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Positivity of HCV, HBV, HIV, and *Treponema pallidum* microbes among blood donors in Khanaqin city

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Abstract
Objective: Detection of viral hepatitis B and C, acquired immunodeficiency syndrome (AIDS), syphilis, and Co-infections *among* serum of blood donors in Khanaqin city.
Material and methods: The conducted investigation was happened in Khanaqin city/ Iraq on blood donors who visiting the main blood bank of diyala health department for period 1/6 to 30/7 -2024. 1500 blood samples were collected from those individuals for detection positivity of microbial infections (HCV, HBS, HIV, and *Treponema palladium)*. Enzyme-linked immune-sorbent assay (ELISA) method used to detect positivity of HCV, HBV, HIV, and *Treponema palladium* microbes among blood donors. SPSS v. 23.0 and Excel 2013 programs were utilized analyze our data.
Results: Study results showed the most participants were; males (78.0%) within age group 41-50 years (32.0%), live in urban (68.0%), blood groups A (36.0%) and O (34.0%), no employed (68.0%), singles (74.0%), secondary education level (56.0%), no smoking (80.0%) and no alcohol use (86.0%). The differences among percentages of demographic features were significant ($p<0.05$), in exception, living and occupation features were no significant ($p>0.05$). Positivity of microbial infections in blood donors were as following; HCV (0.4%), HBV (1.7%), HIV (0.1%), TP (1.3%), and co-infection (HBV+TP) (0.3%). Finally, the correlations between microbial infections and most demographic features were significant ($p<0.05$).
Conclusions; Present study showed the hepatitis B and syphilis infections scored high prevalence among blood donors, while AIDS scored lowered incidence. Singles males within 21-40 years and have A and B blood groups, and secondary education participants are more risk factor for microbial infections. This study highlights the necessity of creating a precise framework for blood donor monitoring. To assist maintain a sustained rise in the blood supply without endangering safety, young female donors should be encouraged to give blood.

Keywords: Viral hepatitis, AIDS, Syphilis, Blood donation, blood bank

Introduction

There is always an imperative to continue blood donation across the globe. The Ministry of Health notes that a 3% blood donor rate is perfect, but the World Health Organization (2010) suggests that at least 1% of people worldwide donate blood. In 2014, the percentage of blood donors was 1.73%; in 2015, it fell to 1.58%; and in 2022, it reached 1.4% (de Freitas *et al*., 2024) [9]. Blood donations in the nation fell by about 20% in 2020 as opposed to 2019 due to the detrimental effects of the coronavirus disease 2019 (COVID-19) pandemic (Pires Brito *et al*., 2020) [25].

Given that the blood supplies is plagued by chronic problems in a large number of nations, this is especially concerning in the current situation. Apart from the established issues with inadequate blood collection methods, restricted blood availability, and microbial diseases, these difficulties are likely to worsen as the demand for blood products rises as a result of a demographic shift in the general population.

The rise in donations of blood and the consumption of blood-related substances is attributed to factors such as longer life expectancies, persistent illnesses associated with aging, and the growing complexity of medicine with large-scale medical care and interventions, including transplantation, operations, oncological processes, and transfusions (Sayers, 2022) [31]. In other words, the old will require more blood. Thus, maintaining blood supply requires both attracting new donors and keeping those who have previously given. The only way to maintain blood supplies is through a steady stream of willing donors, as living donors are the sole supply of blood that can be collected (Jones *et al*., 2021) [15].

The fact that blood donations can spread a variety of viruses has become well acknowledged. The most prevalent ones are the human immunodeficiency virus (HIV), hepatitis B virus (HBV), and hepatitis C virus (HCV). Dangerous, persistent, and deadly illnesses are brought on by these bacteria. Infection with HIV, HBV, and HCV are serious public health concerns. Based on recent estimates, there are around 71 million HCV, 257 million HBV, and 36.9 million HIV infections globally (Belkacemi and Merbouh, 2023) [4]. Individuals who have HBV and/or HCV run the risk of developing problems such liver cirrhosis and cancer, which can cause them to become chronic. Worldwide, 1.4 million fatalities were attributed to HIV, viral hepatitis, and sexually transmitted illnesses in 2016 (Bhadoria *et al*., 2022) [5]. Therefore, patients, doctors, and legislators continue to have serious concerns about viruses that are spread through transfusions.

Syphilis is mostly spread via intercourse between individuals, but it can also spread via blood transfusions and parts of the blood from asymptomatic donors who are infected (Laperche *et al*., 2024) [19]. According to studies conducted in China, 0.33% of blood donors tested positive for syphilis (Chen *et al*., 2022) [7]. According to studies done in Iraq's Thi Qar City, 0.569% of blood donors tested positive for syphilis (Atiyah *et al*., 2023) [1].

Co-infections often define host connections that modify transmission and clinical development. Examples of these infections and illnesses of worldwide significance include

HIV, hepatitis viruses, TB, malaria, leishmaniasis, and dengue fever. When compared to infections by a single pathogen, there is usually a rise in mortality and disability (Oyinloye *et al*., 2024).

Treponema pallidum co-infection has increased in HIV-positive individuals in the past few years (Pati *et al*., 2023) [24].

Research has indicated a connection between HIV and certain sexually transmitted illnesses (STIs), which includes as syphilis and HBV (Tao *et al*., 2023) [32]. In sub-Saharan Africa (SSA), the incidence of co-infections with syphilis and HBV was found to be 13% and 10%, respectively (Getaneh *et al*., 2023) [10, 11]. Co-infections with syphilis and HBV can have serious consequences and result in a great deal of morbidity and death if they are not identified and treated promptly. There is a chance that co-infections with HBV and syphilis will raise plasma HIV-1 RNA levels (Omatola *et al*., 2019) [23]. Research conducted on individuals living with HIV who are on highly active antiretroviral therapy (HAART) suggests that co-infections with syphilis and HBV may affect treatment results, accelerate the development of the illness, and enhance death in PLHIV (Getaneh *et al*., 2023) [10, 11].

Aim of research

Due to lack studies about prevalence microbial infections among blood donors in Khanaqin city, our study aimed to detection of viral hepatitis B and C, acquired immunodeficiency syndrome (AIDS), syphilis, and Co-infections among serum of blood donors in this city.

Materials and Methods

Samples collection

The conducted investigation was happened in Khanaqin city/ Iraq on blood donors who visiting the main blood bank of diyala health department for period 1/6 to 30/7 -2024. 1500 blood samples were collected from those individuals for detection positivity of microbial infections (HCV, HBS, HIV, and *Treponema palladium).* Additionally, we used questioner for collect demographic features (age, gender, living, blood groups, occupation, social status, education level, smoking and alcohol use) in blood donors.

Methods

5 milliliters of blood were collected from every individual, and the blood was divided in gel tubes to generate serum. To create serum, human blood was drawn into gel tubes and spun at 5000 rpm for four minutes. Using the enzyme-linked immune-sorbent (ELISA) method to test every viral infection (HCV, HBS, and HIV) and *Treponema palladium* (Hightop/ China). The manufacturer's technique protocol, which was included in the kit packing, was followed for performing this test.

Statistical analysis

All variables were showed like frequencies and percentages. Pearson-Chi-square test was utilized to detect differences among percentages of all variables. Optimal significant level was *P≤0.05*. SPSS v. 23.0 and Excel 2013 were utilized analyze our data.

Results

1. Demographic features of participants

Results of conducted study showed the most blood donors were; males (78.0%) within age group 41-50 years (32.0%), live in urban (68.0%), blood groups A (36.0%) and O (34.0%), no employed (68.0%), singles (74.0%), secondary education level (56.0%), no smoking (80.0%) and no alcohol use (86.0%). The differences among percentages of all demographic features were significant (p<0.05), in except living and occupation (table 1).

Table 1: Frequency and percentage of demographic features of participants

		Count	Percent	P value
Age groups (years)	21-30	390	26.0%	p<0.05*
	31-40	360	24.0%	
	41-50	480	32.0%	
	51-60	180	12.0%	
	>60	90	6.0%	
Sex	Males	1170	78.0%	p<0.001***
	Females	330	22.0%	
Living	Urban	1020	68.0%	p>0.05
	Rural	480	32.0%	
Blood groups	A	540	36.0%	p<0.01**
	B	390	26.0%	
	O	510	34.0%	
	AB	60	4.0%	
Occupation	No employed	1020	68.0%	p>0.05
	Employed	480	32.0%	
Social status	Married	390	26.0%	p<0.001***
	Single	1110	74.0%	
Education level	No	90	6.0%	p<0.01**
	Primary	240	16.0%	
	Secondary	840	56.0%	
	Tertiary	330	22.0%	
Smoking	No	1200	80.0%	p<0.001***
	Yes	300	20.0%	
Alcohol use	No	1290	86.0%	p<0.001***
	Yes	210	14.0%	

P>0.05 (No significant differences)
P<0.05* (Significant differences)

2. Prevalence microbial infection among blood donors

Our outcomes showed the positivity of microbial infections in blood donors were as following; HCV (0.4%), HBV (1.7%), HIV (0.1%), TP (1.3%), and co-infection (0.3%) with significant differences (p<0.05) among percentages of positivity of microbial infections (table 2).

Table 2: Frequency and percentage of positivity of microbial infection among blood donors

Microbial infections	Results	Count	Percent	P value
HCV	Positive	6	0.4%	P<0.001***
	Negative	1494	99.6%	
HBS	Positive	25	1.7%	P<0.001***
	Negative	1475	98.3%	
HIV	Positive	2	0.1%	P<0.001***
	Negative	1498	99.9%	
TP	Positive	19	1.3%	P<0.001***
	Negative	1481	98.7%	
Co-infection*	Positive	5	0.3%	P<0.001***
	Negative	1495	99.7%	
P value		P<0.001***		

P>0.05 (No significant differences)
P<0.05* (Significant differences)
*Co-infection (HBVand TP)

3. Microbial infections and demographic features of participants

Results of current study showed the age group 21-30 years scored highest infection with HBV (40.0%), 31-40-year

highest infection with HCV (66.7%), 41-50 years highest infection with TP (52.6%), HIV scored equal percentages in 21-30 years (50.0%) and 31-40 year (50.0%), Co-infection scored equal percentages in 51-60 years (40.0%) and >60 year (40.0%). The differences between microbial infections and age groups were significant (p<0.05).

Respect to gender, our study showed most infections in males; HCV (83.3%), HBV (84.0%), TP (73.7%), and Co-infection (80.0%). On other hand, the positivity of HIV was equal in males (50.0%) and females (50.0%). The differences between all microbial infections and gender were significant (p<0.05), in exception was no significant (p>0.05).

Finally, our findings showed the most donors with HIV infection were living in urban (73.7%) than rural (26.3%) with significant different (p<0.05). In contrast, the relation of HCV, HBS, TP and Co-infection were no significant (p>0.05) (table 3).

Table 3: Relation of positivity of microbial infection with age, gender and live features of blood donors

			HCV	HBS	HIV	TP	Co-infection
Age groups (years)	21-30	N	1	10	1	2	1
		%	16.7%	40.0%	50.0%	10.5%	20.0%
	31-40	N	4	6	1	1	0
		%	66.7%	24.0%	50.0%	5.3%	0.0%
	41-50	N	1	5	0	10	0
		%	16.7%	20.0%	0.0%	52.6%	0.0%
	51-60	N	0	3	0	4	2
		%	0.0%	12.0%	0.0%	21.1%	40.0%
	>60	N	0	1	0	2	2
		%	0.0%	4.0%	0.0%	10.5%	40.0%
P value			p<0.001***	p<0.01**	1.00	p<0.001***	p>0.05
Sex	Males	N	5	21	1	14	4
		%	83.3%	84.0%	50.0%	73.7%	80.0%
	Females	N	1	4	1	5	1
		%	16.7%	16.0%	50.0%	26.3%	20.0%
P value			p<0.001***	p<0.001***	1.00	p<0.001***	p<0.001***
Live	Urban	N	2	17	2	14	5
		%	33.3%	68.0%	100.0%	73.7%	100.0%
	Rural	N	4	8	0	5	0
		%	66.7%	32.0%	0.0%	26.3%	0.0%
P value			p>0.05	p>0.05	1.00	p<0.001***	1.00

P>0.05 (No significant differences)
P<0.05* (Significant differences)

Results of current study showed the blood group A scored highest infection with HBV (40.0%) and HCV (50.0%), B group scored highest infection with Co-infection (60.0%), HIV scored equal percentages in A (50.0%) and B (50.0%), Co-infection scored equal percentages in B (36.8%) and O (36.8%). The differences between microbial infections and blood groups were significant (p<0.05), in exception, HIV no showed significant different (p>0.05) with blood groups (table 4).

Table 4: Relation of positivity of microbial infection with blood groups of blood donors

			HCV	HBS	HIV	TP	Co-infection
Blood groups	A	N	3	10	1	5	1
		%	50.0%	40.0%	50.0%	26.3%	20.0%
	B	N	1	5	1	7	3
		%	16.7%	20.0%	50.0%	36.8%	60.0%
	O	N	1	9	0	7	0
		%	16.7%	36.0%	0.0%	36.8%	0.0%
	AB	N	1	1	0	0	1
		%	16.7%	4.0%	0.0%	0.0%	20.0%
P value			p<0.001***	p<0.05*	1.00	p<0.05*	p>0.05

P>0.05 (No significant differences)
P<0.05* (Significant differences)

Respect to occupation, our study showed most infections with TP and Co-infection were in no employed donors (73.7% and 80.0%) than employed (26.3% and 20.0%) with significant different (p<0.05). In contrast, our results not showed significant differences (p>0.05) between HCV, HBS, HIV infections and occupation of donors.

Based on social status, our study showed most infections with HCV and HBVwere singles donors (83.3% and 76.0%) than married (16.7% and 24.0%) with significant different (p<0.05). In contrast, current results not showed significant differences (p>0.05) between HIV, TP, Co-infection infections and social status of donors.

Finally, depend on education level, our study showed most infections with HCV, HBVand TP were in donors with secondary singles education level (50.0%, 44.0% and 73.7%) than other education levels with significant different (p<0.05). In contrast, current results not showed significant differences (p>0.05) between HIV and Co-infection infections with education level of donors (table 5).

Table 5: Relation of positivity of microbial infection with education, social status and occupation features of blood donors

			HCV	HBS	HIV	TP	Co-infection
Occupation	No employed	N	4	16	2	14	4
		%	66.7%	64.0%	100.0%	73.7%	80.0%
	employed	N	2	9	0	5	1
		%	33.3%	36.0%	0.0%	26.3%	20.0%
P value			p>0.05	p>0.05	1.00	p<0.001***	p<0.001***
Social status	Married	N	1	6	0	7	2
		%	16.7%	24.0%	0.0%	36.8%	40.0%
	Single	N	5	19	2	12	3
		%	83.3%	76.0%	100.0%	63.2%	60.0%
P value			p<0.001***	p<0.001***	1.00	p>0.05	p>0.05
Education level	No	N	1	2	0	0	0
		%	16.7%	8.0%	0.0%	0.0%	0.0%
	Primary	N	2	5	0	1	0
		%	33.3%	20.0%	0.0%	5.3%	0.0%
	Secondary	N	3	11	1	14	3
		%	50.0%	44.0%	50.0%	73.7%	60.0%
	Tertiary	N	0	7	1	4	2
		%	0.0%	28.0%	50.0%	21.1%	40.0%
P value			p<0.05*	p<0.05*	1.00	p<0.001***	p>0.05

P>0.05 (No significant differences)
P<0.05* (Significant differences)

Our study showed most infections with HBS, TP and Co-infection were in no smoking donors (72.0%, 84.2% and 80.0%) than smokers (28.0%, 15.8% and 20.0%) with significant different (p<0.05). In contrast, our results not showed significant differences (p>0.05) between HCV and HIV infections with smoking of donors.

Based on alcohol use, the current study showed most infections with HCV, HBVand TP were in no alcohol use by donors (83.3%, 80.0% and 94.7%) than alcohol use by donors (16.7%, 20.0% and 5.3%) with significant different (p<0.05). In contrast, our results not showed significant differences (p>0.05) between Co-infection and HIV infections with alcohol use of donors.

Discussion

The aim of current study is studying the socio-demographic features and microbial infection in blood donors that visit blood bank in Khanaqin city/ Diyala province. de Freitas *et al*., (2024) [9] showed the most blood donors were males (67.7%) with age group >30 years, secondary education (52.3%) and have A and O blood group (33.21% and 37.21%). These findings were matched with present research Another study by Graobe *et al*., (2023) [12] showed the most blood donors were workers with blood group O, and these findings were not compatible to our study that showed most participants were educated with A blood groups. The differences among studies were related to sample size, research place and health awareness. Similar findings were reported by Oliveira *et al*. (2022) [22] whose study revealed that men had been more common to donate blood in Brazil. Several explanations have been offered for the low rate of female donation, such as unpaid bleeding from giving birth and lactation, as well as predonation short-term deferral owing to hemorrhage caused by cycles of menstruation Superstition and socioeconomic circumstances also influence female participation (Oliveira *et al*., 2022) [22].

In terms of age, those who were 30 years of age or older had a higher likelihood of donating blood than those who were younger. This data would suggest that in order to maintain a steady supply of blood over time, efforts should be focused on increasing awareness and encouraging women and young people to donate regularly. In this regard, social media platforms, as well as participating in activities within educational settings and having school groups visit them as part of hemotherapy treatments, might be options for youth (Graobe *et al*., 2023) [12].

Quader, (2021) [27] showed no differences in blood groups, living, occupation, social status and educational levels among blood donors, and these outcomes no matched with our study that showed the most blood donors were singles with A blood group and have secondary educational levels. The causes of these differences is related to sample size and geographic site of research.

Kjerulff *et al*., (2023) [17] showed the most blood donors were non-smokers, and these findings were agree with our investigation. Since donors of blood are required to be in good health at the moment of donation, they are often in better health than people in general. Few donors (2.9%) were inevitably disqualified due to comorbidities. Smoke-related illnesses may make people less inclined to start or continue smoking. The choice bias associated with the good employee impact is reflected in the good smoker effect (Brodersen *et al*., 2023) [6].

Our study showed the most blood donors were no smokers, and these findings were compatible to results Brodersen *et al*., (2023) [6]. Anemia may arise from the abnormal red blood cells that are regularly destroyed too soon in alcoholics. Additionally, alcohol affects white blood cell formation and functioning, particularly those cells that protect the body from bacterial invasion (Ballard *et al*., 1997) [3]. On the other hand, a prior research (D'Alessandro *et al*., 2020) [8] shown that indicators of alcohol intake are linked to a rise in oxidant distress and reduction in energy metabolism, but they have no appreciable effect on hemolytic indicators in preserved red blood cells from normal donor volunteers (Table 1).

With roughly 119 million donations of blood received globally each year and around five million Individuals needing blood transfusions every year, transfusion-transmitted illnesses are a major issue in the medical profession. Provided blood products continue to be a

possible source of bacterial, viral, and parasite transmission even with improvements in testing techniques (Kim and Ko, 2024 [16] Hepatitis is characterized as a disease of the liver's cells which can be brought on by a number of conditions, including autoimmune diseases, high alcohol consumption, medicines, or poisons. That being said, "viral hepatitis"—a viral infection—is the most common cause of hepatitis. Hepatitis A, B, and C are the three strains of viral hepatitis that are most prevalent in the US. Less often occurring forms of viral hepatitis include hepatitis D and E (Pisano *et al*., 2021) [26]. *T. pallidum* is the primary cause of the transmissible sexual illness syphilis. Additionally, infusions of blood can spread it. If therapy is not received, the condition can lead to potentially catastrophic consequences including as impairment to the brain, bones, and eyes (Sankaran *et al*., 2023) [29]. According to a new study, there are notable variations in the frequency of syphilis among different demographic data groups among those who donate blood in the Iraqi population. According to the study, diseased blood donors had a robust cell-based immune response marked by elevated gamma interferon levels (Atiyah *et al*., 2023) [1].

In the present study, blood donors screened, (1.7%) were positive for HBVAg, (0.4%) for HCV, (0.1%) for HIV, (1.3%) for TP, and (0.03%) for co-infection (HBVand TP). These findings were lowest compared to results Xie *et al*., (2015) [33] in Guinea that showed the positivity of HIV, HBV, HCV, *T. pallidum* and co-infection (HBVand TP) in blood donors were 7.83%, 10.01%, 3.71%, 21.51%, and 5.28% respectively. In Pakistan, Jehangir *et al*., (2023) [14] showed (4.5%, 4.07 and 0.0%) of blood donors were positive for HBV, HCV and HIV infection. In Africa, Quintas *et al*., (2024) [28] showed (2.66%) of blood donors were positive for HIV. In Iraq/Basrah, authors showed the prevalence rates of seropositive of viral hepatitis in blood donors were as following: hepatitis B virus (HBV) (1.14%), anti-HCV (0.11%) and syphilis (TP) (0.36%). The differences among studies is related to sample size, test method, social culture and health awareness.

Recent research revealed that the viral hepatitis control strategies were ineffective. To guarantee the early detection of HBV in Angola, regulators should think about using HBV nucleic acid tests in along with liver function indicators, as serological approaches might not be the best for recognition (Jandondo *et al*., 2024) [13].

According to earlier findings, Chinese blood banks should increase the number of qualified new donors who become repeated donors and convert "real family or substitute donors" into volunteer person blood donors in order to lower the danger of HCV being spread through transfusions (Zhou *et al*., 2023) [34].

Because most individuals are committed to using preventative measures against microorganisms, we have observed a decline in the positive of microbial illnesses among individuals who donate blood over time. As a result, infections caused by microbes have decreased among the majority of the general population. Our findings show that screening prior to marriage might be considered an instance of diagnosis, vaccination, and participation in care for individuals in need, even in cases where viral hepatitis incidence rates did not appear concerning. With this data, national hepatitis programmes may create policy changes that will lessen the harm that these diseases do to the general public.

Due to *Treponema pallidum*'s function in lowering immune system function, an earlier investigation found that infection with the parasite predicts pregnancy-related STDs, including hepatitis B virus, herpes simplex virus-2, and human immunodeficiency virus (Ng'wamkai *et al*., 2019) [21]. According to a different research, the burden of co-infections between syphilis and HBV is substantial, especially in males and adolescents who suffer from HIV, and these co-infections impair virologic and immunological outcomes in Ethiopia. Accordingly, the initiative will improve syphilis and HBV testing as well as treatment (Getaneh *et al*., 2023) [10, 11].

According to earlier research, the frequency of syphilis and HIV in adults may be linked to the reality that male adult in the Baghdad community move farther, have more illegal sex, and have sex with their spouses. argues that some adolescents don't obtain the necessary STD testing, and several are uncomfortable discussing their sex lives with nurses or physicians directly, which may make certain young adults more vulnerable to STDs. Additionally, women who participate in hazardous behaviour and seek HIV screening and counselling services—especially those surviving with HIV—tend to misunderstand the societal stigma that restricts them since the Baghdadi society is a more traditional society (Mohammed and Haider, 2023) [20].

In order to better understand transfusions hazards and enhance donor recruiting tactics to stop the propagation of infectious illnesses, it is crucial to continuously track the prevalence of transfusion infection among blood donors. As a result, strict donor choice is necessary for all blood banks in order to ensure blood security. This includes finding random donors and ensuring that donor blood for syphilis and HIV is included using accepted techniques.

The researchers noted that co-infection between HIV and HBV was common among those who donated blood. Among young males between the ages of 18 and 25, it occurs far more frequently. An increased incidence of co-infection between HBV-HCV and HIV-HBV among rhesus-negative blood donors was observed. Furthermore, no co-infection between TP and HBVwas discovered (Konaté *et al*., 2023) [18]. Our investigation, which demonstrated co-infection between TP and HBVin blood donors, did not concur with these results (Table 2).

The research team demonstrated that there was no significant correlation between age and educational attainment and the infections of syphilis, HBV, HCV, or HIV. The truth is that there was no discernible statistical difference between the people in the various age groups. Regarding educational attainment, those with informal schooling had a larger likelihood of having the aforementioned infection as compared to those with more advanced education levels. One possible explanation for this might be that individuals with higher levels of education are more adept at comprehending and implementing sensitizations (Graobe *et al*., 2023) [12].

A prior investigation discovered that a number of donor-related characteristics had no effect on the incidence of viral markers (HCV, HBV, and HIV) in blood donated by donors. These variables include blood types Rhesus and ABO, age, gender, donor status, frequency, type, and location of blood donations (Belkacemi and Merbouh, 2023) [4]. These findings are at odds with those of our investigation, which

showed that the frequency was greater in men over the age of 20. The low incidence of viral biomarkers in this investigation could be a reason for that absence of correlation seen between blood-borne viral infections and the donors' demographics. This could be the result of people's self-reported knowledge about local illnesses.

According to a new study, men in the age range of 20 to 40 who reside in cities, have poor levels of education, are unmarried, and are not working are the majority of blood donors who have HBV infection (Kim and Ko, 2024) [16]. Our research's results aligned with these conclusions. Even though there was minimal statistical power found, these results imply that strategies like mass vaccination drives and awareness-raising should target these susceptible populations in order to stop the spread of HBV in Angola.

Men who have sex with men (MSMs) and, more broadly, people who participate in informal sexual activity continued to have syphilis (alone or as co-infection with HIV), as evidenced by prior findings on blood donors (Pati *et al*., 2023) [24]. It's possible that pre-exposure prophylaxis and antiretroviral therapy contributed to the propagation of STDs. The information above demonstrated that as age increases, the likelihood of HIV/*TP. pallidum* declines. This additionally demonstrates that the probability of STDs, including HIV and *T. pallidum*, is significantly greater in youngsters. As a result, increased focus should be placed on raising knowledge regarding STDs and their role in the transmission/acquisition of HIV and *T. pallidum*, especially among youthful donors (Pati *et al*., 2023) [24] (Tables 3, 4, 5).

Prior research has demonstrated a persistent negative correlation between tobacco and HIV RNA control, preservation, and connection to care. A relationship between excessive alcohol consumption and tobacco was shown to have an insignificant negative impact on linkage to care. However, excessive alcohol consumption had no appreciable impacts on its own. Results encourage efforts to enhance connection to HIV medical care for recently discovered people with HIV (PWH) who reveal using cigarettes and hazardous consumption of alcohol, as well as establishing smoking cessation therapy for all PWH across the spectrum of care, even though scientists were unable to determine causal relationships (Satre *et al*., 2021) [30]. Another investigation found that up to one in three individuals who use crack cocaine (PWUCC) who have been confirmed to have syphilis also had co-infections with HIV-1, HBV, or HCV. The study also revealed that the positive rate for syphilis was 29%. Among those individuals, condom-free sex, consumption of drugs, poverty, lack of schooling, long history of sex work, and limited access to medical treatment were risk factors linked to syphilis (Baia *et al*., 2023) (Table 6).

Conclusions

Present study showed the hepatitis B and syphilis infections scored high prevalence among blood donors, while AIDS scored lowered incidence. Singles males within 21-40 years and have A and B blood groups, and secondary education participants are more risk factor for microbial infections. This study highlights the necessity of creating a precise framework for blood donor monitoring. To assist maintain a sustained rise in the blood supply without endangering safety, young female donors should be encouraged to give blood.

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