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## Original article

# Seroprevalence of hepatitis B surface antigen and its correlation with risk factors among new recruits in Turkey

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### ABSTRACT

**Objectives:** The objective of this cross-sectional study was to determine seroprevalence of hepatitis B surface antigen and related risk factors among new recruits in a military unit in Turkey.

**Methods:** Eight thousand five hundred eighty-nine newly-recruited soldiers were enrolled in the study. Blood samples were drawn from them between January 2006 and December 2006 and ELISA technique was applied to the samples. In addition, questions on the risk factors of hepatitis B exposure were asked to the participants in the survey.

**Results:** The results demonstrated that HBsAg seroprevalence was 2.8%. Further survey results indicated that seropositivity increased depending on certain risk factors. In multiple regression analysis, significant correlations were determined between HBsAg positivity and certain risk factors such as living in the Southeast Anatolia region ( $p < 0.01$ ), having a history of living with a hepatitis B carrier ( $p < 0.001$ ), and presence of a hepatitis B carrier in the neighborhood or at work ( $p < 0.05$ ).

**Conclusions:** The HBsAg seropositivity found in this study supports the fact that Turkey remains in the medium endemicity zone, and that horizontal transmission is predominant.

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## Introduction

Hepatitis B virus (HBV) is a hepatotropic, enveloped and partly double helical DNA virus of genus orthohepadnavirus in the hepadnaviridae family. Owing to its genomic structure composed of only 3200 nucleotides, it is the smallest virus among all the known animal DNA viruses. Of all the members of the hepadnaviridae family, HBV is the only one that causes infection in human beings.<sup>1</sup> It is especially important among diseases transmitted parenterally. HBV is a virus with 400-500 million carriers worldwide, chronic at a rate of 5%, and

accounts for the etiology of 58% of hepatocellular cancer (HCC) cases.<sup>2-4</sup> Thus, it appears to be a significant problem threatening public health.

Distribution of HBV infection in the world varies depending on geographical region, and it is divided into three endemicity zones as low (<2%), medium (2-7%) and high ( $\geq 8\%$ ).<sup>5,6</sup> In regions where HBV endemicity is low, the probability for an adult to contract the infection does not exceed 20% and sexual contact is the most common cause.<sup>2,7</sup> Many studies have been conducted to investigate HBV seroprevalence in Turkey, which shows intermediate endemicity. Medium endemicity profiles are observed in Southern and Eastern Europe, South

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and Central America, and Central Asia and the Middle East, which includes Turkey. 20-60% of adults in these zones have anti-HBs positivity. The infection is mostly contracted during childhood, adolescence or young adulthood, with horizontal transmission being the most common one. However, there are other ways through which the virus is transmitted.<sup>2,7</sup> In Africa and Asia, where higher endemicity is observed, the epidemiological pattern of HBV is quite different. In these zones, more than 10% of the community is chronically infected with HBV and more than 70% of adults have anti-HBs, which indicate a previous HBV infection and subsequent recovery. In higher endemicity zones perinatal infection is the predominant mode of transmission followed by horizontal.<sup>1,2,7</sup>

HBV may be transmitted parenterally, perinatally (vertically), or horizontally (within the family). When parenteral, sexual, or perinatal transmission is not the case, the primary means of domestic transmission are saliva or open injuries.<sup>6,8</sup> However, the exact mechanism of domestic transmission of HBV has not been established yet.<sup>8,9</sup> In this country, common use of personal hygiene materials such as towels, toothbrushes, razors, scissors, or manicure-pedicure kits within the family, improper disinfection of tools at a barber or hairdresser, and kissing, which are all means of horizontal transmission, are the most common ways of contracting the virus.<sup>10</sup>

The data in a great number of previous studies conducted on the prevalence rate of HBV were obtained from blood donors and risk groups, including healthcare staff.<sup>2,11</sup>

The objective of this study was to determine the seroprevalence of hepatitis B surface antigen (HBsAg) among new recruits in Turkey, and to investigate the correlation between risk factors and prevalence of hepatitis B.

## Materials and methods

The study population, consisting of 8,589 new recruits, was randomly selected among the soldiers in a military unit, which is a commando training center, in Isparta (a town in South-west Turkey). The average age of the study population was  $20.5 \pm 1.1$  years. Other descriptive characteristics are displayed on Table 1. The samples in the study were collected from the same military unit. In Turkey, military service is compulsory, thus all men who turn 20 are liable for this duty, and trained for periods ranging from six to 15 months, depending on their education level. If a young man wants to obtain a university degree before military service, he may have it postponed until after graduation.

Turkey is divided into seven geographical regions, which differ from each other in socio-demographic aspects. In the military unit where this study was conducted, new recruits from all seven regions are given military training. Therefore, the study population represents young men in Turkey who are liable for compulsory military service. Where a recruit will perform his military service is randomly determined by the department of conscription of the Ministry of National Defense through a computerized system.<sup>12</sup>

Prior to obtaining the informed consent, the subjects were given information about the subject of the study, where the data would be used, and what interventions would be done.

**Table 1 – Distribution of the study group according to the descriptive characteristics.**

	n	% <sup>a</sup>	HBsAg positive	
			Number	% <sup>b</sup>
<i>District</i>				
Urban area	5120	59.6	137	2.7
Rural area	3469	40.4	106	3.1
<i>Region living in</i>				
Marmara region	1604	18.7	56	3.5
Aegean region	1058	12.3	20	1.9
Central Anatolia region	1777	20.7	40	2.3
Mediterranean region	1039	12.1	27	2.6
Black Sea region	1112	13.1	29	2.6
East Anatolia region	1015	11.8	22	2.2
Southeast Anatolia region	974	11.3	49	5.0**
<i>Marital status</i>				
Married	450	5.2	14	3.1
Bachelor	8119	94.5	229	2.8
Widow	20	0.2	0	0
<i>Educational status</i>				
Not literate	33	0.4	2	6.1
Literate	96	1.1	4	4.2
Primary school graduate	1993	23.2	58	2.9
Secondary school graduate	3125	36.4	74	2.4
High-school graduate	2568	29.9	72	2.8
Senior high school graduate	774	9.0	33	4.3
<i>Job</i>				
Medicine related	58	0.7	4	6.9
Non-medicine related	8531	99.3	239	2.8
<i>Income level</i>				
Very low	543	6.3	17	3.1
Low	1791	20.9	49	2.7
Moderate	5427	63.2	152	2.8
High	791	9.2	23	2.9
Very high	37	0.4	2	5.4
<b>Total</b>	<b>8589</b>	<b>100.0</b>	<b>243</b>	<b>2.8</b>

NS, not significant.

\*\*  $p < 0.01$ .

<sup>a</sup> percent of column.

<sup>b</sup> percent of row.

After that, those who agreed to be involved in the study (100%) were each given a questionnaire to complete. Finally, blood samples were collected.

Having obtained an informed consent from the recruits who agreed to participate, data collection was completed through a questionnaire elaborated by the investigators in order to determine the socio-demographic aspects and risk factors of hepatitis B exposure.

The questionnaires contained questions on socio-demographic characteristics of the individuals (age, gender, educational status, occupation, income level, number of family members sharing the same home, vaccination status for hepatitis B, and number of doses) and risk factors of hepatitis B exposure (prior accident, prior blood or blood product transfusion, prior hospitalization, prior parenteral drug therapy, intravenous narcotic drug use, prior hemodialysis treatment or surgery, having given a birth, prior dental treatment or circumcision, prior wounding by a contaminated syringe, prior

sexual intercourse or contact with an HBV positive individual or carrier or prior contact with body fluids of any suspected individual, prior manicure-pedicure with contaminated kits, shaving with a contaminated razor, common use of bathing materials or toothbrushes, living in crowded environments with poor sanitary conditions, living with a hepatitis B carrier in the same home, and presence of a hepatitis B patient or carrier in the neighborhood, either previously or currently).

In order to determine HBsAg, blood samples of 5 mL were taken from all the recruits who have filled in the questionnaire. Participant's serum removed by centrifugation at 5,000 rpm for five minutes was analyzed for HBsAg by micro ELISA (Abbott/Architect)<sup>®</sup>. Values between 0-0.04 U/mL were classified as negative and values  $\geq 0.05$  U/mL were classified as positive for HBsAg. All individuals found HBsAg positive were appropriately referred to care.

This study was conducted in accordance with the ethical standards of the Declaration of Helsinki,<sup>13</sup> which promotes respect for all human beings and protects their health and rights. Prior to the study, the issues concerning the aim of the study and how the data would be used were explained to the participants, and an informed consent was obtained. The Turkish Land Forces Command was informed of the study in advance, and the study was approved under the authorization number LOJ:4013-131-06/Sağ.D.Rp.ve Sağ.Ş., of May 22, 2006, Turkish Land Forces Command.

### Hypothesis of the study

1. HBsAg seroprevalence in the study universe is consistent with the seroprevalence in similar studies conducted previously in Turkey.
2. Prevalence is high among individuals with known risk factors of hepatitis B exposure.
3. There is an association between HBsAg seroprevalence and certain sociodemographic variables of the individual and of his family.

The study data were evaluated using the Statistical Package for Social Sciences (SPSS 9.0 Inc. California, 1999). The chi-square test, independent t-test, Pearson's correlation, Spearman's correlation, and regression analyses were used for statistical analysis. Significant p-value was set at  $p < 0.05$ .

### Limitations of the study

1. Owing to the limited resources, only HBsAg was evaluated. However, even if an individual is not HBsAg positive, he/she may still have had an encounter with HBV. The fact that parameters such as HBsAb, Anti Hbc IgG core total, HBeAg, HBeAb, AST, and ALT were not examined, and that the cases were not classified in detail (as acute or chronic hepatitis, active or inactive HBsAg carrier) are limitations of the study.
2. Since the study was conducted in a group of males selected from among new recruits, the seroprevalence found only indicates the specific results for a specific age group.
3. In the present study, the data about the risk factors are reliable only to the extent that the participants were willing to provide the factual information, which is another limitation. Questions about risk factors such as sexual

orientation, drug addiction, etc., may not have been answered correctly. The sociocultural characteristics of the participants may have had an effect on their answers.

## Results

For the study population, the distribution of hepatitis B serological test results by region is displayed on Table 1. The distribution of HBsAg positivity by risk factors related to hepatitis B exposure is shown in Table 2. In the study, HBsAg seroprevalence was found to be 2.8%, and only 7.8% ( $n = 19$ ) of the HBsAg positive ( $n = 243$ ) had prior knowledge of their condition.

HBsAg positivity was higher among individuals living in the Southeast Anatolia region ( $\chi^2 = 27.345$ ,  $p < 0.001$ ). No differences were found regarding socio-demographic aspects ( $p > 0.05$ ).

HBsAg positivity was higher among individuals who had had contact with a hepatitis B patient or a carrier ( $\chi^2 = 5.688$ ,  $p < 0.05$ ), who had lived with a hepatitis B carrier in the same house ( $\chi^2 = 68.468$ ,  $p < 0.001$ ), who had a hepatitis B carrier among neighbors or relatives ( $\chi^2 = 21.250$ ,  $p < 0.001$ ), and whose mothers were hepatitis B carriers ( $\chi^2 = 22.828$ ,  $p < 0.01$ ).

Of the study population, 0.8% had been given a single dose, 0.4% a double dose, and 0.6% a triple dose of hepatitis B vaccine, adding up to a total of 1.8% with at least one dose of HBV vaccine. The time from last hepatitis B vaccination in the vaccinated group was  $37.1 \pm 26.5$  months (min 4 - max 120 months). There was no significant correlation between having been vaccinated against hepatitis B and HBsAg positivity.

Significant variables in univariate analyses (geographical region, contact with body fluids of a carrier, having manicure/pedicure with kits in common use, living with a carrier, presence of a hepatitis B carrier in close surroundings, mother being a hepatitis B patient or carrier) were included in the multiple regression model (Table 3). A significant correlation was found between living in the Southeast Anatolia region ( $\beta = 1.8$ , 95% CI: 1.3-2.5,  $p < 0.01$ ), having a history of living with a hepatitis B carrier ( $\beta = 3.8$ , 95% CI: 2.2-6.5,  $p < 0.001$ ), and presence of a hepatitis B carrier close surroundings ( $\beta = 1.6$ , 95% CI: 1.1-2.5,  $p < 0.05$ ).

## Discussion

HBV infection, which has infected two billion people at some point in their lives, is a vital problem threatening public health all over the world. Hepatitis B must be treated seriously owing to the fact that it sets leads to primary hepatocellular carcinoma and cirrhosis.<sup>5,6,14</sup> The etiology of nearly half of acute viral hepatitis cases in Turkey is related to HBV (49,6%).<sup>15</sup> Screening blood donors for hepatitis and introduction of single-use injectors have helped to relatively lower the incidence of parenteral contagion. However, HBV still remains a serious health hazard in developing countries. Studies on hepatitis B seroprevalence in Turkey have been conducted among medical staff<sup>16,17</sup> or among blood donors.<sup>18</sup> Studies involving a wider public screening for hepatitis B are relatively low in number.<sup>19,20</sup> Public screenings for hepatitis have revealed that HBsAg positivity ranges from 4% to 9%.<sup>8</sup> With regard to

**Table 2 – Distribution of the participants according to risk factors.**

	n	% <sup>a</sup>	HBsAg positive	
			Number	% <sup>b</sup>
Total	8,589	100.0	243	2.8
Prior accident	1,580	18.4	34	2.2
History of blood transfusion	533	6.2	17	3.2
History of hospitalization	1,915	22.3	57	3.0
History of injections	630	7.3	223	2.8
Use of intravenous narcotic substance	39	0.5	0	0.0
History of hemodialysis	17	0.2	1	5.9
History of surgery	895	10.4	28	3.1
Prior dental treatment	2,442	28.4	78	3.2
Circumcision	8,451	98.4	238	2.8
Ear piercing	140	1.6	2	1.4
Tattoo	135	1.6	1	0.7
Injury by contaminated syringe	76	0.9	1	1.3
Prior sexual experience	5,653	65.8	157	9.4
Contact with hepatitis B patient or carrier	172	2.0	10	5.8*
Manicure/pedicure with equipment in common use	201	2.3	5	2.5
Shaving with equipment in common use	1,063	12.4	31	2.9
Using bathing material, toothbrush in common use	1,064	12.4	23	2.2
Living in crowded places	653	7.6	23	3.5
Living in crowded areas with poor sanitary conditions	798	9.3	25	3.1
Living with a hepatitis B carrier in the same house	189	2.2	24	12.7***
Haepatitis B carrier among neighbors and relatives	647	7.5	37	5.7***
Mother being a hepatitis B carrier	41	0.5	6	14.6**
Prior blood disorders	38	0.4	1	2.6

<sup>a</sup> percent of column.  
<sup>b</sup> percent of row.  
\* p < 0.05.  
\*\* p < 0.01.  
\*\*\* p < 0.001.

hepatitis B virus endemicity, Turkey ranks in the medium endemicity zone (2%-7%). In this study, HBsAg seropositivity was found to be 2.8%, which indicates medium endemicity.

Following the multiple analyses in the study, a correlation between living in Southeast Anatolia and HBsAg positivity was discovered. Incidence of HBV infections varies depending on environmental factors, level of education, profession, and the region's development status.<sup>21</sup> In studies conducted

in Southeast Anatolia it was reported that HBsAg prevalence was higher in that region compared to other regions.<sup>22-24</sup> In the present study, the finding that HBsAg seroprevalence was meaningfully higher among those who came from Southeast Anatolia is consistent with the literature. Lack of hygiene and low socioeconomic status are risk factors for horizontal contagion.<sup>25</sup> The fact that socioeconomic and human development parameters in Southeast Anatolia are lower, compared to the other regions of Turkey, may explain the higher HBsAg seropositivity in that region.<sup>26</sup>

Most of the studies that analyzed seroprevalence among individuals other than donors were conducted among adults living in urban areas. In some of the rare studies covering both urban and rural cases, there was not a distinct seropositivity difference between rural and urban areas, whereas in other studies HBsAg positivity was higher in urban areas.<sup>27</sup> In the present study, no meaningful difference was found between rural and urban areas regarding HBsAg positivity.

Sharing the same home with a hepatitis B carrier, or presence of a hepatitis B carrier in close surroundings are factors that were found to be related to HBsAg seroprevalence in multiple analyses, suggesting horizontal contagion. In countries such as Turkey, where medium endemicity is observed, horizontal transmission is the primary mode of contagion.<sup>28</sup> In Turkey, it is thought that HBV is transmitted through all known modes, with perinatal and horizontal being primary.<sup>29</sup> Although the exact mechanism is not known, it is thought that contact with a trace of blood, common use of personal

**Table 3 – Results of multiple logistic regression analysis for HBsAg positivity.**

	β	95% CI
Constant	0.2***	
Region (living in Southeast Anatolia Region: 1, other: 0)	1.8**	(1.3-2.5)
History of contact with body fluids of a hepatitis B patient/porter (yes: 1, no: 0)	1.0	(0.5-2.0)
History of living with a hepatitis B carrier (yes: 1, no: 0)	3.8***	(2.2-6.5)
Presence of hepatitis B carrier in close surroundings (yes: 1, no: 0)	1.6*	(1.1-2.5)
Mother with history of a hepatitis B disease or status of being carrier (yes: 1, no: 0)	1.2	(0.4-3.2)

\* p < 0.05.  
\*\* p < 0.01.  
\*\*\* p < 0.001.

hygiene materials, and contracting the virus from a contaminated surface are factors in such transmissions.<sup>30</sup> It is reported that horizontal transmission may occur within<sup>31</sup> or outside of the family.<sup>32</sup> In the present study, both living in the same home as a hepatitis B carrier and presence of a carrier in close surroundings were found to be related to HBsAg seropositivity.

The World Health Organization (WHO) and the International Labour Organization (ILO) recognized hepatitis B as an occupational disease in 1992.<sup>18</sup> In the present study, even though HBsAg seropositivity was found to be higher among healthcare staff compared to other groups, the difference determined was not statistically significant.

In this study, it was found that a very low percentage (2.0%) of the study population and of the medical staff (5.2%) had been vaccinated against hepatitis B. The rate of vaccination found in the present study was very low. All babies born after 1998, when hepatitis B was included in routine vaccination program, have been vaccinated, under the coverage of the state medical insurance. Within the Hepatitis B Control Program launched by the Ministry of Health in 2008, adults in the risk groups are vaccinated at their request. Aiming to increase the rate of vaccination against hepatitis B among adults, a catch-up vaccination campaign was initiated in 2009. In that campaign, the Ministry of Health planned to determine and vaccinate those in the risk groups upon their admission to any medical center for any complaint.<sup>33</sup> Consequently, the rate of individuals vaccinated against hepatitis B is increasing thanks to the introduction of the Hepatitis B Control Program. However, this study covers individuals born before the routine vaccination against hepatitis B started. Moreover, the study was conducted prior to the initiation of the program intended for the vaccination of those in the risk groups because of their professions. The reason for the vaccination rate being so low may be explained by the fact that there was no program or strategy for the risk groups, and individuals could get vaccinated at their own discretion by paying out of pocket, which suggests that prevention of contagious disease may not reach satisfactory levels if left to individual choice. As a result, control programs for the prevention of contagious diseases that threaten public health must be planned and implemented.

## Conclusion

Hepatitis B seroprevalence studies in Turkey are mainly studies conducted among blood donors or risk groups. On the other hand, studies conducted among groups other than these, which reflect a wider population, are limited to regional studies. Field studies which can be generalized to the whole country and which show regional differences are very few. Even though this study was conducted among a certain age group consisting only of males, it may still give an insight, for it was carried out among randomly selected individuals from the seven different geographical regions in Turkey, which enabled the comparison between regions. More importance must be attached to such studies and they must be promoted.

The HBsAg seropositivity percentage, which was found at the conclusion of this study, supports the fact that Turkey is in a medium endemicity zone. In terms of seropositivity, there are differences depending on the region, and Southeast

Anatolia has a higher degree of seropositivity. It is believed that factors related to seropositivity are those of horizontal transmission. The results of the study suggest that in order to prevent horizontal transmission, HBsAg positive family members and students must be screened. In addition, more attention and training must be given so that people grasp the vitality of hygiene and prompt vaccination. Through vaccination and training programs, the rates of morbidity and mortality stemming from hepatitis B and the high cost of treatment can be reduced to a minimum.

## Conflict of interest

All authors declare to have no conflict of interest.

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