

The Sero-Prevalance of Syphilis among Blood Donors in District Mardan, A comprehensive comparative analysis and blood group correlation with findings across different cities

Furqan Ul Haq ^{1,*}, Asfandiyar Khan Mohmand ², Qazi Muhammad Farooq Wahab ³, Waqar Ali Shah ⁴, Muhammad Saad Waqas ⁵, Zakir Ullah Khan ⁶, Attaullah Shah ⁷, Ijaz Hussain ⁸, Kashif Ali ⁹, Numan Salih ¹⁰, Areeba Inam Khan ¹¹, Ahad Nawaz ¹², Aisha Maqbool ¹³ and Jibran Ikram ¹⁴

¹ Radiation Oncology Department, Shifa International Hospital, Islamabad, Pakistan. ²

Internal Medicine Department Park Slope Cardiology Center, Brooklyn.

³ Internal Medicine Department, Khyber Teaching Hospital, Peshawar, KP, Pakistan.

⁴ Internal Medicine Department, Saidu Teaching Hospital, KP, Pakistan.

⁵ Pathology Department, Khyber Girls Medical College, Peshawar, Pakistan.

⁶ Dermatology Department Hayatabad Teaching Hospital, Peshawar, Pakistan.

⁷ Demonstrator at Gajju Khan Medical College, Sawbi, KP, Pakistan.

⁸ Intensive Care Unit Department, Advance International Hospital Islamabad, Pakistan.

⁹ Internal Medicine Department, Ayub Teaching Hospital, KP, Pakistan.

¹⁰ Internal Medicine Department, Khyber Teaching Hospital, KP, Pakistan.

¹¹ Ayub Medical College Abbottabad, Pakistan.

¹² DHQ Hospital MTI Dera Ismail Khan, Pakistan.

¹³ Ayub Niazi Medical College, Sargodha, Pakistan.

¹⁴ Department of Medicine Rahman Medical College Peshawar, Pakistan.

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Abstract

The necessity and importance of blood donation well known like in thalassemia, leukemia, lymphoma, patients on chemotherapy and after massive hemorrhage from trauma etc. but its transfusion can also lead to some major health problems like transmission of infectious diseases such as syphilis and so on. To prevent transmission of infectious diseases through blood transfusion its screening is performed everywhere. For this purpose, a research study is carried out during January 2019 to April 2019 at Mardan medical complex and Mardan teaching institute (MMC-MTI) Mardan KP, Pakistan. The specimens were collected from 625 blood donors with 619 males and 06 females. The samples were sent to the serology section of the pathology department for the diagnosis of syphilis through architect syphilis TP. The sero-prevalence of syphilis and the variation of prevalence in the previous and recent study were the objective of this research. It has found that only 06 male individuals are found to have syphilis infection while there is no such case reported in female individuals. So the overall sero-prevalence and sero-prevalence in male individuals were the same as 0.96%. The most positive cases were in the age group 38-74 years of age individuals. Which is the most sexually active age and it is reported that 1.8% of the sero-prevalence is found. The seroprevalance of syphilis in A- blood group was 5.5%, B+ patients had 1.56%, and with O+ patients it was 1.16%. From the results and analysis, the sero-prevalence of syphilis in the area and population where the study performed are at more risk of syphilis because per annual 0.30 increases is recorded by comparing the recent results with previous studies. As with the passage of time people are educated so we cannot say that it is because of the lack of awareness no also. So the opinion is that the lifestyle, social interaction of people with one another and carelessness in sexual intercourses is the main risk factors responsible for this increase in sero-prevalence of syphilis.

* Corresponding author: Furqan Ul Haq

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1. Introduction

Safe blood transfusion is necessary to neglect the transmission of many infectious diseases but it is a great challenge to the whole world. A study performed at Pakistan the prevalence of transfusion of transmissible infection in blood donors were carried out. They reported that 2.1% of individuals were having syphilis in which the majority of individuals were married. The occurrence of syphilis in adults is 0.025% and it affects 5.6 million people per year¹. A Research study performed in the same population and area by in which they reported the prevalence of syphilis in blood donors up to 0.63% that is slightly less than the current study which is 0.93%. Another study performed at the same area and population, their data were also collected from the same hospital as the current data is collected. They reported the sero-prevalence of syphilis in the blood donor 0.68%². The epidemiology of Syphilis is reported differently but approximately, annually 100,000 individuals die from syphilis while 12 million cases are reported yearly. Only 0.05% of the blood donors found to have syphilis³. About 0.51% of blood donors from Thalassery India are diagnosed through ELISA that they were infected by *Treponema pallidum*⁴. The study performed at Gujarat India show that 0.25% of blood donors were seropositive with syphilis. The study performed at Faridpur Bangladesh in 2017 showed that 2% of the blood donors have syphilis that belongs mostly from the Islam religion. 0.49% of the sero-prevalence is reported by at Kathmandu valley Nepal. The sero-prevalence of syphilis in blood donors has been detected in 0.168% in blood donors of Turkey diagnosed through PCR and VDRL. Another study performed at (turkey) in which they diagnosed the sero – prevalence of syphilis in 0.198% of individuals through VDRL and TPHA tests. About 0.3% of the prevalence is reported. They further aided there result as an alarming situation for the health departments. The sero-prevalence of syphilis reported that 20% of blood donors have syphilis in which the large number of male up to 88% infected while female individuals are infected up to 20%⁵. There is also reported by Liu et al., 2019 at chengdu china that 0.97% of blood donors have confirmed syphilis but they have no infection of HIV, HBV and HCV. In (southeastern china) 0.37% of individuals are diagnosed to have syphilis infection through different serological tests like ELISA, TPPA and TRUST. The transmission of syphilis occurs through various routes such that it can be transmitted through direct contact with the infected person or transmitted from mother to fetus via placenta. It can also transmit rarely through blood transfusion. The volunteer blood donors of Israel were found to have syphilis up to 0.047%. The blood donors of United States of America who donated their blood for the first time were also evaluated to have syphilis and the prevalence was 0.05%⁶. ow prevalence is reported at (Mali South Africa) by Aude et al in 2019 that is 0.04% in blood donors. The anaerobic spirochete bacteria *Treponema pallidum* is causing a disease known as syphilis that transmits through close contact and sex. This greatly affect the developing countries and the sero-prevalence of syphilis in 23.5% of blood donors in south western Soudan. Syphilis is the most sexually transmitted health problem that affects the overall world and 7.5% of the blood donors at Accra, Ghana. The blood donors of magnolia have 2% of confirmed syphilis prevalence. In 2016 the prevalence of syphilis at southern Brazil was 0.70% while in 2015 and 2014 the prevalence was 0.57% and 0.3%⁷. A very less prevalence of syphilis is reported by Mona et al in 2015 that 0.028% of blood donors are infected by *Treponema pallidum*. The results are obtained from the data of anti *Treponema pallidum* antibodies diagnosed through serological tests. The prevalence is 0.031% in the blood donors of Italy. Huge number of the population is screened out at the state of Piaui northeastern Brazil in which 1.76% blood donors identified to have syphilis⁸.

Objective

This research study is the most sophisticated article used to find out the variation between previous and current research studies regarding the prevalence of syphilis in blood donors and to co relate the prevalence with respect to different blood groups. The aim of the study is to find the sero-prevalence of syphilis in blood donors at district Mardan.

2. Material and method

The present study is performed in Mardan district of province Khyber Pakhtunkhwa Pakistan. The participants of the research study were the blood donors who visited the blood bank of Mardan medical complex and medical teaching institute (MMC-MTI). Different materials and reagents were used in the analysis and diagnosis process in which architect syphilis TP, blood bag, disposable syringes, gel tube, centrifuge machine, micropipette and yellow tips are included. While performing the diagnosis process reagents that were used are micro particles, conjugate and assay diluent, pre trigger solution, trigger solution and wash buffer.

2.1. Specimen collection

The blood was collected from the blood donors and transferred to the serology section of the laboratory for screening. For diagnosis of syphilis 3-5 ml of blood were taken in a gel tube and centrifuge for 5-10 minutes at 4000 rpm. The serum from the gel tube was collected in a serum cup which was ready to lead to the architect.

2.2. Methodology

The serum was collected in a gel tube and put into a serum cup. While starting the architect machine the reagents were loader before the test. The serum cups were put in a rack and added to the order in the architect for syphilis test. Wait for the result for up to 30-40 minutes and read the led screen of the architect and compare the results with normal values. The non-reactive sample results are <1.00 S/CO while the reactive sample results are ≥ 1.00 S/CO.

3. Results

Table no. 1 is related to the results of overall individuals from whom the data were collected. There were a total of 625 samples in which 06 samples showed positive results so the overall sero-prevalence of syphilis in blood donors is 0.96%. The sero-prevalence is shown in the table with respect to different variables. Both the male and female gender were included in the research study. The male individuals were most in number up to 619 which is 99.04% of the total sample size and 06 individual samples were positive. So all positive samples were collected from male individuals so the prevalence of syphilis is 0.96%. Only 06 which is 0.96% of the total sample size samples were collected from the female individual all were negative. The age of the population also varies differently. Four classes were arranged in the class interval of 10. In the first class the individuals were 18-27 years old. 360 individuals existed in this class in which 04 samples showed positive results and the prevalence is 1.11%. The second class of individuals was composed of 28-37 years of age. 200 samples were collected from this class in which only 01 samples show positive results and the prevalence is 0.5%. Individuals of 38-47 years old exist in the third class from which 55 samples collected in which 01 samples show positive result the prevalence is 1.8%. Individuals having age above 48 were placed in the fourth class from which 10 samples were collected and all the samples were negative.

Table 1 Demographic variables of reactive and non-reactive Blood donors

Variables	Total	Positive	Percentage
Overall samples	625	06	0.96%
Gender			
Male	619 (99.04%)	06	0.96%
Female	06 (0.96%)	00	00%
Age			
18-27	360	04	1.11%
28-37	200	01	0.5%
38-47	55	01	1.8%
48-above	10	00	00%
Marital status			
Married	364	05	1.37%
Unmarried	261	01	0.38%
Donation			
Voluntarily	149	02	1.34%
Replacement	476	04	0.84%

Table no.2 and figure 1 is the data and result of seroprevalence of syphilis with respect to the blood group of the donor. All the 08 blood groups are included in the research study in which about 154 were collected from the individual having A+ blood group but no sample showed a positive result. Most samples that were collected from the individual having B+ blood group and most of the positive samples were also in this blood group which were 0.3 and the prevalence is 1.56%. 50 samples were collected from the individual having AB+ blood group and all the samples were negative. There were 172 individuals having blood group O+ and 02 samples from this group were positive so the prevalence is 1.16%. 18 individuals have A- blood group in which 01 samples were positive so the prevalence is 5.55% in this blood group. 17 individuals belonged to the B- blood group and all were negative. About 06 samples were collected from the individual having AB- blood Groups all were negative. From O- Blood group donors 16 samples were screened and all were negative.

Table 2 Sero-prevalence of syphilis on basis of donor blood group by taking the numbers of patients present, number of positive cases and their different percentages summarized.

Blood Group	Total	Positive	Percentage
A+	154	00	00%
B+	192	3	1.56%
AB+	50	00	00%
O+	172	2	1.16%
A-	18	1	5.55%
B-	17	00	00%
AB-	06	00	00%
O-	16	00	00%

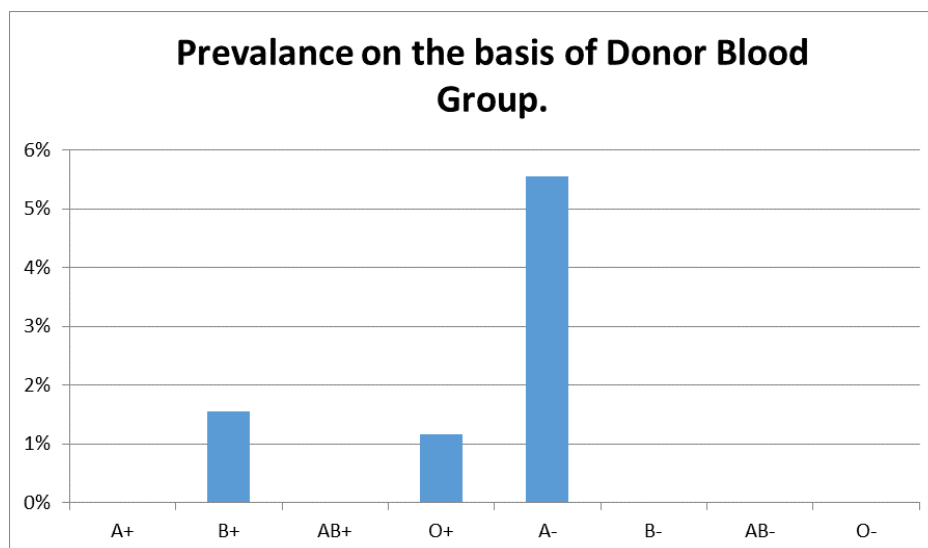
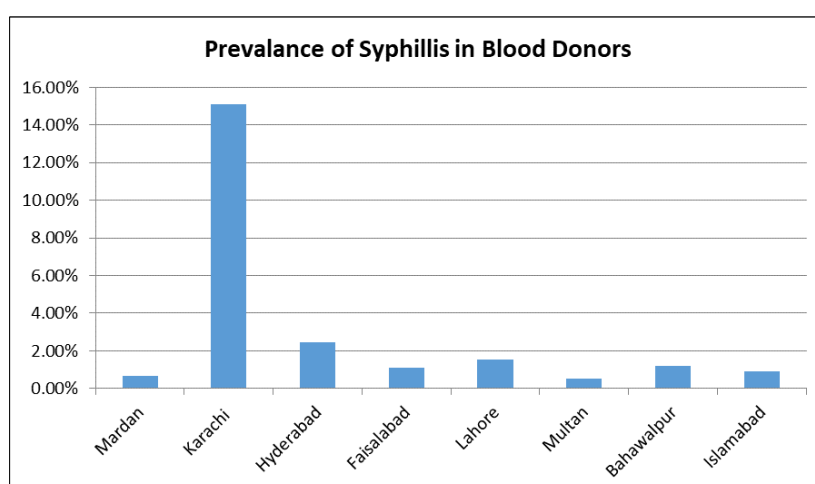


Figure 1 Relationship and prevalence of Syphilis in different blood group people: X axis show blood group and Y axis show prevalence in the form of percentage. A- negative blood group had more prevalence of syphilis could be incidental or could be due to some other mechanism yet to be revealed, this graph emphasize the relationship of sero prevalence which is more in A- but less in other blood group to be the point of future research.

Table no. 3 and Figure 2. Represent the results reported by different authors in other local cities of Pakistan which show a comparison with this result.

Table 3 Comparison of the current study with other local studies

Author	Year of study	Place of study	Result of syphilis+
Faheem anwar <i>et al</i>	2018	Mardan	0.68%
zeeshan <i>et al</i>	2018	Mardan	0.63%
Akhter <i>et al</i>	2018	Multan	0.52%
Jiskani <i>et al</i>	2019	Hyderabad	2.44%
Saeed <i>et al</i>	2017	Lahore	1.55%
Ruqia and asma	2019	Faisal abad	1.10%
Kamran <i>et al</i>	2017	Bahawalpur	1.2%
Usman waheed <i>et al</i>	2012	Islam abad	0.89%
Maria and Farheem	2017	Karachi	15.14%

**Figure 2** Comparison of the current study with other local studies in terms of relative prevalence X axis shows names of cities and Y axis shows percentage of prevalence of syphilis.

4. Discussion

It is the compulsion of humankind to transfuse the blood from one to another in many cases like surgery, pregnancy, surgical emergency, thalassemia patients and so on. But on the other side blood transfusion can also lead to several other problems like transmission of infectious diseases if proper screening and diagnosis is not performed and it is a challenging issue of health¹⁰. During these cases the estimated requirement of blood bags is about 1.5 million bags per year in different private and public hospitals. The requirement is mostly to cover by itself the patients such as to exchange the blood with the friend and relatives while few are voluntarily donating the blood. It is reported that blood transfusion is the most common and easy route of transmission of many infectious diseases like HBV, HCV, HIV, syphilis, malaria and so on. To ensure the safe blood transfusion different serological tests are performed before the transmission of blood¹¹.

In this current research study the screening of blood is performed before the transfusion in which the diagnosis of syphilis is included. Over all 625 blood donors are in this research study and their sero-prevalence of syphilis is the aim of study. From the laboratory examination and result 06 donor's blood were found positive for syphilis and the overall sero-prevalence of syphilis is 0.96%. The overall seroprevalence is slightly higher than the study performed by 0.63% and 0.68% at the same study area and population in 2018. This indicates that the prevalence has increased in one year up to 0.30% which is a clear indication that the lifestyle of people are changing with the passage of time in this area which increased the risk factor of syphilis. About the same sero-prevalence is reported in 2012 at Islamabad Pakistan which is 0.89%¹². The recent sero-prevalence of this research study is also similar with results performed recently in

2019 at chengdu southeastern china. They reported that 0.97% of the blood donors are found to have syphilis. The climate of this research area is similar with this research area and that can also be a reason for this similarity. The seroprevalence is less than the results of which is respectively 2.08%, 2.44% and 1.55%. It shows that the current research study is less at risk of syphilis.

The current sero-prevalence is less than the prevalence reported by in 2014 at southwestern Soudan that is 23.5% which is a very huge number. The prevalence of syphilis in female individuals was 0.0% in this recent research study but male individuals were found to have 0.96% syphilis infection which is the same with prevalence reported in 2017 in Iraq. It showed that 0.91% of male individual have syphilis infection. She also further aided that this prevalence in male is due to no awareness about the infectious disease and its risk factors like homosexuality. The current prevalence is slightly less than the prevalence reported in 2016. About 1.85% of the male have syphilis infection at Lahore Pakistan. They found that only 0.21% of the male individuals were reactive for the syphilis. The sero-prevalence of syphilis with respect to the age of donors varies differently such as in age group 18-27 the prevalence of syphilis is 1.11% which is similar with the prevalence that is 1.1% in blood donors of age 18-20 years. They reported that individuals having age 18-27 years are found to have syphilis about 2%. While the current prevalence of syphilis at age 18-27 years is high than the results reported by sadia sultan et al., 2016 which is 0.5%. The prevalence at age group 28-37 years is 0.5% in the current research study which is slightly similar with the prevalence 0.6% reported by parajpati et al., 2018 at Gujarat India. The current prevalence at age group 28-37 years is less than the prevalence reported by Boldtsets et al., 2014 at Mongolian Blood donors which is 4%. The highest prevalence in this research study is reported at the age group 38-47 years which is 1.8%. Approximately the same prevalence up to 1.67% is reported¹³. This recent prevalence is high than the prevalence reported by Bishnu et al., 2012 in Nepal. But this prevalence is less than the results found by Aine et al., 2018 in Brazil which is 3.37%¹⁴.

The prevalence of syphilis in volunteer blood donors is 1.34% this recent prevalence is about the same with the results of Olokaba et al., 2009 in Nigeria which is 1.2%. The current prevalence is less than the results reported by Diarra et al. 2009 in Turkey which is 0.3%¹⁵. The prevalence of syphilis in the blood donors that donate their blood for replacement was 0.84% which is about the same with the prevalence of Misganaw, 2016 which is 0.7%. The current prevalence is higher than the prevalence of Garg et al., 2001 at western India which is 0.23%¹⁶. In this current research study the prevalence of syphilis based on marital status was also reported in which 1.37% of married individuals have syphilis infection¹⁷. The prevalence in unmarried or single individuals is low in this research study which is about 0.38%. This recent prevalence in unmarried individuals is about the same as the prevalence reported by song et al., 2014 at western china¹⁸.

5. Conclusion

It is concluded from the results and comparison of this study with previous studies that the sero-prevalence of syphilis in blood donors in Mardan is still less as compared to other cities of Pakistan especially in Karachi but the area where the current research study is performed is more under risk of syphilis infection. About 0.30% per annual increase in the prevalence of syphilis is recorded by comparing the current study with the previous studies. In previous studies lack of awareness of masses about the infection were indicated but with the passage of time people are educated and aware. So the opinion is that the lifestyle of the research area's people changed socially which increased the risk factors for this infection such as close interaction with the infected male and female person and carelessness in sexual intercourses. The study reveals interesting relationship of seroprevalance of syphilis in blood group A-, which is needed to researched in future.

Compliance with ethical standards

Acknowledgments

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Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

References

- [1] Arshad A, Borhany M, Anwar N, Naseer I, Ansari R, Boota S, Fatima N, Zaidi M, Shamsi T. Prevalence of transfusion transmissible infections in blood donors of Pakistan. *BMC Hematol.* 2016 Nov 18;16:27. doi: 10.1186/s12878-016-0068-2. PMID: 27891232; PMCID: PMC5116208.
- [2] Jalal Ud Din, Hassan Sher, Muhammad Arif, F. A. I. A. S. M. Z. M. Khan,. (2018). Prevalence of Syphilis in Blood Donors in District Mardan Khyber Pakhtunkhwa Pakistan. *International Journal of Contemporary Research and Review*, 9(07), 20257–20261. <https://doi.org/10.15520/ijcrr/2018/9/07/557>.
- [3] Esmaeilzadeh F, Mohammadi M, Amjadipour A, Jafari A, Ghelichi-Ghojogh M, Khezri R, Rajabi A. Prevalence of Syphilis Infections among the Iranian Population: A Systematic Review and Meta-Analysis. *Iran J Public Health.* 2022 Jul;51(7):1513-1524. doi: 10.18502/ijph.v51i7.10085. PMID: 36248307; PMCID: PMC9529719.
- [4] Brown AE, Chen MP, Boschi-Pinto C, et al. Syphilis control in selected countries: A systematic analysis of epidemiological and health system factors. *PLoS One.* 2017;12(7):e0181630.
- [5] Geremew H, Geremew D. Sero-prevalence of syphilis and associated factors among pregnant women in Ethiopia: a systematic review and meta-analysis. *Syst Rev.* 2021 Aug 12;10(1):223. doi: 10.1186/s13643-021-01786-3. PMID: 34384495; PMCID: PMC8359573.
- [6] Kane, M.A., Bloch, E.M., Bruhn, R. et al. Demographic determinants of syphilis seroprevalence among U.S. blood donors, 2011–2012. *BMC Infect Dis* 15, 63 (2015). <https://doi.org/10.1186/s12879-015-0805-3>
- [7] da Motta LR, Sperhake RD, Adami AG, Kato SK, Vanni AC, Paganella MP, de Oliveira MCP, Giozza SP, da Cunha ARC, Pereira GFM, Benzaken AS. Syphilis prevalence and risk factors among young men presenting to the Brazilian Army in 2016: Results from a national survey. *Medicine (Baltimore).* 2018 Nov;97(47):e13309. doi: 10.1097/MD.00000000000013309. PMID: 30461642; PMCID: PMC6393142.
- [8] Owiredu WK, Sakyi SA, Essuman EA, et al. High transfusion transmission of syphilis in Ghana: A prevalence study. *BMC Infect Dis.* 2018;18(1):582.
- [9] Ali Jiskani, S., Ali Talpur, R., & Abbas Soomro, Q. (2019). Syphilis and Its Seroprevalence in Blood Donors at Rural Area of Sindh. *Asian Hematology Research Journal*, 2(3), 120-124.
- [10] Arshad A, Borhany M, Anwar N, Naseer I, Ansari R, Boota S, Fatima N, Zaidi M, Shamsi T. Prevalence of transfusion transmissible infections in blood donors of Pakistan. *BMC Hematol.* 2016 Nov 18;16:27. doi: 10.1186/s12878-016-0068-2. PMID: 27891232; PMCID: PMC5116208.
- [11] Memon, Faheem Ahmed; Ujjan, Ikram Din; Memon, Amir Iqbal; Shaikh, Abdul Rehman; Rao, Ali Raza; et al. *Pakistan Journal of Medical Sciences Quarterly*; Karachi Vol. 33, Iss. 2, (Apr 30, 2017): 443-446. DOI:10.12669/pjms.332.11691
- [12] Waheed, Usman, Khan H., Satti H S. et al. "Title of the article." *Ann. Pak. Inst. Med. Sci.*, vol. 8, no. 4, 2012, pp. 236-239
- [13] Drago F., Congorno L., Ciccarae G. *International Journal of Infectious Disease*, published in September 2014, <https://doi.org/10.1016/j.ijid.2014.04.008> doi.org/10.1016/j.ijid.2014.0
- [14] Sadiq S, Abdul MA, Ashraf S, et al. Infectious disease markers in blood donors at a tertiary care hospital of Pakistan. *J Infect Dev Ctries.* 2012;6(9):664-669.
- [15] Kaur H, Bhalla P, Toteja GS, et al. Seroprevalence of transfusion-transmissible infections among blood donors in a tertiary care hospital of North India: A five-year study. *Transfus Apher Sci.* 2016;54(3):364-369.
- [16] Noroozi M, Motamedi MRK, Salarian S, et al. Prevalence of transfusion-transmissible infections and nucleic acid testing among blood donors in Bushehr, Iran, from 2005 to 2015. *Arch Iran Med.* 2018;21(1):19-25.
- [17] Adedayo FO, Anjorin SE, Ikusemoran MA. Seroprevalence of transfusion-transmissible infections (HBV, HCV, and HIV) among prospective blood donors in a tertiary health care facility in the Niger Delta region of Nigeria. *Turk J Med Sci.* 2018;48(1):51-57.
- [18] Gupte SC, Patel PR, Chitalia MD, et al. Prevalence and trends of seromarkers of transfusion-transmissible infections among blood donors in a university hospital blood bank: A 3-year study. *Indian J Hematol Blood Transfus.* 2019;35(2):362-368.