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Original Article

Seroprevalence and associated risk factors of HBV and HCV infections in the population of Ghudduwah Village, South Libya

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Abstract

Introduction: Hepatitis B virus (HBV) and hepatitis C virus (HCV) infections are serious public health concerns in Libya, particularly in the southern region. This study aimed to determine the prevalence and associated risk factors for HBV and HCV infections among the general population in Ghudduwah village, south Libya.

Methodology: A cross-sectional study was carried out on 352 individuals from April to October 2018. Data on socio-demographic characteristics and suspected risk factors were obtained by a standard questionnaire. Serum samples were tested for HBV markers (HBsAg, HBcAb, HBeAg, HBeAb and HBsAb) and anti-HCV antibody (HCV-Ab).

Results: The overall prevalence of HBsAg, HBcAb, and HCV-Ab was 2.8%, 21%, and 22.4%, respectively. The rates of HBsAg, HBcAb, and HCV-Ab were significantly higher in males (4.5 %, 25.8% and 26.2 %) than in females (0%, 12.9 %, and 16%, respectively). The high prevalence of HBcAb and HCV-Ab were significantly associated with individuals who had a history of blood transfusion (p = 0.037 and 0.035, respectively) and received dental treatment (p = 0.01 and 0.0001, respectively). In addition, a high prevalence of HCV infection was significantly associated with a family history of viral hepatitis and wet cupping (p = 0.05 and 0.0001, respectively).

Conclusions: Ghudduwah village is an area of low-intermediate hepatitis B endemicity, whereas the local prevalence of hepatitis C infection is classified as high-endemicity. History of blood transfusion, dental treatment, family history of viral hepatitis and wet cupping were the most common risk factors for the transmission of HBV and HCV infection.

Key words: hepatitis B; hepatitis C; Ghudduwah; risk factors.

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Introduction

Hepatitis B virus (HBV) and hepatitis C virus (HCV) infections constitute a major public health problem worldwide. According to estimates by the World Health Organization (WHO) about 296 million people had suffered from chronic HBV infection and 58 million people had chronic HCV infection in 2021, with 1.5 million new infections of both HBV and HCV annually [1,2]. Furthermore, WHO reports 820,000 and 290,000 deaths annually due to HBV and HCV infection, respectively; mostly from cirrhosis and hepatocellular carcinoma [1,2]. Recently, the Eastern Mediterranean Region Office of WHO (EMRO) reported that more than 18 and 12 million people in the region are currently infected with chronic HBV and HCV, respectively [3]. These two blood-borne viruses share common modes of transmission, such as direct contact with blood and blood derivatives, and perinatal or sexual transmission; although sexual transmission is rare in HCV patients [4]. Both HBV and HCV are infectious liver diseases and frequently occur as chronic co-infections, especially in endemic areas and in individuals with high-risk parenteral infection [5,6].

The Libyan HBV immunization program was established in 1989 and is mandatory for children of ages 3 months to 12 years old [7]. However, routine vaccination of newborns and adolescents in Libya remains a challenge and adults born before the introduction of the HBV vaccine remain largely unprotected.

According to a recent report by Olaru *et al*., the global seroprevalence of HBsAg and HCV-Ab was 5.8% and 10.3%, respectively; with the highest prevalence of HBV in the WHO African region (7.8%) and the highest prevalence of HCV in the WHO European region (17.5%) [8].

National surveillance for HBV and HCV infections was performed on more than 65,000 individuals among the general population in different regions of Libya and it was found that the prevalence of HBV was 2.2% and the prevalence of HCV was 1.3% [9]. Additionally, a significant study conducted in Tripoli between 2008–2013 involving 1,008,214 Libyan blood donors found that the prevalence of HCV infection was 1.8% [10]. However, a recent study by Saaed and Ongerth found a high prevalence of HBV (23.4%) and HCV (31.2%) among 3,248 African migrants from different regions of sub-Saharan Africa who arrived in Al-Kufra which is in the southeast of Libya [11].

The southern region of Libya shares borders with sub-Saharan African countries including Niger, Chad, and Sudan. According to personal observations of participants, Ghudduwah village is a transit area for migrants who arrive from high and intermediate endemic areas of HBV and HCV and continue travel to the Mediterranean coast around Tripoli to prepare for departure to European countries.

Surveillance of HBV and HCV infections among the general population in the southern region of Libya is limited. The Ghudduwah village in Fazzan province, southern Libya is located along the migrant route from sub-Saharan African region to the Mediterranean Sea. It was selected to assess the prevalence rate and risk factors associated with HBV and HCV infections among the general population.

Methodology

Study design and setting

A cross-sectional study was conducted from April to October 2018 in a small village called Ghudduwah, that is located in the Fazzan province, in the southern region of Libya; and has an estimated population of around 3,420 inhabitants. The village is situated approximately 70 km south of Sebha city and is bordered by Um-alaranib, Zawilah, Traghin, and Tasawa. Ghudduwah has a primary healthcare center that includes a general practitioner's clinic, dental clinic, pharmacy, and vaccination services. All emergency cases are transferred to a tertiary healthcare center in Sebha (Figure1).

Study population and data collection

In this study, 352 individuals were selected by simple random sampling method from the general population using the EpiInfo program, assuming a 95% confidence level [12]. The study sample was from different age groups, with different occupations, and residing in different parts of the village.

A questionnaire was used to collect demographic data, such as gender, age, and occupation. In addition, data on risk factors for HBV and HCV infections such as blood transfusion, dental surgery, surgical history, vaccination, and use of wet cupping, were recorded.

Serological tests

Serum samples were tested for HBsAg and HBcAb using commercially available enzyme-linked immunosorbent assay (ELISA) (BioTek Instrument, ELx500, NY, USA) following the manufacturer's protocol; whereas HBeAg, HBeAb and HBsAb were tested by chemiluminescent immunoassay method using a fully automated Cobas® e411 analyzer (Roche Diagnostics Mannheim, Germany). The HCV-Ab serological test was conducted using a fully automated VITROS®3600 analyzer (Ortho-Clinical Diagnostics, Illkirch-Graffenstaden, France).

Statistical analysis

Statistical analysis was performed using IBM SPSS version 22 software (IBM Corporation, Somers, New York, USA). Chi-square and Fisher's exact tests were used to determine the differences among various groups and to evaluate the association between seroprevalence and risk factors. p value ≤ 0.05 was considered statistically significant.

Ethical approval

Ethical approval was obtained from the Department of Health Service, Sebha, Libya; and the National Center of Diseases Control (NCDC), Tripoli, Libya.

Figure 1. Map of Libya showing the site of Ghudduwah Village, south Libya.

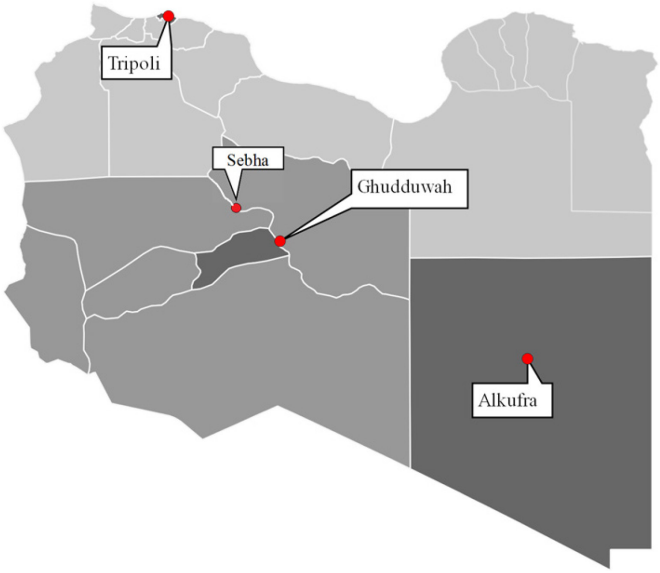

Table 1. Prevalence of HBsAg, HBcAb and anti-HCV by sociodemographic characteristics.

Characteristics	Investigated No. (%)	HBsAg$^+$ No. (95% CI)	*p* value	HBcAb$^+$ No. (95% CI)	*p* value	HCV-Ab$^+$ No. (95% CI)	*p* value
All participants	352	10 (1.55–5.15)	-	74 (17.09–25.58)	-	79 (18.40-27.09)	-
Gender							
Female	131 (37.2)	0	0.016	17 (7.74–19.96)	0.004	21 (10.21–23.45)	0.034
Male	221 (62.8)	10 (2.19–8.16)		57 (20.16–32.09)		58 (20.57–32.57)	
Age							
≤ 15	60 (17)	0	0.22	2 (0.41–11.53)	0.0001	0	0.0001
16–30	130 (36.9)	7 (2.19–10.78)	0.042	26 (13.5–27.92)	0.78	19 (9.03–21.88)	0.007
31–45	97 (27.5)	3 (0.64–8.77)	1.000	32 (23.78–43.27)	0.001	39 (30.37–50.65)	0.0001
46–60	43 (12.2)	0	0.61	12 (15.72–44.58)	0.23	12 (15.72–44.58)	0.43
> 60	22 (6.2)	0	1.000	2 (1.07–28.07)	0.18	9 (19.71–61.46)	0.05
Occupation							
Student	117 (33.2)	0	0.03	5 (1.40–9.69)	0.0001	2 (0.21–6.04)	0.0001
Employed	102 (29)	2 (0.35–9.94)	0.72	39 (28.79–48.39)	0.0001	47 (36.16–56.23)	0.0001
Unemployed	133 (37.8)	8 (4.66–21.89)	0.0001	30 (15.77–30.61)	0.5918	30 (15.77–30.61)	1.0000

anti-HCV: anti-hepatitis C virus antibody; HBsAg and HBcAb are hepatitis B virus markers.

Verbal consent was obtained from adult volunteers, and parental consent was obtained in the case of child volunteers, after informing them about the study and its objectives.

Results

Socio-demographic and population characteristics

A total of 352 individuals were enrolled in the survey. The age range was between 10–80 years (mean age ± standard deviation (SD): 31.3 ± 16.0 years). The participants were divided into five age groups (≤ 15, 16–30, 31–45, 46–60 and > 60 years). The majority were between the ages of 16–30 years (36.9%), followed by the age group 31–45 years (27.5%). In addition, the majority of the studied individuals were males (221, 62.8%) and unemployed (37.8%) (Table 1).

Prevalence of hepatitis B and C viral infections and co-infection

The overall studied population was investigated for sero-markers of HBV and HCV infections. The prevalence of HBsAg, HBcAb, and HCV-Ab were 2.8%, 21% and 22.4%, respectively. Based on the HBV sero-markers patterns (Table 2), the prevalence of chronic HBV infection was 0.87%, while the rate of those who were at the last phase of HBV infection, immune control, or occult HBV infection was 19.6%. Only one person was found to have an acute infection with a high viral replication state, whereas the carrier rate with a low viral replication state was 1.7%. The prevalence rate of those who were immune due to past natural exposure was 1.4% (Table 2). Chronic HBV and HCV infections were detected in only one person, whereas 28 (7.9%) individuals were exposed to past HBV infection as well as infected with HCV infection. The number of individuals infected with HCV alone was 50 (14.2%).

Socio-demographic data associated with hepatitis B and C viral infections

The frequency of positive HBsAg, HBcAb, and HCV-Ab in males was significantly higher (4.5%, 25.8% and 26.2%) than in females ($p = 0.016$, 0.004 and 0.034, respectively; Table 1). The majority of chronic HBV infections were observed in the age group 16–30 years ($p = 0.042$), whereas most past HBV and HCV infections were observed in the age group 31–45 years ($p = 0.001$ and $p = 0.0001$, respectively; Table 1). The presence of chronic HBV infections in unemployed individuals was significantly higher than in other occupation groups ($p = 0.0001$); and the presence of past HBV and HCV infections was significantly higher

Table 2. Patterns of serological markers of HBV, anti-HCV, anti-HDV and anti-HIV among the 352 participants in Ghudduwah, South region in Libya.

Sero-marker	Co-markers	Interpretation	No. of positive/ investigated No.	Prevalence % (95% CI)
HBV infection			10/352	2.8 (1.55–5.15)
HBsAg$^+$	HBsAg$^+$	Chronic HBV infection	3/352	0.87 (0.3–2.53)
	HBsAg$^+$, HBeAb$^+$	Carrier with low viral replication	6/352	1.7 (0.78–3.67)
	HBsAg$^+$, HBeAg$^+$	Acute infection with high viral replication	1/352	0.3 (0.05–1.59)
Past HBV infection			74/352	21 (17.09–25.58)
HBcAb$^+$	HBcAb+	Resolved or occult HBV infection	69/352	19.6 (15.79–24.07)
	HBcAb$^+$, HBsAb$^+$	Immune due to previous natural exposure	5/352	1.4 (0.61–3.28)
HCV infection			79/352	22.4 (18.4–27.09)
Anti-HCV$^+$	Anti-HCV$^+$, HBsAg$^+$	Co-infection	1/352	0.3 (0.25–44.5)
	Anti-HCV$^+$, HBcAb$^+$	Co-infection	28/352	7.9 (26.8–49.8)

Anti-HCV: anti-HCV antibody; CI: confidence interval; HBV: hepatitis B virus; HCV: hepatitis C virus; HDV: hepatitis D virus; HIV: human immunodeficiency virus; HBsAg: HBeAb: HBeAg: HBcAb: and HBsAb and are HBV markers.

among employed individuals (p = 0.0001 and p = 0.0001, respectively; Table 1).

Risk factors associated with hepatitis B and C viral infections

The distribution of various risk factors among chronic and past HBV and HCV infections in comparison with non-infected individuals is shown in Table 3. The unvaccinated individuals had significantly higher association with chronic HBV infection (OR = 0.19, p = 0.026). On the other hand, individuals who previously had a history of blood transfusion (OR = 3.95, p = 0.037) and were treated in a dental clinic (OR = 1.82, p = 0.035) had a significantly higher association with past HBV infection (Table 3). Additional risk factors that were significantly associated with HCV infection included dental clinic treatment (OR = 2.82, p = 0.0001), history of blood transfusion (OR = 5.52, p = 0.01), family history of HCV infection (OR = 3.22, p = 0.05), and wet cupping (OR = 3.86, p = 0.0001) (Table 3).

Discussion

This study aimed to determine the prevalence and risk factors associated with HBV and HCV infections in the southern region of Libya. Ghudduwah village was chosen in this study due to its location along the migrant route from the sub-Saharan countries to the Mediterranean Sea, and because the village hosted many African migrants. The overall prevalence of HBsAg in the study population in Ghudduwah was 2.8%. This is almost similar to two previous local studies carried out in Libya by Daw *et al*. who reported that the prevalence of HBsAg was 2.2% among 65,761 randomly selected individuals [7,13]. In another study conducted on 9,170 persons enrolled from the nine districts of Tripoli, Libya, Daw *et al.* found that the prevalence of HBsAg was 3.7% [7,13]. Thus, Libya ranks in the low-intermediate endemicity class (2–4% category) according to the global level of HBV endemicity categories.

The total prevalence of HBcAb in our studied population was 21%. Out of the 21%, 19.6% of the population was in the last phase of HBV infection, immune control, or occult HBV infection; while the remaining 1.4% was resolved from HBV infection. Studies conducted by Fiasal *et al.* and Shambesh *et al.* [14–16] in the western and eastern regions of Libya concluded that HBcAb prevalence rates were 10.8%, 10%, and 15.6 %, respectively, among healthy blood donors. Another study published by Elzouki *et al.* recorded that the prevalence of HBcAb among Libyan healthcare workers was 8.5% [17]. This increase in HBV infection among various population groups may be attributed to population density and public knowledge regarding HBV transmission. Currently, all blood transfusion centers in Libya screen for HBV infection by detecting only HBsAg in blood. Therefore, it is recommended to implement mandatory screening for HBcAb in blood donors as part of routine laboratory testing in Libyan blood banks. This measure is aimed at ensuring safer blood transfusions and reducing the risk of recipients acquiring HBV infection.

In this study, the prevalence rate of HCV-Ab was 22.4%. Ghudduwah village was classified in the high endemicity class (≥ 5% category) according to the

Table 3. Association between prevalence of HBsAg, HBcAb, and HCV with significant risk factors.

Exposure variable	No. of subjects	HBsAg$^+$ No. (%)	Odds Ratio (95% CI)	p value	HBcAb$^+$ No. (%)	Odds ratio (95% CI)	p value	HCV$^+$ No. (%)	Odd ratio (95% CI)	p value
History of hospitalization										
No	165	9 (5.5)	0.09 (0.01–0.74)	0.007	46 (27.8)	0.45 (0.26–0.77)	0.0038	45 (27.3)	0.59 (0.35–0.98)	0.05
Yes	187	1 (0.5)			28 (15)			34 (18.2)		
History of surgical procedure										
No	292	9 (3.1)	0.53 (0.06–4.28)	1.000	57 (19.5)	1.62 (0.86–3.06)	0.1627	61 (21)	1.62 (0.85–3.01)	0.12
Yes	60	1 (1.7)			17 (28.3)			18 (30)		
Dental procedures										
No	159	7 (4.4)	0.34 (0.08–1.34)	0.195	25 (15.7)	1.82 (1.06–3.11)	0.0350	21 (13.2)	2.82 (1.62–4.90)	0.0001
Yes	193	3 (1.5)			49 (25.4)			58 (30)		
History of blood transfusion										
No	342	9 (2.6)	4.11 (0.46–35.9)	0.253	69 (20.2)	3.95 (1.11–14.05)	0.0378	73 (21.3)	5.52 (1.51–20.10)	0.01
Yes	10	1 (10)			5 (50)			6 (60)		
Family history of viral hepatitis										
No	337	9 (2.6)	2.60 (0.30–21.9)	0.3568	71 (21.1)	0.93 (0.25–3.40)	1.0000	72 (21.3)	3.22 (1.13–9.17)	0.05
Yes	15	1 (6.7)			3 (20)			7 (46.6)		
Wet cupping										
No	310	9 (2.9)	0.81 (0.10–6.60)	1.000	63 (20.3)	1.39 (0.66–2.92)	0.4195	59 (19)	3.86 (1.98–7.54)	0.0001
Yes	42	1 (2.4)			11 (26.2)			20 (47.6)		
History of vaccination										
No	157	8 (5.1)	0.19 (0.04–0.92)	0.026	30 (19)	1.23 (0.73–2.07)	0.5108	–	–	–
Yes	195	2 (1)			44 (22.6)					

CI: confidence interval; HBsAg and HBcAb: hepatitis B virus markers; HCV: hepatitis C virus.

WHO classification [18]. The vast difference between our results and previous local studies [7,17] that show low HCV prevalence rates of 1.2% and 2%, respectively could be attributed to the presence of particular risk factors that encouraged an increased rate of HCV infection. In Ghudduwah, the population of migrants is several times larger than that of the residents, and they reside in camps located at some distance away from the local residents. The migrants and residents frequently shop in one place, pray together at the mosque, visit a single dental care center, and use a common wet cupping facility. Therefore, stakeholders in Ghudduwah could focus on the dental care center and the wet cupping treatment center when developing strategies for HBV and HCV infection prevention and control.

In this study, the prevalence rate of HCV infection was higher than in Maghreb countries (Algeria, Libya, Morocco, Tunisia, and Mauritania), which ranged from 0.6% to 8.4%; while in the Nile Valley region (Egypt and Sudan) the prevalence ranged from 2.2% to 18.9% [19]. The global rate of HCV infection varies in different geographic regions; for instance, estimated prevalence in 2015 in the Eastern Mediterranean and European regions was 2.3% and 1.5% respectively; while the prevalence of HCV infection in sub-Saharan Africa ranges from 0.72% in Southern Africa to 7.82% in Central Africa [20,21].

According to our demographic data, the prevalence of chronic HBV, past HBV, and HCV infections were significantly higher in males than females. This finding has also been reported in previous studies and was explained by males being more frequently exposed to risk factors [13,22–25]. This study found a high prevalence of past HBV and HCV infections among the age group 31–45 (33% and 40.2%, respectively). A former national study reported by Shambesh *et al*. found a high rate of past HBV infection (44.7%) among the age group 30–39 years [16]. The high rate of past HBV and HCV infections in certain age groups may be due to a lack of public health awareness about the risk factors for the transmission of HBV and HCV infections. Other reasons may be the weak infection prevention and control practices in healthcare facilities, especially in dental clinics; and the fact that vaccination program against HBV infection was non-mandatory in Libya.

Several African studies have reported that the prevalence of chronic HBV is high among infants and individuals over 40 years old [26–28]. In the current study, the prevalence of chronic HBV and HCV infections in the ≤ 15 age group was 0%, while past HBV infection was 3.3%, which is incompatible with the data reported by Ali Daw *et al*. who found that the prevalence of chronic HBV infection was 0.8% in Libyan children < 10 years of age [29]. The low rate could be attributed to the compulsory vaccination program against HBV infection for newborns and adolescents in Libya, which was introduced in 1989.

In the current study, one of the risk factors associated with the high prevalence rates of past HBV and HCV infections was dental treatment ($p = 0.035$ and 0.0001, respectively). Additionally wet cupping was significantly associated with HCV infection ($p = 0.0001$). This finding agreed with a study conducted in Saudi Arabia by Al Humayed who showed an association between a history of dental treatment and wet cupping with HBV and HCV infections, respectively [30]. Moreover, a study conducted in Egypt by Heiza *et al.* revealed that dental treatment and wet cupping were significantly associated with HCV infection ($p = 0.04$ and 0.02, respectively) [31].

Study limitations

In this study, the sample size for each age group was inconsistent, leading to low statistical power when assessing risk factors of HBV and HCV infections between the groups. Secondly, collection of blood samples from migrants is challenging, because we need to obtain consent from this group. Thirdly, we could not assess the HBsAb of individuals with negative HBcAb, and thus could not assess the vaccination status of the population of Ghuddwauh.

Conclusions

We observed a low-intermediate endemicity of chronic HBV infection and high-endemicity of HCV infection in Ghudduwah village, located in the south of Libya. Previous treatment in dental clinics was the most important risk factor for past HBV and HCV infections. Other risk factors, including wet cupping, were significant in the case of HCV infection. Precautions should be taken in dental clinics and wet cupping centers in Ghudduwah village. In addition, it is advised to introduce mandatory screening for HBcAb in blood donors, as part of routine laboratory testing in Libyan blood banks, to ensure safer blood transfusions and reduce the risk of recipients acquiring HBV infection.

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Conflict of interests

No conflict of interests is declared.

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