TÜBİTAK

ORIGINAL ARTICLE

Turk J Med Sci
2009; 39 (5): 795-802
© TÜBİTAK
E-mail: medsci@tubitak.gov.tr
doi:10.3906/sag-0804-10

Hanefi Cem GÜL[1]
İsmail Yaşar AVCI[1]
Ömer COŞKUN[1]
Recai OĞUR[2]
Yakup Hakan BAŞARAN[1]
Çakır GÜNEY[3]
Bülent A. BEŞİRBELLİOĞLU[1]
Cengiz Han AÇIKEL[2]
Can Polat EYİGÜN[1]
Alaaddin PAHSA[1]

[1] Department of Infectious Diseases and Clinical Microbiology, Gülhane Military Medical Academy, Ankara - TURKEY
[2] Department of Public Health, Gülhane Military Medical Academy, Ankara - TURKEY
[3] Department of Microbiology and Clinical Microbiology, Gülhane Military Medical Academy, Ankara - TURKEY

Anti-HAV seroprevalence in Turkish military personnel and its relation with demographic properties

Aim: Turkey is a middle endemic area in terms of Hepatitis A Virus (HAV) infection. Previous studies in Turkey showed that most residents had been infected with HAV by the second decade of life. In this study we aimed to detect the anti-HAV seroprevalence rate in Turkish military personnel and its relation with demographic properties.

Materials and methods: Randomly selected 1049 military personnel were enrolled in the study. All were male and their average age was 24.97 ± 6.48 (Range: 20-50) years. A questionnaire about their demographic properties was administered to and informed consent forms were obtained from each subject. Statistical analysis was performed with SSPS 10.0 software (SSPS, Inc, Chicago, Ill., USA). Differences were considered significant when $P < 0.05$ for 2 tails.

Results: Anti-HAV-IgG test yielded a positive result in 889 (84.7%) subjects. The result was positive for 89.9% of the subjects older than 31 years old and 83.3% of the subjects younger than 31 years old ($P > 0.05$).

Of these 1049 subjects, 67.2% were married. Of the anti-HAV-IgG positive subjects, 91.6% were married whereas 81.8% of the anti-HAV-IgG negative subjects were married ($P < 0.01$). Being a villager was observed as a risk factor for HAV infection and HAV endemicity in Marmara and Karadeniz regions was significantly lower than that in the other regions. The educational level of the subjects and also their parents were found to have an effect on anti-HAV seropositivity. As the educational level of the subjects and their parents increased, the anti-HAV IgG seropositivity decreased ($P < 0.01$).

Conclusion: The results of our study reveal that HAV exposure may increase due to risk factors, such as socioeconomic and infrastructural problems, personal hygiene, and sources of water and food. Improvement in these factors will lead to fewer exposures to HAV.

Key words: Anti-HAV seroprevalence, demographic properties, military personnel, Turkey

Türk askeri personelde anti-HAV seroprevalansi ve demografik özellikler ile ilişikisi

Amaç: Türkiye Hepatit A Virüs (HAV) enfeksiyonu açısından orta endemik bölgede yer almaktadır. Yapılan önceki çalışmalar Türkiye'de yaşayanların çoğunun hayatlarının ikinci on yılına kadar HAV ile enfekte olduğunu göstermiştir. Bu çalışmada; Türk askeri personelde anti-HAV seroprevelansı ve demografik özellikler ile ilişkisini saptamayı amaçladık.

Yöntem ve gereçler: Rastgele seçilmiş 1049 askeri personel çalışmaya dahil edildi. Hepsi erkek olup, yaş ortalamaları 24,97 ± 6,48 (20–50 arası) idi. Tüm bireylerden aydınlatılmış onamları alındı ve demografik özellikleri hakkında yazılı bir anket uygulandı. İstatistiksel analizler SSPS 10.0 software (SSPS, Inc, Chicago, Ill., USA) kullanılarak yapıldı. İki kol arasındaki farklılık $P < 0,05$ olarak saptandığında anlamlı olarak yorumlandı.

Bulgular: Anti-HAV-IgG testi 889 (% 84,7) bireyde pozitif sonuç verdi. Sonuç, 31 yaşından büyük olan bireylerin % 89.9'unda pozitif iken 31 yaşın altında olan bireylerin % 83,3'ünde pozitif idi ($P > 0,05$). Bu 1049 kişinin % 67,2'si evli idi. Anti-HAV-IgG pozitif olan 889 bireyin ise % 91,6'sı evli iken,

Received: April 03, 2008
Accepted: June 23, 2009

Correspondence
Hanefi Cem GÜL
Department of Infectious Diseases and Clinical Microbiology,
Gülhane Military Medical Academy,
Ankara - TURKEY

hcgul@yahoo.com

anti-HAV-IgG negatif 140 bireyin % 81,8'i evli idi (P < 0,01) Köyde yaşıyor olmak HAV enfeksiyonu için bir risk faktörü olarak gözlemlendi. Marmara ve Karadeniz bölgelerinde HAV endemisitesi diğer bölgelerden belirgin bir şekilde daha azdı. Bireylerin ve ebeveynlerinin eğitim düzeylerinin anti-HAV seropozitifliğini etkilediği görüldü. Bireylerin ve aynı zamanda ebeveynlerinin eğitim düzeyi arttıkça anti-HAV seropozitifliği azaldı (P < 0,01).

Sonuç: Çalışmamızın sonuçları HAV ile karşılaşmanın sosyoekonomik ve alt yapı problemleri ile kişisel hijyen, su ve gıda kaynakları gibi bir çok faktöre bağlı olarak artabileceğini ortaya koymaktadır. Bu faktörlerdeki iyileştirmeler HAV ile karşılaşmayı azaltacaktır.

Anahtar sözcükler: Anti-HAV seroprevalansı, demografik özellikler, askeri personel, Türkiye

Introduction

Hepatitis A is a viral infection caused by a virus of the Picornaviridae family (1). Hepatitis A virus (HAV) infection has generally been known as a disease found in young children with no major clinical symptoms. The distribution of cases by age groups varies according to environmental conditions and HAV infection is a worldwide disease seen mostly in developing countries (2-4).

In developing countries, practically all children are infected with HAV before the age of 10 (5,6). In these countries, elderly people have a high prevalence of HAV antibodies due to exposure during childhood. The global infection rate has decreased over time (7) but, because infections with clinical manifestations are more frequent in adults than in children, the number of clinical cases may paradoxically increase (8,9).

Turkey is a middle endemic area in terms of HAV infection. However, the frequency of this infection varies due to socio-economic differences in various regions (10). Previous studies in Turkey showed that most residents are infected with HAV by the second decade of life (11).

In this study we aimed to detect the anti-HAV seroprevalence in Turkish military personnel and its relation with demographic properties.

Materials and methods

Study population

Randomly selected 1049 military personnel (candidates for International Security Assistance Force VI task) were enrolled in the study. All participants were male and their average age was 24.97 ± 6.48 (range: 20-50) years. A written questionnaire about their demographic properties, such as age, marital status, their and their parents' educational level, financial income, history of hepatitis, history of boarding school education, water supply, geographic region, and legislative status of the place lived, was administered. An informed consent form was obtained from each subject.

HAV-IgG test

Venous blood sample (5 mL) was drawn from each subject and sera were separated via centrifugation. The serum samples were stored at -70 °C until anti-HAV IgG test performed by an automated system (AxSYM, Abbott Laboratories, USA). Anti-HAV IgG seropositivity was considered as a verification of exposure to HAV (3). Anti-HAV IgG seronegative subjects were included in the vaccination program.

Statistics

Statistical analysis was performed with SSPS 10.0 (SSPS, Inc, Chicago, Ill., USA). Descriptive statistics are given as numbers (%) for nominal data and mean ± SD for continuous data. Univariate and multivariate logistic regression analyses were performed for prediction of risk factors affecting anti-HAV IgG seropositivity. The variables significant in univariate analysis were evaluated in multivariate analysis by the backward elimination method and the smallest model achieved was presented. Categorical variables were analyzed with the chi-square test. Differences were considered significant when $P < 0.05$ for 2 tails.

Results

Anti-HAV-IgG test yielded a positive result in 889 (84.7%) subjects. The result was positive for 89.9% of

the subjects older than 31 years old and 83.3% of the subjects younger than 31 years old (P > 0.05).

Of these 1049 subjects, 67.2% were married. Of the anti-HAV-IgG positive subjects, 91.6% was married whereas 81.8% of the anti-HAV-IgG negative subjects were married (P < 0.01).

Being a villager was observed as a risk factor for HAV infection and HAV endemicity in Marmara and Black Sea regions was significantly lower than that in the other regions. The educational level of the subjects and their parents were found to have an effect on anti-HAV seropositivity. As the educational level of the subjects and their parents increased, the anti-HAV IgG seropositivity decreased (P < 0.01). All demographic properties of the study group are given in Table 1.

Univariate logistic regression analysis showed that, in terms of anti-HAV IgG seropositivity, living in villages was found to be 3.703 times (95% confidence interval (CI): 1.315-10.431) more risky than living in towns or cities. Living in Aegean, Mediterranean, Middle Anatolia, Southeastern Anatolia, and Eastern Anatolia regions was 2.206 (95% CI: 1.186-4.105), 4.969 (95% CI: 2.061-11.978), 3.818 (95% CI: 2.412-6.044), 4.999 (95% CI: 1.737-14.384), and 5.935 (95% CI: 1.784-19.750) times more risky than living in the Marmara Region, respectively.

In terms of marital status; being single was 0.378 (95% CI: 0.240-0.551) times less risky than being married.

Tap water was 0.311 (95% CI: 0.204-0.421) times less risky than other water sources.

In terms of educational level as a risk factor for HAV exposure, high school graduates were 0.485 (95% CI: 0.267-0.883) times and university graduates were 0.431 (95% CI: 0.224-0.829) times less risky than primary school graduates. In terms of their parents' education level, the risk decreased as the educational level increased. The sons of primary school graduates were 0.490 (95% CI: 0.256-0.940) times, secondary school graduates were 0.159 (95% CI: 0.050-0.507) times, high school graduates were 0.167 (95% CI: 0.065-0.429) times, and university graduates were 0.159 (95% CI: 0.046-0.549) times less risky than the sons of uneducated mothers. Also the sons of high school graduates were 0.250 (95% CI: 0.73-0.861)

Table 1. Demographic properties of the study group.

Property	Number	Percent
Anti-HAV Ig G		
Negative	160	15.3
Positive	889	84.7
Marital Status		
Single	705	67.2
Married	344	32.8
Geographic Region Lived		
Marmara Region	235	22.4
Aegean Region	111	10.6
Mediterranean Region	92	8.8
Central Anatolia	409	38.9
Black Sea Region	86	8.2
Eastern Anatolia Region	54	5.2
Southeastern Anatolia Region	62	5.9
Settlement Place		
Province	493	47
Town	455	43.4
Village	101	9.6
Source of Water		
Tap water	127	12.1
Other (well water, etc)	922	87.9
Educational Degree		
Primary School	195	18.58
Secondary School	50	4.76
High School	565	53.86
University	239	22.8
Mothers' Educational Degree		
Uneducated	174	16.6
Primary School	796	75.9
Secondary School	21	2
High School	40	3.8
University	18	1.7
Fathers' Educational Degree		
Uneducated	45	4.3
Primary School	721	68.7
Secondary School	52	5
High School	175	16.6
University	56	5.4
Age Group		
20-30 years	678	64.6
31+ years	371	35.4
Status		
1 (Officer)	60	5.7
2 (NCO)	64	6.1
3 (Civil personnel serving in the army)	39	3.7
4 (Unranked Soldier)	886	84.5
Boarding School History		
No	548	52.2
Yes	501	47.8
Monthly Income		
Less than 500 Dollars per month	212	20.2
Between 501 and 1000 Dollars	685	65.3
Over 1001 Dollars	152	14.5

times and university graduates were 0.208 (95% CI: 0.055-0.790) times less risky than the sons of uneducated fathers. Logistic regression analysis results of factors affecting anti-HAV IgG seropositivity are given in Table 2.

With the multivariate logistic regression analysis model, which included variables found significant in the univariate logistic regression analysis, living in a village (odds ratio (OR): 4.515 95% CI: 1.277-15.963), in regions of Aegean (OR:2.094, 95% CI:1.057-4.146), Mediterranean (OR: 3142, 95% CI: 1.792-5.508), Central Anatolia (OR: 3142, 95% CI: 1.792-5.508), and Southeastern Anatolia (OR:3.735 95% CI: 1.216-11.472) was found to increase the risk for anti-HAV seropositivity. Boarding school history (OR: 2.263 95% CI: 1.190-4.305) also increased the risk for anti-HAV seropositivity as university education (OR: 0.110 95% CI: 0.043-0.279) decreased the risk.

Discussion

Turkey is a middle endemic area with respect to HAV infection. The frequency of HAV infection varies due to socio-economic differences in various regions. It presents features of high endemic regions in some parts of Turkey and most of the children are exposed to HAV before they reach the adolescent age. In Turkey, anti-HAV IgG seropositivity is about 90% (12). In our study, anti-HAV-IgG test yielded a positive result in 889 (84.7%) of the subjects. This rate was slightly lower than Turkish approximation.

The geographic data in our study revealed endemicity in Marmara and Black Sea regions that was significantly lower than that in the other regions. High endemicity becomes evident especially in the east or southeast part of the country as shown in our study (13,14). The western (Marmara and Aegean) regions of Turkey are more developed than the rest of the country. The social and economical status of people is better and the sanitation standards of the cities in these regions are more developed. It seems that these improved social and environmental conditions have shifted the age of infection from childhood to adulthood. The prevalence of HAV exposure was especially high (71% to 84%) in the military personnel from the eastern regions of the country. The main reason for significant differences among regions may be the migration of large amounts of population from rural areas to urban areas in the eastern and south-eastern Anatolian regions in recent years and the inadequacy of sewage infrastructure in rapidly developing urban centers, and also poor socio-economical status of these regions. The low anti-HAV prevalence rate in the Black Sea region may be explained by lower migration rates of rural population to urban areas. The settlement place also affected HAV endemicity in our study; anti-HAV IgG positivity among subjects living in the village was significantly higher than that in other kinds of settlement place as others stated (15).

The anti-HAV IgG result was positive for 89.7% of the subjects older than 31 years old and 83.3% of the subjects younger than 31 years old. However, the increase in the age of HAV exposure is observed in Turkey in the last few years (16-18). This change in HAV epidemiology was noticed in the Middle East, Eastern Europe, Southeast Asia, and Latin America, as well. In those regions, there is a shift from high endemicity to middle or low endemicity due to social and economic development that has occurred over the last 2 decades (18-22).

Non-tap water use is a risk factor for HAV exposure (23). Also in our study anti-HAV seropositivity was significantly lower in subjects using tap water compared to those using water from other sources.

According to logistic regression analysis results; education and parental education and the source of water affected the prevalence of anti-HAV antibody. However, the status in the army and monthly income were not shown to be a specific risk factor for HAV exposure. High level education of the participant or their parents decreased anti-HAV antibody seropositivity. These parameters are concordant with the literature that showed the education level and socioeconomic status of the subjects strictly affected their anti-HAV seropositivity (24,25). Educational level of people living in the western regions is higher compared to those living in the eastern and southeastern regions of Turkey (26). This parameter also affected the significance of anti-HAV seroprevalence among the regions by increased personal hygiene awareness.

Table 2. Logistic regression analysis of factors affecting anti-HAV igG seropositivity.

Location of residence (Count)	Anti-HAV IgG Negative Count (%)	Anti-HAV IgG Positive Count (%)	Crude OR	95% CI	Adjusted OR	95 % CI
City (493)	76 (15.4)	417 (84.6)	r			
Town (455)	78 (17.1)	377 (83.9)	0.911	0.627-1.321	1.360	0.858-2.156
Village (101)	6 (5.9)	95 (94.1)	3.703	1.315-10.431	**4.515**	**1.277-15.963**
Geographic Region Lived (Count)	Anti-HAV IgG Negative Count (%)	Anti-HAV IgG Positive Count (%)	Crude OR	95% CI	Adjusted OR	95 % CI
Marmara Region (235)	67 (28.1)	168 (71.9)	r			
Aegean Region (111)	18 (16.2)	93 (84.8)	**2.206**	**1.186-4.105**	**2.094**	**1.057-4.146**
Mediterranean Region (92)	6 (6.5)	86 (93.5)	**4.969**	**2.061-11.978**	**5.041**	**1.876-13.549**
Central Anatolia (409)	38 (9.3)	371 (90.7)	**3.818**	**2.412-6.044**	**3.142**	**1.792-5.508**
Black Sea Region (86)	24 (27.9)	62 (73.1)	1.056	0.593-1.882	0.867	0.455-1.655
Eastern Anatolia Region (54)	3 (5.6)	51 (94.4)	**5.935**	**1.784-19.750**	3.286	0.944-11.442
Southeastern Anatolia Region (62)	4 (6.5)	58 (93.5)	**4.999**	**1.737-14.384**	**3.735**	**1.216-11.472**
Marital Status (Count)	Anti-HAV IgG Negative Count (%)	Anti-HAV IgG Positive Count (%)	Crude OR	95% CI	Adjusted OR	95 % CI
Single (705)	131 (18.6)	574 (81.4)	r			
Married (344)	29 (8.5)	315 (91.6)	**0.378**	**0.240-0.551**		
Source of Water (Count)	Anti-HAV IgG Negative Count (%)	Anti-HAV IgG Positive Count (%)	Crude OR	95% CI	Adjusted OR	95 % CI
Other (well water, etc) (922)	119 (12.9)	803 (87.1)	r			
Tap (127)	41 (32.3)	86 (67.7)	**0.311**	**0.204-0.421**	0.589	0.326-1.062
Educational Degree (Count)	Anti-HAV IgG Negative Count (%)	Anti-HAV IgG Positive Count (%)	Crude OR	95% CI	Adjusted OR	95 % CI
Primary School (195)	18 (9.2)	177 (90.8)	R			
Secondary School (50)	7 (14.0)	43 (86.0)	0.565	0.204-1.566	0.589	0.184-1.884
High School (565)	92 (16.3)	473 (83.7)	**0.485**	**0.267-0.883**	0.425	0.217-0.835
University (239)	43 (18.0)	196 (82.0)	**0.431**	**0.224-0.829**	**0.110**	**0.043-0.279**
Mothers' Educational Degree (Count)	Anti-HAV IgG Negative Count (%)	Anti-HAV IgG Positive Count (%)	Crude OR	95% CI	Adjusted OR	95 % CI
Uneducated (174)	14 (8.0)	160 (92.0)	r			
Primary School (796)	117 (14.7)	679 (85.3)	**0.490**	**0.256-0.940**		
Secondary School (21)	8 (38.1)	13 (61.9)	**0.159**	**0.050-0.507**		
High School (40)	14 (35.0)	26 (65.0)	**0.167**	**0.065-0.429**		
University (18)	7 (38.8)	11 (61.2)	**0.159**	**0.046-0.549**		

Table 2. (Continued)

Fathers' Educational Degree (Count)	Anti-HAV IgG Negative Count (%)	Anti-HAV IgG Positive Count (%)	Crude OR	95% CI	Adjusted OR	95 % CI
Uneducated (45)	4 (8.9)	41 (91.1)	r			
Primary School (721)	85 (11.8)	636 (88.2)	0.688	0,.06-2.298		
Secondary School (52)	6 (11.5)	46 (88.5)	0.686	0.153-3.078		
High School (175)	47 (26.9)	128 (73.1)	**0.250**	**0.73-0.861**		
University (56)	18 (32.1)	38 (67.9)	**0.208**	**0.055-0.790**		
Age Group (Count)	Anti-HAV IgG Negative Count (%)	Anti-HAV IgG Positive Count (%)	Crude OR	95% CI	Adjusted OR	95 % CI
20-30 years (678)	112 (16.5)	566 (83.4)	r			
31+ years (371)	38 (10.2)	333 (89.8)	1.730	0.931-3.505		
Military Status (Count)	Anti-HAV IgG Negative Count (%)	Anti-HAV IgG Positive Count (%)	Crude OR	95% CI	Adjusted OR	95 % CI
1 (Officer)-60	11 (18.3)	49 (81.7)	r			
2 (NCO)-64	13 (20.3)	51 (79.7)	0.881	0.360-2.152		
3 (Civil personnel in the army)-39	7 (17.9)	32 (82.1)	1.026	0.360-2.924		
4 (Unranked Soldier)-886	129 (14.6)	757 (85.4)	1.317	0.667-2.600		
Boarding School History (Count)	Anti-HAV IgG Negative Count (%)	Anti-HAV IgG Positive Count (%)	Crude OR	95% CI	Adjusted OR	95 % CI
No (548)	93 (17.0)	455 (83.0)	r			
Yes (501)	67 (13.4)	434 (86.6)	1.324	0.942-1.861	**2.263**	**1.190-4.305**
Monthly Income (Count)	Anti-HAV IgG Negative Count (%)	Anti-HAV IgG Positive Count (%)	Crude OR	95% CI	Adjusted OR	95 % CI
Less than 500 Dollars per month(212)	12(5.7)	200 (94.3)	r			
Between 501 and 1000 Dollars (685)	120 (17.5)	565 (82.5)	1.231	0.692-2.191		
Over 1001 Dollars (152)	19 (12.5)	133 (87.5)	1.197	0.146-9.825		

OR: Odds ratio CI: Confidence interval

These data clearly showed that socio-demographic factors determine the anti-HAV prevalence in subjects and it is obvious that large number of soldiers, especially coming from the western regions of Turkey, lack natural immunity to HAV infection and thus are susceptible to the virus. As vaccine to HAV is not included in the routine vaccination program, we suggest that the mean age for naturally acquired HAV infection will shift to older ages with progressive improving life standards in Turkey. It should not be surprising to see more susceptible subjects in the future.

The average age of married subjects was higher than that of single ones but this difference was not significant ($P > 0.05$). The rate of anti-HAV-IgG seropositivity in married subjects was significantly higher than that of single subjects ($P < 0.01$) and this higher rate can attributed to the higher average age of married ones.

In conclusion, the results of the present and previous studies revealed that HAV exposure may increase due to many risk factors. We suggest socioeconomic and infrastructural improvement, raising personal hygiene awareness by means of greater emphasis on education, informed use of sources of water and food, and the prevention of environmental contamination in the framework of long-term precautions to be taken in the country as a whole, all of which will ultimately lead to fewer HAV exposures. Also, the high susceptibility of military personnel to be deployed in high endemic areas and their increased risk of clinical HAV infection necessitate primary immunization.

References

1. Brown EA, Stapleton JT. HepatitisAvirus. In: Murray PR, Baron EJ, Jorfensen JH, Pfaller MA, Yolken RH, editors. Manual of clinical microbiology, Washington: American Society for Microbiology, 2003. pp. 1452-1459.
2. Bell BP, Anderson DA, Feinstone SM: Hepatitis A virus. In: Mandell GL,Bennett JE, Dolin R, editors. Principles and Practice of Infectious Disease, 6th ed. New York: Churchill Livingstone, 2005..pp. 2162-85.
3. Cuthbert JA. Hepatitis A: old and new. Clin. Microbiol Rev 2001; 14: 38-58.
4. Das K, Jain A, Gupta S, Kapoor S, Gupta RK, Chakravorty A, Kar P. The changing epidemiological pattern of hepatitis A in an urban population of India: Emergence of a trend similar to the European countries. Eur J Epidemiol 2000; 16: 507-10.
5. Tanaka J. Hepatitis A shifting epidemiology in Latin America. Vaccine 2000; 18(Suppl 1): 557-60.
6. Jacobsen KH, Koopman JS. Declining hepatitis A seroprevalence: a global review and analysis. Epidemiol Infect 2004; 132: 1005-22.
7. Shapiro CN, Margolis HS. Worldwide epidemiology of hepatitis A virus infection. J Hepatol 1993; 18(Suppl 2): 511-4.
8. Armstrong Gl, Bell BP. Hepatitis A virus infection in the United States: Model-based estimates and implications for childhood immunization. Pediatrics 2002; 109: 839-45.
9. Erdogan MS, Oktun M, Tatman-Otkun M, Akata F, Türe M. The epidemiology of hepatitis a virus infection in children, in Edirne, Turkey. Eur J Epidemiol 2004; 19: 267-73.
10. http://www.saglik.gov.tr/extras/istatistikler/temel2003/tablo50-şekil71.htm. Accessed 15th March, 2008.
11. Mistik R: Epidemiological analysis of viral hepatitis in Turkey [Türkiye'de viral hepatitlerin epidemiyolojik analizi]. Viral hepatitis [Viral Hepatitler]. Ankara,VHSD,2007: 9-50.
12. Akbulut A, Kılıc¸ SS, Felek S, Akbulut HH. The prevalence of hepatitis A in the Elazıg region. Turk J Med Sci 1996; 26: 375-8.
13. Poyraz O, Sumer H, Oztop Y, Saygi G, Sumer Z. Investigation of hepatitis A, B and C virus markers in the general population of Sivas region.[Sivas yöresinde genel toplumda hepatit A, B ve C virus belirleyicilerinin araştırılması] Turkish J Infect 1995; 9: 175-8.
14. Almeida D, Tavares-Neto J, Vitvitski L, Almeida A, Mello C, Santana D, Tatsch F, Paraná R. Serological markers of hepatitis A, B and C viruses in rural communities of the semiarid Brazilian Northeast. Braz J Infect Dis 2006; 10: 317-21.
15. Kurugol Z. Epidemiology of hepatitis A [Hepatit A epidemiyolojisi]. In: Programme and Congress Book of V. National Symposium on Viral Hepatitis; 2000 Nov 9-11, Ankara, Turkey, Viral Hepatitle Savaşım Dernegi 2000; 20-34.
16. Sahin KM, Yarkin F, Kocabas E, Ilkit M, Yildirim S, Akan E. Investigation of HAV, HBV and HCV markers in children with acute hepatitis and in healthy children [Akut hepatit ön tanılı cocuklar ile sağlıklı cocuklarda HAV, HBV ve HCV markırlarının araştırılması]. Viral Hepatit Dergisi 1998; 2: 104–108.
17. Tanaka J. Hepatitis A shifting epidemiology in Latin America, Vaccine 2000; 18(Suppl. 1): 57–60.
18. Barzaga NG. Hepatitis A shifting epidemiology in South-East Asia and China, Vaccine 2000; 18(Suppl.1): 61–4.
19. Tufenkeji H. Hepatitis A shifting epidemiology in the Middle East and Africa. Vaccine 2000; 18(Suppl. 1): 65– 7.
20. Cianciara J. Hepatitis A shifting epidemiology in Poland and Eastern Europe. Vaccine 2000; 18(Suppl. 1): 68–70.
21. Rezig D, Ouneissa R, Mhiri L, Mejri S, Haddad-Boubaker S, Ben Alaya N, Triki H. Seroprevalences of hepatitis A and E infections in Tunisia. Pathol Biol (Paris) 2008; Jan 4 [Epub ahead of print]
22. Rey JL, Ramadani Q, Soarès JL, Nicand E, Ibrahime D, Preteni E, Buisson Y, Teyssou R. Sero-epidemiological study of the hepatitis epidemic in Mitrovica in the aftermath of the war in Kosovo (1999). Bull Soc Pathol Exot 2002; 95(1): 3-7

23. Struchiner CJ, de Almeida LM, de Azevedo RS, Massad E. Hepatitis A incidence rate estimates from a pilot seroprevalence survey in Rio de Janeiro Brazil. Int J Epidemiol 1999; 28:776-81.

24. Zago-Gomes MP, Stantolin GC, Perazzio S, Aikawa KH, Gonçalves CS, Pereira FE. Prevalence of anti-hepatits A antibodies in children of different socioeconomic conditions in Vila Velha, ES. Rev Soc Bras Med Trop 2005; 38: 285-9.

25. Almeida LM, Werneck GL, Cairncross S, Coeli CM, Costa MC, Coletty PE. The epidemiology of hepatitis A in Rio de Janeiro: environmental and domestic risk factors. Epidemiol Infect 2001; 127(2): 327-33.

26. http://www.tuik.gov.tr/BolgeselIstatistik/, Accessed 15th March, 2008.