Haematological Insight: An Epidemiological Study on Prevalence of Anaemia in Diverse Blood Groups within the Population of Hyderabad Sindh

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Background: In Pakistan, iron deficiency anaemia (IDA) is the leading blood disorder due to dietary deficiencies, which is defined by the WHO as low Haemoglobin levels and low red cell death due to a deficiency of iron in the body. This is especially true for lower socioeconomic groups because of cultural influences and a lack of resources. All genders and age groups are affected by iron deficiency anemia (IDA), which can cause microcytic and hypochromic disease with a range of clinical consequences. According to many recent studies, there may be a connection between blood types and IDA, with those who belong to blood groups O and B perhaps at higher risk of developing the anemia. Confirmation of these links and comprehension of the underlying mechanisms need more study.

Materials and Methods: This was a cross-sectional study, conducted at the emergency department of Liaquat University Hospital from June to August 2022 that involved 400 patients who were divided into two groups: a control group comprising 285 patients who were not suffering from iron deficiency anaemia and a study group comprising 415 patients suffering from iron deficiency anemia excluding those with other diseases. A formal consent preceded comprehensive clinical examinations, including blood pressure, pulse rate, and oxygen saturation measurements. Blood group determination employed the glass slide agglutination method, distinguishing A, B, AB, and O groups. Haemoglobin levels were assessed using Sahli's hemoglobinometer, while the complete blood picture was obtained by the blood CP report of the hospital laboratory. Statistical analyses, including Fischer's exact test, were performed using GraphPad 9 prism. Specificity/sensitivity, likelihood ratios, and odds ratios were calculated for further analysis.

Conclusion: This study shows a significant relationship between various blood groups and the prevalence of anaemia in the population.

1. INTRODUCTION

Anaemia is defined by the WHO as a condition in which Haemoglobin levels are lower than normal levels for different ages and genders. According to the WHO, anaemia is classified as milder if it falls between 10 and 11 g/dl, moderate if it falls between 7 and 10 g/dl, and severe if it is less than 7 g/dl. Rather than being caused by other factors, dietary deficiencies are the main cause of anemia in Pakistan [1]. Anaemia is divided into macrocytic, microcytic, and hypochromic anemia [2]. Iron deficiency anaemia (IDA) is one of the most prevalent global anaemia disorders. Males, female, and children are all equally affected by this disorder [3]. According to the World Health Organization (WHO), 30% of the population is affected by the top nutritional condition [4]. According to a global survey in 2016, it is one of the five diseases that cause mortalities and morbidities. In 2010, one-third of the population was suffering from IDA. Women are the major victims of iron deficiency anaemia, and IDA ranks first among them [5]. Iron deficiencies usually involve more in developing countries. It is an estimate that six million people worldwide are suffering from IDA and it costs 840,000 deaths each year. The major cause is nutritional but also geo political reasons are behind it [6]. The most common causes of iron deficiency anaemia are bleeding disorders, gastrointestinal bleeding, and nutritional deficiencies [7]. It is also caused by increased demand and decreased supply, as usually occurs in pregnancy, children, and adolescence [8].

Iron deficiency leads to microcytic and hypochromic anemia. The ability of red blood cells to carry oxygen is reduced when there is an iron deficit. It leads to different clinical conditions, including headaches, exertional dyspnea, cardiovascular complications, and complications during pregnancy, depression, and delayed mile stones Matthew J [9].

The discovery of blood groups dates back to the early 19th century. Since then, a multitude of studies have been carried out globally to explore the connection between blood groups and various health issues, such as cancer, cardiovascular diseases, blood disorders, and preeclampsia. These investigations have been ongoing over time. A meta-analysis in 2021 by Wang et al., involving 40 studies and 30,000 participants, concluded that O blood group patients are at a lower risk of developing IDA while the other groups (OR = 0.86; CI: 0.79–0.940) are more affected. This may be because

of differences in intestinal absorption and its utilization in different blood groups [10]. Another study published in 2019 by Chen et al. investigated the relationship between RhD status and iron deficiency anaemia among pregnant women in China. The authors found that Rh D-negative women had a higher prevalence of iron deficiency anaemia than Rh D-positive women (35.3% vs. 28.5%). The authors suggested that this association could be due to increased iron loss through inflammation in Rh D-negative women, as they are more susceptible to infection due to the absence of the D antigen. Chen et al. [11] in 2021, Li et al. found that individuals with blood group O had higher levels of DcyB than those with other blood groups (p < 0.05). This finding supports previous suggestions that individuals with blood group O may have increased intestinal absorption of iron, which could contribute to a lower risk of iron deficiency anemia [12].

Blood groups play a crucial role in organ and tissue transplantation, as well as blood transfusions. There are four main blood groups: A, B, AB, and O. In 1941, Landsteiner was the first to identify the Rh group. Following this discovery, the Rh group was further classified into positive and negative categories [13]. The ABO blood groups are made up of carbohydrates on the surface of red cells and other epithelial cells that bind to specific allergens, leading to different diseases [14]. The antigens present in the ABO blood groups are found on various structures within the human body, such as red blood cells, the endothelium of blood vessels, platelets, and other cell types. The distribution and function of these antigens is complex and continue to be studied by researchers in the fields of immunology and blood group genetics [15].

The ABO blood group system has been linked to several diseases. Research has shown that individuals with blood group O have a lower risk of developing pancreatic cancer compared to those with non-O blood groups [16]. The ABO blood group system has been found to be connected to allergic bronchospasm, a condition characterized by narrowing of the airways in the lungs. This association is supported by studies that have reported higher levels of eosinophils in certain blood group individuals. The exact mechanism underlying this relationship is still being investigated by researchers in the fields of immunology and allergy [17].

In conclusion, recent studies have provided further evidence for the association between blood groups and iron deficiency anaemia, highlighting differences in intestinal absorption or utilization of iron between individuals with different blood groups [18].

2. METHODOLOGY

This was a cross-sectional study that was conducted in the Department of Physiology of Sindh University Jamshoro in association with the Emergency Department of Liaquat University Hospital Hyderabad from June 2022 to August 2022. The study was conducted and involved 700 patients who came into the medical OPD. The participants were comprised of both males and females between the age groups of 15 and 50 years old. They were divided into two groups: a control group comprising 285 patients who were not suffering from iron deficiency anaemia and a study group comprising 415 patients suffering from iron deficiency anaemia. All those patients who were suffering from any other disease were excluded. Only residents of Hyderabad, Sindh, were included in the study.

Before proceeding with data collection, all the patients were explained about the procedure and the objective of the study. A comprehensive clinical examination was conducted, including blood pressure, pulse rate, and oxygen saturation from the pulse oximeter. The blood groups of the patients were recorded by the glass slide agglutination method. A glass slide was selected, and drops of blood were placed on the slide. Anti-Sera was then mixed with these blood drops. Blood group A was agglutinated by anti-sera A; the B blood group was agglutinated by anti-sera B; and in the AB blood group, both blood drops were agglutinated. In the case of the O blood group, the blood drop was not agglutinated at all. When the blood drop was mixed with anti-sera D, Rh positive was agglutinated, while Rh negative was not agglutinated.

For blood complete picture (CP) Haemoglobin determination 4 ml of venous blood was collected from the medial cubital vein. The blood sample was preserved in a CP bottle and sent to the hospital laboratory for a blood complete picture (CP). The iron deficiency anaemia was diagnosed by decreased serum ferritin and a microcytic and hypochromic picture in the blood report. The estimation of Haemoglobin was determined by Sahli's hemoglobinometer. The graph pad Prism9 was used to do descriptive

analysis. Fischer's exact test was applied to deduce the P value, which was considered significant > 0.05. The specifity/sensitivity, likelihood ratio, and ODD ratio were calculated.

3. RESULTS AND DISCUSSION

Table 1 provides a detailed breakdown of non-anemic and anemic individuals. The observed data, derived from a sample of 700 participants, reveals noteworthy patterns, including a significant chi-square (X²) value indicative of association between O blood group and anemia with gender distribution. The standard deviation, median, and mean values further depict variations in the distribution of anemia within distinct blood group and gender combinations.

Table 2 Displays gender-specific anemia prevalence in Rh-positive and Rh-negative individuals (total 700 participants). Chi-square: 7.8; degrees of freedom: 3. P-value: 0.04 (< 0.05), rejecting the null hypothesis. Overall dataset measures include standard deviation (45.0), mean (147.5), and median (150), indicating data spread, average, and middle value, respectively. With an odds ratio greater than 1, there is a significant association between gender, blood group, and anemia status among the patients.

Table 1. Gender-stratified analysis of non-anemic and anemic individuals by blood group: A comparative analysis"

Gender	Blood Group	Non Anemic	Anemic	Total	X2	d.f	p-VALUE	Std. Deviation	Median	Mean
Male	A	20	50	70				12.9	35	35
	B	50	80	130				20.8	55	55
	AB	15	25	40				5.7	20	20
	O	85	75	160				19.5	67	65
	Total	170	230	400						
Female	A	30	40	70	22.7	9	0.006	12.9	35	35
	B	30	60	90				20.8	55	55
	AB	15	25	40				5.7	20	20
	O	40	60	100				19.5	67	65
	Total	115	185	300						
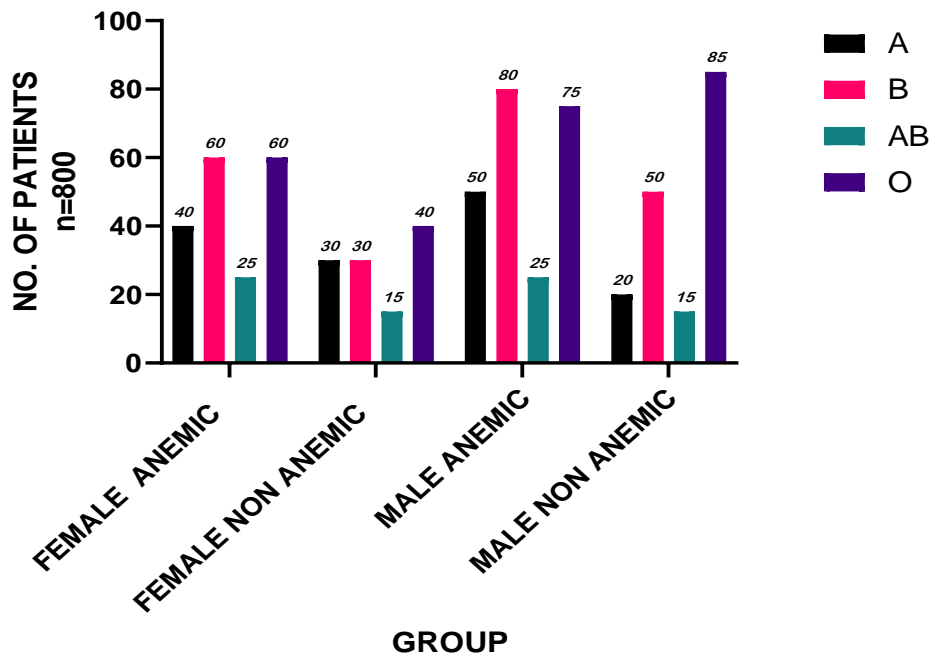
Graph 1. Shows comparison of anemia rates by gender and blood type in a population of 800 patients

Table 2. An epidemiological examination of anemia rates among gender-segregated Rh-positive and Rh-negative populations stratified by blood group

Gender	Blood Group	Anemic	Non Anemic	Total	X2	d.f	p-Value	Std. Deviation	Mean	Median
Male	Rh +	200	150	350				45.0	147.5	150
	RH -	30	20	50				6.4	27.50	27
	Total	230	170	400						
Female	Rh +	150	90	240				45.0	147.5	150
	Rh -	35	25	60	7.8	3	0.04	6.4	27.5	27
	Total	185	115	300						
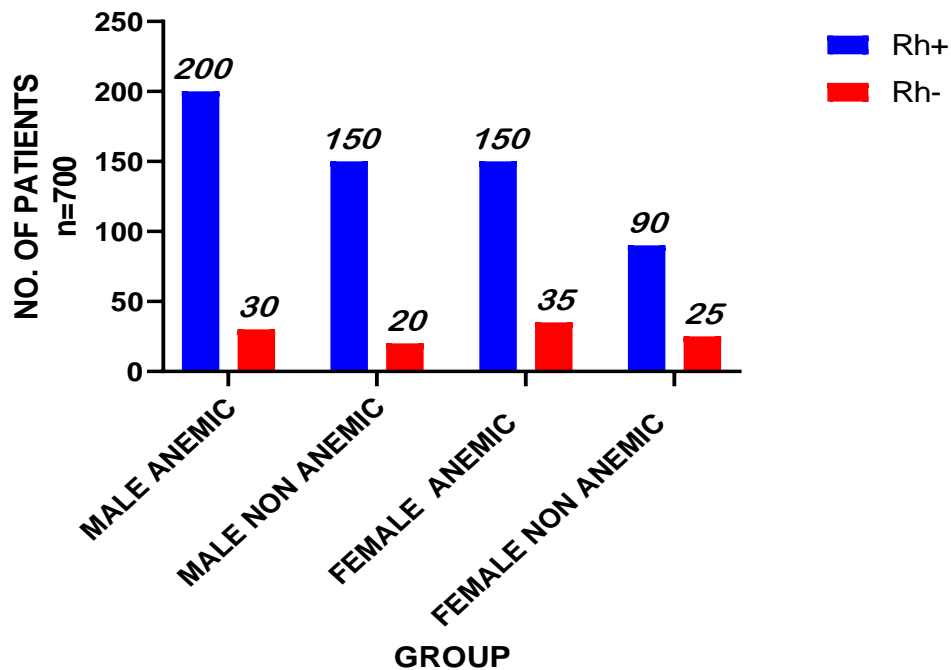
Graph 2. Shows gender and rh factor differences in anemia prevalence among 700 patients

Anaemia is a medical condition characterized by low red blood cell counts and Haemoglobin in the body that affects the normal physiology of body organs. It is more noticeable in one-third of the world's population and impacts all populations in developing or developed nations [18]. Blood is a vital fluid of the body that carries gases and nutrition all around the body and also aids in maintaining homeostasis. The red blood cells contain specific glycoprotein antigens that specify the type of blood, and on their basis, the blood of the population is categorized into four primary groups: A, B, AB, and O [19]. The frequency of several systemic diseases, which include anaemia, cancer, and metabolic disorders, varies substantially among different blood groups, with the most prevalent in the B and O blood groups and the least or protective nature in the Ab blood group [20].

This study shows a strong association between anaemia and blood groups, which also concurs with the results of Basak Asim et al.'s investigation, which show that the prevalence of anaemia varies greatly among blood groups [21]. Similar distributions of a higher prevalence of anaemia in blood types B and O compared to other blood groups are also seen in the study results of Kaur et al. [22] Additionally, a strong correlation between these two entities is evident, with a p value of 0.002, indicating a higher occurrence of anemia in blood types O and B compared to blood groups AB and A, which are more protective factors against anemia. There is also a substantial association because these statistics align with the findings of Retsh Shan et al.'s investigation.

4. CONCLUSION

This study highlights the relationship between anemia prevalence in various blood groups, with blood group O having a higher prevalence that is statistically significant (p-value 0.002).

CONSENT

As per international standards or university standards, patient(s) written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

It is not applicable.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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