

Haematological Changes in Dengue Patients: A Meta-Analysis of Studies in Nepal

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Abstract

Dengue is one of the most important viral infection in Nepal, transmitted to humans from the bite of infected mosquito. This disease is highly prevalent in the *Terai* region, mostly in urban cities of Nepal. This disease is insect born disease and is transmitted to human through the bite of female aedes mosquito. It is known that the infection of this virus causes lower in white blood cell (WBC) and this condition is known as leukopenia due to depletion of bone marrow. Therefore, it is necessary to study the haematological parameters, especially the WBC for the proper diagnosis, management and prognosis of this viral infection. The objective of this meta-analysis is to understand the impact of dengue virus on the haematology of patients from Nepal. A meta-analysis was performed where several articles related to the topic of interest were searched and reviewed. The analysis of the data showed that the average neutrophils was 62.13 ± 5.55 %, lymphocytes was 24.19 ± 3.29 %, eosinophils was 1.35 ± 0.27 %, platelets count was 16326.10 ± 11812.93 cells/ μ l and the total leukocytes counts was 4542.91 ± 269.23 cells/ μ l. The data showed a significantly lower ($p < 0.05$) total leukocytes counts in dengue infected groups than in control group. In conclusion, the study showed a significant decrease in total leukocyte counts in dengue-infected patients, which can increase the risk of secondary infections. Further research, including surveys, can be valuable to understand the source of infection and contribute to minimizing its transmission.

Keywords: dengue, haematology, leucocytes, platelets

1. Introduction

Dengue is one of the most important viral infection in Nepal, transmitted to humans from the bite of infected mosquito. This disease is highly prevalent in the terai region, mostly in urban cities of Nepal. This disease is characterized by high fever usually higher than 104 F, severe headache, pain in joints, bones and eyes, nausea and vomiting (Nyenke et al., 2023). This disease can be fatal in severe cases, therefore requires proper diagnosis and immediate treatment. Usually, the disease is supported by the analgesic medicines as there is no target drug against the virus. The first case of dengue was reported in 2004 in Nepal. Since then, there has been report of yearly outbreaks, especially in rainy seasons. According to Ministry of health and population of Nepal, there was more than 50 thousand cases of dengue in human with approximately 60 fatalities in the year of 2022. Out of the top districts reporting dengue cases, the highest numbers were from Kathmandu with 14,375, Lalitpur with 9,614 and Bhaktapur with 6,145 (Tamang et al., 2023). This disease is insect born disease and is transmitted to human through the bite of female aedes mosquito (Das et al., 2022). Nearly after, 8 to 10 days, the clinical signs start to appear with headache and high fever being the most common.

The method for the diagnosis of dengue is serological test, polymerase chain reaction amplification and haematological analysis. It is known that the infection of this virus causes lower in white blood cell (WBC) and this condition is known as leukopenia due to depletion of bone marrow. In severe cases, the WBC count has been reported lower than 2000 cells/ul. Therefore, it is necessary to study the haematological parameters, especially the WBC for the proper diagnosis, management and prognosis of this viral infection. The objective of this meta-analysis is to understand the impact of dengue virus on the haematology of patients from Nepal. Haematological profiling can provide essential data such as the level of platelets, WBC, RBC, neutrophils, eosinophils etc. which is critical for monitoring the severity of the infection. Therefore, this review aims to collect data from research articles on dengue infections, analyse the haematological profiles of dengue patients, compare these profiles with those of a control group, and conduct further statistical analyses to identify potential patterns and risk factors associated with dengue-related haematological abnormalities. This study will significantly help to understand the importance of dengue fever, its impact on blood haematology, earlier diagnosis, management and prognosis.

2. Materials and Methods

2.1 Literature search

The articles for this study were searched in different electronic databases (Google Scholar and PubMed) using the keywords “Dengue”, “Haematology” and “Nepal”.

The inclusion criteria were,

- Articles published between 2021 and 2025
- Study conducted in Nepal
- Study must contain haematological profiling of dengue infected patient
- Must be research articles

2.2 Data analysis

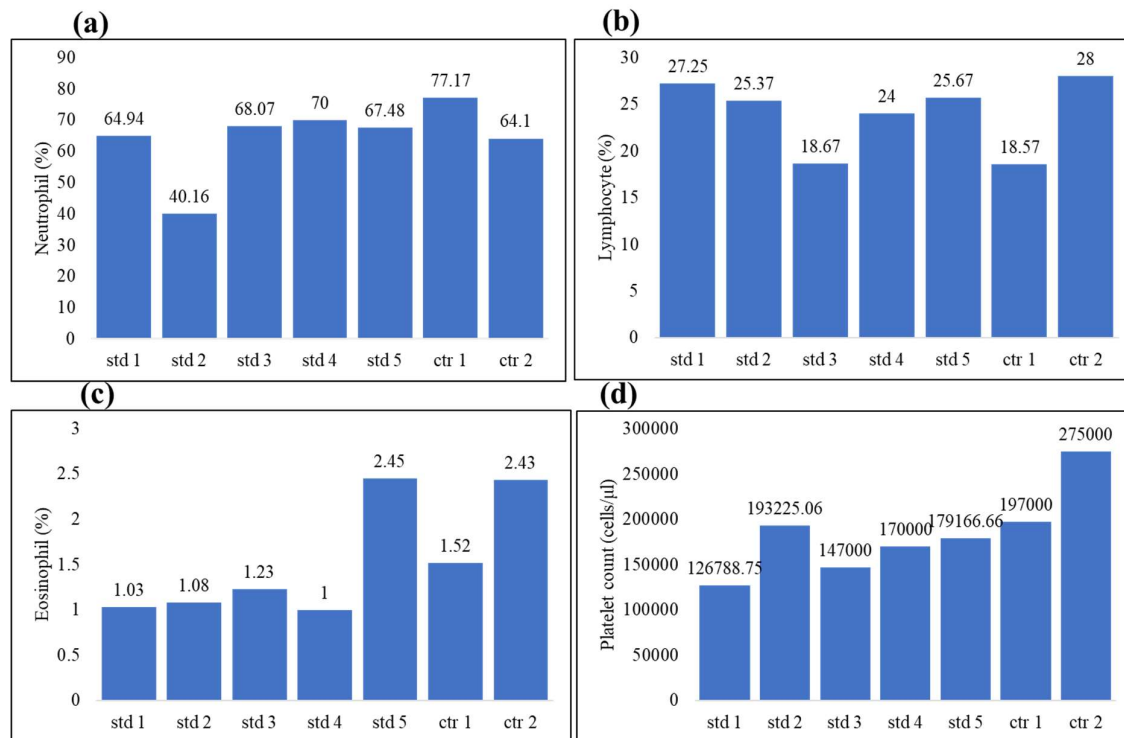
Data were extracted from the selected articles. The data category includes, publication year, experimental design, sample size, platelet count, neutrophils, eosinophils, basophils and total leukocyte counts. Descriptive analysis was used to summarize the extracted data. A random-effects meta-analysis was conducted to compare the haematological parameters of dengue patients with a control group. The data analysis such as independent t test was performed in excel.

3. Results

The total number of samples combined from all the articles were 2016 with 403.2 samples per research articles. The analysis of the data showed that the average neutrophils was 62.13 ± 5.55 %, lymphocytes was 24.19 ± 3.29 %, eosinophils was 1.35 ± 0.27 %, platelets count was 16326.10 ± 11812.93 cells/ μ l and the total leukocytes counts was 4542.91 ± 269.23 cells/ μ l (Tamang et al., 2023; Jha et al., 2022; Rai et al., 2024; Thapa et al, 2023; Tuladhar et al., 2024).

Figure 1: Haematological Parameters of Individual Samples

Bar plot illustrating the haematological parameters of individual biological samples, a. neutrophils, b. lymphocytes, c. Eosinophils and d. platelets count.



The figure 1 showed that there was a slight variation in the haematological parameters between dengue infected and uninfected samples. However, statistical analysis revealed no significant differences in most of the parameters except for total leukocytes counts.

Table 1: Hematological Comparison: Dengue vs. Controls

Table showing a comparison of hematological parameters between dengue-infected individuals and a healthy control group. The table includes mean values, standard deviations, and statistical significance levels for key parameters.

SN	Parameters	Groups	Mean	P value
1	Neutrophil (%)	Dengue patient	62.13±5.55	0.39
		Dengue free patient	70.63±6.53	
2	Lymphocyte (%)	Dengue patient	24.19±3.29	0.88
		Dengue free patient	23.28±6.66	
3	Eosinophil (%)	Dengue patient	1.35±0.27	0.36
		Dengue free patient	1.95±0.45	
4	Platelet count (cells/ μ l)	Dengue patient	16326.10±11812.93	0.32
		Dengue free patient	236000.00±39000.00	
5	Total leucocyte count (cells/ μ l)	Dengue patient	4542.91±269.23	0.003*
		Dengue free patient	6760.00±240.00	

The extracted data was compared with the control group which showed a significantly lower ($p < 0.05$) total leukocytes counts in dengue infected groups as represented in table 1.

4. Discussion

The analysis of the data revealed that the infection of dengue significantly alters the haematological parameters in human beings. The study of several haematological parameters showed that the Neutrophils, lymphocytes, eosinophils and platelets counts slightly decrease in most of the case of dengue but didn't change significantly. Neutrophils and lymphocytes are known to increase in number when bacteriological infections occur (Chan et al., 2021). However, in this case, they decreased which shows a significant clinical importance. Although, the decrease was not significant, the decrease in immune cells has a significant health implication such as it increases the risk of potential secondary infections. Similarly, the decrease of platelets can show the potential risk of thrombocytopenia which is a key feature of dengue (Vijay et al., 2022). The primary function of platelets is to clot blood to prevent bleeding by the process of thrombocytosis. Since, there was no significant decrease in platelets count, shows the majority of the infections were not severe.

The analysis showed a major change in total leucocytes count between dengue infective group and non-infective group. Upon sever infection, the leucocytes count significantly dropped in the dengue infected groups. Several researches have shown a significant reduction in leucocytes counts after the infection of dengue (Zeb et al., 2024). Dengue virus severely affects the bone marrow and disrupts the production of WBC (Losada et al., 2022). Moreover, the dengue virus can directly attack and kill the WBC resulting in lower leucocytes counts. This condition leads to the increase risk of secondary infection, severe bleeding and organ dysfunction. Therefore, monitoring the total leucocytes count for the diagnosis of dengue patient can provide important information required for better prognosis.

As this analysis was solely dependent on secondary data, several key parameters were unavailable. Key parameters such as the impact of infection on liver function and the direct impact on bone marrow formation could provide some important insights. Similarly, the

addition of a survey about the signs, symptoms, demographics, and environment could help understand the source of infection and contribute to minimizing such routes.

5. Conclusion

In conclusion, the study showed a significant decrease in total leukocyte counts in dengue-infected patients, which can increase the risk of secondary infections. Therefore, monitoring haematological parameters can aid in the diagnosis, prognosis, and management of this disease. As this research solely depended on secondary data, it may have impacted the key outcomes. Therefore, further research, including surveys, can be valuable to understand the source of infection and contribute to minimizing its transmission.

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