

GENE DISTRIBUTION AT ABO AND Rh LOCI IN DISTRICT SWAT, KHYBER PAKHTUNKHWA

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Abstract- The current study aimed to find out the gene distribution at the ABO and Rh loci population of District Swat Khyber Pakhtunkhwa. For this purpose data were collected from different localities of Swat Like Mingora, Kanju, Saidu Sharif, Barikot, Odigram, Manglawar, Bahrian, Kalam, Kabal, Khwazakhela, Matta, Charbagh, from the individuals of all the ages. Data was collected from June to September. By classical slide technique and antisera A, B and D the blood group phenotype were determined. Fourteen hundreds samples was collected randomly from individual of all ages and both genders. The most common blood group was O (29.4 %), followed by blood group B (28.5%) than blood group A (27.6 %) and the blood group AB (15%). The proportion of Rh D differs amongst the four ABO blood groups as well. The entire value of Rh antigen positive was (82.7%), while the total value of Rh antigen negative was (17.2%). Then data was analyzed for the distribution of allelic frequencies of ABO and Rh Blood type using online software S2 ABO estimator.

Index Terms- Blood, Platelets, Rh Factor, White Blood cells

INTRODUCTION

RED BLOOD CELLS

Erythrocytes are nucleated cells that are tiny in size. Normally, erythrocytes account for 40 to 50 percent of the total volume of blood. Blood removes carbon dioxide from the body and transports oxygen from the lungs to all tissues. Red blood cells are continuously produced frequency of roughly 2-3 million cells per sec from bone marrow stem cells. Erythrocytes contain around 95% hemoglobin. It is a gas transport molecule that contains approximately 270,000,000 iron-rich hemoglobin molecules [1].

WHITE CELLS

White blood cells, commonly known as leucocytes, are immune system cells that play a role in immunological responses. They account for less than 1% of blood. They are engaged in identifying and neutralizing intruders like viruses, bacteria. The leucocyte's nucleus and mitochondria are normal. (Components of blood (article) | Khan Academy.)

PLATELETS

Platelets are little blood cells with a diameter of 1.5-3 um. They are irregular shapes cell fragments, which travel through the bloodstream until they get stimulated, generate a blood clot, and are eliminated by the spleen. Contribute significantly to homeostasis and the coagulation mechanism. A low platelet count results in thrombocytopenia, a disease that increases the risk of bleeding. A high platelet count causes thrombocytopenia, which is characterized by an increased risk of blood clot formation.

Platelets, that could make a clot in a ruptured blood vessel to reduce bleeding and provide lymphocytes to fight against diseases. Blood adjusts to the demands of the organism via the circulatory system. While in infection blood transport additional lymphocytes to area of infection, where they concentrate to fight against invading organisms. Blood is a valuable fluid because of all of these functions. Year after year, 30 million blood units and its constituents are injected directly to individuals in need in the United States, really be purchased for as much as the price of the equivalent mass of gold.[2,3]

BLOOD GROUP

The overall human blood group is represented by the phrase "blood group" , which includes red blood cell antigen that are particularly regulated by a sequence of genes on same chromosome that can be allelic or extremely strongly connected. The phrase "blood type" applies to the certain sequence of antiserum reactivity when tested with a specific system. Our awareness of blood types has increased over the years to include not just transfusion-related concerns, and yet particular disease connections to RBC surface antigens. In 1900, Karl Landsteiner developed the ABO blood group system.[4,5]

GENETIC STRUCTURE

Both parents' blood groups are passing down to their children. A solitary gene on the nine chromosome's long arm, with three and B couples may have both an AB-type and an O-type children[6].

Three allelic genes on chromosome 9 regulate the A, B, and O antigens, while three allelic genes on chromosome 1 define the Rh antigens [7].

alleles: I, IA, and IB determines ABO blood types. Alleles IA and IB are dominant over I suggesting specific dominance connection (co dominance), meaning that heterozygous kind A

MATERIAL AND METHODS

STUDY SITE

The current research was performed in Swat District. Swat Valley was an affluent independent self-governing state known as "the Yusafzai State of Swat" until 1969, when it became a part of Pakistan.

Swat (also known as Swat Valley) is a mountainous tourist attraction in Pakistan's Khyber Pakhtunkhwa region. The beautiful Swat Valley is located on the Swat River (35°12'N 72°29' E), 247 kilometres (153 miles) from Islamabad.

Swat Valley is well-known for its natural features, which include a breathtakingly diversified scenery and abundant fauna. Swat is known for its gorgeous countrysides, lush forests, and high peak mountains. All of this creates a good natural environment for wildlife while also attracting tourists.

Swat is also known for its beautiful freshwater lakes, rivers, springs, and waterfalls, as well as its nice weather. All of this adds together to make it a safe sanctuary for tourism in Pakistan.

Swat is known as Switzerland of Pakistan having natural resources like lakes, snow peaks and green pastures. Swat is 15th largest district of Khyber Pakhtunkhwa is famous for embroidery. Mingora and Saidu Sharif are the main towns of the valley. Historically Swat is the most interesting valley in Pakistan. its also known as one of the most beautiful and fertile valley.

Swat's people are primarily of the Pashtun (Pashtun) ethnic group, who are related to Afghanistan. They are the Afghan Yusafzai tribe (Yousafzai tribe), who arrived from Afghanistan and lived in Swat five hundred years ago. As a result, the Swat people have kept their distinct tribal culture and traits to this day. thunderstorms and hailstorms. Despite being relatively high throughout the year, December had the greatest relative humidity, at 73.33 percent.

MATERIALS

Alcoholic swabs for fingertip cleansing, disposable lancet for pricking of finger, disposable gloves, Monoclonal antibodies (antisera), Sterilized glass slides, Tooth picks, Magnifying glass(10X), Cotton roll, First Aid kit, For data collection data entry sheet /Proforma, Consent approval form, Waste disposable bags were among the materials used in this study.

METHODS

Before starting a research project, it is important to complete all the necessary planning. This is the most important part of completing any research project. i started my data collection in February because it was the most suitable month to visit any area because the weather was almost pleasant. Blood samples were collected from 1400 unrelated subjects of every age group comprising 746 males and 654 females from February to September.

FIELD WORK

A proforma was designed for field work to collect data from individuals during the visits. The proforma included name, age, gender, locality and also blood group parameters.

DATA ANALYSIS

Using the online software S2 ABO estimator, the data was evaluated and analyzed for ABO and Rh blood group distribution. This information also paints a picture of a frequent genetic condition and its likely link to blood group.

The data was collected from 12 separate sampling sites, with the individuals coming from 12 different towns in the area of Swat. The sample size differed by location. The largest sample obtained in Mingora was 200 subjects recruited from University of Swat, while the smallest sample of 60 persons was gathered from Private School, Odigram.

RESULTS

The current study's findings in the Swat population are described in the three sections that follow.

DATA STRUCTURE

The phenotypic distribution of blood groups in relation to collection sites and caste system is given in this chapter.

GENETIC STRUCTURE OF SWAT POPULATION

The genotypic data and allelic frequencies at the ABO and Rh loci of the studied populations were discussed, site as well as caste specific allelic frequency at AbO and Rh loci have been investigated through S2ABO estimator.

GENETIC DISEASES LINKED WITH BLOOD GROUP

Relationship between ABO and some common genetic diseases have been discussed.

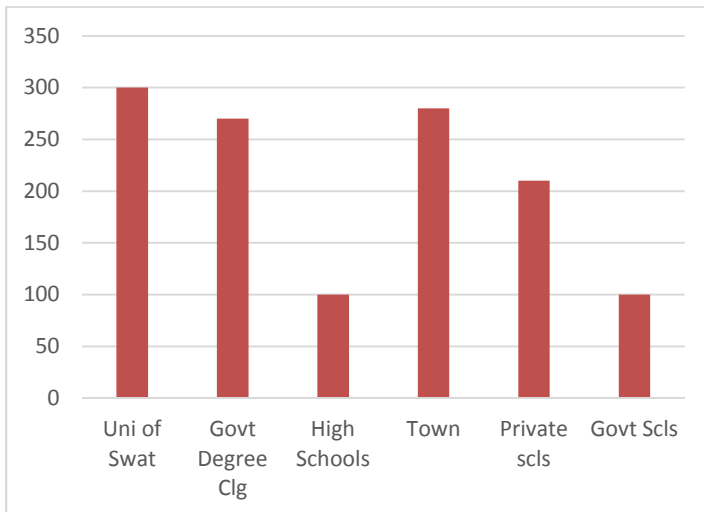
DATA STRUCTURE

SITE SPECIFIC DISTRIBUTION

A total of 1400 persons' blood group phenotypic data were acquired from the population of Swat district. The information was gathered from 12 different sampling locations, the sample size varied by locations. For example the largest sample obtained from university of Swat and some other private schools from Mingora and was about 200 individuals while the smallest sample of 60 persons was gathered from Odigram.

CASTE SPECIFIC DISTRIBUTION

The data was also examined caste by caste. in this case the major data was collected from Miagan (yosafzai) about 100 individuals. while the smallest sample was obtained from Qasi khel (yousafzai) about 17 individuals.



Site-specific distribution of collected data

GENETIC STRUCTURE OF COLLECTED DATA

SITE SPECIFIC ALLELIC FREQUENCY AT ABO AND RH LOCI IN THE STUDIED POPULATION

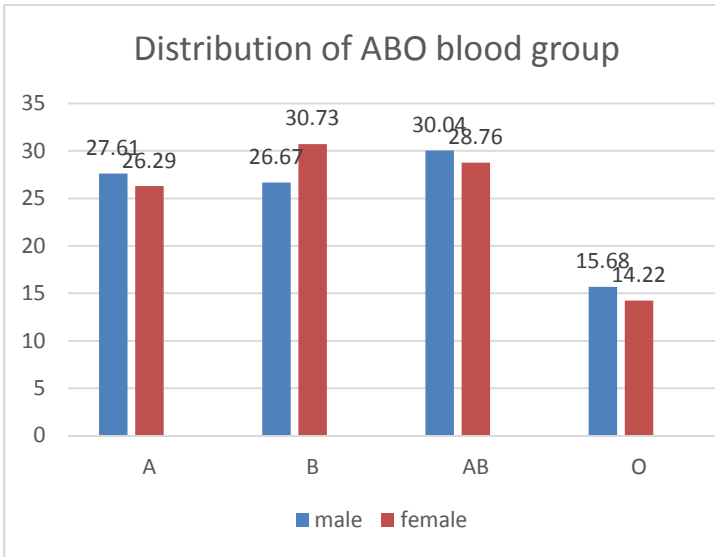
The allelic frequencies of ABO and Rh locus were observed as, Allele $r[O]$ was observed to be the highest with the frequency of 0.542, followed by $q[B]$ and $p[A]$ with the frequencies of (0.248) and (0.238), respectively. At the Rh locus, allele $[D]$ was the highest with average frequency of (0.82). Allele $[d]$ with average frequency of (0.18).

Town/location	Sample size	ABO locus		
		A	B	O
Mingora	200	0.27	0.28	0.51
Kanju	100	0.20	0.25	0.51
Saidu sharif	150	0.211	0.29	0.53
Matta	100	0.23	0.22	0.54
Khwazakhela	120	0.22	0.18	0.58
Bahrain	100	0.21	0.21	0.58
Charbagh	150	0.22	0.23	0.58
Kabal	100	0.18	0.23	0.61
Barikot	140	0.29	0.24	0.47
Kalam	80	0.20	0.20	0.61
Durushkhela	60	0.27	0.27	0.46
Manglawar	100	0.27	0.29	0.46

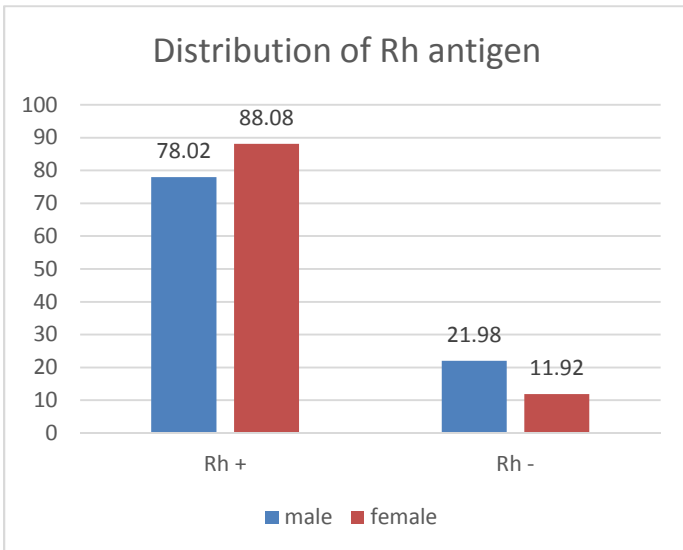
CASTE SPECIFIC ALLELIC FREQUENCY OF ABO AND RH LOCI:

Allelic frequencies at ABO and Rh loci have been calculated as, the highest frequency recorded for allele $p[A]$ was (0.342) in Aka khel (yousafzai) caste, while lowest frequency was found to be (0.133) in Gujjar (gujjar) caste. For allele $q[B]$, highest frequency was (0.351) in Azikhel (yousafzai) caste, while lowest frequency was found to be (0.142) in Pukhtana (yousafzai) caste. For allele $r[O]$, the highest frequency was (0.707) in Gujjar (Gujjar) caste, while lowest was 0.414 in Umar khel (yousafzai). Similarly at Rh locus, highest frequency for allele D was 0.942 in Zargaran (yousafzai), while the lowest was recorded (0.717) in aka khel (Yousafzai).

DISTRIBUTION OF ABO BLOOD GROUP IN IN MALE AND FEMALE



Distribution of ABO blood group



Distribution of Rh Antigen

DISCUSSION

The most critical body fluid is blood because it delivers essential nutrients, enzymes, and hormones throughout the system, and also the most important component, oxygen. Karl Landsteiner, is commonly credited for discovering three unique blood types in 1900, which result in the development of ABO blood group system.[8]

He received the Nobel Prize in 1930 for his research on the A, B, and O blood types. Alfred Von Decastello and Adriano Sturli found the fourth kind, AB, in 1902.[9]

The ABO blood system distinguishes blood groups A, B, AB, and O. while Rh positive and Rh negative blood types are classified in Rh system, dependent on whether or not inherited antibodies are present on red blood cells, antigens might be protein, carbohydrate, glycoproteins or glycolipid.[10]

More than a century ago the discovery of the ABO blood group sparked considerable excitement because, up until then, most blood was thought to be the similar, as well as frequently the devastating repercussions of blood transfusions were unidentified. Once we gained a better knowledge of ABO blood type, not just did transfusions get to be safe and secure, but also scientists can now investigate the first hereditary human characteristics.[11]

And over 20 different systems of blood groups have been discovered since 1901, with the ABO and Rh blood types being functionally significant. Blood transfusion and organ transplantation are two uses for both of these systems.[12]

The population of the district Swat in Khyber Pakhtunkhwa was studied in this study. This is a groundbreaking study aimed at determining the distribution of the ABO and Rh antigens, as well as allelic frequency at the ABO and Rh genes and relationship of these blood groups with other hereditary illnesses. To my knowledge, just a few studies have ever been carried out in district Swat. The study's limitations include a low literacy rate, challenging permission acceptance, and a lack of public awareness.

Blood group phenotypic data was collected from various sites and caste groups in Swat. In order to have a better comprehension of the facts and develop a relevant conclusion,

Varying races have different distributions of these blood types. ABO blood group frequencies differ across one community to the next and from one place to the next. Knowledge of ABO, Rh group distribution in regional and local blood group distribution aids as in proper operation of medical clinics and safer blood transfusion programs.

In medical practise, the ABO and Rh blood type systems are extensively used classifications. Blood typing is required for blood transfusions, organ transplantation, genetic research, and anthropological studies of human ancestry. Certain blood types were correlate with a greater risk of developing certain diseases. ABO blood group, for instance, has been related to peptic ulcer (which are more prevalent in category O people) while gastric cancer (more among A people).(Goodnough *et al.*, 1999; Smart and Armstrong, 2008).

Blood group O was shown to be more prevalent in both genders in the current study, and blood group AB being rarest. ABO blood types has an overall prevalence trend of AB<B<A<O. In addition, allelic frequencies were $r [O]>q [B]>p [A]$.

ABO group distribution varies around the globe. The most prevalent group observed in this investigation was "O," with a frequency of (29.4 percent). The next most prevalent letter was "B," which had a frequency of (28.5percent), followed by "A," which had a frequency of (27.6percent), and "AB," which had a frequency of (15percent). These findings are more or less similar to those of Parveen's 1987 study in the Lahore population "O," which found a frequency of (35.5 percent). The next most prevalent letter was "B," which had a frequency of (31.9 percent), followed by "A," which had a frequency of (24.2 percent), and "AB," which had a frequency of (8.4 percent).[13]

Opposite to our findings are in US population like, Garratty and colleagues (2004) discovered that in a US population, the frequencies of A, B, O, and AB blood groups were (37.1), (12.2), (46.7), and (4.1 percent), respectively, with Rh+ detected in (85.4 percent).

Similarly these percentages were (41.8%), (8.6%), (46.6%), and (3%), for A, B, O and AB respectively, in England. which is also different from our findings. (Garratty *et al.*, 2004).

Different results from our work in which Blood type O was determined to be (37.07 percent), blood group B was (34.32 percent), blood group A was (21.12 percent), and blood group AB was (21.12 percent) in a study from Baluchistan. [14]

Blood type O was found to just be (36%) in a Sindh study, then group B (30%), A (25%), group AB (25%). (7.59 percent).

Some of the contrasts with our results can be found in. [15].

Also a research done in Swat, Pakistan. In which most prevalent blood type was discovered to be B (32.40 percent), then blood groups O (29.10 percent), A (27.92 percent), AB (27.92 percent) (10.58 percent). which is different from our results [16]

ABO distribution is B, A, O, AB, according to a Bannu NWFP study. (36.23 percent), (31.03%), (25.07%), and (7.67 percent), respectively. [17]

According to a Punjab study, the B group (32.4 percent), O group (30.50 percent), A group (22.60 percent), AB blood group (22.60 percent) are the most common blood groups. [18]

In order to provide safe blood transfusion and organ transplantation services, blood banks and hospitals must understand the blood group distribution pattern. The important finding of the present study was frequency distributions of blood type ABO across different ethnicities in Swat found that the "O" blood group was the most prevalent, next by group B, and group A then group AB, with group AB being the least common.

CONCLUSION

The current study's general result is that O is the most frequent blood group and AB is the least common blood group. "O" has the highest frequency of (29.4%), next B, A, AB with (28.5%) (27.6%) (15%) frequencies respectively.

Similarly the allelic frequency for p was (0.238), q (0.248), and for r (0.542).

And allelic frequency of D was (0.828) and d was (0.172).

There is no any genetic disease related to blood group but in my findings most of the people having AB blood type have diabetes.

Knowledge about blood group prevalence is vital for clinical investigations and safer transfusions in the area.

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