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Blood Group Variations and Their Association with Haematological and Hepatic Profiles in Iraqi Patients

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P A P E R I N F O

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A b s t r a c t

Humans are grouped by many different antigens. One of the most common ways to classify humans is with the ABO system - based on a hereditary presence or absence of two glycoproteins, (a&b) on our erythrocyte (red blood cell) membranes. It is a system with the most clinical significance among 44 blood systems, currently recognized by the International Society of Blood Transfusion. Mismatched transfusions or organ transplants can trigger severe immune reactions. Anti- (A, B) antibodies, typically IgM, are naturally produced in early life through exposure to environmental antigens. The aim of the current work was to assess some biochemical parameters alanine transaminase (AST), Aspartate transaminase (ALT) and hematological indices as hemoglobin (HB), white blood cell (WBC), red blood cells (RBC), platelets (PLT), and finally (HCT/PCV) among Iraqi patients according to ABO-blood groups. Eighty samples were collected in autumn 2023 from Baghdad. Results indicated that individuals with blood group A exhibited significant alteration across all measured parameters compared to other groups, while other groups showed selective changes in specific parameters.

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Table 1. If your paper has nomenclature write it in a table like below:

NOMENCLATURE			
AST/GOT	*alanine transaminase*	*ALT/GPT*	*Aspartate transaminase*
HB	*hemoglobin*	*WBC*	*white blood cell*
RBC	*red blood cells*	*PLT*	*platelets*
HCT/PCV	*hematocrit*	*ABO*	*blood groups (A^+, B^+, O^+, A^-, B^-, O^-, AB^+, AB^-)*

1. INTRODUCTION

1.1 The ABO System

The ABO blood group system, which the ISBT (2022) considers the most clinically important blood group classification system, is essential for ensuring the safety of blood transfusions and organ transplants between individuals.(Gassner et al., 2022). The ABO classification is based on A and B erythrocyte antigens and the natural presence of anti-A and anti-B IgM antibodies. These antibodies develop early in life due to exposure to common environmental antigens (Dean & Dean, 2005).

The ABO system was first described by Karl Landsteiner in 1901, a discovery that earned him the Nobel Prize in 1930 and highlighted the evolutionary conservation of this system across primates)Landsteiner,

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1990; Ségurel et al., 2012). Early 20th-century schemes by Janský and Moss used conflicting numerical systems for ABO groups. This mismatch created major clinical confusion.(G. J. T. m. r. Garratty, 2000; Misevic & Genomics, 2018). The National Research Council adopted Landsteiner's alphabetical system (O, A, B, AB). This resolved earlier ambiguities and achieved global acceptance by mid-20th century (Ajmani, 2020; Czerwinski, Kaczmarek, & Glensk, 2022; G. Garratty et al., 2000; Reid, Lomas-Francis, & Olsson, 2012; Schmidt, Okroi, & Hemotherapy, 2001; Storry & Olsson, 2004; Yamamoto, Cid, Yamamoto, & Blancher, 2012).

Subsequent advances further established the system's scientific foundation. The first clinical use of blood typing for transfusion was pioneered in 1907 by Ottenberg (Starr, 2012), and the large-scale adoption of transfusions became feasible during World War I with the introduction of citrate anticoagulation (Patidar & Dhiman, 2021). In 1924, Bernstein proved the Mendelian inheritance of ABO groups. Later, Watkins and Morgan identified the sugar residues defining antigens A (N-acetylgalactosamine) and B (galactose) (Li, 2008). Structural investigations revealed that ABH antigens are primarily expressed on erythrocyte glycoproteins such as band 3, band 4.5, and glycophorin (Shivatare, Shivatare, & Wong, 2022). Yamamoto's group identified the glycosyltransferases producing A, B, and O phenotypes. These advances firmly established the ABO system as central to transfusion medicine (Goel et al., 2021).

1.2 Liver Function Tests (LFTs or LFs)

Liver function tests (LFTs) are blood assays assessing hepatic health. They measure synthetic function (albumin, PT/INR, aPTT), excretory function (bilirubin), and hepatocellular integrity (AST, ALT) (Kwo, Cohen, Lim, & ACG, 2017; Lee, 2009). LFTs aid early detection and monitoring of liver disorders, including GGT and AP for biliary assessment. Since not all tests reflect true function, they are often called "liver chemistries" (Suljić et al., 2021).

These tests play an important role in diagnosing and staging liver disease and monitoring treatment progress, especially in patients taking medications that are harmful to the liver. The main indicators used in these tests include ALT, AST, and ALP enzymes, in addition to analyzing the levels of bilirubin, cholesterol, albumin, and total protein in the blood (Brar, Singla, & Singla, 2021; Tavill, 1970).

1.3 Alanine Transaminase (ALT)

The liver is the major source of ALT although it is found in other tissues where it functions as a cytoplasmic enzyme involved in transaminases (Kim, Flamm, Di Bisceglie, & Bodenheimer, 2008). Elevated AST and ALT levels (below 300 IU/L) may be due to the damage to non-liver tissue, while levels of 500 IU/L or more usually indicate liver cell damage. A persistent increase in the levels of these two enzymes indicates chronic hepatitis)Giannini, Testa, & Savarino, 2005) . Elevated ALT levels are associated with fatty liver disease, whether caused by alcohol consumption or other factors, as well as with non-alcoholic fatty liver disease in obese children, which is often accompanied by metabolic disturbances (Bandin et al., 1996). ALT levels may also be elevated during some pregnancy complications, but they usually return to normal after delivery. Studies have shown that caffeine intake may help lower ALT levels in people at risk (Danielson, Cauley, & Rohay, 1993).

1.4 Aspartate Transaminase (AST)

The AST enzyme is present in both the cytoplasm and mitochondria, and its widespread distribution in tissues limits its usefulness as a diagnostic marker for liver disease compared to the ALT enzyme (Giannini et al., 2005). The level of AST in the blood mainly reflects its concentration in the cytoplasm, while the AST enzyme in the mitochondria is associated with tissue necrosis, especially in cases of heart attack and advanced liver diseases (Kim et al., 2008). AST often rises in cirrhosis and certain pregnancy conditions, but mild increases (<2× ULN) may be insignificant (Bandin et al., 1996).

1.5 AST/ALT Ratio

The aspartate aminotransferase to alanine aminotransferase (AST/ALT) ratio is a useful index in differentiating liver diseases (Gowda et al., 2009). Ratios >2.0 are strongly suggestive of alcoholic hepatitis, whereas values <1.0 are commonly observed in non-alcoholic steatohepatitis and acute viral hepatitis. Ratios >1.0 may indicate advanced fibrosis or cirrhosis of various etiologies, including viral hepatitis (Shivaraj Gowda et al., 2009). Markedly elevated ratios (>4.0) have been described in Wilson's disease and hyperthyroidism (Sheth, Flamm, Gordon, Chopra, & ACG, 1998).

1.6 Complete Blood Count (CBC)

CBC provides both quantitative and qualitative data about blood cells, including red blood cells, white blood cells, platelets, haemoglobin, and haematocrit (B. J. Bain & Leach, 2025). Indicators such as the mean corpuscular volume and haemoglobin concentration help identify the causes of anaemia, while analysis of the different types of white blood cells aids in

the diagnosis of infectious diseases and blood disorders (Buttarello & Plebani, 2008). Modern analyzers employ impedance and flow cytometry technologies, supplemented by smear reviews when needed (International Council for Standardization in Haematology et al., 2014). Interpretation must consider patient demographics and clinical context, as deviations from reference ranges do not always indicate pathology (B. J. J. N. E. J. o. M. Bain, 2005).

1.7 The Study Plan

A total of 40 blood samples from both genders were categorized into eight groups: A^+, B^+, O^+, A^-, B^-, O^-, AB^+, and AB^-. Following participant questionnaires, five milliliters of blood per sample were collected and divided into two portions. One portion, collected in a gel tube, was centrifuged to obtain serum for biochemical analysis, including measurements of ALT/GPT and AST/GOT. The second portion, collected in an EDTA tube, was used for a comprehensive haematological evaluation, which included measuring Hb, WBC, RBC, PLT, and HCT/PCV.

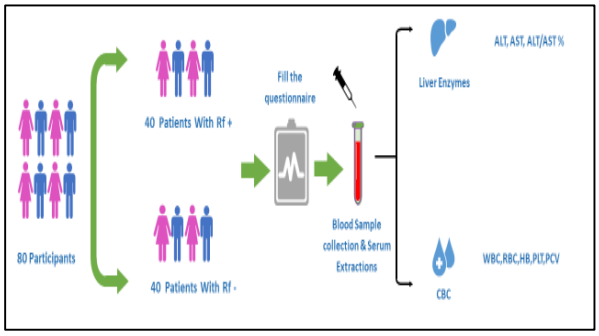

Figure 1. The scheme explains the study plan with the steps collected and the parameters

2- Related Work Section

The link between blood grouping and physiological and pathological variables is increasingly well established, highlighting its clinical significance beyond blood transfusion. Several studies have indicated differences in the distribution of ABO and Rh blood groups among populations in India, suggesting the influence of demographic factors on these variations (Patidar & Dhiman, 2021). Recent studies have also explored the relationship between blood type and susceptibility to COVID-19 infection and its severity, demonstrating how immunological characteristics associated with blood groups can influence disease outcomes (Goel et al., 2021).

A review of several studies revealed correlations between blood types and hematological and liver function. One study conducted on a Turkish population reported statistically significant differences in red blood cell (RBC) and hemoglobin (Hb) counts across different blood types (Shivatare et al., 2022). In South Asia, selective correlations were found between blood types and liver enzyme levels AST and ALT (Goel et al., 2021).

Despite these findings, the evidence remains conflicting and inconclusive regarding the Iraqi population, as several studies have shown that geography plays a different role. Previous studies often suffered from limitations such as not including both ABO and Rh factors in the combined analysis, not simultaneously assessing a comprehensive set of biochemical and hematological parameters, or even the geographical location of the sample. Therefore, this study aims to bridge this gap by systematically investigating the relationship between ABO and Rh blood types and a range of liver indices (ALT, AST and their ratios) and blood indices (Hb, WBC, RBC, PLT, HCT) in a sample of Iraqi patients, thus providing a clearer picture of these interactions in this specific population.

2. Methodology:

The laboratory diagnosis for liver function is based on serum GPT, GOT, and on plasma Hb, WBC, RBC, PLT and HCT or PCV.

2.1 Materials and Methods:

In this study, samples were collected over two months, beginning in November, comprising twenty individuals of both genders across the eight blood groups (A^+, B^+, O^+, A^-, B^-, O^-, AB^+, AB^-), with a mean age of 39 ± 17 years.

2.2 Statistical Analysis:

Statistical analysis was performed using Graph Pad Prism software, version 10. The comparison of the patient groups (hypothyroidism and hyperthyroidism patients) with the control group of healthy individuals is achieved , by using one of the above ways. A p-value less than 0.05 was considered statistically significant, while a p-value less than 0.01 was regarded highly statistically significant. The software also generated seven graphs to visually present the results.

3.1 Results

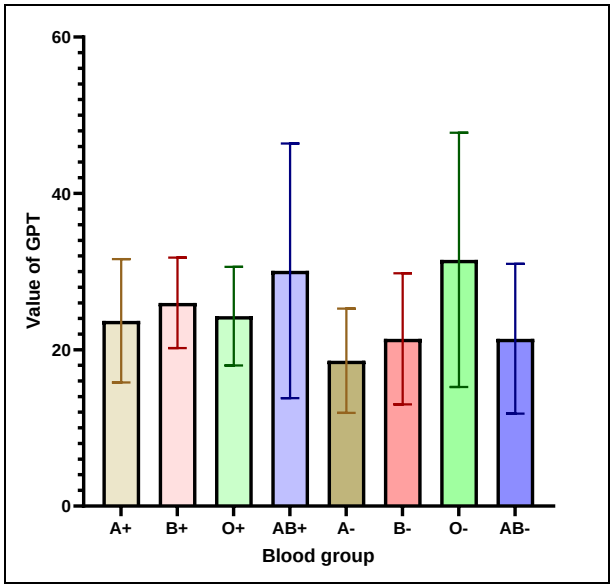

Figure 2. The emissions of serum samples GOT.

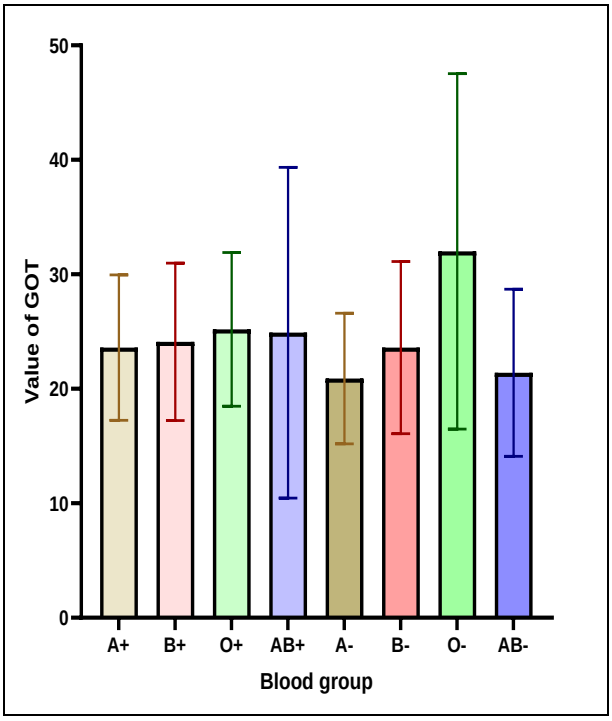

Figure 3. The emissions of serum samples GPT.

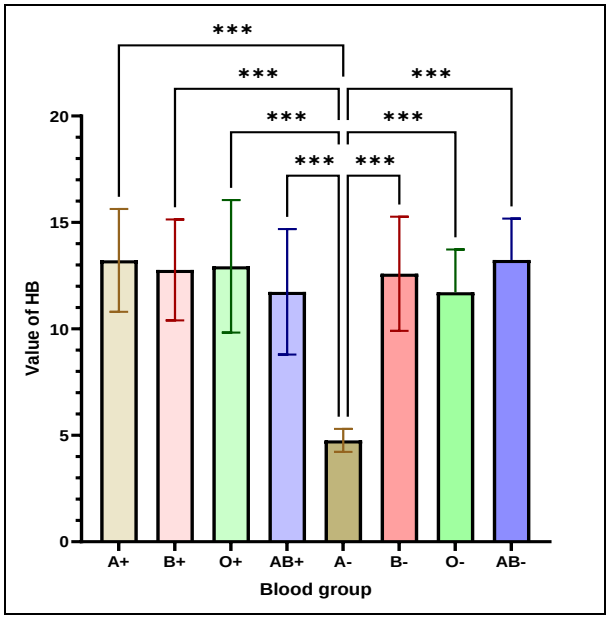

Figure 4. The emissions of plasma samples Hb.

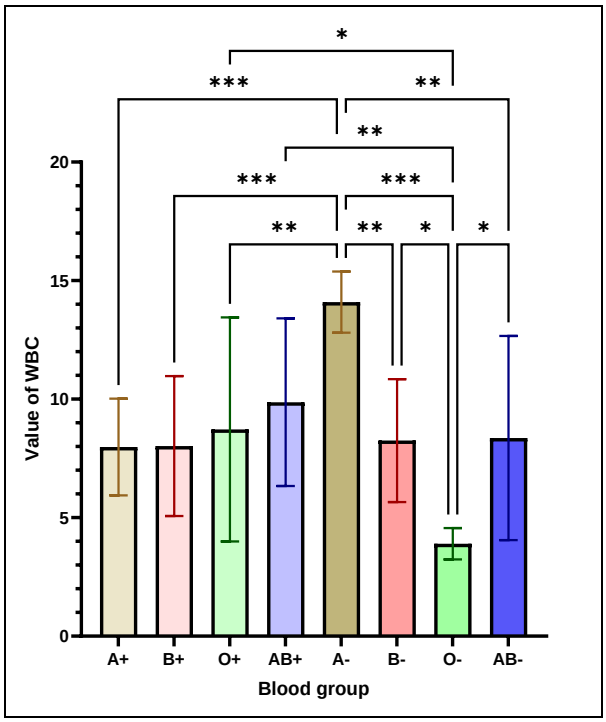

Figure 5. The emissions of whole blood samples WBC.

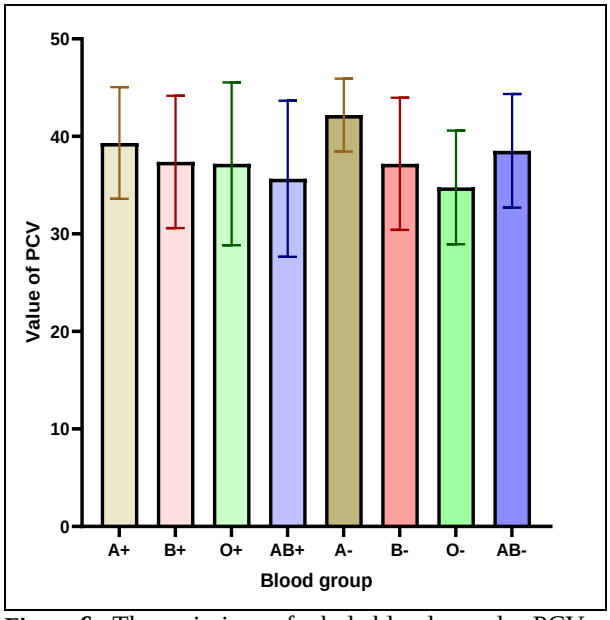

Figure 6. The emissions of whole blood samples PCV.

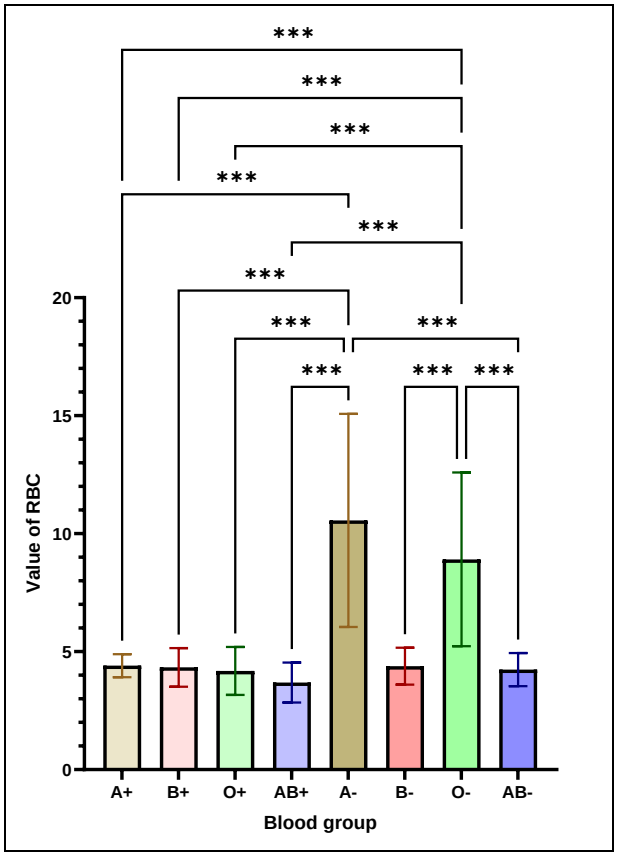

Figure 7. The emissions of whole blood samples RBC.

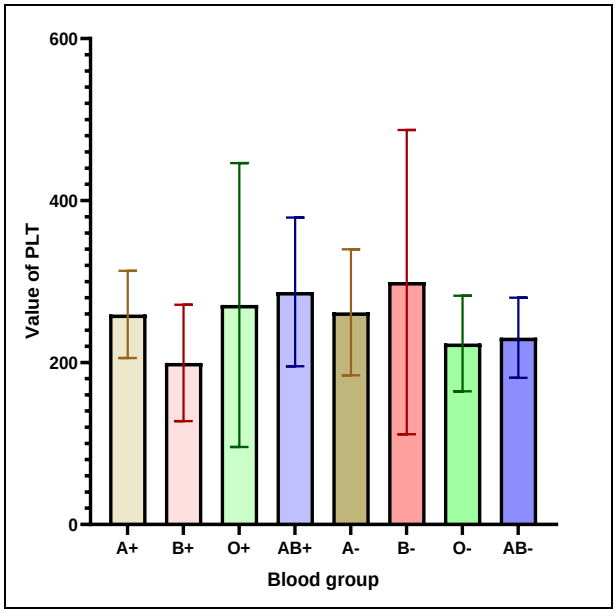

Figure 8. The emissions of whole blood samples PLT.

3.2 Discussion

From the figures (3-1), (3-2), (3-5) and (3-7), we find that GOT, GPT, PCV and PLT were not affected at all, with p-value (0.101, 0.272, 0.296 and 0.462) respectively.

Hb test shown in figure (3-3) found that only A^- give a very high significance with other groups that give p- value with A^+, B^+, O^+, B^-, O^-, AB^+ and AB^- less than (0.001).

However, WBC test shown in figure (3-4), found O^+ vs. O^-, B^- vs. O^-, and O^- vs. AB^- give a significance with p-value (0.016, 0.043, 0.035) respectively. while O^+ vs. A^-, AB^+ vs. O^-, A^- vs. B^-, and A^- vs. AB^- give a high significance with p-value (0.005, 0.001, 0.001, 0.002) respectively. Compared with A^+ vs. A^-, B^+ vs. A^-, and A^- vs. O^- give a very high significance with p-value less than (0.001).

In figure (3-6) , the RBC test showed a very high significance with p-value less than (0.001) between A^+ vs. A^-, A^+ vs. O^-, B^+ vs. A^-, B^+ vs. O^-, O^+ vs. A^-, O^+ vs. O^-, AB^+ vs. A^-, AB^+ vs. O^-, A^- vs. B^-, A^- vs. AB^-, B^- vs. O^-, and O^- vs. AB^-

Our study is consistent with a previous study and it is found that there is a gradual decrease in the prevalence of abnormal hemoglobin variants among our population as it has been found that skin color can affect them. However, the frequencies of ABO and Rh blood groups appear to be stable and consistent with previous published data (Shivatare et al., 2022).

Statistically significant are the reductions of red blood cells (RBC) and white blood cells (WBC). The changes in WBC counts were observed to be in

association with ABO blood groups. The other evaluated factors were not significantly associated with ABO blood groups and this is consistent with a previous study (Goel et al., 2021).

3.3. Conclusion

From the results, we find that GOT, GPT, PCV and PLT are not affected at all. When Hb affected only on A^-.

However, WBC found that there is a clear difference between negative and positive Rh for the same group (O^+ vs. O^- and A^+ vs. A^-). Also the RBC (O^+ vs. O^- and A^+ vs. A^-).

Our study is consistent with a previous study which is found that there is a gradual decrease in the prevalence of abnormal hemoglobin variants among our population, as it has been found that skin color can affect them. However, the frequencies of ABO and Rh blood groups appear to be stable and consistent with previous published data (Shivatare et al., 2022).

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REFERENCES

Ajmani, P. S. (2020). *Immunohematology and blood banking: principles and practice*: Springer Nature.

Bain, B. J., & Leach, M. (2025). *Blood cells: a practical guide*: John Wiley & Sons.

Bain, B. J. J. N. E. J. o. M. (2005). Diagnosis from the blood smear. *353*(5), 498-507.

Bandin, O., Courvalin, J., Poupon, R., Dubel, L., Homberg, J., & Johanet, C. J. H. (1996). Specificity and sensitivity of gp210 autoantibodies detected using an enzyme-linked immunosorbent assay and a synthetic polypeptide in the diagnosis of primary biliary cirrhosis. *23*(5), 1020-1024.

Brar, S., Singla, N., & Singla, L. J. I. J. o. V. R. (2021). Molecular characterization and histo-physiological alterations induced by concurrent helminthosis in the liver of urban commensal rodents in Punjab, India. *22*(1), 15.

Buttarello, M., & Plebani, M. J. A. j. o. c. p. (2008). Automated blood cell counts: state of the art. *130*(1), 104-116.

Czerwinski, M., Kaczmarek, R., & Glensk, U. J. V. S. (2022). Ludwik Hirszfeld: A pioneer of transfusion and immunology during the world wars and beyond. *117*(4), 467-475.

Danielson, M. E., Cauley, J. A., & Rohay, J. M. J. A. o. e. (1993). Physical activity and its association with plasma lipids and lipoproteins in elderly women. *3*(4), 351-357.

Dean, L., & Dean, L. (2005). *Blood groups and red cell antigens* (Vol. 2): NCBI Bethesda.

Garratty, G., Dzik, W., Issitt, P., Lublin, D., Reid, M., & Zelinski, T. J. T. (2000). Terminology for blood group antigens and genes—historical origins and guidelines in the new millennium. *40*(4), 477-489.

Garratty, G. J. T. m. r. (2000). Blood groups and disease: a historical perspective. *14*(4), 291-301.

Gassner, C., Castilho, L., Chen, Q., Clausen, F. B., Denomme, G. A., Flegel, W. A., . . . Keller, M. A. J. V. s. (2022). International Society of Blood Transfusion Working Party on Red Cell Immunogenetics and Blood Group Terminology Report of Basel and three virtual business meetings: update on blood group systems. *117*(11), 1332-1344.

Giannini, E. G., Testa, R., & Savarino, V. J. C. (2005). Liver enzyme alteration: a guide for clinicians. *172*(3), 367-379.

Goel, R., Bloch, E. M., Pirenne, F., Al-Riyami, A. Z., Crowe, E., Dau, L., . . . Rahimi-Levene, N. J. V. s. (2021). ABO blood group and COVID-19: a review on behalf of the ISBT COVID-19 working group. *116*(8), 849-861.

Gowda, S., Desai, P. B., Hull, V. V., Math, A. A., Vernekar, S. N., & Kulkarni, S. S. J. T. P. a. m. j. (2009). A review on laboratory liver function tests. *3*, 17.

International Council for Standardization in Haematology, W. G., Briggs, C., Culp, N., Davis, B., d'Onofrio, G., Zini, G., . . . hematology, I. C. f. S. o. H. J. I. j. o. l. (2014). ICSH guidelines for the evaluation of blood cell analysers including those used for differential leucocyte and reticulocyte counting. *36*(6), 613-627.

Kim, W. R., Flamm, S. L., Di Bisceglie, A. M., & Bodenheimer, H. C. J. H. (2008). Serum activity of alanine aminotransferase (ALT) as an indicator of health and disease. *47*(4), 1363-1370.

Kwo, P. Y., Cohen, S. M., Lim, J. K. J. O. j. o. t. A. C. o. G., & ACG. (2017). ACG clinical guideline: evaluation of abnormal liver chemistries. *112*(1), 18-35.

Landsteiner, K. J. S. J. o. I. (1990). On Individual Differences in Human Blood. *32*(1).

Lee, M. (2009). *Basic skills in interpreting laboratory data*: Ashp.

Li, R. (2008). *Forensic biology: identification and DNA analysis of biological evidence*: CRC press.

Misevic, G. J. B., & Genomics. (2018). ABO blood group system. *2*(2), 71-84.

Patidar, G. K., & Dhiman, Y. J. I. s. s. (2021). Distribution of ABO and Rh (D) Blood groups in India: A systematic review. *16*(1), 37-48.

Reid, M. E., Lomas-Francis, C., & Olsson, M. L. (2012). *The blood group antigen factsbook*: Academic press.

Schmidt, P., Okroi, M. J. T. M., & Hemotherapy. (2001). Also sprach Landsteiner–blood group ‘O’or blood group ‘null’. *28*(4), 206-208.

Ségurel, L., Thompson, E. E., Flutre, T., Lovstad, J., Venkat, A., Margulis, S. W., . . . Sella, G. J. P. o. t. N. A. o. S. (2012). The ABO blood group is a trans-species polymorphism in primates. *109*(45), 18493-18498.

Sheth, S. G., Flamm, S. L., Gordon, F. D., Chopra, S. J. O. j. o. t. A. C. o. G., & ACG. (1998). AST/ALT ratio predicts cirrhosis in patients with chronic hepatitis C virus infection. *93*(1), 44-48.

Shivaraj Gowda, S. G., Prakash Desai, P. D., Vinayak Hull, V. H., Avinash Math, A. M., Sonal Vernekar, S. V., & Shruthi Kulkarni, S. K. (2009). A review on laboratory liver function tests.

Shivatare, S. S., Shivatare, V. S., & Wong, C.-H. J. C. r. (2022). Glycoconjugates: synthesis, functional studies, and therapeutic developments. *122*(20), 15603-15671.

Starr, D. (2012). *Blood: an epic history of medicine and commerce*: Knopf.

Storry, J. R., & Olsson, M. L. J. B. j. o. h. (2004). Genetic basis of blood group diversity. *126*(6), 759-771.

Suljić, A., Konjević, I., Smaka, L., Suleymanoglu, S. L., Subašić, M., & Sofić, N. (2021). *Machine Learning Techniques for Prediction of Liver Fibrosis Based on Biomarkers.* Paper presented at the International Conference on Medical and Biological Engineering.

Tavill, A. S. (1970). *The Measurement of Hepatic Synthesis of Albumin in vivo*: The University of Manchester (United Kingdom).

Yamamoto, F., Cid, E., Yamamoto, M., & Blancher, A. J. T. m. r. (2012). ABO research in the modern era of genomics. *26*(2), 103-118.