



SEROPREVALENCE OF TRANSFUSION TRANSMITTED INFECTIONS AMONG BLOOD DONORS AT TERTIARY CARE HOSPITAL OF SOUTHERN ODISHA

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ABSTRACT

Background

Blood transfusion service is crucial for saving lives but can also pose a life-threatening risk. Sero prevalence of transfusion transmitted infections (TTI) are crucial for determining the safety of blood and blood product and to provide safe and risk free blood to the recipients.

Aims & Objective

The study aimed to estimate TTI risk and trends over five years, evaluating the safeness of blood supply and effectiveness of TTI screening.

Method

A retrospective study was undertaken to determine the seroprevalence of TTI among the blood donors who donated blood at Odisha Blood Centre, Maharaja Krushna Chandra Gajapati Medical College & Hospital, Berhampur, between January 2019 and December 2023. Each blood unit was tested by ELISA method for HIV, Hepatitis B and Hepatitis C virus. Non-reactive units are further subjected to NAT test. Syphilis and Malaria was tested by antigen rapid diagnostic test. All reactive blood units were discarded as per standard operating system of blood centre. This information was extracted from the data base of blood centre.

Results

The study comprised of a total blood donation of 142366 blood donors during the five-years period. The overall seroprevalence rate was 2.17%. The seroprevalence rate of HIV was 0.092%, that of HBV was 1.99%, HCV was 0.066%, Syphilis was 0.22% and Malaria was 0.005% among all the blood donors who showed reactivity for TTI during the five-year period.

Conclusion

There is a need to increase public awareness regarding voluntary donation and its benefits. Adaptation of other newer techniques to detect TTIs as Nucleic acid amplification test (NAT) and Chemiluminescence assay (CLIA) for all viral borne diseases like HBV, HCV, and HIV, CLIA and multiplex flow immunoassay for detecting Syphilis and Enzyme immunoassays (EIA) to detect Malaria along with conventional testing methods. Thorough meticulous screening of blood donors, the implementation of advanced methods for identifying TTIs, stringent post donation counselling and notification with further follow up are strongly advised to guarantee the safety of blood for recipients.

Keywords: transfusion transmitted infections (TTI), hepatitis B virus (HBV), Human Immunodeficiency Virus (HIV).

INTRODUCTION

Blood transfusion services (BTS) plays a vital role in healthcare, as it rescue many lives annually in different circumstances, assist in intricate medical and surgical procedures, and greatly enhance both the quality and longevity of life for individuals with acute and chronic illnesses. BTS aims to provide ample, safe, low-risk, or risk-free blood and blood components to the needy. Each blood transfusion unit carries a 1% risk of noninfectious and infectious complications, including Transfusion-transmitted infections (TTIs).^[1] To prevent the spread of TTIs through blood transfusion, the Government of India has made it mandatory to screen donated blood for hepatitis B virus (HBV) since 1971, Human Immunodeficiency Virus (HIV) since 1989, and hepatitis C virus (HCV) since 2001, along with syphilis and malaria, considering the endemicity of the diseases.^[2]

Meticulous selection of donors is essential to guarantee blood safety and avoid collecting blood from individuals who could be carriers of infectious agents, thereby reducing the risk of (TTIs). Immuno-Chromatographic Assay (ICA) or rapid tests, Enzyme-Linked Immuno-Sorbent Assay (ELISA), and Chemiluminescence Immuno-Assay (CLIA) are routinely used for TTI screening of donated blood in India. Currently, Nucleic Acid Amplification Technologies (NAT) are employed in many blood centers to identify TTIs such as HIV, HBV, and HCV allowing for earlier detection during the progression of infection and decreasing the window period of the disease.^[3] NAT detects targeted nucleic acid sequences in a sample with high sensitivity and specificity. NAT is used for screening blood donations for viruses and parasites globally, reducing the risk of transfusion-transmitted infectious diseases (TTIDs) and thereby providing an additional layer of blood safety.^[4]

Assessments of TTI are crucial for determining the safety of blood supply and tracking the effectiveness of the screening methods currently in use. This retrospective study aims to assess the seroprevalence of TTIs in blood donors from Southern Odisha through detailed serological testing and analysis. By examining the occurrence and distribution of these infections, this study intends to offer significant insights into the present level of blood safety and aid in creating strategies for enhancing donor screening and infection prevention methods. This study also determines the prevalence of TTI among healthy blood donors and the changing trends in TTI among blood donors at Maharaja Krushna Chandra Gajapati Medical College and Hospital, Berhampur, (MKCG MCH) Odisha Blood Center. This seroprevalence study enhances the safety and efficacy of BTS, ensuring that donated blood is as free from infectious risks as far as possible.

MATERIALS AND METHODS

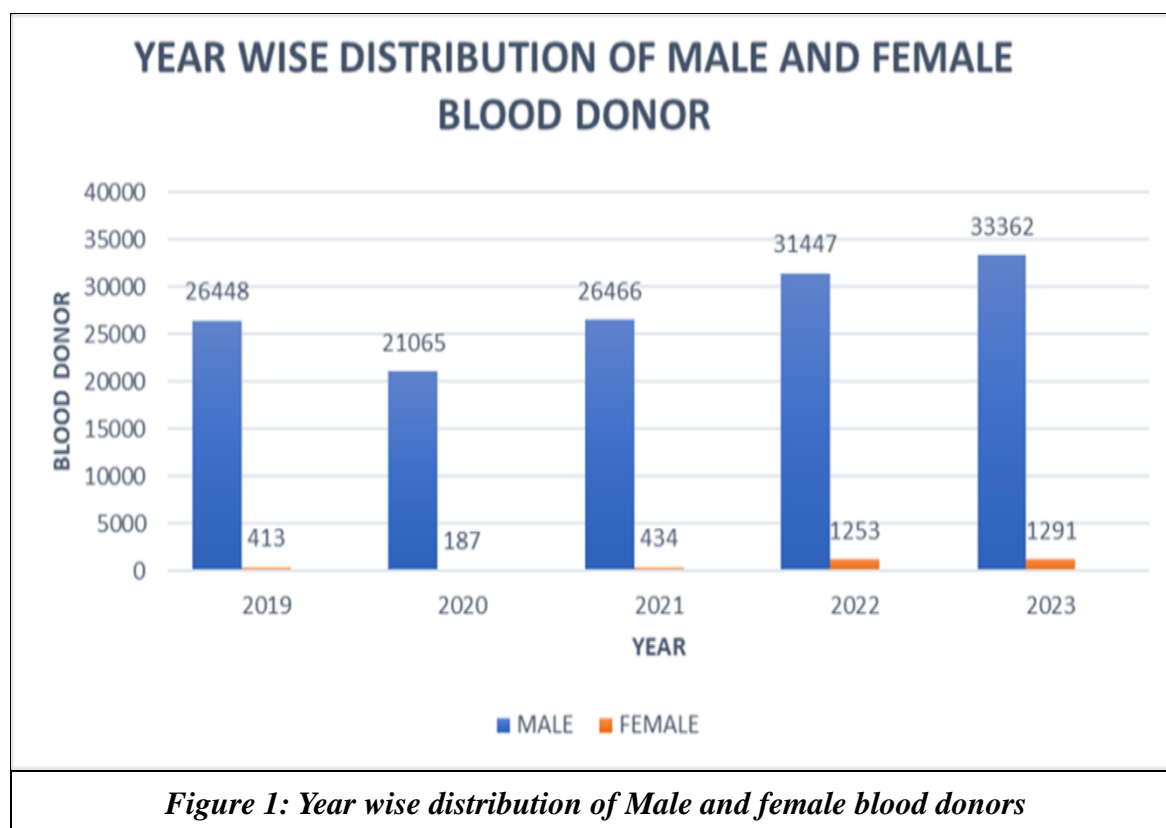
It was a retrospective study conducted in the Odisha Blood Centre of Maharaja Krushna Chandra Gajapati Medical College and Hospital in Southern Odisha, India. The study was carried out using the blood center database. Before the study, ethical clearance was taken from the ethical committee of MKCG MCH vide No.025/Chairman-IEC, M.K.C.G. Medical College, Berhampur-4. Blood

donors were selected and screened as per the Standard Operative Procedures (SOPs) of the Odisha Blood Center MKGC MCH Berhampur. Serum samples were screened for Hepatitis-B Surface Antigen (HBsAg), antibodies to HIV Type 1 and 2, and HCV using ELISA with the fourth and third-generation Kits respectively. Syphilis and Malaria were tested using rapid test kits. ELISA non-reactive samples were subjected to NAT for further screening for viral TTIs like HIV, HBV, and HCV in our blood center.

The sample size included blood donors from January 2018 to December 2023 (142366). The data concerning the screening test results were obtained from the MKCG MCH Odisha Blood Center's blood center register/records.

RESULTS

This study reflected the sero prevalence of transfusion-transmissible infections in the blood donors of MKCG MCH Berhampur, which is one of the leading medical colleges in Southern part of Odisha. Out of the total 142366 blood donors, 138788 (97.49%) were males and 3578 (2.51%) were females. Males outnumbered females in our study. The smaller number of female donors 3578 (2.51%) in the study could be due to the highest number of deferrals among Indian female donors because of the high prevalence of anemia and underweight, less awareness, and low education levels. There has been increased in number of female donors slightly after Covid era i.e. from 187(0.88%) in 2020 to 1291 (3.73%) in 2023. The number of male donors in our study is 138788 (97.49%) which has been more or less constant over the period i.e. in 2019, 26448 (98.46%), in 2020, 31447 (99.12%), in 2021, 26466 (98.39%), in 2022, 31447 (96.17%) and in 2023, 33362 (96.27%) [Fig.-1]



In this study out of the total 142366 numbers of blood donors, 80291(56.4 %) were voluntary, and 62075 (43.6 %) were replacement donors. Slightly increase voluntary donation from 13881(51.68%) in 2019 to 19088 (57.13%) in 2023. [Table 1]

Year	2019	2020	2021	2022	2023	Total
Voluntary (%)	13881 (51.68%)	11787 (55.46%)	15739 (58.51%)	19088 (58.37%)	19796 (57.13 %)	80291 (56.4%)
Replacement (%)	12980 (48.32%)	9465 (44.54%)	11161 (41.49%)	13612 (41.63%)	14857 (42.87%)	62075 (43.6%)
Total	26861	21252	26900	32700	34653	142366

Table 1: Year Wise distribution of voluntary and replacement blood donation

Among all blood donors depicting a line graph [Fig 2] indicating the numbers of blood donors based on gender and type of donation as voluntary or replacement.

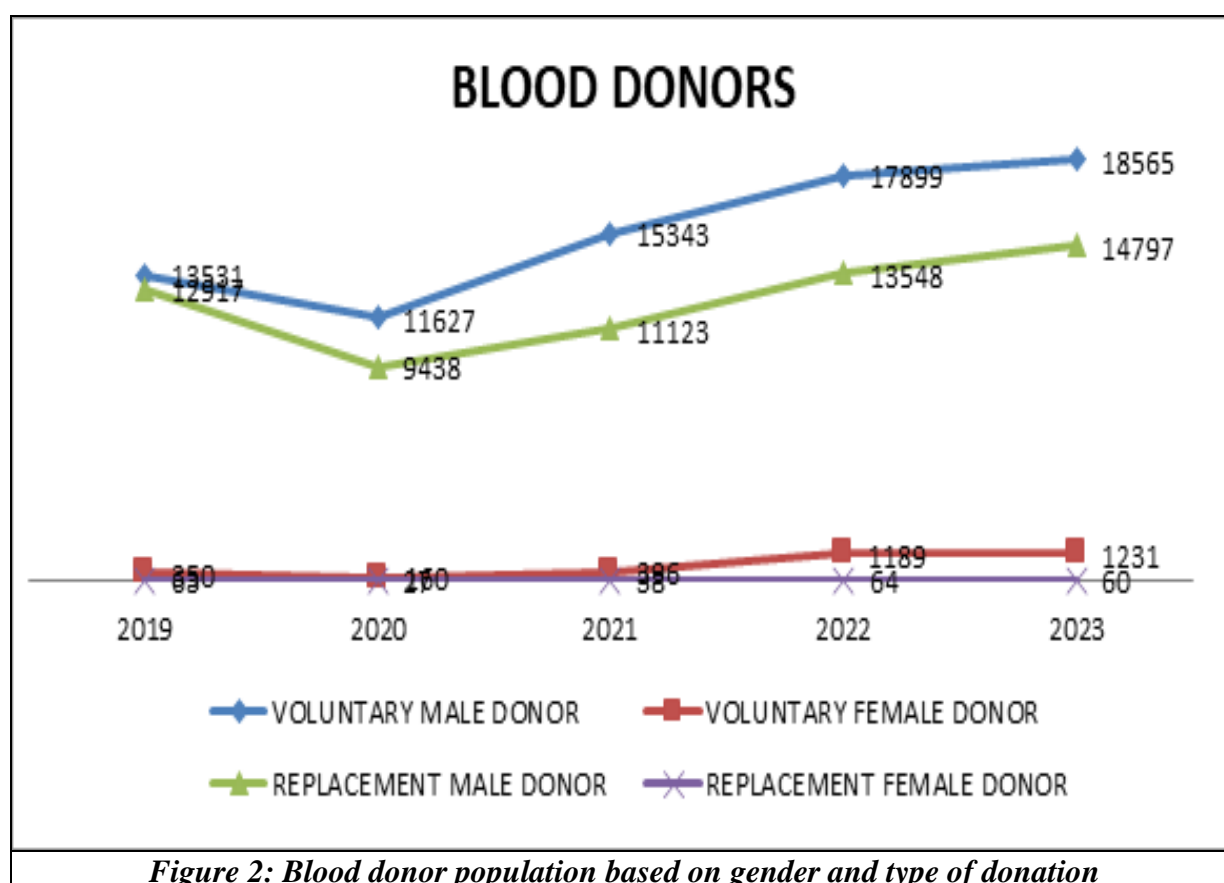


Figure 2: Blood donor population based on gender and type of donation

The year-wise prevalence of different TTIs among blood donors is depicted in [Table-2]. The overall TTI occurrence was as follows: HBV 2838 (1.993%), HIV 131 (0.092%), HCV 94 (0.066 %), Syphilis 31 (0.022%), and Malaria 7 (0.005%) out of total the blood donors during the study period.

The overall seroprevalence of various TTIs among apparently healthy blood donors is 3101 (2.178 %) blood donors. There has been growing trends in seroprevalence of HBV from 1.760 % in 2020 to 2.141 % in 2023. Similarly, the seroprevalence of HCV among donor population is increasing 0.042 % in 2020 to 0.104 % in 2023. However there has been decline in seroprevalence of HIV from 0.123 % in 2021 to 0.078 % in 2023. But again Syphilis is a matter of concern showing an elevated seroprevalence from 0.011 % in 2019 to 0.03 % in 2023. Malaria remains constant on average at 0.005% among blood donor population.

Year	Total Collection	HBV (%)	HIV (%)	HCV (%)	Syphilis (%)	Malaria (%)	Total TTI (%)
2019	26861	626 (2.331%)	30 (0.112%)	24 (0.089%)	3 (0.011%)	1 (0.004%)	684 (2.546%)
2020	21252	374 (1.760%)	20 (0.094%)	9 (0.042%)	1 (0.005%)	1 (0.005%)	405 (1.906%)
2021	26900	505 (1.877%)	33 (0.123%)	13 (0.048%)	14 (0.052%)	2 (0.007%)	567 (2.108%)
2022	32700	591 (1.807%)	21 (0.064%)	12 (0.037%)	0 (0%)	0 (0%)	624 (1.908%)
2023	34653	742 (2.141%)	27 (0.078%)	36 (0.104%)	13 (0.038%)	3 (0.009%)	821 (2.369%)
Total 5 Yr Collection	142366	2838 (1.993%)	131 (0.092%)	94 (0.066%)	31 (0.022%)	7 (0.005%)	3101 (2.178%)

Table 2: Year-wise prevalence of different TTIs among blood donors

DISCUSSION

TTIs pose a significant risk to the safety of recipients of blood and blood components, as well as to the broader community, which is a matter of genuine concern. The presence of HBV, HCV, and HIV in healthy donors highlights the seriousness of the disease and serves as a warning sign for the region. Most common TTI in India are HBV, HCV, HIV, Syphilis and Malaria. and other diseases like Chagas disease, HTLV and Cytomegalovirus can be transmitted through blood [5]. The prevalence of TTIs among the Indian blood donors is reported to be ranging as follows; HBV 0.66% to 12%, HCV 0.5% to 1.5%, HIV 0.084% to 3.87%, and syphilis 0.85% to 3% respectively.^[6]

The aim of this study was to evaluate the seroprevalence of TTIs, such as HIV, HBV, HCV, Syphilis, and Malaria among blood donors in the southern region of Odisha, encompassing both voluntary and replacement donors in a retrospective manner. In the present study majority of blood donors were male, accounting for 97.49%, while females represented 2.51% which is comparable to the studies done by others Pallavi P et al,^[7] Varma, et al.^[8] and Garg S et al.^[9] have similar male prevalence as compared to our study as 97.84%, 97.72% and 97.75% respectively. Anemia and underweight were responsible for deferral among potential female donors. Poor venous access and higher frequency of vasovagal reactions also significantly contributed to deferral in females.^[10] This problem can be resolved by creating awareness and imparting knowledge about the importance of eating a good diet, particularly during adolescence, pregnancy, and the postpartum stage, with the aim to prevent anemia and low weight and to provide psychological support for maintaining of a healthy female pool. Repeated counseling sessions aimed at educating women, particularly in blood donation camps, could decrease female deferral and improve the pool of potential female blood donors. One of the study by Ray Karmakar, et al.^[11] female blood donor were 15% and Mandal R. et al.^[12] 10.04% females constituted the study population, which was much higher in comparison with present study i.e.2.51%. At present slightly increasing trend was seen from 2020(0.88%)to 2023 (3.73%) as there was more use of social media and internet to increase awareness during Covid era.

A very selective group of people who are motivated to accomplish good deeds are voluntary blood donors. In the present study, the voluntary blood donors constituted for 56.39% and the remaining 43.61% were replacement donor [Table-3].

The safest blood donors are voluntary, nonremunerated blood donors, who poses low-risk for TTIs. Voluntary blood donors play a very important role as they can be considered as a cornerstone for a safe and adequate supply of blood and products.^[13] Family/replacement donors are those who give blood when it is required by a member of their own family or community.^[14] In this present study minor increasing trend was seen in voluntary blood donors from 2019 (51.68%) to 2023 (56.39%). Higher numbers of voluntary donor populations were seen in a study by Ray Karmakar, et al.^[11] 93.47% , Garg S et al.[9] 86.71% , and a higher replacement donor population were taken by Mukherjee S et al^[15] 97.3% which was much higher in comparison with the present study.

Year	2019	2020	2021	2022	2023	TOTAL
Voluntary Donor	13881 (51.68%)	11787 (55.46%)	15739 (58.51%)	19088 (58.37%)	19796 (57.13%)	80291 (56.39%)
Replacement Donor	12980(48.32%)	9465 (44.54%)	11161 (41.49%)	13612 (41.63%)	14857 (42.87%)	62075 (43.61%)
Total Blood Donation	26861	21252	26900	32700	34653	142366

Table 3: Year-wise voluntary and replacement blood donors

In this present study, TTI reactive voluntary blood donors and replacement blood donors were nearly equal 51% and 49% in [Fig-3]. In comparison to other studies, reactivity among replacement donors were high as in Shrivastava et al.^[16] where they found seroprevalence rate of TTI was higher (3.8%) in replacement donations, in comparison to voluntary blood donors (2.3%).

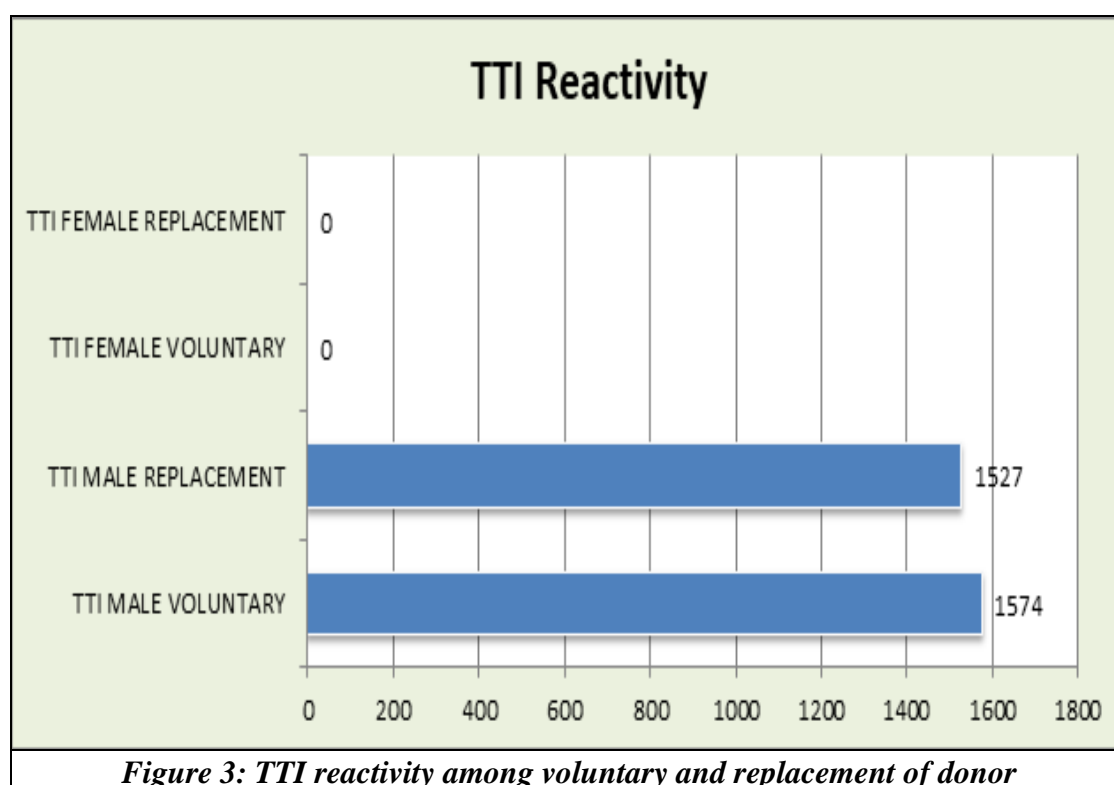


Figure 3: TTI reactivity among voluntary and replacement of donor

In Nilam Hardik Patel et al.,^[17] study the seropositivity for TTI were only in male replacement donors (100%). Individuals who replace blood donors might be engaged in risky behaviors and have

health concerns. They are encouraged to donate blood in order to ensure their patients receive the necessary supply. This present study have total seroprevalence of 3107 reactive TTIs, among there are 1574 (51%) among voluntary blood donors. This highlights the necessity for effective information, education, and communication (IEC) programs through public awareness initiatives, behavior change education program for blood donors, and improved screening processes for all blood donors to ensure that, they are free from these infections. In the present study no female voluntary or replacement donor found seropositive for TTIs [Fig.3.] as similar to Nilam Hardik Patel et al.^[17]

This present study has highest seroprevalence 1.99% of HBV among blood donors. Similar high seroprevalence rate seen in Pallavi P et al.,^[7] (1.27%), Negi G et al.,^[18] (1.29%) Shrivastava, et al.,^[16] (1.8%), Srikrishna et al.^[19] (1.86%) and Chandra et al.^[20] (1.96%) among all TTI prevalence. In some study by Buseri FI et al.^[21] (8.1%) and Terenpuntsag B et al.^[22] (8.1%) where seroprevalence much higher than our study. Another study by Adhikary, et al.^[23] Dhanashree P Inamdar et al.^[24] and Mahapatra S et al.^[25] where seroprevalence were in lower side as 0.28% ,0.42% and 0.5% respectively . Based on the prevalence of Hepatitis B surface antigen, different areas of the world are classified as high ($\geq 8\%$), intermediate (2-7%) or low HBV endemicity. India falls under the category of intermediate endemicity zone (average of 4%). Hepatitis B surface antigen (HBsAg) positivity in the general population ranges from 1.1% to 12.2%, with an average prevalence of 3-4%. Ensuring availability of safe blood and blood products is one of the critical interventions for reducing transmission. One of the ways to ensure safety of blood & blood products is by increasing voluntary blood donations (100%).^[26]

With around 24.67 lakh (20.84-29.52 lakh) people living with HIV (PLHA), India has the second largest HIV epidemic in the world, accounting for around 6.3% of all PLHA worldwide.^[27] In this present study prevalence HIV among blood donors is 0.09% which is quite low in comparison to other studies like Deshmukh S et al.(0.19%)^[28] Negi G et al.,^[18] (0.29%), Mandal R. et al.^[12] (0.42%), and Ray Karmakar, et al.^[11] (0.6%), of HIV prevalence among blood donors . In some of the studies prevalence of HIV reactivity is much lower than Indian blood donors (HIV 0.084% to 3.87%)^[6] as in Adhikary et al.^[23] (0.01%), Cheema et al.^[29] (0.03%) and in comparison to current study. The rate of HCV found in this study is 0.021%, which aligns with the lower seropositivity results reported by Dhanashree P Inamdar et al.^[24] (0.01%), in contrast to other seroprevalence studies of blood donors such as Garg S et al.^[9] (1.16%), Negi G et al.^[18] (0.98%), and Giri et al.^[30] (0.74%). Hepatitis C is transmitted through blood, primarily occurring via blood exposure, drug abuser and most individuals with the infection develop chronic conditions, making them more susceptible to cirrhosis and hepatocellular carcinoma than those infected with HBV. It is essential to carefully select blood donors and Information, Education, and Communication (IEC) young individuals to decrease the prevalence of HCV among this blood donor population.

The seroprevalence of Syphilis among blood donor is 0.06 % in this present study. Similar prevalence seen in Cheema, et al.^[29] (0.05%) and Giri, et al [30] (0.07%). The prevalence of syphilis among blood donors in India was recently reported to be 0.7% [31]. Higher prevalence seen in Rawat et al.^[31] (1.62%) and Nilam Hardik Patel et al., [17](1.32%). Lower prevalence rate was found by in a study by Mahapatra S et al.^[25] (0.001%) and Adhikary, et al.^[23] (0.004%) in comparison to our study. Donor selection is based on information about the donor, identifying risk factors in the donor's behavior, the medical history collected using a questionnaire and physical examination of the donor in order to find clinical signs of the infection. The risk of transfusion-transmitted syphilis is closely related to risk factors in the blood donors, in particular sexual behavior since the disease is primarily transmitted by the sexual route.^[32] High-risk donors may not wish to publicly acknowledge their risk behaviors, a phone/mobile number are given to call within 24 hours during post donation counseling. This is the opportunity given for self-deferral and the blood unit count as confidential unit of exclusion.

The malaria seroprevalence in this present study is about 0.005%. The seroprevalence in studies of Nilam Hardik Patel et al.,^[17] Deshmukh S, Rathod Y, Thakore S, et al.^[28] Adhikary, et al.^[23] and Pallavi P et al.^[7] was 0% which was decreased throughout the years as increase intensive monitoring of cases and potential hotspots to identify and quickly respond to outbreaks under National Vector Borne Disease Control Programme (NVBDCP). Odisha states comes under the "Category II" refers to areas with a moderate level of malaria transmission, typically defined by an Annual Parasite Incidence (API) between 1 and 10 cases per 1,000 population.^[32] Proper screening to the donors those coming from endemic district may decrease seroprevalence burden and also decrease transfusion transmitted malaria cases.

It was also found that among all seropositive donors, 6 donors had dual infections, 3 seropositive donors had HBV with Syphilis, 2 donors had HBV with HIV and 1 donor HBV with HCV, a similar dual infection also found in Ray Karmakar, et al.^[11] 11 numbers, Chandekar, et al.^[33] 6 numbers. A comparative data is plotted in [Table -4] of similar studies with present study.

Study	HBV (%)	HIV (%)	Syphilis (%)	HCV (%)	Malaria (%)	Co Infection (%)
Pallavi P et al., ^[7]	1.27	0.44	0.28	0.23	0	ND
Varma, et al., ^[8]	1.29	0.076	ND	0.072	ND	ND
Garg S et al., ^[9]	0.78	0.057	0.124	1.16	0.014	ND
Ray Karmakar, et al., ^[11]	1.41	0.6	0.23	0.59	ND	11
Mandal et al., ^[12]	1.24	0.42	0.65	0.62	0.004	ND
Mukherjee S et al., ^[15]	0.62	0.073	0.1	0.044	0.12	ND
Shrivastava, et al., ^[16]	1.8	0.2	0.31	0.42	0.008	ND
Nilam Hardik Patel et al., ^[17]	0.52	0.08	1.32	0.14	0	ND
Negi G et al., ^[18]	1.29	0.29	0.44	0.98	0.002	ND
Adhikary, et al., ^[23]	0.28	0.01	0.004	0.12	0	ND
Dhanashree P Inamdar et al., ^[24]	0.42	0.07	ND	0.01	ND	ND
Mahapatra S et al., ^[25]	0.5	0.052	0.001	0.17	0.0005	ND
Deshmukh et al., ^[28]	0.71	0.19	0.47	0.08	0	ND
Cheema, et al., ^[29]	0.49	0.03	0.05	0.5	0.009	ND
Giri, et al., ^[30]	1.09	0.07	0.07	0.74	ND	ND
Rawat et al., ^[31]	1.61	0.32	1.62	0.73	0.06	ND
Chandekar, et al., ^[33]	1.3	0.26	0.28	0.25	ND	6
Present Study	1.99	0.09	0.06	0.021	0.007	6
Table 4: Comparative studies						
(ND= No Data)						

CONCLUSION

The seroprevalence rate of various TTIs in blood donors in southern Odisha is 2.17%. The seroprevalence rate of HIV is 0.09% that of HBV is 1.99%, HCV is 0.06%, Syphilis is 0.021% and Malaria is 0.005% among all the blood donors during the five-year study period. [Table -1]

Thus, there is a need to increase public awareness regarding voluntary donation and its benefits. Female participation has to be encouraged in blood donation. It requires improved post-donation counseling for continued and sustained efforts for case detection, treatment, and other preventive measures to contain the TTIs. Adaptation of other technique to detect TTIs as Nucleic acid amplification test (NAT) and Chemiluminescence assay (CLIA) for all viral borne diseases like HBV, HCV, and HIV, CLIA and multiplex flow immunoassay for detecting Syphilis and Enzyme immunoassays (EIA) to detect Malaria along with conventional testing methods. Thorough meticulous screening of blood donors, the implementation of advanced methods for identifying

TTIs, stringent post donation counselling and notification with further follow up are strongly advised to guarantee the safety of blood for recipients.

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