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Hepatitis B Prevalence and Associated Factors among Hairdressers at Khartoum State, Sudan, 2021

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Abstract **Original Research Article**

This is a cross-sectional descriptive study carried in Khartoum state, Sudan from 2015-2021 among hairdresser. Field work to measure the prevalence rate of hepatitis B and know the risk factors related with this prevalence was done from September 2019 to January 2020. A sample of 274 hairdressers in 31 administrative units within the seven localities in Khartoum state were enrolled randomly in the study using cluster sample and proportionate probability procedure [1, 2]. Verbal data were collected by a structured questionnaire and check list, and four ml of preferable blood was taken from each participant (after interviewing him/her) for laboratory analysis to look for HbsAg. Verbal data (questionnaire) were analyzed by SPSS software version 25 and blood specimens were analyzed by ELISA-test using murex ABsAg commercial kits which are used to detect HBsAg in human serum or plasma [1-5]. Important factors related with hepatitis B prevalence were; marital status, educational level, nature and duration of work, number of clients per day, exposure to wounds at work or at health facility, sharing syringes or reusing razors/sharps, not wearing gloves and not sterilizing the shaving machine after serving clients. Important conclusions were; hepatitis B prevalence was not associated with marital status, education, direct touching of shaving sites and not using gloves and reusing of instruments without sterilizing them, negligence in the importance of personal protection equipment (PPE) and vaccination coupled with rare supervision by health authority, and lack of infection control in work place. Important recommendations were; health education and training for all hairdressers (including road side barbers) on blood diseases and the importance of periodic examination, intensive supervision by health authorities to barbers shops and a manual on health instructions and safety to be distributed to them, provision of vaccine for this risky group with suitable cost and expanding studies on blood diseases to the rest of hairdressers not only in Khartoum state, but in other states.

Keywords: Hepatitis B, Prevalence, Associated Factors, Hairdressers, Khartoum State. Sudan.

INTRODUCTION

Blood-borne viruses, HIV, HBV and HCV infect millions of people worldwide and their continuous spread depends on unsafe use of therapeutic injections, blood transfusions, mother to child transmission, unsafe sexual practices and beauty treatments (tattooing, piercing, manicure, pedicure and shaving) with instruments not properly sterilized [6, 7]. Therefore, rigorous sterilization procedures are essential to avoid any contamination with blood-borne viruses, particularly by beauty instruments, because HBV is not easily inactivated by drying, simple detergents or alcohol [8]. In the last few decades, hairdressing has increased in worldwide popularity [9].

Razor sharing and shaves by the barbers were identified as important risks for blood-borne viruses spread in several investigations carried out in the world. The shaving practice in a shop or on a roadside is widely increasing, but is not estimated as route for blood borne viral diseases [10]. In Ethiopia, shaving at a barber shop was an identified risk factor positively associated with HIV-1 sero-positivity [11], and in Egypt a study on HCV sero-prevalence has shown that shaving at community barbers was a characteristic exposure for the viral transmission [12]. Also daily facial shave has been identified as a risk factor for HCV in Pakistan [13]. Exposure to HBV, HCV and HIV during beauty procedures, including the role of hairdressers, is a risk reported also in industrialized

countries. In Italy, the National Epidemiological Surveillance System has shown an association between acute HBV infection and barber shop shaving, Hepatitis B is an un-curable communicable disease, especially in Africa but can be prevented. Vaccination against hepatitis B in Sudan was just introduced in 2005 for <one year children in the routine immunization program [12, 13], no formal adult vaccination program and hairdressers is a risky and neglected group, and there was no study on the prevalence of hepatitis B among hairdressers in Sudan, so this study was carried to determine the prevalence of hepatitis B among hairdressers. Sudan is classified among countries with high HBsAg, endemicity is > 8%. A study by Hatim Mudawi and others in Khartoum state in 2008 found good knowledge of Barbers towards HIV infection but poor knowledge on HBV, no proper cleaning, sterilization and disposal of equipment, and barbers use contaminated razors blades [14]. Another study by Tajeldin M. Abdallah1, Mamoon H. Mohamed and Abdel Alziem A. Ali in Kassala Teaching Hospital in 2011found; HBV sero-prevalence of 8.2% among healthy visitors [15].

MATERIALS AND METHODS

Study design

The study was descriptive cross-sectional community-based study.

Study Site

Khartoum State (area of 28,000 km2 and 5.352 million populations) is located in the middle of Sudan, at the junction of the White Nile and Blue Nile rivers between 15º 10´and16º 30´N latitude and 31º35´ and 40º 20´E longitudes. It is the capital, political, and commercial centre of the country. There is semi-desert climate including 3 seasons; dry season from March to June with temperature 38ºC to 45ºC and a relative humidity of 20-40%, rainy season; from July to October with annual rainfall about 150 mm in July to 200 mm in August and temperature range of 28º-35ºC and relative humidity of 40-60%, and winter season from November to February with average temperatures of 25ºC to 16ºC and relative humidity of 30-40%.

Administratively, the state is divided into seven localities (Khartoum, Omdurman, Bahri or Khartoum North, Ombada, Karary, Sharg Elneel and Jabal Awlia) which include 101 administrative units. There are 14 administrative units in Khartoum Locality, 13 in Omdurman, 16 in Bahri, 12 in karary, 19 in Ombada, 13 in Sharg Elneel and 14 in Jebel Awlia.

Sample size

For this population, the following formula was used according to W.G, Cochran [1], and Lwaga SK and Lemeshow S [2] as per cluster sample:

$$\mathbf{n} = \frac{\mathbf{Nz^2\,pq}}{\mathbf{d^2(N-1)+z^2\,pq}}\mathbf{df}$$, where:

n; the desired sample size, **N**; number of target population (4176 hairdressers in Khartoum state in December 2018, i,e., last year just before data collection).
Z; standard normal deviate (set at 1.96) which corresponds to the significant level 95-96%
P; prevalence of hepatitis B among hair dressers according to a prior study/survey at Khartoum state or other state/area in Sudan
q; 1-p.
df; design factor equal to 1.5
d; error allowed = 0.05.

Taking p=0.13 (prevalence of HB according to Mohamed Hassan study in Nyala, 2011[16] and e =0.05 (allowed error).

$$n = \frac{4176\,(1.96)^2 x\ 0.13x\ 0.87x1.5}{(0.05)^2(4176-1)+(1.96)^2 x\ 0.13x\ 0.87} = 250.33 \sim 250$$

Note

For the benefits of the target population and health authorities at localities, and to use the remaining amount of the three ELIZA kits bought for laboratory work (for the 250 persons), we decided to extend participation as the kit covers 91 to 92 blood samples, so 274 hairdressers were enrolled proportionally

Sample-collection

After interviewing the selected participants, 4 ml of Venus blood were drawn from them by well-trained health workers and transported in a temp of +8 to the lab where the serum is separated and stored at -20 c for further analysis by ELISA technique. Safety measures like wearing new gloves and saving blood samples in uncontaminated place was strongly considered. First aid kits were also provided for sensitive people [3-5].

Sampling procedure/technique

The sample is multi-stage cluster random sample. The steps of sampling were; first, five administrative units were selected randomly from each of the seven localities in Khartoum state to represent the study site but 31 administrative units were actually enrolled in the study instead of 35 (using PPS; probability proportional size method). Second, the distribution of the sample among both localities and men and women beauty shops was proportional according to their weights. Third, as the total number of population was 4176 dressers, including 2754 males and 1422 females, and if we divide the pop by the sample size we get an interval of 16.7 and hence 2754/16.7 gives 165 barbers' shops and 1422/16.7 gives 85 coiffeurs targeted in the study respectively. Fourth, the minimum number of hairdressers in any recruited shop was two so that one dresser would be chosen randomly. In case of highly populated shops, 50% of the dressers would maximally choose. The first shop to start with between 1 and 16 (the sample interval) was to

be chosen randomly. Then a lottery was made to select the second and other shops from the list of the shops in the administrative units [1].

DATA-ANALYSIS

Verbal data (questionnaire) were stored in Microsoft Excel and analyzed using SPSS version 25 software. Descriptive analysis was performed and the results expressed as numbers and percentages. Multivariable logistic regression was used to determine the likelihood of HBV infection. Probability less than 0.05 was considered statistically significant. Blood specimens were analyzed by the following steps: [3-5].

STEP1	Preparation: Mark three wells as Negative control (e.g. B1, C1, D1), two wells as Positive control (e.g. E1, F1) and one Blank (e.g. A1, neither samples nor HRPConjugate should be added into the Blank well). If the results will be determined by using dual wavelength plate reader, the requirement for use of Blank well could be omitted. Use only number of strips required for the test.
STEP2	Adding Diluents: Add 20µl of Specimen Diluent into each well except the Blank
STEP3	Adding Sample: Add 100µl of Positive control, Negative control, and Specimen into their respective wells except the Blank. Note: Use a separate disposal pipette tip for each specimen, Negative Control, Positive Control to avoid cross contamination. Mix by tapping the plate gently
STEP4	Incubating: Cover the plate with the plate cover and incubate for 60 minutes at 37°C.
STEP5	Adding HRP-Conjugate: At the end of the incubation, remove and discard the plate cover. Add 50µl HRPConjugate into each well except the Blank, and mix by tapping the plate gently.
STEP6	Incubating: Cover the plate with the plate cover and incubate for 30 minutes at 37°C.
STEP7	Washing: At the end of the incubation, remove and discard the plate cover. Wash each well 5 times with diluted Washing buffer. Each time allow the microwells to soak for 30-60 seconds. After the final washing cycle, turn down the plate onto blotting paper or clean towel and tap it to remove any remainders
STEP8	Coloring: Add 50µl of Chromogen A and 50µl Chromogen B solutions into each well including the Blank. Incubate the plate at 37°C for 30 minutes avoiding light. The enzymatic reaction between the Chromogen solutions and the HRP-Conjugate produces blue color in Positive control and HBsAg positive sample wells.
STEP9	Stopping Reaction: Using a multichannel pipette or manually, add 50µl Stop solution into each well and mix gently. Intensive yellow color develops in Positive control and HBsAg positive sample wells.
STEP10	Measuring the Absorbance: Calibrate the plate reader with the Blank well and read the absorbance at 450nm. If a dual filter instrument is used, set the reference wavelength at 630nm. Calculate the Cut-off value and evaluate the results. (Note: read the absorbance within 10 minutes after stopping the reaction).

Ethicalconsiderations

The basic principles that the study considered included; the study proposal was approved by Alazhari University Research Committee and by the ministry of health-Khartoum state that gave a license to conduct the research. The purpose of the research, the procedures to be carried out was clarified before handing the study and health authorities were informed on all the steps and results. Participation in the study was completely voluntary after a formal consent. Privacy of participants was protected by ensuring confidentiality and the participants were informed on the results through their respective localities/administrative units.

RESULTS

Table 1 shows the distribution of hepatitis B cases by gender, administrative units and localities. There is no relation between hepatitis B prevalence and educational level of hairdressers (table 2). Table 3 shows very week relation (P =0.06) compared with the interested cut-off probability (0.05) between hepatitis B prevalence and marital status. Table 4 results show no association between hepatitis B prevalence and working period in hairdressing. Also table 5 reveals no relation between hepatitis B prevalence and umber of served customer/ clients per day. The general knowledge on hepatitis B hadn't affected its prevalence (tables 6). Hepatitis B prevalence was not attributed to exposure to wound at work place or at health setting (table 7 and 8). Sharing syringes and reusing razors has no relation with hepatitis B prevalence (tables 9 and 10). Also hepatitis B prevalence was not associated with not wearing gloves or wearing used gloves (table 11 and 12). Tables 13 and 15 show no relation between hepatitis B prevalence and not sterilizing razor blades and shaving machines. Also hepatitis B prevalence was not associated with continuous direct touching of shaving sites by hairdressers (table 14).

Table-1: Distribution of hepatitis B cases by localities, admin units and gender

Locality	Administrative Unit	Infected Males	Infected females
Jabl Awlia	Alazhari East	1	2
	Aljabal Shamal	1	0
	Aljabal Janoub	1	0
Omdurman	Abu Sied Shamal	2	0
Ombada	Sooq Abu zeid	4	0
Bahri	Shambat	1	1
Sharq Alneel	Algarbia	1	1
	Algreefat Wa Omdom	1	1
Total	7 Admin units	12	5

Table-2: Relation between education level and HB prevalence (n= 274)

Education Level	Number Examined	Positive	Negative	Chi-Square(χ2)	P value
Illitrate	15	0 (0%)	15 (100%)	9.046	0.06
Quoranic school	7	2(28.6%)	5(71.4%)		
Basic school	58	2(3.4%)	56(96.6%)		
Secondary school	102	5(4.9%)	97(95.1%)		
University	92	8(8.7%)	84(91.3%)		
Total	274	17(6.2%)	257(93.8%)		

Table-3: Relation between marital status and HB prevalence (n= 274)

Marital status	Number Examined	Positive	Negative	Chi-Square(χ2)	P value
Single	138	7 (5.1%)	131 (94.9%)	2.062	0.560
Married	122	10 (8.2%)	112 (91.8%)		
Divorced	11	0 (0%)	11 (100%)		
Widowed	3	0 (0%)	3 (100%)		
Total	274	17 (6.2%)	257 (93.8%)		

The results found no association between marital status and HB infection.

Table-4: Relation between working period and HB prevalence (n= 274)

Working period	Number Examined	Positive	Negative	Chi-Square(χ2)	P value
Less than one year	39	2 (5.1%)	37(93.3%)	2.040	0.728
One year	12	0 (0%)	12 (100%)		
Two year	25	1 (4%)	24 (96%)		
Three years	17	2 (11.8%)	15 (88.2%)		
More than three years	181	12 (6.6%)	169 (93.4%)		
Total	274	17(6.2%)	(93.8%)		

Table-5: Relation between number of clients/day & HB prevalence (n= 274)

Daily average number of clients	Number Examined	Positive	Negative	Chi-Square(χ2)	P value
Less than 5	65	6 (9.2%)	59(90.8%)	7.050	0.133
5-10	197	9 (4.6%)	188 (95.4%)		
11-15	8	2 (25%)	6 (75%)		
16-20	3	0 (0%)	3 (100%)		
More than 20	1	0 (0%)	1 (100%)		
Total	274	17 (6.2%)	257 (93.8%)		

Table-6: Relation between HB prevalence and general knowledge on HB (n= 274)

Do you Know hepatitis B	Number Examined	Positive	Negative	Chi-Square(χ2)	P value
Yes	47	1(2.1%)	46 (97.8%)	1.620	0.203
No	227	16 (7%)	211(93%)		
Total	274	17(6.2%)	257(93.8%)		

Table-7: Relation between HB prevalence and exposure to wound while working recently (n=274)

Wounded while shaving recently	Number Examined	Positive	Negative	Chi-Square(χ2)	P value
Yes	13	0 (0%)	13 (100%)	2.496	0.287
No	256	16 (6.3%)	240 (93.7%)		
Don't remember	5	1 (20%)	4 (80%)		
Total	274	17 (6.2%)	257 (93.8%)		

Table-8: Relation between HB prevalence and exposure to wound or blood in a health setting (n=274)

Exposed to wound or blood in health setting	Number Examined	Positive	Negative	Chi-Square(χ2)	P value
Yes	23	2 (8.7%)	21 (91.3%)	0.329	0.848
No	250	15 (6%)	235 (94%)		
Don't remember	1	0 (0%)	1 (100%)		
Total	274	17 (6.2%)	257 (93.8%)		

Table-9: Relation between HB prevalence and sharing of syringes for giving/taking drugs recently (n=274)

Shared syringes for drugs recently	Number Examined	Positive	Negative	Chi-Square(χ2)	P value
Yes	2	0(0%)	2 (100%)	0.133	0. 715
No	272	17 (6%)	255 (94%)		
Total	274	17(6.2%)	257(93.8%)		

Table-10: Relation between HB prevalence and reusing razors (n=274)

Reused razors for shaving/finger cutting	Number Examined	Positive	Negative	Chi-Square(χ2)	P value
Yes	2	0(0%)	2 (100%)	0.133	0.715
No	272	17 (6%)	255 (94%)		
Total	274	17(6.2%)	257(93.8%)		

Table-11: Relation between HB prevalence and not-wearing gloves (n=274)

Wearing gloves while working	Number Examined	Positive	Negative	Chi-Square(χ2)	P value
Yes	69	5 (7%)	64 (93%)	0.172	0. 678
No	205	12 (5.9%)	193 (94.1%)		
Total	274	17(6.2%)	257(93.8%)		

Table-12: Relation between HB prevalence and wearing of used gloves for new clients/customers (n=274)

Wear new gloves for new client	Number Examined	Positive	Negative	Chi-Square(χ2)	P value
Yes	79	4 (5%)	75 (95%)	0.248	0 .618
No	195	13 (6.7%)	182 (93.3%)		
Total	274	17(6.2%)	257(93.8%)		

Table-13: Relation between HB prevalence and not keeping the razor blade in an antiseptic (n=274)

Keep razor blade in an antiseptic	Number Examined	Positive	Negative	Chi-Square(χ2)	P value
Yes	76	2 (2.6%)	74 (97.4%)	2.307	0 .129
No	198	15 (7.6%)	183 (92.4%)		
Total	274	17(6.2%)	257(93.8%)		

Table-14: Relation between HB prevalence and touching the shaving site without wearing gloves (n=274)

Use new razors for new clients	Number Examined	Positive	Negative	Chi-Square(χ2)	P value
Yes	61	6 (9.8%)	55 (90.2%)	1.778	0.182
No	213	11 (5.2%)	202 (94.8%)		
Total	274	17(6.2%)	257(93.8%)		

Table-15: Relation between HB prevalence and not sterilizing the shaving machine after serving clients (n=274)

Use new razors for new clients	Number Examined	Positive	Negative	Chi-Square(χ2)	P value
Yes	240	15 (9.8%)	225 (90.2%)	0.007	0.934
No	34	2 (5.2%)	32 (94.8%)		
Total	274	17(6.2%)	257(93.8%)		

DISCUSSION

The prevalence of hepatitis B among hairdressers in this study was 6.2% which is equal to hepatitis B prevalence among adults in the WHO western pacific and the African regions, 6.2 and 6.1 respectively, but higher than that on the general population in the WHO Easter Mediterranean region, in the WHO south-east Asia region and in the WHO European region, 3.3%, 2.0% and 1.6% respectively [17, 18]. It is also higher than prevalence among adults in; North America, Middle East and Indian subcontinent; 1%, 5% respectively, and higher than the internationally targeted; 4-5% [17, 19]. But this prevalence is less than previous prevalence on adults in Sudan (8%) and in sub-Saharan Africa, south-east Asia and among barbers in Ethiopia, Pakistan and Bangladesh; 34-49% [20].

Hepatitis B infection was not related with the educational level of the participants (table 2) and this result disagree with a study on awareness on HBV and hepatitis B infection among hairdressers and teachers in Ibadan, Nigeria [21] where infection was greater among hairdressers (13%) than among teachers (4.8%). Awareness of hairdressers & barbers on blood borne diseases rely on their educational level [21].

The study findings found no relation between marital status and infection by hepatitis B (table 3), although married hairdressers were more infected than single ones and this is a dangerous result as infected individuals may blindly and silently infect their families and hence all healthy ones should seek prevention as prompt as possible. In addition, infected mothers can transfer the disease to their new-bornes, especially where there is no or inadequate vaccination program starting immediately after birth and complete 3 doses are in-accessible or the mothers deliver at home and do not go for vaccination.

Also our results found no association between longevity of work and infection by hepatitis B (table 4), although the literature stated risks on the repeated use of implements on many customers (can come at any time) into contact with customer's blood [21]. If that customer is infected, the residue from a tiny bit of blood will contaminate the equipment/instruments. Moreover, table 5 revealed no association between the number of served clients per day and the risk of infecting hairdressers, and this may be due to the few number of barbered clients as most of the hair-dressers serve between 5-10 customers per day.

Table 6 results found no association between hepatitis B awareness and its spread which agrees with a study in Kangavar, Iran among female barbers that; in spite of positive attitude towards personal hygiene, work place and tools, but hepatitis B was prevalent among this group. It was seen that the existing attitude was not converted to performance [23]. Moreover, 4.4 million of Americans were once caught by chronic hepatitis, but most of them do not know they are infected.

No relation found between hepatitis B cases among the participant hairdressers and their exposure to wound or blood (at work or in health facilities) (tables 7 and 8), and also the hepatitis cases were not related with sharing syringe for treatment or reusing razors shaving or cutting fingers (tables 9 and 10). The few infected hairdressers might be caught since child hood as the literature said; 80-90% of infected infants develop chronic infections and also 30-50% of children infected before the age of 6 years develop chronic HB infection. While less than 5% of healthy persons infected as adults will develop chronic infections [24].

In this study, hepatitis B prevalence among hairdressers was not attributed to the following practices; sharing syringes for taking drugs, not keeping the razor blades in an antiseptic, using old (not brand new) razors, touching the shaving site without wearing gloves and not sterilizing the shaving machine after serving clients (tables; 11, 12, 13, 14, 15). These results looks strange and such practices are connected with disinfection/sterilization and infection control. In addition to, lack of implementation of safety guide lines at work place can expose workers to health risks, and salon technicians/workers who don't strictly follow infection control guides are in a prime position to spread viral hepatitis. Also low literacy and increased frequency of direct contact and blade/razors use can expose barbers and their clients to blood and body fluids and thus if you want to protect yourself and others from hepatitis, make sure the salon you visit is aware of and implements a strict infection control policy [25]. Reports from many countries showed that HBV can be transferred by blade sharing and barber-related instruments [26, 27, 28, 29]. Today, the use of single-use materials is becoming widespread in modern salons, so different/new tools should be used for each customer [30]. In a study by Boztaş *et al*., most of the participant hairdressers stated that their tools had risk of infection. Tools, such as razor blades, razors and depilation needle tips which can be risky regarding

blood-borne infections, should be disposed of in medical waste containers in order to prevent contamination [31].

The important conclusions were; hepatitis B prevalence was not associated with education, marital status, ill-practices like direct touching of shaving sites, inadequate sterilizing and reusing of razors because of no infection control procedures due to in-adequate supervision by health authorities.

Important recommendations were; health education and training for all hairdressers (including road side barbers) on blood diseases, intensive supervision by health authorities to barbers shops, distribution of a manual on health instructions and safety, provision of vaccine with suitable cost and expanding studies on blood diseases to the rest of hairdressers in Khartoum state and other states.

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