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Original Article

Serologic Profile of Hepatitis B Virus among Pregnant Women in Kafr El-Sheikh Governorate, Egypt

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Abstract

Background: Infection with the hepatitis B virus (HBV) is a worldwide public health issue. Egypt is classified as an area of intermediate endemicity. Hepatitis B has high materno-fetal transmission. Infants who are infected through their mothers are at a significant risk of acquiring chronic liver disease.
Objective(s): To determine the prevalence and associated risk factors of HBV infection among pregnant females in Kafr El-Sheikh Governorate as well as to compare HBV serologic profile among HBV vaccinated and non-vaccinated pregnant women.
Methods: A cross sectional study was performed on 456 pregnant women attending antenatal care clinics at Kafr El-Sheikh general hospitals. This study was carried out from June 2020 through February 2021. Sociodemographic data were collected through a predesigned questionnaire. Study participants were screened for hepatitis B core antibody (anti-HBc), hepatitis B surface antibody (anti-HBs) and hepatitis B surface antigen (HBsAg). Positive ones for the latter were subjected to hepatitis B e antigen (HBeAg) detection.
Results: The majority of pregnant women (73%) were susceptible to HBV infection, while 2.4% had immunity following infection and 12.4% had immunity related to vaccination. HBsAg was detected in 1.8% and sole anti-HBc detected in 9.9%. There was a significant statistical association between HBsAg positivity and age, lack of vaccination, family history of HBV infection and unsafe injection.
Conclusion: The prevalence of HBsAg among pregnant women in Kafr El-Sheikh Governorate was 1.8% especially in those with risk factors. Thus, it is highly recommended that the Ministry of Health and Population should implement a program to screen all pregnant women for HBV at the antenatal care units. In addition, hepatitis B vaccine proved to be an effective tool against HBV infection among studied pregnant women.

Keywords: Hepatitis B virus, pregnancy, hepatitis B virus markers, HBsAg, sole anti-HBc, materno-fetal transmission, vaccine

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INTRODUCTION

HBV infection is a serious infection, and is considered within the most fatal ten health problems.[1, 2] It is one of the silent killers because many people are not aware that they have HBV infection till late stages.[3] HBV can develop chronic hepatitis and put people at high risk of mortality from cirrhosis and liver cancer in up to 5% of adults and up to 90% of infections occurring within the first year of life. HBV infection affects 296 million people worldwide, with 1.5 million new infections occurring each year. Hepatitis B caused an estimated 820 000 deaths in 2019, largely from cirrhosis and primary liver cancer (hepatocellular carcinoma).[4]

HBsAg is the most used test for diagnosing acute HBV infections or detecting carriers. HBsAg can be detected as early as one or two weeks and as late as eleven or twelve weeks after exposure to HBV. Anti-HBc develops in all HBV infections, appears shortly after HBsAg in acute disease, and generally persists for life. Anti-HBc indicates HBV infection at some undefined time in the past. Anti-HBs is a protective, neutralizing antibody. The presence of anti-HBs following acute HBV infection generally indicates recovery and immunity against reinfection. Anti-HBs can also be acquired as an immune response to hepatitis B (HepB) vaccine. HBeAg is a marker that is associated with a high number of infective HBV particles in the serum and a higher risk of infectivity.[5] In Egypt, HBV is considered intermediately endemic, with prevalence between 3 to 11% mainly in males.[6] Pregnant women infected with hepatitis B can transmit the infection to their new born through perinatal transmission.[7] This is usually associated with little knowledge about HBV among pregnant women as

well as absence of HBV screening in antenatal care units.[8]

The probability of materno-fetal transmission is increased when there is active hepatitis, positive HBeAg, or significant viral replication.[9] However, hepatitis B vaccination and one dose of hepatitis B immune globulin (HBIG) administered within 24 hours after birth are 85% to 95% effective in preventing chronic HBV infection.[5] Routine HBV vaccination for children aged 2, 4, and 6 months was introduced in Egypt in 1992. [10] These factors highlight the significance of including HBV screening by testing for HBsAg in antenatal care programs.[11] To our knowledge, routine HBV testing for pregnant women is not performed at antenatal care clinics.

This study aimed to assess markers of HBV infection and its associated risk factors among pregnant females in Kafr El-Sheikh Governorate as well as to compare HBV serologic profile among HBV vaccinated and non-vaccinated pregnant women.

METHODS

A total of 456 pregnant women attending antenatal care clinics at Kafr El-Sheikh general hospitals were enrolled in this cross-sectional study. This study was conducted from June 2020 through February 2021. Using Epi info 7 software a sample size of 456 pregnant females was required to detect 5% prevalence of HBV among pregnant women.[12] Calculation was done based on a margin of error 2% and alpha error 0.05%. Pregnant women of all ages and at any trimester were included in this study. Pregnant women were consecutively enrolled till reaching the required sample size.

The research was approved by the High Institute of Public Health (HIPH) Ethics Committee as well as the Ministry of Health and Population Ethics Committee. After obtaining a written consent from each pregnant woman, a pre-designed questionnaire sheet was completed for each participant including an inquiry about personal data, medical history and obstetric history. We informed their obstetrician with the results of this work to carry out the appropriate measures required for both the women and their newborns.

Five milliliters of blood were drawn from all pregnant women enrolled in this study. To separate the serum, 5000 rpm centrifugation was done. Sera were stored at -20^{o}C until used for detection of HBsAg, anti-HBc and anti-HBs by enzyme linked immunosorbent assay (ELISA).[13] Samples positive for HBsAg were subjected to HBeAg ELISA testing. All laboratory work was carried out at the Microbiology Laboratory of HIPH.

Statistical methodology

Data were fed into the computer and analysed with the IBM SPSS software package version 20.0. IBM Corp., Armonk, NY. Qualitative data were described using numbers and percentages. To ensure that the distribution was normal, the Kolmogorov-Smirnov test was used. Quantitative data were described using the following terms: range (minimum and maximum), mean, standard deviation, median, and interquartile range (IQR). Chi-square test was used for categorical variables. To compare between different groups, Fisher's Exact or Monte Carlo correction was used for chi-square when more than 20% of the cells have expected count less than 5. Student t-test was used for normally distributed quantitative variables, to compare between two studied groups. Kappa test was used for agreement between markers**.** Significance of the obtained results was judged at the 5% level.

RESULTS

Among the 456 pregnant women tested, 8 (1.8%), 64 (14%) and 70 (15.4%) were positive for HBsAg, anti-HBc and anti-HBs, respectively. All HBsAg positive pregnant women were negative for HBeAg. No HBV markers were detected in 333 (73%) of the studied pregnant women.

The results of this study demonstrated that HBsAg was not detected alone in any of the studied population. However, HBsAg was detected with anti-HBc in 8 (1.8%) of the studied pregnant women. Those positive for both markers were not vaccinated against HBV. Anti-HBc was a sole marker in 45(9.9%) of the pregnant women. All of them were not vaccinated against HBV. Among the 456 studied pregnant women, anti-HBs was detected alone in 59 (12.9%), all of them received HBV vaccine. Anti-HBs and anti-HBc were detected together in 11(2.4%) of the studied population, all of them didn't give history of HBV vaccination. (Table 1a) Among the 213 vaccinated pregnant women, none was positive for HBsAg or anti-HBc while 59 (27.7%) have anti-HBs. This result was statistically significant. (Table 1b)

All the 392 anti-HBc negative pregnant women were negative for HBsAg. Most of them 333(84.9%) had undetectable anti-HBs while 59 (15.1%) were positive for it. Among the 64 anti-HBc positive pregnant women, 56 (87.5%) and 53 (82.8%) were negative for HBsAg and anti-HBs, respectively, while 8 (12.5%) and 11 (17.2%) were positive for HBsAg and anti-HBs, respectively. There was a significant fair agreement between anti-HBc and HBsAg. However, no significant agreement was detected between anti-HBc and anti-HBs. (Table 2)

Table (1a): HBV markers in relation to HBV vaccination among 456 pregnant women in Kafr El-Sheikh Governorate

	No.	%	History of HBV vaccination			
			Vaccinated (n = 213)		Non-vaccinated (n = 243)	
			No.	%	No.	%
HBsAg alone	0	0.0	0	0.0	0	0.0
Anti-HBc alone	45	9.9	0	0.0	45	100.0
Anti-HBs alone	59	12.9	59	100.0	0	0.0
HBsAg + anti-HBc	8	1.8	0	0.0	8	100.0
Anti-HBs + anti-HBc	11	2.4	0	0.0	11	100.0

Table (1b): HBV markers in relation to HBV vaccination among 456 pregnant women in Kafr El-Sheikh Governorate

HBV Vaccination	N	HBsAg				Anti-HBc				Anti-HBs			
		Negative (n = 448)		Positive (n = 8)		Negative (n = 392)		Positive (n = 64)		Negative (n = 386)		Positive (n = 70)	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Vaccinated	**213**	213	100.0	0	0.0	213	100.0	0	0.0	154	72.3	59	27.7
Non Vaccinated	**243**	235	96.7	8	3.3	179	73.7	64	26.3	323	95.5	11	4.5
χ^2 (p)		7.138^{*} ($^{FE}p=0.008^{*}$)				65.258^{*} ($<0.001^{*}$)				46.905^{*} ($<0.001^{*}$)			

$\chi 2$: Chi square test, FE: Fisher Exact test p: p value for comparing between negative and positive

*: Statistically significant at $p \leq 0.05$

Table (2): Agreement between HBV serologic markers among 456 pregnant women in Kafr El-Sheikh Governorate

	Anti-HBc			
	Negative (n = 392)		Positive (n = 64)	
	No.	%	No.	%
HBsAg				
Negative	392	100.0	56	87.5
Positive	0	0.0	8	12.5
Kappa (p)	0.197^{*} ($<0.001^{*}$)			
Anti-HBs				
Negative	333	84.9	53	82.8
Positive	59	15.1	11	17.2
Kappa (p)	0.021 (0.660)			

p: p value for comparing between negative and positive

*: Statistically significant at $p \leq 0.05$

Among the sociodemographic factors shown in Table 3, only age was significantly associated to HBV markers. HBsAg and anti-HBc positivity was significantly higher among women aged >29 years than those aged ≤ 29 years (p=0.008 and p<0.001, respectively). On the other hand anti-HBs seropositivity was higher among women aged ≤ 29 years than older women (p<0.001).

The results of this study demonstrated that the percentages of HBsAg positive women among those with history of surgical operation, blood transfusion, tattooing and tooth manipulation were higher than among those without history of such risk factors. However, these differences were not statistically significant. In addition, the percentages of HBsAg positive women among those with history of unsafe injection and family HBV infection were higher than those without history of such risk factors (19.4% *vs* 0.5% and 75% *vs* 1.1%, respectively). These differences were statistically significant (Table 4).

Table (3): HBV markers in relation to sociodemographic and maternal factors among 456 pregnant women in Kafr El-Sheikh Governorate

Socio demographic data	N	HBsAg				Anti-HBc				Anti-HBs			
		Negative (n = 448)		Positive (n = 8)		Negative (n = 392)		Positive (n = 64)		Negative (n = 386)		Positive (n = 70)	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Age (years)													
≤29	**213**	213	100.0	0	0.0	213	100.0	0	0.0	154	72.3	59	27.7
>29	**243**	235	96.7	8	3.3	179	73.7	64	26.3	232	95.5	11	4.5
χ^2 (p)		7.138*(FEp=0.008*)				65.258* (<0.001*)				46.905* (<0.001*)			
Max.–Min.		35.40–21.0		35.0–30.0		35.40–21.0		35.0–30.0		35.40–21.0		34.50–21.0	
SD.±Mean		3.18±29.44		1.82±31.94		3.20±29.07		1.32±32.04		3.13±29.81		2.88±27.72	
Median (IQR)		32)–30(28		33.6)–32(30.3		32)–29.0 (27		33)–32.0 (31		32)–30.7 (28		29)–27.4 (26	
t(p)		3.773*(0.006*)				12.866* (<0.001*)				5.502* (<0.001*)			
Address													
Urban	**201**	198	98.5	3	1.5	166	82.6	35	17.4	165	82.1	36	17.9
Rural	**255**	250	98.0	5	2.0	226	88.6	29	11.4	221	86.7	34	13.3
χ^2 (p)		0.143(FEp=1.000)				3.399 (0.065)				1.812 (0.178)			
Occupation													
House wife	**262**	258	98.5	4	1.5	228	87.0	34	13.0	215	82.1	47	17.9
Working	**194**	190	97.9	4	2.1	164	84.5	30	15.5	171	88.1	23	11.9
χ^2 (p)		0.185 (FEp=0.728)				0.571 (0.450)				3.174 (0.075)			
Education													
Read and write	**23**	22	95.7	1	4.3	20	87.0	3	13.0	17	73.9	6	26.1
Secondary certificate	**222**	218	98.2	4	1.8	199	89.6	23	10.4	187	84.2	35	15.8
University certificate	**211**	208	98.6	3	1.4	173	82.0	38	18.0	182	86.3	29	13.7
χ^2 (p)		1.036 (MCp=0.530)				5.266 (0.072)				2.489 (0.288)			
Marriage duration (years)													
4–1	**184**	181	98.4	3	1.6	154	83.7	30	16.3	155	84.2	29	15.8
9–5	**183**	179	97.8	4	2.2	162	88.5	21	11.5	157	85.8	26	14.2
>9	**89**	88	98.9	1	1.1	76	85.4	13	14.6	74	83.1	15	16.9
χ^2 (p)		0.378 (MCp=0.905)				1.803 (0.406)				0.363 (0.834)			
Current pregnancy order													
Primigravida	**26**	26	100.0	0	0.0	26	100.0	0	0.0	23	88.5	3	11.5
Multigravida	**430**	422	98.1	8	1.9	366	85.1	64	14.9	363	84.4	67	15.6
χ^2 (p)		0.492 (FEp=1.000)				4.502*(FEp=0.036*)				0.308 (FEp=0.781)			
Pregnancy trimester													
First Trimester	**393**	388	98.7	5	1.3	340	86.5	53	13.5	336	85.5	57	14.5
Second Trimester	**37**	36	97.3	1	2.7	31	83.8	6	16.2	29	78.4	8	21.6
Third Trimester	**26**	24	92.3	2	7.7	21	80.8	5	19.2	21	80.8	5	19.2
χ^2 (p)		5.451 (MCp=0.057)				0.826 (0.662)				1.638 (0.441)			

χ2: Chi square test FE: Fisher Exact MC: Monte Carlo test
t: Student t-test p: p value for comparing between negative and positive
*: Statistically significant at $p \leq 0.05$ SD: Standard deviation IQR: Inter Quartile Range

Table (4): HBV markers in relation to risk factors among 456 pregnant women in Kafr El-Sheikh Governorate

Risk factors	N	HBsAg				Anti-HBc				Anti-HBs			
		Negative (n = 448)		Positive (n = 8)		Negative (n = 392)		Positive (n = 64)		Negative (n = 386)		Positive (n = 70)	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Surgical operations													
No	**382**	377	98.7	5	1.3	324	84.8	58	15.2	326	84.5	56	14.5
Yes	**74**	71	95.9	3	4.1	68	91.9	6	8.1	60	81.1	14	18.9
χ^2(p)		2.710 (^{FE}p=0.125)				2.572 (0.109)				0.865 (0.352)			
Blood transfusion													
No	**429**	422	98.4	7	1.6	367	85.5	62	14.5	366	85.3	63	14.7
Yes	**27**	26	96.3	1	3.7	25	92.6	2	7.4	20	74.1	7	25.9
χ^2(p)		0.633 (^{FE}p=0.389)				1.045 (^{FE}p=0.403)				2.470 (^{FE}p=0.162)			
Tattoing													
No	**440**	433	98.4	7	1.6	379	86.1	61	13.9	375	85.2	65	14.8
Yes	**16**	15	93.8	1	6.3	13	81.3	3	18.8	11	68.8	5	31.3
χ^2(p)		1.944 (^{FE}p=0.250)				0.306 (^{FE}p=0.480)				3.226 (^{FE}p=0.082)			
Unsafe injection													
No	**425**	423	99.5	2	0.5	383	90.1	42	9.9	366	86.1	59	13.9
Yes	**31**	25	80.6	6	19.4	9	29.0	22	71.0	20	64.5	11	35.5
χ^2(p)		59.779*(^{FE}p<0.001*)				89.356*(^{FE}p<0.001*)				10.375*(^{FE}p=0.003*)			
Tooth manipulation													
No	**198**	197	99.5	1	0.5	168	84.8	30	15.2	163	82.3	35	17.7
Yes	**258**	251	97.3	7	2.7	224	86.8	34	13.2	223	86.4	35	13.6
χ^2(p)		3.169 (^{FE}p=0.146)				0.362 (0.548)				1.457 (0.227)			
Previous delivery place													
Not applicable	**26**	26	100.0	0	0.0	26	100.0	0	0.0	23	88.5	3	11.5
Clinic	**286**	281	98.3	5	1.7	243	85.0	43	15.0	248	86.7	38	13.3
Hospital	**144**	141	97.9	3	2.1	123	85.4	21	14.6	115	79.9	29	20.1
χ^2(p)		0.203 (^{MC}p=1.000)				4.518 (0.104)				3.769 (0.152)			
Method of delivery													
Not applicable	**26**	26	100.0	0	0.0	26	100.0	0	0.0	23	88.5	3	11.5
Cesarean Section	**276**	271	98.2	5	1.8	238	86.2	38	13.8	226	81.9	50	18.1
Normal Labour	**154**	151	98.1	3	1.9	128	83.1	26	16.9	137	89.0	17	11.0
χ^2(p)		0.125 (^{MC}p=1.000)				5.297 (0.071)				4.118 (0.128)			
Abortion													
No	**419**	412	98.3	7	1.7	358	85.4	61	14.6	351	83.8	68	16.2
Yes	**37**	36	97.3	1	2.7	34	91.9	3	8.1	35	94.6	2	5.4
χ^2(p)		0.210 (^{FE}p=0.495)				1.172 (0.279)				3.065 (0.080)			
Family HBV													
No	**452**	447	98.9	5	1.1	392	86.7	60	13.3	383	84.7	69	15.3
Yes	**4**	1	25.0	3	75.0	0	0.0	4	100.0	3	75.0	1	25.0
χ^2(p)		125.606*(^{MC}p<0.001*)				24.717* (^{FE}p<0.001*)				0.289 (^{FE}p=0.488)			

χ^2: Chi square test FE: Fisher Exact MC: Monte Carlo test
p: p value for comparing between negative and positive *: Statistically significant at $p \leq 0.05$

DISCUSSION

Egypt is considered epidemiologically as intermediate area of HBV infection. [14] Between 1980 and 2007, HBV prevalence in Egypt was 11.7 %, 4.6 %, and 4 % in upper Egypt, lower Egypt, and pregnant women, respectively with a general prevalence of 6.7 %. [15] A subsequent cross-sectional study conducted in 2017 revealed a lower general prevalence of HBV (1.4 %) in the Egyptian population (1.9 % in males and 1.1 % in females).[16]

Several studies in different Egyptian governorates were performed to determine HBV prevalence among pregnant women. In this study, the HBV prevalence was 1.8 % in Kafr El-Sheikh Governorate. Similar results were obtained in Benha where the HBsAg prevalence among pregnant women was 1.56 %.[17] However, higher HBsAg prevalence was detected in Alexandria (3.39 %), Assuit (4.8 %), and Ismailia (5 %) governorates.[12, 18, 19]

Similar to our results, researchers in Libya and Algeria reported low prevalence of HBV (1.5 – 1.6%) among pregnant women.[20] Higher HBV prevalence was demonstrated in Saudi Arabia and Pakistan where HBsAg was 4.1 % and 4.6 %, respectively.[21, 22] Much higher prevalence was reported from antenatal clinics in Sudan and Nepal.[23, 24]

Such variability of HBV prevalence in different Egyptian governorates and different countries may be explained by difference in sample size, non-identical age categories and distinct sociodemographic status of the studied populations.

According to the findings of this study, the prevalence of HBV cases was greater in rural areas than in urban areas, although the difference was not statistically significant, which is consistent with other studies.[12, 18] However, in a separate study conducted in Minia, rural areas had significantly higher prevalence than urban areas, which could be explained by differences in educational levels and the high percentage of home deliveries in these rural areas.[25]

HBV was more frequent in those above the age of 29, with a statistically significant difference. Other researchers have confirmed this. [12, 26] This could be due to the fact that the cases were born before HBV vaccine was implemented. In contrast to our findings, another study found no significant link between age and HBV infection. [18]

In the current study, there was no significant difference in relation to gestational age. Fekry et al., and Yohanes et al., both concurred that gestational age had no bearing on HBV infection.[18, 27] Other researchers in Ethiopia and Saudi Arabia also found similar findings.[28, 29]

In this work, there was a significant difference between multigravidae and anti-HBc. Both multigravidae and primigravidae did not differ significantly in relation to HBsAg in our investigation. This was in line with prior researches conducted in Benha[17] and Nigeria.[30] However, Azhar et al. found that multigravidae had a greater rate of infection, which they attributed to numerous pregnancies, blood transfusions, and hospitalization.[31]

Despite the fact that blood transfusion is a risk factor for hepatitis B transmission, our results did not demonstrate such relation. Other researchers in Egypt, Mexico, and Saudi Arabia reported similar findings. [32-34] This outcome was expected as a result of the Egyptian national screening system for HBV and other blood-borne viruses, which is used in blood banks. Blood transfusion, on the other hand, was a significant risk factor in other nations lacking such screening system.[22]

Previous surgery was not found to be a significant risk factor for HBV infection in this study, which was consistent with the findings of other studies.[17, 18] This could be attributed to infection control measures being implemented in health care institutions. In Bahir Dar, Ethiopia, however, Zenebe et al. found a significant link between past surgery and HBV infection.[35] This could be explained by the lack of safety precautions used in these locations during surgical procedures.

The findings of this study revealed a significant prevalence of HBsAg positivity in people with a family history of HBV. This could be due to the presence of contaminated infected surfaces with HBV in the living areas of chronically infected people. This was consistent with the findings of numerous other studies conducted in Egypt and other countries.[26, 32, 36, 37]

In our study, there was a highly significant link between unsafe injection as a habit of using one syringe multiple times and HBV infection in pregnant women, which was consistent with another study in Menoufia governorate.[38] This could be due to low socioeconomic status and a lack of knowledge about HBV transmission routes among these pregnant women.

In our study, there was no significant relationship between tattooing, previous delivery location, marital duration, abortion, and HBV status of study participants, which was consistent with other studies.[26, 39, 40] Also, there was no significant association between the analyzed group of pregnant women's HBV status and their educational level or occupation in this study. This emphasizes the importance of community-wide education on the prevention of high-risk behaviors, regardless of degree or career. Other researchers had come to similar conclusions.[38, 41]

In this study, no significant association was found between the history of tooth manipulation of the studied group of pregnant women and their HBV status. This finding was in agreement with that

reported by other researchers in Menoufia Governorate. [38] However, significant association between the history of tooth manipulation of the studied group of pregnant women and their HBV status was documented in other studies.[26, 39]

Other risk factors, such as multiple sexual partners and a history of sexually transmitted illnesses, have been identified as important risk factors in other Ethiopian studies.[42, 43] However, these factors were not addressed in this study due to religious and social constraints.

There was a significant association between HBV vaccination and prevention of HBV infection in our study as all vaccinated women were negative to both HBsAg and anti-HBc. This result was similar to those obtained by other researches in Egypt and other countries.[12, 26, 32, 44] Among the vaccinated women enrolled in this study, 72.3% were negative to anti-HBs. This may be explained by undetectable low level of anti-HBs. This explanation is supported by negativity of both HBsAg and anti-HBc among this group. The decline of anti-HBs level years after HBV vaccination was also previously documented in several studies.[45-47]

In this work, anti-HBc represented the sole HBV marker in 45 (9.9%) of the studied pregnant women, which was higher than that reported among pregnant women in Ismailia (6.7%).[12] In other studies among HIV patients, higher percentages of sole anti-HBc (12.7-17.7%) were detected in several studies in Alexandria, Boston and Italy.[48-50] Sole anti-HBc may refer to one of four possibilities either false positive result, chronic infection with undetectable HBsAg, occult hepatitis B or post infection immunity with undetectable anti-HBs.

Those with sole anti-HBc as a result of undetectable low HBsAg or occult hepatitis B infection may escape screening using HBsAg alone. This highlights the importance of anti-HBc as a co-marker with HBsAg in the screening system. Sole anti-HBc may require detection of HBV DNA to reach the proper diagnosis.

In this study, 8 (1.8%) had both HBsAg and anti-HBc denoting chronic infection. All of them were non-vaccinated against HBV infection. Other researchers reported higher percentages (4.06%) with 25% of them having history of vaccination.[50] They explained such result by non-responsiveness to HBV vaccine.

All the eight HBsAg positive women were negative for HBeAg. This was similar to results obtained in a study conducted in Alexandria where the twelve HBsAg positive pregnant women were HBeAg negative.[18] On the other hand, other researchers performing a cross-sectional study on a large scale for pregnant women in Tanta (1948 participants) have reported higher percent of HBeAg (6.67%) among HBsAg positive pregnant women.[26]

In this work, 11(2.4%) of the pregnant women have both anti-HBs and anti-HBc denoting resolving infection with post infection immunity. They were all non-vaccinated. In other studies, anti-HBs and anti-HBc represent higher percentages (6-19%) of the studied population with 25-57% of them having history of vaccination.[12, 50]

CONCLUSION AND RECOMMENDATIONS

In conclusion, hepatitis B vaccine proved to be an effective tool against HBV infection among pregnant women. However, HBV is still detected among them, especially those with risk factors. Thus, it is highly recommended that the Ministry of Health and Population should implement a program to screen all pregnant women for HBV at the antenatal care units. Health education to all the population categories about the risk factors and mode of transmission of HBV is highly required.

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CONFLICT OF INTEREST
The authors declare that they have no conflict of interests.

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