International Journal of Zoology and Applied Biosciences **ISSN: 2455-9571**
Volume 2, Issue 5, pp: 211-217, 2017
https://doi.org/10.5281/zenodo.1312074
http://www.ijzab.com
Research Article

A STUDY ON THE PREVALENCE OF ABO BLOOD GROUPS AND RHESUS FACTOR AMONG THE GIRL STUDENTS AROUND PERAMBALUR IN TAMILNADU

Jayakkodi Gauthaman*
Department of Zoology, Kunthavai Nachiaar Government Arts College for Women (Autonomous), Thanjavur- 613003, Tamil Nadu, India.

Article History: Received 21st September 2017; Accepted 7th October 2017; Published 9th October

ABSTRACT

Blood groups are genetically determined. The frequencies of ABO and Rh blood groups vary from population to population and from time to time in the same region. A study was conducted among selected Government Higher Secondary Schools of Perambalur District from December 2016 to July 2017. Blood groups of 2148 girl students from 15 schools were screened by antigen antibody agglutination method using commercially available antisera. The study revealed that the commonest ABO blood group was O with 34.64%, followed by B group with 33.75%, A with 22.39% and AB with the least % of 9.22. Rh+ type were 96.51% and Rh- type were making up to 3.49% of the population studied .Counseling sessions were conducted in the schools to create awareness on Rh incompatibility.

Keywords: Blood groups, Rh factor, Girl students, erythroblastosis fetalis.

INTRODUCTION

Human blood types are classified based on the presence or absence of antigenic substances on the surface of red blood corpuscles and antibodies in the blood serum. A total number of 35 human blood group systems are now recognized by the International Society of Blood Transfusion (ISBT, 2014). The two most important ones are ABO and Rhesus (Rh) blood group systems.

All humans can be typed for the four principal blood types A, B, AB and O. A, B and O blood types were discovered by Karl Landsteiner in 1900 (Landsteiner, 1900) for which he was awarded the Nobel prize in 1930. Alfred Von Decastello and Adriano Sturli discovered the fourth type AB in 1902 (Von Decastello and Sturli, 1902).There are two antigens and antibodies; the specific combination of these four components determines an individual's blood type. People with blood group A have antigen A and antibodies against B antigen. Therefore, A individuals can receive blood only from individuals of group A or O and can donate blood to individuals with type A or AB. Those with B group have B antigen and anti-A antibodies and they can receive blood from B or O individuals and can donate to individuals with B or AB. AB people have both A and B antigens and do not have antibodies. Therefore, they can receive from any group, but cannot donate to any group other than AB and are known as universal recipients. Individuals with blood group O do not have either A or B antigens and their blood serum contain both anti-A and anti-B antibodies. Therefore, they can receive blood only from group O individuals, but can donate to individuals of any ABO blood group. They are known as universal donors.

Rhesus system is the second most important blood group system from transfusion point of view. Rhesus system was discovered by Landsteiner and Alexander S. Weiner in 1937 (Landsteiner and Weiner, 1940). Rhesus system is composed of 58 different antigenic specificities (Chou and Westhoff, 2011). The presence of the Rh factor, a protein on the cell surface, constitutes Rh positive (Rh+) person, whereas the absence of Rh factor indicates a negative (Rh-) person. In addition to the blood group A, B, AB and O, Rh factor is written as either positive or negative. Weiner realized adverse reactions from transfusions were also resulting from Rh factor.

The distribution of ABO and Rh blood group systems has been repeatedly investigated in various populations all over the world and their frequencies exhibited considerable variation in different geographic locations, reflecting the

*Corresponding Author: Dr. Jayakkodi Gauthaman, Associate Professor and Head, Department of Zoology, Kunthavai Nachiaar Government Arts College, for Women (Autonomous), Thanjavur- 613003, Tamil Nadu, India, Email: jayagpraba@gmail.com

underlying genetic and ethnic diversity of human populations .The frequency of these two blood groups not only varies in populations throughout the world but even in different parts of country. The knowledge of distribution of ABO and Rh blood groups at local and regional levels are helpful in the effective management of blood banks and safe blood transfusion services. Identification of Rh system is important to prevent erythroblastosis fetalis, which commonly arises when a Rh negative mother carries a Rh positive fetus.

Blood group frequency studies have been carried out in different populations of the world. The present study was carried out to record the frequency of various blood groups with special reference to Rh factor among the girl students from the Government Higher Secondary Schools of Perambalur District mostly from the central and western parts. The study was conducted with an aim to create basic awareness about the significance of Rh system among the girl students which would help to eliminate the risk of erythroblastosis fetalis in the region.

MATERIALS AND METHODS

The study was carried out in 15 Government Higher Secondary Schools of Perambalur District from December 2016 to July 2017.Girl students of twelfth and eleventh standard classes were considered for the study; students of tenth and ninth standard classes were also included in several schools.

Blood group analysis of the candidates was performed with the commercially available standard monoclonal antisera by agglutination technique. Blood group details including the Rh factor of each student were recorded. The recorded data were tabulated and consolidated class wise and school wise.

OBSERVATIONS

Table 1 gives the blood group details of the population studied during the study period. 225 candidates of the Government Higher Secondary School, V. Kalathur were analyzed for their blood groups. Among the 225, 50 belong to A+ and 2 A- making a total of 52 A group candidates; 76 were B+ and 2 were B- making a total of 78 B group candidates; 19 belong to AB+ type and 2 were AB- group making a total of 21 AB candidates; 73 were with O+ and 1 with O- making a total of 74 O group candidates.

160 candidates of the Government Higher Secondary School, Perambalur were analyzed for their blood groups. Among them, 34 belong to A+ group and 2 were A- making a total 36 A group candidates; 47 belong to B+ and 2 to B- making a total of 49 B group candidates; 12 candidates were with AB+ and 1 with AB- making a total of 13 AB candidates; 61 belong to O+ group and 1 with O- making a total of 62 O group candidates.

133 candidates of the Government Higher Secondary School, Ammapalayam were analyzed for their blood groups. Among them, 26 belong to A+ and one with A- making a total of 27 A group candidates; 38 were with B+ and one is with B- making a total of 39 B group candidates; 10 were AB+ and one with AB- making a total of 11 AB candidates; 56 belong to O group with 55 O+ and 1 with O-.

188 candidates of the Government Higher Secondary School, Kurumbalur were analyzed for their blood groups. Among them,39 belong to A+ and 3 with A- making a total of 42 A group candidates; 65 belong to B group and all were B+. 19 were AB+ and one with AB- making a total of 20 AB group candidates; 61 belong to O group with 56 O+ and 5 O-.

65 candidates of the Government Higher Secondary School, Melapuliyur were analyzed for their blood groups. Among them,14 belong to A+ and one with A- making a total of 15 A group candidates;19 were with B+ and none with B-; 5 were AB+ and none with AB-; 26 were with O+ and none with O-.

324 candidates of the Government Higher Secondary School, Chettikulam were analyzed for their blood groups. Among them, 73 belong to A+ and 3 with A- making a total of 76 A group candidates; 99 were B+ and 1 with B- making a total of 100 B group candidates; 27 belong to AB + group and one with AB- making a total of 28 AB; 116 were with O+ and 4 with O- making a total of 120 O group candidates.

100 candidates of the Government Higher Secondary School, Esanai were analyzed for their blood groups. Among them, 22 belong to A+ and two with A-making a total of 24 A candidates ; 30 were with B+ and one with B- making a total of 31 B candidates; 10 with AB+ and none with AB-; 34 were with O+ and one with O- making a total of 35 with AB group.

107 candidates of the Government Higher Secondary School, Siruvachur were analyzed for their blood groups. Among them, 30 belong to A+ and one with A- making a total of 31 A group candidates; 29 were with B+ and none with B- ; 5 were AB+ and none with AB-; 42 were with O+ and none with O-.

A total number of 130 students were analyzed for their blood groups in Government Higher Secondary School, Veppanthattai for their blood groups. Among them, 27 belong to A+ and 3 with A- making a total of 30 A group candidates; 43 were with B+ and one with B- making a total of 44 B group candidates; 11 were AB+ and one with AB- making a total of 12 AB candidates; 43 were with O+ and one with O- making a total of 44 O group candidates.

217 candidates of the Government Girls Higher Secondary School, Kolakkanatham were analyzed for their blood groups. Among the 217, 40 belong to A+ and one A- making a total of 41 A group candidates; 74 were with B+ and 2 were B- making a total of 76 B group candidates; 31 belong to AB+ type and one with AB- group making a total of 32 AB candidates; 65 were with O+ and 3 with O- making a total of 68 O group candidates.

A total number of 69 students were analyzed for their blood groups in Government Higher Secondary School, Pasumbalur. Among them, 7 belong to A+ and none with A-.32 were with B+ and one with B- making a total of 33 B group candidates; 7 were AB+ and none with AB-; 19 were with O+ and 3 with O- making a total of 22 O group candidates .

158 candidates of the Government Higher Secondary School, Kai Kalathur were analyzed for their blood groups. Among them 39 belong to A+ and none with A- ; 51 were with B+ and 4 were B- making a total of 55 B group candidates; 13 belong to AB+ type and none with AB-; 50 were with O+ and one with O- making a total of 51 O group candidates.

A total number of 62 students were analyzed for their blood groups in Government Higher Secondary School, Nerkunam. Among the 62, 10 belong to A+ and none with A-; 24 were with B+ and 2 were B- making a total of 26 B group candidates; 8 were AB+ and none with AB-; 17 were O+ and one with O- making a total of 18 O group candidates.

152 candidates of the Government Higher Secondary School, Padalur were analyzed for their blood groups. Among them 38 belong to A+ and two with A- making a total of 40 A group candidates ; 54 were with B+ and none B-; 8 belong to AB+ type and one with AB- making a total of 9 AB group candidates. 48 were with O+ and one with O- making a total o f 49 O group candidates.

A total number of 58 students were analyzed for their blood groups in Government Higher Secondary School, Koothur. Among the 58, 9 belong to A+ and 2 with A- making a total of 11 A group candidates; 25 were with B+ and 2 were B- making a total of 27 B group candidates; 4 were AB+ and none with AB- ; 15 were O+ and one with O- making a total of 16 O group candidates.

Table 1. Blood group details of the population studied.

S. No.	School	A+	A-	B+	B-	AB+	AB-	O+	O-	Total
1	G.G.H.S. School, V. Kalathur	50	02	76	02	19	02	73	01	225
2	G.H.S. School, Perambalur	34	02	47	02	12	01	61	01	160
3	G.H.S. School, Ammapalayam	26	01	38	01	10	01	55	01	133
4	G.H.S. School, Kurumbalur	39	03	65	-	19	01	56	05	188
5	G.H.S. School, Melapuliyur	14	01	19	-	05	-	26	-	65
6	G.H.S.School, Chettikulam	73	03	99	01	27	01	116	04	324
7	G.H.S. School, Esanai	22	02	30	01	10	-	34	01	100
8	G.H.S. School, Siruvachur	30	01	29	-	05	-	42	-	107
9	G.H.S. School,Veppanthattai	27	03	43	01	11	01	43	01	130
10	G.H.S. School, Kolakkanatham	40	01	74	02	31	01	65	03	217
11	G.H.S. School, Pasumbalur	07	-	32	01	07	-	19	03	69
12	G.H.S. School, Kai,Kalathur	39	-	51	04	13	-	50	01	158
13	G.H.S. School, Nerkunam	10	-	24	02	08	-	17	01	62
14	G.H.S. School, Padalur	38	02	54	-	08	01	48	01	152
15	G.H.S. School, Koothur	09	02	25	02	04	-	15	01	58
	Total	458	23	706	19	189	09	720	24	2148
	Total		481		725		198		744	2148

Table 2 gives the frequency of various blood groups including ABO and Rh in the studied population. In the whole population studied, among the 2148 subjects, 481 belong to A group with a percentage of 22.39; among the 481, 458 were A+ making a percentage of 22.09 of the Rh+ population and 23 were of A- type making up to 30.67 % of the Rh- population. Among the 2148 candidates, 725 have blood type B making a percentage of 33.75; among the 725, 706 students have B+ type making up to 34.06% of Rh+ population and 19 were of B- type making up to 25.33% of the Rh- population .198 candidates were of AB group making a percentage of 9.22; 189 of them were AB+ with percentage of 9.12 of Rh+ population and 9 were AB-, their percentage being 12 of the Rh- population. 744 of the studied population belong to O group with a percentage of 34.64; among the 744,720 belong to O+ making a percentage of 34.73 of Rh+ population and 24 have O- blood type with 32 % of Rh- population. Among the 2148 candidates, 2073 were Rh+ type making 96.51% of the studied population and 75 were with Rh- type making up to 3.49% of the population studied.

Table 2. Frequency of blood groups (ABO & Rh) in the population studied.

S. No.	Blood Group	Total Subjects (n)	%	Total Rh+ Subjects (n)	Rh+ %	Total Rh- subjects (n)	Rh- %
1	A	481	22.39	458	22.09	23	30.67
2	B	725	33.75	706	34.06	19	25.33
3	AB	198	09.22	189	09.12	09	12.00
4	O	744	34.64	720	34.73	24	32.00
	Total	2148	100.00	2073	100.00	75	100.00

Rh+ = 96.51%: Rh- = 3.49%

DISCUSSION

ABO and Rh phenotypes vary widely across races and geographic boundaries. Blood types are inherited and represent contributions from both parents. The resultant polymorphism remains important in population studies estimating the availability of the compatible blood, evaluating the probability of haemolytic disease of the new born, resolving disputes of paternity etc.

Thus due to its medical importance, pursuing a line of investigation on the ABO and Rh blood group systems has been of significance for years. The relative frequencies of various blood groups have been studied on different populations of the world including studies among Indian population. India carries a lot of diversity in the distribution of blood groups. Geographic distribution of blood groups in India shows that in Northern, Central and Western parts of India, B is the commonest blood group.

Studies done by authors like Tulika Chandra and Gupta Ashish (2012) at Lucknow, by Sidhu (2003) and Rahman and Lodhi (2004) in Punjab, Rajshree (2013) in Western Rajasthan and Nanu and Tapliyal (1977) showed blood group B was the commonest followed by O,A and AB. Studies done in Western parts of India like in Eastern Ahmedabad by Wadhwa *et al.* (1998), Western part of Ahmedabad by Patel Piyush *et al.* (2012), in Loni-Maharastra by Giri *et al.*(2011), in Latur-Maharastra by Deshpande and Wadde (2013) and by Mehta Nidhi and Swadas Bhawna (2012) at Surat showed blood group B as the commonest followed by O,A and AB. Studies in Central Indian regions like Indore by Gupta Narendra Kumar and Dadwal (2012) also revealed B group to be the most common followed by O, A and AB.

In Eastern and Southern parts of India O is the most frequently occurring blood group. Study done in Durgapur by Nag and Das in 2012 showed O to be the commonest group. In Southern parts of India studies by Periyavan *et al* (2010) at Bangalore,Reddy and Sudha (2009) at Chittoor, Das *et al*(2001) at Vellore, at Devanagere by Mallikarjuna (2012) and at Shimoga Malnad by Girish *et al.*, (2011) found that the commonest blood group was O followed by B, A and AB, A multicentric study carried out in India representing the eastern, western, northern, southern and central regions of the country also revealed O as the commonest blood group closely followed by B, followed by A and AB was the least prevalent group (Agarwal *et al*., 2014). The incidence of the ABO blood groups in the above regions is in consonance with the present study. Thus studies done in most parts of India show the commonest blood group is either B or O followed by A and AB.

The study conducted by Naidu and Veeraju (1982) shows predominance of A group in Brahmin community and B group in Kammas community of coastal Andhra Pradesh. Datta *et al* (1997) observed high incidence of group A among Lodha tribe of West Bengal. These findings are different from those reported in other studies and the difference is because these studies were limited to individual communities/ tribal population.

Outside India, in Pakistan, study by Hammed *et al.*(2002) shows the commonest blood group is B. Bernhard (1980) investigated different native ethnic groups of Hindu Kush region of Pakistan and Afghanistan for distribution of ABO group which revealed a relatively high frequency of blood group A and of extremely low frequencies of groups B and O. The distribution differs appreciably from that of Indian subcontinent. Study done in Nepal by Pramanik and Pramanik (2000) found the commonest blood group was A. A report by Tomilin and Gurtovaia (1999) on a population of the Russian Federation also showed A as the most prevalent blood group.

Studies done in Britain by Frances (2002) and in USA by Mollison *et al.* (1993) showed O group to be the most prevalent followed by A, B and AB. Thus if the data reported from countries across the world is compared, there is an almost equal predominance of both O and B groups in Indian and neighboring countries, in contrast to dominance of O and A groups in the European and African countries. The least reported group in all these populations has been AB; this holds good for the present study also.

The frequency of Rh blood types differs in various populations of the world (Parveen, 1983; Rashid, 1983; Lyko *et al.*,1992; Gaertner *et al.*, 1994; Subhan *et al.*, 2000; Mack, 2001; Shamin *et al.*, 2002). The studies show a global trend of Rh positive being significantly higher than Rh negative individuals. 94.60% of people of Peshawar in Pakistan were of Rh+ type and 5.40% were Rh- (Shamin *et al.*, 2002); in Nigeria 95.67% were Rh+ and 4.33% were Rh- (Gaertner *et al.*, 1994); in Kenya it was 96.10% and 3.90% (Lyko *et al.*, 1992); in Azad Jammu and Kashmir,

97.70% were Rh+ and 2.30% were Rh- (Rashid, 1983); in Lahore region of Pakistan the frequency was 92.00% and 8.00% (Parveen, 1983); in Islamabad area of Pakistan Rh+ people were 92.67% and Rh- were 7.33% (Subhan *et al*., 2000); another study in the Bannu region of Pakistan shows the frequencies of 89.27% and 10.73% (Khan *et al.,* 2004). Study conducted in Nepal showed 96.7% of Rh+ type and 3.3% of Rh – type (Pramanik and Pramanik, 2000). Studies across USA and Britain showed a higher fraction of prevalence of Rh– type (Mollison *et al*., 1993; Frances, 2002). A study conducted by Yousaf and his colleagues in Bahawalpur division of Pakistan revealed a population of exclusively Rh positive people (Yousaf *et al*., 1988).

The incidences of Rh blood types have also been studied in many parts of India. In Lucknow, 95.71% were found to be Rh+ with Rh - % being 4.29% (Tulika Chandra and Gupta Ashish, 2012). In Punjab, Rh + was found to be 97.3% and Rh- was 2.7%. Studies in Ahmedabad showed 95.05% Rh+ and 4.95% Rh-in Western part (Patel Piyush *et al*., 2012) and 94.20% Rh + and 5.80% Rh-in eastern part (Wadhwa *et al*., 1998). Rh+ was found to be 94.18% and Rh – as 5.82% in Surat (Mehta Nidhi and Swadas Bhawna, 2012). In Indore, Rh + % was 95.43 and Rh-% was 4.57 (Gupta Narendra Kumar and Dadwal, 2012). In Latur of Maharastra 95.19% of blood donors were Rh+ and 4.81% were Rh- (Deshpande and Wadde, 2013). Nag and Das (2012) report in Durgapur showed Rh+ 94.70% and Rh –5.30%. In Bangalore, the % of Rh+ type was 94.2 and that of Rh– was 5.8 (Periyavan *et al*., 2010). In Vellore, Rh+ type was 94.5% and Rh- was 5.5% (Das *et al*., 2001). Study by Mallikarjuna (2012) at Devanagere showed 94.8% Rh + type and 5.2% Rh- type. In Shimoga-Malnad, Rh + % was 94.93 whereas that of Rh – was 5.07(Girish *et al*., 2011). In Thanjavur, Rh + % was 83.08 and that of Rh- was 16.92 among women (Jayakkodi Gauthaman and Kalaiselvi, 2013). A multicentric study by Agarwal *et al.* (2014) showed that 94.61% of the studied population were Rh + and rest 5.39%, were Rh -.

The present study also shows a higher frequency of Rh+ individuals, their percentage being 93.83 and that of Rh- being 6.17%. The study shows that the percentage of Rh- cases in the studied population follows the global trend of being significantly rarer than Rh+ individuals. Rh antigen is present in Rh + blood type and absent from Rh - blood. Both Rh+ and Rh- types of persons are normal and none has natural anti-Rh antibodies in their blood plasma. However Rh- person can develop these antibodies on receiving Rh antigens through transfusion of Rh+ blood. Such a blood transfusion will be safe only when the recipient had never been exposed to Rh+ blood earlier. If already exposed, the previously developed anti-Rh antibodies will agglutinate the donor's red blood cells. The degree of agglutination depends upon the amount of anti-Rh antibodies present. High concentration of anti-Rh causes severe agglutination of red blood cells which sometimes proves fatal (Verma and Agarwal, 2004).

Whether or not a person has the Rh factor is genetically determined. The Rh factor is a dominantly inherited autosomal trait. The population is divided into Rh+ individuals, either homozygous or heterozygous for a gene that specifies antigen D. The Rh locus carries a set of multiple alleles. If any one of the multiple alleles is dominant, Rh antigen is produced, resulting in Rh+ blood type. One must receive a recessive allele from both parents to be Rh-. If this occurs in the mother, and the father is Rh+, then the baby will have either a 50% chance of having the Rh protein, depending on if the father is heterozygous dominant or a 100% chance if the father is homozygous dominant for Rh factor.

A woman with Rh- blood type is at risk when she bears an Rh+ child. While the mother's and baby's blood systems are separate. There are times when the blood from the baby can enter into the mother's system. This can cause the mother's white blood cells to produce antibodies against the Rh factor. If this happens the mother is said to be sensitized. The mother's immune system begins to produce long-term Rh antibodies. Clinical situations like fetomaternal hemorrhage could also arise during the course of pregnancy through Rh incompatibility.

However sensitization can also occur during a miscarriage, abortion, ectopic pregnancy and even during some procedures like amniocentesis. Mixing of maternal and fetal blood does not normally occur but may take place before or during birth if a tear in a placenta allows some fetal blood to enter the mother's circulatory system. For initial sensitization, transplacental transfer of at least 0.5 cc of fetal blood is necessary which usually takes place during first delivery, subsequent sensitization by as little as 0.3 cc of blood during subsequent pregnancies is sufficient to cause haemolytic anaemia in fetus or newborn (Sathya Gupta, 1978). Erythroblastosis fetalis or Haemolytic disease of the Newborn (HDN), can manifest in various grades of severity affecting the vital organs and present many complications.

Most cases of Rh disease are prevented today because prenatal care currently tests all women who plan on having a baby. During every pregnancy the blood groups of the father and mother should be checked routinely. In cases of Rh incompatibility, maternal anti-D-titres should be checked regularly. Rising maternal antibody titre is a more important criterion. Coomb's test is a sensitive method of demonstrating the presence of antibodies absorbed or bound to the red blood cells; the test is used to demonstrate circulating antibodies in the maternal serum by demonstrating agglutination of Rh+ red blood cells by addition of antiglobulin serum (Sathya Gupta, 1978).

Women who are not yet sensitized are given an Rh immunoglobulin drug which is both necessary and effective for preventing Rh disease consequences. The drug used is called RhoGAM, and it is injected directly into the woman's muscle at least twice for every pregnancy. By this means the Rh positive fetal cells that have entered the maternal blood are destroyed before the mother can produce her own Rh antiserum. The injected drug then disappears, and the Rh antiserum is no longer present at the next pregnancy (Bowman, 1998; Strickberger, 2001).

Weiner pioneered the exchange transfusion to combat erythroblastostosis fetalis in new born infants. This transfusion technique saved the lives of many thousands of infants before intrauterine transfusion was invented which enabled much more severely affected fetuses to be successfully treated. Other methods of therapy include phototherapy, phenobarbitones and albumin administration (Sathya Gupta, 1978).

An association of complications like erythroblastosis fetalis with Rh blood group would make the data generated by the study, to be useful for health planners, while making efforts to face the future health challenges in the region.

CONCLUSIONS

The relevance of having knowledge about the blood group systems in any population is enormous. The types of information obtained from the findings are useful for genetic information, genetic counseling, medical diagnosis as well as general and physiological wellbeing of individuals in a population. The present study has a significant implication of generation of simple database of blood groups in the studied area. It not only provides scientific data but also serves to enable insight into possibilities of future burden and prevention of erythroblastosis fetalis which commonly arises when a Rh- mother carries a Rh+ fetus.

ACKNOWLEDGEMENTS

Author expresses her deep sense of gratitude to the University Grants Commission (SERO) for funding the study. The author also thanks the Chief Educational Officer of Perambalur district for permission granted to carry out the study across the Government Higher Secondary schools of the district and the DEO for the encouraging words. Finally the author acknowledges the help and support rendered by the head masters of the schools in which the screening and counseling sessions were carried out.

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