Effects of Carica papaya leaf extract on platelet recovery in dengue fever

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ABSTRACT
Dengue infection is a major global health threat, often manifesting as thrombocytopenia. While *Carica papaya* is traditionally used to enhance platelet counts, synthesized clinical evidence regarding its efficacy remains limited. This study evaluated the effectiveness of *Carica papaya* leaf extract (CPLE) on platelet count recovery in adult dengue patients. Following PRISMA 2020 guidelines, a systematic literature search was conducted across two databases (PubMed and Google Scholar) to identify randomized controlled trials (RCTs) published between 2012 and 2024. Risk of bias was assessed using Cochrane RoB 2, and data were analyzed in R Studio using a random-effects model. Four RCTs involving 279 adult participants were included. The meta-analysis demonstrated that CPLE significantly increased platelet counts compared to controls, with a pooled mean difference of 14.34 × 10^3/μL (95% CI: 5.90 to 22.77; p = 0.0124 for overall effect). Statistical heterogeneity was low-to-moderate (I^2 = 27.0%), indicating a generally consistent therapeutic direction. In conclusion, CPLE serves as a viable adjunctive therapy for accelerating platelet recovery in adult dengue patients. However, given the sensitivity of the pooled estimates to specific highly weighted trials, future large-scale, rigorously blinded RCTs are needed to solidify these findings and confidently support their integration into clinical management protocols.
Keywords: *Carica papaya*; dengue fever; thrombocytopenia; platelet recovery; meta-analysis; adjucntive therapy

INTRODUCTION
With an estimated 100–400 million infections annually, dengue fever (DF) poses a severe global health and socio-economic burden [1,2]. The clinical spectrum ranges from a self-limiting febrile illness to severe forms like Dengue Shock Syndrome (DSS) and Dengue Hemorrhagic Fever (DHF) [3], driven by viral NS1 protein interactions causing systemic plasma leakage [4,5]. A hallmark of this infection is thrombocytopenia (<150,000/μL) [6], resulting from a complex interplay between immune-mediated peripheral destruction and bone marrow malfunction [7,8]. Because severe thrombocytopenia significantly increases the risk of spontaneous bleeding [9], current global clinical guidelines prioritize fluid resuscitation and evidence-based symptom control [10].

To complement conventional treatments, the integration of traditional medicines is increasingly recognized as a viable approach in national healthcare optimizations [11,12]. *Carica papaya* leaf extract (CPLE) is a prominent example; its utility is deeply rooted in regional ethnopharmacopoeia, such as the Balinese *Usada Taru Pramana*, which historically identifies its pharmacological potential [13,14]. Transitioning from traditional preparations to modern standardized extracts, CPLE has emerged as a practical adjunctive treatment to accelerate platelet recovery [15–18]. Supported by rigorous toxicological safety evaluations [19] , its bioactive compounds, such as carpaine and quercetin, have been shown to upregulate ALOX12 and PTAFR genes, triggering megakaryocyte differentiation and platelet formation [20,21].

Despite multiple pilot studies and randomized controlled trials (RCTs) demonstrating that CPLE significantly improves platelet counts and reduces hospital stays [22,23], methodological variability has yielded mixed conclusions in the broader literature. This uncertainty is critical given that conventional interventions, such as prophylactic platelet transfusions, frequently fail to enhance clinical outcomes and carry inherent risks [9,24,25]. Consequently, a rigorous quantitative synthesis is urgently needed to establish clinical consensus [26].

This systematic review and meta-analysis of RCTs aims to conclusively evaluate the efficacy of CPLE on platelet recovery in dengue patients, clarifying the robustness of available clinical evidence and informing future management protocols.

METHODS
Study design & eligibility criteria (PICOS framework)
This study employed a systematic review and meta-analysis design focusing on randomized controlled trials (RCTs). To guarantee reproducibility and transparency, the methodology adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 declaration [27]. The protocol for this review was not registered in PROSPERO. The primary focus of the study protocol was the clinical outcomes of administering *Carica papaya* leaf extract (CPLE) to patients with dengue fever. Studies were screened and selected based on predefined inclusion criteria framed by the PICOS (Population, Intervention, Comparison, Outcome, Study design) parameters, restricted to English and Indonesian publications.

Table 1. PICOS Framework

Question	Application of the criteria
P	Patients diagnosed with dengue fever including dengue hemoragic fever regardless of age or sex
I	Administration of Carica papaya leaf extract in any pharmaceutical formulation (liquid extract, tincture, or capsule)
C	Placebo or standard therapy witout *Carica papaya* leaf extract
O	Primary outcome: Platelet count × 10^3/μL, reported as mean ± standard deviation at the study-defined endpoint
S	Randomized Controlled Trial (RCT)

Search strategy and information sources

A comprehensive systematic literature search was performed across two primary electronic databases: PubMed and Google Scholar, from inception up to March 2026. To maximize retrieval, different search strings were optimized for each database to accommodate their specific indexing and search algorithms. For PubMed, an optimized Boolean search string using MeSH terms and publication types was utilized: ("*Carica papaya*" OR "papaya leaf extract" OR CPLE) AND (dengue OR "dengue fever" OR "dengue hemorrhagic fever") AND (randomized OR randomised OR RCT OR trial) AND (platelet OR thrombocytopenia).

For Google Scholar, a specific keyword-based string ("*Carica papaya* leaf extract" dengue randomize) was applied to capture gray literature and journals not indexed in PubMed. Due to the search engine's algorithm returning an unmanageable volume of broadly related documents, the Google Scholar search was purposefully restricted to the first 200 relevance-ranked hits. This is a recognized methodological practice to efficiently capture the most pertinent gray literature without compromising search feasibility.

Data extraction and management

Data extraction began with screening titles and abstracts. After all databases were screened, a full-text assessment was performed. The extracted data was entered into an extraction table, which included study characteristics (authors, year, country), participant demographics (sample size, age, baseline platelet count), intervention details (formulation, duration), and clinical outcomes (mean platelet count and SD at the endpoint).

Risk of bias assessment

The Cochrane Risk of Bias tool for randomized controlled trials (RoB 2) was used to evaluate the methodological quality of the included RCTs. There are 5 domains that are assessed: Bias arising from the randomization process, deviations from intended interventions, missing outcome data, measurement of the outcome, selection of the reported result. Discrepancies were resolved through consensus or consultation with a third reviewer.

Statistical analysis

Statistical synthesis was carried out using a random-effects model to account for clinical and methodological heterogeneity. Between-study variance (tau^2) was calculated using the Restricted Maximum Likelihood (REML) estimator, and the Hartung-Knapp adjustment was used to control for type 1 error, ensuring conservative 95% confidence intervals (CIs). All outcomes are reported as mean platelet counts (cells/mm^3) and pooled as mean differences. Heterogeneity was quantified using the I^2 statistic (with >50% indicating substantial heterogeneity) and tau^2. All analyses, including forest plots and sensitivity analyses, were performed using R version 5.4.2 ('meta' and 'metafor' packages).

RESULTS

Study selection

A systematic data search was used to identify an initial 263 records. Four randomized controlled trials (RCTs) were selected for inclusion in the quantitative synthesis after thorough text evaluation and abstract screening. The PRISMA flowchart (Figure 1) shows the complete selection process.

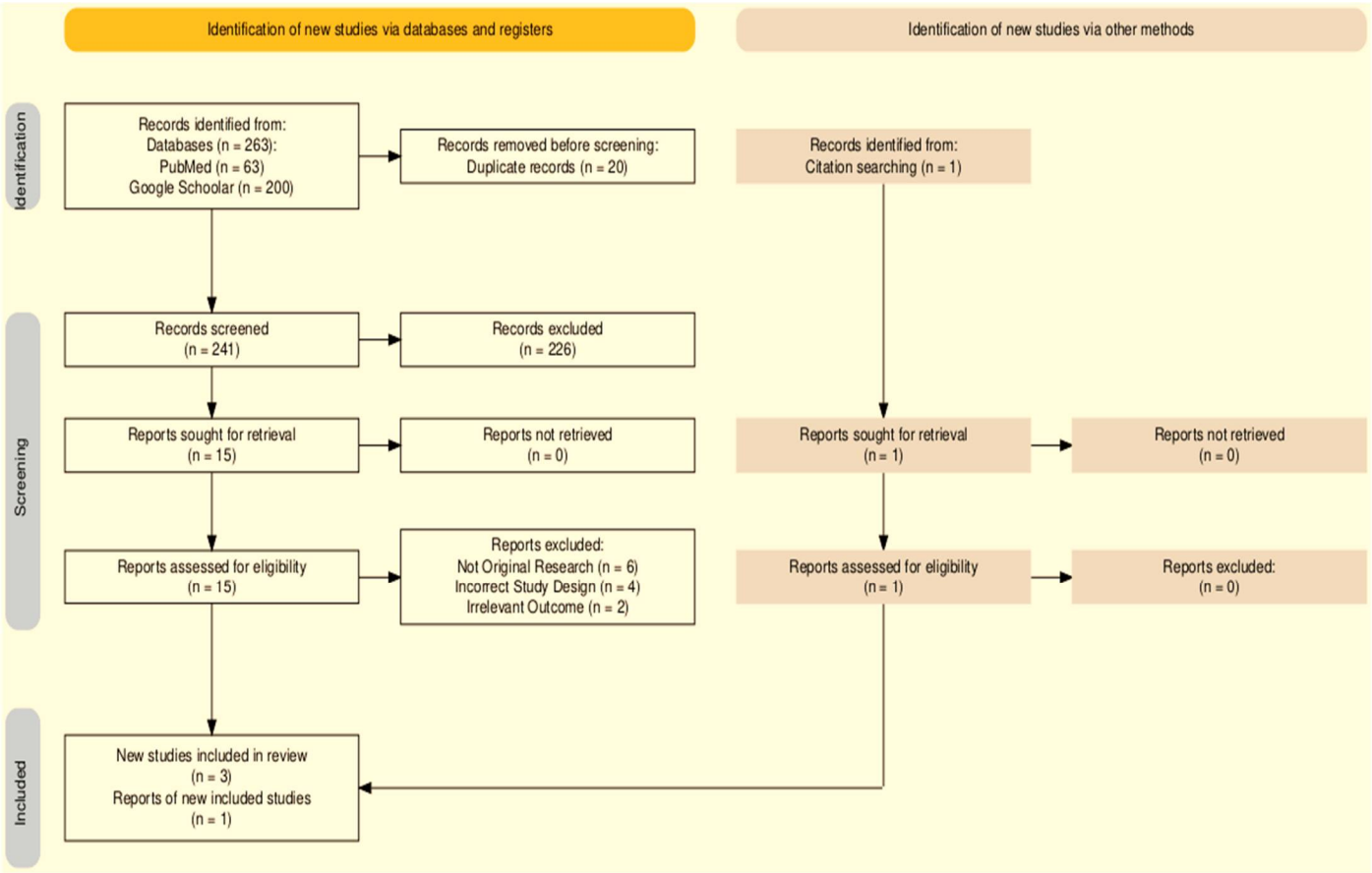

Figure 1. PRISMA 2020 flowchart [28]

Study characteristics

A total of 279 people participated in the four randomized controlled trials (RCTs). The pharmaceutical formulations and geographic locations differed, according to the study. Table 1 summarizes detailed characteristics of the studies, including dosage and baseline demographics.

Table 1. Study characteristics

Authors, year	Country	Sample size	Age	Baseline platelet count (×10³/µL)	Formulation	Dosage	Duration	Mean platelet count (×10³/µL)
Singh et al., 2023 [16]	India	50	<20 to >40 years	112.52	Homeopathy *Carica papaya* mother tincture	10 drops dissolved in water, 3 times a day	Not specifically stated in number of days	Treatment: 217.25 ± 57.89 Control: 174.48 ± 69.01
Yunita et al., 2012 [15]	Indonesia	80	15 – 55 years	Treatment: 98.33 ± 38.72 Control: 100.10 ± 28.98	*Carica papaya* leaf extract capsule	2 Capsule (550 mg each), 3 times a day	3 to 5 days (based of length of stay)	Treatment: 133.88 ± 33.96 Control: 117.48 ± 24.55
Kaspa & Govindu, 2020 [17]	India	30	18 – 60 years	Treatment: 38.87 ± 5.29 Control 39.73 ± 4.38	*Carica papaya* leaf extract tablet	1100 mg (not specified)	5 days	Treatment: 96.13 ± 7.74 Control: 81.40 ± 6.62
Hettige et al. 2020 [18]	Sri Lanka	119	18 – 60 years	Treatment: 105.09 ± 41.70 Control: 107.37 ± 45.57	*Carica papaya* leaf pure extract dissolved in water	20 ml given each 12 hours (2 times a day)	Based of length of stay (average length of intervention stay 3.69 days)	Treatment: 67.47 ± 33.39 Control: 60.96 ± 33.74

In conjuction with these characteristic, the methodological quality of the four RCTs was evaluated using the Cochrane RoB 2 tool. Overall the assesment identified “some concerns” across all studies.

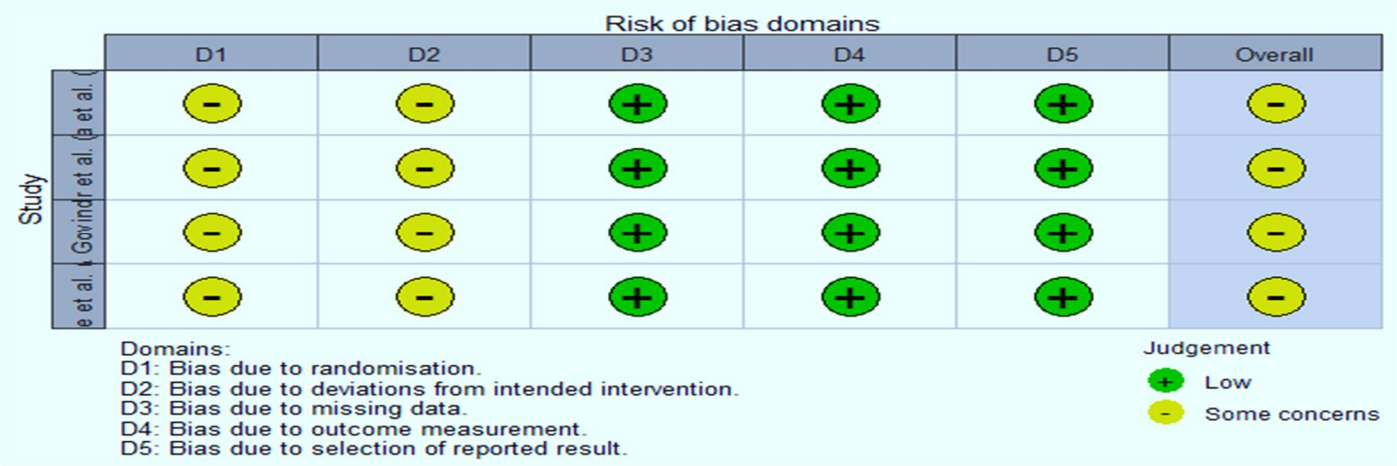

Figure 2. Cochrane risk of bias 2 tool summary

Quantitative synthesis

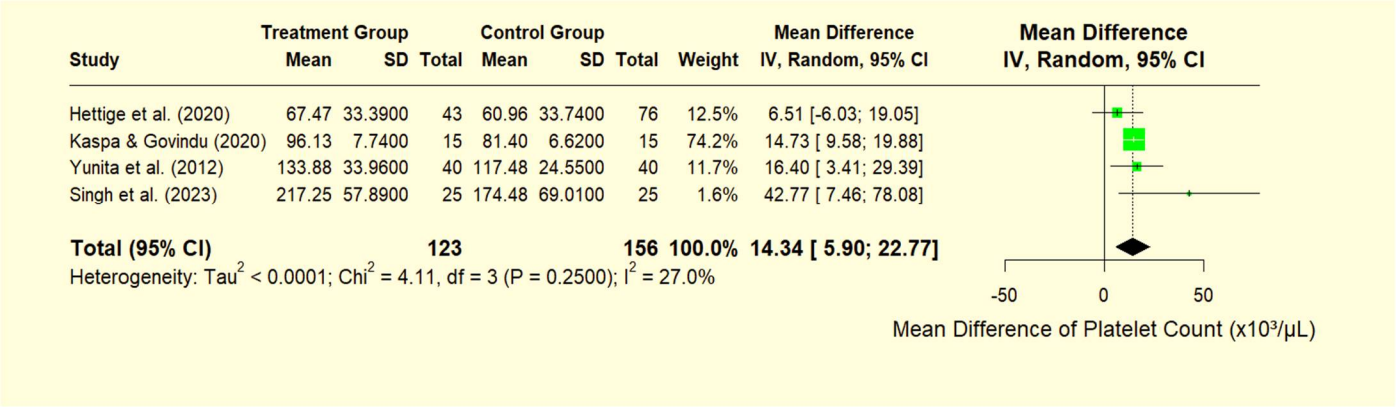

Figure 3. Forest plot of the random-effect meta-analysis evaluating the effect of CPLE on the platelet count (10³/µL). The square size indicates the weight of each study, and the horizontal line indicates the 95% confidence interval (CI). The pooled mean difference is indicated by the diamond below it.

Platelet counts in the CPLE group were statistically significantly higher than those in the control group, according to a pooled quantitative analysis, performed using a random-effects model with Hartung–Knapp adjustment. According to the meta-analysis, the pooled mean difference was 14.34 × 10^3/μL (95% CI: 5.90 – 22.77; p = 0.0124). There was very little statistical heterogeneity (I^2 = 27.0%), indicating a high degree of consistency across trial results, despite differences in dosage form and geographic location. Across each study, the forest plot (Figure 3) showed a consistent direction of effect favoring the CPLE intervention.

Sensitivity analysis

A leave-one-out sensitivity analysis was conducted to establish the robustness of the pooled estimates and evaluate the influence of individual studies. While the positive direction of the therapeutic effect remained consistent across all iterations (pooled mean difference ranging from 13.88 to 15.46 × 10^3/μL), the statistical significance was sensitive to the removal of specific trials. Notably, the omission of the study by Kaspa & Govindu (2020) or Yunita et al. (2012) resulted in a loss of statistical significance, yielding 95% CIs of -18.07 to 47.56 and -3.33 to 31.13, respectively. This indicates that the overall pooled effect is heavily driven by these specific trials. Conversely, the omission of Singh et al. (2023) completely resolved the statistical heterogeneity, reducing I^2 to 0%, which suggests that this study was the primary source of variance within the meta-analysis.

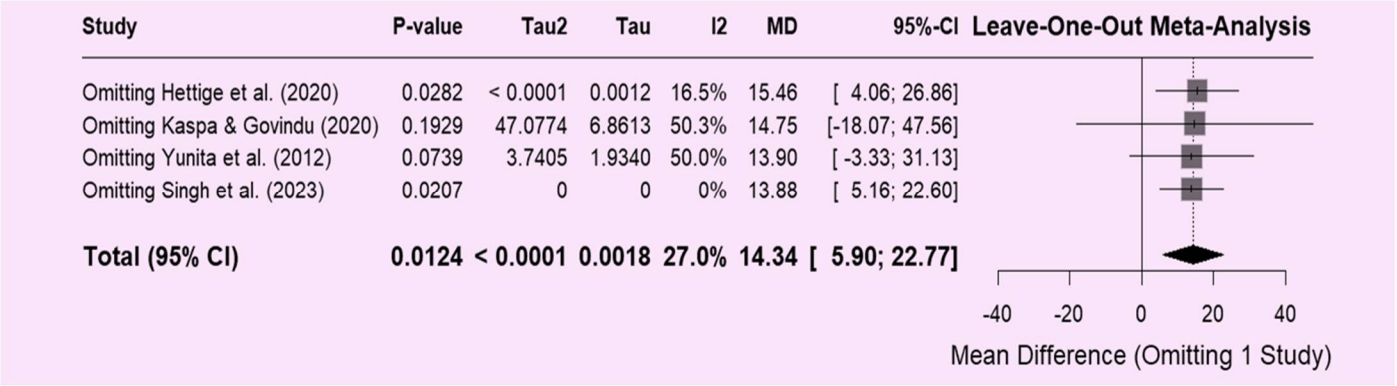

Figure 4. Leave-one-out sensitivity analysis

DISCUSSION

Interpretation of the primary finding

The results of this meta-analysis quantitatively validate the efficacy of CPLE in endemic areas. The pooled analysis demonstrated a statistically significant mean difference of 14.34 × 10^3/μL (p = 0.0124), indicating that CPLE effectively accelerates platelet recovery in adult dengue fever patients. While the numerical increase may appear modest, its effectiveness as an adjunct therapy is reinforced by the consistent positive direction of effect across the included trials. Based on previous observations, CPLE effectively influences platelet dynamics within 24 to 48 hours. This aligns closely with the expected clinical trajectory, where hematological improvement typically begins around the fifth day of illness [18,29,30].

Clinical significance and patient safety

In clinical practice, an accelerated increase in platelet count of approximately 14,000 to 15,000/μL plays a critical role in patient management during the critical phase of dengue fever. This elevation can prevent platelet counts from dropping below the critical threshold for spontaneous bleeding (<20,000/μL). By stabilizing platelet levels, CPLE may significantly reduce the dependency on prophylactic platelet transfusions. This is particularly crucial given recent robust findings by Goh et al. (2024), which highlighted that such transfusions do not consistently yield better clinical outcomes and may introduce unnecessary risks and healthcare costs [9]. Reducing transfusion dependency minimizes exposure to transfusion-related adverse effects and allows for more efficient allocation of hospital resources, ultimately reducing patient burden and optimizing bed occupancy [6,31].

Proposed biological mechanism

The thrombopoietic properties of CPLE are primarily driven by bioactive compounds such as quercetin and carpaine, which upregulate ALOX12 and PTAFR gene expression. These molecular triggers are critical for megakaryocyte differentiation and subsequent platelet production [20,21]. The immunomodulatory and antioxidant capacity of these phytochemicals is consistent with the broader pharmacological profile of other regional medicinal plants (such as *Azadirachta indica* and *Syzygium cumini*), which have been similarly documented to control oxidative stress and improve histopathological structures [32,33]. In the specific context of dengue infection, CPLE complements direct megakaryocyte stimulation with dual-action anti-inflammatory and antiviral properties. By stabilizing the oxygen endothelium and modulating cytokine production, CPLE minimizes plasma leakage and immune-mediated platelet destruction, thereby mitigating both the hematological and virological burdens of the disease [22–24,34–36].

Consistency and generalizability (I^2 analysis)

A compelling aspect of this meta-analysis is the low-to-moderate overall statistical heterogeneity (I^2 = 27.0%), suggesting that the thrombopoietic action of CPLE is a robust biological phenomenon across different geographic locations (Indonesia, India, Sri Lanka) and formulations (extracts or capsules) [22,25]. However, the leave-one-out sensitivity analysis revealed important nuances regarding the data's robustness. While the therapeutic direction remained positive, the statistical significance of the pooled effect was heavily driven by the trials conducted by Kaspa & Govindu (2020) and Yunita et al. (2012); omitting either study resulted in a loss of statistical significance. Conversely, the omission of Singh et al. (2023) completely resolved the statistical heterogeneity (I^2 = 0%), indicating that this specific trial was the primary source of variance within the pooled analysis. These dynamics highlight the need for larger trials to solidify the statistical weight of the current evidence.

Limitation and risk of bias

Despite the noteworthy results, several limitations must be acknowledged. The overall assessment of "some concerns" using the RoB 2 tool indicated ambiguities in the reporting of randomization and allocation concealment procedures in the primary studies. While the objective nature of automated platelet counting minimizes the risk of detection bias (Domain 4), more rigorously documented and double-blinded trials are required to ensure absolute internal validity. Furthermore, due to the relatively small total sample size (n = 279), conducting robust subgroup analyses based on dengue severity grades or specific viral serotypes was not feasible.

CONCLUSION

Carica papaya leaf extract (CPLE) significantly accelerates platelet recovery in dengue patients, with consistent positive effects across diverse study settings. Although sensitivity analyses show that the strongest statistical signals come from a few highly weighted trials, the overall trend; supported by objective laboratory platelet counts indicates meaningful clinical benefit. Faster hematologic recovery may help prevent progression to severe hemorrhagic states and reduce reliance on prophylactic transfusions, especially in resource-limited settings. To support formal clinical adoption, future research should include large, rigorously blinded, multi-center randomized trials that assess broader clinical outcomes such as major bleeding events and hospital length of stay.

Ethical consideration, competing interest and source of funding

-Since this study used a systematic literature review and meta-analysis design, ethical approval was not necessary. The study did not include human subjects, biological samples, or personally identifiable information; instead, it relied solely on secondary data and previously published research. Therefore, formal ethical approval and informed consent were not required in compliance with well recognized research ethics norms. However, the review was carried out transparently and responsibly, adhering to the standards of academic honesty and responsible research conduct and carefully citing all sources.

-There is no conflict of interest related to this publication.

-Source of funding is authors.

REFERENCES

1. World Health Organization. Dengue and severe dengue [Internet]. [cited 2026 Apr 3]. Available from: https://www.who.int/health-topics/dengue-and-severe-dengue#tab=tab_1
2. European Centre for Disease Prevention and Control. ECDC [Internet]. 2026 [cited 2026 Mar 2]. Dengue worldwide overview. Available from: https://www.ecdc.europa.eu/en/dengue-monthly
3. Guzman MG, Gubler DJ, Izquierdo A, Martinez E, Halstead SB. Dengue infection. Nat Rev Dis Primers. 2016 Aug 18;2(1):16055. doi:10.1038/nrdp.2016.55
4. Beatty PR, Puerta-Guardo H, Killingbeck SS, Glasner DR, Hopkins K, Harris E. Dengue virus NS1 triggers endothelial permeability and vascular leak that is prevented by NS1 vaccination. Sci Transl Med. 2015 Sep 9;7(304). doi:10.1126/scitranslmed.aaa3787
5. Jayathilaka D, Gomes L, Jeewandara C, Jayarathna GeethalSB, Herath D, Perera PA, et al. Role of NS1 antibodies in the pathogenesis of acute secondary dengue infection. Nat Commun. 2018 Dec 7;9(1):5242. doi:10.1038/s41467-018-07667-z
6. S. B. V, Kauser MM, Mangasuli V, S. R. VK, Sree S, Varghese SA. Effect of *Carica papaya* leaf extract (CPLE) on thrombocytopenia among dengue patients of tertiary care hospital, Chitradurga, India. International Journal of Advances in Medicine. 2018 Jul 23;5(4):974. doi:10.18203/2349-3933.ijam20183131
7. Duggal S, Rawat S, Siddqui G, Vishwakarma P, Samal S, Banerjee A, et al. Dengue virus infection in mice induces bone marrow myeloid cell differentiation and generates Ly6Glow immature neutrophils with modulated functions. J Leukoc Biol. 2024 Jan 5;115(1):130–48. doi:10.1093/jleuko/qiad099
8. Cherie TJJ, Choong CSH, Abid MB, Weber MW, Yap ES, Seneviratne SL, et al. Immuno-haematologic aspects of dengue infection: Biologic insights and clinical implications. Viruses. 2024 Jul 6;16(7):1090. doi:10.3390/v16071090
9. Goh ZJ, Li R, Wang MX, Chia PY, Lim JT. Transfusion of blood products and clinical outcomes for patients with dengue fever: A systematic review and meta-analysis. Open Forum Infect Dis. 2024 Aug 30;11(9). doi:10.1093/ofid/ofae507
10. World Health Organization. WHO guidelines for clinical management of arboviral diseases : dengue, chikungunya, zika and yellow fever. WHO; 2025.
11. Muderawan IW, Budiawan IM, Giri MKW. The potential of ayurvedic medicinal plants for prevention and therapeutic treatment of Covid-19: A review article. International Journal of Ayuvedic and Herbal Medicine. 2021;11(2):3954–96.
12. Agustini NMM, Giri MKW. Knowledge and perception of hebal medicine competencies among first year medical students. Jurnal Sains dan Kesehatan. 2025 May 31;6(1):67–72. doi:10.30872/jsk.v6i1.632
13. Purnama BIA, Lasmawan IW, Parmiti DP. Usadha Bali di era digital: Studi kasus persepsi, praktik, dan minat generasi muda terhadap tanaman obat lokal di Bali. Jurnal Pendidikan Biologi Undiksha. 2025 Dec 2;12(2):124–48. doi:10.23887/jjpb.v12i2.106894
14. Muderawan IW, Giri MKW, Widana GAB. Usada Taru Premana: The Balinese etnopharmacopoeia. International Journal of Ayuvedic and Herbal Medicine. 2024;14(5):4509–30.
15. Yunita F, Hanani E, Kristianto J. The effect of *Carica papaya L*. leaves extract capsules on platelets count. Int J Med Arom Plants. 2012;2(4):573–8.
16. Singh AK, G M, S M, S R. Role of homoeopathic medicine *Carica papaya* mother tincture in improvingplatelet count in cases of dengue fever-an add-on randomised single blind placebo controlled trial. World J Pharm Res. 2023;12(14):913–20.
17. Kaspa C, Govindu S. Effectiveness of *Carica papaya* leaf extract on thrombocytopenia among dengue patients admitted in a tertiary care hospital, South India -A Pilot Study. IJMSIR. 2020 Jun;5(3):80–4.
18. Hettige S, Pushpakumara J, Wanigabadu LU, Hettige EMR, Kottege A, SD J, et al. Controlled clinical trial on effect of *'Carica papaya'* leaf extract on patients with dengue fever. Journal of Clinical Medicine and Research. 2020 Jun;3(3):1–7.
19. Giri MKW, Sastri NLPP, Permasutha MB, Muderawan IW. Toxicological evaluation of ginger (*Zingiber afficinale*) and kayu secang (*Biancaea sappan*) extracts using brine shrimp (*Artemia salina L*.). Ganesha Medicine. 2024 Nov 18;4(2):118–23. doi:10.23887/gm.v4i2.85425

20. Subenthiran S, Choon TC, Cheong KC, Thayan R, Teck MB, Muniandy PK, et al. *Carica papaya* leaves juice significantly accelerates the rate of increase in platelet count among patients with dengue fever and dengue haemorrhagic fever. Evidence-Based Complementary and Alternative Medicine. 2013;2013:1–7. doi:10.1155/2013/616737
21. Munir S, Liu ZW, Tariq T, Rabail R, Kowalczewski PŁ, Lewandowicz J, et al. Delving into the therapeutic potential of *Carica papaya* leaf against thrombocytopenia. Molecules. 2022 Apr 25;27(9):2760. doi:10.3390/molecules27092760
22. Sathyapalan DT, Padmanabhan A, Moni M, P-Prabhu B, Prasanna P, Balachandran S, et al. Efficacy & safety of *Carica papaya* leaf extract (CPLE) in severe thrombocytopenia (≤30,000/µl) in adult dengue – Results of a pilot study. PLoS One. 2020 Feb 19;15(2):e0228699. doi:10.1371/journal.pone.0228699
23. Srivastava R, Jaiswal N, Kharkwal H, Dubey NK, Srivastava R. Phytomedical properties of *Carica papaya* for boosting human immunity against viral infections. Viruses. 2025 Feb 16;17(2):271. doi:10.3390/v17020271
24. Shoyshob TZ, Heya IA, Afrin N, Enni MA, Asha IJ, Moni A, et al. Protective mechanisms of *Carica papaya* leaf extract and its bioactive compounds against dengue: Insights and prospects. Immuno. 2024 Dec 12;4(4):629–45. doi:10.3390/immuno4040037
25. Maideen NMP, Balasubramanian R, Shanmugam A, Gobinath M, Hussain MHJ. A review of potentials of *Carica papaya* leaves in dengue viral infection – insights of clinical and preclinical studies. Drug Res. 2025 Feb 22;75(02):49–59. doi:10.1055/a-2509-8644
26. Charan J, Saxena D, Goyal J, Yasobant S. Efficacy and safety of Carica papaya leaf extract in the dengue: A systematic review and meta-analysis. Int J Appl Basic Med Res. 2016;6(4):249. doi:10.4103/2229-516X.192596
27. Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ. 2021 Mar 29;n71. doi:10.1136/bmj.n71
28. Haddaway NR, Page MJ, Pritchard CC, McGuinness LA. PRISMA2020: An R package and shiny app for producing PRISMA 2020-compliant flow diagrams, with interactivity for optimised digital transparency and Open Synthesis. Campbell Systematic Reviews. 2022 Jun 27;18(2). doi:10.1002/cl2.1230
29. Firmansyah Sabir MF, Suciangto W, Rahmani MZ, Eka Lestari A, Mubin RH. Potency of *Carica papaya* leaf extract as thrombocytopenia therapy for dengue hemorrhagic fever: A systematic review of randomized control trials. SCRIPTA SCORE Scientific Medical Journal. 2023 Mar 1;4(2):57–66. doi:10.32734/scripta.v4i2.9541
30. Yudisthira D, Firdausi FF, Alyani CF, Nurkolis F, Al Rasyid H, Yusuf VM, et al. Potential of *Carica papaya* leaf extract as an future medicine for thrombocytopenia in dengue patients: from traditional to scientific drug discovery. Advances in Traditional Medicine. 2024 Jun 25;24(2):389–402. doi:10.1007/s13596-023-00701-6
31. K. V, R. M. S, B. R. H. Role of *Carica papaya* leaf extract tablets/capsules on platelet counts in cases of dengue thrombocytopenia. International Journal of Advances in Medicine. 2018 Jul 23;5(4):845. doi:10.18203/2349-3933.ijam20182500
32. Dinata IGS, Udrayana O, Suparna K. Diabetic foot ulcer healing potential mechanism from *Azadirachta indica* (Neem) leaves. Journal of Ayurvedic and Herbal Medicine. 2023;9(4):92-8.
33. Rahmayani I, Christi A GJ, Hasanah AR N. Potensi tanaman jamblang (*Syzygium Cumini L*) Sebagai antidiabetes: Literatur review. Media Kesehatan Politeknik Kesehatan Makassar. 2023;18(1):45–55.
34. Masooma, Qaiser A, Ali DS, Manzoor DS. Prospects of *Carica papaya* in the treatment of human viral infections: A comprehensive and a systematic review. Heliyon. 2024 Nov;10(21):e39635. doi:10.1016/j.heliyon.2024.e39635
35. Sarker MdMR, Khan F, Mohamed IN. Dengue Fever: Therapeutic potential of *Carica papaya L*. Leaves. Front Pharmacol. 2021 Apr 26;12. doi:10.3389/fphar.2021.610912
36. Mohd Abd Razak, Mohd Ridzuan, Mohmad Misnan N, Md Jelas NH, Norahmad NA, Muhammad A, et al. The effect of freeze-dried Carica papaya leaf juice treatment on NS1 and viremia levels in dengue fever mice model. BMC Complement Altern Med. 2018 Dec 5;18(1):320. doi:10.1186/s12906-018-2390-7