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Distribution of ABO and Rh (D) Blood Group System Among College Entrants at Kancheepuram, Tamil Nadu

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ABSTRACT
The most important and widely practised ABO and Rh (D) blood group system varies in frequency from population to population. The data of distribution of blood group is necessary for planning health care delivery in regard to blood transfusion service. As there is no data available in our region we undertook this study. To provide data regarding distribution of ABO and Rh (D) system at Kancheepuram, Tamil Nadu, India. This was a cross sectional study where the anonymised blood group data of college entrants at Kancheepuram were analyzed and presented. There were 1038 subjects, M:F 583:455, the age of the subjects were 17 Yrs 19.20%, 18 yrs 29.76%, 19 yrs 32.36%, 20 yrs 15.70% and 21 yrs 2.986%, the frequency distribution of ABO and Rh (D) system was: A group 19.17%, B group 36.31%, O group 38.63%, AB group 5.876%, Rh positive 94.5% and Rh negative 5.491%. This can be represented as O>B>A>AB. The allele frequencies of our study were A group allele frequency -0.2032, B group allele frequency -0.3945 and O group allele frequency -0.4023, Rh (D) positive allele 0.4712 and Rh (D) negative allele 0.0275. The results of our study are consistent with studies from our region. Worldwide the common blood groups are O and B. Our study included college entrants which resemble the general population unlike hospital-based volunteer blood donors data. The frequency distribution of ABO and Rh (D) at Kancheepuram is O>B>A>AB which is consistent with our neighbouring region.

INTRODUCTION

The information or data on the frequency distribution of blood groups is important in planning health care facilities especially in an era when blood transfusion and organ transplantation show an increasing trend[1]. Blood group distribution differs from population to population and race to race. Even in a given geographical area blood group distribution may show wide variation[1]. The widespread awareness of the blood groups can avoid unnecessary mismatched blood transfusion. The blood group system is studied for its relationship with certain disease conditions like peptic ulcer, stomach cancer and interestingly for predictability of severity of Covid -19 disease. Anthropology also finds blood group systems useful to find the migration pattern of the population[1]. Forensic science relies on blood group systems to settle certain legal issues like paternity.

The red cell membrane has a specific antigen which determines the blood group of the individual[2]. The blood group antigens are determined by the genes which follow the Mendelian mode of inheritance. They have stable characteristics. The gene for ABO system antigens are located at chromosome nine (9q) and for Rh (D) antigen at chromosome one (1p) respectively. The phenotype expression occurs during early foetal life and persists throughout life unchanged. There are nearly 30 different blood group systems, the most important and widely practised are ABO and Rh(D) systems. The A and B antigens in the red blood cell membrane and corresponding antibodies anti A and anti B in the plasma of the individual whose RBCs lack the corresponding antigen are expressed as A and B blood group phenotypically. The A and B antigens express in a co-dominant manner. In the Rh system the antigen is named as D. The three alleles of the ABO genes in the ABO system are IA, IB and IO with six possible genotypes. The phenotype A group is represented genotypically as IA IA, IA IO, B group as IBIB, IBIO, O group IO IO and AB as IAIB. In the Rh (D) system Rh positive is expressed as ID ID or ID Id and Rh negative as Id Id. There is no data available regarding frequency distribution of blood group system in our geographical area and hence we undertook this study. Aim: To provide data on frequency distribution of ABO and Rh (D) blood groups at Kancheepuram, Tamil Nadu, India.

MATERIALS AND METHODS

This was a descriptive epidemiological cross-sectional study. The anonymised data of ABO and Rh (D) blood group system available was analysed retrospectively. The data belonged to college entrants of university situated at Kancheepuram. Majority of the students (about 40%) admitted in this university were from Southern region. Rest of the students were from various states of India, representing diverse geographical areas, ethnicity and culture. Most of the students belonged to Class II of modified Kuppuswamy Socio-economic Scale. We believe this could be considered to mimic real world situation. The data was collected in the month of September, 2023. An informed general consent was obtained from participants. The blood grouping and typing was done by slide method. Simple statistical methods i.e. average, proportion, percentage were employed in analysing the data. Kancheepuram, an ancient city of historical importance is a semi urban, multi ethnic town situated 70 kms south west of Chennai, Tamil Nadu with a population of 3998252 (censu). The average literacy rate is 84.49%. The frequency data which we have cited in this article were from our neighbouring centres. The centres are: 1) Chengalpattu -45 kms away, 2) Chennai - 65 kms away, 3) Vellore - 70 kms away, 4) Bengaluru -280 kms away. Demographically there is no gross difference between these centres.

RESULTS

There were 1038 subjects in total, Male: Female 583:455 (56.1%:43.8%), 199 (19.20%) were aged 17 yrs, 309 (29.76%) were aged 18 yrs, 336 (32.36%) were aged 19 yrs, 163 (15.70%) were aged 20 yrs and 31 (2.986%) were aged 21 yrs, the mean age was 18.51+/-1.06 yrs, median age was 19. The frequency distribution of ABO and Rh (D) group is given in table number 1. Table number 2 shows gender wise distribution of ABO and Rh system.

The allele frequencies were calculated based on the simplified Hardy-Weinberg equilibrium. This is reasonably acceptable though it may not reflect real-world allele frequencies. The allele frequencies of our study were A group allele frequency -0.2032, B group allele frequency -0.3945 and O group allele frequency -0.4023, Rh (D) positive allele 0.4712 and Rh (D) negative allele 0.0275. Many studies on allele frequency do not show difference between allele frequency and phenotypic frequency.

DISCUSSIONS

The frequency distribution of ABO and Rh system in our area is A group -19.17%, B group -36.31%, AB group -5.876%, O group -38.63%, Rh positive -94.5% and Rh negative -5.491%. The frequency of distribution can be represented in the descending order as O>B>A>AB. The most common is the “O” group followed by B, A and AB. The majority of subjects are Rh (D) positive. This is consistent with other studies from India. Table number 3 shows comparison with few of Indian studies. The data of Sigamani K from Chengalpattu is concurrent with our data[2]. The frequency of blood groups were A group -22.03%, B

Table 1. Gender Wise distribution of ABO and Rh (D) System

	A	B	AB	O	Rh +ve	Rh -ve
Male	104	210	29	240	548	35
Female	95	167	32	161	433	22
Total Number	199	377	61	401	981	57
Proportion	0.1917	0.3631	0.5876	0.3863	0.9450	0.5491
Percentage	19.17%	36.31%	5.876%	38.63%	94.5%	5.491%

Table 2. Age group wise distribution of ABO and Rh groups

Age group		A	B	AB	O	Rh +ve	Rh -ve
1	17 years	47	63	14	75	192	7
2	18 years	59	108	17	125	287	22
3	19 years	56	134	19	127	317	19
4	20 years	31	61	9	62	157	6
5	21 years	6	11	2	12	28	3
Total number		199	377	61	401	981	57

Table 3. Comparison of our data with few Indian studies

Author and reference number	A group	B group	O group	AB group	Rh +ve group	Rh-ve group	Frequency in descending order
Amit Agrawal[1] combined data of all centres	22.88	32.26	37.12	7.14	94.61	5.39	O>B>A>AB
Amit Agrawal[1] data from Southern centre (Chennai)	20.68	33.07	38.99	6.25	93.91	6.08	O>B>A>AB
Amit Agrawal[1] data from Northen centre (Uttarakhand)	24.53	34.47	29.43	11.5	94.8	5.19	B>O>A>AB
Sigamani.K.[2] Chengalpattu.	22.03	30.92	39.17	7.88	95.96	4.04	O>B>A>AB
Sundar Periyavan[3] Bengaluru	23.85	29.95	39.81	6.37	94.2	5.79	O>B>A>AB
Das P.K.[4] Vellore.	18.85	32.69	38.75	5.27	94.53	5.47	O>B>A>AB
Present study Kancheepuram	19.17	36.31	38.63	5.876	94.5	5.491	O>B>A>AB

group -30.92%. O group -39.17%, AB group -7.88%, Rh positive -95.96% and Rh negative -4.04%. Sundar Periyavan reported data of 36964 blood donors from Bengaluru and it showed O group to be high (39.81%) followed by B group (29.95%), A group (23.85%) and AB group 6.37% Rh positive 94.1% and Rh negative 5.79%. It can be represented as O>B>A>AB[3]. Those results are consistent with our data. Das PK from Vellore reported similar data from blood donors[3]. A group -18.85%, B group -32.69%, O group -38.75%, AB group -5.27%, Rh positive -94.53% and Rh negative -5.47%. Our data is concurrent with their data.

Amit Agrawal *et al*. reported the results of multi-center study in India and our data are in agreement with them[1]. They have collected nearly 10,000 blood samples from five centres of India representing Northern, Central, Eastern, Western, Southern region and analysed them. Chennai was selected to represent the Southern region. The result of Chennai data was A group -20.68%, B group -33.07%, O group -38,99%, AB group -6.25%, Rh positive 93.91% and Rh negative 6.08. This was from volunteers of blood donation who were distributed throughout the Southern region. In the same study, data from Uttrakh and representing the Northern region showed the frequency as follows: A group -24.53%, B group -34.47%; O group -29.43%; AB group -11.55%, Rh positive -94.8% and Rh negative -5.19%. B group is prominent in the Northern region and the O group in the Southern region. The Southern regional data is concurrent with “Asiatic Trend”. The combined data of all centres is given in table number 3, which is consistent with our data. Throughout the world O or B group is the most common blood groups described. The migration of the population can be inferred from the blood group distribution studies. The result of this study is concurrent with larger studies from our neighbouring areas. In this study Male: Female proportion was 0.561:0.438. The female subjects were substantially high. Most of the other studies were conducted in hospital blood banks, especially volunteers of blood donation where male population was very high. The population of our study was mixed one with least gender disparity.

CONCLUSION

The frequency distribution of ABO and Rh (D) at Kancheepuram is O>B>A>AB which is consistent with our neighbouring regions. This will be helpful to formulate regional health care policy.

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