

ASSESSMENT OF LIVER ENZYME ALANINE AMINOTRANSFERASE (ALT) AND ASPARTATE AMINOTRANSFERASE (AST) IN DENGUE-INFECTED PATIENTS IN FAISALABAD, PUNJAB PAKISTAN IN 2026.

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DOI: <https://doi.org/10.5281/zenodo.20665535>

Received	Accepted	Published
14 April 2026	25 May 2026	12 June 2026

ABSTRACT

A cross sectional study was conducted in 2026 in Faisalabad, Punjab, Pakistan, to assess liver functional abnormalities in dengue patients by estimation of serum ALT and AST levels. The total number of serologically confirmed dengue cases included was 200, of which 120 (60%) cases were diagnosed as Dengue Fever and 80 (40%) cases as Dengue Hemorrhagic Fever. There were 115 females (57.5%) and 85 males (42.5) in the study population ranging from 15 years to 50 years of age, while the 21-25 years age group had the highest prevalence of the disease (20.5%). The blood samples collected at the time of diagnosis were used to confirm Dengue infection by NS1 antigen, IgM and IgG. ALT and AST levels were measured. The results showed that the values of ALT and AST had significant increase in all dengue positive cases as compared to normal range (40U/L) which showed there was significant liver involvement. Mean ALT levels were significantly higher in DHF patients (356.43 ± 85.29 U/L) than in DF patients (182.79 ± 56.98 U/L) ($p < 0.001$), while AST levels were also markedly elevated in DHF patients (500.81 ± 105.21 U/L) compared with DF patients (261.06 ± 72.85 U/L) ($p < 0.001$). Pearson correlation showed there was a strong positive correlation between ALT and AST levels ($r = 0.631$, $p < 0.001$), indicating that both enzymes raise concurrently in the presence of dengue infection. In addition, AST levels were higher than ALT levels in most patients, and 19.5% of patients had an AST/ALT ratio less than one reflecting predominant mitochondrial hepatic injury. The results show that there is significant liver damage after dengue virus infection, and that the liver damage is more extensive in DHF patients. Therefore, periodic monitoring of ALT and AST levels can be a practical and cost-effective method to assess liver injury and disease severity in dengue patients in Faisalabad.

Keywords: ALT Alanine aminotransferase), AST(aspartate aminotransferase), Dengue Fever (DF), Dengue Hemorrhagic Fever (DHF).

INTRODUCTION

Dengue fever is among the most significant mosquito transmitted viral diseases in tropical and sub-tropical countries. The dengue virus (DENV),

a flavivirus, is the cause of the disease and is transmitted mainly by infected *Aedes aegypti* and *Aedes albopictus* mosquitoes. Dengue infection has various clinical presentations, from no symptoms

or mild, classical Dengue Fever (DF) to severe Dengue Hemorrhagic Fever (DHF) and Dengue Shock Syndrome (DSS). The spread of dengue has dramatically risen in Pakistan in the past few years especially in urban areas where suitable environmental conditions provide favorable breeding grounds for mosquitoes and transmission of the disease (Wagle et al., 2025). While dengue is known to be a febrile disease, it is also known to involve many organ systems including liver. Liver involvement is frequently seen in dengue infection and can be mild with raised liver enzymes or severe, with hepatitis and acute liver failure in critical cases. Direct invasion of hepatocyte, immune mediated hepatocyte injury, inflammatory phenomena due to cytokines, and circulatory disturbance due to severe disease are responsible for liver injury. Therefore, the assessment of liver function has become an important part in the clinical evaluation and management of dengue patients (Campana et al., 2024) (Swamy et al., 2021).

Alanine aminotransferase (ALT) and aspartate aminotransferase (AST) are commonly used to assess hepatocellular injury among biochemical markers of liver injury. An increase in the level of these enzymes has been detected in many cases of dengue and is often linked to the severity of the disease. Higher levels of AST than ALT were found in previous studies to occur frequently in dengue infection, indicating not only liver injury but involvement of extrahepatic tissues like skeletal and cardiac muscles. In addition, ALT and AST have also been shown to be important markers for the severity of clinical situations, with high levels of these enzymes being associated with poor clinical outcomes (Sadiq et al., 2024).

Pakistan still suffers from regular dengue outbreaks, which poses a major public health challenge. The problem of dengue transmission in Faisalabad has not been eradicated yet; rapid urbanization, climatic conditions, and population density are risk factors for the transmission of the disease in the city (Rama Ravo & Yap, 2025). Although the number of dengue cases in the region is growing every year, there is little local information available on the level of hepatic involvement and its relationship with severity of

the disease. Hence, the study of liver enzyme alterations in patients with dengue infection can be useful to understand the disease pathogenesis and help the clinician identify those who are more susceptible to complications (Schaefer et al., 2024).

The transmission of the dengue virus occurs in the same way as malaria is transmitted, via bite of an infected female *Aedes* mosquito, primarily *Aedes aegypti*. Subsequently, it was discovered that day-biting mosquito *Aedes aegypti* is found in the tropics and subtropics (Niriella et al., 2026). When it comes into contact with a dengue carrier, this typical female mosquito, which grows in collected stagnant water, catches dengue. This means that someone who is not already infected by an infected mosquito, at a later time. Dengue virus incubation period is 8 to 10 days. There is a range of clinical symptoms associated with this fever, from low fever to worst muscle lymph node aches and discomforts (Bano et al., 2022) (Mohapatra et al., 2025) (L. Ali et al., 2022).

Dengue is a significant burden in the world. The US Centers for Disease Control and Prevention (CDC) estimate that the virus causes 400 million illnesses and 40,000 deaths each year, at an economic cost to the world of more Than US\$8.9 billion (Campana et al., 2024). Although it is widespread in the tropics and subtropics, the true incidence of the disease is under diagnosed, as most of those who become infected with it either have very mild or no symptoms at all, and often present with misdiagnosis, particularly in regions where malaria Typhoid fever are also endemic (Huong et al., 2024) (Leowattana & Leowattana, 2021) .

Dengue fever outbreak has been a public health problem since the first outbreak occurred in Jakarta, Indonesia in 1779. It is estimated that the annual incidence of DANV Infection in the world 100-400 million cases. The annual number of cases has increased by about eight times over the last 20 years, from 505, 430 in 2000 to over 2.4 million in 2010 and 4.2 million in 2019 (Yuan et al., 2022), (Eltom et al., 2021). Dengue fever is found in the Americas, Africa, Southeast Asia, Europe, Western Pacific and Eastern Mediterranean, and is a serious threat to public

health. It is an endemic disease caused by an arbovirus and affects more than 96 million people with symptoms of varying severity in more than hundred countries. Dengue is a significant cause of severe illness and economic burden in many parts of the world, Especially in Southeast Asian and Indian subcontinent nations (Bhatt et al., 2021) (Zerfu et al., 2023) (Islam et al., 2021).

Dengue epidemic has increased over the last few decades; four serotypes and different dengue genotypes have been found in PR China. Several local endemics and multiple epidemics of dengue were seen in southern and coastal region. Dengue cause that were important were the primary cause of the epidemics. Increased environmental sanitation, vector mosquito control, public awareness, a national reporting system for infectious diseases and public health emergencies, and personal protection have all helped to significantly reduce the prevalence of dengue, despite the fact that there is currently no approved vaccine or antiviral medication for the disease in PR China (Wu et al., 2022) (Nie et al., 2025).

The first epidemic of dengue were reported in Africa in 19th century from Zanzibar Island in 1823 and 1870, South Africa in 1926 and 1927, and Burkina Faso in 1925. Report of Laboratory confirmation of outbreaks began to emerge in a large number of more African countries in 1960s. The four serotypes (DENV-1-4) had been reported on continent, and DENV-1 and DENV-2 were the most commonly reported serotypes. Although it occurrence in different epidemiological situation is uncertain, dengue is becoming more widespread throughout Africa. This might be attributable to the fact that there is a lack of laboratory capacity to differentiate dengue from other febrile illness with similar clinical presentation and geographical distribution like malaria, chikungunya, Zika, yellow fever, typhoid fever and Leptospirosis (Mwanyika et al., 2021) (Poongavanan et al., 2024).

All four serotypes have been detected in more than in more than one outbreak in Pakistan. In 2011 DENV-2 was the most frequently reported serotype but DENV-I, DENV-II, DENV-III and DENV-III were found to co-circulate in outbreak, in 1998 and 2006, respectively (L. Ali et al., 2022).

DENV-I and DENV-II were the two major serotypes found in Pakistan. DENV-II was identified during the 2000 dengue out break and the distribution of serotype is not uniform across Pakistan. Since 2005 and 2006, when DENV-II and III were identified, there were approximately 52 death reported, Sindh province had nearly 37 deaths due to dengue in 2005-06, with majority being from Karachi (Khattak et al., 2024). Dengue in Pakistan has developed from cases to an endemic season pandemic. Punjab is troubled annually particularly with regards to industrial and rapidly growing cities such as Faisalabad. Faisalabad, popularly referred to as the hub of the big textile industry and a special urban rural border, is a mosquito hotspot. During the post monsoon season, the city's healthcare system is usually overloaded with patient with violent illness. Although thrombocytopenia low platelet count is the hallmark of dengue, local study result indicate that the degree of liver enzyme rise is a significantly more accurate predictor of the severity of the illness and length of hospital stay (Jamil et al., 2025) (Shetty et al., 2024).

MATERIAL AND METHODS:

Study Design

A prospective cross-sectional study was conducted in 2026 in Faisalabad, Punjab, Pakistan, to evaluate the serum alanine aminotransferase (ALT) and aspartate aminotransferase (AST) levels to assess hepatic involvement in patients with dengue infection (Jamil et al., 2025). The study was conducted in association with health centers and laboratories that are engaged in the diagnosis and treatment of dengue patients.

Study Population and Sample Size

The non-probability, consecutive sampling techniques was used for sample collection. Initially 250 patients were screened for suspected dengue infection. After screening, 200 serologically diagnosed dengue patients were included for final analysis and remaining 50 were excluded. The study population comprised male and female patients between the ages of 15 and 50 years who were confirmed as being infected with the dengue virus in the laboratory. There were 200 patients,

120 of which were classified as Dengue Fever (DF), and 80 as Dengue Hemorrhagic Fever (DHF), based on the World Health Organization (WHO) diagnostic criteria.

Inclusion and Exclusion Criteria.

This study included all age groups with confirmed diagnosis by (ELISA) who had complete laboratory data (LFT, CBC and demographics) at the time of admission and discharge. Patients with the diagnosis of dengue but incomplete information regarding demography and laboratory parameters, however, were excluded because this information was crucial to assess the primary objectives of the study.

Data collection form

Patients were selected from the respective record centers and data were collected from patient record files with the help of a pre-structured data collection form. Demographics (age, weight, socioeconomic status, gender, residence in rural and urban area), diagnostic technique (NS-1 and IgM, IgG antibodies), family and disease history (kidney diseases, Hypertension, diabetes and liver diseases), clinical presentations (Fever > 2 and < 10 days and associated with two symptoms from headache, retro-orbital pain, myalgia, bone pain), warning signs (persistent vomiting, lethargy, restlessness, increase in bleeding tendency, severe abdominal pain, laboratory result (CBC, LFTs,)). Laboratory data were recorded on admission and discharge. Patient data were gathered daily until discharge or death.

Laboratory Procedures (Biochemical analysis)

Venous blood was taken (approximately 5 mL) from each participant under aseptic conditions. Blood samples were centrifuged and serum was separated for biochemical analysis. Serum Alanine

Aminotransferase (ALT) and Aspartate Aminotransferase (AST) levels were measured using an automated chemistry analyzer Micro-Lab 300 semi-automated chemistry analyzer for the estimation of ALT and AST levels according to the manufacturer's instructions. The quality of the products was taken care of with internal quality control measures made on a daily basis to obtain accurate and reliable test results. Normal reference ranges were deemed as:

- ALT: 10-40 U/L
- AST: <40 U/L

Higher levels of enzymes were classified as:

- Mild: <2x upper limit of normal (ULN)
- Severe elevation: >10 times ULN
- Higher elevation: >10 times ULN

Data Analysis:

Data were coded and analyzed in SPSS version 26.0. When numerical data were obtained, they were presented as means ± standard deviation (SD) for quantitative variables like age, ALT, AST levels. Qualitative variables, like gender and enzyme elevation categories, were described by frequencies and percentages. The mean ALT and AST value amongst various group of dengue infected-patient were compared using an independent t-test

RESULTS

1-Gender Distribution of Participants

The study sample's gender distribution was described using a frequency distribution. (Table 1) shows that of the 200 participant, 85 were men (42.5%) and 115 were women (57.5%). The majority of the sample was female, which could be a reflection of the study site's local demographics or patterns of healthcare-seeking behavior. Pie chart for gender distribution is shown in (Figure 1).

Table 1: Gender Distribution of Participants

Gender	Frequency	Percent	Valid percent	Cumulative Percent
Male	85	42.5	42.5	42.5
Female	115	57.5	57.5	100.0
Total	200	100.0	100.0	

Out of the 200 participants included in the study, 85 (42.5%) were male and 115 (57.5%) were female. The findings indicate that female respondents constituted the majority of the sample, accounting for more than half of the participants, while males represented a smaller proportion. This distribution suggests a moderate predominance of females in the study, which may influence the overall perspectives and responses reflected in the research findings.

2-Age Distribution

The age group 21–25 years had the largest proportion (20.5%) while 26–30 years age group had the second largest proportion (17.5%). Findings showed that, majority of the people with dengue infection were young adults as shown in (Figure 2) and (Table 2)

Table 2: Age Distribution Chart

Age Group (Years)	Frequency	Percentage (%)
15–20	24	12.0
21–25	41	20.5
26–30	35	17.5
31–35	26	13.0
36–40	31	15.5
41–45	24	12.0
46–50	18	9.0
>50	1	0.5

The age distribution of the 200 participants indicates that the largest proportion of respondents belonged to the 21–25 years age group, comprising 41 participants (20.5%), followed by the 26–30 years age group with 35 participants (17.5%). Participants aged 36–40 years accounted for 15.5%, while those aged 31–35 years represented 13.0% of the sample. The 15–20 years and 41–45 years age groups each

constituted 12.0% of respondents. The 46–50 years age group had the lowest representation among the major categories, with 18 participants (9.0%), whereas only one participant (0.5%) was older than 50 years. Overall, the findings show that the sample was predominantly composed of young adults, particularly those between 21 and 30 years of age, indicating that this age segment was the most represented in the study.

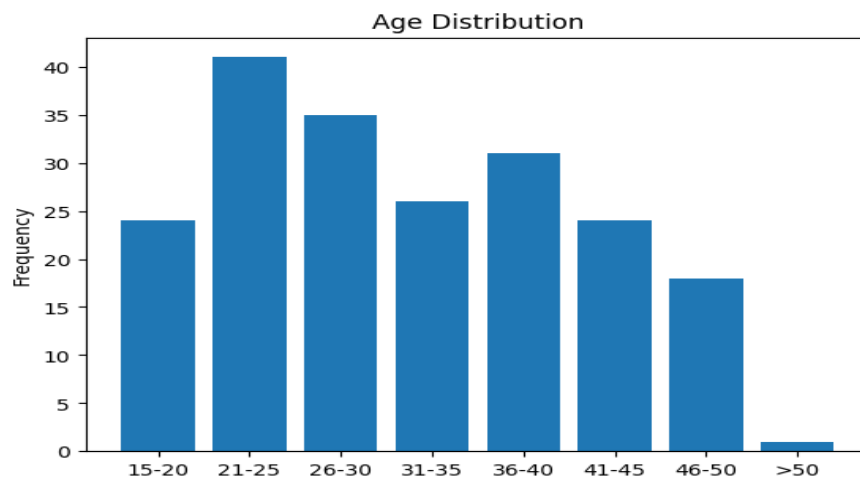


Figure 2: Age Distribution

3-Clinical Classification of Dengue Patients

A significant proportion of patients (40.0%) had Dengue Hemorrhagic Fever, with most patients (60.0%) being diagnosed with Dengue Fever as shown in (Table 3) and (Figure 2). It presents the clinical classification of 200 dengue patients. Among them, 120 patients (60.0%) were diagnosed with Dengue Fever (DF), while 80 patients (40.0%) had Dengue Hemorrhagic Fever (DHF). The results indicate that Dengue Fever was

the most common clinical presentation among the study participants. However, a considerable proportion of patients suffered from Dengue Hemorrhagic Fever, reflecting a significant burden of severe dengue cases. These findings emphasize the need for timely diagnosis, careful monitoring, and effective management to prevent complications and reduce the severity of dengue infection.

Table 3: Clinical Classification of Dengue Patients

Group	Frequency	Percentage (%)
DF	120	60.0
DHF	80	40.0
Total	200	100.0

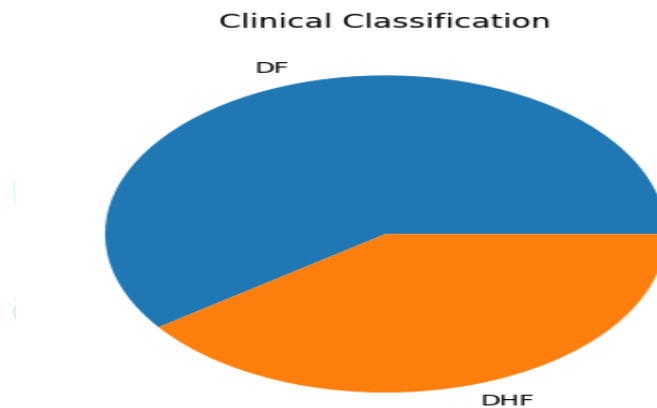


Figure 3: Clinical Classification of Dengue Patients

4- Comparison of Liver Enzyme Levels between DF and DHF Patients

The patients with DHF had significant higher AST and ALT levels compared with DF patients as shown in (Table 4). The mean ALT level was 182.79 ± 56.98 U/L in DF patients and 356.43 ± 85.29 U/L in DHF patients, while the mean AST level was 261.06 ± 72.85 U/L in the DF group and 500.81 ± 105.21 U/L in the DHF group. Both ALT and AST levels were considerably higher

among patients with DHF compared to those with DF, indicating more pronounced liver involvement in severe dengue cases. These findings suggest that elevated liver enzymes are associated with increased disease severity and may serve as important indicators of hepatic dysfunction in patients with Dengue Hemorrhagic Fever. The difference was significant ($p < 0.001$) and represented a higher degree of hepatic involvement in severe infection of dengue.

Table 4: Comparison of Liver Enzyme Levels between DF and DHF Patients

Parameter	DF Mean \pm SD	DHF Mean \pm SD
ALT (U/L)	182.79 ± 56.98	356.43 ± 85.29
AST (U/L)	261.06 ± 72.85	500.81 ± 105.21

5- Pattern of ALT Elevation

A high level of ALT (more than 62.0%) was found in 62.0% of patients, which indicated a severe degree of hepatocellular injury in most patients. As shown (Table 5) and (Figure 4). The results show that 124 patients (62.0%) had severe ALT elevation, while 76 patients (38.0%) exhibited moderate ALT elevation. The predominance of

severe ALT elevation indicates that liver involvement was substantial in the majority of patients, suggesting significant hepatocellular injury associated with dengue infection. These findings highlight the importance of monitoring liver function in dengue patients, as marked elevations in ALT may reflect increased disease severity and a higher risk of hepatic complications.

Table 5: Pattern of ALT Elevation

ALT Category	Frequency	Percentage (%)
Moderate	76	38.0
Severe	124	62.0

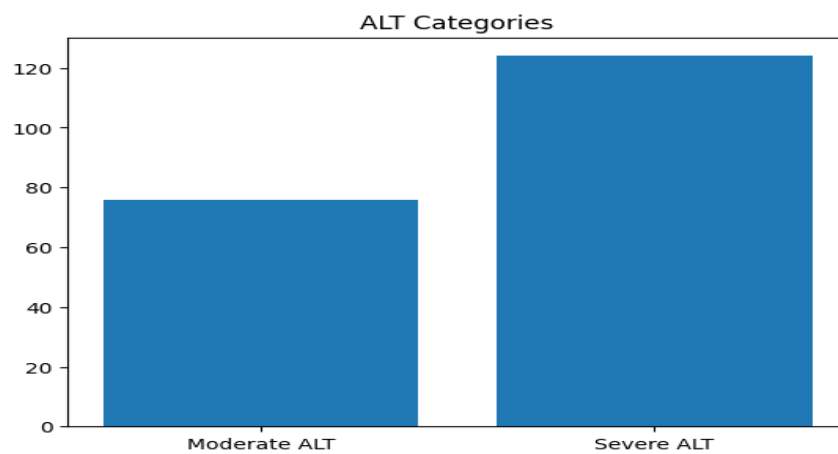


Figure 4: Pattern of ALT Elevation

6-Pattern of AST Elevation

Severe AST elevation occurred in 85.5% of patients, whereas the same was seen in only 14.5% of patients with ALT elevation as shown in (Table 6) and (Figure 5). The findings reveal that 171 patients (85.5%) had severe AST elevation, whereas only 29 patients (14.5%) showed moderate AST elevation. The overwhelming

predominance of severe AST elevation indicates extensive hepatic involvement in most patients and suggests that AST levels are markedly affected during dengue infection. These results underscore the significant impact of dengue on liver function and highlight the value of AST as an important biochemical marker for assessing disease severity and monitoring potential hepatic complications.

Table 6: Pattern of AST Elevation

AST Category	Frequency	Percentage (%)
Moderate	29	14.5
Severe	171	85.5

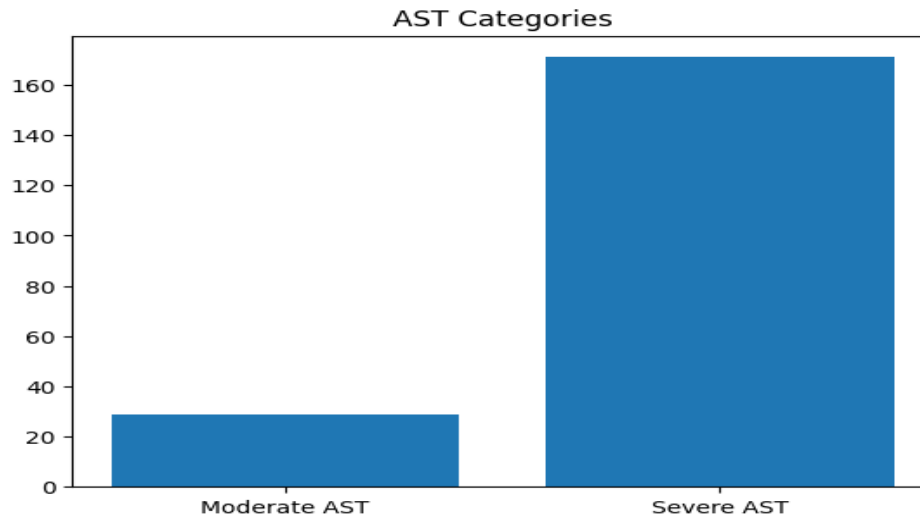


Figure 5: Pattern of AST Elevation

7-AST/ALT Ratio among Dengue Patients

AST predominance was seen in 80.5% of patients, suggesting that AST is more sensitive indicator of hepatic involvement in dengue infection as shown in (Table 7). Out of 200 patients, 161 (80.5%) demonstrated AST predominance (AST/ALT ratio >1), whereas 39 patients (19.5%) showed ALT predominance (AST/ALT ratio <1). The predominance of AST in the majority of patients

suggests that AST levels were more markedly elevated than ALT levels during dengue infection. This pattern is consistent with the characteristic hepatic involvement seen in dengue and may reflect not only liver injury but also damage to other tissues such as skeletal and cardiac muscles, where AST is also present. These findings indicate that AST predominance is a common biochemical feature among dengue patients and may be associated with greater disease severity.

Table 7: AST/ALT Ratio among Dengue Patients

Category	Frequency	Percentage (%)
ALT Predominance (<1)	39	19.5
AST Predominance (>1)	161	80.5

8- Correlation between ALT and AST Levels

Pearson correlation analysis demonstrated a significant positive correlation between ALT and AST levels, indicating that increases in one enzyme

were associated with increases in the other as shown in (Table 8).

Table 8: Correlation between ALT and AST Levels

Correlation		ALT (U/L)	AST (U/L)	p-value
ALT (U/L)	Pearson Correlation	1	.631	<0.001
	Sig. (2-tailed)		.000	
	N	200	200	
AST (U/L)	Pearson Correlation	.631	1	
	Sig. (2-tailed)	.000		
	N	200	200	

The correlation analysis demonstrated a **significant positive relationship between ALT and AST levels** among dengue patients, with a **Pearson correlation coefficient ($r = 0.631$, $p < 0.001$)**. This indicates a moderately strong positive correlation, meaning that as ALT levels increased, AST levels also tended to increase. The statistically significant p-value confirms that this association is unlikely to have occurred by chance. Based on data from **200 patients**, the findings suggest that both liver enzymes rise concurrently during dengue infection, reflecting a common pattern of hepatic involvement and liver injury. Therefore, monitoring both ALT and AST levels may be useful in assessing the extent of liver dysfunction and disease severity in dengue patients.

Elevated ALT and AST value associated with:

- Prolonged fever
- Presence of bleeding symptom
- Thrombocytopenia

While AST can be utilized as early indicator of severe dengue infection, patient with AST > 400 U/L were more likely to experience problem.

Discussion:

Alanine Aminotransferase (ALT) and aspartate Aminotransferase (AST) two liver enzyme were measured in dengue patients in Faisalabad, Punjab, Pakistan. A total of 200 patients were included in our study: 120 (60%) had been diagnosed with dengue fever (DF) and 80 (40%) had been diagnosed with dengue hemorrhagic fever (DHF) all patients had significantly higher ALT and AST values, with DHF patients showing higher values than DF patients. The current study is completely in line with several local and international publication from 2021- 2025 that highlight. Routine enzymes as an important aid in the diagnosis and management of dengue morbidity.

This study revealed all 200 cases of dengue infection had ALT and AST level significantly higher than the reference value of 40 U/L, indicating liver involvement in all cases of dengue infection. While the mean AST levels were 261.06 ± 72.85 in DF patients and 500.81 ± 105.21 U/L in DHF patients, the total mean ALT was 182.79 ± 56.98 in DF case and 356.43 ± 85.29 U/L in

DHF ones these findings are consistent with those of (Samdani et al., 2025) who found that elevated Aminotransferase level indicate hepatic involvement in 85% of dengue case; AST and ALT levels were significantly higher in DHF patients then in DF patients (AST ratio 286 VS 98 IU/L, $p < 0.001$; ALT: 198 VS 68 IU/L, $p < 0.001$). To date, very little clinical awareness of liver damage as one of the significant effects of dengue. The thorough Systematic review (Campana et al., 2024). These issues were highlighted and good correlation between higher AST and ALT level with disease progression and mortality was found in (2024) published in virology.

In a cut-cross sectional study of 149 dengue patients (68 in DHF and 81 in DF) conducted in Islamabad, (Saghir et al., 2023) found an elevated ALT in 87.23% of the DHF patients and 4.26% of DF patients ($p = 0.007$), with 68% of the patients appearing with the study. This was a finding that was very similar to our own and it indicated that there was a positive correlation between increased enzymes and severity in the clinical presentation, as shown in this investigation. In another study, whereby (Nguyen et al.) Recruited 230 children in Vietnam, AST and ALT levels were found to be significantly higher in severe dengue compared to non-severe dengue (146.0 vs. 43.3 U/L for AST and 86.0 vs. 23.0 U/L for ALT respectively; $p < 0.001$). This finding has been validated with the aminotransferases as markers of severity in dengue. Additionally, (Priyangika et al., 2021) in a Sri Lankan study demonstrated that transaminase levels were found to be elevated in the febrile stage and were helpful in identifying severe dengue in adults admitted to tertiary care hospital.

At the moment, 161 (80.5%) had AST dominance (AST/ALT > 1) while the remaining 39 patients (19.5%) had ALT dominance (AST/ALT < 1). This is a reversed ratio of AST/ALT as compared to other viral hepatitis, and has been reported frequently and is considered a marker of liver involvement in dengue. The findings of (Sadiq et al., 2024) published in Journal of Rawalpindi Medical College revealed that there was an increase in AST within three days of infection in 71.7% patients while 50% patients had elevated ALT levels, As mentioned in this publication, the

AST/ALT ratio can be used as an early diagnostic parameter and is indicative of the diagnosis, dengue hepatitis.

The results of this study will greatly contribute to the understanding of clinical and public health aspects of managing dengue in Faisalabad and in Pakistan as a whole. Standard liver function testing is performed at the time of diagnosis of dengue as both ALT, AST are almost raised in all dengue patients, with a very high level in DHF patients. This is especially crucial in low resource countries, though, there is a pressing need for a biomarker accessible and affordable for early risk assessment. In the same way, the researchers from Nepal, (Wagle et al., 2025) came up with their results in the paper titled liver enzyme screening in early risk stratification and clinical management of dengue patients in resource poor settings. Otherwise, the WHO guidelines for dengue in 2009 (WHO, 2009) also suggested AST or ALT \geq 1000 U/L as a criterion for severe dengue which we strongly recommend to be applied in the clinical practice in Pakistan.

Conclusion:

The result shows that hepatic failure is one of the most common sign of dengue infection. Higher concentration of ALT and AST, especially AST, might be considered as important biochemical marker that could be utilized to monitor progression and severity of the disease in the dengue patient

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