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AMB and GHA conceived and designed the study; AMB and WAA did literature search; GHA performed clinical trials; AMB and GHA performed experiments; WE and WAA did data analysis; AMB and WE wrote and revised the paper; AMB and WAA review the manuscript.


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Prevalence of Hepatitis B Surface Antigen among Orphans Children Living in Orphanage in Sana'a City, Yemen

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Hepatitis B virus (HBV) is considered a serious public health issue in Yemen and disease epidemiology among orphaned children is not well known. Consequently, the current study was aimed to determine the prevalence of Hepatitis B infection among children living in the orphanage in Sana'a city, Yemen. A cross-sectional descriptive study was conducted from March to May 2021 to determine the HBsAg seroprevalence among children living in orphanage in Sana'a city. Three hundred and thirty-three (333) blood specimens were randomly collected from orphan children and the HBsAg was determined by using an enzyme-linked immunosorbent assay (ELISA). Also, the needed data and associated risk factors were collected by a standard questionnaire. The results revealed that the rate of HBsAg seroprevalence was (0.0%) recorded among participated children which means all of them are free of HBV infection. The rest of the factors failed to achieve any statistical significance with the seroprevalence of HBsAg. Moreover, the most who participated in this study were children in the age group 11-15 years old, not having work and family history of HBV, didn't smoke, medication, shared a toothbrush with another person, and infected relative HBV. Also, the vast majority of all participants had no risk factors parameters for HBV according to hemodialysis, blood transfusion, organ transplantation, cupping, and vaccination. It is recommended that the implementation of an effective health program such as hepatitis B vaccination and health education would further reduce the prevalence of hepatitis B.

INTRODUCTION

Hepatitis B virus is a major public health problem in the world and one of the leading causes of death (Kalim *et al.*, 2017a,b). More than 2 billion people globally have been infected by this virus and among these individuals, 296 million people, or nearly 5% of the world's population, were living with chronic hepatitis B infection in 2019 (WHO, 2021).

However, about 1.5 million new cases were infected by HBV each year. Also, it was annually estimated that about 820 thousand people die resulting mostly from cirrhosis (52%) and hepatocellular carcinoma (38%) (WHO, 2016a; 2021). Globally, between 60% to 80% of the cases with hepatocellular carcinoma progressed resulting from HBV infection which has been categorized as a Group 1 carcinogenic agent to humans by the International Agency for Research on Cancer (IARC, 2012).

The elevation of liver enzymes is responsible for liver disorders (Toor *et al.*, 2016) leading to hepatitis (Hussien *et al.*, 2018; Iqbal *et al.*, 2019). The mode of HBV transmission is transfusion of infected blood, sexual exposure, use of contaminated equipment for medical processes, and sharing of piercing tools (Jafari *et al.*, 2010). Also, it can be transmitted from an infected mother with HBV to her infants and 90% of them are becoming a chronic carrier. Between 15 to 25% of these children have a risk of dying due to cirrhosis or liver cancer during adulthood (Camvulam *et al.*, 2010; Bakthavatchalu, 2012).

WHO sets a strategy to decrease HBV incidence in children under-five to below 1% by 2020, and reduce the incidence to 0.1% by 2030 (WHO, 2016b). According to the recent estimation by WHO that observed the incidence of HBV among children aged under five years dropped to just under 1% in 2019 (WHO, 2016b; 2021).

Yemen is one of the developing countries that lack an effective health system due to war since 2015 and so on. Therefore, most diseases are spreading during this period due to increased poverty level, inadequate personal hygiene, and lack of safe water (Alhlale *et al.*, 2019;

Alshahethi *et al.*, 2020; Al-Khawlany *et al.*, 2021; Edrees and Anbar, 2021; Edrees *et al.*, 2022).

However, some reports focused in the frequency of common infectious viruses among children and adults in the community (Abdullah *et al.*, 2020; Gobara'a *et al.*, 2020). The previous national reports reported that the prevalence of positive HBsAg was ranged between 8% to 20% among adults (Al-Shamahy *et al.*, 2003; Sallam *et al.*, 2003) and 4.1% among infants (AL-Shamahy, 2000). Recently, Al-Shamahy *et al.* (2019) revealed that the prevalence rate of HBsAg among children was 1.8% in Sana'a city and 3.8% in Shabawah governorate.

Up to now, no study estimated the HBV infection among orphaned children in Yemen. Consequently, this study was aimed to determine the prevalence of Hepatitis B infection among children living in the orphanage in Sana'a city, Yemen.

MATERIALS AND METHODS

Design study and period

This is a cross-sectional descriptive study carried out at Ahmed's orphanage which is located on Taiz Street southeast of Sana'a city, Yemen, between March to May 2021. There are more than 800 orphans living in Ahmed's orphanage coming from different regions of Yemen.

Population study

The target population was orphans children aged 5 to 20 years who living in Ahmed's orphanage in Sana'a city, Yemen. Three hundred and thirty-three (333) male children were randomly chosen for this study.

Data collection

A standard designed questionnaire was used for data collection from each participant. Before data collection, the purpose of this work was explained to the orphanage director and children. Also, the required data such details of

demographic data and risk factors were gathered by interview face to face.

Ethical statement

The study protocol was permitted by the Al-Razi University, Yemen Research Ethics Review Committee and Administration of Orphanage at Sana'a city.

Inclusion and exclusion criteria

Male children aged between 5 to 20 years old who informed written consent and didn't vaccinate were included. In contrast, the children who were vaccinated against hepatitis B virus or under viral drugs treatment were excluded.

Samples collection and examination

Five milliliters (5 mL) of venous blood was obtained from the study participant by vein puncture and transferred into a tube. The blood specimen for each participant was independently centrifuged at 3000 rpm for five minutes and the separated serum was transferred into Eppendorf tube and stored at -20°C until analyzed for hepatitis B surface antigen. The HBsAg was determined by using an enzyme-linked immunosorbent assay (ELISA) (Labsystem Reader) using a commercially available kit (Biokit, Spain) at the National Center for Central Public Health laboratories (NCPHL).

Statistical analysis

The obtained results were statistically analyzed using the SPSS program (Version 20) for descriptive measurements such as frequency,

the proportion for categorical variables, and the mean and standard deviation. Also, the significant consideration (*P*-value) was set at $P \leq 0.05$.

RESULTS

Demographical characteristics

Figure 1 showed that the most participants of age group enrolled in this study were between 11 to 15 years 168 (50.45%), followed by the age group 16-20 years 99 (29.73%), and the age group 5 to 10 years 66(19.82%) with mean±SD, (13.47 ± 3.042).

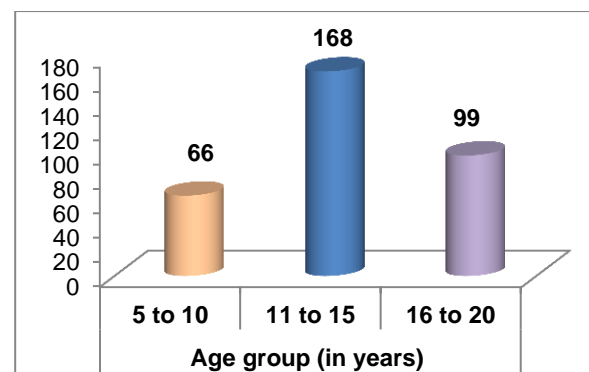


Fig. 1. Age group of study participants.

Frequency of general risk factors among participants

The majority of participants were (96.4%) had not worked, not had family history of HBV (99.4%), no eating red meat, smoking, medication, sharing toothbrush with other person, and infected relative with HBV (Table 1).

Table 1. Frequency of general risk factors among participants.

General risk factors	Yes		No		P-value
	No. (%)	Mean ± SD	No. (%)	Mean ± SD	
Work	12 (3.6)	0.04 ± 0.015	321(96.4)	0.03 ±0.019	0.119
Family history of HBV	2 (0.6)	0.04 ± 0.001	331(99.4)	0.03 ±0.019	0.290
Red meat	0 (00.)	N	333(100)	N	N
Smoking	0 (0.0)	N	333(100)	N	N
Medication	0 (0.0)	N	333(100)	N	N
Sharing toothbrush with other person	0 (0.0)	N	333(100)	N	N
Infected relative with HBV	0 (0.0)	N	333(100)	N	N
Sharing razor with other person	3 (0.9)	0.00±0.001	330(99.1)	0.03 ±0.019	0.020

Significant statistics at *p*-value <0.05. N= not applied

Frequency of medical risk factors among participants

The vast majority for all items (100%) of subjects had no risk factors for HBV according to

hemodialysis, blood transfusion, organ transplantation, cupping, and vaccinated. In contrast, only 3.0% for each who reported with surgical operation and injury as well as 5.4% for dental loss (Table 2).

Table 2. Distribution frequency of medical processors among subjects.

Medical risk factors	Yes		No		P-value
	No. (%)	Mean ± SD	No. (%)	Mean ± SD	
Hemodialysis	0 (0.0)	N	333(100)	N	N
Blood transfusion	0 (0.0)	N	333(100)	N	N
Organ transplantation	0 (0.0)	N	333(100)	N	N
Surgical operation	10(3.0)	0.04 ± 0.013	323(97.0)	0.03 ±0.019	0.063
Dental loss	18 (5.4)	0.02 ± 0.020	315 (94.6)	0.03 ± 0.019	0.037
Injury	10(3.0)	0.03 ± 0.021	323(97.0)	0.03 ± 0.019	0.869
Cupping	0 (0)	N	333 (100)	N	N
Vaccinated	0 (0)	N	333 (100)	N	N

Significant statistics at p-value <0.05. N= not applied

Hepatitis B surface antigen result

The present study revealed that 100% of participated children were negative for HBsAg seroprevalence (Figure 2).

laboratory data for HBV with mean age among subjects (P= 0.000).

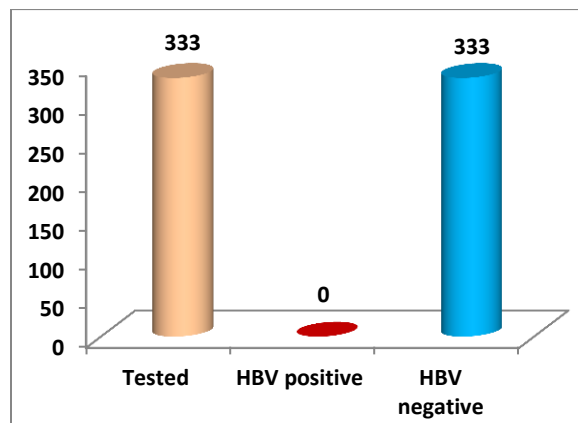


Fig. 2. Age group of study participants

Association between risk factor and laboratory data of HBV

Table 3 shows that there was statistical significant relationship between mean score of

Table 3. Association between mean of age and laboratory data of HBV

Demographic and laboratory data	Mean	SD	R	P-value
Age (year)	13.47 ± 3.042		0.447	0.000
HBV by ELISA	0.03 ± 0.019			

Significant statistics at p-value <0.05. R= Regression

DISCUSSION

Despite the availability of an effective and safe vaccine, HBV infection remains a life-threatening globally (Dilshad et al., 2016). The endemicity of positive HBsAg prevalence in Yemen was ranged from 8% to 20%, and up to 50% of the population (Al-Shamahy, 2000; Almezgagi et al., 2020; Al-Ofairi et al., 2020). While the prevalence of hepatitis B among children living in orphanages in Yemen is not well known.

Most participants in this study were children in the age group 11-15 years old, not having work and a family history of HBV, no eating red meat, smoking, medication, sharing a toothbrush with

another person, and infected relative with HBV. Also, the vast majority of all items (100%) of the subjects were had no risk factors parameters for HBV according to hemodialysis, blood transfusion, organ transplantation, cupping, and vaccinated. In contrast, only 3% for each who reported surgical operation and injury as well as 5.4% for dental loss.

The present result overall rate of HBV antigen surface was 0.0% recorded among participating orphans. This result is in agreement with the finding by Gacche and Kaid (2012) showed that the rate of HBsAg was 0.0% was recorded among children aged ≤ 14 years in Ibb city, Yemen. Also, Bawazir *et al.* (2010) in Aden, showed that the children aged less than 18 years were free of HBsAg.

However, the lower rate of HBsAg seroprevalence among children was noticed in several studies. A study conducted in Anambra, Nigerian by Oluboyo *et al.* (2014) showed that 0.6% of examined children resident in orphanages had an HBsAg positive. Also, it was reported that the HBsAg was 0.56% found among post-vaccinated children in Cambodia (Ork *et al.*, 2019).

The seroprevalence of HBsAg among children in Yemen was 1.8% recorded in Sana'a by Al-Shamahy *et al.* (2011) and 2.8% among non-vaccinated children in Sana'a city in 2001 (Al-Shamahy *et al.*, 2003). Recently, Al-Shamahy *et al.* (2019) reported that the prevalence rate of HBsAg was 1.8% and 3.8%, respectively, recorded among children in Sana'a city and in Shabawah governorate.

The present study is completely different from some investigations conducted in different countries. A study by Haukenes *et al.* (1992) found that 20.8% was reported among children in an orphanage in Romania. Similarly, 54.6% of infants living in orphanages in Bucharest were found to be HBsAg-positive (Paquet *et al.*, 1993). Recently, it was found that the HBsAg seroprevalence was 20.0% recorded among children living in Nigerian orphanages (Ogbonna *et al.*, 2021).

This result indicates that the absence of HBsAg seroprevalence among participants children might be protected by the vaccine that were introduced previously in Yemen. Hence receiving vaccination not only reduce individual chance of being infected and prevent serious illness, it also contributes to public protection, reducing the probability of virus transmission.

In Yemen, raising awareness among the community greatly contributed to their knowledge of the ways of disease transmission (Alhlale *et al.*, 2020). It has been observed that low rate of diseases caused by pathogenic microorganisms was noticed among the participants who had knowledge about the mode of disease transmission and strictly adherent to infection prevention and control (Al-Haik *et al.*, 2017; Edrees and Anbar, 2020; Edrees and Al-Awar, 2020; Mogalli *et al.*, 2020; Edrees, 2021).

CONCLUSION

The absence of HBsAg seroprevalence among participated children in this study does not definitively indicate that this age group is completely far away from the risks of future exposure to hepatitis HBV infection, unless they had previously been vaccinated. Therefore, enough doses of the HBV vaccine, which will be the only guarantee to protect children and prevent virus transmission in the community. In addition, reinforce existing awareness, monitoring, and application of infection control procedures as well as increased coverage of hepatitis B vaccination would further reduce prevalence of hepatitis B.

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CONFLICT OF INTEREST

The authors declare that this article's content has no conflict of interest.

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