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EPIDEMIOLOGY OF INFECTIOUS AND PARASITIC DISEASES IN CANDIDATES FOR BLOOD DONATION

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ABSTRACT: This research aimed to identify the epidemiological profile of blood donors from the Sergipe Blood Center between 2012 and 2017. Sociodemographic and reactive serology variables of blood transfusion-transmitted infections of all candidates were evaluated. There were 157,549 blood donors; they were predominantly male (71.7%), aged between 26 and 36 years (36.1%) and considered repeat donors (72.6%). The prevalence of reactive serology was 5.4%, including hepatitis B (43.8%), syphilis (28.7%) and HIV (16.7%). Individuals with positive serology were mostly donating for the first time ($p < 0.05$) and were almost 5 times more likely to be reactive than repeat donors. Finally, a local assessment of blood centres reflects the population's condition regarding infectious diseases and can be extremely significant in defining health campaigns that include the relevance of blood donation as well as care in relation to the prevention of these diseases.

KEY WORD: Blood banks; Blood safety; Serologic tests.

EPIDEMIOLOGIA DAS DOENÇAS INFECCIOSAS E PARASITÁRIAS EM CANDIDATOS À DOAÇÃO DE SANGUE

RESUMO: O objetivo da pesquisa foi identificar o perfil epidemiológico de candidatos à doação de sangue do Hemocentro de Sergipe entre 2012 e 2017. Foram avaliadas variáveis sociodemográficas e de sorologia reagente das infecções transmitidas pela transfusão sanguínea de todos os candidatos a doação. Foram registrados 157.549 candidatos à doação, predominantemente do sexo masculino (71,7%), com faixa etária de 26-36 anos (36,1%) e considerados candidatos de repetição (72,6%). A prevalência de sorologia reagente foi de 5,4%, destacando-se Hepatite B (43,8%), Sífilis (28,7%) e HIV (16,7%). Os indivíduos com sorologia positiva, majoritariamente de primeira doação ($p < 0,05$), apresentaram quase 5 vezes mais chances de serem reagentes, comparados com doadores de repetição. A avaliação local dos hemocentros é reflexo da condição da população em relação às doenças infecto parasitárias e pode ser de extrema relevância para definir campanhas de saúde que incluam a importância da doação de sangue e a prevenção destas doenças.

PALAVRAS-CHAVE: Bancos de sangue; Segurança do sangue; Testes sorológicos.

INTRODUCTION

The process of donating blood and blood products is of fundamental importance to ensure the treatment of patients with

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different clinical conditions such as considerable blood loss and in several pathologies, such as hereditary anaemia, as well as in patients undergoing chemotherapy, transplantation or presenting some coagulation disorder. Blood allows the transport of nutrients and oxygen that are essential for the maintenance of life and the efficient functioning of the different defence mechanisms against viruses, bacteria and parasites, among others. Therapeutic treatment using blood or haemotherapy is carried out through the transfusion of blood, blood components or blood products. It is an assistance activity that presents epidemiological risks since blood can be a vehicle for several infectious diseases[1]. The transmission of pathogens by transfusion can happen when an infectious agent present in the donor's blood is not detected by serological screening tests due to failures in the diagnostic tests or because it is in the immunological window period[2,3].

The transmission of infectious diseases through the blood has been known since before the existence of the first blood banks. However, with the advent of HIV (human immunodeficiency virus) in 1981 and the confirmation of the possibility of transmission by blood, there have been important advances in the application of serological screening tests that are routinely used in the laboratory for haemotherapy services worldwide. The development and adoption of new diagnostic technologies aim to minimize transfusion risks, especially regarding the prevention of the transmission of infectious agents. In general, blood banks carry out two steps to better track infections, which aim to improve the quality of the blood components to be transfused. The first stage consists of clinical screening with a donor's anamnesis, aiming to analyse the donor's clinical history, and the second stage is serological screening, which consists of carrying out diagnostic tests to search for various infectious agents[4,5].

The National Health Surveillance Agency (ANVISA) in Brazil, through Resolution of the Collegiate Directorate (RDC) nº 158, from February 4, 2016, establishes the mandatory registration of blood donors as well as the performance of serological tests for screening of collected blood in order to prevent the spread of disease. For each donation, serological tests must be performed for the following pathogens: HIV 1 and 2 (human immunodeficiency virus 1 and 2), HTLV I and II (human T lymphotropic virus I, II), HCV (hepatitis C virus), HBV (hepatitis B virus), *Trypanosoma cruzi*, *Treponema pallidum*, *Plasmodium* spp. (in malaria endemic areas) and CMV (cytomegalovirus) for immunosuppressed patients[6]. As a complement to serological screening tests, the NAT (nucleic acid test) has been routinely implemented in the laboratory of the blood bank; it is a molecular analysis methodology that allows the diagnosis even in the period of the immunological window and is currently applied to the diagnosis of hepatitis B and C and HIV[7]. Thus, the serological screening of donation candidates is an extremely relevant mechanism in an attempt to minimize the spread of various infectious diseases.

However, serological data must be worked on in conjunction with evaluating the sociodemographic characteristics of the donation candidates, aiming to generate information on risk groups, certify and promote the dissemination of prevention services and prophylactic care and health care, and provide information to improve blood donor uptake. Thus, the objective of this research was to evaluate the serum prevalence of various infectious agents and the sociodemographic aspects of blood donation candidates at the Hemocentro de Sergipe (HEMOSE) from 2012 to 2107.

METHODOLOGY

This is a cross-sectional study based on sociodemographic and serology data from January 2012 to December 2017 from blood donation candidates from the HEMOSE, Brazil. To apply as a donor, candidates must be older than 18 years and fill in all the information in the HEMOSE database; thus, the sample was composed of all the files of blood donation candidates who volunteered during the study period, regardless of age or sex.

The data were collected using the HEMOVIDA management system, which concentrates all the information about blood donation candidates, and the information was transferred to a spreadsheet for the treatment and presentation of data through graphs and tables.

The following variables were evaluated: sex, age, education, candidate's address and information regarding

the detection of positive serology for HTLV I and II, HBsAg and anti-HBc, anti-HCV, Chagas disease (anti-IgG T. cruzi) and syphilis (VRDL). All the variables considered in the study are part of the information contained in the donation applicant's form.

Seropositivity for any of the diseases under study was considered a dependent variable and characterized as a nominal dichotomous variable (positive/negative). The blood donor candidate was considered seropositive after taking a second confirmatory sample and became part of the group of serologies included in the research: hepatitis B (HBsAg and anti-HBc); hepatitis C (anti-HCV); syphilis (treponemic or non-treponemic test); human cell lymphotropic virus (HTLV I and II); human immunodeficiency virus (HIV I and II); Chagas disease (anti-*Trypanosoma cruzi*); and cytomegalovirus.

To perform the statistical analysis, SPSS software (Statistical Package for the Social Sciences), version 22, was used, using a 95% confidence interval ($p < 0.05$) for statistical significance. The Kolmogorov-Smirnov normality test with Lilliefors correlation was used in order to verify the distribution of numerical variables (age) against the results of the serology and the types of reagent serology. After verifying nonparametric variables (heterogeneous distribution containing extreme values), the Mann-Whitney U nonparametric test of independent samples was used to compare age in the serology groups (reagent and non-reagent), and the Kruskal- Wallis was used for independent samples to compare the age distribution among the types of infections. Regarding the Kruskal-Wallis test, the post hoc Kruskal-Wallis test was used to compare pairs of samples, allowing a group-by-group comparison and making it possible to identify the significant differences between them.

Pearson's chi-square test was used to assess the distribution between the variables of age group, gender, marital status, year of donation and type of donation in relation to serology. Odds ratios (ORs) were also used in order to verify the ratio of chances of reaction in serology between males and females and according to the type of donation. When used to assess the probabilities of the type of reactive serology in relation to sex and the type of donation, it was necessary to use only the data from individuals who presented reactive serology in order to determine a more reliable probability.

ETHICAL ASPECTS

This study was approved by the Human Research Ethics Committee of Tiradentes University under protocol No. 2.954.787.

RESULTS

The study evaluated a population of 157,549 blood donation candidates who were mostly single males aged between 26 and 35 years old, who were living in the capital Aracaju, who had complete high school and who were considered repeat donors (Table 1).

Regarding serology according to sex, it was possible to identify a higher frequency of seropositivity in males ($p < 0.05$), showing that women were less likely to be seropositive than men (OR = 0.886) (Table 2).

Table 1. Distribution of blood donation candidates according to sex, age group, origin, marital status and level of education at the Coordinating Blood Center of Sergipe-HEMOSE from January 2012 to December 2017

(Continuation)

Variable	n° (%)
Sex	
Male	113,036 (71.7)
Female	44,513 (28.3)
Age range (year)	
< 18	2,576 (1.6)
Between 18 - 25	45,075 (28.3)
Between 26 - 35	56,847 (36.1)
Between 36 - 45	33,779 (21.4)
> 45	19,271 (12.2)
Absent	1 (0)
County	
Aracaju	84,336 (53.5)
Interior of Sergipe	69,749 (44.3)
Other states	3,428 (2.2)
Absent	36 (0)

(Conclusion)

Variable	n° (%)
Marital status	
Single	103,472 (65.7)
Married	48,033 (30.5)
Divorced	3,523 (2.2)
Widowed	5,611 (0.4)
Other	1,673 (1.1)
Absent	287 (0.2)
Education level	
Not literate	970 (0.6)
Incomplete elementary school	22,503 (14.3)
Complete elementary school	11,187 (7.1)
Incomplete high school	16,390 (10.4)
Complete high school	61,116 (38.8)
Incomplete graduation	26,813 (17)
Complete graduation	17,298 (11)
Absent	1,272 (0.8)
Donation type	
First time	43,119 (27.4)
Repeat donation	114,430 (72.6)

Table 2. Distribution of serological reactivity in relation to the sex of blood donation candidates at the Coordinating Hemocenter of Sergipe from January 2012 to December 2017

Serology	Sex n (%)		Total n (%)	p*	Odds ratio
	Female	Male			
Reagent	2,203 (4.9)	6,272 (5.5)	8,475 (5.4)	0.001	0.886 (0.843–0.932)
Non-Reagent	42,310 (95.1)	106,764 (94.5)	149,074 (94.6)		
Total	**44,513 (28.4)**	**113,036 (71.6)**	**157,549 (100)**		

* Pearson's Chi-square

When evaluating the types of reactive serologies, there was a higher prevalence of hepatitis B for both sexes followed by syphilis and HIV. However, there was a higher prevalence in men when evaluating syphilis, hepatitis C and HIV, with rates of 29.3%, 19.9% and 16.9%, respectively, while women had a higher prevalence of hepatitis B, HTLV and Chagas disease (CD), with rates of 44.5%, 3.9% and 2.2%, respectively ($p < 0.05$).

When comparing the prevalence of reactive and nonreactive serologies according to the classification of the frequency of donation, first-time donation (single donation) and repeated donation (two or more donations), a higher prevalence of seropositivity was observed among the first-time candidates [12.3% ($p < 0.05$)] who presented an approximately 5 times higher chances of presenting reactive serology (OR = 4.887 CI 4,670-5,114) than individuals classified as repeat donors.

When evaluating the individuals in relation to reagent serology, the majority of seropositive individuals for syphilis, HIV, hepatitis C and CD were repeat donors ($p < 0.05$) and had greater chances of positivity than first-time donation candidates (OR = 0.883; OR = 0.426; OR = 0.542; and OR = 0.685, respectively). In relation to hepatitis B, first-time donation candidates had a higher prevalence of infection than repeat donation candidates ($p < 0.05$), with higher chances of seropositivity (OR = 2.247) (Table 3).

Table 4 shows the evolution of the prevalence of serological discharge in the studied period in relation to sex. In the years studied, there was a greater number of positive serologies among males, which decreased over the study period, and this decrease was more significant than that observed in females ($p < 0.05$).

Table 5 shows a higher prevalence of seropositivity for VDRL, HIV, HBv, HBc and CD in male donors ($p < 0.05$), who showed greater chances of positivity than females (OR = 0.891; OR = 0.961; OR = 1.036; OR = 0.963; and OR = 1.214, respectively). In relation to HTLV, females showed a higher prevalence than males ($p < 0.05$) and were almost twice as likely to be seropositive (OR = 1.912).

Table 3. Distribution of blood donation candidates according to the number of donations made and positivity on serological screening tests at the Coordinating Blood Center of Sergipe-HEMOSE from January 2012 to December 2017

Reagent serology	Classification		Total n (%)	p*	OR** (IC)
	First time n (%)	Repeat donor n (%)			
Syphilis	1,467 (27.7)	964 (30.3)	2,431(28.7)	0.012	0.883 (0.802 – 0.973)
HIV	639 (12.1)	777 (24.4)	1,416 (16.7)	<0,001	0.426 (0.379 – 0.478)
HTLV	137 (2.6)	82 (2.6)	219 (2.6)	0.969	1.006 (0.762 – 1.327)
Hepatitis B	2,704 (51.1)	1,011(31.8)	3,715 (43.8)	<0.001	2.247 (2.049 – 2.463)
Hepatitis C	258 (4.9)	275 (8.6)	533 (6.3)	<0.001	0.542 (0.455 – 0.647)
Chagas disease	86 (1.6)	75 (2.4)	161 (1.9)	0.017	0.685 (0.501 – 0.936)
Total	**5,291 (62.4)**	**3,184 (37.6)**	**8,475 (100)**	-	-

* Pearson's chi-square

** Odds ratio

Table 4. Evolution of the prevalence of positive serology according to the sex of candidates for blood donation at the Coordinating Hemocenter of Sergipe-HEMOSE from January 2012 to December 2017

Year	Sex		Total n (%)	P*
	Male n (%)	Female n (%)		
2012	1,384 (22.1)	441 (20)	1,825 (21.5)	0,008
2013	1,137 (18.1)	389 (17.7)	1,526 (18)	
2014	1,249 (19.9)	397 (18)	1,646 (19.4)	
2015	868 (13.8)	319 (14.5)	1,187 (14)	
2016	831 (13.2)	329 (14.9)	1,160 (13.7)	
2017	803 (12.8)	328 (14.9)	1,131 (13.3)	
Total	**6,272 (74)**	**2,203 (26)**	**8,475 (100)**	

* Pearson's chi-square

Table 5. Distribution of seroprevalence of infectious diseases routinely diagnosed in the laboratory by sex among blood donation candidates at the Coordinating Hemocenter of Sergipe-HEMOSE from January 2012 to December 2017

Reagent serology	Sex n (%)		Total n (%)	p*	OR (IC)
	Female	Male			
VDRL	594 (27)	1,837 (29.3)	2,431 (28.7)	0.038	0.891 (0.799 – 0.994)
Anti-HIV	359 (16.3)	1,057 (16.9)	1,416 (16.7)	0.547	0.961 (0.843 – 1.095)
HTLV	87 (3.9)	132 (2.1)	219 (2.6)	<0.001	1.912 (1.452 – 2.518)
Anti-HBV	980 (44.5)	2,735 (43.6)	3,715 (43.8)	0.475	1.036 (0.940 – 1.143)
Anti-HBC	135 (6.1)	398 (6.3)	533 (6.3)	0.717	0.963 (0.788 – 1.179)
Chagas disease	48 (2.2)	113 (1.8)	161 (1.9)	0.265	1.214 (0.863 – 1.708)
Total	**2,203 (26)**	**6,272 (74)**	**8,475 (100)**	-	-

* Pearson's chi-square

Between 2012 and 2017, 8,475 reactive serological tests were detected for any of the infectious diseases under study. Hepatitis B was the infection with the highest number of cases among the serologies surveyed; however, since 2014, a constant decrease in the absolute number of cases has been shown. Syphilis and HIV are the serologies that presented with intermediate absolute numbers below that of hepatitis B and above those of HTLV, hepatitis C and CD. The number of cases of HIV-positive serology showed a steady decrease since 2012 and stabilized in 2016. The least frequent serologies during the study period were HTLV, CD and hepatitis C; the last two did not show considerable variations during the study period.

Regarding the age of the donors, an average age of 34 years was observed for sera-reactive individuals, and 30 years was the average age among nonreactive individuals ($p < 0.05$). On the other hand, when age was assessed according to the types of reactive serologies, individuals with syphilis had the oldest median age of 37 years, while the youngest individuals were HIV-positive individuals, at 30 years ($p < 0.05$).

DISCUSSION

According to the Ministry of Health, the inability to donate blood can be permanent or temporary. Among the main causes of permanent disability are chronic alcoholism, various types of cancer, severe heart disease, diabetes mellitus, CD, extrapulmonary tuberculosis, viral hepatitis after 10 years of age, infections with the hepatitis virus B and C, HIV, HTLV I and II, epilepsy and recurrent syphilis. Among the causes of temporary disability are anaemia, abortion, acupuncture, the use of piercing and/or tattooing, allergies, breastfeeding, headache, surgeries in general and pregnancy[6].

The prevalence of blood-borne infectious diseases leading to inaptitude for blood donation has decreased considerably in recent times as transfusion medicine has evolved and improved, but the risk of infection continues to exist[8]. Thus, research that evaluates the prevalence of infectious diseases in blood donation candidates is an important tool to verify the effectiveness of programmes to control these pathologies.

The results of the profiles of blood donation candidates for the state of Sergipe observed in this study were similar to those reported in a study carried out in Três Lagoas-MS that showed that males represent 61% of blood donors as well as those reported in previous work carried out in Sergipe[9,10]. This characteristic has been observed in several studies in the world, showing the greater availability of males for donation, and it is mainly related to physiological issues that often incapacitate women for donation[6,9].

Serological screening is a fundamental mechanism to prevent the transmission of infectious diseases and represents the rate of serological discharge (prevalence of reagent serology for markers routinely surveyed in the blood bank laboratory) in the population of candidates for donation. The prevalence is variable and may reflect the situation of these diseases in the local population. In general, the general prevalence of disposal (seropositive samples) varies between 3 and 5% and probably depends on the study site, as shown in several studies; in Brazil in Cruz Alta-RS, a prevalence of 4.56% was determined[11]; in Colombia, there was a prevalence of 3.3%[12]; and in Eritrea (Africa), there was a prevalence of 3.7%[13].

Regarding the age of blood donation candidates, there was a greater number of young adult donors aged from 26-35 years who represented 36.1% of blood donation candidates. Donors in younger age groups donate more; studies have also showed that with increasing age, there is a tendency to decrease the percentage of donors[14].

The present study showed a higher prevalence of reactive serologies in first-time blood donation candidates; this result shows the importance of creating strategies for the loyalty of voluntary and habitual blood donors, a trend that has been valued in Brazil and worldwide since repeat donors are less likely to have positive serology[15].

In a survey carried out between 2004 and 2006 at the same blood centre in Sergipe, hepatitis B was the main cause of serological disability[10]. In the present study, of a total of 157,549 donation candidates who underwent clinical screening, 8,475 were considered serologically unfit, with the three main reasons being hepatitis B (44%), syphilis (29%) and HIV (17%), with greater prevalences in males. In women, the main causes of serological disability were hepatitis C (19.9%), HTLV (3.9%) and CD (2.2%).

The percentage distribution of serological disability is a characteristic of each locality and represents the situation of infectious and parasitic diseases that circulate in the environment. Research carried out in Montes Claros-MG showed that, among the reasons for the inability of candidates for blood donation, hepatitis C (44.4%), syphilis (23.9%) and CD (22.7%) stand out; the state of Minas Gerais has already been considered one of the places with the greatest transmission of CD in the past decades, which is currently reflected in donation candidates who have chronic CD[16]. Research carried out between 2017-2018 in Iraq showed that the main cause of serological disability was hepatitis B (84.3%)[17]; and in Australia, hepatitis B and C accounted for 87.3% of cases in 2016[18].

In the present study, the seroprevalence of reactivity for hepatitis B was 44.5%; thus, there is a large circulation of the hepatitis B virus in the population. A study carried out at the Cruz Alta blood centre in Rio Grande do Sul showed a prevalence of 46.1% of serological reagents for hepatitis B, which corroborates the data obtained in the present study[11]. The average prevalence in Brazil is approximately 8%[19], which is reflected in blood banks that can register high levels of anti-HBc positivity, leading to the exclusion of a significant number of donors. On the other hand, it was found that the average age of people with anti-HBc was 34 to 66 years, and there was a significantly higher prevalence in more advanced age groups. This fact suggests that the time of exposure (increasing age) is one of the factors that explains the increase in the prevalence of infection by the hepatitis B virus[20].

These results reinforce the need for knowledge of the local serological inability to define specific prevention campaigns to reduce the transmission of diseases in the population, such as the importance of vaccination against hepatitis B.

Syphilis is an infectious disease with a chronic evolution caused by *Treponema pallidum*; in some countries, such as Brazil, it is considered an important public health problem similar to other infectious diseases in the country. Its transmission occurs predominantly through sexual intercourse, but it can also be transmitted through direct contact with syphilis lesions on the skin, via transplacental transmission or by blood transfusions[21].

The present study found high rates of syphilis detection in blood donation candidates during the period studied (28.8%). Other studies carried out in Brazil showed varying prevalences that depend on the study period. Aguiar et al. (2018)[22] found a prevalence of syphilis of 6.5% over a period of 4 months in individuals who visited a Basic Health Unit in Amapá, while in Paraná, in a survey of candidates for donation for a year, the prevalence was 7.4%[23]. In general, the results presented here call attention to the need to plan strategic actions aimed at reducing cases of syphilis and promoting the health of blood donation candidates and the population in general.

HIV serological screening is relevant to transfusion safety due to the great impact of this epidemic. Data on the prevalence of HIV-positive serology among blood donation candidates in Brazil are still scarce, but it is possible to observe that there was a reduction in transfusion contamination cases reported to the Ministry of Health in the nineties. This reduction can be explained by the methods used in donor screening, which seeks to eliminate donors with risky behaviour and reduce the period of immunological window through more sensitive tests for the detection of anti-HIV antibodies[7]. In the present study, a prevalence of almost 17% was found for HIV in the period studied, with this prevalence being considered high for both sexes. Research carried out in the same blood centre has already reported similar values (18%) of prevalence for HIV, which shows that this profile has not shown relevant changes[10].

It is important to highlight that the increase in the prevalence of HIV infection among women in many developing countries characterizes a trend in which the disease, initially predominant in the male population (mainly homosexuals and bisexuals), has started to spread in the heterosexual population, providing an increase in vertical transmission. Thus, it is also mandatory to perform serological tests to diagnose the status of HIV infection during prenatal care[24].

Hepatitis C was the fourth most prevalent serology in the present study. The hepatitis C virus is primarily transmitted by transfusion of blood and blood products, haemodialysis, and contamination of needles, syringes and intravenous materials, and, secondarily, sexually. Hepatitis

C is considered the main type of hepatitis transmitted by blood transfusion and blood products[16].

In the present study, the prevalence of reagent serology for hepatitis C was 6.3%. Studies carried out in Brazil have shown lower prevalence rates of positive anti-HCV serology than the present study. In Uberaba-MG, in a retrospective study of donations made between 1995 and 2008, the researchers found a rate of 0.4%, and in Sergipe, during 2004 to 2006, the inability to donate due to anti-HCV positive serology was 0.49%[10]. This discrepancy can be explained by the implementation of tests of high specificity for the referred serology; the NAT reduces the immunological window, reducing the probability of diagnosis of false negatives[7].

The rate of serological disability for HTLV I and II was 3.9% among cases in the present study. Approximate prevalence values for this pathology have been reported in the city of Três Lagoas-MS, where the seroprevalence rate for HTLV I and II was 6.7% over a 4-year period[9]. Although this rate is considered high, studies have shown a reduction in seropositivity for HTLV I and II over the years[25].

Chagas disease is still frequent in several countries in Central and South America in regions where environmental conditions exist or human habitations persist that favour the proliferation of vectors; currently in Brazil, one of the main forms of infection is through the oral route. Despite advances in disease control, the diagnosis of chronic cases remains a challenge and is considered an important cause of permanent disability for blood donation[6].

A study carried out in the main coordinating blood centres in Brazil in 2007 showed a 0.2% rate of serological disability due to CD, and in the Northeast, this rate was 0.3%[26]. In the present study, 2.2% of reactive serologies for CD were found. The high rates of CD in the present study can be justified by the fact that the state of Sergipe, in the past, was an area of high vectorial transmission of the infection. Despite the fact that CD is an infection originating in the Americas, migratory processes have led to its spread across several continents, requiring control of CD today in the blood centres of many countries[27].

Repeated donors are considered to be a low-risk population for blood donation; therefore, it is desirable that the participation of these candidates for donation increases even more, allowing for a lesser loss of bags by reagent serology[3], since the literature and the present study show a higher prevalence of reagent serology in first-time donors.

On the other hand, gender is also a variable that appears in several studies of donors in blood banks and that show a higher prevalence of seropositivity for sexually transmitted diseases (STDs) related to males, which can be justified by the attitudes of greater risk when starting sexual life[19]. It is interesting to note that in the present study, the male gender presented higher seroprevalences of all STDs screened by serological tests performed at the blood bank. These results reinforce the need for campaigns to prevent these infections since risk groups have ceased to exist and the number of reported STD cases has been increasing[28].

In the studied period, there was a greater quantity of positive serologies among males, which decreased significantly over the study period ($p < 0.05$). Other studies also corroborate the data found in this research and have shown a gradual decrease in the prevalence of reactive serologies and the higher prevalence associated with males[29]; this decrease is probably associated with the population's awareness policies regarding STD prevention.

Regarding the median age of donors with reactive serology in the present study, average values of 34 years and 30 years were observed for reactive individuals and nonreactive individuals, respectively. Several studies have shown that the majority of candidates for donation are people who are considered young adults, which shows the need for educational and awareness campaigns regarding health care and that encourage blood donation by individuals over 35 years, remembering that the maximum age limit for donation is 69 years. When age was observed according to the types of reactive serology, individuals with syphilis had the highest median age of 37 years, while those at the lowest age of 30 years were HIV-positive individuals. In a study carried out with blood donors from the Ceres-GO blood centre, ages similar to those observed in this study were found (29-30), which shows that the two infections, mainly HIV, affect young individuals, which is a strategic point to implement policies to raise awareness among the younger population about methods of preventing sexually transmitted diseases[28,30].

CONCLUSION

The present study evaluated the sociodemographic and serological profiles of candidates for blood donation in Hemocentro de Sergipe. The results show that the male population still represents the majority of candidates for donation and has the highest prevalences of most diseases surveyed in the blood bank. Epidemiological data show the need for permanent knowledge of the donor's profile to guide preventive actions in the general population in order to ensure less loss of resources for the blood bank and a greater supply of blood and blood products for the population.

The results of this research generate relevant information about a specific group of individuals in the population who are candidates for blood donation. The epidemiological assessment of this group in relation to socioeconomic and seropositivity variables allows construction of a picture of the population in general, which can guide specific prevention actions to decrease the prevalence of various infections, guaranteeing a decrease in the loss of donors and the costs due to disability.

REFERÊNCIAS

1. Inamdar DP, Anuradha B. Seroprevalence of transfusion transmissible infections among blood donors at tertiary care hospital in southern Telangana - A 3 year cross sectional study. Indian Journ of Micro Res. 2018; 5(4):446-50.

2. Yasmeen H, Hasnain S. Epidemiology and risk factors of transfusion transmitted infections in thalassemia major: a multicenter study in Pakistan. Hematol Transfus Cell Ther. 2019. Disponível em: https://doi.org/10.1016/j.htct.2019.03.008

3. Carrazzone CFV, Brito AM, Gomes YM. The importance of pre-transfusional serological screening in blood transfusion recipients. Rev Bras Hematol Hemoter. 2004; 26(2):93-8.

4. Velati C, Romano L, Picinini V, Marano G. Prevalence, incidence and residual risk of transfusion-transmitted hepatitis C virus and human immunodeficiency virus after the implementation of nucleic acid testing in Italy: a 7-year (2009-2015) survey. Blood Transfus. 2018; 16:422-32.

5. Marca F, Weidlich L. Soroprevalência em doadores de sangue do Vale do Taquari, RS. Rev Bras Anali Clin. 2016; 48(3):240-4.

6. Brasil. Agência Nacional de Vigilância Sanitária. Resolução da Diretoria Colegiada (RDC) n° 75, de 2 de maio de 2016. Altera a Resolução da Diretoria Colegiada RDC n° 34, de 11 de junho de 2014, que dispõe sobre as Boas Práticas no Ciclo do Sangue. Brasília, 02 mai. 2016. Seção 1, p. 32.

7. Kameda K, Corrêa MCDV, Cassier M. A incorporação do teste diagnóstico baseado na amplificação de ácidos nucleicos (NAT) para triagem de sangue no SUS: arranjos tecnológicos para a nacionalização do "NAT brasileiro". Physis: Rev Saúde Coletiva. 2018; 28(1):e280108.

8. Sultan S, Zaheer HA, Waheed U, Baig MA, Asma Rehan, Syed Mohammed Irfan SM. Internal quality control of blood products: An experience from a tertiary care hospital blood bank from Southern Pakistan. J Lab Physicians. 2018; 10(1):64-7. Disponível em: http://www.jlponline.org/temp/JLabPhysicians10164-5024534_135725.pdf

9. Rodrigues AMX, Barbosa ML, Silva KMR, Santos JS, Costa ACR. Prevalência das principais doenças investigadas na triagem sorológica em unidades de um hemocentro. Reon Facema. 2018; 4(1):835-40.

10. Santos EA, Marcellini PS, Ribeiro JP. Avaliação epidemiológica das rejeições dos doadores de sangue no HEMOLACEN/SE no período de 2004 a 2006. Rev Bras Anal Clin. 2008; 40 (4):251-6.

11. Martins APB, Silva B, Molin DBD, Mendes GA. Soroprevalência de doenças infecciosas em doadores de sangue do Hemocentro de Cruz Alta - Rio Grande do Sul. Clin Biomed Res. 2015; 35(4):211-6.

12. Bedoya JAP, Cortes MMM, Cardona AJA. Seroprevalence of markers of transfusion transmissible

infections in blood bank in Colombia. Rev Saúde Pública. 2012; 46(6):950-9.

13. Siraj N, Achila OO, Issac J, Menghisteab E, Hailemariam M, Hagos S, Gebremeskel Y, Tesfamichael D. Seroprevalence of transfusion-transmissible infections among blood donors at National Blood Transfusion Service, Eritrea: a sevenyear retrospective study. Infec Disease. 2018;18:264.

14. Santos RF, Bordin RO, Alves SM, Medeiros MO. Perfil etário dos doadores de sangue da unidade de coleta e transfusão "Dr. Marcio Curvo de Lima" polo de Rondonópolis, Mato Grosso em 2015. Biodiversidade. 2018; 17(1):143-53.

15. Macedo FRM, Terra FS, Santos SVM, Miranda RPR. Perfil sociodemográfico e epidemiológico de candidatos à doação de sangue. Arq Ciênc Saúde. 2015; 22(4):87-91.

16. Magalhães TA, Teles LF, Nascimento JE, Oliveira LMM, Xavier SEM, Aguiar KM. Prevalência de inaptidão sorológica dos doadores de sangue no hemocentro regional de Montes Claros, Minas Gerais. Res: fundam care online. 2016; 8(3):4864-71.

17. Al-Nafakh RT, Al-Fadhul SAI, Al-Sherees HAA, Al-Charrakh AH. Seroprevalence of HBV, HCV, and HIV among Blood Donors in Main Blood Bank in Najaf Province, Iraq. Indian J Public Health Res Dev. 2019; 10(4):393-8.

18. Seed C, Khawar L, Hoad V, Guy R. Editores. Transfusion-transmissible infections in Australia - Surveillance Report 2017. Kirby Institute, UNSW Sydney, and the Australian Red Cross Blood Service; 2017.

19. Oliveira TJB, Reis LAP, Barreto LSLO, Gomes JG, Manrique EJC. Perfil epidemiológico dos casos de hepatite C em um hospital de referência em doenças infectocontagiosas no estado de Goiás, Brasil. Rev Pan-Amazônica Saúde. 2018; 9(1):51-7.

20. Silva RA, Souza MH, Caldeira MPS, Tavares LF, Brito APSO, Cordeiro HP, *et al*. Coinfecção de hepatites virais e HIV na região Norte do Brasil. REAC. 2019;4:e498.

21. Rebouças KAAF, Narici FM, Junior MNS, Neres NSM, Oliveira MV, Souza CL. Seroprevalence of transfusion-transmissible infectious diseases at a hemotherapy service located in southwest Bahia, Brazil. Hematol Transf Cell Thera. 2019. Disponível em: **https://doi.org/10.1016/j.htct.2019.03.007**

22. Aguiar DS, Brito AL, Pojo IGS, Silva RN, Silva MCG, Menezes RAO. Enfermagem frente à testagem rápida de sífilis, HIV e hepatites virais em uma comunidade periférica de Macapá, Amapá. Braz J Hea Rev. 2018; 1(1):164-84.

23. Oliveira VM, Verdasca IC, Monteiro MC. Detecção de sífilis por ensaios de ELISA e VDRL em doadores de sangue do Hemonúcleo de Guarapuava, Estado do Paraná. Rev Soc Bras Med Trop. 2008; 41(4):428-30.

24. Friedrich L, Menegotto M, Magdaleno AM, Silva CLO. Transmissão vertical do HIV: uma revisão sobre o tema Vertical transmission of HIV: a review. Bol Cient Pediatr. 2016; 05(3):81-6.

25. Lima GM, Eustáquio JMJ, Martins RA, Josahkian JA, Pereira GA, Souza HM, *et al*. Declínio da prevalência do HTLV-1/2 em doadores de sangue do Hemocentro Regional da Cidade de Uberaba, Estado de Minas Gerais, 1995 a 2008. Rev Soc Bras Med Trop. 2010; 43(4):421-4.

26. Silva VRC, Luna EJA. Prevalência de infecção pelo *T. cruzi* em doadores de sangue nos hemocentros coordenadores do Brasil em 2007. Epidemiol Serv Saúde. 2013; 22(1):103-10.

27. Requena-Méndez A, Albajar-Viñas P, Angheben A, Chiodini P, Gasco J, Muñoz J *et al*. Health policies to control Chagas disease transmission in european countries. PLoS Negl Trop Dis. 2014; 8(10):e3245.

28. Pinto VM, Basso CR, Barros CRS, Guituerrez EB. Fatores associados às infecções sexualmente transmissíveis: inquérito populacional no município