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Intra-Household Transmission of Hepatitis B Virus in Rasd, Abyan -Yemen

Ali N. M. Gubran [1 *], Khaled A. Al-Moyed [2], Ahmed M. Al-Haddad [3], Ahmed. A. Ageel[4]
[1] Department of Health Sciences, Faculty of Medicine and Health Sciences, University of Science and Technology, Aden, Yemen.
[2] Department of Medical Microbiology, Faculty of Medicine and Health Sciences, Sana'a University, Sana'a, Yemen.
[3] Department of Basic Medical Sciences, Faculty of Medicine and Health Sciences, Hadhramout University, Mukallah, Yemen.
[4] Medical Laboratory Department, Higher Institute of Medical Sciences and Technologies, Bani Waleed, Libya

[*]*Corresponding author:* abuyafa201@yahoo.com

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Abstract:
Transmission of HBV within household contacts is considered a phenomenon. This study aimed to determine the prevalence of HBV infection among household contacts with a member (index case) and identify the intra and extra-household risk factors contributing for HBV infection. An analytical cross-sectional study was conducted on hepatitis B positive patients and their household contacts in Rasd, Abyan-Yemen. Blood was collected from members; the sera were separated and the HBsAg was determined by using ELISA kit. The prevalence HBV infection among household contacts was 10.7%. The highest prevalence was 25.3% recorded among age group 20–29 years (p=0.001), 11.3% among household contacts who were in close contact with male index cases, and 41.2% among brothers while no case was observed among fathers and other relatives. Highly statistically significant association among those who were accompanied with the index cases, shared the same sleeping place and shared nail clippers (p=0.001) each. It can be concluded that the prevalence of HBV infection among household contacts was common in Yemen and higher than that reported among most general Yemeni population. The highest prevalence was found in age group 20-29 years, among household contacts who were in close contact with male index cases, those who were accompanied with the index cases, shared the same sleeping place and shared nail clippers. The most frequent relatives with HBV infection were brothers, while a negative prevalence was observed among fathers and other relatives.

Keywords: Intra-household, Hepatitis B virus, Transmission, Abyan.

الانتقال المنزلي لفيروس التهاب الكبد B بمديرية رصد- أبين- اليمن

علي ناصر محمد جبران[1*]، خالد عبدالكريم المؤيد [2]، احمد محمد الحداد[3]
[1] قسم العلو م الصحية، كلية الطب العلوم والعلوم الصحية، جامعة العلوم والتكنولوجيا، عدن، اليمن
[2]كلية الطب والعلوم الصحية، جامعة صنعا، صنعاء، اليمن
[3]كلية الطب والعلوم الصحية، جامعة حضرموت، المكلا، اليمن
[4]قسم تقنية المختبرات، المعهد العالي للعلوم والتقنيات الطبية، بني وليد، ليبيا

الملخص

الانتقال المنزلي لفيروس التهاب الكبد البائي يعتبر ظاهره، لذلك هدفت هذه الدراسة الى تحديد معدل انتشار خمج فيروس التهاب الكبد B بين المخالطون منزليا للشخص المصاب بمديرية رصد-ابين، وتحديد عوامل الاخطار الداخلية والخارجية التي تؤدي الى انتشار خمج الفيروس بين هؤلاء المخالطون. اجريت هذه الدراسة التحليلية ذات المقطع العرضي على حالات ايجابية لخمج فيروس التهاب الكبد B وكذلك المخالطين منزليا لهم، وتم جمع عينات الدم ثم تم فصل المصل واختباره للمستضد السطحي باستخدام طريقة مُقَايَسَةُ المُمْتَزّ المَناعِيّ المُرْتَبِطِ بالإنْزِيْم. اظهرت نتائج الدراسة ان معدل انتشار خمج فيروس التهاب الكبد B في مديرية رصد- ابين كان 10.7%. وكانت اعلى نسبة انتشار في الفئة العمرية 20-29 سنة حيث كانت هذه النتيجة ذات دلالة احصائية, 11,4% عند المخالطون لمصابين ذكور، وبين كانت بين الاخوة بالنسبة للأقارب بنسبة41.2% لم تظهر هذه الدراسة أي اصابة لدا الاباء والاقرباء الاخرون. بالنسبة لعوامل الاخطار داخل العائلة كان هناك اعلى النسب ذو دلالة احصائية عند المخالطين الذين يرافقون الشخص المصاب واولئك الذين يتشاركون في استخدام مقص الأظافر والذين يتشاركون اماكن النوم والذين يتشاركون ادوات (قيمة الاحتمال = 0.001) لكل منهم. يستنتج من هذه الدراسة أن انتشار فيروس التهاب الكبد B بين المخالطين منزليا للشخص المصاب شائع في اليمن وكانت النسبة اعلى من تلك التي وجدت بين معظم السكان بشكل عام، ونسبة الإصابة كانت عالية في الفئة العمرية 20-29 سنة. وان الاخوة هم الاكثر اصابة من بقية الاقارب وان الاصابة داخل العائلات تكون اعلى عندما يكون الشخص المصاب ذكر، ولم تظهر هذه الدراسة أي اصابة لدا الاباء والاقرباء الاخرون. كما ان النسبة كانت اعلى بين اولئك الذين يرافقون الشخص المصاب او يشاركون اماكن نومه وأدواته الشخصية

الكلمات المفتاحية: داخل الأسرة، فيروس التهاب الكبد الوبائي ب، انتقال المرض، أبين.

Introduction

Hepatitis B is a serious life-threatening liver infection by virus belonging to the Hepadnaviridae known as hepatitis B virus (HBV) (Van Damme et al., 2022). In contrast to other hepatitis viruses, HBV has DNA genome which is partially double strand. This genome is surrounded by icosahedral nucleocapsid and covered by glycolipid envelope (Levison et al., 2018). Hepatitis B is differed in severity which ranges from a mild illness, lasting a few weeks acute, to a serious long-term chronic illness that can lead to the development of liver carcinoma or failure of liver (You et al., 2014). It is heavy public health burden worldwide (Yen Dewa et al., 2023). Despite the presence of vaccination against virus, it estimated that one third of world peoples are exposed to virus, annually, one million and half new cases and two hundred and ninety-six million had chronic HBV infection (WHO, 2022). The major transmission route of HBV virus is contact with the blood or other body fluids of an infected person (Than et al., 2019). In addition to apart from parenteral, sexual and vertical transmission (Duarte et al., 2021), HBV may be transmitted through child to child or household personal contact (Alavian et al., 2007), but not casual contact, and spread of the infection has been reported through household contacts (Mansour-Ghanaei et al., 2013). HBV is found in most body fluids including; urine, saliva, nasopharyngeal fluids, semen and menstrual fluids, vaginal discharges, seminal fluid, colostrum and breast-milk, serous exudate and can be transmitted through contact with these fluids (Medforth et al., 2017). The presence of hepatitis B surface antigen has also been reported in faces and bile usually as a result of contamination with blood (Katamba & Philippe, 2021). Transmission of HBV within household contacts is considered a phenomenon which occurs commonly among family members who live with chronic HBV patients (Salkic et al., 2009). Distribution of HBV infection among family members is not associated with either genetic factors or implies sexual transmission (Katamba & Philippe, 2021). The mechanism of spreading of infection among those members remains unclear (Khan et al., 2023). The differences in cultural and religious aspects may interfere with transmission and prevalence HBV infection among household members (Mohammed et al., 2021). The intra-household prevalence and transmission of HBV infection have not been well defined in Yemen. Two studies conducted in Yemen among family members in Yemen (10.2% and 10.7%) **(**Al-Shahari, 2012 and Gubran et al., 2019**)** respectively. A better understanding of the prevalence and risk factors for HBV infection among household contacts are necessary to better strategies for the control of HBV infection. So, our study aimed firstly to determine the prevalence of HBV infection among household contacts with a member (index case) who was confirmed to have HBV infection, secondly to identify the intra and extra-household risk factors contributing for HBV infection in general and among household contacts.

Subjects and Methods

This an analytical cross-sectional study was conducted on previously known hepatitis B positive patients (index cases) and their household contacts in Rasd, Abyan -Yemen. Among the (index cases) who were recruited in this study, only 45 (index cases) with 45 household families (382) members were accepted for participation in the study. The data was collected questionnaires which contain questions as socio-demographic data, relation to index case and other questions about risk factors for HBV infection. Five ml of blood were collected in plane tube and

after clotting of blood the serum was separated and hepatitis B surface antigen (HBsAg) in both index cases and household contacts was determined by using enzyme-linked immunosorbent assay (ELISA) kit. Analysis of the data was performed by using SPSS (Version 20), where $P \leq 0.05$ was considered statistically significant.

Results

Out of the 382 household contacts that belong to the 45 index cases, the average was 8.5 (382/45) members from each family, a total median and interquartile range age of were 18 ±24 years. The minimum and maximum of the total age were 4 months and 80 years (table 1). In our study the overall prevalence of HBV infection was 41(10.7%). The highest prevalence was 25.3% recorded among age group 20–29 years, 13.1% males, 12.6% married, 11.3% those household who were in close contact with male HBV positive and 41.2% among brothers. highly statistically significant association between HBV infection and those who were accompanied with the index cases, those who shared the same sleeping place and those who shared nail clippers (p=0.001) each.

Discussion

The intra-household prevalence of HBV infection in our study was nearly similar to other studies conducted in Yemen (10.2%) (Al-Shahari, 2012), Brazil (10.1%) (Lobato et al., 2006), Iran (11%) (Alizadeh et al., 2005). In addition, the one of the highest prevalence at all was reported in Iran (61.5%) (Hsieh et al., 2017). The rates were also high in Iran 49.4% (Ranjbar et al., 2012), Turkey (38%) (Erol et al., 2003), India (30.6%) (Gupta *et al*, 2008), Egypt (29.3%) (Nemr et al., 2022), Brazil (24.3%) (Lobato *et al*, 2006), Iran (20-25%) (Ranjbar *et al*, 2012; Sofian et al., 2016), India (19.4%) (Chakravarty *et al,* 2005), yemen (19%) (**Gubran et al., 2019**), Greece (16%) Salkic et al., 2007), Indonesia (15.15%) (Kambuno et al., 2019) and in Bosnia and Herzegovina (12.1%) (Salkic et al., 2007). El-Sayed et al., was found lower prevalence (1.3%) (El-Sayed et al., 2010). In the present study, the prevalent rate among household contacts was lower than that reported among the general population in Yemen, (48.83%) and (42.67%) (Al-Hegami *et al*, 2015' El-Morsy et al., 2022) and among hemodialysis patients (12%) (Bahaj, 2005). (12.6%) (Rashed *et al*, 2005), but it was higher than that recorded among healthy blood donors in Yemen in general which ranged from 5.1- 7.1% (Al-Waleedi and Khader, 2012) and 8.9% among hemodialysis patients (Amran et al., 2019),

Table 1: The age and sex distribution of household contacts in Rousd-Abyan.

[1]	[3] **Male**		[4] **Female**		[5] **Total**	
[2] **Age groups/years**	[6] **No.**	[7] **%**	[8] **No.**	[9] %	[10] **No.**	[11] %
[12] **< 10**	[13] 72	[14] 40.9	[15] 43	[16] 20.9	[17] 115	[18] 30.1
[19] **10 – 19**	[20] 40	[21] 22.7	[22] 40	[23] 19.4	[24] 80	[25] 20.9
[26] **20 – 29**	[27] 30	[28] 17	[29] 49	[30] 23.8	[31] 79	[32] 20.7
[33] **30 – 39**	[34] 16	[35] 9.1	[36] 32	[37] 15.5	[38] 48	[39] 12.6
[40] **≥ 40**	[41] 18	[42] 10.2	[43] 42	[44] 20.4	[45] 60	[46] 15.7
[47] **Total**	[48] **176**	[49] **46.1**	[50] **206**	[51] **53.9**	[52] **382**	[53] **100**
[54] **Median/years**	[55] 13.5		[56] 24		[57] 18	
[58] **Range/years**	[59] 79.7		[60] 76.5		[61] 79.7	
[62] **Min/months**	[63] 4		[64] 6		[65] 4	
[66] **Max/years**	[67] 80		[68] 77		[69] 80	

A study performed in Iran was in agreement to our results in which the highest prevalence was observed in the age group 21-30 (Hatami et al., 2013). Some studies as in Turkey was noted that the highest prevalence in the age groups 41-50 and 51-60 years respectively (Ucmak *et al*, 2007), age group 40-49 years and age group 30-39 years in Iran and yemen (Zali *et al*, 2005; Nokhodiyan *et al*, 2009; Katoonizadeh et al., 2018; Gubran et al., 2019), age groups 30-40 years in Yemen (Al-Shahari, 2012), age groups 31-40 years in Pakistan (Khan et al., 2023), age groups less than 15 years in India (Gupta, 2008) and age groups less than10years in Bosnia and Herzegovina (Salkic *et al*, 2007).

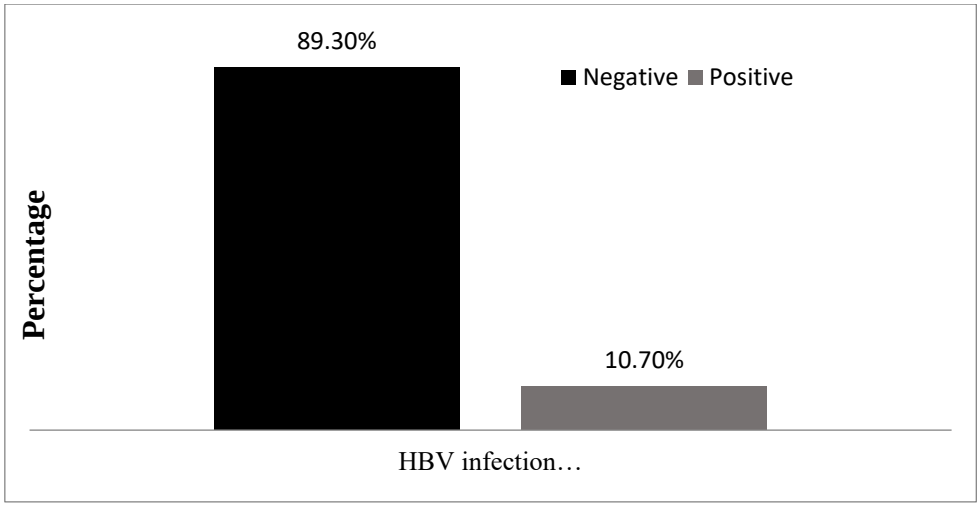

Figure 1: The prevalence of HBV infection among household in Rasd-Abyan-Yemen.

Table 2: The prevalence of HBV infection among household contacts according to their age and sex in Rasd-Abyan-Yemen

Age groups/ years	HBV + ve		OR	CI	*p*
	No.	%			
< 10 (n=115)	7	6.1	0.44	0.19-1.0	0.054
10–19 (n=80)	2	2.5	0.17	0.04-0.73	0.007
20–29 (n=79)	20	25.3	4.6	2.3 – 8.9	0.001
30–39 (n=48)	8	16.7	1.8	0.79 – 4.2	0.156
≥ 40 (n=60)	4	6.7	0.55	0.18 – 1.6	0.268
Sex					
Male (n=176)	23	13.1	1.6	0.82-3.0	0.173
Female (n=206)	18	8.7	0.63	0.33-1.2	
Marital status					
Married (n=127)	16	12.6	1.3	0.68-2.6	0.406
Unmarried (n=255)	25	9.8	0.75	0.39-1.5	

$p \leq 0.05$ (significant), OR> 1 at risk

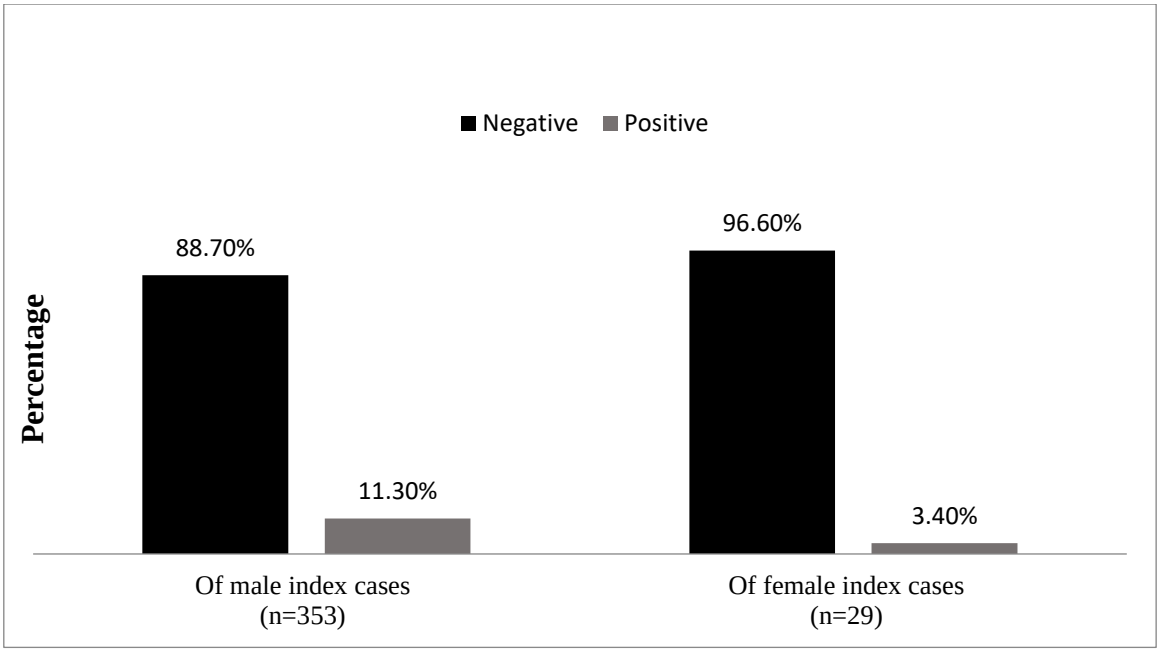

Figure 2: The prevalence of HBV infection among household contacts according to their relations to the sex of index cases in Rasd-Abyan-Yemen.

***Of male index cases** are those household who were in close contact with male HBV positive.
****Of male index cases** are those household who were in close contact with female HBV positive.

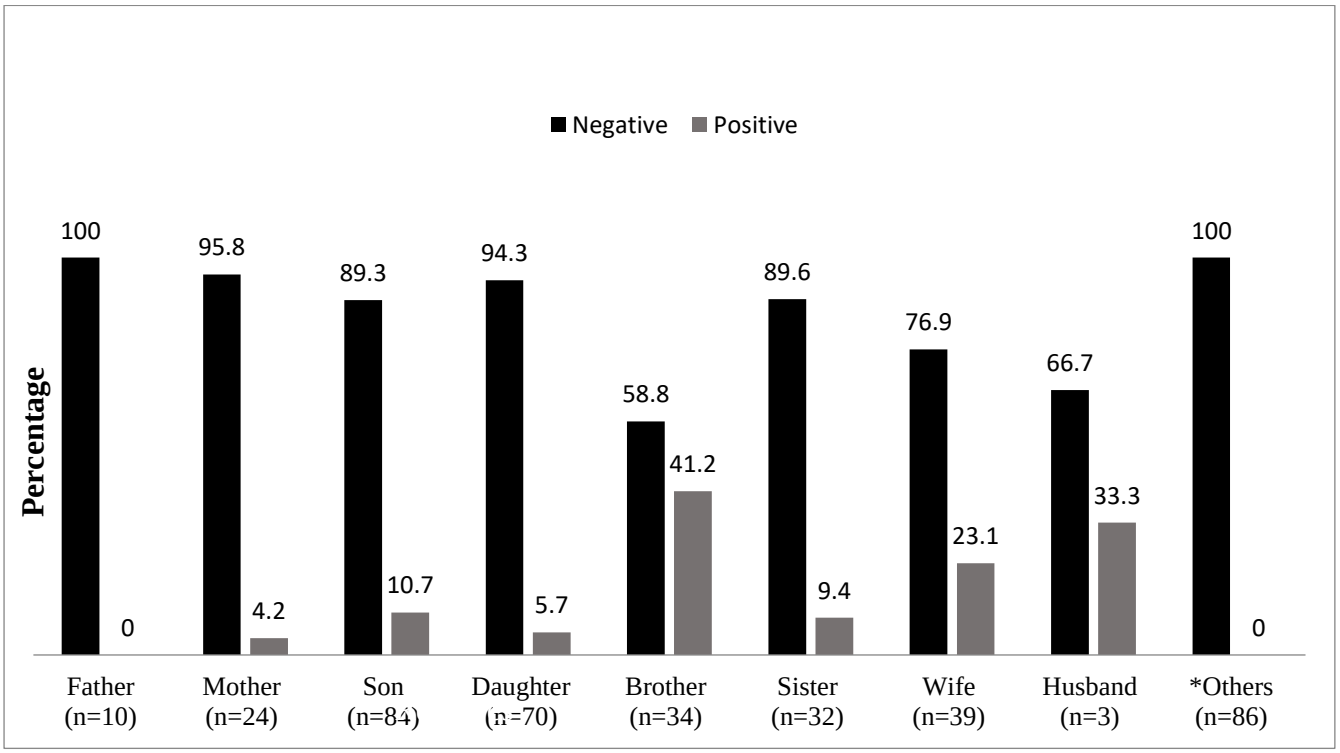

Figure 3: Clustering of HBV infection among household contacts according to their relation to the index case in Rasd, Abyan-Yemen.

***Others** are other relative who include grandfathers, grandmothers, nephew, niece, sister-in-law, daughter in law, grandson and granddaughter.

This variation in results from study to another might be explained by the higher frequency of HBV infection among index case in the age group 30-40 years and due to the differences in the life style of household contacts. The present result was in agreement with that reported higher prevalence of HBV infection among male household contacts rather than female contacts (Al-Shahari, 2012; Hsieh et al., 2017; Gubran et al., 2019; Siddique et al., 2021; Nemr et al., 2022). Other studies were found that highest rate among females (Salkic *et al*, 2007; Khan et al., 2023). Hsieh et al.were found similar result highest prevalence was found among household contacts who were in close contact with male index cases (Hsieh et al., 2017) but disagreed with that conducted in Bosnia and Herzegovina, Egypt and Yemen (Salkic *et al*, 2007; El-Sayed et al., 2010; Gubran et al., 2019). These differences might be attributed to that the number of female index cases were low.

Table 3: The intra-household risk factors contracting for HBV infections among household contacts in Rasd, Abyan-Yemen

Risk factors	**HBV +ve**		**OR**	**CI**	***p***
	No.	**%**			
Shared shaving tools (n=32)	8	25.0	3.2	1.3 – 7.7	0.006
Shared toothbrush (n=15)	4	26.7	3.2	0.98 – 10.7	0.042
Shared spoon and eating utensil (n =269)	32	11.9	1.6	0.72 – 3.4	0.257
Exposed to needles stick (n=7)	1	14.3	1.4	0.16-11.9	0.759
Exposed to biting of index case (n=18)	3	16.7	1.7	0.50-6.2	0.405
Sharing of nail clippers (n=191)	34	17.8	5.7	2.5 -13.2	0.001
Sharing of towels (n=83)	12	14.5	1.6	0.77-3.2	0.215
Shared the same sleeping places (n=131)	32	24.4	8.7	4.0 -18.9	0.001
Accompany with index cases (n=66)	23	34.8	8.9	4.4-17.7	0.001

$p \leq 0.05$ (significant), OR> 1 at risk

This present result demonstrated that brothers had the highest prevalence of HBV infection rather than other household members (Figure 3). Other study undertaken in Iran, in which the highest prevalence was also found among brothers (Hatami *et al*, 2013). Other data reported that offspring (Sali et al., 2019), parents (Kambuno et al., 2019), wives (Alizadeh *et al*, 2005), fathers (El-Sayed et al., 2010; Gubran et al., 2019), mothers (Sofian et al., 2016), and spouse (Khan et al., 2023) had highest rates. There was no positive HBV cases observed among fathers and other relatives in present study which was in agreement with a study done in Bosnia and Herzegovina (Salkic et al, 2007). Lobato et al., reported zero cases among fathers and Sibling (Lobato et al., 2006) while Gubran et al., report highest rate among fathers (Gubran et al., 2019**).** This may be attributed to that the adult brothers may be shared the shaving tools and the brothers are also the breadwinners of the house and always travel or work together in- and/or out-doors.

Regarding intra-household risk factors, current results showed highly statistically significant association between HBV infection and those who were accompanied with the index cases, those who shared the same sleeping place and those who shared nail clippers (p=0.001) each. A study conducts in Egypt showed significant association among those who were accompanied with the index cases (p=0.035). Gubran et al., reported highes rate among those who were accompanied with the index cases (Gubran et al.,2019). On other hand the extra-household risk factors contracting for HBV infections showed that a borderline statistical significance among those who were exposed to dental procedures ($p = 0.006$). This statistical result disagreed with that reported in Brazil (Lobato et al., 2006).

Only 4.4% of the HBV positive household contacts with previous HBV vaccination. A study by Siddique et al. was found that 28.8% had vaccinated against HBV. (Siddique et al., 2021). A study carries out in Egypt showed

that prevalent rate among vaccinated family members was (32.9%) (Nemr et al., 2022). A study conducted by Gubran et al showed that zero case among previous HBV vaccination (Gubran et al.,2019).

Table 4: The extra-household risk factors contracting for HBV infections and vaccination status among among household contacts in Rasd, Abyan-Yemen

Risk factors	HBV +ve		OR	CI	*p*
	No.	%			
Surgical operation (n=40)	6	15	1.5	0.60-3.9	0.357
Blood transfusion (n=28)	4	14.3	1.4	0.47-4.3	0.528
Cupping (n=14)	0	0	-	-	-
Acupuncture (n=4)	0	0	-	-	-
Dental procedures (n=183)	28	15.3	2.6	1.3-5.2	0.006
Tattooing (n=23)	1	4.3	0.36	0.05-2.8	0.307
Shared of ear pricing tools (n=15)	1	6.7	0.58	0.07-4.6	0.768
Vaccination status					
Vaccinated (n= 91)	4	4.4	0.32	0.11-0.91	0.025

$p \leq 0.05$ (significant), OR> 1 at risk

Conclusions

From this study we can concluded that the prevalence of HBV infection among household contacts this study was common in Yemen and higher than that reported among general Yemeni population. The highest prevalence was found in age group 20-29 years, among household contacts who were in close contact with male index cases, those who were accompanied with the index cases, shared the same sleeping place and shared nail clippers. The most frequent relatives with HBV infection were brothers, while a negative prevalence was observed among fathers and other relatives.

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