



## Seroprevalence of Hepatitis B, Hepatitis C, and HIV Infections Among Pregnant Women and Newborns in Mogadishu, Somalia: A Four-Year Retrospective Study

### Mogadişu, Somali'de Gebe Kadınlarda ve İnfantlarda Hepatit B, Hepatit C ve HIV Enfeksiyonlarının Seroprevalansı: Dört Yıllık Retrospektif Bir Çalışma

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#### Abstract

In Somalia, the prevalence of hepatitis B virus (HBV), hepatitis C virus (HCV), and human immunodeficiency virus (HIV) infections have different distributions according to gender, age, geographical regions of the country with different conditions, and subgroups of the population which have different characteristics or a specific disease. After the increasing number of general prevalence studies across the country in recent years, the need to examine the prevalence of relevant viral infections in subgroups of the society, which are especially important for public health, has arisen. In this study, it was aimed to investigate the frequency and epidemiological characteristics of HBV, HCV, and HIV infections in pregnant women and children under one year of age who admitted to our hospital. In our study, between 2015-November and 2019-November, 4,274 pregnant women (Group 1; mean age of 26.3±5.697 and an age range of 15-49) who were followed up or delivered in our hospital, 1,534 non-pregnant female patients with various diseases (Group 2; mean age 34.5±12.589 years, age range 15-95), and 1,059 infants under one age were retrospectively investigated. Newborn (<1 month) in the third group were also examined as a subgroup. The seroprevalence of anti-HBs, HBsAg, anti-HCV, and anti-HIV, which are viral infection markers, in pregnant women were found as 17.2% (n=644), 2.8% (n=116), 0.17% (n=7), and 0.14% (n=6), respectively. In non-pregnant women, the seroprevalence of anti-HBs, HBsAg, and anti-HCV were found as 27% (n=324), 6.4% (n=95), and 1% (n=14), respectively, and these rates were significantly higher than in pregnant women (Group 1) (p<0.001). The anti-HIV seropositivity rate in non-pregnant women (Group 2) was 0.07% (n=1), and this value was lower than the incidence in pregnant women (p=0.6881). In infants (Group 3), the seroprevalence of anti-HBs, HBsAg, anti-HCV, and anti-HIV was found as 35.6% (n=320), 0.8% (n=9), 1.4% (n=14), and 0.4% (n=4), respectively. High anti-HBs seropositivity was associated with the vaccination campaign carried out across the country and in our hospital. While HBsAg seroprevalence in infants was very low compared to hospital-wide data (0.8% vs. 8.1%), anti-HCV seroprevalence (1.4%) was similar to hospital-wide data (1.41%). Anti-HIV seroprevalence in infants (0.4%) was higher than both hospital-wide data (0.32%) and prevalence data for under 15s (0.15%). The high rate of anti-HBs due to vaccination was also notable in the newborns subgroup, however three (1.09%) newborn babies were HBsAg positive, indicating vertical maternal transmission. Similarly, two out of four HIV-infected infants (50%) were diagnosed in the neonatal period, indicating mother-

to-child transmission. Our study data show that in Mogadishu, a region where access to treatment is easier than in the rest of the country, the impact of HBV infection tends to decrease, however HBV and HCV infections and HIV infections, although at low prevalence, continue to be transmitted from mothers to their babies. We think that the results of this study are valuable, especially in terms of revealing the changing trends in the epidemiology of infections in the region.

**Keywords:** HBV, HCV, HIV, Pregnancy, Infant, Newborn, Somalia.

## Özet

Somali'de Hepatit B virusu (HBV), hepatit C virusu (HCV) ve insan immünyetmezlik virusu (*human immunodeficiency virus*, HIV) enfeksiyonlarının prevalansı cinsiyete, yaşa, ülkenin farklı koşullara sahip coğrafi bölgelerine, toplumun farklı özelliklere veya spesifik bir hastalığa sahip alt gruplarına göre farklı dağılımlar göstermektedir. Ülke genelinde son yıllarda artan sayıdaki genel prevalans çalışmalarından sonra, ilgili viral enfeksiyonların toplumun özellikle halk sağlığı için öncelikli alt gruplarında görülme sıklıklarının incelenmesi gereksinimi doğmuştur. Bu çalışmada HBV, HCV ve HIV enfeksiyonlarının hastanemize gelen gebelerde ve bir yaş altı çocuklarda görülme sıklığını ve epidemiyolojik özelliklerini araştırmak amaçlanmıştır. Çalışmamızda 2015-Kasım ve 2019-Kasım tarihleri arasında; takip veya doğumu hastanemizde yapılan 4.274 gebe (Grup 1; yaş ortalaması 26.3±5.697 ve yaş aralığı 15-49), çeşitli hastalıklara sahip 1.534 gebe olmayan kadın hasta (Grup 2; yaş ortalaması 34.5±12.589 yıl, yaş aralığı 15-95) ve bir yaş altı 1.059 bebek (infant) retrospektif olarak incelenmiştir. Üçüncü grupta yer alan yenidoğanlar (<1 ay) ise bir alt grup olarak ayrıca incelenmiştir. Gebe kadınlarda viral enfeksiyon belirteçlerinden anti-HBs, HBsAg, anti-HCV ve anti-HIV seroprevalansı sırasıyla %17.2 (n=644), %2.8 (n=116), %0.17 (n=7) ve %0.14 (n=6) olarak bulundu. Gebe olmayan kadınlarda ise anti-HBs, HBsAg ve anti-HCV seropozitifliği sırasıyla %27 (n=324), %6.4 (n=95) ve %1 (n=14) olarak bulundu ve bu oranlar gebe kadınlara (Grup 1) göre anlamlı derecede yüksekti (p<0.001). Gebe olmayan kadınlarda (Grup 2) anti-HIV seropozitiflik oranı ise %0.07 olup (n=1), bu değer gebe kadınlara göre daha düşüktü (p=0.6881). İnfantlarda (Grup 3) anti-HBs, HBsAg, anti-HCV ve anti-HIV seroprevalansı sırasıyla %35.6 (n=320), %0.8 (n=9), %1.4 (n=14) ve %0.4 (n=4) olarak bulundu. İnfantlarda gözlemlenen yüksek anti-HBs seropozitifliği ülke genelinde ve hastanemizde yürütülen aşılama kampanyası ile ilişkili idi. İnfantlarda HBsAg seroprevalansı hastane geneli verilerine göre çok düşük (%0.8'e karşın %8.1) iken, anti-HCV seroprevalansı (%1.4) hastane geneline (%1.41) benzerdi. İnfantlarda anti-HIV seroprevalansı (%0.4) ise hem hastane geneli verilerine göre (%0.32), hem de 15 yaş altı prevalans verilerine göre (%0.15) daha yüksekti. Yenidoğan alt grubunda da aşılamaya bağlı yüksek anti-HBs oranı dikkati çekerken, anneden bulaşa işaret edecek şekilde üç (1.09%) yenidoğan bebek HBsAg pozitif idi. Benzer şekilde HIV enfeksiyonu tanısı alan dört infanttandır ikisi (%50) yenidoğan döneminde tanı almıştı ve bu durum anneden bebeğe bulaşı gösteriyordu. Çalışma verilerimiz tedavi erişiminin ülke geneline göre daha kolay olduğu değerlendirilen bir bölge olan Mogadishu'da HBV enfeksiyonunun etkisinin azalma eğiliminde olduğuna, ancak HBV ve HCV enfeksiyonlarının ve her ne kadar düşük prevalansta olsa da HIV enfeksiyonlarının annelerden bebeklerine bulaşmaya devam ettiğini göstermektedir. Bu çalışma sonuçlarının özellikle bölgedeki enfeksiyonların epidemiyolojisindeki değişim trendlerini ortaya koyması yönü ile değerli olduğunu düşünüyoruz.

**Anahtar Kelimeler:** HBV, HCV, HIV, Gebelik, İnfant, Yenidoğan, Somali.

## Introduction

Hepatitis B virus (HBV), hepatitis C virus (HCV) and human immunodeficiency virus (HIV) are the global public health issues and infectious agents that can be transmitted from infected mothers to their babies during pregnancy, birth and breastfeeding (for HIV) and can cause pregnancy complications and acute or chronic clinical disorders and long-term psychological consequences in infected children [1-3].

Although HBV transmission is primarily through parenteral route and sexual contact, vertical (transmission from infected mother to newborn) and horizontal (contact with infected persons) transmission are also of great importance in developing countries [4]. Without intervention, 70% to 90% of babies born to mothers positive for HBV surface antigen (HBsAg) and HBV e antigen (HBeAg) will be chronically infected with HBV [1]. Vertical transmission of

HBV is preventable using early antenatal testing for HBV and infant HBV vaccination, including timely administration of the HBV birth dose with, or without, passive immunization with HBV immunoglobulin (HBIG) [1]. Furthermore, the World Health Organization recommends prenatal screening for HBV and HIV at least once in pregnancy and as early as possible [1].

Vertical transmission of HCV occurs in 5% to 15% of pregnant women infected with the virus and progresses to chronic infection in children in 3% to 5% of cases [2]. Although there is no treatment available to prevent mother-to-child transmission of HCV during pregnancy, screening for HCV infection during pregnancy allows healthcare providers to simultaneously identify infected mothers who should receive treatment in the postpartum period and infants who should receive treatment at the approved time [5]. The American Academy of Pediatrics and the Center for Disease Control recommend that babies born to HCV-positive women be screened for anti-HCV antibodies after 18 months [2].

Babies born to HIV-infected mothers face an increased risk of morbidity and mortality [1,6]. HIV infection can be vertically transmitted to the baby during pregnancy, during birth and through breastfeeding, and without any intervention, this probability rate is 15-45% [1,3]. However, with interventions that can be summarized as the mother receiving antiretroviral treatment during pregnancy and being under the supervision of a physician, giving birth by cesarean section at the 38th week, giving antiretroviral prophylaxis to the baby after birth and not breastfeeding, the rate of transmission can be lower than 2% [6].

In this study, it was aimed to investigate the frequency and epidemiological characteristics of HBV, HCV, and HIV infections, which stand out with their pregnancy complications, the risk of mother-to-baby transmission, and the burden they impose on child and public health, in pregnant women and children under one year of age who admitted to our hospital.

## **Material and Method**

The study was conducted after ethical approval from the ethics committee of Somalia

Turkey Recep Tayyip Erdogan Education and Research Hospital, date: 12.02.2020, decision no: 217, number: MSTH/3400), and the study was performed according to the ethical principles of the Declaration of Helsinki.

### *Study population and design*

This study was carried out between November 2015 and November 2019 in Mogadishu Somalia Turkey Recep Tayyip Erdoğan Training and Research Hospital. Anti-HBs, HBs-Ag, anti-HCV, and anti-HIV seropositivity rates were investigated in patients categorized in three groups and a subgroup who applied to our hospital for pregnancy following, delivery or different treatment reasons during the four-year period.

Group 1 consists of all pregnant women (15-49 age range) whose antenatal pregnancy follow-up or delivery were carried out in our gynecology and obstetrics department. Group 2 include all other patients (15-95 years old women) admitted to same department (inpatient service or outpatient clinic) with different disease profiles other than pregnancy. Group 3 included all infants under 1 year of age who were followed up or treated in our hospital during the same period with "Group 1 and Group 2", and all newborns (<1 month age) in this group were also examined as a subgroup.

### *Serological analysis*

Serological markers (Anti-HBs, HBs-Ag, anti-HCV, anti-HIV) of HBV, HCV, and HIV infections were analyzed by the chemiluminescent ELISA technique. Two different devices were used for this analyzes: (1) Architect diagnostic kits (Abbott Diagnostic, Germany) were used to analyzing of all samples on the Architect I 2000 SR (Abbott Diagnostics, USA) system (the assessment procedures have been discussed in detail in previous articles [7-9]), (2) samples with low-level reactivity or gray zone results in the first detection system were reanalyzed using a second diagnostic assay on a different ELISA based system (Cobas e 411 analyzer, Roche Diagnostics, Germany). Our hospital has switched to a different device and test system as of the beginning of 2020, and our study data does not cover the period after 2020.

**Statistical analysis**

Frequency, mean, and standard deviation values were calculated for each group. The chi-square test was used to examine the differences in categorical variables between groups. When the scenario of low expected cell frequencies encountered in small sample size the Fisher's Exact test was used. Results were considered statistically significant when  $p < 0.05$  with a 95% confidence interval (CI). The data were compiled and analyzed using SPSS v. 22.0 (IBM Corp, Armonk, NY).

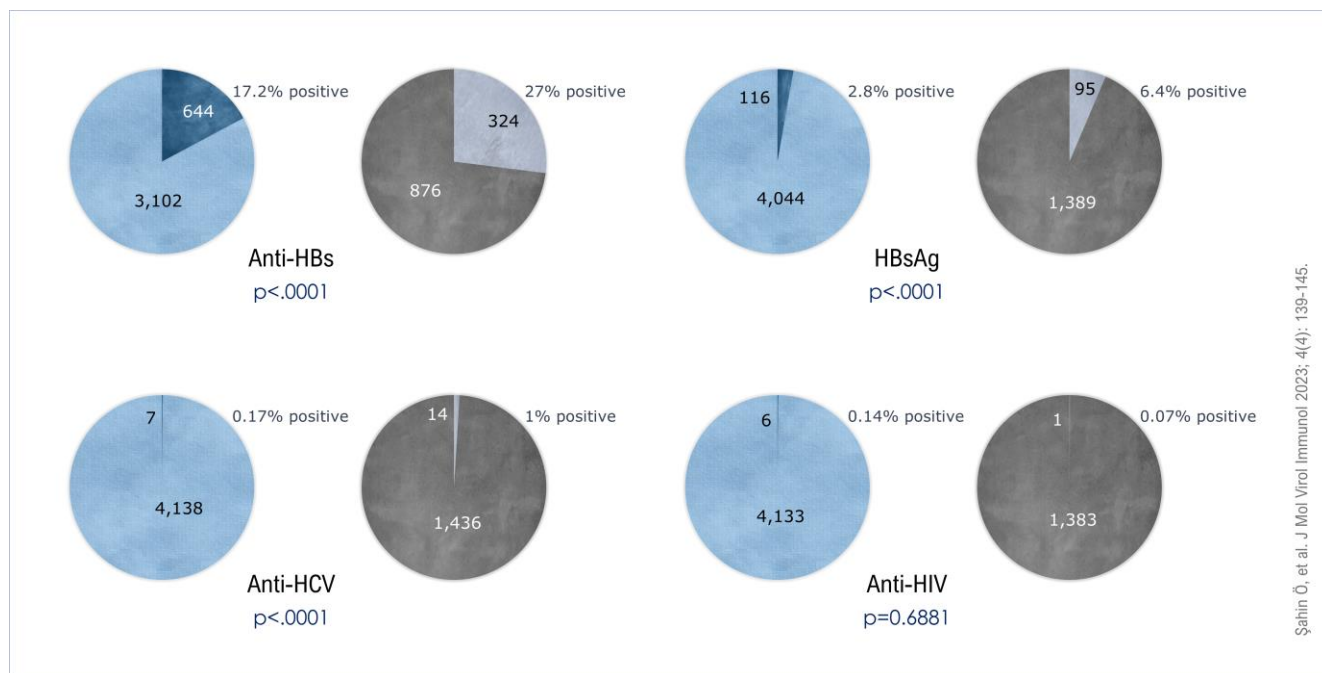
**Results**

Group 1 consisted of 4,274 pregnant women with a mean age of  $26.3 \pm 5.697$  years, median age of 26, and distribution range of 15-49. Of the pregnant women, 72.6% (n=3,102) were tested for anti-HBs, 94.6% (n=4,044) for HBsAg, 96.8% (n=4,138) for anti-HCV, and 96.7% (n=4,133) for anti-HIV. All serological markers in pregnant women were at lower positivity rates compared to all hospital-wide data, all female patients, and all women between the ages of 15-49 (Table 1).

Group 2 consisted of 1,534 non-pregnant female patients with a mean age of  $34.5 \pm 12.589$  years, median age of 30, and distribution range of 15-95. Of these non-pregnant female patients,

78.2% (n=1,200) were tested for anti-HBs, 96.7% (n=1,484) for HBsAg, 94.5% (n=1,450) for anti-HCV, and 90.2% (n=1,384) for anti-HIV (Table 2). In the patients in Group-2, HBV and HCV serological markers were similar, while the anti-HIV seropositivity rate was low to all female patients overall the hospital. Anti-HBs, HBsAg, and anti-HCV seroprevalence were found to be 27% (n=324), 6.4% (n=95), and 1% (n=14), respectively, in non-pregnant women, and these rates were significantly higher ( $p < 0.001$ ) than in pregnant women (Group 1) (Figure 1).

Group 3 consisted of 1,059 infants with a mean age of  $114 \pm 136.07$ -days, median age of 113 day, and distribution range of 1-365 days. Of the infants, 84.9% (n=899) were tested for anti-HBs, all (n=1,059) for HBsAg, 95.2% (n=1,008) for anti-HCV, and 90.4% (n=957) for anti-HIV (Table 3). In infants, HBsAg seroprevalence was very low (0.8% vs. 8.1%) compared to hospital-wide data, but anti-HCV seroprevalence was similar (1.4% vs. 1.41%). A high anti-HBs seropositivity rate was detected in infants (35.6%) and in the newborns (19.1%). Anti-HIV seroprevalence in infants (0.4%) was higher than both hospital-wide data (0.32%) and prevalence data for under 15s (0.15%). Of the newborns, two (0.75%) were anti-HIV and three (1.09%) were HBsAg positive.



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**Figure 1.** Comparison of HBV, HCV, and HIV seroprevalence data between Group 1 (pregnant women; blue circles) and Group 2 patients (non-pregnant female patients; gray circles).

**Table 1.** HBV, HCV, and HIV seropositivity rates of pregnant women and hospital-wide data (2015-2019).\*

	age (pregnant women)			test results (pregnant women)			test results (hospital-wide)			
	mean age (year±SD)	median age (year)	age range (years)	positive n (%)	negative n	total tested n	in women (15-49 age)	in females (all ages)	in males (all ages)	in all applicants
Anti-HBs	26.3±5.685	26	15-49	644 (17.2)	3,102	3,746	22.6%	31.3%	33.9%	32.7% <sup>a</sup>
HBsAg	26.3±5.702	26	15-49	116 (2.8)	4,044	4,160	5.7%	6.9%	9.2%	8.1% <sup>b</sup>
Anti-HCV	26.3±5.701	26	15-49	7 (0.17)	4,138	4,145	0.44%	1.15%	1.64%	1.41% <sup>c</sup>
Anti-HIV	26.3±5.699	26	15-49	6 (0.14)	4,133	4,139	0.43%	0.37%	0.29%	0.32% <sup>d</sup>

SD; Standard deviation. <sup>a</sup>; n=79,410 [8]. <sup>b</sup>; n=115,946 [8]. <sup>c</sup>; n=102.601 [9]. <sup>d</sup>; n=82,954 [7].

**Table 2.** HBV, HCV, and HIV seropositivity rates of non-pregnant women and hospital-wide data (2015-2019).\*

	age (non-pregnant women)			test results (non-pregnant women)			test results (hospital-wide)			
	mean age (year±SD)	median age (year)	age range (years)	positive n (%)	negative n	total tested n	in women (15-49 age)	in females (all ages)	in males (all ages)	in all applicants
Anti-HBs	34.1±14.71	29	15-95	324 (27)	876	1200	22.6%	31.3%	33.9%	32.7% <sup>a</sup>
HBsAg	34.4±14.92	30	15-95	95 (6.4)	1389	1484	5.7%	6.9%	9.2%	8.1% <sup>b</sup>
Anti-HCV	34.6±14.99	30	15-95	14 (1)	1436	1450	0.44%	1.15%	1.64%	1.41% <sup>c</sup>
Anti-HIV	34.8±15.11	30	15-95	1 (0.07)	1383	1384	0.43%	0.37%	0.29%	0.32% <sup>d</sup>

SD; Standard deviation. <sup>a</sup>; n=79,410 [8]. <sup>b</sup>; n=115,946 [8]. <sup>c</sup>; n=102.601 [9]. <sup>d</sup>; n=82,954 [7].

**Table 3.** HBV, HCV, and HIV seropositivity rates of <1 years old infants and hospital-wide data (2015-2019).\*

	age (<1 years old infants)			test results (<1 years old infants)			test results (hospital-wide)			
	mean age (day±SD)	median age (day)	age range (days)	positive n (%)	negative n	total tested n	newborns (<30 day)	1-15 age	≥50 age	in all applicants
Anti-HBs	138±113.4	120	1-364	320 (35.6)	579	899	19.1% (43/225)	23.4%	57.9	32.7% <sup>a</sup>
HBsAg	137±113.3	116	1-364	9 (0.8)	1,050	1,059	1.09% (3/275)	1.72%	11.7%	8.1% <sup>b</sup>
Anti-HCV	136±115.1	112	1-365	14 (1.4)	994	1,008	0% (0/267)	0.14%	4.35%	1.41% <sup>c</sup>
Anti-HIV	133±114.3	104	1-364	4 (0.4)	953	957	0.75% (2/266)	0.15%	0.23%	0.32% <sup>d</sup>

SD; Standard deviation. <sup>a</sup>; n=79,410 [8]. <sup>b</sup>; n=115,946 [8]. <sup>c</sup>; n=102.601 [9]. <sup>d</sup>; n=82,954 [7].

## Discussion

The transmission of HBV, HCV, and HIV infections, which are important for public health, from mother-to-child can be prevented or eliminated through some basic interventions [3]. In order to determine the intervention method and prevention targets for these infections, especially in selected subgroups of society, it is important to firstly determine their prevalence. Studies on the prevalence of HBV, HCV, and HIV infections in Somalia revealed that HBV infections are a more common public health problem than HCV and HIV infections throughout the country [7-10]. Studies also point out that HBV infections are more common in men [8,10] and HIV infection is more common in women population [7]. The

high prevalence rate of HBV and HCV infections seen in older ages tended to decrease for both infections in recent years and the positive advances observed as a result of vaccination (for HBV) studies are promising [8]. These infections also show different distributions in subgroups of the society with different characteristics or specific diseases. The higher rates of HCV infections in hemodialysis patients than in the general population can be given as an example of this situation [11].

All serological markers investigated our study were at lower seropositivity rates in pregnant women compared to all hospital-wide data including women between the ages of 15-49, ( $p < 0.001$ ) (Table 1), the most important reasons

for this finding are that pregnant women generally consist of healthy people and are a young population (average age 26.3) compared to the significant age-related prevalence increase across the country. Anti-HBs, HBsAg, and anti-HCV seroprevalence were significantly higher in non-pregnant female patients than in pregnant women ( $p < 0.001$ ). This situation can also be attributed to age-related prevalence.

In a study conducted in Türkiye and including a total of 838 people whose parents were HBsAg positive, it was found that the mothers of 389 (46.4%) of the cases, the fathers of 404 (48.2%), and both the mothers and fathers of 45 (5.4%) cases were HBsAg positive [4]. Of the people whose mother and/or father were HBsAg positive, 14.4% (121/838) were acutely infected (HBsAg positive, anti-HBs negative), 5.3% (44/838) of the people were immune (HBsAg negative, anti-HBs positive), and others remained sensitive. In the same study, the HBsAg positivity rate was found to be significantly higher in those whose mothers were HBsAg positive (25.2%; 98/389) than in those whose fathers were HBsAg positive (2.5%; 10/404) ( $p < 0.001$ ), and it has been emphasized that mothers play an important role in HBV transmission [4]. The most important strategy to prevent mother-to-child transmission of HBV is to administer the first dose of monovalent HBV vaccine as soon as possible after birth, preferably within 24 hours, followed by at least two subsequent doses [1]. In our study, HBsAg seroprevalence in 1,059 infants was much lower compared to hospital-wide data (8.1% versus 0.8%). This data stands as a good example that HBV can be prevented by immunoglobulin and vaccination interventions. However, the HBsAg positivity observed in 3 (1.09%) newborn babies shows that HBV transmission from mother to baby continues in the region. We believe that, despite the low HBsAg rates in infants and newborns (0.8% and 1.09%, respectively), high rate anti-HBs seropositivity (35.6% and 19.1%, respectively) was a positive reflection of the vaccination campaigns carried out in our hospital and across the country.

The prevalence of serum anti-HCV antibodies in pregnant women is estimated to be 0.1% to 3.6% in studies conducted in large cohorts [2].

However, the detection rate of perinatal HCV is low due to lack of screening, slow onset of symptoms, and inadequate adherence to the 18-month follow-up requirement after birth [2]. In our study, while anti-HCV seroprevalence in pregnant women was found to be quite low compared to hospital data (1.41% and 0.17%, respectively), the 1.4% rate detected in infants indicates that babies infected with HCV through their mothers probably cause an increase in general HCV prevalence of the country. It is recommended that HCV-infected babies should be monitored when they reach the age of 3 so that treatment with direct-acting antivirals can be initiated [5]. The possible risk of mother-to-child transmission of HCV is related to maternal HIV co-infection and maternal HCV-RNA levels [2]. In a Nigerian pediatric HIV study, 7.7% and 5.2% of the HIV-infected children were co-infected with HBV and HCV, respectively [3]. Although the rate of HIV-HCV co-infection is low in Somalia [7], it is important to increase the awareness of healthcare personnel for HCV by avoiding the use of fetal scalp electrodes and iatrogenic birth trauma in preventing HCV transmission [2].

In our study, anti-HIV seropositivity rate is higher in pregnant women, however no significant difference was observed between the Group 1 and Group 2. Anti-HIV seropositivity rate (0.07%) in non-pregnant female patients was also lower than hospital-wide data. One of the reasons for this was that the pregnant women were young and sexually active people than the Group 2 patients, also that the HIV infected patients may apply to other units in our hospital rather than the gynecology clinic. However, in our study, anti-HIV seroprevalence in infants (0.4%) and newborns (0.75%) was higher than both hospital-wide data (0.32%) and prevalence data under the age of 15 (0.15%). These findings and the fact that two out of four HIV-infected babies under the age of one (50%) were diagnosed in the neonatal period indicate that HIV infections transmitted from mother to baby are not a rare situation. In a study conducted in Türkiye, two (6.25%) of 32 babies born to HIV-infected mothers, followed between 2007 and 2015, were found to be HIV-infected [6]. One of the HIV-infected cases died at the age of 4 months due to lung infection and sepsis. In

the same study, HIV diagnosis was made before pregnancy in 15 (46.9%) of the mothers, during pregnancy in 10 (31.3%), and during birth in seven (21.8%) [6]. In our study, an important reason for the high seroprevalence rate indicating vertical transmission is that, by our observations, pregnant women usually learn that they are HIV-infected through screening test during birth and do not receive antiretroviral treatment. Although perinatal transmission of HIV from mother to baby can be reduced by measures to be taken before, during and after birth [1,6], late diagnosis and lack of treatment remain the most important obstacles for Somalia.

**Conflict of interest:** The authors declare that there is no conflict of interest. The authors alone are responsible for the content and writing of the paper. **Financial disclosure:** There is no financial support to this study.

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## Conclusion

Our results show the positive impact of HBV vaccinations on the decreasing trend in the prevalence of HBV in the country. As a reflection of the high HBV prevalence across the country, HBV transmission from mothers to child continues. Limited preventive measures for HCV and late diagnosis for HIV cause high rates of mother-to-child transmission for both viruses. The rate of babies born infected with HIV, which is higher than the HIV prevalence in the society, contributes to the spread of the infection and infant mortality rates in the country, where access to treatment is difficult.