Volume 3, Number 3, 2026

Pages 458-470

Bioscience Insights

ISSN: 3080-3489 (Print)
ISSN: 3080-3497 (Online)

BiosciInsights.com

PREVALENCE OF HEPATITIS AND PATTERNS OF HEMATOLOGICAL ABNORMALITIES AMONG PREGNANT WOMEN IN NAROWAL

Muhammad Irfan[1*], Mehwish Ishaq[2], Abdul Qadoos[3], Dr. Muhammad Asim[4], Prof. Dr. Abdul Majid Khan[5]

[1*]*Università degli studi di Bologna, Bologna, Italy*
[2]*University of Education, Lahore, Pakistan*
[3,5]*University of The Punjab, Lahore, Pakistan*
[4]*University of Narowal, Narowal, Pakistan*

[1*]muhammad.irfan92@studio.unibo.it

https://doi.org/10.5281/zenodo.23386314

Article Information

Article History

Received:	June 19, 2026
Revised:	August 19, 2026
Accepted:	September 07, 2026
Available Online:	October 15, 2026

Keywords:
Pregnant women, Hepatitis B, Hepatitis C, Hematological abnormalities, Chi-square test.

Copyright @Author
Corresponding Author: *
Muhammad Irfan

Abstract

Hepatitis B and C infections and hematological abnormalities such as anemia and thrombocytopenia, are critical health issues during pregnancy that pose serious risks to both maternal and fetal outcomes. This study aimed to determine the prevalence of hepatitis B virus (HBV), hepatitis C virus (HCV), and hematological abnormalities among pregnant women attending antenatal clinics in District Narowal, Punjab, Pakistan. In total, 225 diagnostic reports were taken into consideration during the nine months interval (October 2024-June 2025) of pregnant women from the following different municipal (District headquarters hospital) and non-municipal hospitals (Fatima, Saadat, Shukar Deen and Safeena). Hematological parameters were assessed using complete blood count (CBC) reports, while HBV and HCV infections were determined using HBsAg and anti-HCV serological test results. The data were categorized into age groups, and the association between age and disease prevalence was analyzed using the Chi-square test. The 4 percent of the women were Hepatitis B positive and 18.2 percent of Hepatitis C positive. Among the most common types of hematological abnormalities were microcytic anemia (51 percent), normocytic anemia (24 percent), thrombocytopenia (9 percent) and leukopenia (1 percent). The reported chi-square statistic for age category and hepatitis positivity exceeded the critical value (χ^2=10.23, df=2;

critical $\chi^2=5.99$ at $\alpha=0.05$) whereas the reported statistic for hematological abnormalities ($\chi^2=4.56$, $df=6$; critical $\chi^2=12.59$ at $\alpha=0.05$) did not exceed the critical value. The study provides a weighty disease burden between viral hepatitis and hematological abnormalities in the women of reproductive age of the region.

INTRODUCTION

Viral hepatitis remains one of the leading infectious causes of morbidity and mortality worldwide (Stanaway et al., 2016). Among the five major hepatitis viruses, hepatitis B virus (HBV) and hepatitis C virus (HCV) are responsible for the greatest burden of chronic liver disease, cirrhosis, and hepatocellular carcinoma. According to the World Health Organization, more than 300 million people worldwide are living with chronic hepatitis B or C infection, resulting in approximately 1.3 million deaths annually. Despite the availability of effective preventive measures and treatment strategies, viral hepatitis continues to pose a major public health challenge, particularly in low- and middle-income countries (Lemoin et al., 2013).

Pregnancy is a unique physiological condition in which viral hepatitis has important implications for maternal and neonatal health (Dunkelberg et al., 2014). Maternal liver complications, preterm delivery, low birth weight, fetal growth restriction and mother-to-infant transmission are associated with chronic HBV and HCV infections. Mother-to-child transmission is one of the major pathways for the persistence of hepatitis B infection globally, therefore it is important to perform routine antenatal screening and timely preventive interventions (World Health Organization, 2020).

The hematologic profile during pregnancy is also commonly affected by physiologic changes in plasma volume, hormonal changes and increased nutritional demands (Opaets and Pecheriaha 2026). Mild hemodilution is considered normal but pregnancy is often complicated by pathological conditions like iron deficiency anemia, thrombocytopenia and leukopenia, especially in developing countries where nutritional deficiencies and infectious diseases are common. These anomalies may be linked to increased risk of maternal morbidity, postpartum hemorrhage, fetal growth restriction, and adverse neonatal outcomes. Recent evidence further suggests that chronic HBV infection may be involved in the development of anemia in pregnancy through inflammatory and immunological mechanisms (Huang et al., 2025).

Pakistan is one of the countries with an intermediate to high burden of HBV and HCV infection (Bibi et al., 2026). Many epidemiological studies have indicated significant regional variations in disease prevalence due to differences in health infrastructure, unsafe injection practices, blood transfusion safety and public awareness. Women of childbearing age represent an important high-risk population because undiagnosed infection during pregnancy may facilitate vertical transmission and adversely affect pregnancy outcomes (Santos et al., 2026). Routine antenatal hepatitis testing is patchy in many rural and semi-urban healthcare facilities, despite national screening recommendations.

Narowal District, Punjab is predominantly rural where limited healthcare resources, inadequate infection-control practices and insufficient maternal screening programs may contribute to continued transmission of viral hepatitis. However, there is a lack of epidemiological data describing the burden of HBV, HCV and associated hematological abnormalities in the pregnant women of this district. In Pakistan, previous studies (Nawaz et al., 2026; Gupta et al., 2025) have been mainly focused on viral hepatitis or hematological disorders individually and little information is available regarding their co-existence among antenatal women attending gynecology hospitals.

Therefore, the present study was conducted to determine the prevalence of hepatitis B and hepatitis C infections along with common hematological abnormalities among pregnant women attending selected gynecology hospitals of District Narowal, Punjab, Pakistan. Further, the study also analyzed age-wise distribution patterns and association of maternal age with viral hepatitis and hematological abnormalities. The findings provided baseline epidemiological evidence that may assist clinicians and public health

authorities in strengthening antenatal screening programs, improving maternal healthcare services, and reducing pregnancy-related complications associated with viral hepatitis and hematological disorders.

MATERIALS AND METHODS

Study Area

The current research study was conducted in Narowal district, which is situated in the northeast Punjab, Pakistan, which borders with India and has both urban and rural communities. The Narowal district is populated by about 1.7 million persons as per the current estimations. Although healthcare facilities are available in the district, healthcare access remains limited in many rural areas because of inadequate infrastructure and low health awareness. Unfortunately, this is not the case especially within the rural settings where medical facilities are available but culturally inaccessible. Unsafe medical practices, poor health literacy, and inadequate screening programs contribute to the spread of hepatitis B and C. This aspect renders Narowal as a vital zone to investigate the rate of hepatitis and hematological impairment accompanied by that. The objective of the study was to present epidemiological findings that could be used to develop strategies towards the improvement of public health, based on need and suitability in the region.

Table 1.1: Location of sampling sites

Sr. No.	Hospital Name	Latitude	Longitude
I.	DHQ	32.09920°	74.88390°
II.	Safeena	32.09475°	74.88067°
III.	Saadat	32.09316°	74.86963°
IV.	Fatima	32.09459°	74.87949°
V.	Shukar din	32.09416°	74.87571°

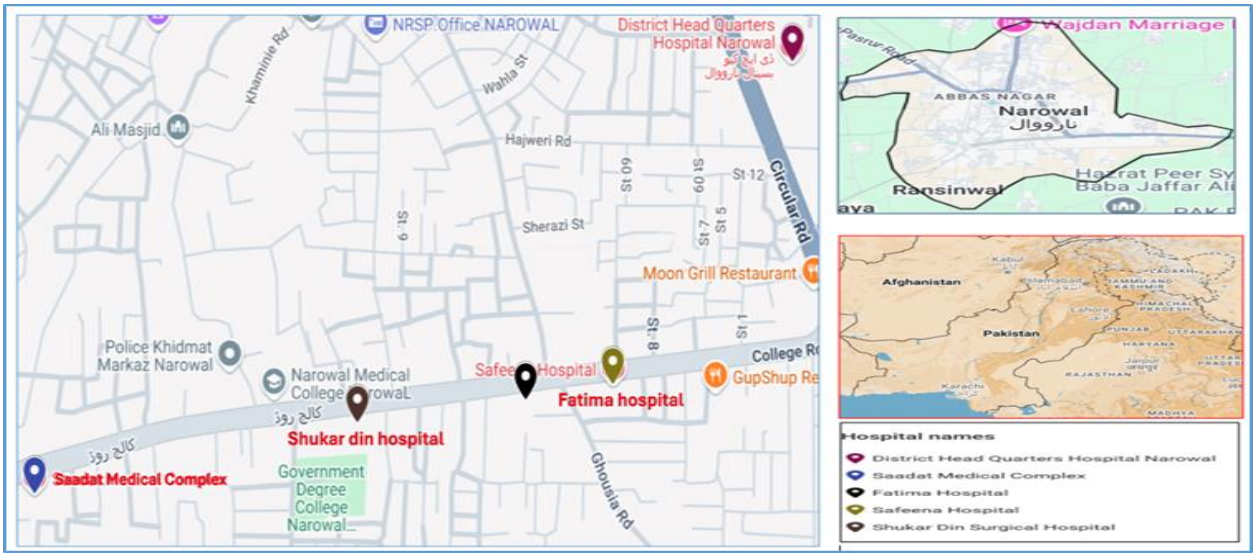


Figure 1.1: Map of District Narowal showing location of sampling sites

Target Population and Sample size
The research population included 225 cases of expectant females with different gestation ages that were reported in normal antenatal clinics during the study time. To recruit the participants that met the inclusion criteria a non-probability purposive sampling technique was employed.

Inclusion Criteria
- Verified pregnancy (in accordance with either ultrasound or clinical criteria)
- Willingness to participate
- The age of 18- 45 years

Exclusion Criteria
- History of chronic liver disease or auto immune disease
- Chronic therapy of hematological disorders
- Incomplete laboratory record

A total of 225 pregnant women were included in the study.

Demographic Distribution Analysis
In order to see the trends in hepatitis and the frequency of hematological abnormalities occurrence with respect to age, the study was split into predetermined age classes. They were 18–25 years, 26–35 years and 36–45 years. Every patient was put into an appropriate group based on the age that is stated in the diagnostic report. Infected patients were enumerated according to the age group. This enabled it to know how the condition manifested itself at various age stages. The table of the age-wise distribution was introduced to the analysis. It also assisted in pictorializing the age frequencies that were increased.

Data Processing
All the diagnostic reports were thoroughly read before the analysis to make them complete and dependable. All the reports were reviewed manually to eliminate any duplication and incomplete records. There were no automated applications applied however, close human judgment was of primary concern in the process of cleaning the dataset. Each entry included was checked twice or more to eliminate errors on entering data. This procedure assisted in the fact that only objective and full data were considered to be further compared, and the credibility and consistency of the research findings were guaranteed.
Data collection was completed by key information contained in 225 diagnostic reports in an excel sheet manually. All the details needed in the reports were present, such as patient demographics (name, age,), CBC parameters (hemoglobin levels, MCV, MCH, and RBC counts), and hepatitis factors (HbsAg and anti-HCV) because the data were not stored based on identification data, only the statistical data (Health Law 2017). The attention to such peculiarities and plan for such a data collection process allowed both keeping its accuracy and respecting ethical standards of research. The procedure made the results of the study to be dependable and be of value to the study of pattern of hepatitis and prevalence of hematological abnormalities among pregnant women in District Narowal.

Tools and software
Microsoft Excel was utilized to do the manual input data reporting of medical diagnosis, cataloging of patient data, prepping of data tables, to check the prevalence and pattern of disease. A geographical location of the study area, District Narowal was identified and visualized through Google Maps. This instrument was used to develop an accessible comprehensible mapping which they used to assist in the space content of the study.

RESULTS

This research work examined the prevalence of hepatitis B, hepatitis C and related hematological abnormalities among pregnant women in District Narowal. Medical records were used as a source of data and placed into categories depending on pretentious age distribution facts and certain hematological profiles.
In our study group, the number of pregnant women under care in the gynecology hospitals was 225. In such patients 192 cases were observed with 114 affected patients of microcytic anemia, 54 normocytic anemia, 3 leukopenia and 21 thrombocytopenia patients. In addition to it, they were identified as hematological abnormal pregnant women (Table 1.2. and Figure 1.2.).

Table 1.2: Prevalence of hematological abnormalities among pregnant women at gynecology hospitals in District Narowal

Hematological abnormalities	Total no. of affected pregnant women	Total no. of reports	Prevalence of affected pregnant women patients
Microcytic anemia patients	114	225	51%
Normocytic anemia patients	54	225	24%
Leukopenia patients	3	225	1%
Thrombocytopenia patients	21	225	9%

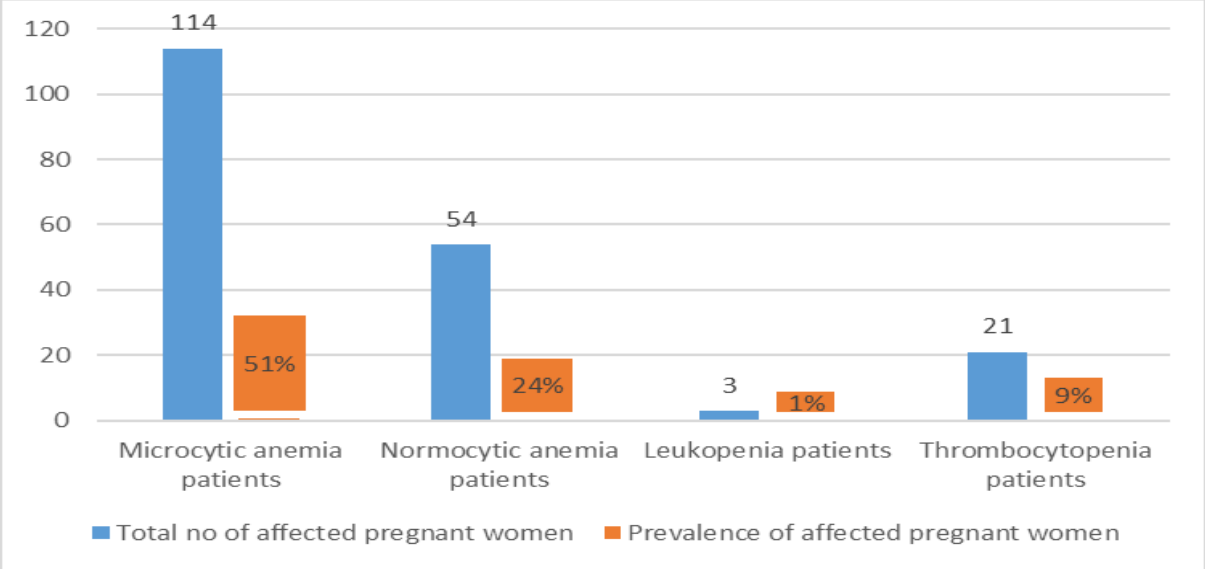


Figure 1.2: Patterns of hematological abnormalities and its prevalence among pregnant women at gynecology hospitals Narowal.

The degree of freedom (df) was 6, p = 0.05 → 12.59 and Chi-square x^2=4.56, Since 4.56 < 12.59, there was no statistically significant association between age group and hematological abnormalities. Microcytic anemia and normocytic anemia had the highest number of affected patients (114 patients with prevalence rate of 51% and 54 patients with prevalence rate of 24%) meanwhile, the prevalence rate of thrombocytopenia (9%) was high as compared to leukopenia. The frequency of leukopenia among all pregnant women was very low near to 0% to 0.9% (Table 1.3. and Figure 1.3.).

Table 1.3: Demographic distribution of hematological abnormalities cases by maternal age group by using Chi-square test.

Hematological abnormalities	Age group	Affected Patients	Total no. of reports	Prevalence	Expected values(x)	Chi-square values(x^2)
Microcytic anemia	18 to 25	46	225	20%	39.78	0.97
	26 to 35	62		28%	66.50	0.30
	36 to 45	6		3%	7.72	0.38
Normocytic anemia	18 to 25	15	225	7%	18.84	0.78
	26 to 35	34		15%	31.50	0.20
	36 to 45	5		2%	3.72	0.45
Leukopenia	18 to 25	1	225	0.4%	1.05	0.00
	26 to 35	2		0.9%	1.75	0.03
	36 to 45	0		0%	0.21	0.21
Thrombocytopenia	18 to 25	5	225	2%	7.33	0.74
	26 to 35	14		6%	12.23	0.27
	36 to 45	2		0.9%	1.42	0.23

The prevalence of hepatitis B and C were 4% and 18.2% respectively. Only 50/225 cases of hepatitis reported and remaining 78% were uninfected (Tab 4.3. and Fig 4.3.).

Table 1.4: Prevalence of hepatitis B and C among pregnant women at gynecology hospitals in District Narowal

Hepatitis	Total no. of infected pregnant women	Total no. of reports	Prevalence of infected Pregnant women
Hepatitis B	9	225	4%
Hepatitis C	41	225	18.20%

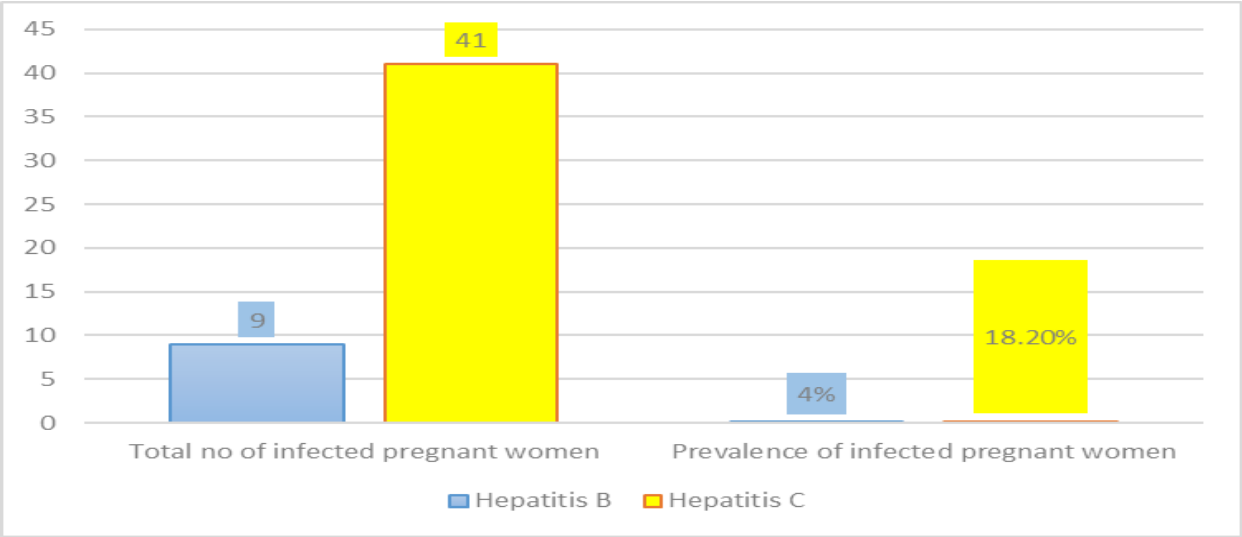


Figure 1.1: Prevalence of hepatitis B and C among pregnant women at gynecology hospitals Narowal

The degree of freedom (df) was 2 and Chi-square was $x^2 = 10.23$ so, critical χ^2 at $p = 0.05$ ($df = 2$) ≈ 5.99 Since $10.23 > 5.99$, there was a significant association between age group and hepatitis infection. These analyses include 225 pregnant women among 50 were infected out of which total infected patient of hepatitis B was 9 and hepatitis C was 41. So, the prevalence rate of hepatitis C was found higher in age group of (26-35 and 36-45 years) among pregnant women. (Table 1.5. and Figure 1.4.).

Table 1.5: Demographic prevalence of hepatitis among pregnant women at gynecology hospitals by using Chi-square test

Hepatitis	Age-group	Infected patients	Total no. of reports	Prevalence	Expected values(x)	Chi-square values(x^2)
Hepatitis B	18 to 25	2	225	0.8%	3.00	0.33
	26 to 35	5		2.2%	3.00	1.33
	36 to 45	2		0.8%	3.00	0.33
Hepatitis C	18 to 25	5	225	2.2%	13.67	5.50
	26 to 35	18		8%	13.67	1.57
	36 to 45	18		8%	13.67	1.57

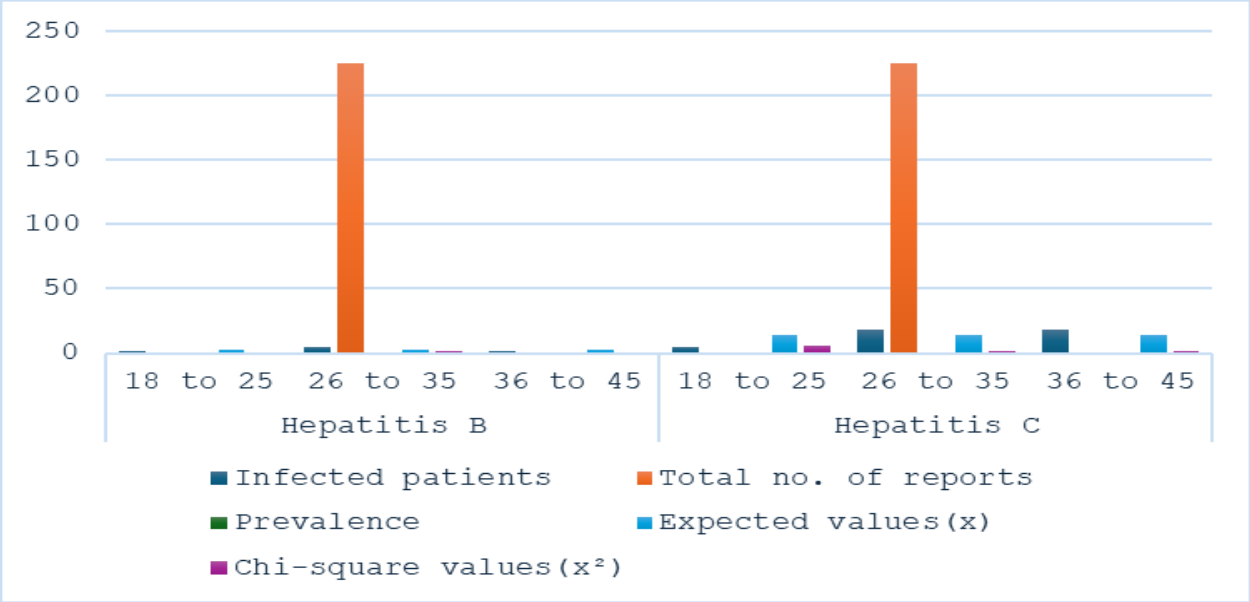


Figure 1.4: Demographic prevalence of hepatitis among pregnant women using Chi-square analysis

DISCUSSION

The present study demonstrated that hematological abnormalities were highly prevalent among pregnant women attending gynecology hospitals in District Narowal. Microcytic anemia was the most frequently observed abnormality (51%), followed by normocytic anemia (24%), thrombocytopenia (9%), and leukopenia (1%). Furthermore, no statistically significant association was observed between maternal age and hematological abnormalities, suggesting that these disorders affected women across all reproductive age groups rather than being confined to a specific age category. These findings highlight the substantial burden of maternal hematological disorders in the study population and emphasize the importance of routine antenatal hematological screening.

Anemia is the most common hematologic problem encountered during pregnancy globally. Hemodilution due to physiological expansion of plasma volume during pregnancy is one cause of anemia; however, iron deficiency is the most significant cause of anemia during pregnancy. Anemia during pregnancy has been associated with an increased incidence of pre-term delivery, low birth weight, post-partum bleeding, maternal fatigue (James, 2021).

The prevalence of microcytic anemia seen in the current research highly indicates iron deficiency as the leading cause. This kind of phenomenon has been noticed worldwide, where iron deficiency is responsible for nearly fifty percent of anemia cases during pregnancy, especially in developing nations where there is lack of nutrition, recurrent pregnancies, and insufficient antenatal care (Means, 2020; Georgieff, 2020).
Anemia prevalence in our research study (75%) was found to be much greater compared to the worldwide estimates from the latest meta-analyses. For instance, Karami et al. (2022) reported a significantly lower pooled prevalence rate of anemia in pregnant women in their systematic literature review that included research conducted in different nations; however, significant variations between regions were noted. Higher prevalence in District Narowal might be associated with social inequality, insufficient diet, late ANC attendance, lack of adherence to iron supplements, and poor nutrition.
In addition, our results are consistent with those obtained by James et al. (2008), which showed that hematological reference ranges are highly variable among different populations as a consequence of ethnic differences, nutrition, environment, and health care. According to their study, international hematological references might underestimate or overestimate the magnitude of hematological alterations associated with pregnancy in particular populations. In line with this, the high frequency of anemia among pregnant women in Narowal implies the need for population-specific epidemiological data to make healthcare policy decisions.
The nonexistence of a correlation between age and hematology parameters in this study implies that anemia is prevalent among women of all age groups during their reproductive years. This finding indicates the existence of the idea that nutritional inadequacy and physiological effects of pregnancy are frequent causes of anemia irrespective of maternal age. This conclusion has been reached recently in clinical reviews where it was found out that iron deficiency anemia is determined by nutritional status, iron stores before conception, parity, and prenatal supplementation rather than age itself (Obianeli et al., 2024; James, 2021).
Thrombocytopenia was found in 9% of the studied population of pregnant women; this corresponds to other literature data that describe thrombocytopenia as the second most common hematological problem occurring in pregnancy after anemia. Majority of cases of pregnancy-related thrombocytopenia are caused by gestational thrombocytopenia, a benign physiological state associated with hemodilution and accelerated platelet destruction. However, thrombocytopenia can be a sign of other pathological processes such as immune thrombocytopenia, hypertension of pregnancy, viral infection, or liver diseases.
The extremely rare occurrence of leukopenia in this study (1%) is expected due to the normal physiological leukocytosis in pregnancy. Leukocyte levels tend to rise during pregnancy because of hormonal influences and increased bone marrow function, which makes leukopenia rare in pregnancy unless it is a result of viral infections, malnutrition, autoimmunity, or bone marrow depression. Therefore, leukopenia tends to be a rare phenomenon in normal pregnancy. (Cines & Levine, 2013).
These findings together reveal that anemia continues to be the leading hematologic disorder seen in pregnant women within District Narowal. With its very high prevalence rate, efforts to enhance the process of antenatal CBC testing and early detection of iron deficiency, along with iron folic acid supplements, should be of prime concern.
As found in the current study, the prevalence rate of infection with hepatitis B virus (HBV) among pregnant women is 4.0%, whereas the prevalence of hepatitis C virus (HCV) infection is relatively high, i.e., 18.2%. In addition, there is a significant statistical association between the age of mothers and the prevalence of hepatitis infection, and HCV infection is found to be higher in mothers who are between 26 and 45 years old.
In the current study, the HBV infection rate is found to belong to the category of moderate endemicity according to the classification set by the WHO but is relatively lower than the global pooled prevalence rate. A recently conducted systematic review and meta-analysis involving various countries concluded that the global pooled prevalence rate of HBV infections among pregnant women is about 4.8% while the rate is relatively higher in poor and developing nations. These findings suggest that the HBV burden observed in District Narowal is comparable to many resource-limited settings and supports the continued implementation of universal antenatal HBV screening and neonatal immunoprophylaxis.

Although the prevalence of HBV in our study was moderate, its clinical importance should not be underestimated because chronic maternal infection is one of the principal sources of mother-to-child transmission worldwide. Recent evidence demonstrates that vertical transmission remains a major contributor to chronic HBV infection, particularly where maternal antiviral therapy, birth-dose vaccination, and hepatitis B immunoglobulin are not consistently implemented. Universal antenatal screening combined with timely neonatal vaccination has been shown to dramatically reduce perinatal transmission and should therefore remain a priority in Pakistan.

In contrast, the prevalence of HCV infection in the present study (18.2%) was considerably higher than recent global estimates. Abbasi et al. (2023), in the first worldwide systematic review and meta-analysis of HCV infection among pregnant women, estimated a pooled global seroprevalence of approximately 1–3%, with considerable geographical variation. Similarly, another relatively recent global meta-analysis study that involved more than 311 million pregnant women found an overall pooled prevalence rate of about 2.6%, but much higher rates were found among the groups that had greater exposure to the risk factors. When compared to these global prevalence rates, the prevalence rate in District Narowal is extremely high.

The extremely high prevalence of HCV in the present study is in line with prior epidemiologic findings which show that Pakistan is among those countries with the highest burden of HCV in the world. According to Al Kanaani et al., (2018), there is a pooled prevalence of HCV at about 6.2% in the overall Pakistani population, and unsafe healthcare practices such as reuse of syringes and injections and poor infection control practices were identified as the main sources of transmission. The significantly high prevalence among pregnant women in Narowal District could thus be attributed to the continued exposure to these health risk factors among others.

HCV infection in mothers carries significant weight other than causing chronic liver disease because such mothers continue to be vectors for vertical transmission of the virus. According to Benova et al. (2014) in their systematic review and meta-analysis, the risk of mother-to-child transmission was estimated at approximately 5.8% among HCV RNA-positive mothers; however, the risk rises significantly in case of mothers who have co-infection with HIV. Even though the possibility of vertical transmission was not assessed in the current study, due to the high prevalence of HCV in mothers, many children could still be at risk.

The important relationship between the age of mothers and hepatitis infection noted in the present study is biologically plausible since the total exposure to risky factors such as contamination during medical procedures, blood transfusion, dental treatment, and others is expected to be larger in case of increased age. The age-dependent pattern has also been found in the course of international epidemiologic studies, where women in the reproductive age group were always found to be more infected with HCV as compared to young women.

In general, the results of the current study highlight the fact that viral hepatitis still remains a serious problem among mothers in the District of Narowal, especially with regards to HCV infections. Expanding the practice of regular antenatal testing for HBV and HCV, infection prevention techniques, increasing awareness levels, timely HBV vaccination of infants, and making sure that antivirals are accessible to patients remain crucial steps towards minimizing morbidity rates in Pakistan.

There are clinical and public health considerations associated with the results of this study. The presence of both a high incidence of hepatitis C virus infection and hematological disorders among pregnant women suggests that there is a considerable problem of preventable health conditions among the expectant mothers in District Narowal. As pregnancy ensures multiple chances to visit a healthcare facility, antenatal care can be used as an essential tool for the detection of viral hepatitis, anemia, and other hematological disorders. Early diagnosis combined with proper treatment can help to prevent the occurrence of complications and enhance the outcome of pregnancy. Recent studies have noted that the inclusion of hepatitis screening in the antenatal care program can be considered as one of the most efficient ways to improve the health of mothers and newborns in endemic areas (Kamani & Abdul Razzak, 2024).

It should be noted that the unusually high frequency of HCV detected in the present study is especially important in the context of the situation in Pakistan. The country has the biggest share of hepatitis C

cases among all countries in the world. Even though there is very potent antiviral therapy available, it is still impossible for Pakistan to reach the goals set by WHO, owing to late diagnosis, lack of sufficient screening, and continued health care related infection. According to Mooneyhan et al. (2023), Pakistan has to considerably improve its screening rates to eliminate HCV.

Therapeutic injections that are unsafe, substandard sterilization procedures of the tools and implements used in the provision of medical and dental care, unscreened blood transfusions, and lack of proper infection control continue to be some of the key factors behind the spread of hepatitis infections in Pakistan. This is more apparent in rural and semi-urban settings, where there is not enough health-care infrastructure in place. Infection prevention, ensuring the safety of blood transfusion, encouraging the usage of single-use syringes, and conducting awareness campaigns within communities need to continue to be public health priorities in Pakistan (Mooneyhan et al., 2023).

The high frequency of anemia seen in this study serves to emphasize the need to improve the maternal nutrition programs during pregnancy. Iron deficiency is the commonest cause of anemia in pregnancy, and it plays an important role in causing maternal morbidity, postpartum hemorrhage, preterm delivery, fetal growth retardation, and low birth weight. Therefore, complete blood count evaluation, iron-folic acid supplements, nutrition advice, and continuous antenatal care should be an integral part of maternal care. Screening for viral hepatitis and hematology disorders during the antenatal period may constitute a viable strategy for achieving this objective (Kamani & Abdul Razzak, 2024).

Among the key strengths of this current research is that it not only assessed viral hepatitis but also hematological disorders in the pregnant woman population across various gynecology hospitals in District Narowal. This makes it possible to establish a baseline level of epidemiological data in an area where information is quite scarce in scientific literature. Moreover, performing laboratory tests for complete blood count along with serological studies of HBV and HCV increased the accuracy of disease diagnosis.

Nonetheless, some weaknesses in the study cannot be overlooked. Firstly, the retrospective cross-sectional study design hampers the determination of causality between hepatitis infection and hematological disorders. Secondly, certain clinical parameters, such as gestational age, gravida, nutritional factors, socio-economic features, hepatitis immunization history, anti-viral treatment history, and risky behavior, were not available. Thirdly, there is no molecular diagnosis through detection of HBV DNA and HCV RNA; hence, the assessment of active replication and infectiousness of viruses was not possible. Lastly, due to the limited scope of the research to specific hospitals in one particular district, generalizability of results to other parts of Pakistan is doubtful. Future multi-center prospective studies with molecular diagnosis, follow-ups of mother and baby, and risk factor assessment are recommended.

In summary, the current study reveals that HCV infection and hematological disorders are still significant health problems facing pregnant women in District Narowal. The results of this study emphasize the need for the universal screening of HBV, HCV, and hematological disorders, along with improved nutrition, infection control measures, and provision of antiviral therapy. These maternal health care measures will be helpful in decreasing maternal morbidities, preventing vertical transmission, and helping in Pakistan's effort to eliminate viral hepatitis from the country as a public health problem by 2030 (Kamani & Abdul Razzak, 2024; Mooneyhan et al., 2023).

Conclusion

From this current study, a high incidence of viral hepatitis and hematological problems have been shown in pregnancy at the gynecology hospitals of Narowal District. It is important to note that the prevalence rate of HCV infection was significantly higher than that of HBV infection, whereas microcytic anemia was the most frequently encountered hematological disorder. An association between age and infection with hepatitis virus was significantly noted in this study; however, hematological disorders were not significantly associated with maternal age. Therefore, it is necessary that maternal antenatal screening is routinely performed for HBV, HCV, and hematological problems in order to improve health care management for mothers and babies.

Recommendations

In light of the results of this study, the screening for hepatitis B, hepatitis C, and complete blood count must be included as a part of the prenatal health care program for all pregnant women, especially those from rural and underserved communities. The iron and folic acid supplementation, along with proper nutritional counseling and continuous monitoring of hematological parameters, must be intensified to decrease the burden of pregnancy-induced anemia. The public health sector needs to focus on educating people about the mode of transmission of the disease, along with promoting safe injections and blood transfusions, and improving infection control within the healthcare facility. Apart from that, the universal vaccination for hepatitis B, along with timely administration of the vaccine to the infants born to hepatitis B positive mothers, must be practiced strictly in line with WHO guidelines to reduce the chances of mother-to-child transmission.

REFERENCES

Abbasi, F., Almukhtar, M., Fazlollahpour-Naghibi, A., Alizadeh, F., Behzad Moghadam, K., Jafari Tadi, M., & Rostami, A. (2023). Hepatitis C infection seroprevalence in pregnant women worldwide: A systematic review and meta-analysis. *EClinicalMedicine, 66*, 102327. https://doi.org/10.1016/j.eclinm.2023.102327

Al Kanaani, Z., Mahmud, S., Kouyoumjian, S. P., & Abu-Raddad, L. J. (2018). The epidemiology of hepatitis C virus in Pakistan: Systematic review and meta-analyses. *Royal Society Open Science, 5*(4), 180257. https://doi.org/10.1098/rsos.180257

Benova, L., Mohamoud, Y. A., Calvert, C., & Abu-Raddad, L. J. (2014). Vertical transmission of hepatitis C virus: Systematic review and meta-analysis. *Clinical Infectious Diseases, 59*(6), 765–773. https://doi.org/10.1093/cid/ciu447

Bibi, S., Beg, S. S., Younas, N., Hussain, M., Ain, Q. U., & Gul, J. (2026). Seroprevalence of Hbv, Hcv, and Hiv In Patients With Dialysis. *Pakistan Journal of Medical & Cardiological Review*, *5*(1), 2435-2447. https://doi.org/10.66021/pakmcr772

Cines, D. B., & Levine, L. D. (2013). Hematologic complications of pregnancy. *Seminars in Hematology, 50*(3), 222–231. https://doi.org/10.1053/j.seminhematol.2013.06.004

Dunkelberg, J. C., Berkley, E. M. F., Thiel, K. W., & Leslie, K. K. (2014). Hepatitis B and C in pregnancy: A review and recommendations for care. *Journal of Perinatology, 34*(12), 882–891. https://doi.org/10.1038/jp.2014.167

Georgieff, M. K. (2020). Iron deficiency in pregnancy. *American Journal of Obstetrics and Gynecology, 223*(4), 516–524. https://doi.org/10.1016/j.ajog.2020.03.006

Gupta, B. P., Sah, A. K., Sah, A. K., Gupta, V. P., Ghimire, D. P., Acharya, N., & Wagle, C. (2025). Seroprevalence of hepatitis E in general, hepatic, and pregnant populations in Nepal, Bangladesh, and Pakistan: a systematic review and meta-analysis. *Virology Journal*, *23*(1), 6. https://doi.org/10.1186/s12985-025-03027-8

Haider, B. A., Olofin, I., Wang, M., Spiegelman, D., Ezzati, M., & Fawzi, W. W. (2013). Anaemia, prenatal iron use, and risk of adverse pregnancy outcomes: Systematic review and meta-analysis. *BMJ, 346*, f3443. https://doi.org/10.1136/bmj.f3443

Huang, R., Lu, Z., Li, X., Zhou, D., Xu, J., Lin, D., & Yu, X. (2025). Positive association between chronic hepatitis B virus infection and anemia in pregnancy in Southern China. *Scientific Reports, 15*, 1980. https://doi.org/10.1038/s41598-024-84927-7

James, A. H. (2021). Iron deficiency anemia in pregnancy. *Obstetrics & Gynecology, 138*(4), 663–674. https://doi.org/10.1097/AOG.0000000000004559

James, T. R., Reid, H. L., & Mullings, A. M. (2008). Are published standards for haematological indices in pregnancy applicable across populations? An evaluation in healthy pregnant Jamaican women. *BMC Pregnancy and Childbirth, 8*, 8. https://doi.org/10.1186/1471-2393-8-8

Kamani, L., & Abdul Razzak, A. (2024). Hepatitis-C during pregnancy: Antenatal period challenges, management and the way forward. *Pakistan Journal of Medical Sciences, 40*(1), 227–232. https://doi.org/10.12669/pjms.40.1.7578

Karami, M., Chaleshgar, M., Salari, N., Akbari, H., & Mohammadi, M. (2022). Global prevalence of anemia in pregnant women: A comprehensive systematic review and meta-analysis. *Maternal and Child Health Journal, 26*(7), 1473–1487. https://doi.org/10.1007/s10995-022-03450-1

Lemoine, M., Nayagam, S., & Thursz, M. (2013). Viral hepatitis in resource-limited countries and access to antiviral therapies: current and future challenges. *Future virology*, *8*(4), 371-380. https://doi.org/10.2217/fvl.13.11

Means, R. T. (2020). Iron deficiency and iron deficiency anemia: Implications and impact in pregnancy, fetal development, and early childhood parameters. *Nutrients, 12*(2), 447. https://doi.org/10.3390/nu12020447

Mooneyhan, E., Qureshi, H., Mahmood, H., Tariq, M., Maqbool, N. A., Anwar, M., & Razavi, H. (2023). Hepatitis C prevalence and elimination planning in Pakistan, a bottom-up approach accounting for provincial variation. *Journal of Viral Hepatitis, 30*(4), 345–354. https://doi.org/10.1111/jvh.13802

Nawaz, R., Nawaz, A., Arif, M. A., Rehman, Z., Shah, R., Shafi, F., & Idrees, M. (2026). Characterization of the Hepatitis C virus in Pakistan: comprehensive molecular and epidemiological insights. *BMC Infectious Diseases*. https://doi.org/10.1186/s12879-026-14248-9

Obianeli, C., Afifi, K., Stanworth, S., & Churchill, D. (2024). Iron deficiency anaemia in pregnancy: A narrative review from a clinical perspective. *Diagnostics, 14*(20), 2306. https://doi.org/10.3390/diagnostics14202306

Opaets, M., & Pecheriaha, S. (2026). Hematological And Coagulation Changes in Physiological Pregnancy. *STREDOEVROPSKY Vestnik Pro Vedu a VYZKUM*, *2*(4). https://doi.org/10.65237/2336-3630-2026-4(2)-8

Riches, N., Henrion, M. Y. R., MacPherson, P., Hahn, C., Kachala, R., Mitchell, T., & Stockdale, A. J. (2025). Vertical transmission of hepatitis B virus in the WHO African region: A systematic review and meta-analysis. *The Lancet Global Health, 13*(3), e447–e458. https://doi.org/10.1016/S2214-109X(24)00506-0

Santos, A. A. D., Lemos, A. D. O., Rosolen, B. B., Papini, B. D., Nakagava, C. N., Trentin, H. P., & Araujo Júnior, E. (2026). Viral hepatitis in pregnancy: integrating clinical management, perinatal outcomes, and long-term health impact. *The Journal of Maternal-Fetal & Neonatal Medicine*, *39*(1), 2692858. https://doi.org/10.1080/14767058.2026.2692858

Shiha, G., Soliman, R., Mikhail, N. N., & Easterbrook, P., et al. (2024). Global epidemiology, natural history, maternal-to-child transmission, and treatment with direct-acting antivirals of pregnant women with hepatitis C virus infection: A systematic review and meta-analysis. *eClinicalMedicine*. https://doi.org/10.1016/j.eclinm.2024.102747

Stanaway, J. D., Flaxman, A. D., Naghavi, M., Fitzmaurice, C., Vos, T., Abubakar, I., & Cooke, G. S. (2016). The global burden of viral hepatitis from 1990 to 2013: findings from the Global Burden of Disease Study 2013. *The Lancet*, *388*(10049), 1081-1088. https://doi.org/0.1016/S0140-6736(16)30579-7

World Health Organization. (2020). Hepatitis: Preventing mother-to-child transmission of the hepatitis B virus. Geneva, Switzerland: World Health Organization.

World Health Organization. (2020). Prevention of mother-to-child transmission of hepatitis B virus: Guidelines on antiviral prophylaxis in pregnancy. *Geneva, Switzerland*: Author. https://apps.who.int/iris/handle/10665/333391

World Health Organization. (2024). *Hepatitis*. Geneva, Switzerland: World Health Organization. Retrieved from WHO website.

Wu, S., & Wang, J., et al. (2023). Prevalence of human immunodeficiency virus, syphilis, and hepatitis B and C virus infections in pregnant women: A systematic review and meta-analysis. *Clinical Microbiology and Infection*. https://doi.org/10.1016/j.cmi.2023.05.019