Epidemiology of hepatitis B among professional male athletes in Qatar

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ABSTRACT

الأهداف: تقييم حالة التهاب الكبد الوبائي (B) للمرضى الرياضيين المتنافسين في قطر مع نظرة لتقييم خطر نقل المرض.

الطريقة: صممت دراسة مقطعية وأجريت دراسة تحليل المصل على 780 رجل رياضي مريض حضروا إلى مستشفى الطب الرياضي وجراحة العظام – الدوحة – قطر خلال الفترة من مارس 2008م و فبراير 2009م لفحص ما قبل المشاركة.

النتائج: يقدر معدل انتشار التهاب الكبد الوبائي (B) 2.2%، وانعدام المناعة 53.3%. لوحظ ارتفاع معدلات الالتهاب في المرضى غير القطريين الجنسية بالتحديد ذو الأصول الإفريقية. لايوجد أي علاقة واضحة مع العمر، ومستوى المناعة. إلا أنه تبين أن النسبة العالية لالتهاب الكبد الوبائي (B) كانت بين راكبي الدراجات. لم يكن هنالك اختلاف في معدلات الإصابة بالالتهاب بين الرياضة التي تتطلب الاحتكاك، والتي لا تتطلب.

خاتمة: تم تقدير خطر انتقال الكبد الوبائي (B) في 12.5 مليون مشترك لكرة القدم، ولكن تشير النسبة العالية لانعدام المناعة بأن الرياضيين المتنافسين محالة لمخاطر عدوى التهاب الكبد الوبائي (B)، لذلك فإن هذا الاختلال في معدلات العدوى والمناعة يتطلب إجراء المزيد من الفحوصات والإجراءات العاجلة.

Objectives: To assess the Hepatitis B status of sportsmen competing in Qatar and to evaluate the risk of transmission.

Methods: In a cross-sectional study design, serological analysis was carried out on 780 sportsmen who attended the Qatar Orthopaedic and Sports Medicine Hospital, Doha Qatar, between March 2008 and February 2009 for a pre-participation screening.

Results: Hepatitis B infection prevalence of 2.2% and a lack of immunity in 53.3%. Highest rates of infection were observed in non-Qatari nationals, particularly those of African origin. There was no clear trend with age and immunity level, but cycling was found to have significantly higher rates of Hepatitis B infection. There was no difference in infection rates between contact and non-contact sports.

Conclusion: The risk of Hepatitis B transmission in football was assessed at one transmission in 12.5 million football matches, but the high rate of non-immunity suggests that sportsmen competing in Qatar are at elevated risk of Hepatitis B infection should they be exposed. This imbalance of infection and immunity rates requires further investigation and urgent redress.

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Hepatitis B is a viral infection, endemic in many regions. In the Middle East, viral hepatitis is recognized as a major public health issue with a prevalence of up to 14% in some groups,[1] and is associated with up to one million deaths worldwide each year due to liver cirrhosis and hepatocellular carcinoma.[2] Transmission of Hepatitis B occurs predominantly via cross contamination of blood, semen, and vaginal secretions,[3] but may also occur via body fluids such as saliva and sweat.[4,5] In endemic areas, the most frequent mode of transmission is perinatal from infected mothers[6] and post natal spread between siblings.[1] In the sporting arena, transmission may theoretically occur through percutaneous transfer between open wounds or bleeding.[7] In addition, Olympic wrestlers were recently shown to secrete Hepatitis B in their sweat, implicating sweat as a potential source of Hepatitis B transmission.[8] The horizontal transmission of Hepatitis B has been

described in American Football,[9] Orienteering (cross-country running requiring map reading),[10] Sumo Wrestling,[11] and among injecting anabolic steroid users.[12]

Based on the Qatar National Register of infectious disease, Hepatitis B has an incidence of 4.7/10000/year, is more frequent in those older than 15 years, and has a significantly higher incidence in non-Qatari Nationals.[13] Pregnant women in Qatar have recently been shown to have a prevalence of 1% for Hepatitis B.[6] While Hepatitis B vaccination has been part of childhood vaccinations in Qatar since 1991, with coverage reportedly reaching 82-98% of the population,[6] the rate of uptake in the competitive sporting population is unknown. Furthermore, a number of sportsmen in Qatar have origins in countries known not to have routine vaccination schedules.[2] Transmission of Hepatitis B in sport, while well recognized,[8,9,12] is generally considered low risk, with individuals and teams encouraged to ensure appropriate vaccination of players and to utilize universal precautions.[7] However, despite the numerous guidelines for sports practitioners and clubs,[14-16] even professional physiotherapists working within sports teams have been shown not to adhere to basic universal precautions.[17]

Neither the prevalence of Hepatitis B, nor the prevalence of Hepatitis B immunity within sportsmen in Qatar is known. The Qatar Orthopaedic and Sports Medicine Hospital are responsible for the medical provision to all Clubs and Federations within the State of Qatar, with non-mandatory pre-participation screening, including Hepatitis B serological evaluation, offered to all club and federation athletes. The aim of this study was to assess the prevalence of both Hepatitis B positive serology and Hepatitis B immunity in Sportsmen and to assess the risk of Hepatitis B transmission for sportsmen in Qatar.

Methods. Utilizing a cross sectional study design, all male athletes who attended pre-participation Athlete screening in the Qatar Orthopaedic and Sports Medicine Hospital, Doha Qatar, between March 2008 and February 2009 were included in this study. Athletes completed a written consent to their anonymous data being utilized for research. Refusal to consent or failure to have blood drawn resulted in exclusion from the study. Fasting blood samples were taken on arrival at the hospital, by a qualified phlebotomist and samples underwent immediate analysis. Hepatitis B serology assessment was performed on an AxSYM System Plus Analyser (Abbott Park, Illinois, USA) utilizing microparticle enzyme immunoassay technology.

Routine serological analysis included Hepatitis B surface antibody total (HBsAb), Hepatitis B surface antigen (HbsAg) and Hepatitis B core antibody IgM (HBcIgMAb). In the event of a positive HBsAg, further serology was performed including hepatitis B core antibody total (HBcAb), hepatitis B e antibody and hepatitis B e antigen (HBeAg). Hepatitis B infection was defined as reactive for HBsAg.[3] Hepatitis B vaccination status was defined as immune (HBsAb >10 mIU/ml) or non-immune (HBsAb < 10 mIU/ml).[2]

Seven hundred and eighty athletes were included in the cohort, which was analyzed by age, country of origin and sport (**Table 1**). Footballers and football referees were the largest sporting groups accounting for 368 and 89 athletes respectively. Football referees were included in this sample of athletes as they train in a manner similar to players, are screened annually and are in close contact with players. Trends were analyzed using chi-square analysis, with a significance level set at $p<0.05$. The risk of hepatitis B transmission in football players in Qatar was evaluated using the formula modified from Brown et al[18] Risk of hepatitis B transmission = prevalence of athletes infected with Hepatitis B multiply by risk for percutaneous Hepatitis B transmission (based on data for a contaminated needle-stick injury; HBeAg positive (>30% risk) or HBeAg negative (<6% risk)[3] – in this analysis we have assumed HBeAg negative status) multiply by risk of bleeding incident in opponent (0.0258 bleeds/player/game for Rugby League football[19]) multiply by risk of bleeding injury in player (0.0258 bleeds/player/game).

Results. Over the time period of data collection, no athletes refused consent or failed to have blood drawn and hence all were included in the analysis. Of 780 athletes screened for hepatitis, 17 (2.2%) were hepatitis B infection positive, 347 (44.5%) hepatitis B immune and 416 (53.3%) had no hepatitis B immunity. Hepatitis B status by sport, region of origin, and age is illustrated in **Figures 1-3**. Of the hepatitis B positive athletes, one was found to have an acute infection, and subsequently seroconverted to an immune state, and the remainders were hepatitis B carriers. Two athletes were HBeAg positive and 2 athletes were unreported HBeAg. Hepatitis B carrier rates in cycling were significantly higher (Chi-square test 6.6; $p=0.01$) than the overall group, and volleyball had a significantly higher rate of non-immune athletes compared to the sample as a whole (chi-square 4.6; $p=0.032$). No other sports significantly deviated from the group trends. No difference was observed between contact and non-contact sports with respect to hepatitis B immunity or carrier rates. However, with specific regard to Qatari athletes, contact sport athletes had significantly higher rates of hepatitis B immunity than those non-contact sport athletes (chi-square 4.57; $p<0.033$), but no difference was observed with respect

Table 1 - Age distribution and Hepatitis B status of athletes depending on their country of origin and sport played.

Variables	Africa (n=140)			Qatar (n=455)			Europe (n=37)			South America (n=44)			Asia (n=20)			North America (n=16)			Others (n=68)			Total
Age (years) (mean ± SD)	23.4 ± 7.0			19.4 ± 7.5			28.2 ± 5.3			27.1 ± 5.2			24.4 ± 4.6			28.0 ± 2.4			28.0 ± 2.4			20.9 ± 6.6
Sport	IM	N	INF	IM	N	INF	IM	N	INF	IM	N	INF	IM	N	INF	IM	N	INF	IM	N	IMF	
Track & Field	5	5	0	6	11	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	31
Basketball	8	9	1	1	5	0	1	0	0	0	0	0	0	0	0	6	8	0	1	2	0	42
Billiards	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Football	28	33	6	118	88	3	7	10	0	6	22	0	3	7	0	0	0	0	18	18	0	367
Bowling	0	0	0	6	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9
Cycling	0	4	0	4	4	2	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	17
Equestrian	0	0	0	2	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8
Gymnastics	2	1	0	11	10	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	25
Handball	0	4	0	10	18	0	3	9	0	0	1	0	0	0	0	0	0	0	1	2	0	48
Referees	2	11	0	27	35	1	0	1	0	0	0	0	0	1	1	0	0	0	6	4	1	90
Volleyball	3	8	1	2	1	0	2	4	0	1	12	0	0	0	0	1	1	0	0	0	0	36
Other	3	6	0	39	42	0	0	0	0	0	2	0	7	1	0	0	0	0	3	4	0	107
Totals	**51**	**81**	**8**	**226**	**222**	**7**	**13**	**24**	**0**	**7**	**37**	**0**	**10**	**9**	**1**	**7**	**9**	**0**	**33**	**34**	**1**	**780**

IM - immune HBsAb >10 mIU/ml), N - non-immune HBsAb <10 mIU/ml, INF - positive hepatitis B infection HBsAg positive,
*Significantly different from group as described in text.

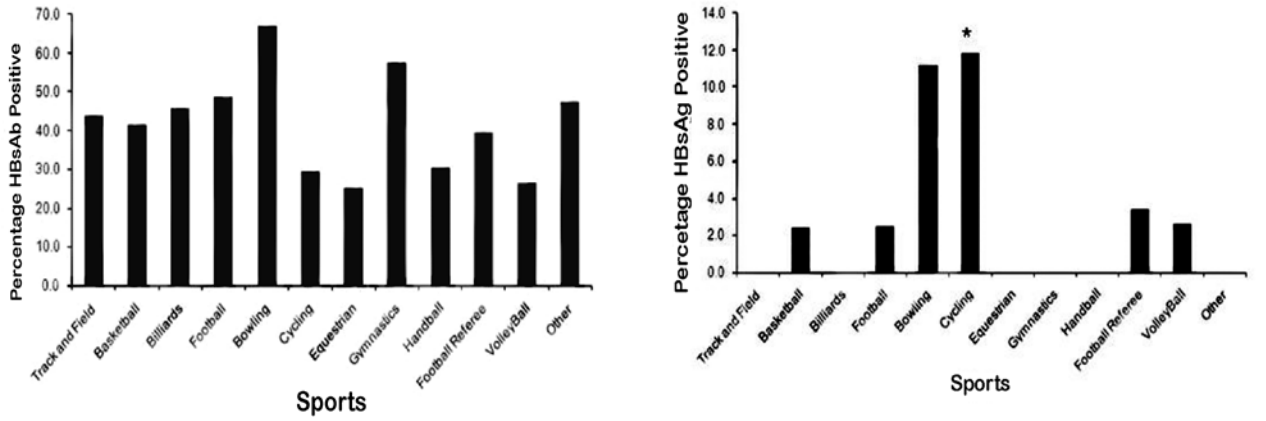

Figure 1 - Hepatitis B status according to sport **a**) rates of hepatitis B immunity (HBsAb >10 mIU/ml) **b**) rates of Hepatitis B infection (HBsAg positive).

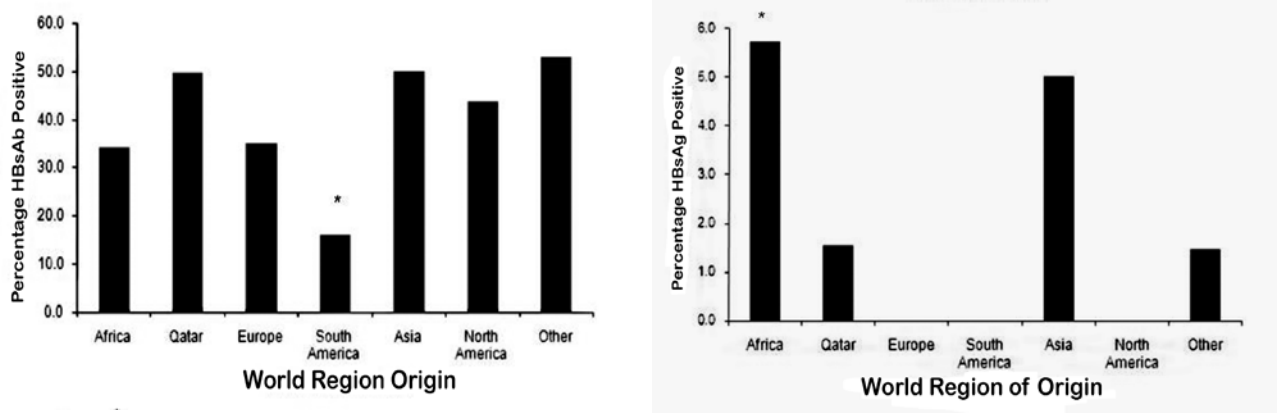

Figure 2 - Hepatitis B status according to world region of origin a) rates of hepatitis B immunity (HBsAb >10 mIU/ml) b) rates of Hepatitis B infection (HBsAg positive).

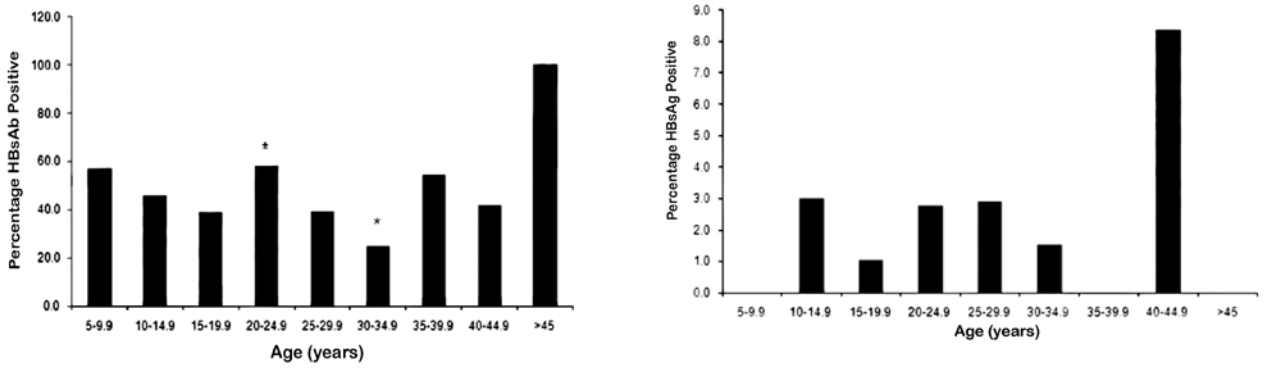

Figure 3 - Hepatitis B status according to age group **a**) rates of hepatitis B immunity (HBsAb >10 mIU/ml) **b**) rates of Hepatitis B infection (HBsAg positive).

to hepatitis B infection rates or non-immune status (**Figure 1**). Athletes of African origin had a significantly higher rate of hepatitis B carriage (chi-square 6.7; p=0.009) and South American Athletes a significantly lower rate of hepatitis B immunity than the group (chi-square 13.9; p=0.001). No other country of origin data reached statistical significance (**Figure 2**).

Significantly higher and lower rates of immunity were observed in the 20-24.9 year (chi-square 10.2; p=0.001) and 30-34.9 year (chi-square 10.2; p=0.001) age groups. When Qatari Nationals were analyzed separately, there was a trend for Qatari athletes less than 18 years of age to have higher rates of non-immunity to Hepatitis B than those over 18 years of age (chi-square 3.64; p<0.056) (**Figure 3**).

Post-hoc analysis of our data for football was performed using the previously described formula for calculating the risk of blood borne transmission,[18] taking into account the known prevalence of hepatitis B in Qatari athletes.[3] Thus, the calculation performed was prevalence of HBsAg positive Qatari sportsmen (0.0022) x risk of percutaneous hepatitis B transmission via contact with hepatitis B infected athlete (<0.06)[3] x risk of bleeding incident in opponent (0.0258)[19] x risk of bleeding injury in player (0.0258).[19] This results in a calculated risk for hepatitis B transmission of <0.08/100,000 matches or one transmission in every 12.5 million matches.

Discussion. Non-compulsory screening for hepatitis B in sportsmen was carried out in Qatar as a result of the endemic nature of hepatitis in the general population and the desire to ensure adequate levels of immunity within sportsmen. Internationally, voluntary screening is recommended for high risk athletes, including those living in endemic areas such as the Middle East.[7] Our results indicate a prevalence of hepatitis B among sportsmen in Qatar of 2.2%. This prevalence is markedly higher than that observed in Australian Rules Footballers (0.85%)[20] and Sumo Wrestlers during an outbreak (1.6%).[11] Furthermore, while the prevalence is higher than that observed in studies involving pregnant Qatari women (1%),[6] the observed tendency for higher rates of hepatitis B in non-Qatari nationals is consistent with previous data for Qatar.[13] While the cross sectional nature of this study does not allow confirmation of chronicity, it is likely that most of cases were chronic carriers, reflecting high incidence of childhood infection in endemic regions. Indeed, our 2 positive cyclists in a small cohort (n=17) were siblings, potentially illustrating either perinatal or horizontal transmission found in families of endemic areas.[1]

The prevalence of hepatitis B immunity in all athletes was found to be 44.5%, with athletes from South America, Africa and Europe all having a prevalence of immunity less than 40%. While highest in Qatari Nationals, but the overall levels of immunity were still lower than anticipated given increasing awareness and uptake of hepatitis B vaccination by countries around the world. While the higher rates of immunity observed in Qatar reflect positively on the national childhood vaccination program, a seroconversion prevalence of 50% in Qatari sportsmen remains inadequate. Furthermore, despite the presence of a vaccination program in Qatar since 1991, there was a non-significant trend for Qatari athletes under the age of 18 to have lower rates of immunity. This may reflect either a lack of compliance with the vaccination schedule, or failure to seroconversion following vaccination.

It is disappointing that higher rates of immunity were not observed in the youngest age groups whom theoretically should have both exposures to the most mature vaccination schedules and the highest rates of seroconversion. Football players formed the largest single sport cohort, and despite the potential for high profile players to be exposed to multiple risk factors for hepatitis B transmission,[7] only 48.6% of players were

hepatitis B immune, while the prevalence of hepatitis B carriage was 2.4%. The majority (11/17) of hepatitis B positive cases lacked HBeAg, and so are considered to have low infectivity, however, transmission remains possible.

The probability of hepatitis B transmission in any given sport is difficult to elucidate, but for it to eventuate there is required the presence of an infected athlete, the occurrence of a bleeding wound or exudative skin lesion, the presence of a susceptible athlete with a skin lesion or exposed mucous membrane and sustained contact between the source and the susceptible athlete.[21] Quantitatively, it may be considered to be the prevalence of persons infected with hepatitis B, the risk for percutaneous hepatitis B transmission, the risk for laceration in an opponent and the risk for any bleeding injury per game for each player.[18] The risk of hepatitis B transmission in sports has alternatively been estimated as between one transmission in every 850 000 to 4.25 million games and one transmission in 10 000-50 000 games[7] or 1/20 000 per player per game.[19] However, when the specific prevalence is known, formula such as this may actually underestimate the risk for transmission.[22] In its most simple assessment, with 2 of every 100 players in Qatar infected, and more than 50 not immune, the risk of transmission would appear high. Our analysis of one transmission per 12.5 million match exposures suggests that despite our relatively high prevalence of hepatitis carriage there may be a lower risk for transmission than previous estimates,[7,19] and approximate estimates of human immunodeficiency virus (HIV) transmission in sport.[7] Each sport will have a distinct bleeding risk, exposure risk and prevalence of infection and immunity, with a subsequent distinct risk of transmission and infection. Given current data, it is difficult to estimate transmission risk for each sport, and hence sports should assume the highest level of risk and utilize universal precautions, beginning with appropriate vaccination. It is important to recall that this estimation describes only the risk of hepatitis B transmission, and only the risk of transmission via contact with open wounds. It does not necessarily account for the risk of transmission through other means such as the sharing of drink bottles, and does not reflect the risk to those with high exposure, such as medical and physiotherapy staff. Risk of subsequent infection will however depend on the host immunity, and given our low prevalence of hepatitis B immunity, the risk for infection following transmission remains unacceptably high in this region. However, given the high rate of chronic infection observed in young men, the lack of distinction between contact and non-contact sports, there is little evidence to suggest that sport in the Middle East is a propagator of hepatitis B infections. Rather, the high prevalence of infection and the low rate of immunity implies elevated risk of infection, following potential transmission for sportsmen in this region. It is the risk of developing infection that can be simply prevented with appropriate vaccination.

Consistent with international recommendations,[14-16] it is not the authors policy to recommend exclusion of hepatitis B positive athletes from active sports participation, but rather to recommend universal precautions for athletes and clubs. However, given the low rate of immunity observed in this group, the application of universal precaution, which includes the vaccination of all players and other at risk staff members, appears to date, to have been incomplete. Given this consideration may be given to either excluding either players who are found to be hepatitis B positive, or those who have no hepatitis B immunity. Both options raise complex ethical issues, and must be weighed against the actual risk of transmission, and the potential long term health consequences.[22]

The major limitations to this study are the cross-sectional design and lack of DNA analysis to assess the infectivity of the seropositive athletes. The cross-sectional design of the study does not allow us to infer any prevalence data, etiological mechanisms, or chronicity, merely supplying a snapshot of what is occurring in Qatar athletes. Deoxyribonucleic acid is now the gold standard for diagnostic and prognostic accuracy and now forms part of our complete assessment.

In conclusion, chronic hepatitis B infection has a prevalence of over 2% in Gulf athletes, with our data suggesting that most of these infections result from childhood or perinatal transmission rather than sport related transmission. Despite this, our analysis suggests a very low risk of hepatitis B transmission in a sport such as football. Of equal significance in this study was the low rate of hepatitis B immunity observed. It is unclear why such a high proportion of this sporting population is not vaccinated, but this requires urgent redress. While without substantial rule changes, it is difficult to envisage a means to further reduce the low risk of virus transmission in contact sports, the risk of transmission can be minimized with the use of universal precautions, and subsequent infection can be eradicated with appropriate vaccination. Further, research is required to evaluate the reasons behind such a low seroconversion rate, to ensure vaccination strategies are optimized and risks for athletes are thereby reduced.

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Related topics

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