Effects of dengue and malaria on CBC parameters and liver profile

* Asfa Ilyas, **Umair Waqas, **Mahnoor Fatima, **Waqar Mehmood, *Zouha Zafar, *

* University Institute of Medical Lab Technology, University of Lahore, Punjab, Pakistan
** Department of Allied Health Sciences, University of Chenab, Gujrat, Punjab, Pakistan.

ABSTRACT

BACKGROUND: The study's goal is to determine how dengue and malaria infection affect CBC parameters and the liver profile. Malaria and dengue cases are rising yearly in the tropical and subtropical regions. If left untreated, it will only get worse and may even result in human death. Therefore, it is necessary to periodically examine how mosquito-borne illnesses like dengue and malaria affect CBC values, raise liver enzyme levels, and result in organ dysfunction in humans.

Methodology: Data was gathered in accordance with the guidelines established by the university of Lahore's ethics committee. The inclusion and exclusion criteria were used to choose the participants for this data. Without regard to age restrictions or gender discrimination, 140 samples were taken from individuals who had tested positive for dengue and malaria and whose CBC and liver profiles were abnormal. Blood was drawn into the appropriate vial tube, subjected to the appropriate testing, such as CBC on the Mindray BC600 and LFT on spectrometry, and the results were obtained.

Results: CBC and LFT were performed to check the effects of mosquito bite infection like malaria and dengue total 140 sample size were tested. when a patient contracts either malaria or dengue, malaria has a greater impact on HB levels than dengue. with dengue had lower TLC and PLT levels than those with malaria, which is mild. According to the severity of the infection, RBC damage, and the level of RBC in both infections is not significantly impacted. In contrast to dengue, malaria has a lower HCT%. Additionally, the patients' MCV, MCH, and MCHC levels reveal anemia and thalassemia. hepatic dysfunction in both infection malaria and dengue are associated with elevated levels of ALT, AST, and bilirubin.

Conclusion(s): We came to the conclusion that both dengue and malaria can result in serious haematological and hepatic alterations, with a high frequency of lymphopenia, anaemia, and thrombocytopenia in cases of malaria infection, and leukaemias in cases of dengue infection. Both infections can induce an increase of liver enzymes. When the aforementioned signs are present, the diagnosis of malaria and dengue should always be taken into consideration because the blood and liver profile changes are so distinctive.

Keywords: Dengue, Malaria, Hepatic dysfunction, HCT, TLC, PLT, HB, RBC

INTRODUCTION

An important animal vector that can transmit a number of diseases to humans is the mosquito[1]. One of the major causes of febrile sickness in the tropical and subtropical region is dengue, sometimes known as "break bone fever," which has increasingly gained notoriety. Dengue is a typical mosquito-transmitted illness that is currently the leading global cause of arboviral disease, second only to malaria. Around 2.5 billion people in 100 endemic countries are thought to be susceptible, and a sizable number of tourists visit these tropical and subtropical regions as well[2].

DENVs are spread by the Aedes aegypti mosquito and less frequently by the Aedes albopictus mosquito. and frequently bites multiple times prior to oogenesis[3]. If the mosquito feeds within the 5-day window of human viremia, it contracts the disease and the DENV moves from the insect's midgut to the salivary glands. When temperatures are ideal, the DENV life cycle takes 8–12 days to complete inside the mosquito, at which point the mosquito becomes infectious and can bite another host to spread the virus[2]. Clinically, dengue fever is defined as an acute febrile sickness with two or more symptoms, which may include headache, pain behind the eyes, myalgia, arthralgia, rash, hemorrhagic characteristics, or leucopenia[4].

Dengue's pathogenesis has been linked to a number of viral and host factors, including the non-structural protein 1 (NS1) viral antigen, DENV genome variation, sub genomic RNA, antibody-dependent enhancement (ADE), memory cross-reactive T cells, anti-DENV NS1 antibodies, and autoimmune. The combination of all the aforementioned elements has been attributed as the primary cause of the severe dengue symptoms in people[5]. Dendritic cells that have been infected mature and go to nearby or regional lymph nodes, where they offer viral antigens to T cells and start the cellular and humoral immune responses. Additionally, there is proof that peripheral blood monocytes, macrophages in lymph nodes, the liver, the spleen, and the parenchyma of the liver are all capable of reproducing DENVs in large quantities[6]. As a result, the infection spreads faster and the lymphatic system becomes more active. Several mononuclear cells, including blood-derived monocytes, were affected by this primary viremia[7]. macrophages in the liver and spleen[8].

The positive ssRNA genome of DENV is translated into a polyprotein of 3400 amino acids after being liberated from the capsid and entering the host cell. Viral and host proteases cleave the polyprotein into 10 different types of protein after that. Seven nonstructural (NS) proteins (NS1, NS2A, NS2B, NS3, NS4A, NS4B, and NS5) and three structural proteins (C, E, and pre-membrane (prM)) make up this group of proteins[9]. The structural proteins play a crucial role in virion maturation, release, and infectiousness. The principal roles of the NS proteins, in contrast, are viral reproduction and escape from host cell immune response. Each of the four serotypes of DENV (DEN 1-4) shares 60% to 70% amino acid sequence identity[10].

The liver is one of the common organs involved in dengue infection. Hepatic complications were found in 60%-90% of infected patients included hepatomegaly, jaundice, elevated aspartate aminotransferase (AST), elevated alanine aminotransferase (ALT), and acute liver failure (ALF). All four serotypes have been associated with dengue-related liver injury, but DENV-1 and DENV-3 have more significant injuries[11]. The AST released from damaged myocytes could explain the higher levels of AST than those of ALT in patients with dengue fever at an earlier stage[12].

Involvement of the liver leading to hepatic dysfunction is a well-recognized complication of dengue[13]. Although dengue associated acute liver failure is thought to occur due to liver injury as a result of prolonged shock, it is also known to occur in the absence of shock [14].

In terms of blood investigations, leucopenia is observed usually in the course of dengue fever. Thrombocytopenia is considered a predictor of dengue hemorrhagic fever (DHF). Hemoconcentration is also a common finding due to the concentration of plasma fluid leakage, causing an increase in the hemoglobin weight in a unit volume of blood[15].

The critical phase is characterized by plasma leakage with or without bleeding, which starts abruptly after defervescence. During this phase, an increase in capillary permeability with the rising of hematocrit can occur[16]. The accumulation of fluids in the abdominal cavities and thoracic could be detected, leading to hypovolemic shock resulting in multiple organ dysfunctions, metabolic acidosis, disseminated intravascular coagulation (DIC), and severe bleeding[17].

The second most significant public health issue is malaria caused by P. vivax. Due to the hypnozoites' reactivation in the liver cells, it is characterized by the recurrence of malaria relapses. Even though it is a very rare complication of P. vivax infection, rupture of an enlarged spleen does occasionally happen and can be fatal[18] The pathogen is one of five Plasmodium species(Plasmodium vivax, Plasmodium ovale wallickeri, Plasmodium ovale curtisi, and Plasmodium knowlesi), that can cause disease in humans.[19].

The sickness brought on by infection with these parasites is known as malaria, and those who have asymptomatic parasitemia are said to have asexual-stage parasites in their blood. Humans contract Plasmodium species through the bite of female Anopheles mosquitoes. During the incubation stage of infection, the parasite's motile forms (sporozoites) quickly travel from the skin to blood vessels to hepatocytes where they engage in extensive intracellular asexual replication. The brood of parasites emerges from the hepatocyte after one or more weeks and returns to the bloodstream, where they quickly invade red blood cells (RBCs) and undergo repeated asexual reproduction cycles, with new parasites emerging every 24 to 72 hours, depending on the parasite species[20].

At the start of the asexual blood stage, merozoites infiltrate erythrocytes and go through a trophic phase[21]. Schizonts are created as a result of numerous rounds of nuclear division without cytokinesis. Merozoites are released from the ruptured schizonts in the blood stream, and an additional round of the blood stage replicative cycle is started by the invasion of erythrocytes. At this stage, some of the merozoites can re-infect the mosquito host during a subsequent blood meal by differentiating and maturing into male and female gametocytes[22]. Malaria infections become severe when crucial organ malfunctions or abnormal metabolism aggravate them[23]. Erythrocytes infected with P. falciparum that are sequestered in essential organs during infection might cause inflammation and even organ damage. These occurrences are associated with the rapid release of miRNAs into the host fluids, which can be found as promising biomarkers for the prognosis of SM[24].

Changes in blood cell counts are a well-known feature of malarial infections. These changes involve major cell lines including red blood cells (RBC), leukocytes and thrombocytes. Hematological changes in the course of a malaria infection, such as anemia, thrombocytopenia and leukocytosis or leucopoenia are well recognized. These alterations vary with the level of malarial endemicity, background hemoglobinopathy, nutritional status, demographic factors, and also malaria immunity[25].

The sporozoites type of the malarial parasite can infect liver cells, resulting in organ congestion, sinusoidal obstruction, and cellular inflammation. The parenchymal (transaminases) and membranous (alkaline phosphatase) liver enzymes can leak out into the circulatory system as a consequence of these alterations in the hepatocytes. Since the serum activity of these liver enzymes increased along with the increase in malarial parasite density, the increase in liver enzymes AST, ALT, and ALP seen in malaria-infected individuals also supported this theory. This modification might be due to the fact that the hepatic stage of the parasite's development in the human host is accompanied by a sizable disruption in the parenchyma and membrane of the hepatocyte, leading the leakage of liver enzymes into the circulatory system[26].

The purpose of this study is to evaluate the liver profile and complete blood count parameters in both malaria and dengue patients. This research will contribute to our understanding of how dengue and malaria infection influence human blood cells, liver enzymes, and the immune system. and which infections among individuals can lead to significant problems.

Material and methods:

Study design, duration and setting

A cross-sectional study was conducted**.** The duration of the trial was about 4 to 6 months. A total of 140 samples from dengue and malaria patients with disturbed CBC and liver parameters were collected

Inclusion:

1. All age group and gender (Male and female) patients with positive dengue and malarial infection were included in this study.
2. Positive dengue and malaria patients with disturb CBC and liver parameter were included.

Exclusion:

- Any other chronic disease was excluded in this study

Ethical approval and Consent

Ethical approval was taken from Institutional Review Board (IRB) of University of Lahore, Punjab, Pakistan. An informed was taken from the participants before collecting data. Ensured that data would be used for only research purpose. The research project was approved by research and ethics committee of University of Lahore

Data collection procedure and tools

The request form was design as a data collection tool in order to collect the information from the Laboratory. The form will be comprised of data of chemistry and hematology section of the Lab.

Samples collection and processing:

Venipuncturing was used to collect venous blood samples. For the CBC and liver profiles, samples were taken in plain and EDTA vacutainers, respectively. Before testing, blood was mixed on a roller mixer for the complete blood count (CBC), and blood for the liver profile was centrifuged for two minutes at 3000 rpm

ANALYSIS

CBC and Liver profile analysis

CBC was performed on Mindray BC-6000. Which is 6-part differential machine its 5 parts for white blood cells (WBC) and 6^{th} part for nucleated RBCs. Its principle based on electrical impedance, colorimeter and flow cytometry.

Electrical impedance

The aspirated sample enters the RBCs meter unit the little opening on the meter unit is called Aperture. A pair of electrodes is positioned on both side of the aperture to create a consent current supply. As cells are poor conductor when each sample in the diluted sample passes through the aperture a transitory change in the direct current resistance between the electrodes is produced. The change in the electrical pulses which is measurable in proportional to the practical size the number of pulses generates indicated the number of the particle pass through the aperture and amplitude of each pulse is proportional to the volume of each particle. Each pulse is amplified and compared to the internal reference voltage channel which only accept the pulse of the certain amplitude only include cerebrospinal fluid and serous cavity fluid (pleural fluid and acetic fluid). The cells size distribution width is represented by the number of particles for each channel. The two-dimensional distribution diagram (scattered gram) with the x axis representing cell volume and y axis representing relative cell number show the distribution of cell population.

Colorimeter

According to the Lambert bear principle when a beam of monochromatic light passes through a well-proportioned non scattering light absorbing solution the absorbance A is proportional to the product of the thickens L concentration C. the sample in the HB channel act as the light absorbing substance after being treated by reagent therefore the HB concentration can be measured by measuring the absorbance.

Flow cytometry

Flow cytometry is the passage of cells in single file in front of a laser so they can be detected, counted and sorted. Cell components are fluorescently labeled and then excited by the laser to emit light at varying wavelengths. The fluorescence can then be measured to determine the amount and type of cells present in a sample.

Chemistry analyzer

Liver profile was performed on chemistry analyzer. The chemistry analyzer machine is based on the selective absorption of light by a substance, i.e., spectrophotometry. The principle of chemistry analyzer is still based on Beer's law that is the absorptive capacity of a dissolved substance is directly proportional to its concentration in a solution.

Statistical analysis:

The Statistical Package for Social Sciences (SPSS) 20.0 was used to examine the data (SPSSA Inc. Chicago, USA). The categorical value was expressed in the form of frequency and percentages. The data was shown using pie charts and bar charts. To examine the data, appropriate statistical methods were used.

Results:

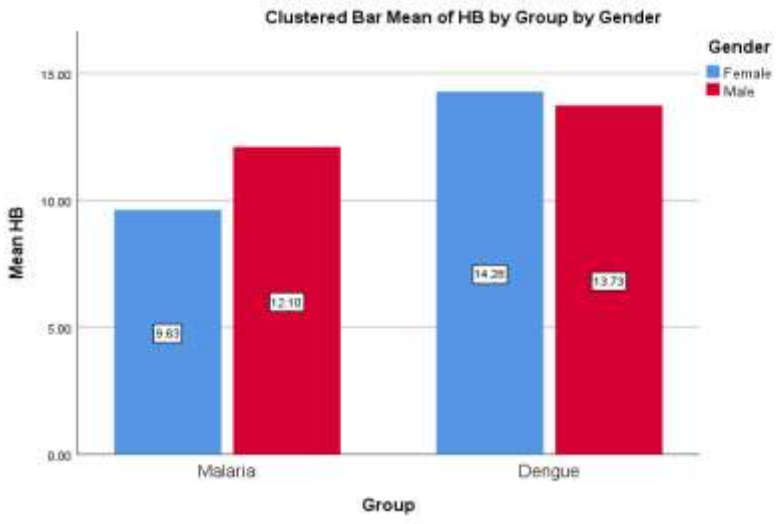
The blood sample of dengue and malaria positive patients was collected and used for further analysis in the lab. all CBC and LFT parameter sensitivities fluctuate according to the days of infection.

After applying statistical tools on my data. Results are shown and explained here with the help of graphs and tables.

Table and Graph-1:

Parameter of CBC	Patients	Gender	Mean	Standard value
HB	Dengue	Male	13.73	13.8 to 17.2(g/dL) in male
		Female	14.28	
	Malaria	Male	12.10	12.1 to 15.1(g/dL) in female
		Female	9.63	

Table-1: Demonstrates the HB result of dengue and malaria patient



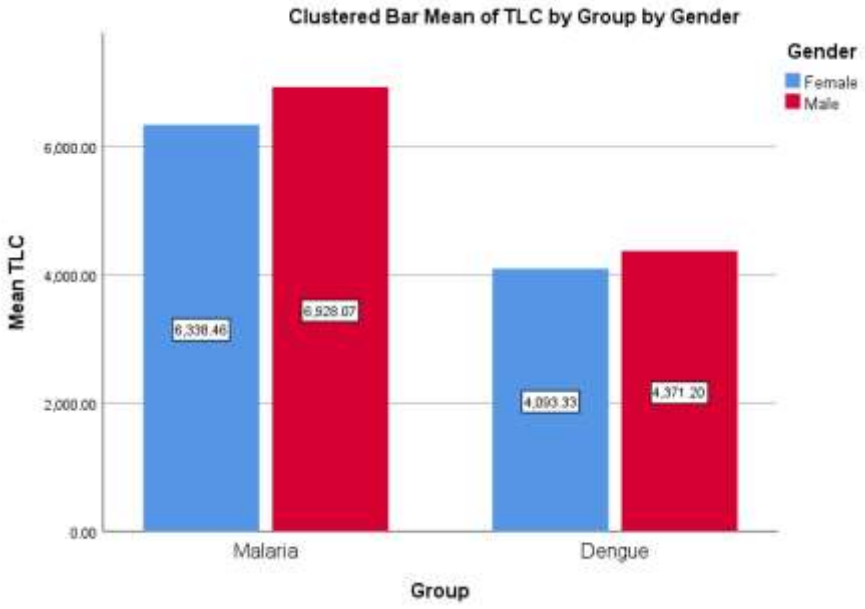
The average HB level in malaria patients is 9.6 grammes per deciliter (g/dL) in females and 12.1 grammes per deciliter (g/dL) in males. However, the average HB level in dengue patients is 13.7 (g/dL) in men and 14.2 (g/dL)

in women.The amount of normal HB in a person's body varies depending on gender. The typical HB level for men ranges from 13.8 to 17.2 (g/dL) and from 12.1 to 15.1 (g/dL) for women. So, when a patient contracts either malaria or dengue, my research shows that malaria has a greater impact on HB levels than dengue.

Table and Graph-2

Parameter of CBC	Patients	Gender	Mean	Standard value
TLC	Dengue	Male	4371.20	Between 4,000 to 11,000µl
		Female	4093.33	
	Malaria	Male	6928.07	
		Female	6338.46	

Table-2: Demonstrates the TLC result of dengue and malaria patients



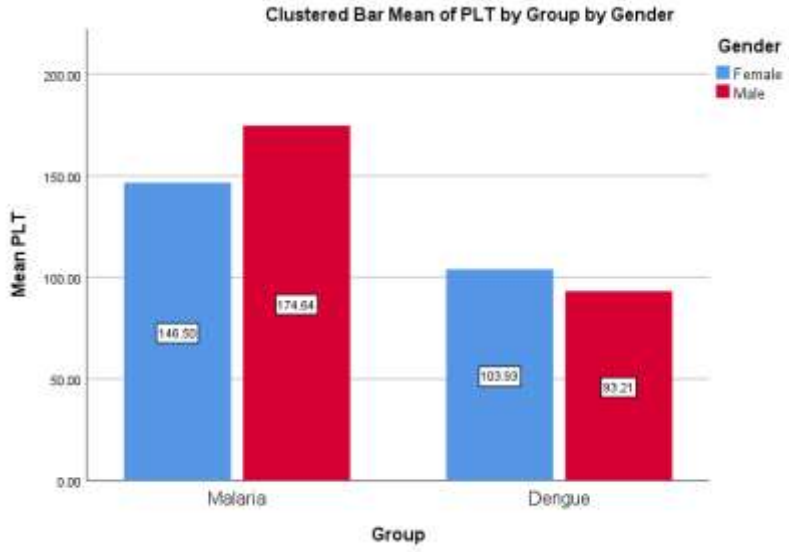
Male malaria patients often have 6338.46µl, whereas female patients typically have 6928.07µl. The average TLC level in dengue patients is, however, 4093.33µl for women and 4371.20µl for men.

The amount of typical TLC that both men and women's bodies require is the same. approximately 4,000 to 11,000µl. Thus, my research's main finding is that patients with dengue had lower TLC levels than those with malaria, which is mild.

Table and graph-3

Parameter of CBC	Patients	Gender	Mean	Standard value
PLT	Dengue	Male	93.21	135,000 and 317,000 (mcL)in male
		Female	103.93	
	Malaria	Male	174.64	157,000 and 371,000(mcL) in female
		Female	146.50	

Table-3: Demonstrates the PLT result of dengue and malaria patient

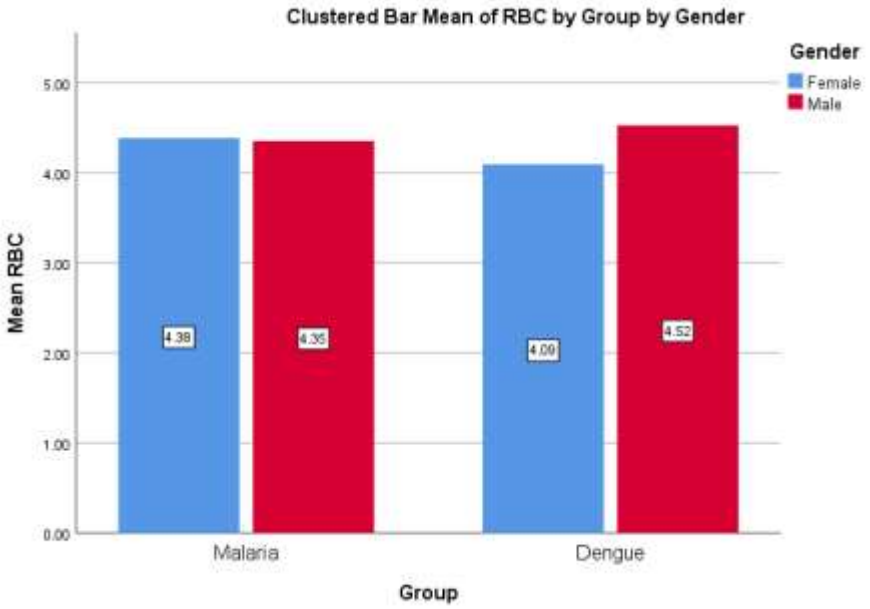


Our blood contains platelets, also known as thrombocytes, which are tiny, colorless cell fragments that help to stop or slow bleeding. The presence of certain malignancies or infections may be indicated by a low platelet count. You run the risk of developing deadly blood clots or having a stroke if your platelet count is high levels in patients with malaria are typically 174.64(mcL) in men and 146.50(mcL) in women. The average PLT level in dengue patients is, however, 103.93 (mcL) in women and 93.21 (mcL) in males. Depending on a person's gender, different amounts of normal PLT exist in their body. PLT levels are typically between 135,000 and 317,000 (mcL) for men and between 157,000 and 371,000 (mcL) for women. My research therefore comes to the conclusion that PLT levels are decreasing in dengue patients and rising in malaria patients.

Table and graph-4

Parameter of CBC	Patients	Gender	Mean	Standard value
RBC	Dengue	Male	4.52	4.0 to 5.9 x 10*12/L in male
		Female	4.09	
	Malaria	Male	4.35	3.8 to 5.2 x 10*12/L in female
		Female	4.38	

Table-4: Demonstrates the RBC result of dengue and malaria patient

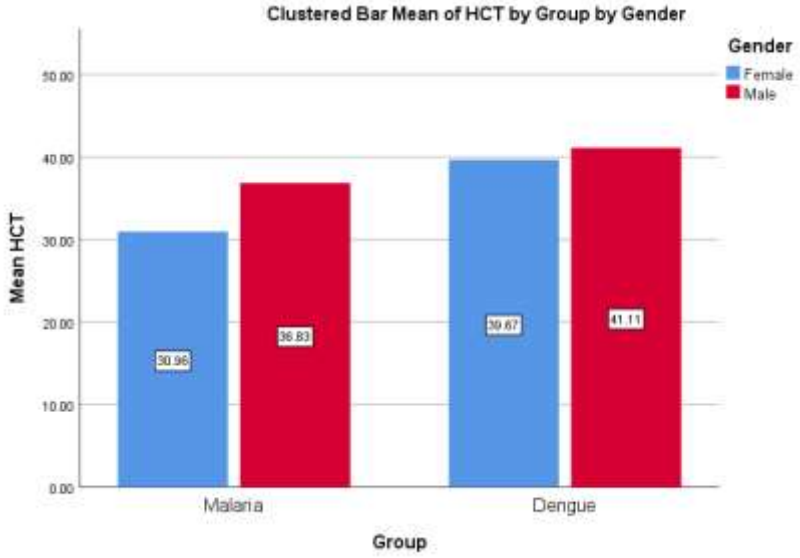


Red blood cells become infected from an infectious mosquito bite. Red blood cells burst after that infection cycle is over. In malaria patients, the average RBC level is 4.38 x 10*12/L for females and 4.35 x 10*12/L for males. But in dengue patients, the average RBC level is 4.52 x 10*12/L for men and 4.09 x 10*12/L for women. Depending on a person's gender, their body contains a different amount of normal RBC. Male RBC levels typically vary from 4.0 to 5.9 x 10*12/L, while female RBC levels typically range from 3.8 to 5.2 x 10*12/L. According to the severity of the infection, RBC damage, my research has found that the level of RBC in both infections is not significantly impacted

Table and graph-5

Parameter of CBC	Patients	Gender	Mean	Standard value
HCT	Dengue	Male	41.11	41% to 50% in male
		Female	39.67	
	Malaria	Male	36.83	36% to 48% in female
		Female	30.96	

Table-5: Demonstrates the HCT result of dengue and malaria patient



The proportion of red blood cells in your blood is known as the hematocrit. Male and female malaria patients have an average HCT level of 36.83% and 30.96%, respectively. The average HCT level in dengue patients is 39.67% for women and 41.11% for males.

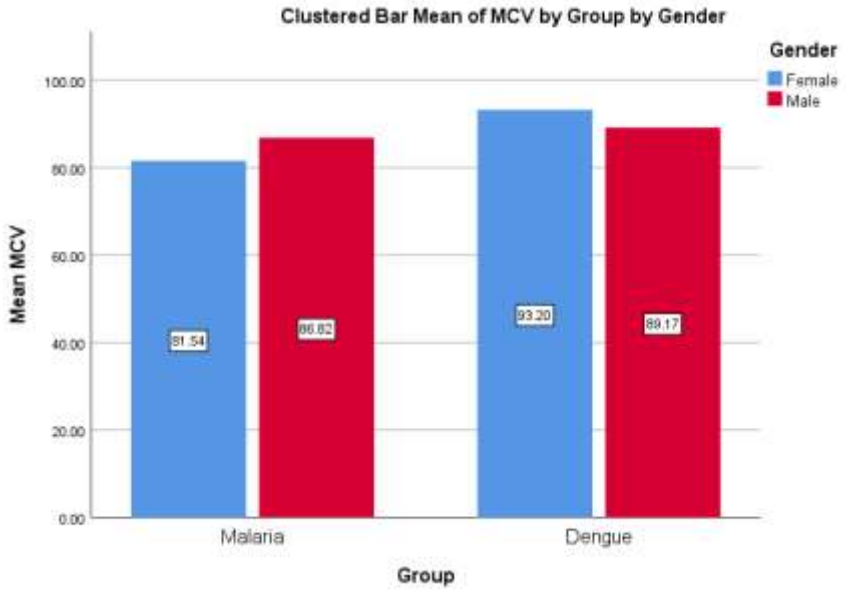
Gender affects how much normal HCT is present in an individual's body. Men's typical HCT levels range from 41% to 50%, while women's average levels range from 36% to 48%. In contrast to dengue, my research shows that malaria has a lower HCT%.

Table and graph-6

Parameter of CBC	Patients	Gender	Mean	Standard value
MCV	Dengue	Male	89.17	

		Female	93.20	80–100 fl
	Malaria	Male	86.82	
		Female	81.54	

Table-6: Demonstrates the MCV result of dengue and malaria patient

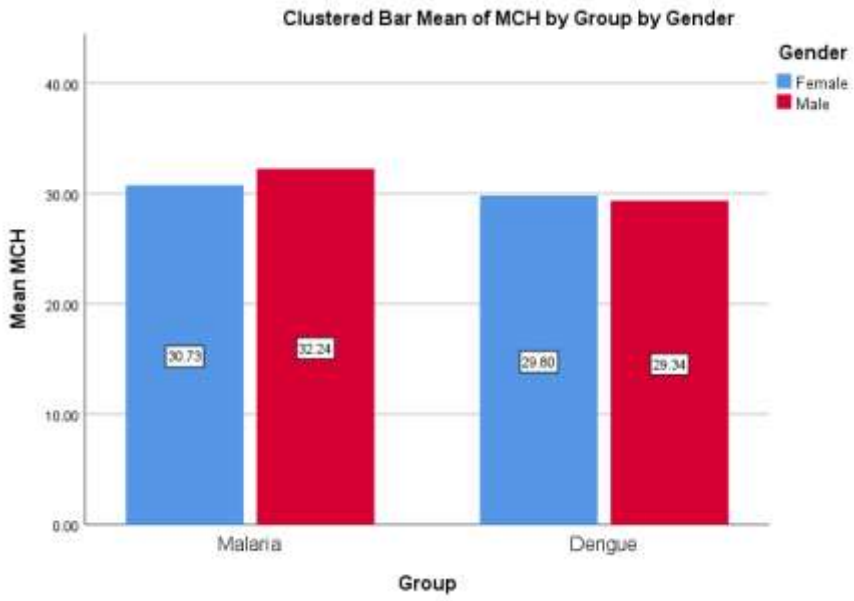


In malaria patients, the average MCV level is 86.82fl in men and 81.54fl in women. However, in dengue patients, the average MCV level is 93.20fl in women and 89.17fl in males. The quantity of regular MCV that both men and women need in their bodies is the same. The normal MCV range for both sexes are 80-100fl. If you have anemia, liver illness, or other diseases, MCV can assist diagnose them. Compared to malaria, a dengue patient's MCV level is higher.

Table and graph-7

Parameter of CBC	Patients	Gender	Mean	Standard value
MCH	Dengue	Male	29.34	Between 27.5 and 33.2 (pg)
		Female	29.80	
	Malaria	Male	32.24	
		Female	30.73	

Table-7: Demonstrates the MCH result of dengue and malaria patient

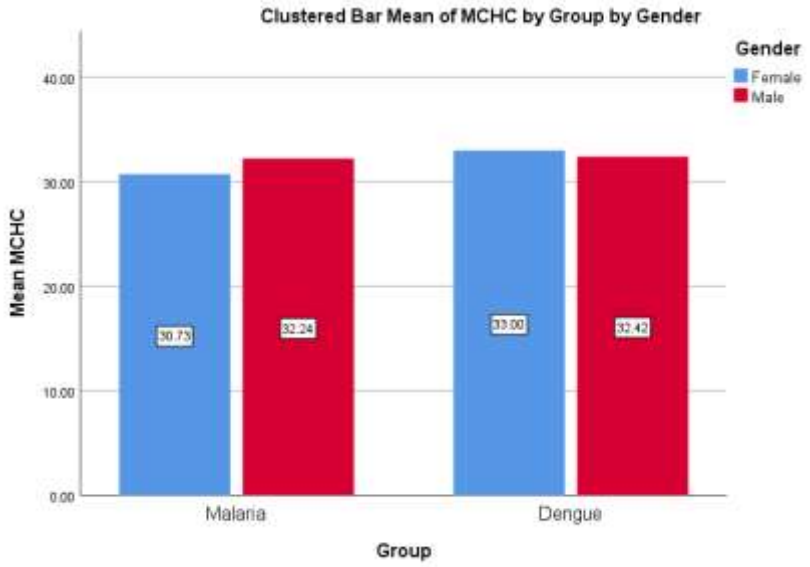


Male and female malaria patients often have MCH levels of 32.24(pg) and 30.73(pg), respectively. However, the average MCH level in dengue patients is 29.3 pg in males and 29.80 pg in women. The same quantity of typical MCH is required by both men and women. The typical MCH level for both sexes are between 27.5 and 33.2 picograms (pg). A low MCH can indicate diseases like thalassemia and anaemia. If you have renal or lung problems, you may have high MCH levels. Therefore, malaria has a higher MCH content than dengue.

Table and graph-8

Parameter of CBC	Patients	Gender	Mean	Standard value
MCHC	Dengue	Male	32.42	34 ± 2 g/dl
		Female	33.00	
	Malaria	Male	32.24	
		Female	30.73	

Table-8: Demonstrates the MCHC result of dengue and malaria patient



Male patients with malaria had an average MCHC level of 32.24 g/dl, whereas female patients have a level of 30.73 g/dl. The average MCHC level, however, is 33.00 g/dl for women and 32.42 g/dl for males in dengue patients.

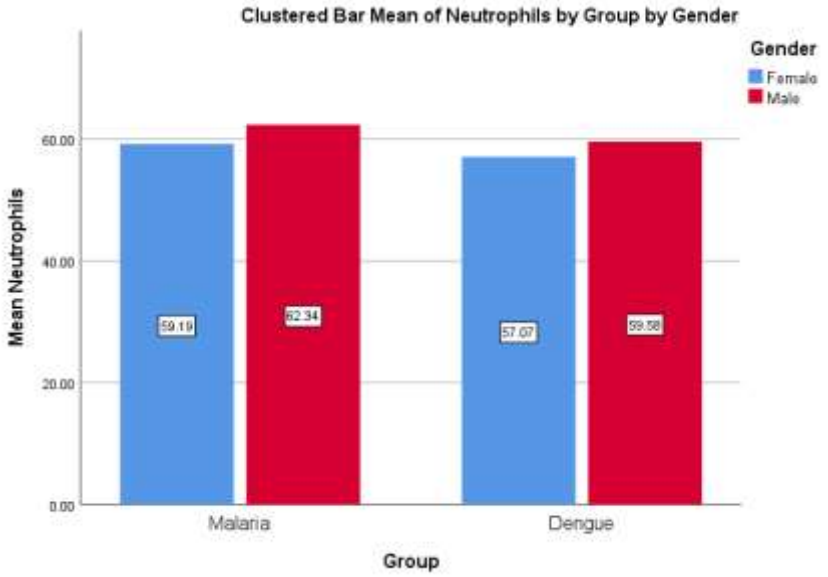
Equal amounts of typical MCHC are required by both males and women. The typical MCHC level in people of both sexes is 34 2 g/dl. Anaemia, or a lack of sufficient healthy red blood cells, may be indicated by MCHC values that are below or above the normal range.

Table and graph-9

Table-9:

Parameter of CBC	Patients	Gender	Mean	Standard value
Neutrophils	Dengue	Male	59.58	40% to 60%
		Female	57.07	
	Malaria	Male	62.34	
		Female	59.19	

Demonstrates the Neutrophils result of dengue and malaria patient



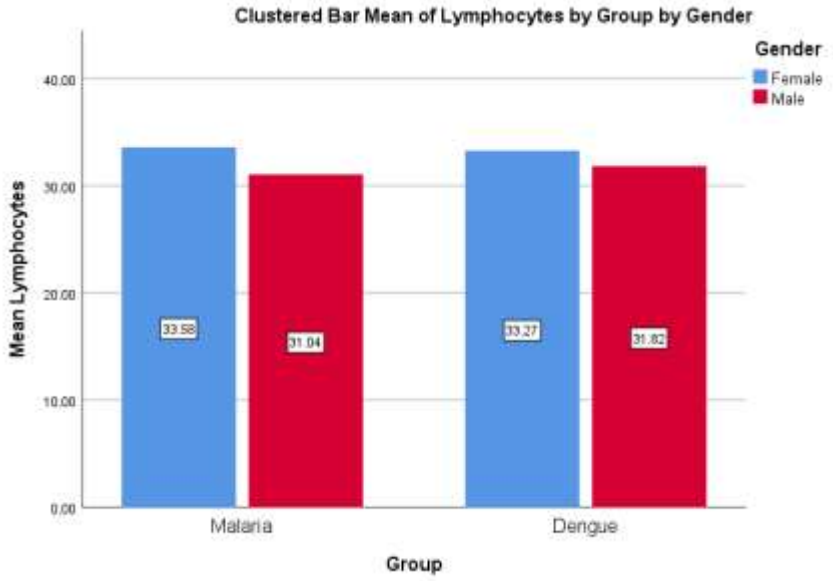
Neutrophils are among the first immune cells to react when the body is invaded by bacteria or viruses. Above graph shows that the average percentage of neutrophils in malaria patients is 62.34% in men and 59.19% in women. The average amount of neutrophils in dengue patients is 57.07% in women and 59.89% in males.

Both men and women require 40% to 60% of their typical neutrophils in their bodies. In contrast to dengue, my study found that patients with malaria had higher neutrophil levels.

Table and graph-10

Parameter of CBC	Patients	Gender	Mean	Standard value
Lymphocytes	Dengue	Male	31.82	20% to 40%
		Female	33.27	
	Malaria	Male	31.04	
		Female	33.58	

Table-10: Demonstrates the lymphocytes result of dengue and malaria patient



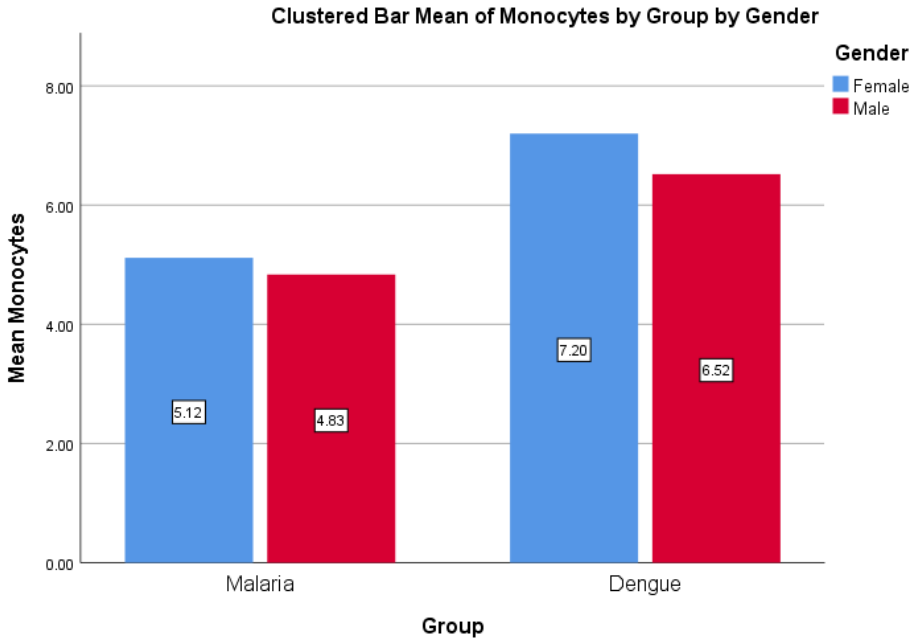
The immune system of your body uses lymphocytes to combat foreign viruses, germs, and cancer (antigens). Your body occasionally manufactures additional lymphocytes to aid in the defense against diseases and infections. Both men and women require 20% to 40% of their total body weight in normal lymphocytes.

According to the graph above, the average percentage of lymphocytes in malaria patients is 33.58% for females and 31.04% for males. However, in dengue patients, the average lymphocyte count is 33.27% in women and 31.82% in males.

Table and graph-11

Parameter of CBC	Patients	Gender	Mean	Standard value
Monocytes	Dengue	Male	6.52	2% to 8%
		Female	7.20	
	Malaria	Male	4.83	
		Female	5.12	

Table-11: Demonstrates the Monocytes result of dengue and malaria patient



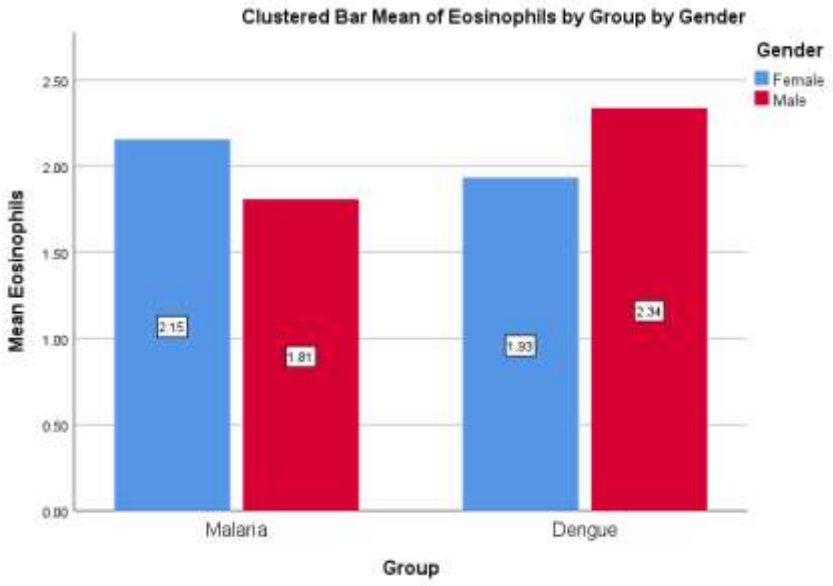
One variety of white blood cell is the monocyte. They support your body's defenses against viruses, germs, and other illnesses. Inflammation, infection, acute stress, blood abnormalities, and other health problems may all be indicated by a high monocyte count. Men and women both require 2% to 8% of the normal monocytes that are present in their bodies.

According to the graph above, the typical Monocytes level in malaria patients is 5.12% in females and 4.83% in males. However, the average Monocytes level in dengue patients is 6.52% in men and 7.20% in women.

Table and graph-12

Parameter of CBC	Patients	Gender	Mean	Standard value
Eosinophils	Dengue	Male	2.34	1% to 4%
		Female	1.93	
	Malaria	Male	1.81	
		Female	2.15	

Table-12: Demonstrates the Eosinophils result of dengue and malaria patient



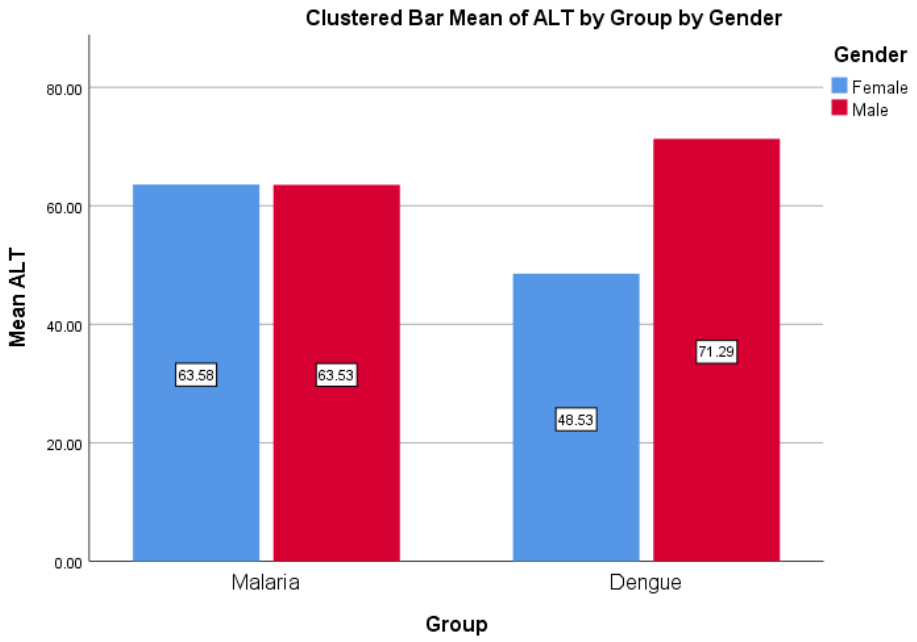
Eosinophils are a type of white blood cell that fights infection. The most typical diagnoses for this illness are malignancy, an allergic reaction, or a parasite infection. Both men and women require 1% to 4% of typical Eosinophils in their bodies. According to the above table, male and female malaria patients have average Eosinophil levels of 1.81% and 2.15%, respectively. But in dengue patients, the average Eosinophil count is 2.34% in men and 1.93% in women.

Comparing patients with severe hepatic dysfunction to those with mild or moderate hepatic dysfunction, individuals with an increasing trend in aminotransferases had more serious consequences and a worse result.

Table and graph-13

Parameter of LFT	Patients	Gender	Mean	Standard value
ALT	Dengue	Male	71.29	29 to 33(IU/L) in male
		Female	48.53	
	Malaria	Male	63.53	19 to 25(IU/L) in female
		Female	63.58	

Table-13: Demonstrates the ALT result of dengue and malaria patient

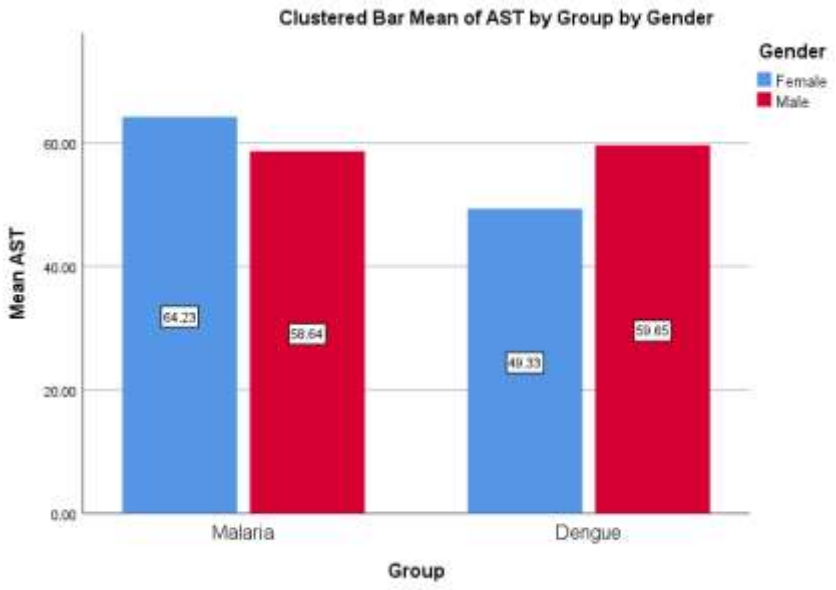


An enzyme called ALT aids the liver in converting food into energy. High enzyme concentrations may indicate a damaged or inflamed liver where the enzymes are seeping from the liver cells. Males have somewhat higher levels of ALT than females, which range from 29 to 33 (IU/L) in men and 19 to 25 (IU/L) in women. According to the above table, the average ALT level in patients with malaria is 63.58 (IU/L) in females and 63.53 (IU/L) in males. But in dengue patients, the average ALT level is 48.53(IU/L) for women and 71.29(IU/L) for men.

Table and graph-14

Parameter of LFT	Patients	Gender	Mean	Standard value
AST	Dengue	Male	59.65	14 to 20 units/L in male
		Female	49.33	
	Malaria	Male	58.64	10 to 36 units/L in female
		Female	64.23	

Table-14: Demonstrates the AST result of dengue and malaria patient



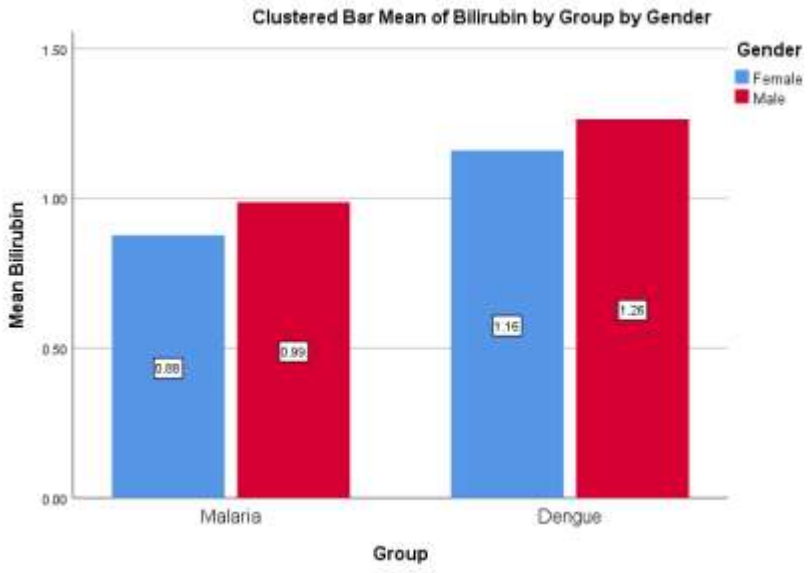
When your muscles or liver are harmed, an enzyme called aspartate transaminase (AST) is released. Males have somewhat higher AST levels than females, which range from 14 to 20 units/L in men and 10 to 36 units/L in women.

According to the above table, male and female malaria patients' average AST levels are 58.64 and 64.23 units/L, respectively. But in dengue patients, the average AST level is 49.33 units/L in women and 59.65 units/L in males.

Table and graph-15

Parameter of LFT	Patients	Gender	Mean	Standard value
Bilirubin	Dengue	Male	1.26	0.1 to 1.2 mg/dL
		Female	1.16	
	Malaria	Male	0.99	
		Female	0.88	

Table-15: Demonstrates the Bilirubin result of dengue and malaria patient



Hemolysis of parasitized and no parasitized RBC and/or hepatocyte injury are the main causes of elevated bilirubin. The standard range for bilirubin in both men and women is 0.1 to 1.2 mg/dL.

The average bilirubin level in malaria patients, according to the above table, is 0.88 mg/dL in females and 0.99 mg/dL in males. But in dengue patients, the average bilirubin level is 1.26 mg/dL for men and 1.16 mg/dL for women.

Discussion

In march 2015 kotepu stated that Changes in blood cell parameters are already a well-known feature of malarial infections. Neutrophil and platelet counts were significantly higher; however, RBC count was significantly lower in patients with P. falciparum infection compared to those with P. vivax infection ($p<0.0001$). Leukocyte counts were

also significantly higher in patients with high parasitemia compared to those with low and moderate parasitemia. In addition, patients infected with different malarial densities also exhibited important changes in leukocyte count, platelet count and hemoglobin concentration during the infection.

Al-Salahy in 2016 Mar 9 concluded Plasmodium falciparum malaria is the most common infection in Yemen. Patients with parasitemia tended to have significantly lower hemoglobin, hematocrit, white blood cell count, lymphocytes, and platelets, compared with healthy normal subjects. Serums AST, ALT, ALP, and bilirubin (total and direct) in falciparum malaria patients were significantly higher ($p < 0.0001$) than those of falciparum malaria of free individuals.

Ananda Rao *in* 2020 Nov 20 analyzed Dengue fever is endemic in more than 100 countries. Early indicators of prognosis are vital to reduce the fatality rate associated with dengue fever. The objective of this study is to investigate the value of a complete blood count (CBC) in determining the prognosis of dengue fever. Results Thrombocytopenia was the most common hematological feature, in 50 cases (~90%), followed by leukopenia in 43 cases (~76%). The duration of hospital stay ranged from two to seven days. Interestingly, the percentage of lymphocytes in the differential leukocyte count at the time of admission showed a significant negative correlation with the duration of hospital stay ($p=0.028$). Also, three distinct trends were observed in the sequence of recovery of platelets and white blood cells (WBCs). The higher the percentage of lymphocytes, the faster the recovery from dengue and shorter the duration of stay in the hospital.

Various factors determine the severity of a dengue or malaria infection. Temperature, precipitation, and relative humidity (the quantity of moisture in the air) are the three primary meteorological variables that directly influence the spread of malaria and dengue. The pattern of malaria transmission and the severity of the issue can also be affected by a number of non-climatic factors, such as variations among human hosts, human migration, and development initiatives.

In my study total of 140 dengue and malaria patients with disturbed CBC and liver parameters were collected in the duration of 4 to 6 month. The amount of normal HB in a person's body varies depending on gender. Thus, my research's main finding is that patients with dengue had lower TLC levels than those with malaria, which is mild. PLT levels are decreasing in dengue patients and rising in malaria patients.

According to the severity of the infection, RBC damage, my research has found that the level of RBC in both infections is not significantly impacted. In contrast to dengue, my research shows that malaria has a lower HCT. Additionally, the patients' MCV, MCH, and MCHC levels reveal anemia and thalassemia.
In contrast to dengue, my study found that patients with malaria had higher neutrophil levels.
According to the results of my study, hepatic dysfunction in both infection malaria and dengue are associated with elevated levels of ALT, AST, and bilirubin.

CONCLUSIONS

We came to the conclusion that both dengue and malaria can result in serious hematological and hepatic alterations, with a high frequency of lymphopenia, anemia, and thrombocytopenia in cases of malaria infection, and leukemias

in cases of dengue infection. Both infections can induce an increase of liver enzymes. When the aforementioned signs are present, the diagnosis of malaria and dengue should always be taken into consideration because the blood and liver profile changes are so distinctive.

Conflict of Interest: The authors declare that there is no conflict of interest regarding this study.

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Authors

First Author: Asfa Ilyas, DMLS, University institute of Medical Lab Technology, The University of Lahore, Punjab, Pakistan.

Second Author: Umair Waqas, Imran Idress Institute of Rehabilitation Sciences, Sialkot.

Third Author: Mahnoor Fatima, Lecturer, The University of Chenab, Gujrat

Fourth Author: Waqar Mehmood Dar, Lecturer, The University of Chenab, Gujrat.

Fifth Author: Zouha Zafar, the University of Chenab, Gujrat.