Original Research Article

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

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ABSTRACT:

BACKGROUND: In Pakistan, Iron deficiency anemia(IDA) is the leading blood disorder due to dietary deficiencies, which are defined by the WHO as low hemoglobin levels and low red cell dices due to 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.

Material Methods: This was a cross-sectional study, conducted at emergency Department of Liaquat University Hospital from June to August 2022, that involved 400 patients who were divided in two groups, a control group comprising of 205 patients who were not suffering from iron deficiency anemia and a study group comprised of 195 patients suffering from iron deficiency anemia. Sindh. 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. Hemoglobin levels were assessed using Sahli's haemoglobinometer while the complete blood picture was obtained by blood CP report of hospital laboratory. Statistical analyses, including Fischer's exact test, were performed using Graph Pad rism 9. 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 anemia in the population.

Key words: Blood groups, Iron deficiency, Anemia, Hyderabad

INTRODUCTION:

Anemia is defined by the WHO as a condition in which hemoglobin levels are less than normal levels for different age and gender. According to the WHO, anemia 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] Anemia is divided in macrocytic, microcytic and hypochromic anemic.[2] Iron deficiency anemia(IDA) is one of the most prevalent global anemic disorder. Male, females and children are all equally effected by this disorder.[3] World Health Organization(WHO) ranked it number one nutritional disorder and describe involvement of 30% population suffering from it.[4] According to a global survey in 2016 it is one of the five diseases that causes mortalities and morbidities. In 2010 one third of word population was suffering from IDA. Women are the major victim of iron deficiency anemia and IDA ranked first in them.[5] Iron deficiency usually involve more in developing countries. It is an estimate that six million peoples 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 anemia are bleeding disorders, gastrointestinal bleeding and nutritional deficiencies.[7] It is also caused by increase demand and decreased supply as usually occur in pregnancy, children and adolescence.[8]

Iron deficiency leads to microcytic and hypochromic anemia. The deficiency of iron leads to decrease oxygen carrying capacity of red blood cell. It leads to different clinical conditions including headache, exertional dyspnea, cardiovascular complications, complications during pregnancy, depression and delayed mile stones.[9] Matthew J

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 patient 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 difference in intestinal absorption and its utilization in different blood groups.[10] Another study published in 2019 by Chen et al investigated the relationship between Rh D status and iron deficiency anemia among pregnant women in China. The authors found that Rh D-negative women had a higher prevalence of iron deficiency anemia 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.[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 carbohydrate on the surface of red cells and other epithelial cells which 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 are complex and continue to be studied by researchers in the field 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, while 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 field of immunology and allergy.[17]

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

METHODOLOGY:

This was a cross sectional study which 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 that involved 700 patients who came in the medical OPD. The participants were comprised of both male and female between the age group 15-50 years of age group. They were divided in two groups, a control group comprising of 285 patients who were not suffering from iron deficiency anemia and a study group comprised of 415 patients suffering from iron deficiency anemia.. All those patients who were suffering from any other disease were excluded. Only residents of Hyderabad Sindh were included in the study.

Before preceding for data collection all the patients were explained about the procedure and the objective of the study. A formal consent was taken in written. 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 glass slide agglutination method. A glass slide was selected and drops of blood were placed on the glass slide then Anti Sera was mixed with these blood drops. Blood group A was agglutinated by anti-sera A, B blood group was agglutinated by anti-sera B while in AB blood group both blood drops were agglutinated. In case of O blood group blood drop was not agglutinated at all. When the blood drop was mixed with anti-sera D, Rh positive was agglutinated while Rhesus negative was not agglutinated.

For blood complete picture (CP) hemoglobin determination 4 ml of venous blood was collected from the medial cubital vein. The blood sample was preserved in a CP bottle and was sent to hospital laboratory for blood complete picture(CP). The iron deficiency anemia was diagnosed by decreased serum ferritin and microcytic and hypochromic picture in blood report. The estimation of hemoglobin was determined by Sahli's haemoglobinometer. The graph pad Prism9 was used to do descriptive analysis. Fischer' exact was applied to deduce P value which was considered as significant > 0.05. The specifity/ sensitivity, Likehood ratio and ODD ratio were calculated.

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Results

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	22.7	9	0.006			
Female	A	30	40	70				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						

Table 1 provides a detailed breakdown of non-anemic and anemic individuals categorized by gender and blood group, with a focus on counts and key statistical measures. The observed data, derived from a sample of 700 participants, reveals noteworthy patterns, including a significant chi-square (X^2) value indicative of associations. The standard deviation, median, and mean values further depict variations in the distribution of anemia within distinct blood group and gender combinations. Overall, the table presents a comprehensive exploration of anemia prevalence, offering valuable insights into the nuanced relationships across different demographic categories.

Graph 1. Shows Comparison of Anemia Rates by Gender and Blood Type in a Population of 800 Patients

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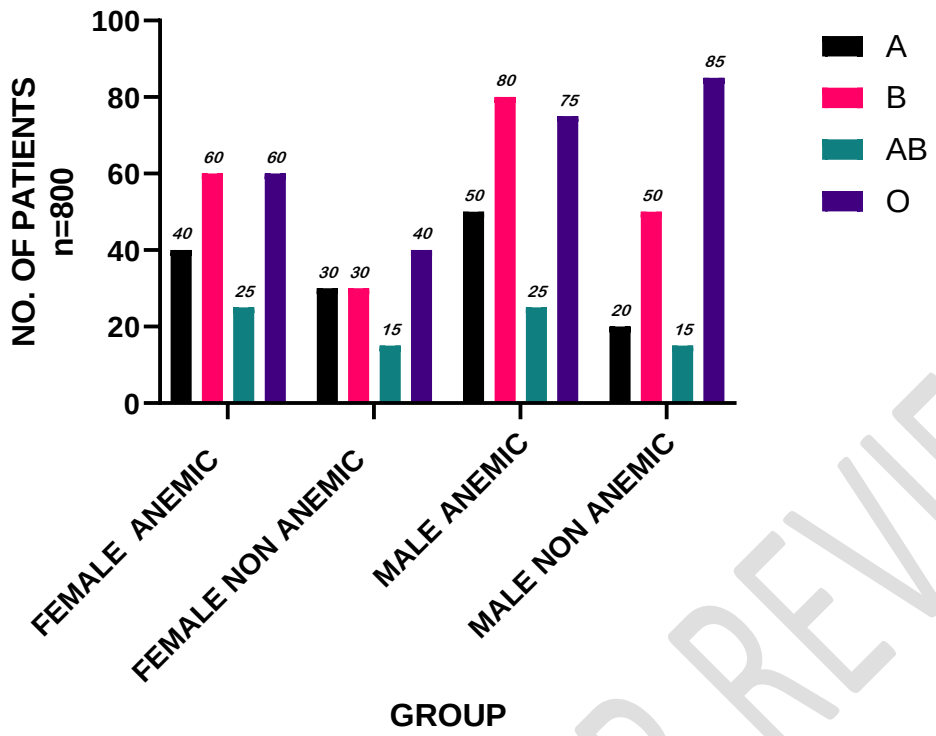

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Table 2: An Epidemiological Examination of Anemia Rates among Gender-Segregated Rh-Positive and Rh-Negative Populations Stratified by Blood Group

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	7.8	3	0.04	6.4	27.50	27
	Total	230	170	400						
female	Rh +	150	90	240				45.0	147.5	150
	Rh -	35	25	60				6.4	27.5	27
	Total	185	115	300						

Table 2 presents a gender-specific breakdown of anemia prevalence in Rh-positive and Rh-negative individuals within a total sample size of 700 participants. The table also shows the chi-square statistic, the degrees of freedom, the p-value, the standard deviation, the mean, and the median for the whole dataset. These are measures of the overall fit and variability of the data. The chi-square statistic is 7.8, which measures the difference between the observed and expected frequencies. The degrees of freedom is 3, which is calculated by multiplying the number of rows minus one by the number of columns minus one. The p-value is 0.04, which is the probability of obtaining a chi-square statistic as large or larger than 7.8 by chance, assuming that the null hypothesis of independence is true. The p-value is less than the common significance level of 0.05, which means that we can reject the null hypothesis and conclude that there is a significant association between gender, blood group, and anemia status among the patients. The standard deviation is 45.0, which measures the spread of the data around the mean. The mean is 147.5, which is the average of the data. The median is 150, which is the middle value of the data when arranged in ascending order.

Graph 2. Shows Gender and Rh Factor Differences in Anemia Prevalence Among 700 Patients

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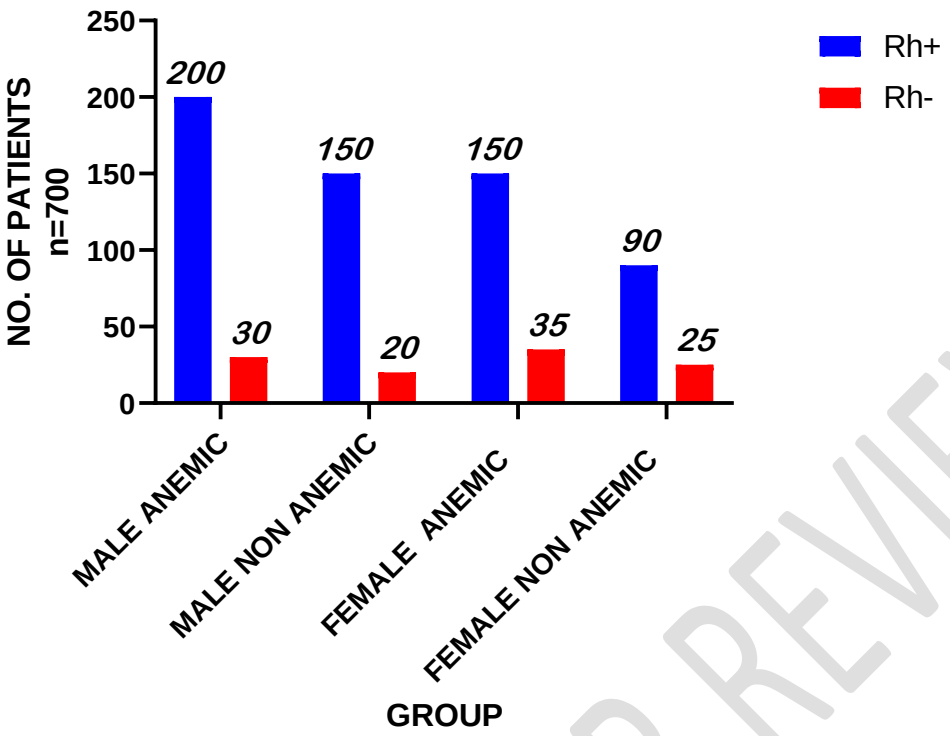

DISSCCUSION:

Anemia is a medical condition characterized by low red blood cell counts and hemoglobin 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 anemia, 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 anemia and blood groups , which also concurs with the results of Basak Asim et al.'s investigation, which show that the prevalence of anemia varies greatly among blood groups.[21] Similar distributions of higher prevalence of anemia 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 [24]

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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).

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