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ASSOCIATION OF ABO BLOOD GROUPS WITH DIABETES MELLITUS AND HEPATITIS B AND C VIRUS INFECTIONS IN THE GILGIT POPULATION, PAKISTAN

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Abstract

Diabetes mellitus is a disease characterized by persistent hyperglycemia while hepatitis B and C are viral illnesses that cause inflammation of liver. The ABO antigens are among the most clinically significant antigens, primarily present on red blood cells. Some studies suggest that different ABO blood types might be linked to different diseases. Some blood groups are naturally protected, and some are naturally prone to certain diseases.

Objectives:

The purpose of this study was to find the frequency of ABO blood groups in patients with diabetes mellitus, hepatitis B and hepatitis C and to find an association between them in the population of Gilgit region.

Methodology:

This study was an observational cross-sectional study in which 120 patients who were diagnosed with diabetes mellitus and hepatitis B and hepatitis C. Questionnaires and laboratory tests were used to collect data. Diagnosis of diabetes mellitus was done using microlab 300. Quick immune-chromatographic test kits were used for diagnosis of hepatitis B and hepatitis C. Blood groups were determined using tile method. Statistical analysis was performed on SPSS and Microsoft Excel 2013.

Results:

In 120 participants, the most frequent blood type in diabetes mellitus, hepatitis B and hepatitis C was B blood group. AB was least common in diabetes whereas A blood type was less common in case of hepatitis. The most prevalent disease was type 2 diabetes, followed by hepatitis B, hepatitis C and type1 diabetes. The age group which is at higher risk for diabetes mellitus is 50-69 years old, while for hepatitis the most susceptible was 30-49 years old age group. Slight male predominance is seen in both diseases.

Conclusion:

It is concluded that B blood group individuals, especially males who are 50–69 years old, are more susceptible to diabetes mellitus and viral hepatitis in the Gilgit region.

INTRODUCTION:

During the maturation of red blood cells, several antigens, which are polysaccharides and proteins in nature, are expressed on their cell surface (Naeini et al., 2010; Aggarwal et al., 2017; Batool et al., 2017; Javed et. al., 2017; Sharjeel et al., 2021). A total of 30 blood group systems has been described until now. These blood groups systems are classified into major and minor blood group systems. Major blood groups are ABO and Rh blood groups while the rest are minor blood groups (Aggarwal et al., 2017; Batool et al., 2017; Mandal et. al., 2018; Tasneem et al., 2021). In 1901, an Austrian scientist, Karl Landsteiner discovered ABO blood group antigen and later classified these according to the presence of different antigens on the surface of red blood cells (Aggarwal et al., 2017; Javed et. al., 2017; Mandal et. al., 2018; Tasneem et al., 2021; Prakash et. al., 2022, Khalid et. al., 2024).

The gene for ABO blood group antigens is present on chromosome number 9. This gene controls the expression of polysaccharide antigens (A, B, O or AB) on the surface of red blood cells (Aggarwal et al., 2017; Mandal et al., 2018; Prakash et. al., 2022). For many years, scientists have been conducting various studies on ABO blood groups and their linkage to various diseases, and how these affect our immune system and expression of different diseases (Waseem et al., 2012; Aggarwal et al., 2017; Batool et al., 2017; Javed et. al., 2017; Mandal et al., 2018; Shakeel et. al., 2018; Tasneem et al., 2021; Prakash et. al., 2022; Khalid et. al., 2024; Manasa *et al.*, 2024).

Diabetes mellitus is one of the most prevalent medical conditions that has a high morbidity and mortality rate around the world (Annis et al., 2005; Abdul Ghani Waseem et al., 2012; Tasneem et al., 2021; Alrashed et al., 2023). Defect in insulin secretion or an increased resistance to insulin at cellular level results in high levels of glucose (hyperglycemia) in blood and the condition in which blood glucose levels in blood are persistently higher than normal is called diabetes mellitus (Sharjeel et al., 2021; Tasneem et al., 2021; Alrashed et al., 2023). It is further divided into two types; insulin-dependent diabetes mellitus or type 1 diabetes mellitus, and non-insulin-dependent diabetes mellitus or type 2 diabetes mellitus (Tasneem et al., 2021).

Viral hepatitis infections, especially hepatitis B virus (HBV) and hepatitis C virus (HCV) infections are one of the most prevalent viral infections which remains a great risk to public health worldwide (Marcellin, 2009, Shakeel et. al., 2018; Khalid et. al., 2024). Inflammation of liver (hepatocytes) in general is called hepatitis. It is divided into two types; viral and non-viral hepatitis (WHO, 2020; Grant & Purres, 2024). Liver Cirrhosis and Liver cancer (Hepatocellular Carcinoma/ HCC) are mainly caused by HBV and HCV; these infections have high morbidity and mortality rates as compared to other viral infections (Marcellin, 2009; Shakeel et. al., 2018; Khalid et. al., 2024).

MATERIALS AND METHODS

Study design

This study was a cross-sectional observational study which was designed to investigate the association of ABO blood groups with diabetes mellitus and hepatitis B and C virus infection in the population of the Gilgit region. Data was collected using questionnaires and laboratory testing to investigate the association of ABO blood groups with diabetes mellitus, HBV, and HCV infections in the population of the Gilgit region.

Study population

In this study we included those patients who were already diagnosed with diabetes mellitus (Type I or Type II) and/or hepatitis (B or C).

Sampling

Approximately 2–3 ml of blood was collected in k3EDTA tube for blood grouping, in sodium fluoride tube for glucose testing, and in gel activator tube for hepatitis B and hepatitis C testing. A senior lab technician collected these samples via the aseptic venipuncture technique.

Laboratory Testing

Blood grouping:

ABO blood groups were determined using the Standard forward and reverse grouping method. Clumping/agglutination was observed and noted down the results accordingly (Waseem et

al., 2012; Wang et al., 2012, Javed et. al., 2017; Shakeel et al., 2018).

Diabetes Mellitus

Glucose levels of patient samples were determined using the MicroLab 300 semi-automatic biochemistry analyzer. Before the estimation the instrument was calibrated with calibrators. Controls were also tested and found to be within normal limits. Based on the standard curve, the analyzer automatically determined the glucose concentration in the tested sample and showed the result in milligrams per deciliter.

Hepatitis

For the diagnosis of hepatitis B and C, the rapid kit method was used, which works on the principle of immunochromatography. Blood sample collected in the gel activator tube and centrifuged to separate the serum. For hepatitis B, HBsAg was performed and for hepatitis C, Anti-HCV was performed. Both tests are rapid one-step tests which follow the principle of immunochromatography. The test kit and buffer solution which are needed for these tests were prepared, and the test cassette pouch was opened and placed on a clean, dry surface. The cassette was labeled with the patient's ID. One to two drops of the patient's serum sample and 2–3 drops of buffer were added. Then this cassette was kept at room temperature and after 10-15 minutes observed the cassette again. The results were noted and data was documented as per standard protocol (Shakeel et al., 2018).

Statistical analysis of data

Collected data was expressed as frequencies and % through MS Excel 2013 and SPSS.

RESULTS

Descriptive Statistics

Age

Ages of patients in this study ranged from 10-89 years old. The most common age group was 50-69 years, with 55 patients (45.8%), and the least one was 10-29 years (5%), with 6 patients. All the values were provided in Table 1 and Figure 1.

Table 1: Frequency Distribution of patients by Age groups

Age Groups	Frequency	Percent
10-29	6	5.0
30-49	43	35.8
50-69	55	45.8
70-89	16	13.3
Total	120	100.0

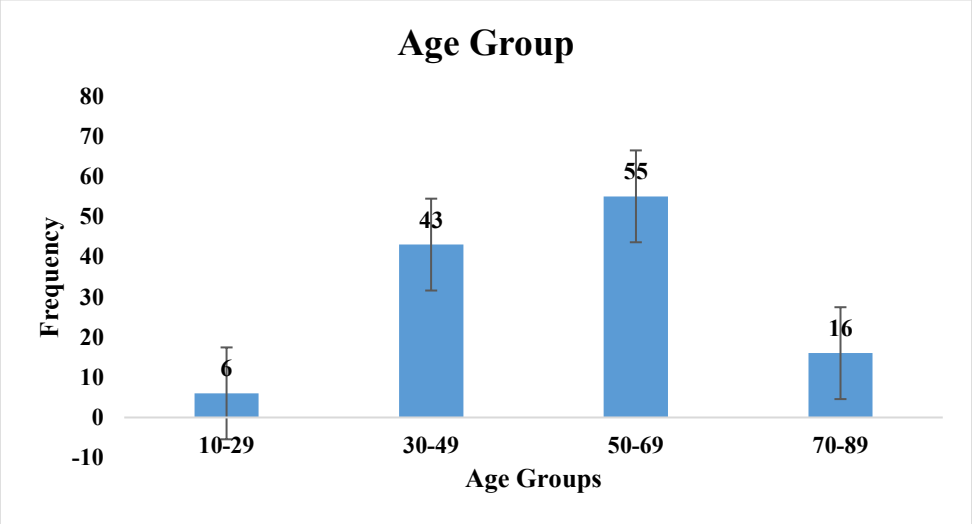

Figure 1: Frequency Distribution of patients by Age groups

Gender

Among 120 patients, 65 patients (54.2%) were males, and 55 patients (45.8%) were females. All the values were provided in Table 2 and Figure 2.

Table 2: Frequency Distribution of patients by Gender

Gender	Frequency	Percent
Male	65	54.2
Female	55	45.8
Total	120	100.0

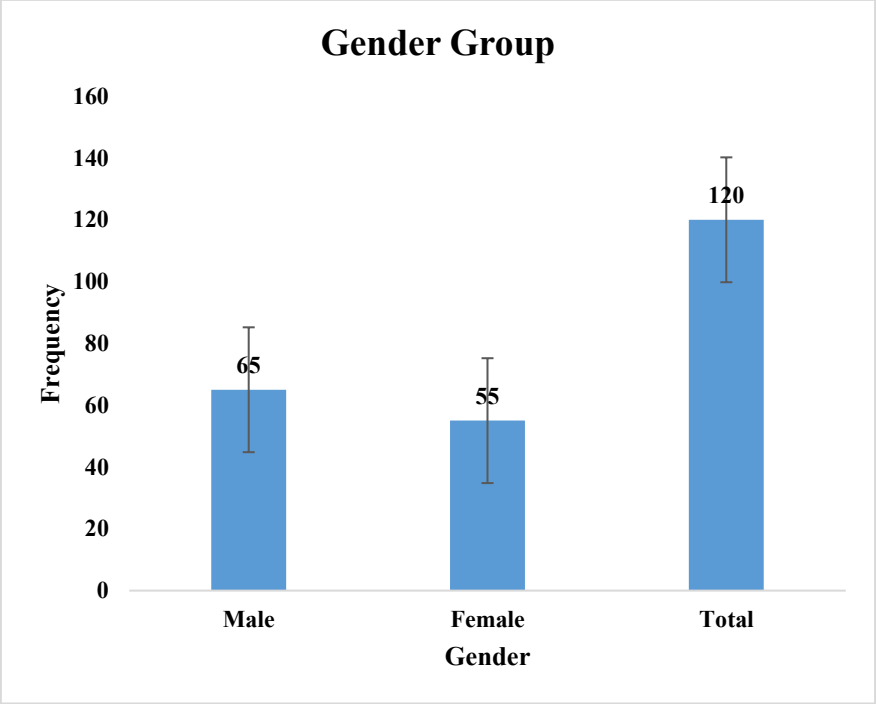

Figure 2: Frequency Distribution of patients by Gender

Diagnosed Disease (Diabetes Mellitus type 1 and type, hepatitis B and Hepatitis C)

Out of 120 patients who were part of our study, 109 patients (90.8%) were those who had type 2 diabetes mellitus, only 2 patients (1.7%) were diagnosed with type 1 diabetes. Hepatitis B was found in 8 patients, accounting for 6.7% in the total, whereas Hepatitis C was reported in 3 individuals (2.5%). All the values were provided in Table 3 and Figure 3.

Table 3: Frequency Distribution of patients by type of Disease Diagnosed

Disease Type	Frequency	Percent
Diabetes Mellitus (Type 1)	3	1.7
Diabetes Mellitus (Type 2)	109	90.8
Hepatitis B	8	6.7
Hepatitis C	3	2.5
Total	120	101.7

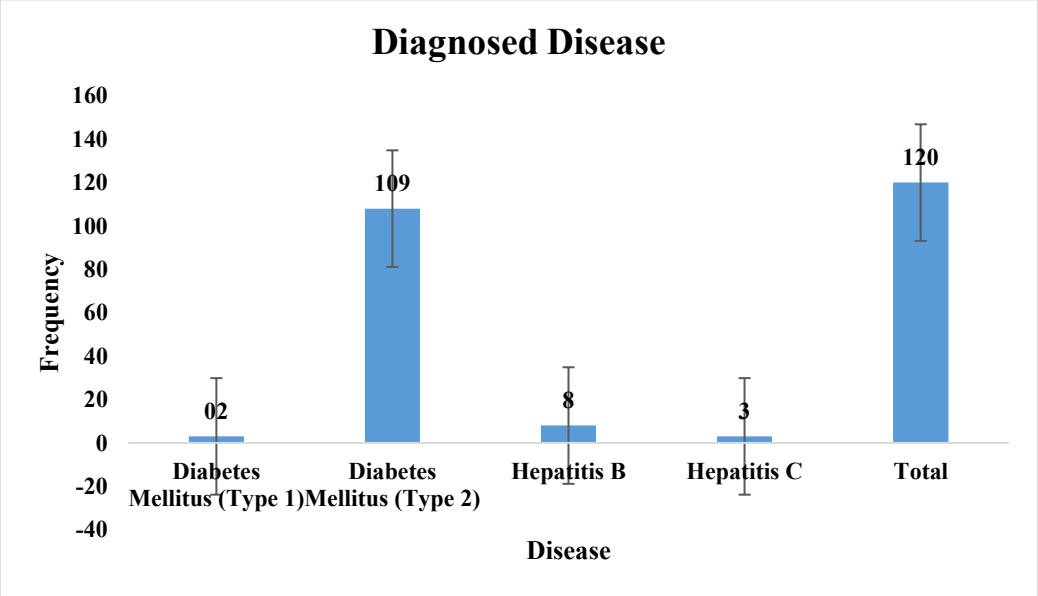

Figure 3: Frequency Distribution of patients by type of Disease Diagnosed

Family History of Disease

A total of 44 patients (36.7%) showed positive family history for diabetes mellitus and hepatitis B/C. The remaining 76 patients (63.3%) did not report any familial predisposition. All the values were provided in Table 4 and Figure 4.

Table 4: Frequency Distribution of Family History of Disease

Family History	Frequency	Percent
Diabetes	43	35.9
Hepatitis B\C	1	0.8
None	76	63.3
Total	120	100.0

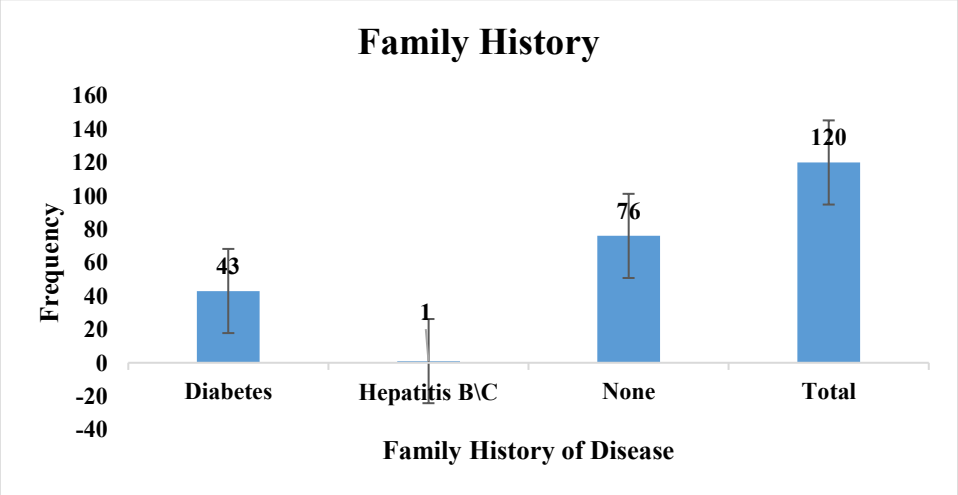

Figure 4: Frequency Distribution of Family History of Disease

Transfusion History

Out of the total patients, only 1 patient (0.8%) had a history of Blood transfusion, while 119(99.2%) had no history of prior blood transfusion. All the values were provided in Table 5 and Figure 5.

Table 5: Frequency Distribution of Transfusion History

Transfusion History	Frequency	Percent
Yes	1	0.8
No	119	99.2
Total	120	100.0

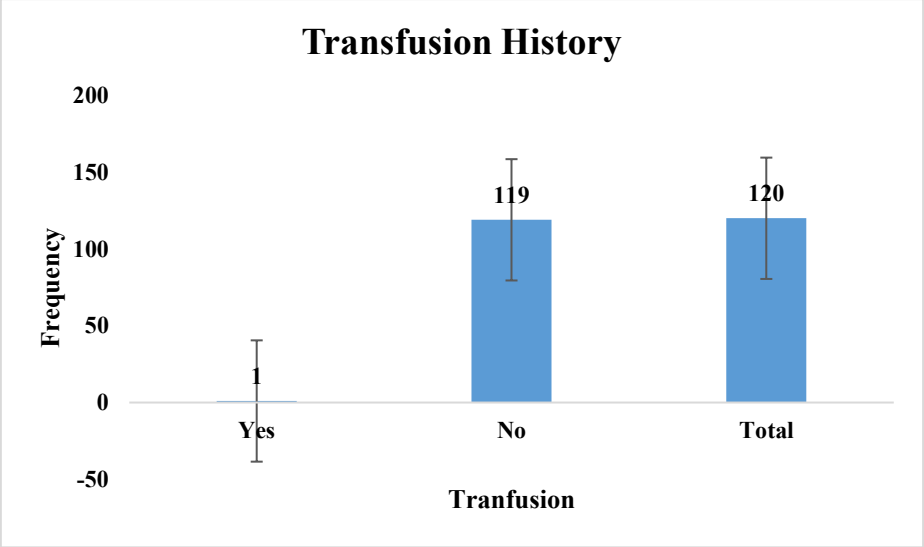

Figure 5: Frequency Distribution of Transfusion History

Drug Intake

25 patients (28.8%) reported smoking tobacco, whereas 95 patients (79.2%) were not taking any drugs during the time of data collection. All the values were provided in Table 6 and Figure 6.

Table 6: Frequency Distribution of people taking Drugs

Drug Intake	Frequency	Percent
Smoke tobacco	25	20.8
None of the above	95	79.2
Total	120	100.0

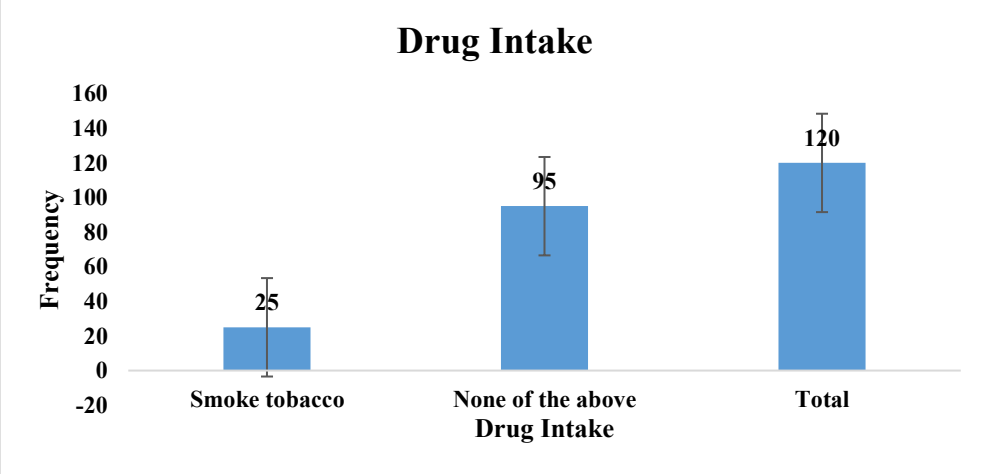

Figure 6: Frequency Distribution of people taking Drugs

Physical Activity

In terms of physical activity, most patients (n=75, 62.5%) were engaging in moderate physical activity. Light activity was the second most reported category with 40 patients (33.3%). A small portion of patients (n=3, 2.5%) were classified as sedentary and only 2 patients (1.7%) were involved in heavy physical activity. All the values were provided in Table 7 and Figure 7.

Table 7: Frequency Distribution of people taking Drugs

Physical Activity	Frequency	Percent
Sedentary	3	2.5
Light Activity	40	33.3
Moderate Activity	75	62.5
Heavy Activity	2	1.7
Total	120	100.0

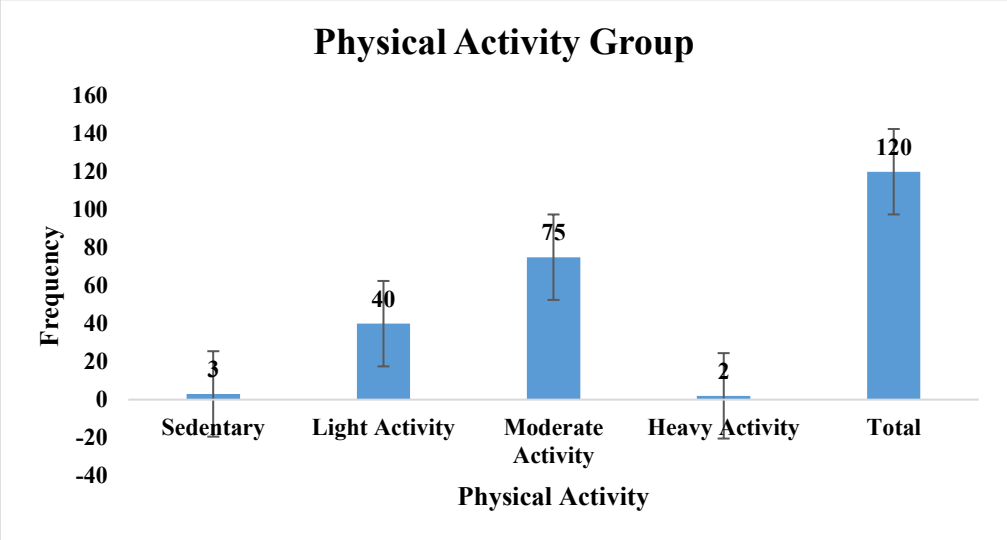

Figure 7: Frequency Distribution of people according to Physical Activity

Blood Group

The most frequently observed blood group was B blood type, found in 57 patients (47.5%), followed by A blood group reported 26 patients (21.7%), O in 21 patients (17.5%) and AB in 16 patients (13.3%). All the values were provided in Table 8 and Figure 8.

Table 8: Frequency Distribution of Blood Groups in Diabetes Mellitus, Hepatitis B and Hepatitis C Patients

Blood Groups	Frequency	Percent
A	26	21.7
B	57	47.5
AB	16	13.3
O	21	17.5
Total	120	100.0

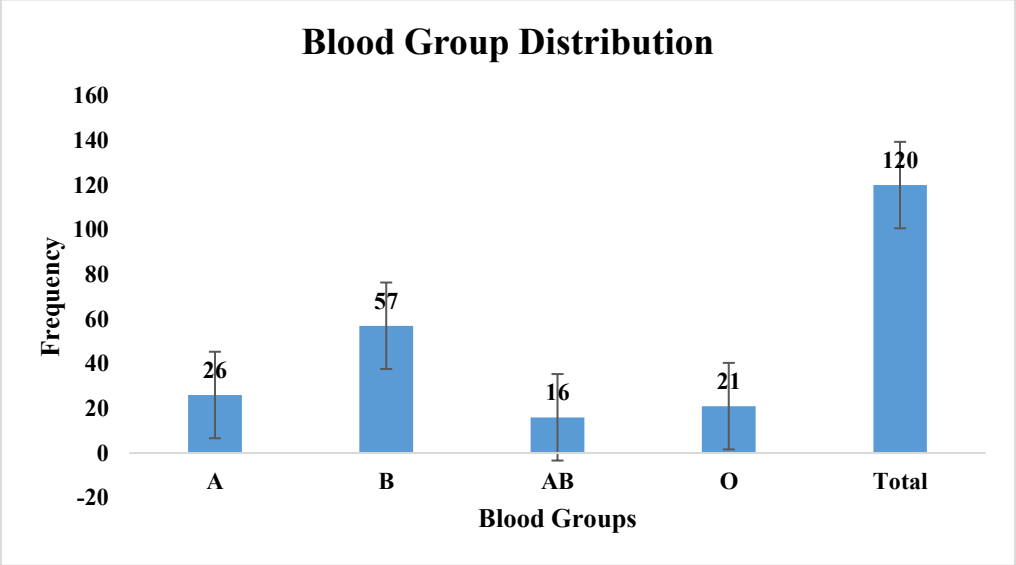

Figure 8: Frequency Distribution of Blood Groups in Diabetes Mellitus, Hepatitis B and Hepatitis C Patients

HBsAg and HCV Ab Status

HBsAg, a marker of active hepatitis B infection, was positive in 7 patients (5.8%) and another test HCV Ab test done to diagnose hepatitis C infection was positive in 3 patients (2.5%) and 110 patients (91.7%) were tested negative for HBsAg and HCV Ab. All the values were provided in Table 9 and Figure 9.

Table 9: Frequency Distribution of HBsAg and HCV Ab positive cases

HBsAg and HCV Ab Status	Frequency	Percent
HBsAg positive	7	5.8
HCV Ab positive	3	2.5
Negative	110	91.7
Total	120	100.0

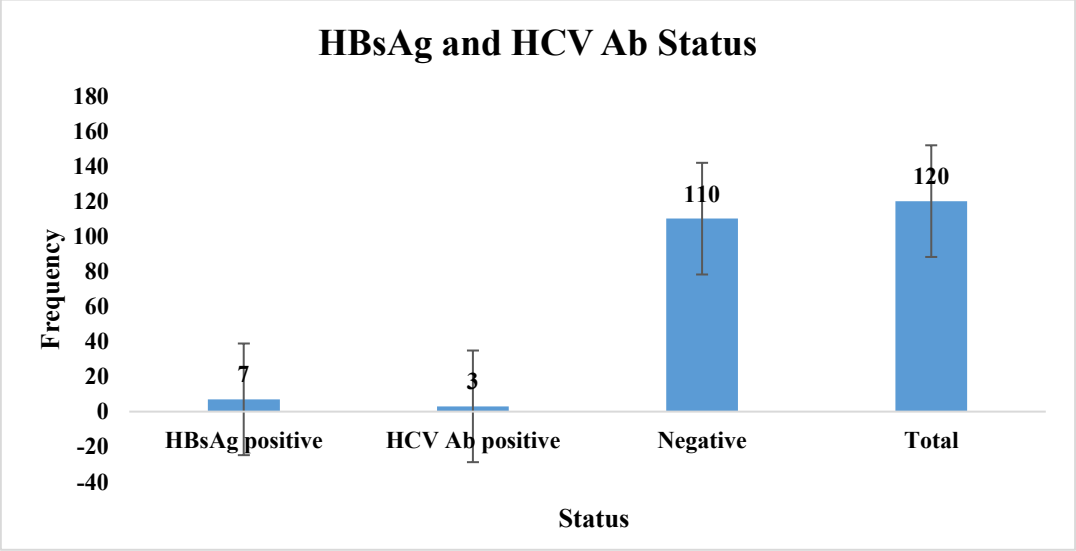

Figure 9: Frequency Distribution of HBsAg and HCV Ab positive cases

Occupation

Out of total patients, 33 (27.5%) retired, followed by 25 (20.8%) who were homemakers, 14 (11.7%) were skilled labors, and 48 (40%) were in other occupations including students, professionals, government employees, farmers,

business owners, and unemployed. All the values were provided in Table 10 and Figure 10.

Table 10: Frequency Distribution of Occupations

Occupation	Frequency	Percent
Student	4	3.3
Professional	8	6.7
Homemaker	25	20.8
Skilled Labor	14	11.7
Government Employee	12	10.0
Retired	33	27.5
Farmer	12	10.0
Business owner	11	9.2
Unemployed	1	0.8
Total	120	100.0

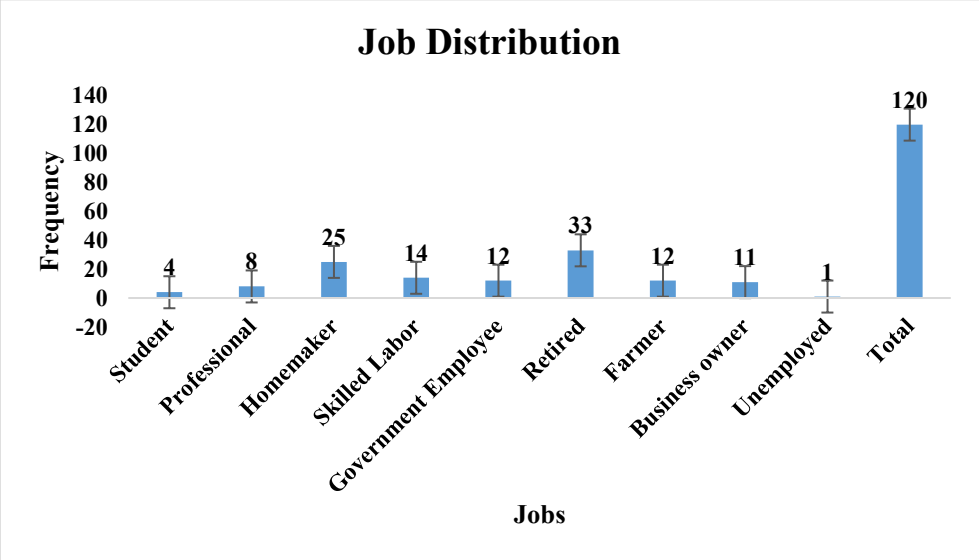

Figure 10: Frequency Distribution of Occupations

Time since Diagnosis of Diabetes Mellitus

92 patients (76.7%) out of 120 patients were diagnosed with diabetes within last 1-9 years, 16 (13.5%) were diagnosed in last 10-19 years, 3 patients (2.5%) were diagnosed 20-29 years ago and only 9 patients were nondiabetic. All the values were provided in Table 11 and Figure 11.

Table 11: Frequency Distribution of groups which shows Time since Diagnosis of Diabetes Mellitus

Time since Diagnosis if patient is diabetic	Frequency	Percent
1-09	92	76.7
10-19	16	13.3
20-29	3	2.5
N\A	9	7.5
Total	120	100.0

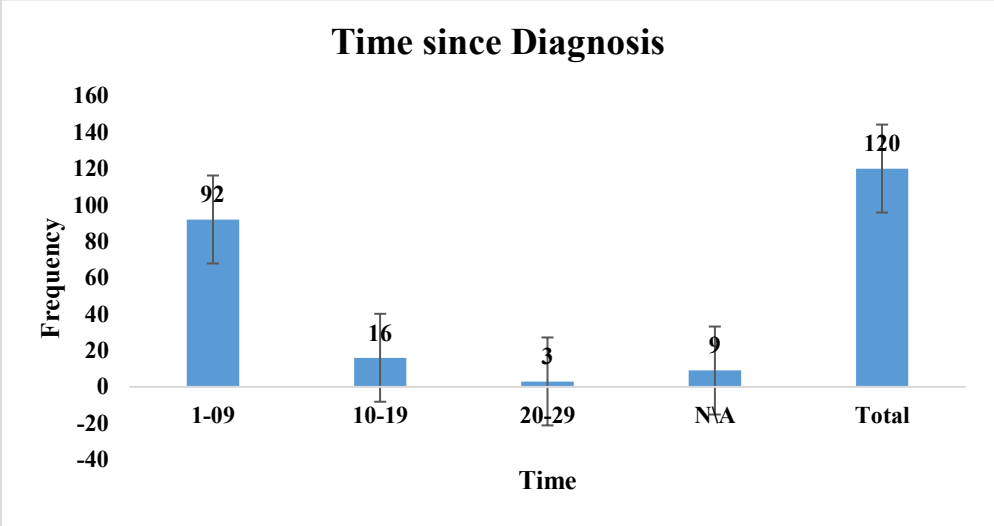

Figure 11: Frequency Distribution of groups which shows Time since Diagnosis of Diabetes Mellitus

DISCUSSION

The ABO blood group system is the major human blood group classification. No disease directly results from absence of ABO antigens (Javed et al., 2017). Many studies have shown that people with certain ABO blood type are susceptible to certain diseases more than others. Present study aims to find out frequency of ABO blood groups in patients who have diabetes mellitus, hepatitis B and C in Gilgit region.

Demographic Factors (Age and Gender)

In this study, most patients were in the age group of 50-69 years, followed by those who were aged 30-49 years. The estimated mean was 53.0 years. This showed that the middle aged and the older people are more affected by diabetes mellitus and hepatitis related conditions. A slight male predominance was observed in our study. Other regional studies with similar age distribution and gender wise distribution of diabetes mellitus were reported by Javed et al. (2017) Prakash et al. (2022) Tasneem et al. (2021).

Family History of Disease

Our study showed a strong familial history for diabetes mellitus type 2. Previous studies have shown that type 2 diabetes mellitus has a strong familial history and the individuals who have family history of diabetes are at higher risk of developing diabetes than someone who has no familial history. If both parents are diabetic, then the chances of developing diabetes in their offspring are highest (Alrashed et al., 2023; Annis et al., 2005).

ABO Blood Groups

For the first time in the mid-1950s, researchers identified a relationship between ABO blood groups and systemic diseases. Since then, various studies have been conducted which suggest that ABO blood group is linked to various diseases like diabetes mellitus, viral hepatitis, vascular disorders etc (Tasneem et al., 2021).

In the present study, the most frequently reported blood group in Gilgit region according to our findings was B, followed by A, O, and AB. In our stream of patients, we found out that the most susceptible blood group for diabetes mellitus, hepatitis B and C is blood group B. Similar results for diabetes mellitus were reported by Tasneem et al. (2021) and Prakash et al. (2022) Aggarwal et al. (2017) and Waseem et al. (2012) showed contradictory findings, according to them blood group AB is at higher risk of developing type 2 diabetes followed by O blood type and blood group A and B are less likely to have diabetes mellitus. Contradictory to our findings for hepatitis B and C, research conducted in Iran indicated that the percentage of CD4+ T-lymphocytes is higher in individuals with B blood type in comparison with other blood types. From this it can be inferred that people with B blood group is at lower risk for viral and infectious diseases (Naseri et al., 2016; Manasa et al., 2024).

The link between ABO blood groups and the risk of developing type 2 diabetes mellitus is not fully understood so far. Studies have shown the

association between them, but it is still a topic of debate. Findings from recent genome-wide association's studies have shown that the presence of certain ABO blood group antigens may influence the body's inflammatory processes. Specific genetic variations at the ABO locus have been associated with elevated levels of inflammatory markers such as tumor necrosis factor (TNF)-alpha and soluble intercellular adhesion molecule-1. Increased production of TNF-alpha causes more inflammation. These markers are known to contribute to insulin resistance, which is the key factor in development of type 2 diabetes mellitus (Tasneem et al., 2021; Aggarwal et al., 2018).

CONCLUSION

We concluded that the most susceptible blood type for diabetes mellitus (DMT1 and DMT2) and hepatitis B and C is B blood type. 120 patients were included in our study who were diagnosed with diabetes mellitus, hepatitis B and hepatitis C. In diabetes mellitus the most frequent blood type was type B. In case of hepatitis B and hepatitis C, again blood group B was more frequent. The most susceptible age group for diabetes was 50-69 years group. The most frequent age group in hepatitis B and hepatitis C was 30-49 years group. Both diseases were more frequent in males as compared to females.

Based on the findings of this current study, a large-scale study with in-depth investigation about genetics and role of ABO blood groups and how these blood group antigens play a role in diabetes mellitus, hepatitis B and C should be conducted and proper screening programs should be introduced for high-risk individuals. Also, physicians should advise special diet and exercise plans for high-risk individuals.

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