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Research Article

Seroprevalence of Hepatitis B Virus in Iraqi Population

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Abstract

Background: Hepatitis B is a major public health problem worldwide. In Eastern Mediterranean Region, two third of liver cirrhosis and HCC were attributed to HBV infections.

Aim of the Study: To determine the seroepidemiology of hepatitis B viral infections in Samara community.

Settings: Samara General Hospital and primary health care centers in Samara District.

Study Design: The study design of two parts, the first one is a retrospective study and the second part is a descriptive case control study.

Study Population: The study conducted in Samara General Hospital and primary health care centers in Samara District. Records of subjects with hepatitis B during three years (2011, 2012 and 2013) were included in the study. Their age range from 1 to 59 years, with a mean age of 26.7±4.9 years. The total numbers of tested serum samples were 16165, of them 5683 for 2011, 5809 for 2012 and 4673 for 2013. Of the total 9648 (60%) are male and 6517 (40%) are female.

Results: The overall seroprevalence of HBsAg was found to be 3.2% and none of them was positive for HIV antibody. This indicated that Samara district categorized within intermediate endemicity of HBV infection. The highest seroprevalence of HBsAg was found in the 2013 collected samples which form 4.73%, followed by 3.55% for 2012 and 1.6% 2011. HBV prevalence was significantly increased with time, which is in contrast to expectation, and these illustrate a pocket gag in the endemicity and epidemicity of the disease. The overall seroprevalence of HBsAg was not influenced by gender, however, on years analysis basis gender influence the prevalence of the HBsAg. There was a highly significant higher seroprevalence of HBsAg in females compared with males for 2013. The seroprevalence of HBsAg was twice in female compared with male. In contrast, for 2012, HBsAg seroprevalence was significantly higher in male compared to female. However, there was no significant difference in HBsAg seroprevalence between male and female for 2011. Comparison according to years of data collection indicated a highly significant difference in male and female.

Conclusions: Samara district categorized within intermediate endemicity of HBV infection

Keywords: Hepatitis; HBV; Seroepidemiology; Samara

Introduction

HBV was of moderate endemicity in Iraqi population with a rate of 3% [1]. The highest concentrations of infectious HBV are in blood, serum and serum-derived body fluids, such as semen and saliva [2]. It has been reported earlier in 2002 that the hepatitis B virus can live for several days in dried blood on table surfaces, needles, syringes and razors [3,4]. The World Health Organization (WHO) estimates that hepatitis B result in 563 000 deaths annually from the estimated 350 million carriers [5,6]. The hepatitis B virus is transmitted by contact with infected blood or body fluids of an infected person. Chronic infection after exposure to hepatitis B virus (HBV) has been observed in 30% to 90% of children aged less than five years. On the other hand, exposed adults become chronic carriers of HBV in only 2 to 5% of cases [7]. Based on the prevalence of HBV chronic carriers (individuals positive for hepatitis B

surface antigen) amongst adults in the general population, countries are classified as having low endemicity <2%, intermediate endemicity 2%-8% or high endemicity >8% of infection) [8]. Even with three effective doses of the vaccine available, hepatitis B remains a stubborn, unrelenting health problem, especially in Africa and other developing areas. The disease and its complications cause an estimated one million deaths globally each year [9]. Studies in the Middle East showed that the prevalence of HBs Ag ranged from 3% to 11% in Egypt [10]. Hepatitis B vaccination is the most effective measure to prevent HBV infection and its consequences. However, for persons already infected with HBV, antiviral agents are available that may prevent the serious sequel of chronic liver disease, which highlights the importance of identifying infected individuals.

In a recent study [11], the national estimate of HBs antigen prevalence rate was 1.6%. Anti-HBs IgG (total) had a higher prevalence rate of 16.9% and HBc antibodies 9.8%. The prevalence of HBsAg was lowest in the first decade of life (0.9%), and increase with age to reach a maximum prevalence rate of 2.4% in the fifth decade of life. The risk of testing positive for HBs antigen is almost doubled in the 3rd decade of life compared to 1st decade of life. Being in the fifth decade of life significantly increased the risk of having positive HBs antigen by 2.6 times compared to 1st decade of life. Male gender significantly increases the risk of having positive HBs antigen by 41% compared to females. The prevalence rate of positive HBs antigen was lowest in Maysan, Dhi Qar, Al Qadisiyah and Al Muthanna (<0.5%). The prevalence rate was highest in An Najaf, Dahuk, Salah ad Din and Babil (>3%). The prevalence of anti-HBs antibodies was lowest in the 3rd decade of life (12.2%), and is slightly, but not significantly higher in older ages. The prevalence rate of positive anti-HBs anti-bodies is highest in the first decade of life 32.2%. Compared to the 3rd decade of life the risk of testing positive is significantly increased by 38% in the 2nd decade of life and by 2.63 times in the first decade of life. Male gender significantly increased the risk of having positive anti-HBs IgG antibodies by 33% compared to females. The anti-HBc IgG antibodies shows a positive age trend as opposed to the negative age trend observed with anti-HBs IgG antibodies. The anti-HBc IgG antibodies prevalence rate was lowest in the first decade of age (3.8%) and highest in the 5th decade of life (14%). Gender showed no important or statistically significant association with anti-HBc antibodies.

HBV infections are among the most prevalent infectious diseases in humans worldwide. The infections are associated with a broad range of clinical presentations ranging from acute or fulminant hepatitis to chronic infection that may be clinically asymptomatic or may progress to chronic hepatitis and liver cirrhosis [12]. The prevalence of infection with HBV varies from one country to another depending upon a complex mixture of behavioral, environmental and host factor. The prevalence of HBs antigen (HBsAg) positivity in different populations ranges from less than 0.5% to as high as 20%. A study conducted in Aurangabad reported 6.42% carriage in resident doctors [13]. Another study con-ducted in Delhi reported 6.9% transfusion associated hepatitis (TAH) among patients receiving blood transfusion for cardiac surgery; of the total TAH cases 20% were related to HBV [14]. The spread of hepatitis B virus continues to be at an alarming rate worldwide and this created an impact on many countries. Although the rate of expo-sure to HBV in Pakistan is not fully confirmed, Awan et al. [15] reported ~38% prevalence of different hepatitis B markers, with a 4% HBs Ag carrier rate and 32% with anti-HBV surface antibodies (Anti HBs Ab) by natural conversion [15]. High prevalence of HBV was observed in geographical areas of low economic status, which underscores the importance in controlling this disease [16,17]. The present study gives a highlight on HBV activity in Iraq. It demonstrated that the prevalence rate of HBs Ag in apparently healthy individuals was 1.6%. It was more frequent in age group above 40 years and in males more than females. The results of Attalla et al [11] survey comply with the results of other published articles in neighbor populations. Schreiber et al. [18] reported an intermediate prevalence of 2-8% for HBV infection in Egypt. Another study reported the prevalence of HBsAg among Kuwaiti national and non-Kuwaiti Arab at 1.1 and 3.5%, respectively [19]. High prevalence results of HBV in males compared to females have been observed in earlier studies in Pakistan [8,20]. Similar results have also been obtained in Bangladesh where the researchers reported higher prevalence in males (67.86%) than females (32.14%) [21]. The aforementioned gender disproportion may be explained by the increased frequency of high risk jobs and behavior in men, like multiple sexual partners, drug use and unhygienic barber shaving practices. The prevalence of HBV infection rises gradually with age. Higher risk of infection was found in the older subjects as compared to the younger ones. The higher prevalence among older age groups may be attributed to the more frequent and continuous exposure to risk factors of hepatitis B (HBV infection).

The prevalence of HBV infection and immunity was determined in a representative sample of the US population for the period 1999-2006. National Health and Nutrition Examination Surveys participant's ≥6 years of age were tested for antibody to hepatitis B core antigen (anti-HBc), hepatitis B surface antigen (HBsAg), and antibody to hepatitis B surface antigen (anti-HBs). The prevalence of anti-HBc increased from 0.6% in children aged 6-19 years to 5.9% among adults 20-49 years of age, and further in-creased to 7.2% among older persons (≥50 years) [22]. In Tarky et al. [11] 2013 study the prevalence of antibody to hepatitis B core antigen (anti-HBc) showed a weak positive age trend. Anti-HBc antibodies is expected to increase with age in a pattern that is similar to HBs Ag marker, since this type of antibodies is only produced by natural infection and not by vaccination. Prevalence of Anti-HBs IgG was negatively correlated with age, ranging from 53.5%

among persons aged 6-11 years to 5.1% among person's ≥60 years of age [22]. In the current study of Iraqi community the prevalence rate of positive anti-HBs was highest in children and lowest in the 3rd decade of adult life and then rises again. The main reason for this in-crease in prevalence rate of anti- HBs Ab in the first decade of life is the vaccination program, however vaccination give antibodies to HBs Ag at a lower titer than that of natural infection, in addition Anti HBs IgG in natural infection is always associated with anti-HBc antibodies. Another fact is that about 60% of vaccinated individuals have no detectable antibody in their blood after 9 to 15 years after vaccination, al-though they were still immune due to availability of memory cells [23]. In Iraq, hepatitis B vaccination was introduced on 1993 for the first time as a part of Expanded Program of Immunization (EPI) and was applied on children below 5 years of age [24], accordingly those Iraqi whom were above 30 years of age at the time of conducting the study were not vaccinated.

Materials and Methods

Settings: Samara General Hospital and primary health care centers in Samara District.

Study Design: The study design of two parts, the first one is a retrospective study and the second part is a Descriptive Case Control Study.

Study Population: The study conducted in Samara General Hospital and primary health care centers in Samara District. Records of subjects with hepatitis B viral infections during three years (2011, 2012 and 2013) were included in the study. Their age range from 1 to 59 years, with a mean age of 26.7±4.9 years. The total numbers of tested serum samples were 16165, of them 5683 for 2011, 5809 for 2012 and 4673 for 2013. Of the total 9648 (60%) are male and 6517 (40%) are female (Table 1).

Year	Number tested	Male number [%]	Female number [%]
2011	5683	3204 [56.4]	2479 [43.6]
2012	5809	3091 [53.2]	2718 [46.8]
2013	4673	3353 [71.7]	1320 [28.3]
X^2			
P			
Total	16165	9648 [59.7]	6517 [40.3]

Table 1: Study population.

All the serum samples were tested for HBsAg, using commercially-available (ELISA) kits. The results read by a Microwell reader and compared in a parallel manner with controls; optical density read at 450 nm on an ELISA reader.

Results

Prevalence of Hepatitis B virus

In all, 16165 serum samples were processed for HBsAg detection over 3 years period in Samara general hospital. The seroprevalence of HBsAg was found to be 3.2% (518/16165) and none of them was positive for HIV antibody. The highest seroprevalence of HBsAg was found in the 2013 collected samples which form 4.73% (221/4673), followed by 3.55% (206/5809) for 2012 and 1.6% (91/5683) for 2011. There was a highly significant (X^2=90.3, P=0.000) differences in seroprevalence of HBsAg between the 3 years (Table 2).

Year	Number tested	Number positive	Percent
2011	5683	91	1.60
2012	5809	206	3.55
2013	4673	221	4.73
X^2	90.3		
P	0.000		
Total	16165	518	3.20

Table 2: Prevalence of Hepatitis B Virus.

Gender Influence on Prevalence of Hepatitis B Virus

Gender influences on seroprevalence of HBsAg are shown in (Table 3).

Year	Number tested		Number positive		Percent		Male Vs. Female	
	Male	Female	Male	Female	Male	Female	X^2	P
2011	3204	2479	52	39	1.62	1.57	0.005	NS
2012	3091	2718	126	80	4.08	2.94	5.43	0.02
2013	3353	1320	123	98	3.67	7.42	29.7	0.000
X^2			37.9	93.8				
P			0.000	0.000				
Total	9648	6517	301	217	3.12	3.33		
Total male versus female: X^2 = 0.553, P = NS								

Table 3: Gender Prevalence of Hepatitis B Virus.

The overall seroprevalence of HBsAg was 3.12% (301/9648) for male and 3.33% (217/6517) for female, and the difference was not statistically significant (X^2=0.553, P>0.05). However, there was a highly significant (X^2 =29.7, P=0.000) difference in seroprevalence of HBsAg between male (3.67%, 123/3353) and female (7.42%, 98/1320) for 2013. The seroprevalence of HBsAg was twice in female compared with male.

For 2012, HBsAg seroprevalence was significantly (X^2=5.43, P=0.02) higher in male (4.08%, 126/3091) compared to female (2.94%, 80/2718). However, there was no significant (X^2=0.005, P>0.05) difference in HBsAg seroprevalence between male (1.62%, 52/3204) and female (1.57%, 39/2479) for 2011. Comparison according to years of data collection indicated a highly significant differences in male (X^2=37.9, P=0.000) and female (X^2 =93.8, P=0.000).

Age Distribution of Hepatitis B Virus

Age distribution of hepatitis surface antigen is shown (Table 4).

Year	Variable	Age group in years				X^2	P
		1-4	5 – 14	15 – 45	>45		
2011	Number tested	94	199	4811	579	57.4	0.000
	Number positive	2	6	53	30		
	Percent	2.13	3.02	1.10	5.18		
2012	Number tested	80	275	4959	495	32.5	0.000
	Number positive	7	11	151	37		
	Percent	8.75	4.00	3.04	7.50		
2013	Number tested	72	191	4063	347	66.4	0.000
	Number positive	1	10	163	47		
	Percent	1.40	5.24	4.01	13.54		
	X^2	6.73	1.24	76.8	20.9		
	P	0.035	NS	0.000	0.000		
Total	Number tested	246	665	13833	1421	122	0.000
	Number positive	10	27	367	114		
	Percent	4.07	4.06	2.65	8.02		

Table 4: Age group Distribution of the Prevalence of Hepatitis B Virus.

The overall HBsAg seroprevalence was higher in the age group of >45 years of age (8.02%, 114/1421), followed with the age of 1-14 years (4.06%, 37/911), while the lowest (2.65%, 367/13833) was in the age of 15-45 years. The differences in seroprevalence between the age groups was highly significant (X^2=122, P=0.000). According to study years analysis, HBsAg seroprevalence was significantly (X^2=57.4, P=0.000) higher in age of >45 years (5.18%, 30/579) as compared to age of 1-14 (2.73%, 8/293) years, and 15-45 years (1.10%, 53/4811). In addition, for 2012 the differences in HBsAg seroprevalence was significant ((X^2=32.5, P=0.000) and the highest seroprevalence was in the age group of 1-4 years (8.75%, 7/80), followed by age group of >45 years (7.5%, 37/495). Furthermore, in 2013, the HBsAg seroprevalence was significantly (X^2=66.4, P=0.000) different between age groups with higher prevalence (13.54%, 47/347) in age group of >45 years.

Within age group of >45 years, HBsAg seroprevalence was significantly (X^2=20.9, P=0.000) different between 2011, 2012 and 2013, with trend of increased seroprevalence with time. In addition, for age group of 15-45 years, HBsAg seroprevalence was significantly (X^2=76, P=0.000) different between 2011, 2012, and 2013, with increasing pattern with time. Furthermore, age group 1-4, the highest seroprevalence was for 2012 (8.75%, 7/80), with a significant (X^2=6.73, P=0.035) difference from that of 2011 (2.13%) and 2013 (1.4%). However, in the age group of 5-14 years, there was no significant (X^2=1.24, P>0.05) difference in HBsAg seroprevalence between the study years, with trend of increasing with time.

Age Group Distribution of the Prevalence of Hepatitis B Virus in Relation to Gender

The age distributions of the Seroprevalence of HBsAg are shown in (Table 5).

Year	Gender	Variable	Age group in years				X^2	P
			1 - 4	5 - 14	15 - 45	>45		
2011	Male	Number tested	56	150	2731	267	21.1	0.000
		Number positive	1	4	34	13		
		Percent	1.79	2.67	1.24	4.87		
	Female	Number tested	38	49	2080	312	38.4	0.000
		Number positive	1	2	19	17		
		Percent	2.63	4.08	0.91	5.45		
	X^2		0.08	0.25	1.19	0.10		
	P		NS	NS	NS	NS		
2012	Male	Number tested	47	161	2632	251	16.5	0.001
		Number positive	4	8	93	21		
		Percent	8.51	4.97	3.53	8.37		
	Female	Number tested	33	114	2327	244	17.2	0.001
		Number positive	3	3	58	16		
		Percent	9.09	2.63	2.49	6.56		
	X^2		0.01	0.95	4.53	0.58		
	P		NS	NS	0.033	NS		
2013	Male	Number tested	46	120	2953	234	36.4	0.000
		Number positive	1	6	91	25		
		Percent	2.17	5.00	3.08	10.68		
	Female	Number tested	26	71	1110	113	32.7	0.000
		Number positive	0	4	72	22		
		Percent	0	5.63	6.49	19.47		
	X^2		0.57	0.04	24.3	6.79		
	P		NS	NS	0.000	0.009		
Total	Male	Number tested	149	431	8316	752	64.4	0.000
		Number positive	6	18	218	59		
		Percent	4.03	4.18	2.62	7.85		
	Female	Number tested	97	234	5517	669	56.9	0.000
		Number positive	4	9	149	55		
		Percent	4.12	3.85	2.70	8.22		
	X^2		0.001	0.04	0.08	0.07		
	P	NS	NS	NS	NS	NS		

Table 5: Age Group Distribution of the Prevalence of Hepatitis B Virus in Relation to Gender.

The overall seroprevalence was with high significant differences between the age groups in both male (X^2=64.4, P=0.000) and female (X^2=56.9, P=0.000). However, within each age group, there was no significant difference between male and female (Table 5).

For the year 2011, there was a significant difference in HBsAg seroprevalence between the age groups for both female (X^2=38.4, P=0.000) and male (X^2=21.1, P=0.000), while there was no significant differences between male and female within each age group. The higher seroprevalence was demonstrated in the age group of >45 years for both male (4.87%) and female (5.45%).

Concerning 2012, there was a significant difference in HBsAg seroprevalence between the age groups for both female (X^2=17.2, P=0.001) and male (X^2=16.5, P=0.001). In addition, there was a significant (X^2=4.53, P=0.033) difference in HBsAg seroprevalence between male (3.53%, 93/2632) and female (2.49%,58/2327) in the age group 15-45 years. However, while there was no significant differences between male and female within 1-4, 5-15, and >45 years age groups. The higher seroprevalence in for both male (8.51% and 8.37% respectively) and female (9.09% and 6.56% respectively) was found in 1-4 years age group, followed by >45 years age group.

For the year 2013, HBsAg seroprevalence was significantly different between the age groups for both male (X^2=36.4, P=0.000) and female (X^2=32.7, P=0.000), with a highest seroprevalence in >45 years age groups in both male (10.68%) and female (19.47%). In addition, there was a significant differences in seroprevalence between male and female within the 15-45 (6.49%; X^2=24.3, P=0.000) and >45 (19.47%; X^2=6.79, P=0.009) years age groups.

Discussion

Hepatitis B is a major public health problem worldwide [WHO 2002]. This infection with global burden due to its link with the development of liver cirrhosis and hepatocellular carcinoma (HCC), which forms around 2% of all death and is, expected to increase over the next decades [25] were attributed to HBV infections [26].

In any country, the epidemiologic data about HBV provide significant information for health provider and health control programs managers to plan their strategy of prevention and controls [27]. There are few properly published reports on HBV infections because most of them deals with risk groups and only two large retrospective and 2 prospective studies were reported for Iraq [28-30]. The present study deals with prevalence of HBV infections in a mixed population of healthy control individuals came for routine investigations such as pre-marital checkup or employment or preoperative preparation and those with suspected hepatitis cases. The seroprevalence of HBsAg was 3.2% with a significant increase with time (X^2=90, P=0.000), which was 1.6%, 3.55% and 4.74% for 2011, 2012, and 2013 respectively. This finding indicated 2.96 times prevalence for 2013 as compared to 2011. This increase in HBV prevalence represents a public health problem which may be a reflection of increase of vertical and horizontal transmission and /or disruption in the Expanded Program of Immunization (EPI).

Iraq is with intermediate prevalence of hepatitis B virus [28,30]. The present study findings indicated that HBV seroprevalence was lower to that reported for Iraq [31-35], however, higher to other studies in Iraqi population [11,28,29]. Skinho and Al-Kassab [35] reported HBsAg seroprevalence of 3.6% in blood donors, while Hussein [36] reported the same seroprevalence in military personnel blood donors. Omer and Thewaini [32] found that HBsAg prevalence was 3.3% in apparently normal population, while other study reported about the same rate (3.4%) [34] In normal population. However, Omer and Al-Dowri [37] reported a higher (4.3%) in normal population, while other research group reported a prevalence of 4.1% in blood donor.

The above mentioned studied with the exception of five studies [11,28,29,31] were performed in seventies, eighties and nineties. Ataallah et al [28] found HBsAg seroprevalence of 0.66% in blood donors in Baghdad, while Al-Hammieary reported a 1.02% seroprevalence of HBsAg in normal population in Al-Rusafa sector of Baghdad and 0.96% in health care workers. However, other study performed in 2007 in Baghdad reported a seroprevalence rate of 7.33% [31]. Omer and Al-Salmani [38] HBsAg was 1.2% among normal population. In addition, the mean of the HBsAg seroprevalence before 2000 was 3.6% in normal population and 3.76% in blood donors, while after 2002, it was 0.97% in blood donor and 4.17% in apparently healthy population [29,31,39]. Furthermore, HBsAg seroprevalence was 0.8% in healthy individuals of Babylon [40]. One national large scale community based study performed in Iraq indicated that HBsAg seroprevalence was 1.6% [11].

The seroprevalence of HBsAg in risk group reported for Iraq with a wide range of 5 to 73.1%. In health care workers, HBsAg seroprevalence was with range of 0.96% to 5.4% [29,34,41]. In inherited blood disorders, HBsAg seroprevalence was with range of 0.09% to 32.5% [42], while in those receiving blood transfusion was 40% [43]. Furthermore, the HBsAg seroprevalence was 73.1% in individuals using glass syringe for injection [44] and with a range of 14.28% to 34% in parenteral drug administration [45,46]. In the national community based study, higher prevalence rate was reported for Al Najaf, Salahuldean and Babylon (>3%), while the lowest prevalence was for Maysan, Al-Qadisiyah, DhiQar, and Al Muthana (<0.05%). However, Al Ramadi, Karbala, and Waset were with prevalence of HBsAg of 2.0%-2.99%, while in Baghdad, Basrah, Diyala, and Al Tameem are with prevalence rate of 1.00% to 1.99%. Ninewa, Arbil and Sulaimania were with prevalence rate of 0.5% to 0.99% [11].

The above data collectively indicated that HBsAg seroprevalence varies considerably with study target population, however, it may be contributed that HBV infections decline in Iraq. The prevalence reduced from that before 2000 to that after, but our data indicated an increase in the prevalence of the disease during study period (2011-2013). Our study seroprevalence was higher to that reported for Baghdad in two recent studies as they report 1.02% and 1.2% [29,38] and the national community based study (1.6%) [11]. This phenomenon was a reflection of many underlying etiology, such as the disruption of health care providing system, improper surveillance of infectious disease, disruption of prevention and control program of notifiable communicable diseases, all of these may lead to unsafe parenteral injection, blood and blood product transfusion. A national effective prevention and control programs application is required and new research community based studies is warranted to clarify the health impact of HBV on community.

The seroprevalence HBV findings of this study in normal population categorize Iraq in the area of intermediate endemicity, while that of Baghdad categorize it in low endemicity area. This variation could be a reflection of increased HBV transmission in recent years. Considering Iraqi's geographical region, it is similar to United Arab Emirates in having intermediate endemicity while Bahrain, Iran and Kuwait having low endemicity. Jordan, Palestine, Saudi Arabia and Yemen have high endemicity [47-49]. However, within the same country, the origin of the investigated samples may influence the prevalence; for example, HBsAg was with 1.1% prevalence rate in Kuwaiti and 3.5% in non-Kuwaiti nationality [13].

Recent review [50] of 39 studies of HBV maternal infections in low and intermediate socioeconomic developing countries reported prevalence of 0.34% to 25%. However, a review in 2013 concerning HBV indicated lower range of infection which extends from 1% to 10.8% in Arab Countries [51]. These two reviews illustrated a reduction HBV maternal infection which may be reflected on reduction of vertical transmission of the virus as this method of transmission represent the 1st contagious pattern of HBV transmission [52]. In China, HBV seroprevalence in child bearing age was from 6.71% to 9.51% [53,54], while it is 1.2% in Spain [55], 1.16% in Greece [56], 0.5% in Nepal [57].

Hepatitis B virus infections occur worldwide [27], with a highest carrier rates in developing countries [58]. The reported global studies indicated a wide variation in HBsAg seroprevalence between countries and in different regions of the same country. HBsAg seroprevalence was 0.2%-8.5% in Brazil [59-61], 0.4% in Canada [62], 0.9% in Ethiopia [63], 1.6%-2.5% in Nepal [57], 0.87%-2% in India [64], 1%-2.28% in Pakistan [65], 3.58% in Poland [66], 6.71%-9.8% in China [67], 4.8%-18% Asian American [68].

Four recent reviews, 2 for Europe and 2 global, in addition to large American study indicated that implementation of effective vaccination programs has resulted in a significant decrease in the incidence of chronic HBV infection. However, HBV remains an important cause of mortality and morbidity among the chronic HBV infection [58]. Hahne et al. [69] reported that HBsAg prevalence in the general population varied widely between European countries, ranged from 0.1%-5.6%. The lower estimated number of chronic HBV infection was found in Ireland, while the higher was found in Turkey. North-western European countries had a low prevalence, whilst those in the south and south-east had an intermediate to high prevalence. Romania with high (5.6%) prevalence of HBV, while Belgium (0.7%), Sweden (0.2%), Germany (0.6%) and the Netherlands (0.1%) have low prevalence. However, Meffre et al. [70] reported that France was with low prevalence of hepatitis B infection in general population. A recent systematic review of chronic hepatitis B virus prevalence in Turkey [71] was reporting west to east gradient rate of prevalence similar to that reported by Hahne et al. [69].

Chu et al. [72] in their review concluded that international migration has an impact on HBV prevalence in six European countries with evident differences between migration and general population in HBV prevalence. Ott et al. [73,74] in a global systematic review from 1999 to 2005 found that the prevalence of chronic HBV infection decreased in most regions. Decrease in chronic hepatitis B infection was evident in Tropical and Central Latin America, Central sub-Saharan Africa, Central Europe and South East Asia. However, the overall number of chronically infected hepatitis B individuals was increasing and the widespread global differences in hepatitis B virus prevalence call for targeted approaches to tackle hepatitis B virus related mortality and morbidity.

Hwang and Cheung [58] reviewed HBV infection according to the 6 regions defined by the WHO. For America, the United States and Canada was with low prevalence (0.5%-1%), while Mexico, Central America and South America with significant higher prevalence (0.5% - 8%). In Europe, HBV seroprevalence ranged from 0.1% to 12% [75]. Europe divided into 3 types epidemiological patterns, low carriers (<1%) in Northern Europe, intermediate (0.1%-0.5%) in most Western European countries, the 3rd pattern in Southern Europe and Eastern Europe with carrier rate >8% [75,76]. HBV seroprevalence in the Eastern Mediterranean region range from 1% to 10%, making it intermediate to high endemicity [Custer et al. 2004]. In Africa, HBV seroprevalence range from 6% to 20%, South- East Asia was with intermediate to high endemicity (1%-10%), while Western Pacific with prevalence range from 0.1% to 30% [58].

From our study findings and that reported for Iraq and Arabian countries, regional and global studies indicated a heterogeneous pattern of HBsAg seroprevalence throughout the world, ranging from <1% to 30%. There is an overall decline in hepatitis virus

infection prevalence due to EPI programs, post exposure prophylaxis and antiviral therapy [Hwang and Cheung 2011]. However, hepatitis B virus infection prevalence data are needed at country and sub-national level (Governorate and town level) to estimate disease burden and guide health and vaccine policy [73].

The overall seroprevalence of HBsAg was 3.12% for male and 3.33% for female, and the difference was not statistically significant (X^2=0.553, P>0.05). However, there was a highly significant (X^2=29.7, P=0.000) difference in seroprevalence of HBsAg between male (3.67%) and female (7.42%) for 2013. The seroprevalence of HBsAg was twice in female compared with male. In addition, for 2012, HBsAg seroprevalence was significantly (X^2=5.43, P=0.02) higher in male (4.08%) compared to female (2.94%). However, there was no significant difference in HBsAg seroprevalence between male and female for 2011. Comparison according to years of data collection indicated a highly significant differences in male (X^2=37.9, P=0.000) and female (X^2=93.8, P=0.000).

This results show a non consistent pattern of gender influence with time, however, there was significant pattern of increase in HBsAg prevalence in female with time. But HBsAg was lower in 2011 and subsequently increased in 2012, and the decreased in 2013. Thus each gender show different pattern of prevalence with time. The non significant difference in seroepidemiology as this study indicated was not consistent with that reported for Iraq which suggest higher HBsAg in male compared to female [11,29,31,32,34,43, 46]. Two studies reported a non significant difference in prevalence of HBsAg in blood between male and female [28,77].

Some global studies indicated high significant HBsAg in male compared with male [73,78,64], while other studies reported higher prevalence in female [62,79]. However, some studies not reported a significant difference in HBsAg between male and female [63,66,68]. The high prevalence of HBsAg positivity in male explanation might be difficult, however, this may be contributed to that male are exposed more frequently for risk factors than female [80]. Female are more likely to develop anti-HBs [81], and this may influence the decline in HBsAg titre in female, resulting in a shorter duration of the carrier state [82].

Age of hepatitis B virus acquisition is an important determinant of the virus epidemiology. In area with low rate endemicity, the infection occur in adolescents and young adults, and in the area with high endemicity the infection occur in children with age of 4-8 years [83]. The present study indicated that overall HBsAg seroprevalence was higher in the age group of >45 years of age (8.02%), followed by the age of 1-14 years (4.06%), while the lowest (2.65%) was in the age of 15-45 years. The difference in seroprevalence between the age groups was highly significant for total study population and for years of study and within the age groups, except 5-14 years age group.

Our study found a prevalence of HBsAg of 4.07% in age of 1-4 years which is higher to that reported before in Iraqi normal population, while the higher seroprevalence in the age >45 years was consistent with its results [29]. The high seroprevalence in the 1-4 years age group may be due to vertical transmission of the virus or they may not be enrolled in the immunization program. The high prevalence in the older age group may be due to that are not included in the immunization program since it is started in 1993 in Iraq or they are prone to get infection through horizontal way by contamination with blood, blood products or sexual contact [84].

The reported studies for Iraq indicated HBsAg prevalence peak of 20-45 [37], 30-39 [44], 30-49 [43,46] and >40 years [11]. Thus our study not consistent with the national community based study in regard to prevalence in age <10 years, however, it was consistent in regard to old age >40 years.

Global studies reported that the peak of HBsAg prevalence was 11-20 years in India [65], 21-40 years in Pakistan [17], 25 -34 years in Bahrain [47], 50-79 years in Canada [63], ≥40 years' immigrants in USA [69], 20-34 years in China [84], ≥50 years in USA [79], ≥ 30 years in Ethiopia [64], 21-40 years in Nepal [58]. In a recent review [59], reported age prevalence by WHO region and thus the age of peak prevalence was in adults (>20 years), with the exception of Africa (10-20 years) and Mediterranean regions (14-18 years). Most the studies concerning HBsAg age prevalence was illustrated that the infection is more predominant in adult which is mainly a reflection of the effective vaccination programs worldwide.

The present study indicated that the pattern of HBV seroprevalence across age in our study population exhibit a rapid increase in the prevalence, peaking first in ages 1-4 years (4.07%) and 5-14 (4.06%) years and later in ages >45 years (8.02%), with a decline in the ages 15-45 years (2.65%). Thus our study shows double peck curve, while Ataalla et al [11] study shows single peak curve. The diversity between the two studies may reflect the difference in sampling. The modes of transmission, age distribution, and prevalence of HBV in any community have important clinical significance as they help to clarify the pattern of infection and successful management. Globally, three patterns of chronic hepatitis B virus infection were described [53]. The 1st pattern characterized by vertical route of transmission, which followed by high incidence of chronic liver infection (90%) and seen in China and other Asia-Pacific countries [53]. The 2nd pattern is characterized by horizontal transmission in early childhood, which followed by high incidence of chronic HBV infection (30%) and is seen in South Asia, African in South Asia, Africa and Mediterranean countries. The 3rd pattern is characterised by horizontal transmission in adults through sexual contact, intravenous drug abuse, or transfusion of infected blood products, which followed by low

(2%) of chronic HBV infection and seen in Western countries [53].

In our community, the proposed pattern of chronic hepatitis B infection is a combination of the 1st and 3rd patterns, where the infection transmission occurs vertically and horizontally. This pattern illustrates the difficulty of performing control and prevention programs because it must cover a wide range of community. However, implementation of effective antenatal screening, infant vaccination program and safe injection will contribute to reduction in HBV infections and chronicity.

World Health Organization recommends serologic surveys to demonstrate reduction in the prevalence of hepatitis B chronic infection among children born after vaccine introduction [27]. Expanded Program on Immunization technical advisory group in the Eastern Mediterranean Region recommended that Member States [Including Iraq] adopt a goal of reducing the prevalence of chronic HBV infection among cohorts of children born after vaccine introduction to <1%. The present study indicated HBsAg prevalence of 3.20%, which it is too much higher than goal prevalence. Post- vaccination survey in the Eastern Mediterranean Regions that were performed in Oman, Egypt and Saudi Arabia, demonstrate a reduction in the prevalence of chronic hepatitis B infection to <1% [85-87].

The high HBV prevalence at ages of >45 years in both genders suggest that development of comprehensive blood–borne pathogen standard precautions with attendant regulations in Iraq is urgently needed to reduce transmission of hepatitis B and C infection in health care settings. The implementation of such standard needs governance and support at high levels, including legislation and/or regulations to ensure that health care workers are protected and that health care facility are complaint with standards precautions. In addition to legislation, intersectoral collaboration with ministries of labour or social welfare as well as nongovernmental institutions can be helpful in organize these efforts [27]. Occupational safety and health; injection safety and infection control; implementation of infection control; safe blood transfusion and blood product use; and harm reduction strategy are the keys for development of blood-borne HBV standard precautions [81,27]. As an example, in Tikrit city, two general surgeons are carriers of hepatitis B virus and still provide health care to the community in governmental and their private clinics.

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