



# Prevalence of Viral Hepatitis Infections in Misan Province, Iraq, 2013 through 2017

Sanaa Basheer Kadhem, Zainab Mohammad Edi Maysaa Ghazi Jumaa ,Majid Shayal Rhaymah

*Department of Microbiology, College of Medicine,  
University of Misan, Misan, Iraq.*

## Abstract

Viral hepatitis is a systemic disease primarily involving the liver. The present study was accomplished to estimate the prevalence of viral hepatitis A, B and C infections in Misan province, Iraq in the past five years and to evaluate the incidence of these infections among community categories depending on gender, residence place and age groups. A total of 1548 positive cases data of viral hepatitis A, B and C infections were collected from the records of Central Public Health laboratory of Misan Province for the period between January 2013 through December 2017. The present study demonstrated that, Hepatitis A virus (HAV) was the most predominant type, accounting for 71.4% of the cases, followed by Hepatitis B virus (HBV) 18.6% and Hepatitis C virus (HCV) 10%. Males were the most affected gender by all viral hepatitis infections with 54.47%, 84.03% and 55.48% for HAV, HBV and HCV respectively. Regarding to residence place, citizens were the most affected by viral hepatitis infections with 75.93%, 57.64% and 64.52% for HAV, HBV and HCV respectively. HAV infections predominate in patients less than 14 years old with 95.11% of viral hepatitis cases while HBV and HCV most affect age group (25-50) years with 61.11% and 45.81% of viral hepatitis cases respectively. Hepatitis Awareness programs should be done to control the incidence of viral hepatitis focusing on personal hygiene, the importance of using clean water for drinking and cooking and protected sexual contact.

**Keywords:** Hepatitis A, Hepatitis B, Hepatitis C, Misan, Iraq.

## INTRODUCTION

Acute viral hepatitis is a systemic infection affecting the liver predominantly. Almost all cases of acute viral hepatitis are caused by one of five viral agents: hepatitis A virus (HAV), hepatitis B virus (HBV), hepatitis C virus (HCV), the HBV-associated delta agent or hepatitis D virus (HDV), and hepatitis E virus (HEV) (1). It is estimated that about 780,000 people die each year due to consequences of hepatitis B, such as liver cirrhosis and liver cancer and 257 million people are living with hepatitis B virus infection (defined as hepatitis B surface antigen positive) (HBV), and about 71 million people have chronic hepatitis C infection (HCV) and about 1.4 million new hepatitis A virus infections occur globally each year (2,3,4,5). In Saudi Arabia, profiling of viral hepatitis was conducted based on the reports of The Ministry of Health in Saudi Arabia about Hepatitis A, B and C infections in all regions from the period of January 2006 to December 2010, hepatitis B virus (HBV) was the most predominant type, accounting for (53%) of the cases, followed by Hepatitis C virus (HCV) (30%) and HAV (17%). HAV infection predominates in children (5-14 years) with 60% of viral hepatitis cases, HBV in young adults (15-44 years) with 69% of viral hepatitis cases, and HCV in older adults (>45 years) with 59% of viral hepatitis cases (6). Based on the available data from the Jordanian Ministry of Health in 2003, the incidence rates of hepatitis A and B were 10.2 and 0.8 per 100 000 per year, respectively. On the other hand, sufficient information about the incidence of hepatitis C is not available (7), until 2012 when a study that conducted to determine HCV prevalence. The study concluded that the prevalence of HCV infection in the population recruited from different health centers in Jordan is relatively low and

estimates a prevalence of 0.42% among all age groups and 0.56% among those aged >15 years old (8).

Hepatitis A virus (HAV) is a major cause of waterborne hepatitis worldwide especially in tropical and subtropical regions (9,10). The mode of transmission is by the fecal-oral route through close personal contact (11). Infection with hepatitis A virus (HAV) causes a highly contagious illness that can lead to serious morbidity and occasional mortality (12). Hepatitis B virus (HBV) chronically infects 250 million people worldwide, resulting in nearly one million deaths annually (13). HBV is highly contagious and is transmitted through parenteral, sexual and vertical (perinatal transmission) routes (14). Infection of hepatitis C virus (HCV) results in Hepatitis C, a liver disease. On a global scale, approximately 700,000 out of 150 million people with chronic HCV infection succumb each year to the hepatitis C-related liver diseases such as cirrhosis, hepatocellular carcinoma, and liver failure (15,16). Well-known risk factors for HCV infection transmission include, blood product transfusion, organ transplantation, and chronic hemodialysis and injection drug use (17). We had conducted this study to estimate the prevalence of viral hepatitis infections in the province in the past five years among patients who referred to Central Public Health laboratory and to evaluate the incidence of these infections among patients categories depending on gender, residence place and age groups. The prevalence of viral hepatitis infections have not been well documented in Iraq as well as in Misan Province.

## METHODS

The patients data were collected from the records of Central Public Health laboratory of Misan Province for the period between January 2013 through December 2017. In

present study, we emphasized on the incidence of viral hepatitis infections among patients according to gender, residence place (city or suburbs) and patient age groups. A total of 1548 positive cases of viral hepatitis A, B and C infections were included in the study. The mean age of the patients was 45 years and the total number of males and females was 930 and 618 respectively. Serum samples were tested for anti-HAV, HBsAg and anti-HCV with use of a third-generation enzyme immunoassay (MINI VIDAS, BIOMÉRIEUX, Italy). Infections were confirmed with use of ELISA (BioTek®, U.S.A). The cases were referred to Central Public Health laboratory after physical examinations by physicians. Some HBV and HCV cases were asymptomatic and they are diagnosed accidentally by routine blood testing conducted by blood bank of Misan after blood donation by the carriers. Results of the present study were subjected to statistical analysis using the Statistical Analysis System-SAS, version 2012. The comparison between percentage was determined depending on Chi-square test.

### RESULTS

During the period between January 2013 through December 2017, 1548 positive cases of viral hepatitis were documented, of these cases, there were 1105 (71.4%) cases of HAV, 288 (18.6%) cases of HBV and 155 (10%) cases of HCV. The prevalence of HAV infections were statistically significant in 2013, 2014 and 2015 respectively (Table 1).

The cases of viral hepatitis affected males significantly. Statistically, the differences were variable among highly significant, significant or non-significant, and they were 602 (54.47%), 242 (84.03%) and 86 (55.48%) for HAV, HBV and HCV respectively. Table (2, 5 and 8).

According to the residence place, cases of viral hepatitis were highly significant for each type of viral hepatitis ( $p < 0.01$ ). The majority of viral hepatitis cases were of patients who reside the city. The cases were 839 (75.93%), 166 (57.64%) and 100 (64.52%) for HAV, HBV and HCV respectively. (Table 3, 6 and 9).

The age group of viral hepatitis cases was significantly different. Statistically, the differences were variable among highly significant, significant or non-significant. For HAV, the most affected age group was less than 14 years old with total number of 1051 cases that represent 95.11% of HAV cases, while for HBV and HCV, the most affected age group was (25-50) years with a total number of 176 (61.11%) and 71 (45.81%) respectively. (Table 4, 7 and 10).

In 2013, the predominant cases were of HAV with a total of 394 cases, of them, 230 (58.38%) in males, 314 (79.7%) of patients who reside city and 370 (93.91%) cases of patients who are less than 14 years old. HAV cases followed by HBV cases with a total of 76 cases which 65 (85.53%) of cases were males, 51 (67.11%) of patients who reside city and 48 (63.16%) cases within the age group (25-50) years. The lowest number of reported cases were for HCV with a

total of 31 cases. 19 (61.29%) of the cases were males, 22 (70.97%) of patients who reside city and 19 (61.29%) within the age group (25-50) years old.

In 2014, HAV cases showed a decline in the number of reported cases but still the predominant one with a total of 150 cases. Of these cases, 82 (54.67%) were males, 118 (78.67%) of cases were patients who reside city and 140 (93.33%) cases of patients who are less than 14 years old. HBV cases ranked second in this year too, with a total of 75 cases. 65 (86.67%) of males, 43 (57.33%) of citizens and 48 (64%) within the age group (25-50) years old. HCV were the less reported cases with a total of 26 cases. 14 (53.85%) were females, 21 (80.77%) were citizens and 12 (46.15%) were patients within the age group (25-50) years.

In 2015, the reported cases of HAV raised again and still the predominant cases for the third year respectively with a total of 289 cases. 147 (50.87%) of cases were males, 199 (68.86%) of citizens and 282 (97.58%) of patients less than 14 years. HBV cases showed a decline in the number of the reported cases. However they still ranked second to viral hepatitis infections in the province with a total of 46 cases, of them, 42 (91.3%) were males, 25 (54.35%) of citizens and 30 (65.22%) within the age group (25-50) years. The reported cases of HCV in this year were the highest number of reported cases compared with the last two years with the total of 44 cases. 24 (54.55%) were females, 23 (52.27%) were citizens and 21 (47.73%) patients who are more than 50 years old.

In 2016, the reported cases of HAV stayed at the highest records of the viral hepatitis infections but showed a decline in the number of reported HAV cases compared with the last year. The total number of HAV were 142. Of these cases 82 (57.75%) were males, 106 (74.65%) of citizens and 37 (78.72%) patients less than 14 years. HBV cases followed HAV cases with a total of 47 cases. Of them, 37 (78.72%) were males, 29 (61.7%) of citizens and 27 (57.45%) were patients within the age group (25-50) years. HCV showed a decline in the number of the reported cases with a total of 24 cases. Of these cases 16 (66.67%) were males, 14 (58.33%) of citizens and 13 (54.17%) of patients within the age group (25-50) years.

In 2017, as the previous years, the predominant cases were of HAV infections which decreased than that of the last year with a total of 130 cases. 69 (53.08%) cases were females, 102 (78.46%) of citizens and 127 (97.69%) of patients less than 14 years. HBV cases, as usual, followed HAV cases according to the number of cases, and they showed a little decrease than the last year with a total of 44 cases, of them, 33 (75%) were males, 26 (59.09%) of suburbans and 23 (52.27%) of patients within the age group (25-50). The lowest number of the reported viral hepatitis infections were of HCV with a total of 30 cases. Of these cases, 19 (63.33%) were males, 20 (66.67%) of citizens. Both age groups of (15-24) years and (25-50) years had an equal numbers of cases which were 10 (33.33%) for each group.

**Table 1. Distribution of study sample according to type of hepatitis virus**

Year	Type of hepatitis virus No (%)			Chi-Square
	Type A	Type B	Type C	
2013	394 (35.66%)	76 (26.39%)	31 (20.00%)	5.37 *
2014	150 (13.58%)	75 (26.04%)	26 (16.77%)	4.25 *
2015	289 (26.15%)	46 (15.97%)	44 (28.39%)	5.07 *
2016	142 (12.85%)	47 (16.32%)	24 (15.48%)	1.15 NS
2017	130 (11.76%)	44 (15.28%)	30 (19.36%)	2.64 NS
Total	1105	288	155	

\* (P&lt;0.05).

**Table 2. The relationship between the prevalence of HAV and gender.**

Year	No.	Male		Female		Chi-Square
		No	%	No	%	
2013	394 (35.66%)	230	58.38	164	41.62	7.35 **
2014	150 (13.58%)	82	54.67	68	45.33	4.51 *
2015	289 (26.15%)	147	50.87	142	49.13	0.873 NS
2016	142 (12.85%)	82	57.75	60	42.25	6.17 **
2017	130 (11.76%)	61	46.92	69	53.08	2.39 NS
Total	1105	602	54.47	503	45.52	
Chi-Square	---	---	5.27 *	---	5.27	---

\* (P&lt;0.05), \*\* (P&lt;0.01).

**Table 3. The relationship between the prevalence of HAV and residence place.**

Year	No.	City		Suburbs		Chi-Square
		No	%	No	%	
2013	394 (35.66%)	314	79.70	80	20.30	12.84 **
2014	150 (13.58%)	118	78.67	32	21.33	12.62 **
2015	289 (26.15%)	199	68.86	90	31.14	9.96 **
2016	142 (12.85%)	106	74.65	36	25.35	11.54 **
2017	130 (11.76%)	102	78.46	28	21.54	12.36 **
Total	1105	839	75.93	266	24.07	12.75 **
Chi-Square	---	---	4.37 *	---	4.37 *	---

\* (P&lt;0.05), \*\* (P&lt;0.01).

**Table 4. The relationship between the prevalence of HAV and age groups**

Year	No.	Age group (year)				Chi-Square
		Less than 14	15-24	25-50	More than 50	
2013	394 (35.66%)	370 (93.91%)	18 (4.57%)	3 (0.76%)	3 (0.76%)	14.54 **
2014	150 (13.58%)	140 (93.33%)	7 (4.67%)	1 (0.67%)	2 (1.33%)	14.61 **
2015	289 (26.15%)	282 (97.58%)	4 (1.38%)	2 (0.69%)	1 (0.34%)	14.76 **
2016	142 (12.85%)	132 (92.96%)	9 (6.34%)	1 (0.70%)	0 (0.00%)	14.29 **
2017	130 (11.76%)	127 (97.69%)	2 (1.54%)	1 (0.77%)	0 (0.00%)	14.86 **
Total	1105	1051 (95.11%)	40 (3.62%)	8 (0.72%)	6 (0.54%)	14.47 **
Chi-Square	---	1.47 NS	1.39 NS	0.064 NS	0.095 NS	---

\*\* (P&lt;0.01).

**Table 5. The relationship between the prevalence of HBV and gender.**

Year	No.	Male		Female		Chi-Square
		No	%	No	%	
2013	76 (26.39%)	65	85.53	11	14.47	13.52 **
2014	75 (26.04%)	65	86.67	10	13.33	13.67 **
2015	46 (15.97%)	42	91.30	4	8.70	14.27 **
2016	47 (16.32%)	37	78.72	10	21.28	12.84 **
2017	44 (15.28%)	33	75.00	11	25.00	12.35 **
Total	288	242	84.03	46	15.97	13.48 **
Chi-Square	---	---	6.13 **	---	6.13 **	---

\*\* (P&lt;0.01).

**Table 6. The relationship between the prevalence of HBV and residence place.**

Year	No.	City		Suburbs		Chi-Square
		No	%	No	%	
2013	76 (26.39%)	51	67.11	25	32.89	9.84 **
2014	75 (26.04%)	43	57.33	32	42.67	6.27 **
2015	46 (15.97%)	25	54.35	21	45.65	4.30 *
2016	47 (16.32%)	29	61.70	18	38.30	9.21 **
2017	44 (15.28%)	18	40.91	26	59.09	6.38 **
<b>Total</b>	<b>288</b>	<b>166</b>	<b>57.64</b>	<b>122</b>	<b>42.36</b>	<b>6.13 **</b>
<b>Chi-Square</b>	<b>---</b>	<b>---</b>	<b>8.56 **</b>	<b>---</b>	<b>8.56 **</b>	<b>---</b>

\* (P&lt;0.05), \*\* (P&lt;0.01).

**Table 7. The relationship between the prevalence of HBV and age groups**

Year	No.	Age group (year)				Chi-Square
		Less than 14	15-24	25-50	More than 50	
2013	76 (26.39%)	4 (5.26%)	7 (9.21%)	48 (63.16%)	17 (22.37%)	12.58 **
2014	75 (26.04%)	0 (0.00%)	7 (9.33%)	48 (64.00%)	20 (26.67%)	12.42 **
2015	46 (15.97%)	0 (0.00%)	1 (2.17%)	30 (65.22%)	15 (32.61%)	12.84 **
2016	47 (16.32%)	0 (0.00%)	9 (19.15%)	27 (57.45%)	11 (23.40%)	10.52 **
2017	44 (15.28%)	1 (2.27%)	11 (25.00%)	23 (52.27%)	9 (20.45%)	10.39 **
<b>Total</b>	<b>288</b>	<b>5 (1.74%)</b>	<b>35 (12.15%)</b>	<b>176 (61.11%)</b>	<b>72 (25.00%)</b>	<b>12.08 **</b>
<b>Chi-Square</b>	<b>---</b>	<b>2.07 NS</b>	<b>8.26 **</b>	<b>5.11 *</b>	<b>4.74 *</b>	<b>---</b>

\* (P&lt;0.05), \*\* (P&lt;0.01).

**Table 8. The relationship between the prevalence of HCV and gender.**

Year	No.	Male		Female		Chi-Square
		No	%	No	%	
2013	31 (20.00%)	19	61.29	12	38.71	9.25 **
2014	26 (16.77%)	12	46.15	14	53.85	2.41 NS
2015	44 (28.39%)	20	45.45	24	54.55	4.38 *
2016	24 (15.48%)	16	66.67	8	33.33	9.61 **
2017	30 (19.36%)	19	63.33	11	36.67	9.42 **
<b>Total</b>	<b>155</b>	<b>86</b>	<b>55.48</b>	<b>69</b>	<b>44.52</b>	<b>4.29 *</b>
<b>Chi-Square</b>	<b>---</b>	<b>---</b>	<b>8.36 **</b>	<b>---</b>	<b>8.36 **</b>	<b>---</b>

\* (P&lt;0.05), \*\* (P&lt;0.01).

**Table 9. The relationship between the prevalence of HCV and residence place.**

Year	No.	City		Suburbs		Chi-Square
		No	%	No	%	
2013	31 (20.00%)	22	70.97	9	29.03	11.46 **
2014	26 (16.77%)	21	80.77	5	19.23	13.19 **
2015	44 (28.39%)	23	52.27	21	47.73	1.84 NS
2016	24 (15.48%)	14	58.33	10	41.67	6.38 **
2017	30 (19.36%)	20	66.67	10	33.33	9.71 **
<b>Total</b>	<b>155</b>	<b>100</b>	<b>64.52</b>	<b>55</b>	<b>35.48</b>	<b>9.47 **</b>
<b>Chi-Square</b>	<b>---</b>	<b>---</b>	<b>8.62 **</b>	<b>---</b>	<b>8.62 **</b>	<b>---</b>

\*\* (P&lt;0.01).

**Table 10. The relationship between the prevalence of HCV and age groups**

Year	No.	Age group (year)				Chi-Square
		Less than 14	15-24	25-50	More than 50	
2013	31 (20.00%)	2 (6.45%)	4 (12.90%)	19 (61.29%)	6 (19.35%)	11.56 **
2014	26 (16.77%)	4 (15.38%)	4 (15.38%)	12 (46.15%)	6 (23.08%)	9.35 **
2015	44 (28.39%)	1 (2.27%)	5 (11.36%)	17 (38.64%)	21 (47.73%)	9.02 **
2016	24 (15.48%)	2 (8.33%)	4 (16.67%)	13 (54.17%)	5 (20.83%)	9.39 **
2017	30 (19.36%)	6 (20.00%)	10 (33.33%)	10 (33.33%)	4 (13.33%)	10.42 **
<b>Total</b>	<b>155</b>	<b>15 (9.68%)</b>	<b>27 (17.42%)</b>	<b>71 (45.81%)</b>	<b>42 (27.09%)</b>	<b>9.61 **</b>
<b>Chi-Square</b>	<b>---</b>	<b>7.63 **</b>	<b>7.28 **</b>	<b>9.04 **</b>	<b>9.16 **</b>	<b>---</b>

\*\* (P&lt;0.01).

## DISCUSSION

The present study is the first and most updated epidemiological study of viral hepatitis infections (HAV, HBV, HCV) in Misan province, Iraq.

HAV infection is hyper endemic in Iraq with a national estimate of IgG sero-prevalence rate of 98% in the 5th decade and older age group (41+). The prevalence rate is almost constant from the second decade of life through after, which reflects the bad hygienic situation of the country (18). Results of our study were compatible with the national estimation, and it indicates that, the incidence of HAV is higher than those of HBV and HCV in Misan Province with a percentage of 71.4%, 18.6% and 10% respectively. This increased percentage returns to many reasons related to social and water and sewage services factors, such as poverty, education, poor hygiene and lack of health awareness. In addition to poor sanitation and the damage of water supply infrastructure and its contamination with sewage (19).

The present study showed that; HBV infection rate was 18.6% of the reported viral hepatitis cases. It is a low prevalence rate and this result agree with that of a national survey which revealed that, Iraq is of low prevalence with HBsAg and it was the lowest in some provinces including Misan (<0.5%) (20). In Baghdad, a cross-sectional study showed that the prevalence of HBsAg in blood donors attending the National Blood bank was 0.6% in all donors (21). Another cross-sectional observational study in Basrah province showed the prevalence of HBsAg among all blood donors to be 0.2% (22). Present study also comply with the national study of Kuwait that showed the prevalence of HBsAg among Kuwaiti national and non-Kuwaiti Arab at 1.1% and 3.5% respectively (23).

In the present study, HCV cases were the lowest infection rate among viral hepatitis infections which were 10%. This result agree with the national survey that indicates the decreased HCV infection rate if compared with HAV and HBV cases which was 0.4% only (20). Similar results were obtained by studies in Baghdad and Basra which showed that, the prevalence of HCV cases were 0.7% and 0.12% respectively among blood donors (21,22). All of these studies gave decreased infection rates if compared with Saudi Arabia which showed 30% of reported cases (6), and Egypt which showed an infection rate of 5-25% among blood donors (24). Present study also comply with the national study of Kuwait, that showed the prevalence of anti-HCV among Kuwaiti national and non-Kuwaiti Arab first-time donors was 0.8% and 5.4% respectively (23).

However, according to WHO, Iraq is a low endemicity country for hepatitis B and C. The usual mode of transmission is blood transfusions or repeated exposure to blood and its derivatives (post-transfusion non-A non-B hepatitis) (25).

Regarding to gender, infection rate among male was higher than that of females for all years of the study period for all viral hepatitis infections, although there is no indication of different incidence of acute viral hepatitis A infections among male and female (26). This result was incompatible

with that of the national estimation study which indicates that, no gender differences were observed for HAV (19). High prevalence results of HBV and HCV in males compared to females have been observed in the national survey which indicates that, male gender significantly increases the risk of having positive HBs antigen by 41% compared to females and also increases the risk of having positive anti-HCV IgG antibodies by 75% compared to females, but this association was not significant statistically (20). Similar results of gender disproportion were obtained in Baghdad, Basra and Thi-Qar Provinces, Iraq (21,22,27). This gender disproportion may be attributed to many personal and social factors, such as sexual activities (usually illegal) in country or abroad, participation of shaving tools among customers, tattooing, cupping and drug use. Regarding to residence place, viral hepatitis infection rates in city were higher than that of suburbs in all the years of the study period for all viral hepatitis infections. The decreased number of the reported cases of HAV might be attributed to neglecting of patients to visit Central Public Health laboratory in the center of the province to do the necessary tests due to poverty and the far distance, in addition to the absence of strict instructions which obligate patient to visit Central Public Health laboratory contrarily of that of HBV and HCV cases.

Regarding to age groups, HAV infection predominates in age group less than 14 for all years of the study period with 95.11%. this result agree with the national estimation study which showed an obvious increase between the first and second decade of life for HAV (19). It is also compatible with the Saudi study which showed the incidence of HAV infections in children (5-14) years (6). For HBV and HCV, the most affected age group was (25-50) years for all years of the study, and this could be attributed to that, this life stage considered as the peak of lifetime activities, and therefore the possibility of exposure to the risk factors.

## CONCLUSIONS

HAV infections were the predominant one among viral hepatitis infections in all the years of the study period followed by HBV and HCV respectively in Misan province, Iraq. All viral hepatitis infections were most frequent in males and citizens. Regarding to the age groups, less than 14 years were the more susceptible to the infection by HAV, while it was (25-50) for HBV and HCV. Although of these recorded cases we couldn't determine whether the province is endemic for any of these viral infections, due to the absence of precise and up to date population census.

## Acknowledgements

We thank Saleem Helo and Abbas Jumaa Sultan / Central Public Health laboratory of Misan Province, and Hassan Rahman Shawi / Blood Bank of Misan Province.

## Conflicts of Interest

The authors declare that there are no conflicts of interest.

## REFERENCES

1. Dennis L. Kasper, Anthony S. Fauci, Stephen L. Hauser, Dan L. Longo, J. Larry Jameson, Joseph Loscalzo. *Harrison's principles of internal medicine*, 19th Edition. USA: McGraw-Hill Education; 2015. 2004 p.
2. World Health Organization. Hepatitis B [Internet]. Geneva: World Health Organization; 2017 [cited 2018 Jul 20]. Available from: <http://www.who.int/news-room/fact-sheets/detail/hepatitis-b>.
3. World Health Organization. Hepatitis C [Internet]. Geneva: World Health Organization; 2017 [cited 2018 Jul 20]. Available from: <http://www.who.int/news-room/fact-sheets/detail/hepatitis-c>.
4. Jamali R. *Epidemiologic Studies on Viral Hepatitis: A Short Review*, Thrita [Internet]. 2014 Feb [cited 2018 Jul 20];3(1):e15376. Available from: <http://thritajournal.com/en/articles/18185.html> DOI: 10.5812/thrita.15376.
5. World Health Organization. Vaccines and diseases, Hepatitis B [Internet]. Geneva: World Health Organization; 2018 [cited 2018 Jul 20]. Available from: <http://www.who.int/immunization/diseases/hepatitisB/en/>.
6. Alshabanat AA, Albacker RB, Basalama AA, Bin Salamah AA, Alfrayh AS. Profile of viral hepatitis in Saudi Arabia. *Biomed. Res.* 2013 May;24(3): 396-399.
7. Hassan ZM, Wahsheh MA, Shishani KR, Pryor ER. Hepatitis needs assessment among Jordanian healthcare workers. *Int Nurs Rev.* 2008;55: 142-147.
8. Hamoudi W, Sheikh Ali SA, Abdallat M, Estes CR, Razavi HA. HCV infection prevalence in a population recruited at health centers in Jordan. *J Epidemiol Glob Health.* 2013 Mar;3: 67-71.
9. Global Burden of Disease Study Collaborators. Global, regional, and national incidence, prevalence, and years lived with disability for 301 acute and chronic diseases and injuries in 188 countries, 1990-2013: a systematic analysis for the Global Burden of Disease Study 2013. *Lancet.* 2015 Aug;386(9995):743-800. doi: 10.1016/S0140-6736(15)60692-4.
10. Khalili M, Sharifi-Mood B. Hepatitis A Virus Infection. *Int. j. infect [Internet].* 2016 [cited 2018 Jul 20];4(1):e38666. Available from: <http://intjinfection.com/en/articles/14772.html>. DOI: 10.17795/iji-38666.
11. Carroll KC, Morse SA, Mietzner TA, Miller S. *Medical Microbiology*. 27<sup>th</sup> ed. USA: McGraw-Hill Education; 2016. 506 p.
12. Koenig KL, Shastry S, Burns MJ. Hepatitis A Virus: Essential Knowledge and a Novel Identify-Isolate-Inform Tool for Frontline Healthcare Providers. *West J Emerg Med [Internet].* 2017 [cited 2018 Jul 20];18(6):1000-1007. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5654866/pdf/wjem-18-1000.pdf>. DOI: 10.5811/westjem.2017.10.35983.
13. Tsai KN, Kuo CF, Ou JJ. Mechanisms of hepatitis B Virus persistence. *Trends Microbiol.* 2018 Jan 01;26(1):33-42.
14. Alavian SM. Military personals should be vaccinated against hepatitis B infection. *J. Arch. Mil. Med. [Internet].* 2014 [cited 2018 Jul 21];2(1):e16450. Available from: <http://jammonline.com/en/articles/20773.html>. DOI: 10.5812/jamm.16450.
15. Mohd HK, Groeger J, Flaxman AD, Wiersma ST. Global epidemiology of hepatitis C virus infection: new estimates of age-specific antibody to HCV seroprevalence. *Hepatology.* 2013 Apr;57(4):1333-42.
16. WHO. 2016. Guidelines for the screening, care and treatment of persons with chronic hepatitis C infection [Internet]. Geneva: WHO publications; 2016 [cited 2017 Jun 21]. 133 p. Available from: <http://www.who.int/hepatitis/publications/hepatitis-c-guidelines-2016/en/>.
17. Ghany M, Strader B, Thomas DL, Seeff LB. Diagnosis, management, and treatment of hepatitis C: An update. *Hepatology.* 2009 Apr;49(4):1335-1374.
18. CDC Center. Communicable Disease Control Guidelines [Internet]. Baghdad: Ministry of Health; 2012 [cited 2018 Jul 25]. 118 p. Available from: [https://reliefweb.int/sites/reliefweb.int/files/resources/ATT\\_1421348\\_262557\\_cdc\\_guideline\\_english.pdf](https://reliefweb.int/sites/reliefweb.int/files/resources/ATT_1421348_262557_cdc_guideline_english.pdf).
19. Turky AM, Akram W, Al-Naaimi AS, Omer AR, Al- Rawi JR. Analysis of Acute Viral Hepatitis (A and E) in Iraq. *Glob J Health Sci.* 2011 Apr;3(1):70-76. doi:10.5539/gjhs.v3n1p70.
20. Tarky AM, Akram W, Al-Naaimi AS, Omer AR. Epidemiology of viral hepatitis B and C in Iraq: a national survey 2005-2006. *Zanco J Med Sci.* 2013;17(1):370-380.
21. Turky AM, Khaleel HA, Kadoori MS, Alaani SA. Prevalence of hepatitis B and C among blood donors attending the National Blood Transfusion Center in Baghdad, Iraq from 2006-2009. *Saudi Med J.* 2011;32(10):1046-1050.
22. Al-Rubaye A, Tariq Z, Alrubaiy L. Prevalence of hepatitis B seromarkers and hepatitis C antibodies in blood donors in Basra, Iraq. *BMJ Open Gastroenterol [Internet].* 2016 [cited 2018 Aug 15];3:e000067. Available from: <https://bmjopengastro.bmj.com/content/bmjgast/3/1/e000067.full.pdf>. DOI:10.1136/bmjgast-2015-000067.
23. Mahtab MA, Rahman S, Karim MF, Khan M, Foster G, Solaiman S, et al. Epidemiology of hepatitis B virus in Bangladeshi general population. *Hepatobiliary Pancreat Dis Int.* 2008 Dec;7(6):595-600.
24. Mohamoud YA, Mumtaz GR, Riome S, Miller D, Abu-Raddad LJ. The epidemiology of hepatitis C virus in Egypt. *BMC Infect Dis [Internet].* 2013 Jun [cited 2018 Aug 16];13(288). Available from: <https://doi.org/10.1186/1471-2334-13-288>.
25. World Health Organization EMRO. Iraq Viral hepatitis [Internet]. Geneva: World Health Organization; 2018 [cited 2018 Aug 12]. Available from: <http://www.emro.who.int/irq/programmes/hepatitis.html>.
26. Fresner G. *Hepatitis A virus: text book of human virology*. Belshe, R.B. edition. Massachusetts: PGS Publishing Company; 1984. 707-727 p.
27. Abass YA, Khawam R. Epidemiology of Hepatitis HBV and HCV at Thi-Qar Province-Iraq. *QMJ.* 2008 Jun;4(5):160-171.