TÜBİTAK

Turkish Journal of Medical Sciences

http://journals.tubitak.gov.tr/medical/

Research Article

Turk J Med Sci
(2014) 44: 824-831
© TÜBİTAK
doi:10.3906/sag-1309-25

Seroprevalences and associated risk factors of hepatitis B and C in adults

Mustafa YILDIRIM[1,*], Selma ÇAKIR[2], Mehmet Faruk GEYİK[1], Davut ÖZDEMİR[1], Ertuğrul GÜÇLÜ[3], Mehmet ÇAKIR[4]

[1]Department of Infectious Diseases, School of Medicine, Düzce University, Düzce, Turkey
[2]Department of Infectious Diseases, Gölcük Necati Çelik State Hospital, Kocaeli, Turkey
[3]Department of Infectious Diseases, Sakarya Education and Research Hospital, Sakarya, Turkey
[4]Gölcük Kavaklı Primary Care Center, Kocaeli, Turkey

Received: 09.09.2013 • **Accepted:** 15.12.2013 • **Published Online:** 15.08.2014 • **Printed:** 12.09.2014

Background/aim: Chronic hepatitis due to hepatitis B and hepatitis C virus infections is the most common cause of chronic liver disease. In this study we aimed to find out seroprevalences and associated risk factors of hepatitis B and C in adults in Düzce.

Materials and methods: The sample of study was determined with a cluster-type sampling method. The study included 1321 people, consisting of 667 women and 654 men who were 18 years or older. A questionnaire about demographic information and risk factors was applied.

Results: Seroprevalences of HBsAg, anti-HBs, and anti-HCV were 4.8%, 9.4%, and 0.7%, respectively. HBsAg seroprevalences were found to be statistically higher in the dental visit group (8.9% versus 4.0%, P = 0.002) and in people living within the same house with hepatitis B carriers (11.5% versus 4.6%, P = 0.036). Living in Düzce during the 1999 earthquake and staying in prefabricated houses after the earthquake were not risk factors of HBsAg carriage.

Conclusion: HBsAg and anti-HCV seroprevalences in Düzce were in parallel with the previous data from Turkey and a low ratio of anti-HBs appeared. Identifying risk groups with large epidemiological screening studies and vaccination of nonimmune people are essential.

Key words: Hepatitis B, hepatitis C, seroprevalence, risk factors, adults

Introduction

Chronic hepatitis due to hepatitis B virus (HBV) and hepatitis C virus (HCV) infections is the most common cause of chronic liver disease. Risk for developing cirrhosis, hepatic insufficiency, and hepatocellular carcinoma (HCC) is higher in subjects infected by HBV than the normal population. It is estimated that 350 to 400 million people worldwide have chronic HBV infections (1,2). In Turkey, about 5% of people (3.5 to 4 million subjects) are estimated to be carriers of HBsAg and approximately 10,000 to 15,000 subjects and 5000 subjects are estimated to die due to cirrhosis and its complications and HCC, respectively, resulting from chronic hepatitis B infection (3). HBV is frequently contracted in humans by parenteral contact with infected blood or body secretions, sexual intercourse, transmission from infected mothers to newborns, and other nonsexual close contact with infected subjects. Carriers of HBsAg with a healthy appearance, chronic patients, and individuals with acute infection play an important role in transmission (4).

It is estimated that more than 170 million people are infected by HCV worldwide (5). In Turkey, HCV seropositivity varies between 1% and 2.4% (6). Chronic hepatitis C infection leads to about 25% to 40% of chronic hepatic disease; 40% of patients requiring liver transplantation have chronic hepatitis infection (1). Intravenous drug abusers, people who received blood transfusions before 1990, dialysis patients, and children delivered by infected mothers constitute the main risk groups (6).

Knowing the HBV and HCV prevalence within a population is crucial and required for combating these infections. The aim of this study is to determine the rate of carriage of HBV and HCV and to create awareness of transmission of and protection from HBV and HCV in Düzce, Turkey.

2. Materials and methods

The present study was conducted in the Düzce city center and in town centers like Akçakoca, Gölyaka, Gümüşova,

* Correspondence: mustafayildirim4@yahoo.com

and Kaynaşlı and their villages. A multistep method was used for sampling. In the first step, town population was divided into 2 areas: the town center (urban area) and the rural area. In the second step, sample size was determined by cluster-type exemplification method in town centers according to their populations (family heath care centers were accepted as a cluster). During the third step, subjects for sampling were determined by randomization. In total, 1321 subjects (667 women, 654 men) were considered as the sampling group among 194,000 subjects who were ≥18 years of age in Düzce. Sampling size was determined according to population percentage by considering sex and age range. Among the study group, 547 (41.4%) were from rural areas near Düzce and 794 (58.6%) were from urban areas. Subjects were classified in 5 groups according to age (18 to 29, 30 to 39, 40 to 49, 50 to 59, and 60 years of age or more) and 6 groups according to educational level (not literate, literate, graduated from primary school, graduated from secondary school, graduated from high school, and graduated from university). Classification of professional groups was as follows: farmer, industrial worker, housewife, state employee, security staff, artisan, healthcare professional, driver, retired, and other.

An 8-mL blood sample was obtained in a vacuum tube with gel from the forearm of the subjects during visits to family healthcare centers. Samples were centrifuged at 3000 rpm for 5 min and serum was separated. Serum samples of subjects were analyzed on the same day at the Düzce University Faculty of Medicine Infectious Diseases Laboratory. HBsAg (Equipar Diagnostici, Saronno, Italy) was analyzed by membrane-based immunodiagnostics, and anti-HBs (Equipar Diagnostici) and anti-HCV (Equipar Diagnostici) were assessed by a chromatographic immunoassay one-step quick diagnostic test.

The study was approved by the Ethics Committee of the Düzce University School of Medicine. Informed consent was obtained from all subjects and a questionnaire was completed in a face-to-face interview. Demographics such as age, sex, marital status, residence area, and profession were determined by questionnaire. Education level, income level, and number of family members were recorded in order to determine socioeconomic level. In addition, certain risk factors for hepatitis virus were examined (i.e. dental care during the last year, blood transfusion, surgery, hospital admission, razor usage, usage of hematite at hair salons). In addition, subjects were asked about their circumcision method, history of hepatitis B vaccination, residency in Düzce during the 1999 earthquake, lifestyle following the earthquake in prefabricated houses, and history of hepatitis B, hepatitis C, cirrhosis, and liver cancer in the immediate family or relatives or history of another person with hepatitis C also living in the same house.

In this study, all subjects giving blood samples and responding to the questionnaire were trained about virus transmission, how to protect against HBV and HCV infections, and the significant role of vaccinations in protection from HBV infection.

The obtained data were transferred to SPSS 10.0 for Windows. Mean values were calculated as arithmetical mean ± standard deviation. If necessary, the chi-square test and Fisher's exact test were used in comparisons between groups. Results of analysis were evaluated at a 95% confidence interval. $P < 0.05$ was considered statistically significant.

3. Results

The study included 1321 people, 667 (50.5%) of whom were women and 654 (49.5%) of whom were men, with a mean age of 41.9 ± 15.7 years old (age range: 18–87). Among the included subjects, 547 (41.4%) were from rural areas and 774 (58.6%) were from urban areas.

In Düzce, the carriage rate of HBsAg was 4.8% (64/1321). This was 4.3% (29/667) in women and 5.4% (35/654) in men ($P = 0.396$). HBsAg carriage according to age was significantly different between groups ($P = 0.005$). Excluding the age groups with the highest and lowest carriage rates, the HBsAg carriage rate was not significantly different between groups; significance was due to the difference in age groups of 40 to 49 (8.4%) years and of 60 years or greater (1.0%) ($P < 0.001$). Distributions of HBsAg carriage according to age and sex are shown in Table 1. Positivity of HBsAg was 5.3% (29/547) in rural areas and 4.5% (35/774) in urban areas ($P = 0.516$). It was 4.3% in the Düzce city center, 6.7% in Akçakoca, 6.2% in Gölyaka, 1.4% in Gümüşova, and 6.8% in Kaynaşlı. The lowest positivity of HBsAg was in Gümüşova, but statistical analysis showed no significant differences among these residential areas ($P = 0.309$).

Positivity of HBsAg was 3.1% in subjects who were not literate, 6.3% in only literate subjects, 5.3% in subjects who graduated from primary school, 4.6% in subjects who graduated from secondary school, 5.0% in subjects who graduated from high school, and 3.3% in subjects who graduated from university ($P = 0.854$). It was 5.8% in subjects with a low socioeconomic level, 4.4% in subjects with a moderate socioeconomic level, and 2.3% in subjects with a high socioeconomic level. There was no statistically significant difference between groups ($P = 0.211$).

HBsAg positivity was higher in subjects with dental intervention ($P = 0.002$) and also in subjects with a history of cohabitation with individuals with hepatitis B ($P = 0.036$) (Table 2). It was 11.3% in men circumcised during a common circumcision ceremony, 5.0% in subjects circumcised at home, and 2.6% in subjects circumcised in a healthcare setting. Carriage rate was lower in subjects

Table 1. Distribution of HBsAg carriage according to age and sex.

Age group	Women		Men		Total	
	Number	Percent	Number	Percent	Number	Percent
18 to 29	10/196	5.1	9/161	5.9	19/357	5.3
30 to 39	6/165	3.6	8/142	5.6	14/307	4.6
40 to 49	10/124	8.1	13/151	8.6	23/275	8.4
50 to 59	3/92	3.3	3/86	3.5	6/178	3.4
60 and older	0/90	0.0	2/114	1.8	2/204	1.0
Total	29/667	4.3	35/654	5.4	64/1321	4.8

Table 2. Distribution of HBsAg positivity according to risk factors.

Risk factors		Number	HBsAg-positive		HBsAg-negative		P
			N	(%)	N	(%)	
Dental intervention within the last year	Yes	238	21	(8.8)	217	(91.2)	0.002
	No	1083	43	(4.0)	1040	(96.0)	
Operation within the last year	Yes	131	4	(3.0)	127	(97)	0.4
	No	1290	6	(4.7)	1230	(95.3)	
Hospital admission within the last year	Yes	192	5	(2.6)	187	(97.4)	0.118
	No	1129	59	(5.2)	1070	(94.8)	
Blood transfusion within the last year	Yes	35	0	(0.0)	35	(100.0)	0.41
	No	1286	64	(4.9)	1222	(95.1)	
Blood transfusion within the last 20 years	Yes	60	1	(1.7)	59	(98.3)	0.36
	No	1261	63	(5.0)	1198	(95.0)	
Sharing a house with a subject with hepatitis B	Yes	52	6	(11.5)	46	(88.5)	0.036
	No	1269	58	(4.6)	1211	(95.4)	
Presence of hepatitis B in partner	Yes	37	4	(10.8)	33	(89.2)	0.1
	No	1284	60	(4.7)	1224	(95.3)	
Shared razor usage in men	Yes	59	2	(3.4)	57	(96.6)	0.761
	No	595	33	(5.5)	562	(94.5)	
Hematite usage in men at hair salon	Yes	204	13	(6.4)	191	(93.6)	0.435
	No	450	22	(4.9)	428	(95.1)	
At least one injection	Yes	1212	56	(4.6)	1156	(95.4)	0.205
	No	109	8	(7.3)	101	(92.7)	
Syringe injury with risk	Yes	19	1	(5.3)	18	(94.7)	0.613
	No	1302	63	(4.8)	1239	(95.2)	
Family history of cirrhosis or liver cancer	Yes	104	9	(8.7)	95	(91.3)	0.059
	No	1217	55	(4.5)	1162	(95.5)	

circumcised in a healthcare setting; however, the difference was not statistically significant between groups (P = 0.309).

In addition, carriage of HBsAg was evaluated in subjects living in Düzce during the earthquake and continuing to live in prefabricated houses following the earthquake. There was no significant difference between subjects living in Düzce during the earthquake and subjects who were not in Düzce (P = 0.309). Similarly, there was no significant difference between subjects living in prefabricated houses following the earthquake and those who had no history of living in these houses (P = 0.916).

HBsAg positivity was evaluated by distribution according to professional groups and the rate was relatively higher in security staff (11.1%) and drivers (13.2%), but these differences were not statistically significant (P = 0.151) (Table 3).

The anti-HBs positivity rate was found to be 9.4% (124/1321) in the population analyzed for carriage of HBsAg (Table 4). This was due to hepatitis B vaccination in 17.7% (22/124) of the anti-HBs–positive subjects, while other cases were due to natural immunity resulting from past infections of hepatitis B.

According to the results of this study, prevalence of anti-HCV was 0.7% (9/1321) in the region. Distribution of anti-HCV positivity according to age groups and residential areas are shown in Tables 5 and 6, respectively.

4. Discussion

Prevalence of HBV infection varies in different areas of the world. Therefore, world countries are classified in 3 groups. The first is highly endemic areas, where the population's HBsAg positivity rate is higher than 8%. Many Asian countries (except Japan and India), the Amazon region, the Pacific islands, Australia, and New Zeeland are in this group. Moderately endemic areas are those where HBsAg positivity is between 2% and 7%. This includes North African countries, Middle Eastern countries, the Mediterranean region (including Turkey), East Europe, and Russia. The lowest endemic areas are those where the HBsAg positivity rate is less than 2%. This includes North America and North and West Europe (2). HBsAg carriage rates have been reported to vary from 2.7% to 13.6% in different regions of Turkey (7–13). In the present study, it was found to be 4.8% in the Düzce region. This prevalence is consistent with prevalence rates determined for moderately endemic regions, which includes Turkey.

It is well known that urban and rural areas should be collectively screened to find the real prevalence of HBsAg in the normal population (4). Dursun et al. found a higher prevalence of HBsAg positivity in rural areas (8.2%) than in urban areas (6.2%) (14). In Turkey, other studies did not show any significant difference between rural and urban areas in respect to carriage rate (12,15). In this study, HBsAg positivity was higher in rural areas (5.3%) than urban areas (4.5%), which was statistically insignificant (P = 0.516).

Transmission of hepatitis virus is well recognized in dental clinics from patient to patient by direct contact with blood and body secretions or contaminated instruments (16). Khan et al. determined that dental procedures (tooth extraction, channel treatment, etc.) are major risk factors for HBV (17). In a study conducted by Sali et al., visits to dentists did not constitute a risk for hepatitis B; however, dental procedures done by individuals other than dentists increased HBV risk (18). Erden et al. determined that tooth extraction was a risk factor for HBsAg positivity

Table 3. Distribution of HBsAg positivity according to profession.

Profession	Total	HBsAg-positive		HBsAg-negative	
		N	(%)	N	(%)
Farmer	61	2	(3.3)	59	(96.7)
Industrial worker	238	15	(6.3)	223	(93.7)
Housewife	549	27	(4.9)	522	(95.1)
State employee	108	4	(3.7)	104	(96.3)
Security	27	3	(11.1)	24	(89.9)
Artisan	78	2	(2.6)	76	(97.4)
Healthcare professional	46	1	(2.2)	45	(97.8)
Driver	38	5	(13.2)	33	(86.8)
Retired	107	3	(2.8)	104	(97.2)
Other	69	2	(2.8)	67	(97.2)

Table 4. Distribution of anti-HBsAg positivity according to certain groups.

Groups			Anti-HBs–positive		Anti-HBs–negative		
			N	(%)	N	(%)	P
Sex	Female	667	78	(11.7)	589	(88.3)	0.004
	Male	654	46	(7.0)	608	(93.0)	
Residential area	Rural	547	39	(7.1)	508	(92.9)	0.018
	Urban	774	85	(11.0)	689	(89.0)	
Presence of hepatitis B in partner	Yes	37	4	(10.8)	33	(89.2)	0.772
	No	1284	120	(9.3)	1164	(90.7)	
*Socioeconomic level	Low	625	46	(7.4)	579	(92.6)	0.017
	Moderate	568	59	(10.4)	509	(89.6)	
	High	128	19	(14.8)	109	(85.2)	
Educational level	Not literate	96	9	(9.4)	87	(90.6)	0.241
	Only literate	64	3	(4.7)	61	(95.3)	
	Primary school	663	64	(9.7)	599	(90.3)	
	Secondary school	109	7	(6.4)	102	(93.6)	
	High school	238	20	(8.4)	218	(91.6)	
	University	151	21	(13.9)	130	(86.1)	
Total		1321	124	(9.4)	1197	(90.6)	

*: Significant difference among 3 groups of socioeconomic levels in respect to anti-HBs positivity was present between low and high socioeconomic levels (P = 0.006) and this was determined by comparison of paired groups.

Table 5. Distribution of anti-HCV positivity according to age groups and sex.

Age group	Women		Men		Total	
	Number	Percentage	Number	Percentage	Number	Percentage
18 to 29	2/196	1.0	1/161	0.6	3/357	0.8
30 to 39	2/165	1.2	0/142	0.0	2/307	0.6
40 to 49	1/124	0.8	0/151	0.0	1/275	0.4
50 to 59	0/92	0.0	1/86	1.2	1/178	0.5
60 and older	1/90	1.1	1/114	0.9	2/204	1.0
Total	6/667	0.9	3/654	0.5	9/1321	0.7

Table 6. Distribution of anti-HCV positivity according to residential area.

Residential area			Anti-HCV–positive		Anti-HCV–negative	
			N	(%)	N	(%)
Center	Rural	(393)	1	(0.3)	392	(99.7)
	Urban	(481)	5	(1.0)	476	(99.0)
	Total	(874)	6	(0.7)	868	(99.3)
Akçakoca	Rural	(29)	0	(0.0)	29	(100.0)
	Urban	(164)	1	(0.6)	163	(99.4)
	Total	(194)	1	(0.5)	193	(99.5)
Gölyaka	Rural	(46)	0	(0.0)	46	(100.0)
	Urban	(50)	0	(0.0)	50	(100.0)
	Total	(96)	0	(0.0)	96	(100.0)
Gümüşova	Rural	(38)	1	(2.6)	37	(97.4)
	Urban	(31)	0	(0.0)	31	(100.0)
	Total	(69)	1	(1.4)	68	(98.6)
Kaynaşlı	Rural	(41)	0	(0.0)	41	(100.0)
	Urban	(47)	1	(2.1)	46	(97.9)
	Total	(88)	1	(1.1)	87	(89.9)
Total in general	Rural	(547)	2	(0.4)	545	(99.6)
	Urban	(774)	7	(0.9)	767	(99.1)
	Total	(1321)	9	(0.7)	1312	(99.3)

(19). However, Aşan et al. found no statistical significance between dental procedures and HBsAg positivity (11). In the present study, HBsAg positivity in the group with dental treatment was significantly higher than carriage in subjects without dental treatment (4.0%) (P = 0.002). As hepatitis B may be transmitted by HBV-contaminated instruments during dental procedures, dentists and their staff should pay more attention to sterilization and disinfection.

HBV carriage among family members may be related to sharing the same house, if no other means of transmission are present (2). A study showed that close contact with an HBV-infected family member was an independent risk factor for HBV dissemination (18). Another study showed that sharing the house with a subject with a past HBV infection or HBV carriage significantly increased contamination risk (7). Our results are concordant with these data, showing a higher HBsAg positivity rate (11.5%) in subjects with history of sharing the same house with a subject with hepatitis B compared to the subjects without such a history (4.6%) (P = 0.036). Contact with blood and serous secretions or infected skin may occur for people sharing the house with HBV-infected subjects. Therefore, subjects sharing their house with a subject with hepatitis B should be screened, those with HBsAg positivity should be monitored, and those are not yet infected should be immunized by vaccine.

In a study conducted by Wang et al., HBsAg positivity was 2.6 times more frequent in subjects with family history of HCC (20). In this study, HBsAg positivity in subjects with a family history of cirrhosis or liver cancer was notably higher (8.7%) than HBsAg carriage rate in subjects without this risk factor (4.5%); however, the difference did not reach a statistically significant level (P = 0.059). Family members could be responsible for HBV transmission in these subjects with high risk of having HBV infection.

Hepatitis B may be transmitted during circumcision done by nonsterile instruments. In a study done by Otkun et al., commonly shared circumcision procedures may be an independent risk factor for hepatitis B transmission (23). According to our survey, although the difference between groups was not statistically significant (P =

0.309), HBsAg carriage (11.3%) was relatively high for commonly shared procedures. Therefore, commonly shared procedures should be avoided and circumcision at healthcare institutions should be promoted.

Transmission and dissemination of infectious diseases is high in regions impacted by earthquakes. Emergency surgery procedures and intensive blood transfusions following an earthquake may contribute to dissemination of infectious diseases transmitted via blood (24). In the present study, there was no significant difference between subjects living in Düzce during the earthquake in 1999 and subjects who were not in Düzce, nor between subjects living in prefabricated houses following the earthquake and those who had no history of living in such houses.

Security staff, hair dressers, and drivers were determined as high-risk professions in respect to HBsAg carriage (4,18). In this study, although there was no statistically significant difference between professional groups (P = 0.151), carriage rate was relatively higher in security staff (11.1%) and drivers (13.2%) (Table 3). Lifestyle and routine contact with different kinds of people may cause higher HBsAg carriage rates in these groups.

Anti-HBs positivity may be due to either hepatitis B vaccination or natural immunity related to past infection (4). In Düzce, the anti-HBs positivity rate was 9.4%, and this was due to hepatitis B vaccination only in 17.7% of the anti-HBs–positive subjects. It is clear that, in this region, risk groups should be determined by large screening studies and sensitive subjects should be immunized by active immunization.

HCV is a major public health problem and one of the leading causes of chronic liver diseases. In the United States, 1.8% of the population is HCV-seropositive (1). Prevalence of HCV is less than or equal to 0.5% in Austria, Scandinavia, and the Netherlands and greater than or equal to 3% in Italy, Bulgaria, Greece, and Romania (25). Prevalence of anti-HCV is 2.1% in Thailand and 1.6% in the Orissa region of India (26,27). Studies conducted in Turkey showed that prevalence of HCV was in the range of 0.5% to 3.9% (8–10,13,28–30). In our study, prevalence of anti-HCV was found to be 0.7% in the Düzce region. This result is consistent with other studies' results obtained in Turkey.

In conclusion, this is the first study to determine prevalence of HBsAg and anti-HCV in adults in Düzce including rural and urban areas. Overall results were consistent with the previous reports conducted in Turkey. Performing necessary screening, especially in risk groups, and determining subjects who are in contact with HBsAg carriers are important steps to prevent new cases. Common circumcisions should be stopped, inspections of dentist offices should be increased, and dental staff should be trained about sterilization. In addition, training courses for increasing the awareness of people regarding hepatitis B and C should be organized.

References

1. Dienstag JL. Chronic viral hepatitis. In: Mandell GL, Bennett JE, Dolin R, editors. Mandell, Douglas and Bennett's Principles and Practice of Infectious Diseases. 7th ed. Philadelphia, PA, USA: Churchill Livingstone; 2010. pp. 1593–1617.
2. Özaçar T. Hepatit B virüsü. In: Willke TA, Söyletir G, Doğanay M, editors. İnfeksiyon Hastalıkları ve Mikrobiyololjisi. 3rd ed. İstanbul, Turkey: Nobel Tıp Kitabevleri; 2008. pp. 1882–1904 (in Turkish).
3. Tabak F. Viral hepatitler. In: Hamuryudan V, Öztürk R, editors. Türkiyede Sık Karşılaşılan Hastalıklar I. İstanbul, Turkey: İ.Ü. Cerrahpaşa Tıp Fakültesi Sürekli Tıp Eğitimi Etkinlikleri Dizisi; 2007. pp. 195–214 (in Turkish).
4. Taşyaran MA. HBV infeksiyonu epidemiyolojisi. In: Tekeli E, Balık İ, editors. Viral Hepatit 2003. Ankara, Turkey: Viral Hepatitle Savaşım Derneği; 2003. pp. 121–128 (in Turkish).
5. Ray SC, Thomas DL. Hepatitis C. In: Mandell GL, Bennett JE, Dolin R, editors. Mandell, Douglas and Bennett's Principles and Practice of Infectious Diseases. 7th ed. Philadelphia, PA, USA: Churchill Livingstone; 2010. pp. 2157–2185.
6. Sünbül M. HCV infeksiyonunun epidemiyolojisi ve korunma. In: Tabak F, Balık İ, Tekeli E, editors. Viral Hepatit 2007. İstanbul, Turkey: Viral Hepatitle Savaşım Derneği; 2007. pp. 208–219 (in Turkish).
7. Kaçar F, Erol S, Parlak M, Kadanalı A. Seroprevalence of hepatitis B virus infection in Erzurum. Infek Derg 2003; 17: 389–393 (in Turkish with an English abstract).
8. Aslan G, Ulukanlıgil M, Seyrek A. Şanlıurfa'da HBsAg, Anti-HBs ve Anti HCV seroprevalansı. Viral Hepatit Derg 2001; 7: 408–410 (in Turkish).
9. Banak S, Yoldaşcan E, Kılıç B. The prevalence of hepatitis B surface antigen (HBsAg) and anti-hepatitis C virus (anti-HCV) in subjects of age ten and over in the semirural areas of Adana and factors affecting the prevalence. Infek Derg 2002; 16: 133–140 (in Turkish with an English abstract).
10. Kaçmaz B. Seroprevalence of hepatitis B and hepatitis C infections in Ankara city. Viral Hepatit Derg 2003; 8: 97–101 (in Turkish with an English abstract).
11. Aşan A, Açar S, Çatak B, Karahasanoğlu FB, Turgut H. Evaluation of hepatitis B seroprevalence of Denizli city. Viral Hepatit Derg 2007; 12: 40–48 (in Turkish with an English abstract).
12. Karabay O, Serin E, Tamer A, Gökdoğan F, Alpteker H, Ozcan A, Gündüz H. Hepatitis B carriage and Brucella seroprevalence in urban and rural areas of Bolu province of Turkey: a prospective epidemiologic study. Turk J Gastroenterol 2004; 15: 11–13.

13. Delialioğlu N, Öztürk C, Aslan G. Seroprevalence of HBsAg, anti-HBs, anti-HCV and anti-HDV in Mersin. Viral Hepatit Derg 2001; 7: 416–418 (in Turkish with an English abstract).

14. Dursun M, Ertem M, Yılmaz Ş, Saka G, Özekinci T, Şimşek Z. Prevalence of hepatitis B infection in the southeastern region of Turkey: comparison of risk factors for HBV infection in rural and urban areas. Jpn J Infect Dis 2005; 58: 15–19.

15. Yalçın D, Yeler H, Tufan N, Gedik R. Sivas C.Ü. Diş Hekimliği Fakültesine başvuran hastalarda Hepatit B, Hepatit C sıklığının saptanması. CÜ Diş Hek Fak Derg 2001; 4: 97–101 (in Turkish with an English abstract).

16. Doğru Ü. Nozokomiyal viral infeksiyonlardan korunma.. Klimik Derg 2000; 33: 32–34 (in Turkish).

17. Khan H, Hayat Z, Rehman SU, Zarif M. Comparative analysis of risk factors and complications of hepatitis B and C infections at Khyber Teaching Hospital, Peshawar. Hepat Mon 2007; 7: 83–86.

18. Sali S, Bashtar R, Alavian SM. Risk Factors in chronic hepatitis B infection: a case-control study. Hepat Mon 2005; 5: 109–115.

19. Erden S, Büyüköztürk S, Çalangu S, Kardeş BA, Kaysı A, Yılmaz G, Badur S, Palandüz Ş. Seroprevalences of HBsAg, anti-HBs, and anti-HCV in out patients. Türk Mikrobiyol Cem Derg 2000; 30: 131–134 (in Turkish with an abstract in English).

20. Wang CS, Chang TT, Yao WJ, Chou P. Comparison of hepatitis B virus and hepatitis C virus prevalence and risk factors in a community-based study. Am J Trop Med Hyg 2002; 66: 389–393.

21. Yenice N, Cansız M, Arıcan N, Gökten Y, Durgut C, Türkmen S. HBsAg and anti-HCV seroprevalence in spouses of patients with chronic hepatitis B and chronic hepatitis C. Akademik Gastroenterol Dergisi 2004; 3: 79–82 (in Turkish with an English abstract).

22. Nurgalieva ZZ, Hollinger FB, Graham DY, Zhangabylova S, Zhangabylov A. Epidemiology and transmission of hepatitis B and C viruses in Kazakhstan. World J Gastroenterol 2007; 13: 1204–1207.

23. Otkun M, Erdoğan MS, Tatman M, Akata F. Exposure time to hepatitis B virus and associated risk factors among children in Edirne, Turkey. Epidemiol Infect 2005; 133: 509–516.

24. Khan S, Rai MA, Khan A, Farooqui A, Kazmi SU, Ali SH. Prevalence of HCV and HIV infections in 2005 earthquake-affected areas of Pakistan. BMC Infect Dis 2008; 8: 147.

25. Badur S. Hepatitis B infections: epidemiology and vaccine. Klinik Gelişim 2005; 18: 32–43 (in Turkish with an abstract in English).

26. Sunanchaikarn S, Theamboonlers A, Chongsrisawat V, Yoocharoen P, Tharmaphornpilas P, Warinsathien P, Sinlaparatsamee S, Paupunwatana S, Chaiear K, Khwanjaipanich S et al. Seroepidemiology and genotypes of hepatitis C virus in Thailand. Asian Pac J Allergy Immunol 2007; 25: 175–182.

27. Mishra S, Chayani N, Sarangi G, Mallick B, Pati SB. Seroprevalence of anti HCV antibody in and around Cuttack, Orissa. Indian J Med Microbiol 2002; 20: 40–41.

28. Kölgeliler S, Ertek M, Erol S, Taşyaran MA. Hepatit C virus seroprevalence central and rural areas of Erzurum. Viral Hepatit Derg 2003; 8: 166–170 (in Turkish with an English abstract).

29. Ağuş N, Özkalay Yılmaz N, Cengiz A, Şanal E, Sert H. HBsAg, anti-HCV and anti-HIV seroprevalence in blood donors. ANKEM 2008; 22: 7–9 (in Turkish with an English abstract).

30. Kökoğlu ÖF, Geyik MF, Uçmak H, Aslan S, Ayaz C, Hoşoğlu S. The prevalence of HBsAg and anti-HCV in blood donors at Diyarbakır region. Viral Hepatit Derg 2003; 8: 56–59 (in Turkish with abstract in English).