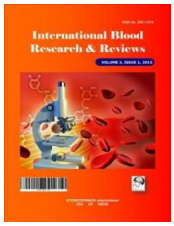

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Female Contribution in Blood Donation and Alternatives: Fact & Factual

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Authors' contributions

This work was carried out in collaboration between all authors. Authors DCS and AJ designed the study, wrote the protocol and wrote the first draft of the manuscript. Authors PW and SR managed the literature searches, analysis of the study performed and the spectroscopy analysis. Author LT managed the experimental process. Authors JB and RG supervised the research work. All authors read and approved the final manuscript.

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ABSTRACT

Background: Blood can neither be manufactured nor can be procured from other creatures and can only be taken from healthy human beings between the ages 18-65 years for providing safe blood/component to the needy human beings. So, equal participation from males and females should be an ideal situation.
Aims of Study: This study aims at elaborating the contribution of female participation in voluntary blood donation in developing countries.
Materials and Methods: This is a retrospective cross-sectional study. Data of blood donors, visiting at the blood bank, J. A hospital, Gwalior from 2004-2014 for blood donation were retrieved, compiled and analyzed on gender basis.
Results: A total number of 1, 37,767 donors donated blood during the above mentioned period,

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94,729 (68.8%) were voluntary and 43,038 (31.2%) were relative donors (p= 0.00000). Proportion of male vs. female blood donation was found to be 1, 32,470 (96.16%) & 5,297 (3.84%) respectively and we found a statistically significant difference in blood donation rate between males and females p<0.00001.

Conclusion: From the present study, it can be concluded that female participation in Gwalior, India is significantly lower as compared to findings from developed countries. There is a need to educate the female population to address the negative perceptions against blood donation and the importance of blood donation.

Keywords: Female; contribution; blood donors.

1. INTRODUCTION

Blood Donation is a service to humankind, by donating blood you help a needy and save a precious life. Human blood is a vital and an essential element of the human life and there are no substitutes for it [1]. In the treatment of human beings in routine and emergency blood/ blood component transfusion has a vital role in the patient management. Blood can be procured from the healthy person between the ages 18-65 years. Other possible ways to procure human blood for the treatment of patients is cord blood and cadaveric blood but unfortunately, these are uncommon procedures even though are well documented in the history. In 1929, Professor Vladimir Shamov of Kharkiv, USSR [2] and Russian surgeon Sergei Yudin in 1930 [3] used cadaveric blood for transfusion. Advantages of cadaveric blood are that 1.5 to 2 liters blood from a cadaver can be procured and transfused to a person which requires massive transfusion to avoid multiple exposures but presently it's obsolete. Niranjan Battacharya stated that umbilical cord whole blood transfusion is an alternative of adult whole blood transfusion [4]. He transfused more than 400 units in multidisciplinary patients successfully without any adverse effects. Advantages of umbilical cord whole blood over adult whole blood are:- it is free from infection, hypoantigenic with altered metabolic profile, filled with growth factor and cytokine-filled plasma, with the potential of higher oxygen-carrying capacity than adult blood, as an emergency source of blood for the management of disaster or crises anywhere in the world. It also may be safely used for the treatment of malignant and nonmalignant disorders [5]. Development of the blood substitutes such as stoma free hemoglobin solution (SFHS), the perfluorochemicals (PFCs) and hemoglobin encapsulated are still not approved for human use [6]. In the present scenario, blood can only be procured from healthy human beings between the ages of 18 to 65 years and rest of the alternatives are concerned for further studies in future.

The safest donors are found among people who donate their blood voluntarily purely out of altruism and are self-aware of their unsuitability to serve as blood donors [7]. Voluntary, non-remunerated blood donation has been universally shown to be the cornerstone of safe blood [8]. According to World Health Organization (WHO), the estimated blood requirement for the Southeast Asian region is about 16 million units per annum, but it collects just about 9.4 million units, leaving a gap of six million units [9,10].

Worldwide, there is a wide range of disparity in voluntary blood donation and female participation from developed to developing and transitional countries. Globally, more than 70 countries had a blood donation rate of less than 1% (10 donations per 1000 population) in 2006 [11]

Dr. Samreen Siraj Bala, et al. from Srinagar, J&K, India [12] reported male predominance in blood donation i.e male (95.56%) and female (4.44%). A similar incidence was quoted from Western Ahmedabad where 95.48% were males and 4.52% were females and from Hyderabad where 97.73% were males and 2.27% were females, which are comparable with countries like Bahrain, Kuwait, Yemen, Qatar etc. While, in countries like Australia and Finland males and females donate in almost same proportion [13].

Female blood donor participation is an important concern in this study. There is a scarcity of facts on female participation in blood donation. Only minor percentage is contributed by the female donors. Cultural and religious issues such as women's dependence on men, the erroneous belief that men are healthier than women, that women make monthly blood donations to nature through their menstrual cycle besides other factors such as pregnancy and breastfeeding

further restrict many women from donating blood [14]. There is a need to develop an evidence-based educational, cultural and religious-focused and friendly interventions that encourage females to donate blood. There is a need to educate the female population to address the negative perceptions against blood donation and the importance of blood donation [14]. The present study is to elaborate the lower rate of female participation in voluntary blood donation in developing countries.

2. MATERIALS AND METHODS

The study was conducted in blood bank, J.A hospital and G. R. medical College Gwalior, India. This is a retrospective cross-sectional study. Donors visiting blood bank for blood donation from January 2004- December 2014 were included in the study. Donors were screened and selected/ rejected by trained personnel after satisfactorily answering the donor's questionnaire, their physical examination and hemoglobin (Hb %) estimation as per the standard operating procedure (SOP). A total of 1, 37,767 blood Donations from the selected donors were collected over a period of eleven years. These donors were Voluntary Donors (VD) and Replacement Donors (RD). Replacement donors were those donors who donated blood for ailing patients and were family members and close relatives. The Voluntary donations were obtained from walk in donors and in voluntary blood donation camps organized by different institutions, neighboring colleges, different social and political organizations. Professional and paid donors were carefully eliminated at the stage of donor's selection and physical examination. Written consent from the donor was also taken prior to donation. 3 ml blood in plain vial and 2 ml blood in EDTA (ethylene diamine tetra acetic acid) vial taken from the satellite bag for testing of transfusion- transmitted infections (TTI), blood grouping, cross matching, etc.

Data was collected from the existing blood bank record and was compared statistically by frequency distribution and percentage proportion. Chi-square (χ^2) test was applied to know the statistically significant difference in blood donation rate between males and females (*p*-value). Epicalc version 2000 software was used for statistical analysis.

3. RESULTS

A total number of 1, 37,767 donors donated blood from January 2004- December 2014, out of which 94,729 (68.8%) were voluntary and 43,038 (31.2%) were replacement donors (Table 1). A significant increase in voluntary blood donation was reported from the year 2004 to 2014 which was 15.2% to 95.0% and it was statically significant $p<0.00001$ (Fig. 1). The proportion of male vs. female blood donation in the study came out to be 96.16% & 3.84% respectively and it was found highly significant statistically ($p< 0.00001$). No significant variation of male vs. female ratio was reported among voluntary and replacement blood donors i.e. male: female-96.11%: 3.89% and 96.28%: 3.72% respectively in the present study (Table 1). Proportion of female blood donors in the present study was 3.67% in the year 2004, 3.90% in 2005, 3.34% in 2006, 3.18% in 2007, 3.32% in 2008, 3.71% in 2009, 3.66% in 2010, 3.96% in 2011, 4.57% in 2012, 4.50% in 2013 and 4.18% in 2014. There was a marginal improvement in the female donation in last three years of the study but it was only significant statistically in voluntary donation group. The *p* values are p =0.265, p=0.0013 and p=0.999 in replacement, voluntary and total donations respectively.

4. DISCUSSION

According to 2012 World Health Organization (WHO) report, in India only nine million units are collected annually, while the need is for 12 million units [15]. As total population of India is 1.2 billion, there is 1% donation and a deficit of 3 million units per year. The gap between demand and supply can be bridged by carrying out a proper assessment so that the demand can be met through planned donor recruitment and planned production of blood components and plasma derivatives. The WHO recommends that 1% to 3% of a country's population should donate blood to meet the needs of that country [16]. The sex ratio for the entire world population is 101 males to 100 females [17]. In the United States, the sex ratios at birth over the period 1970–2002 were 1.05 for the white non-Hispanic population, 1.04 for Mexican Americans, 1.03 for African Americans and Indians, and 1.07 for mothers of Chinese or Filipino ethnicity [18]. Among Western European countries in 2001, the ratios ranged from 1.04 in Belgium to 1.07 in Switzerland [19], Italy [20] and Ireland [21]. In the aggregated results of 56 Demographic and Health Surveys [22] in African countries, the ratio is 1.03, though there is also considerable country-to-country variation [23].

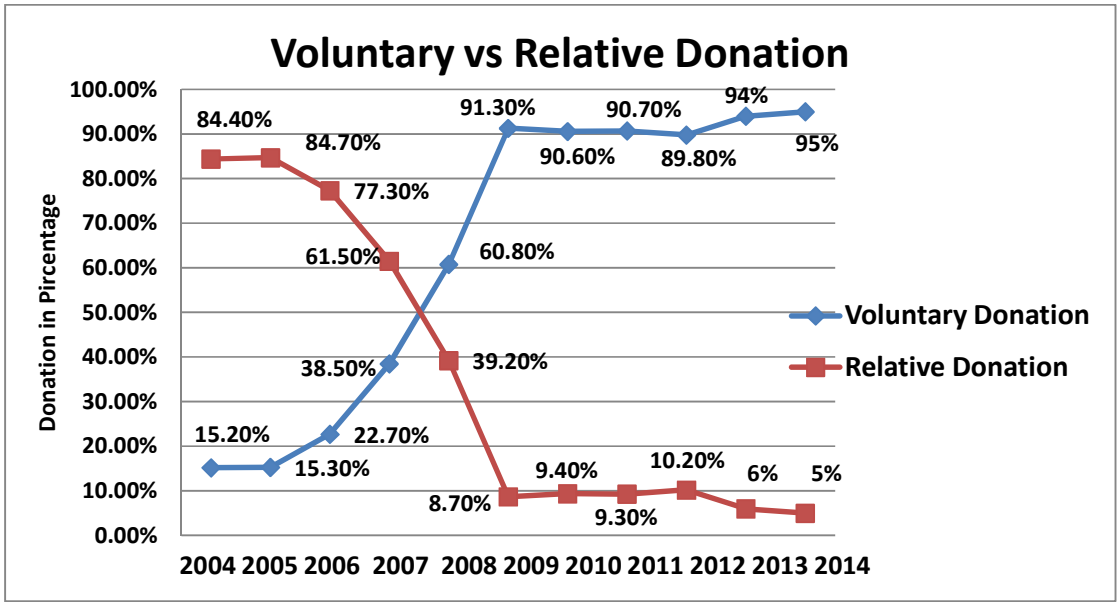

Fig. 1. Increasing pattern of voluntary blood donation

Table 1. Distribution pattern of blood donation from 2004-2014

Year	Total donation			Voluntary donation			Replacement donation		
	Total (*p* value)	Male	Female	Total (*p* value)	Male	Female	Total (*p* value)	Male	Female
2004	7900 P<0.000	7610 (96.33%)	290 (3.67%)	1201 P<0.000	1162 (96.74%)	39 (3.26%)	6699 P<0.000	6448 (96.26%)	251 (3.74%)
2005	8201 P<0.000	7881 (96.10%)	320 (3.90%)	1254 P<0.000	1220 (97.29%)	34 (2.71%)	6947 P<0.000	6661 (95.89%)	286 (4.11%)
2006	11366 P<0.000	10986 (96.66%)	380 (3.34%)	2528 P<0.000	2422 (95.81%)	106 (4.19%)	8838 P<0.000	8564 (96.90%)	274 (3.10%)
2007	14461 P<0.000	14001 (96.82%)	460 (3.18%)	5580 P<0.000	5360 (96.06%)	220 (3.94%)	8881 P<0.000	8601 (96.85%)	280 (3.15%)
2008	12946 P<0.000	12515 (96.68%)	431 (3.32%)	7878 P<0.000	7598 (96.45%)	280 (3.55%)	5068 P<0.000	4907 (96.83%)	161 (3.17%)
2009	12914 P<0.000	12434 (96.29%)	480 (3.71%)	11788 P<0.000	11377 (96.52%)	411 (3.48%)	1126 P<0.000	1087 (94.54%)	39 (3.46%)
2010	12638 P<0.000	12175 (96.34%)	463 (3.66%)	11449 P<0.000	11018 (96.24%)	431 (3.76%)	1189 P<0.000	1152 (96.89%)	37 (3.11%)
2011	13106 P<0.000	12586 (96.04%)	520 (3.96%)	11886 P<0.000	11405 (95.96%)	481 (4.04%)	1220 P<0.000	1171 (96.99%)	49 (4.01%)
2012	14001 P<0.000	13360 (95.43%	641 (4.57%)	12573 P<0.000	12031 (95.69%)	542 (4.31%)	1428 P<0.000	1329 (93.07%)	99 (6.93%)
2013	14473 P<0.000	13821 (95.50%)	652 (4.50%)	13613 P<0.000	13025 (95.68%)	588 (4.32%)	860 P<0.000	796 (92.56%)	64 (7.44%)
2014	15761 P<0.000	15101 (95.82%)	660 (4.18%)	14979 P<0.000	14418 (94.26%)	561 (3.74%)	782 P<0.000	718 (91.82%)	64 (8.18%)
Total	137767 P<0.000	132470 (96.16%	5297 (3.84%)	94729 P<0.000	91036 (96.1%)	3693 (3.89%)	43038 P<0.000	41434 (96.28%)	1604 (3.72%)

The first step toward blood safety remains the recruitment of voluntary non-remunerated donations from low-risk repeat donors [24,25]. In a developing country like India the male to female ratio of blood donation is significantly low though the ratio of male to female population is almost equal. In the present study it can be seen that in the past decade the blood donations by

male donors is way too high (96.16%) as compared to the female blood donors (3.84%). Previous research has revealed a higher rate of deferral in females, primarily because of anemia [26]. In our study females were not allowed to donate blood mainly due to anaemia and low weight. In 2003 female blood donors represented 40% of the blood donor population in Austria, 49.7% in France, 50% in Norway and 55% in Great Britain [27]. Greece and Italy are the only European countries in which the percentage of female donors is about 33% [28]. In Spain, 46% of the blood donors are women [29], in Portugal 43% [30], in Belgium 45.4%, [31] in Netherlands 50% [32], in France 50%, [33] and in Finland 55% [34]. This is in affirmation of the WHO report that there are more male donors in Nigeria [35]. Factors such as their frequent menstrual cycles, pregnancy, and lactation may prevent them from donation.

About 234 million major operations are performed worldwide every year, with 63 million people undergoing surgery for traumatic injuries, 31 million more for treating cancers and another 10 million for pregnancy-related complications require a blood transfusion [36,37]. About 300 000 infants are born each year with Thallassemia and sickle-cell disease and need regular blood transfusion [38].

Developed countries with well-structured health systems and blood transfusion services based on voluntary blood donation are generally able to meet the demand for blood and blood products. First-time donors are of great importance because they represents the continuation of blood supply [39]. Their conversion into repeat donors is easier to achieve than recruiting people who have never donated [40].

In the WHO African region, blood requirements were estimated at about 8 million units in 2006, but only 3.2 million units were collected – about 41.5% of the demand [41].

South-East Asia accounts for about 25% of the world's population; but collects only 9% of the world's blood supply – 7 million units a year compared with an estimated requirement for a total of 15 million units [42]. Globally, over 81 million donations of blood are collected annually, but only 45% of these are donated in developing and transitional countries, where 81% of the world's population lives [11].

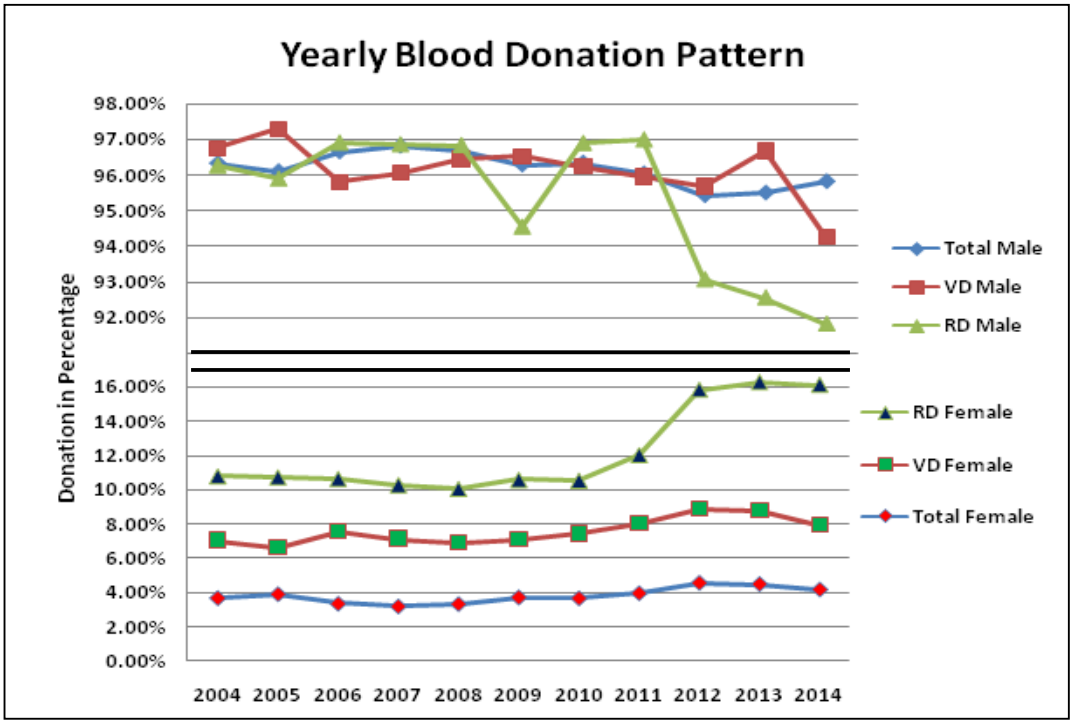

Fig. 2. Yearly male/female blood donation pattern
VD = Voluntary Donation, RD = Replacement Donation

In the view of Indian perspective, if blood donation is increased up to 2% by ensuring maximum participation of the females, extending component therapy to the remote areas of the country (which is presently restricted only in larger cities) and ensuring rational use of blood, the deficit between demand and supply could be leveled. Presently, alternative of human whole blood and endorsement of the blood substitutes is still a question mark. Further, retrospective cross-sectional studies have some limitations such as selection bias, information bias and also certain key statistics which cannot be measured.

5. CONCLUSION

The present study shows that female participation in blood donation is extensively low, as reported from other parts of India and underdeveloped countries. While in developed countries it is almost equal or even higher. There's need to encourage females by various evidence-based educational interventions about the importance of blood donation, so that there could be equal participation from them which may result in leveling the deficit of demand and supply of blood which currently resides in our country. Also, component therapy and rational use of blood should be taken into consideration throughout the country including the remote rural areas for a better tomorrow.

ETHICAL APPROVAL

All author(s) hereby declare that all procedure have been examined and approved by the appropriate ethics committee of Gajra Raja Medical College, Gwalior, India and research have therefore been performed in accordance with the ethical standards laid down in the 1964 declaration of Helsinki.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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