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Phenotypic distribution of ABO Blood Group and Rhesus factor among some college and school students of Karjat city, Ahilyanagar

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Abstract

The ABO blood group and Rh system is very much important for transfusion of blood and blood component, transplantation of organs and medico legal cases. ABO Blood group system is divided into A, B, AB and O on the basis of presence and absence of antigen A and B on the surface of the Red Blood Cells. Also Rhesus blood group is divided into positive and negative on the basis of presence or absence of D antigen. The current cross sectional study was carried out from August 2024 to October 2024. We use Spanclone Anti A + B + D (Rh0) Monoclonal Diagnostic reagents (Agglutinating Antisera) of Arkray Company for determination of blood groups. In that study we identified 548 (Male 292 & female 256) students blood groups from Dada Patil Mahavidyalaya and Mahatma Gandhi Vidyalaya, Karjat, Ahilyanagar. In the current study on the blood group distribution, the blood group B was 34.12%, then followed by blood group O (32.97%), blood group A (25.91%), and AB (12.41%) blood group. Also only a lesser number of the students were Rh negative (07.48 %), with the majority of Rh positive (92.52 %). Overall, the study serves as a valuable resource for enhancing blood center operations and ensuring preparedness in critical situations.

Keywords: Phenotypic, ABO blood group, Rhesus factor

Introduction

Blood in the body of human is considered to be the identity for all ^[18]. The blood type is determined by genes in their parents, blood group types differ between sister and brothers ^[8]. For blood transfusion and transplantation of organs the ABO and Rhesus blood systems are the most essential human blood type systems ^[4]. The Karl Landsteiner (1900) was discovered the ABO blood group type and Rhesus blood group system was discovered in 1939 ^[4, 8]. Following the discovery of ABO, blood transfusion became a reality ^[6].

Karl Landsteiner was a revolutionary figure in the field of blood grouping and antigen antibody reaction. His contributions in the ABO blood group system significantly influenced in the field of medicine. He and his colleagues "Decastello and Sturli" discovered the "AB" blood group in 1902, enhancing our understanding of blood types and compatibility in medicine. By his essential contributions to transfusion system, Karl Landsteiner was honoured with the Nobel Prize in Physiology and Medicine in 1930 ^[23]. Levine and Stetson made an important discovery by identifying the "Rh blood group system in the 1940. Understanding the local and regional distribution of this system is vital for competently operating blood banks and safety transfusion of blood ^[29]. About 29 blood group systems and an extensive array of over 700 distinct blood group antigens of the ABO blood group system and Rh blood group systems stand out as the foremost in importance, playing a crucial role in understanding and blood compatibility ^[16]. The principles of Mendelian genetics was adhere the ABO and Rh blood group system. The gene of ABO blood group system was situated on chromosome 9 and gene of Rh blood group system was situated on chromosome 1 ^[5]. In this system, antibodies are present in the plasma of blood without prior exposure through transfusion or pregnancy ^[17]. ABO and Rh blood group combinations vary extensively across races, ethnicities and socioeconomic groups globally. Understanding these variations is important for healthcare and efficient transfusion of blood in worldwide. Also this technique finds helpfulness in various scientific and medical fields, including

medico legal cases, genetic, forensic science and the enquiry of population migration outlines. The transfusing ABO incompatible blood poses risks like hemolysis (acute intravascular), kidney failure and possibly fatal outcomes [29]. Understanding the ABO and Rh blood group system is vital for working Blood Bank Centre, local blood transfusion facility or a national level ensuring safe and effective transfusion practices [10]. This study will document the spreading and occurrence of ABO and Rh phenotype blood group and produce social awareness about safe blood transfusion facilities. The aim of the current study was to identify the distribution of ABO and Rh phenotype blood group between college and school students.

A person's blood type is determined based on the presence or absence of antigen A and B on the surface of red blood cells [8]. If the person have antigen A belong to blood group A, if the person have antigen B belong to blood group B, if the person have both antigen A and B belong to group AB and person without antigen A and B belong to the blood group O [8]. Also antigen D found on RBCs, a person with antigen D is Rhesus Positive and a person without D antigen is Rhesus Negative [4]. Knowing the blood group distribution in the community was important in case of the patients need blood urgently, is usually useful in managing alloimmunization situations and emergency cases like patients with rare blood group [6]. The distribution and frequency of blood group types vary from country to country, the most common blood type in the world is O, followed by A and followed by B and AB [13]. But in Turkey the most common blood type is A [12]. Pakistan the blood type is B. Rhesus blood type is more common in Rhesus-positive people, much less Rhesus-negative [26].

Materials and Methods

In the present study a total of 548 college and highschool students are participated in the camp of blood group checking and check their blood group.

We interacted with participants in the study for taken information like name, sex and age. The blood samples were collected from the participants by finger pricking method of blood collection. For identification of ABO and Rhesus factor blood types by using the slide method (antibody-antigen agglutination). We use Spanclone Anti A + B + D (Rh₀) Monoclonal Diagnostic reagents (Agglutinating Antisera) of Arkray Company.

For identification take three separate drops of blood sample on the slide and then add antisera A, B and D and mixed them by using toothpicks. Then we observed Agglutination process for identification of blood groups. If agglutination was observed in A, it belonged to the A blood group. If observed agglutination in B; it belonged to B blood group. If agglutination observed in both A and B; it belonged to AB blood group and if no agglutination in both A and B then it belonged to the blood group O. If the agglutination was observed in 'D', it is Rhesus-positive; if there is no agglutination, it is Rhesus-negative.

Result

In the current study, out of 548 student participants screened for blood group types from Dada Patil Mahavidyalaya and Mahatma Gandhi Vidyalaya, Karjat, district Ahilyanagar 292 (53.28%) were males and remaining 256 (46.72%) were females (Table A). In current study, most common blood group type observed among the participants was blood

group B i.e. 187 (34.12 %), followed by blood group O i.e. 151 (32.97 %), then blood group A i.e. 142 (25.91 %) and blood group AB i.e. 68 (12.41 %) (Table B). Also the Rh positive participants in current study were 507 (92.52 %) and Rh negative participants were 41 (07.48 %) observed (Table C). The distribution of blood group among the college and highschool students in present study was shown in the table D.

Table 1: Characteristic of the student participants

Sr. No.	Characteristics	Frequency	Percentage (%)
01	Male	292	53.28
02	Female	256	46.72
Total		548	100 %

Table 2: Distribution of ABO blood group of student participants

Sr. No.	Blood Group type	Frequency	Percentage (%)
01	A	142	25.91
02	B	187	34.12
03	AB	68	12.41
04	O	151	32.97
Total		548	100

Table 3: Distribution of Rh factor of student participants

Sr. No.	Rhesus Type	Frequency	Percentage (%)
01	Positive	507	92.52
02	Negative	41	07.48
Total		548	100

Table 4: Distribution of ABO Blood Group in the Students

Sr. No.	Blood groups type	Frequency		Percentage (%)
		Male	Female	
01	A+	69	60	23.54
02	A-	5	8	2.37
03	B+	81	90	31.20
04	B-	9	7	2.92
05	AB+	37	27	11.68
06	AB-	3	1	0.73
07	O+	85	58	26.10
08	O-	3	5	1.46
Total		292	256	100 %

Discussion

In India observed that differences in ABO blood group distribution [1, 2, 9, 7, 14, 19, 20, 24, 25, 26, 30]. Based on review of literature of "Northern India and Western India" the blood group B confirmed the highest occurrence (34-40%), then followed by blood group O (29-36%), blood group A (21-24%) and AB (5-11%) blood group [1, 7, 20, 24, 25, 26, 30]. Blood group B, on the other hand, is the most frequent in Pakistan, according to Sharma, *et al.* In present study, ABO blood group distribution closely matches previous research findings, with the notable exclusion of Agarwal *et al.* [1] multicentric study. This research highlighted that, Western India as having the maximum incidence of O blood group. Also research conducted in Eastern India and Southern India indicated that O blood group has the peak occurrence, ranging from 34-40%, followed by blood group B (30-40%), blood group A (20- 24%) and AB (6-7%) blood group. Agrawal *et al.* [2, 9, 19], identified O blood group with the maximum incidence, while research by Gupta *et al.* [1, 7, 14, 20, 24, 25, 26, 30] stated that, blood group B as the predominant blood group in Central India. The diversity in ABO and Rh blood grouping across regions and ethnicities highlights the

significance of precise blood typing. This informative research is important for maintaining thorough records at blood centers, ensuring effective transfusion services and addressing legal and medical issues with accuracy^[5]. The distribution of ABO and Rh blood group is dynamic for the efficient administration of blood centers. Therefore, it is vital to possess evidence regarding the prevalence of this blood group in any given resident. The knowledge of the blood group distribution is important for the operations and holds significant importance in clinical studies. This information is instrumental in addressing public health challenges, particularly in decreasing the maternal death rate. The overall Rhesus positivity and negativity were 507 (92.52%) and 41 (07.48%), respectively, which is consistent with the bulk of research conducted in different parts of the world^[3, 11, 15, 22, 26, 30].

Conclusion

The present study accompanied at Dada Patil Mahavidyalaya and Mahatma Gandhi Vidyalyaya, Karjat provides comprehensive understandings into blood group distribution. It finds blood group “B” as the most predominant and blood group AB as the least common. In the current study on the blood group distribution, the blood group B was 34.12%, then followed by blood group O (32.97%), blood group A (25.91%), and AB (12.41%) blood group. Also only a lesser number of the students were Rh negative (07.48 %), with the majority of Rh positive (92.52 %). This information would be valuable in the healthcare field, blood transfusion programs and medico legal cases. Overall, the study serves as a valuable resource for enhancing blood center operations and ensuring preparedness in critical situations.

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