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PREVALENCE OF HEPATITIS B VIRUS INFECTION AMONG BARBERS AND BUTCHERS

Sura Mustafa Qasim * and Qasim SM.

Department Basic Sciences, College of Dentistry, Tikrit University, Salah Al-Din, Iraq
* Corresponding Author; Email: sura.m.qasim@tu.edu.iq.

ORCID Details
Sura Mustafa Qasim: https://orcid.org/0009-0006-9069-705X

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ABSTRACT

Background: Barbers and butchers handle sharp instruments that are frequently contaminated with blood, placing them at increased occupational risk of hepatitis B virus (HBV) infection. This study estimated the prevalence of hepatitis B surface antigen (HBsAg) among barbers and butchers in Salah Al-Din Governorate, Iraq, compared with unexposed controls, and described the demographic and occupational characteristics of HBsAg-positive workers.

Methods: A cross-sectional study was conducted from January to June 2025 and enrolled 900 participants aged 20–70 years: 300 barbers, 300 butchers, and 300 healthy male controls. Serum HBsAg was detected by ELISA; reactive samples were retested for confirmation. Groups were compared using the chi-square or Fisher's exact test, $P < 0.05$ was considered significant.

Results: HBsAg was detected in barbers (11.3%) and butchers (9.3%) but in none of the controls (0%), a difference that was highly significant. Prevalence did not differ significantly between barbers and butchers .Among barbers, positivity was associated with age, whereas no age association was found among butchers. About three-fifths of positive workers in both groups were asymptomatic. Work-related cuts were reported by 52.9% of positive barbers ($P < 0.001$).

Conclusion: Barbers and butchers carry a burden of HBV infection six to seven times that of the general population, attributable to frequent occupational cuts and to instrument-cleaning practices that do not inactivate the virus; most infections are clinically silent. These occupational groups should be prioritized for HBV vaccination, periodic serological screening.

Keywords: Hepatitis B Virus; Hbsag; Prevalence; Occupational Exposure; Barbers; Butchers; ELISA; Iraq.

1 INTRODUCTION

Hepatitis B virus (HBV) is an enveloped, partially double-stranded DNA virus of the family *Hepadnaviridae*. Its compact genome of approximately 3.2 kb contains four overlapping open reading frames encoding the surface (S), core (C),

polymerase (P) and X proteins. Replication proceeds through an RNA intermediate by reverse transcription, which contributes to the considerable genetic diversity of the virus; ten genotypes (A–J) are recognized, and genotype D predominates in the Middle East, including Iraq [1–3]. Hepatitis B surface antigen (HBsAg) is the first serological marker to appear after infection, and its persistence for more than six months defines chronic infection.

HBV is of particular concern in occupations that involve repeated contact with blood and sharp instruments. The virus is highly transmissible, has a very low infectious dose, and remains infectious on environmental surfaces for at least seven days, so contaminated razors, blades, scissors and knives can act as vehicles of transmission [4, 5].

Globally, an estimated 254 million people were living with chronic HBV infection in 2022, and the infection causes about 1.1 million deaths each year, mainly from cirrhosis and hepatocellular carcinoma; despite an effective vaccine, most infected individuals remain undiagnosed and untreated [5]. Iraq is classified as a country of low-to-intermediate endemicity, with a national HBsAg prevalence of approximately 1.6% [2]; nevertheless, higher rates have been reported among blood donors and in specific regions and population subgroups, indicating that the burden is unevenly distributed [6–8].

Barbers and butchers may face a higher occupational risk of HBV infection because their work routinely involves exposure to blood and the use of sharp instruments. Reported HBsAg prevalence among barbers varies widely between countries, from about 2% in India and Turkey to more than 14% in Ghana, Cameroon and China [4, 9–12, 21–24], whereas studies of butchers and slaughterhouse workers have generally reported lower but still appreciable rates [16–19]. Poor knowledge of HBV transmission and inadequate handling or disinfection of sharp instruments further increase the risk [9, 13–15]. To our knowledge, no published study has assessed HBV infection in these two occupational groups in Salah Al-Din Governorate.

The aims of this study were therefore to determine the prevalence of HBsAg among barbers and butchers in Salah Al-Din Governorate, Iraq; to compare it with that of occupationally unexposed controls; and to describe the demographic and occupational characteristics of HBsAg-positive workers.

2 MATERIALS AND METHODS

2.1 Study design and setting

A cross-sectional study was conducted in Salah Al-Din Governorate, northern-central Iraq, between January and June 2025. Barbers were recruited from barbershops and butchers from retail meat shops and the municipal abattoir in the governorate's main districts. Controls were apparently healthy adults with no occupational exposure to blood or sharp instruments, recruited from the same communities during the same period.

2.2 Participants

A total of 900 participants aged 20–70 years were enrolled: 300 barbers, 300 butchers and 300 controls. Within each occupational group, participants were recruited by quota sampling stratified by age, with 60 participants in each of five ten-year age bands (20–30, 31–40, 41–50, 51–60 and 61–70 years) to allow age-specific comparison. All barbers and butchers were male, reflecting the composition of these trades locally; controls were also all male and were frequency-matched to the occupational groups by age, with 60 participants in each of the same five age bands. Exclusion criteria were known chronic viral hepatitis under treatment, blood transfusion within the preceding six months, hemodialysis, and immunosuppressive illness or therapy.

2.3 Sample size

Assuming an expected HBsAg prevalence of about 10% among exposed workers, a 5% absolute precision and a 95% confidence level, a minimum of 139 participants per group was required; the sample was enlarged to 300 per group to permit age-stratified analysis.

2.4 Data collection

Demographic and occupational data were collected by face-to-face interview using a structured questionnaire covering residence (urban/rural), age, marital status, educational level, history of accidental cuts at work, exposure to blood, presence of symptoms suggestive of hepatitis (fatigue, anorexia, nausea, jaundice, dark urine, right upper-quadrant pain), and the method used to decontaminate working instruments.

2.5 Laboratory methods

About 5 mL of venous blood was collected aseptically into a plain tube without anticoagulant. Samples were centrifuged at 4500 rpm for 10 min, and the separated serum was stored at −80 °C until testing. HBsAg was detected using a commercial enzyme-linked immunosorbent assay by using Murex HBsAg Version 3 enzyme immunoassay (DiaSorin S.P.A., UK/Italy; catalogue No. 9F80-01) according to the manufacturer's instructions, with positive and negative controls included in every run. Results were interpreted according to the kit cut-off (sample absorbance/cut-off ratio ≥ 1.0 considered reactive). All initially reactive samples were retested in duplicate, and only repeatedly reactive samples were considered HBsAg positive.

2.6 Statistical analysis

Data were analysed using IBM SPSS Statistics (IBM Corp., Armonk, NY, USA). Categorical variables are presented as frequencies and percentages. Prevalence estimates are reported with 95% Wilson confidence intervals (CI). Differences between groups were tested using the Pearson chi-square test; Fisher's exact test was used for 2 × 2 tables with small expected frequencies. Odds ratios (OR) with 95% CI were calculated to compare barbers with butchers; because no positive cases occurred in the control group, ORs versus controls were calculated after adding 0.5 to each cell (Haldane–Anscombe correction). A two-sided P value < 0.05 was considered statistically significant.

2.7 Ethical considerations

The study protocol was approved by the Research Ethics Committee of the College of Dentistry, Tikrit University **(**Ethical approval No: 117726 in 18/9/2026**)** and was conducted in accordance with the Declaration of Helsinki. Written informed consent was obtained from all participants after explanation of the study objectives. Participants found to be HBsAg positive were informed confidentially and referred to the Tikrit Teaching Hospital for further evaluation and management.

3 RESULTS

3.1 Occupational exposure and HBsAg positivity

All 900 participants provided a serum sample and completed the questionnaire. Circulating HBsAg, the marker of current HBV infection, was detected in 34 of 300 barbers (11.3%; 95% CI 8.2–15.4) and 28 of 300 butchers (9.3%; 95% CI 6.5–13.2), whereas none of the 300 occupationally unexposed controls was reactive (0%; 95% CI 0–1.3) (Figure 1). The excess of infection in the two occupational groups was highly significant (P < 0.001), and the prevalence in each group was approximately six- to seven-fold higher than the national estimate of 1.6% for the Iraqi general population [2]. Positivity was slightly more frequent among barbers than butchers, but the difference was small and not statistically significant (OR 1.24; 95% CI 0.73–2.11), indicating that both trades carry a comparable excess burden of infection.

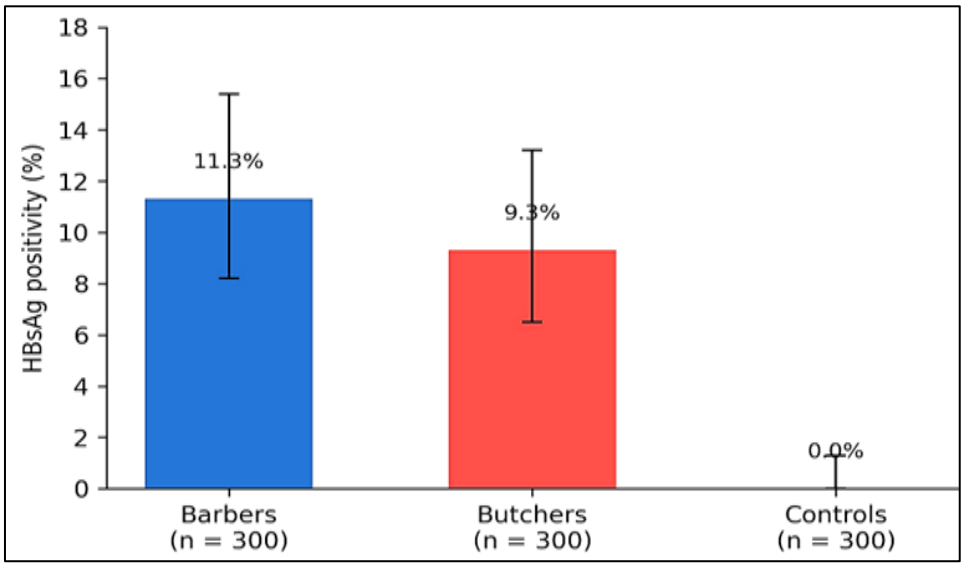

Figure 1: Prevalence of HBsAg positivity by study group (N = 900). Error bars represent 95% Wilson confidence intervals.

3.2 Age pattern of infection

The two occupations showed different age profiles of infection (Table 1). Among barbers, positivity rose from 5.0% in the youngest workers (20–30 years) to a peak of 20.0% at 31–40 years, remained high at 41–50 years (16.7%), and then declined to 6.7–8.3% in workers older than 50 years; this age dependence was statistically significant (P = 0.034). In other words, one in five barbers in the fourth decade of life was carrying HBsAg. Among butchers, by contrast, positivity fluctuated between 6.7% and 15.0% across the age bands without a consistent trend, the highest value being recorded at 51–60 years, and no significant association with age was found (P = 0.495).

Table 1: HBsAg positivity among barbers and butchers by age group.

Age group (years)	Barbers			Butchers		
	Positive n (%)	Negative n (%)	Total	Positive n (%)	Negative n (%)	Total
20–30	3 (5.0)	57 (95.0)	60	6 (10.0)	54 (90.0)	60
31–40	12 (20.0)	48 (80.0)	60	4 (6.7)	56 (93.3)	60
41–50	10 (16.7)	50 (83.3)	60	5 (8.3)	55 (91.7)	60
51–60	4 (6.7)	56 (93.3)	60	9 (15.0)	51 (85.0)	60
61–70	5 (8.3)	55 (91.7)	60	4 (6.7)	56 (93.3)	60
Total	34 (11.3)	266 (88.7)	300	28 (9.3)	272 (90.7)	300

Chi-square test for association between age group and HBsAg status: barbers, $\chi^2 = 10.42$, df = 4, P = 0.034; butchers, $\chi^2 = 3.39$, df = 4, P = 0.495. All expected cell frequencies were ≥ 5.

3.3 Clinical, demographic and occupational profile of infected workers

The characteristics of the 62 HBsAg-positive workers are summarized in Table 2. The most striking clinical finding was that infection was silent in the majority: 21 of 34 positive barbers (61.8%) and 17 of 28 positive butchers (60.7%) reported no symptom suggestive of liver disease at the time of sampling, and the minority who were symptomatic described only non-specific complaints such as fatigue or anorexia. None had been previously diagnosed with hepatitis B.

Infected barbers were mainly urban residents (55.9%), whereas infected butchers were predominantly from rural areas (75.0%; P = 0.014), a distribution that mirrors where the two trades are practised in the governorate. Most infected workers in both groups were married (52.9% of barbers and 67.9% of butchers), with no significant difference in marital-status distribution. Educational attainment was generally low: only one worker in each group had a university education, and one-third of infected butchers were illiterate; the educational profiles of the two groups did not differ significantly.

Occupational injury was common. A history of accidental cuts at work was reported by 52.9% of infected barbers and 71.4% of infected butchers. The methods used to clean working instruments, however, differed fundamentally between the trades (Table 2). Infected barbers most often used alcohol or another chemical disinfectant (58.8%), and 29.4% reported using a sterilization device, whereas 11.8% used soap and water only. Among infected butchers, 89.3% relied exclusively on soap and water, 10.7% used a chemical disinfectant, and none used any form of sterilization (P < 0.001). Thus, virtually all infected butchers and more than one in ten infected barbers were using a cleaning method that does not inactivate HBV.

Table 2: Demographic, clinical and occupational characteristics of HBsAg-positive barbers (n = 34) and butchers (n = 28).

Characteristic	Barbers (n = 34) n (%)	Butchers (n = 28) n (%)	Test statistic, P value
Clinical presentation			
Asymptomatic	21 (61.8)	17 (60.7)	$\chi^2 = 0.007$, df = 1, P = 0.933
Symptomatic	13 (38.2)	11 (39.3)	
Residence			
Urban	19 (55.9)	7 (25.0)	$\chi^2 = 6.01$, df = 1, P = 0.014; Fisher P = 0.020
Rural	15 (44.1)	21 (75.0)	
Marital status			
Married	18 (52.9)	19 (67.9)	$\chi^2 = 1.99$, df = 2, P = 0.369
Single	10 (29.4)	7 (25.0)	
Divorced	6 (17.6)	2 (7.1)	
Accidental cut at work			
Yes	18 (52.9)	20 (71.4)	$\chi^2 = 2.21$, df = 1, P = 0.137; Fisher P = 0.191
No	16 (47.1)	8 (28.6)	
Instrument decontamination method			
Water only	0 (0.0)	0 (0.0)	$\chi^2 = 37.5$, df = 2, P < 0.001†
Soap and water	4 (11.8)	25 (89.3)	
Alcohol or other disinfectant	20 (58.8)	3 (10.7)	
Sterilization device	10 (29.4)	0 (0.0)	
Educational level			
Illiterate	8 (23.5)	9 (32.1)	$\chi^2 = 8.30$, df = 4, P = 0.081†
Primary school	5 (14.7)	11 (39.3)	
Secondary school	9 (26.5)	4 (14.3)	
Diploma / institute	11 (32.4)	3 (10.7)	
University or higher	1 (2.9)	1 (3.6)	

Percentages are column percentages of HBsAg-positive participants. †Some expected cell frequencies < 5; the chi-square P value should be interpreted with caution.

4 DISCUSSION

To our knowledge, this study provides the first estimate of HBV infection among barbers and butchers in Salah Al-Din Governorate and demonstrates that roughly one in nine barbers and one in eleven butchers are currently HBsAg positive, compared with none of the age- and sex-matched unexposed controls and with a national prevalence of about 1.6% [2] and 1–4% among Iraqi blood donors [6, 7].

The magnitude and consistency of this excess across two trades that share a single common feature, daily handling of sharp instruments that come into contact with blood, strongly implicates the occupational environment as the route of acquisition.

4.1 Biological basis of occupational transmission

HBV is exceptionally well suited to transmission through contaminated instruments. Its concentration in the blood of infected individuals can reach 10^8–10^{10} virions per millilitre, and as little as 0.00004 mL of blood may transmit infection, roughly 50–100 times less than the dose required for hepatitis C virus and around 100 times less than that for HIV. The virion is stabilized by its lipid envelope and the surrounding excess of surface-antigen particles, and it retains infectivity in dried blood on surfaces for at least seven days at room temperature [5].

A razor, blade or knife that has nicked one infected person can therefore inoculate the next person through microscopic breaks in the skin, even when no visible blood remains. In barbershops the risk arises from shaving and hairline trimming, which routinely cause micro-abrasions in the client, so that a reused blade transfers blood from client to client and to the barber through cuts on the hands. In butchery the exposure is different: animal blood does not carry HBV, so infection results from the cuts and puncture wounds that butchers sustain while working, combined with the sharing of knives and cleavers among co-workers, whereby the blood of an infected colleague contaminates a tool that then enters the wound of another.

The very high frequency of work-related cuts that we recorded, more than half of infected barbers and nearly three-quarters of infected butchers, is fully consistent with this mechanism, and a documented outbreak of acute hepatitis B among four employees of a single butcher's shop traced to an asymptomatic infected co-worker shows that such chains of transmission occur in practice [20].

4.2 Inadequate decontamination as the enabling factor

The decontamination practices we observed explain why exposure translates into infection. Washing with soap and water removes gross soiling but does not inactivate HBV, because the mechanical action leaves residual virus in the crevices of blades and handles and surfactants alone do not disrupt the envelope reliably. This was the sole method used by nine out of ten infected butchers. Alcohol, the predominant method among barbers, is virucidal against enveloped viruses when applied at 60–90% concentration for an adequate contact time on a pre-cleaned surface.

In practice barbers typically wipe or briefly dip instruments, which is unlikely to achieve the required exposure, and alcohol has poor penetration through organic residue. Only physical sterilization (autoclaving or dry heat) or immersion in a high-level disinfectant such as sodium hypochlorite or 2% glutaraldehyde reliably destroys HBV, and this was practiced by less than one-third of barbers and by no butcher.

The near-universal reliance on inadequate methods among butchers, whose infection rate nonetheless approached that of barbers, suggests that the butchers' higher injury rate compensated for what may be a somewhat lower frequency of contact with infected human blood in the abattoir than in the barber's chair.

Comparable deficits in knowledge and practice have been described among barbers in Pakistan, Bangladesh, Ghana and India [9, 13–15].

4.3 Interpretation of the age pattern

The age distribution of infection among barbers is informative. HBsAg positivity in adults represents the sum of chronic carriage acquired earlier in life and new infections acquired in adulthood. Two factors are likely to explain the peak at 31–40 years. First, this is the period of maximal occupational activity and therefore of maximal cumulative exposure to clients' blood, after which many barbers reduce their workload or leave the trade; the decline in prevalence after the age of 50 is consistent with either spontaneous clearance of HBsAg, which occurs in about 1% of chronic carriers per year, or with a survivor effect.

Second, workers in this age band were born before or during the introduction of universal infant hepatitis B vaccination in Iraq and belong to largely unvaccinated cohorts, whereas the youngest workers (20–30 years) are more likely to have been vaccinated in infancy, which would account for their much lower prevalence (5.0%).

The absence of an age trend among butchers, whose infections were distributed across all ages with a peak at 51–60 years, suggests that in this trade the risk is governed less by cumulative years of exposure than by the sporadic occurrence of deep cuts and by sharing of tools, events that can occur at any age. Because the study is cross-sectional, these interpretations describe associations and cannot establish causation.

4.4 Silent infection and its public-health implications

Approximately three-fifths of infected workers had no symptoms. This is the expected natural history of HBV: acute infection in adults is icteric in only about one-third of cases, and chronic carriage is typically asymptomatic for decades

until cirrhosis or hepatocellular carcinoma supervenes. The clinical silence is a direct consequence of the non-cytopathic nature of the virus; liver injury is mediated by the host immune response rather than by viral replication itself, so carriers with a weak or tolerant immune response may harbour high viral loads and be highly infectious while feeling entirely well. In an occupational setting this means that an infected barber or butcher can transmit the virus to clients, co-workers and household contacts for years without being recognized.

Symptom-based identification is therefore ineffective, and serological screening is the only means of detection, in keeping with WHO guidance that recommends HBsAg testing of populations in which prevalence exceeds 2% [5].

4.5 Comparison with other settings

The prevalence among barbers in this study is in the upper range reported internationally: 1.9% in Morocco [23], 2.2% in Turkey [24], 2% in India [12] and 4.2% in Egypt [11], but 14.5% in Ghana [9], 15.0% in Cameroon [4] and 16.8% in China [10]; case–control studies from Iran have likewise found higher HBV prevalence among barbers than among unexposed controls [21, 22]. For butchers, our figure is higher than the 3.1% reported in Sudan [19] but comparable to the 9.4–11.6% reported in Nigeria [17, 18], in line with evidence that slaughterhouse workers carry an excess burden of viral hepatitis [16]. Such variation reflects background endemicity, vaccination coverage, and the degree of regulation of the informal sector, which in Iraq has been weakened by years of conflict and displacement.

The zero prevalence among controls deserves comment. With a national prevalence of 1.6%, about five positive individuals would have been expected among 300 unexposed adults; the upper limit of the 95% CI (1.3%) is compatible with this expectation, and the absence of positives probably reflects the small expected number together with the exclusion of individuals with known hepatitis. The comparison with the national and blood-donor prevalence is therefore the more robust benchmark for the size of the occupational excess.

Strengths and limitations

Strengths of this study include the large sample, the inclusion of an age- and sex-matched unexposed control group, and confirmatory repeat testing. Several limitations must be acknowledged. Only HBsAg was tested; anti-HBc and anti-HBs were not measured, so past resolved infection, vaccine-induced immunity and occult infection could not be assessed, and acute infection could not be distinguished from chronic carriage. Vaccination status was not recorded and is an important potential confounder. The demographic and occupational comparisons were made between infected barbers and infected butchers; because the same variables were not analysed in uninfected workers, the study could not estimate the risk attributable to individual practices, and multivariable analysis was not possible. Occupational exposures were self-reported and subject to recall bias. HBV DNA testing and genotyping were not performed. Finally, the study was confined to one governorate and used quota sampling, which limits generalizability.

5 CONCLUSION

Barbers and butchers in Salah Al-Din Governorate carry a burden of current HBV infection six to seven times that of the general population, driven by frequent occupational injury with sharp instruments and by decontamination practices that do not inactivate the virus. Most infections are clinically silent and would remain undetected without serological screening. These findings justify recognizing both trades as high-risk occupational groups and implementing a package of measures: hepatitis B vaccination of all workers, periodic HBsAg screening linked to licensing, mandatory single-use blades in barbershops, provision of sterilization equipment and cut-resistant gloves, and structured training in sharps safety and instrument disinfection. Future multicentre studies should include full HBV serology, vaccination history, comparison of practices between infected and uninfected workers, and molecular confirmation with genotyping to trace transmission chains.

STATEMENTS ON COMPLIANCE WITH ETHICAL STANDARDS

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Statement of ethical approval

Approved by the Research Ethics Committee of the College of Dentistry, Tikrit University. Ethical approval No: 117726 in 18/9/2026.

Statement of informed consent

Written informed consent was obtained from all participants.

Data availability

The data supporting the findings of this study are available from the corresponding author on reasonable request.

Author contribution

S.M.Q. conceived and designed the study, collected the samples, performed the laboratory work and statistical analysis, and wrote and approved the final manuscript.

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