332(7537): 328-336.
- Reddick KL, Jhaveri R, Gandhi M, James AH, Swamy GK. Pregnancy outcomes associated with viral hepatitis. *J Viral Hepat.* 2011; 18(7):394-398.
- Safir A, Levy A, Sikuler E, Sheiner E. Maternal hepatitis B virus or hepatitis C virus carrier status as an independent risk factor for adverse perinatal outcome. *Liver Int.* 2010; 30(5): 765-770.
- Lee NM, Brady CW. Liver Disease in pregnancy. *World J Gastroenterol.* 2009; 15(8): 897-906.
- Kolgelier S, Demir LS, Demir NA, Özçimen S, Tabak S. Adıyaman İlindeki Gebelerde HBsAg ve Anti-HCV Pozitifliği. *Vir Hep Derg.* 2012; 18(3): 98-101.
- Gambarin-Gelwan M. Hepatitis B in pregnancy. *Clin Liver Dis.* 2007; 11: 945-963.
- Yogeswaran K, Fung SK. Chronic hepatitis B in pregnancy: unique challenges and opportunities. *Korean J Hepatol.* 2011; 17: 1-8.
- Tran TT. Management of hepatitis B in pregnancy: Weighing the options. *Cleve Clin J Med.* 2009; 76(Suppl 3): 25-29.
- Wiseman E, Fraser MA, Holden S, Glass A, Kidson BL, Heron LG, Maley MW, Ayres A, Locarnini SA, Levy MT. Perinatal transmission of hepatitis B virus: an Australian experience. *Med J Aust.* 2009; 190(9): 489-492.
- Dwivedi M, Misra SP, Misra V, Pandey A, Pant S, Singh R, Verma M. Serorevalence of hepatitis B infection during pregnancy and risk of perinatal transmission. *Indian J Gastroenterol.* 2011; 30(2): 66-71.
- Mıstık R, Balık İ. Türkiye’de viral hepatitlerin epidemiyolojik analizi. Ed. Kılıçturgay K, Badur S. *Viral Hepatit.* 2001. İstanbul. 2001:10-55.
- Tekay F, Özbek E. Şanlıurfa Kadın Hastalıkları ve Doğum Hastanesine Başvuran kadınlarda hepatit B, hepatit C ve insan immün yetmezlik virüsü seropozitifliği. *Mikrobiyol Bült.* 2006; 40: 369-373.
- Erdem M, Şahin I, Erdem A, Gürsoy R, Yıldız A, Güner H. Prevalence of hepatitis B surface antigen among pregnant women in a low-risk population. *Int J Gynaecol Obstet.* 1994; 44(2): 125-128.
- Kuru U, Turan O, Kuru N, Sağlam Z, Ceylan Y, Nurluoğlu M, Ağacıdan A. Prevalence of hepatitis B virus infection in pregnant Turkish women and their families. *Eur J Clin Microbiol Infect Dis.* 1996; 15(3): 248-251.
- Kaleli B, Kaleli I, Aktan E. Gebelerde ve bebeklerinin kordon kanlarında HBsAg. *Perinatoloji Derg.* 1997; 5: 42-43.
- Kanadalı A, Çelebi S, Aydos SK, Kanadalı S, Ayyıldız A. Erzurum’da hepatitis B virusunun perinatal geçiş sıklığı. *AÜTD.* 1997; 29: 450-452.
- Gul A, Turkdogan MK, Zeteroglu S. Bir grup gebede hepatit B ve hepatit C prevalansı. *Perinatoloji Dergisi.* 1998; 6: 67-69.
- Şengür CS, Orbay E, Aksoy H, Gökçe K, Ünal O. The prevalence of hepatitis B virüs in healthy and high risk pregnant. *J Kartal TR.* 1999; 10(3): 761-764.
- Sağöz N, Apan T. Gebelerde tetanoz, hepatit B ve rubella seropozitiflik oranları *T Klin J Gynecol Obst.* 2002; 12: 52-55.
- Zeteroglu S, Sahin G, Devci A, Güvercinci M, Sürücü R. Van ili bölgesindeki gebelerde HBV ve HCV seroprevalansı. *Vir Hep Derg.* 2002 (1): 433-435.
- Tosun S, Erensoy S, Ozacar T, Yücebilgin S, Altınay B. Gebelerin ve bebeklerin hepatit virus enfeksiyonları yönünden araştırılması ve izlenmesi. *Türk Mikrobiyol Cem Derg.* 2003; 33: 153-159.
- Karaca Ç, Karaca N, Usta T, Demir K, Kaymakoglu S, Besişik F. Gebe popülasyonunda hepatit B, C, D virus enfeksiyonu sıklığı ve hepatit C virusunun perinatal yolla geçiş oranı. *Akademik Gastroenteroloji Derg.* 2003; 2: 122-124.
- Yılmaz M, Altındiş M, Cevrioğlu S, Fenkçi V, Aktepe O, Sırthan E. Afyon bölgesinde yaşayan gebe kadınlarda toksoplazma, sitomegalovirus, rubella, hepatit B, hepatit C seropozitiflik oranları. *Kocatepe Tıp Dergisi.* 2004; 5: 49-53.
- Kaynakgoz OO. Gebelerde HBsAg ve Anti-HCV seroprevalansı. SB İstanbul Eğitim ve Araştırma Hastanesi Aile Hekimliği Uzmanlık Tezi. İstanbul 2008.
- Atılğan R, Kavak SB, Çelik A. Gebelerde hepatit B ve hepatit C seropozitiflik oranları. *Türkiye Klinikleri J Gynecol Obst.* 2009; 19: 34-37.
- Dundar Ö, Çelik S, Tütüncü L, Ergür AR, Atay V, Müngen E. 2000-2005 yılları arasında kliniğimizde doğum yapan gebelerde hepatit B, hepatit C, HIV, Toxoplazma ve Rubella prevalansının araştırılması. *Zeynep Kamil Tıp Bülteni.* 2009; 1: 1-9.
- Köksaldı MV, Evirgen Ö, Aksakal M, İnci M, Önlen Y, Ocak S. Hatay Doğum ve Çocuk Bakımevi Hastanesi’ne Başvuran Kadınlarda Hepatit B ve Hepatit C Seropozitifliği. *Viral Hepatit Derg.* 2010; 16: 53-56.
- Gönen İ. Kırsal Kesimde Gebelerde HBV ve HCV sıklığı. *Viral Hepatit Dergisi.* 2011; 17(2): 66-68.
- Varol FG, Sayın NC, Soysüren S. Trakya yöresinde antenatal bakım alan gebelerde Toxoplazma gondii antikor seroprevalansı. *J Turk Soc Obstet Gynecol.* 2011; 8: 93-99.
- Karlıdag GE. Elazığ kent merkezinde bir hastaneye başvuran gebelerde HBsAg seroprevalansı. *FÜ.Sağ.Bil.Tıp Derg.* 2011; 25(3): 111-113.
- Araz NC, Dikensoy E. Seroprevalence of hepatitis B among pregnant women in southern Turkey. *J Pak Med Assoc.* 2011; 61(2): 176-177.
- Cicek AC, Duygu F, İnakçı İH. Şanlıurfa ilinde kadın hastalıkları ve doğum hastanesinde başvuran kadınlardaki hepatit B ve hepatit C seroprevalansı: Üç yıllık değerlendirme. *Vir Hep Derg.* 2012; 18(1): 15-18.
- Yıldız B, Erten Bucaktepe G, Yıldız İ, Kara İH. Kadın Hastalıkları ve doğum kliniğinde yatan gebeler ile diğer hastaların HBsAg ve Anti-HCV seropozitiflik oranları ve risk faktörleri ile ilişkileri. *Konuralp Tıp Dergisi.* 2012; 4(3): 27-34.

37. Ozlu T, Tas T, Mengeloglu FZ, Kocoglu E, Donmez ME. Üçüncü basamak bir hastanedeki gebe ve/veya jinekolojik hastalıklı kadınlarda HBsAg, anti-HCV ve anti-HIV sıklığı. *J Clin Exp Invest*. 2013; 4(2): 166-170.
38. El-Magrahe H, Furarah AR, El-Figih K, El-Urshfany S, Ghengesh KS. Maternal and neonatal seroprevalence of Hepatitis B surface antigen (HBsAg) in Tripoli, Libya. *J Infect Dev Ctries*. 2010; 4(3): 168-170.
39. Sami S, Korejo R, Bhutta SZ. Prevalence of hepatitis B and C: a Jinnah Postgraduate Medical Centre experience. *J Obstet Gynaecol Res*. 2009; 35(3): 533-538.
40. Lin CC, Hsieh HS, Huang YJ, Huang YL, Ku MK, Hung HC. Hepatitis B virus infection among pregnant women in Taiwan. *BMC Public Health*. 2008; 7(8): 49.
41. Madzime S, Adem M, Mahomed K, Woelk GB, Mudzamiri S, Williams MA. Hepatitis B virus infection among pregnant women delivering at Harare Maternity Hospital, Harare Zimbabwe, 1996 to 1997. *Cent Afr J Med*. 1999; 45(8): 195-198.
42. Bertolini DA, Pinho JR, Saraceni CP, Moreira RC, Granato CF, Carrilho FJ. Prevalence of serological markers of hepatitis B virus in pregnant women from Parana State, Brazil. *Brazil J Med Biol Res*. 2006; 39(8): 1083-1090.
43. Denis F, Ranger-Rogez S, Alain S, Mounier M, Debrock C, Wagner A, Delpyroux C, Tabaste JL, Aubard Y, Preux PM. Screening of pregnant women for hepatitis B markers in a French Provincial University Hospital during 15 years. *Eur J Epidemiol*. 2004; 19: 973-978.
44. Stroffolini T, Bianco E, Szklo A, Bernacchia R, Bove C, Colucci M, Cristina Coppola R, D'Argenio P, Lopalco P, Parlato A, Ragni P, Simonetti A, Zotti C, Mele A. Factors affecting the compliance of the antenatal hepatitis B screening programme in Italy. *Vaccine*. 2003; 21: 1246-1249.
45. Harder KM, Cowan S, Eriksen MB, Krarup HB, Christensen PB. Universal screening for hepatitis B among pregnant women led to 96% vaccination coverage among newborns of HBsAg positive mothers in Denmark. *Vaccine*. 2011; 29(50): 9303-9307.
46. Okoth F, Mbutia J, Gatheru Z, Murila F, Kanyingi F, Mugo F, Esamai F, Alavi Z, Otieno J, Kiambati H, Wanjuki N. Seroprevalence of hepatitis B markers in pregnant women in Kenya. *East Afr Med J*. 2006; 83(9): 485-493.
47. Gutierrez-Zufiaurre N, Sanchez-Hernández J, Munoz S, Marín R, Delgado N, Saenz MC, Muñoz-Bellido JL, García-Rodríguez JA. Seroprevalence of antibodies against *Treponema pallidum*, *Toxoplasma gondii*, rubella virus, hepatitis B and C virus, and HIV in pregnant women. *Enferm Infecc Microbiol Clin*. 2004; 22(9): 512-516.
48. Rabiou KA, Akinola OI, Adewunmi AA, Omololu OM, Ojo TO. Risk factors for hepatitis B virus infection among pregnant women in Lagos, Nigeria. *Acta Obstet Gynecol Scand*. 2010; 89(8): 1024-1028.
49. Zhang S, Li RT, Wang Y, Liu Q, Zhou YH, Hu Y. Seroprevalence of hepatitis B surface antigen among pregnant women in Jiangsu, China 17 years after introduction of hepatitis B vaccine. *Int J Gynaecol Obstet*. 2010; 109(3): 194-197.
50. Ramos JM, Toro C, Reyes F, Amor A, Gutierrez 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): 83-85.
51. Mehta KD, Antala S, Mistry M, Goswami Y. Seropositivity of hepatitis B, hepatitis C, syphilis, and HIV in antenatal women in India. *J Infect Dev Ctries*. 2013; 7(11): 832-837.
52. Murad EA, Babiker SM, Gasim GI, Rayis DA, Adam I. Epidemiology of hepatitis B and hepatitis C virus infections in pregnant women in Sana'a, Yemen. *BMC Pregnancy and Childbirth*. 2013; 13: 127.
53. Lobstein S, Faber R, Tillmann HL. Prevalence of hepatitis B among pregnant women and its impact on pregnancy and newborn complications at a tertiary hospital in the eastern part of Germany. *Digestion*. 2011; 83(1-2): 76-82.