International Journal of Trend in Scientific Research and Development (IJTSRD)
Volume 9 Issue 3, May-Jun 2025 Available Online: www.ijtsrd.com e-ISSN: 2456 – 6470

Comprehensive Evaluation of Mashak Jaal: A Novel Pediatric Mosquito Repellent Formulation

Sreedevi AP[1], Maneesha KS[2], Anu Joy[3], Reeshma CR[4], Sibi Narayanan[5], Adithya Peethambara Panicker[6]

[1,3]Research Officer, [2]Jr. Officer, [4]Jr. Chemist, [5]Manager,
[1,2,3,4,5]R& D Department, Sitaram Ayurveda Pvt. Ltd., Kerala, India
[6]AGM-M&I, Sitaram Ayurveda Pvt. Ltd., Kerala, India

ABSTRACT

Introduction: Mosquito-borne diseases like malaria, dengue, and Zika pose serious risks to children, especially in tropical regions. While synthetic repellents are effective, their safety concerns highlight the need for natural alternatives. Mashak Jaal is a herbal mosquito repellent formulated with Aloe Vera, *Devadaram, Tulasi, Ramacham*, and lemongrass oil, offering gentle, long-lasting protection. This study evaluates its efficacy, safety, and acceptability in children aged 1 to 12 years, aiming to support safer, child-friendly mosquito prevention strategies.

Objective: To evaluate the efficacy, safety, and acceptability of Mashak Jaal in reducing mosquito bites and ensuring user satisfaction over a 15-day period.

Methods: A prospective, open-label study was conducted with 50 children aged 1–12 years residing in mosquito-prone areas. Efficacy was assessed using a 7-domain questionnaire covering mosquito bite reduction, duration of repellent effect, skin safety, sensory acceptance, perceived effectiveness, parent satisfaction, and future use.

Results: Mashak Jaal achieved a mean total score of 29.8 ± 3.2, with 82% of participants rated in Grade A (27–31, high efficacy) or A+ (32–35, excellent efficacy). Significant bite reduction (Grade 4 or 5 in 78% of cases) and prolonged repellent effect (4–6 hours in 70%) were observed. No adverse skin reactions were reported, and 88% of parents were satisfied or very satisfied.

Conclusion: Mashak Jaal is a highly effective, safe, and well-accepted mosquito repellent for children, offering a natural alternative to synthetic formulations. Its integration into pediatric care in mosquito-prone regions is recommended.

How to cite this paper: Sreedevi AP | Maneesha KS | Anu Joy | Reeshma CR | Sibi Narayanan | Adithya Peethambara Panicker "Comprehensive Evaluation of Mashak Jaal: A Novel Pediatric Mosquito Repellent Formulation" Published in International Journal of Trend in Scientific Research and Development (ijtsrd), ISSN: 2456-6470, Volume-9 | Issue-3, June 2025, pp.395-401, URL: www.ijtsrd.com/papers/ijtsrd79839.pdf

IJTSRD79839

KEYWORDS: *Mosquito repellent, Peadiatric, Mashak Jaal, Ayurvedic formulation, Clinical study*

1. INTRODUCTION

Mosquito-borne diseases, such as malaria, dengue, chikungunya, and Zika, represent a formidable public health challenge, particularly in tropical and subtropical regions where environmental conditions favor mosquito proliferation . According to the World Health Organization, malaria alone caused an estimated 241 million cases and 627,000 deaths globally in 2020, with children under five years accounting for 77% of fatalities [1]. Dengue, with an estimated 390 million infections annually, and Zika, linked to congenital anomalies, further exacerbate the burden on pediatric populations [2, 3]. These diseases not only contribute to significant morbidity and mortality but also impose substantial economic and social costs on affected communities, perpetuating cycles of poverty and health inequity [4].

Children are particularly susceptible to mosquito-borne pathogens due to physiological and

behavioral factors. Their thinner skin facilitates easier penetration by mosquito proboscises, increasing bite frequency and pathogen transmission risk [5].

Additionally, childrens developing immune systems are less equipped to combat infections, leading to more severe disease manifestations [6]. Behavioral tendencies, such as playing outdoors during peak mosquito activity periods (dawn and dusk), further heighten exposure [7]. Consequently, effective mosquito bite prevention is critical for pediatric populations, necessitating repellents that are both safe and efficacious for young users.

Synthetic mosquito repellents, notably those containing N,N-Diethyl-meta-toluamide (DEET), have been the cornerstone of bite prevention for decades due to their proven efficacy [8]. However, DEET-based products are not without drawbacks, particularly for children. Reported adverse effects include skin irritation, allergic reactions, and, in rare cases, neurotoxicity, especially with prolonged or high-concentration use [5]. The American Academy of Pediatrics recommends limiting DEET concentrations to 30% for children and avoiding its use in infants under two months [9]. Other synthetic alternatives, such as picaridin and IR3535, offer improved safety profiles but may still cause irritation in sensitive pediatric skin [10]. Moreover, environmental concerns, including the non-biodegradability of synthetic compounds, have prompted a shift toward sustainable alternatives [11].

Mashak Jaal is a natural mosquito repellent cream formulated with a powerful blend of traditional herbal ingredients known for their protective and soothing properties. Enriched with Aloe Vera, *Devadaram* (*Cedrus deodara),* Tulasi (Holy Basil), Ramacham (Vetiver), and *Cymbopogon citratus* (lemongrass oil) etc. This formulation offers a safe and effective alternative to chemical-based repellents. Each ingredient plays a unique role—Aloe Vera moisturizes and soothes the skin, while Devadaram and Tulasi are renowned for their insect-repelling and antimicrobial benefits. Ramacham adds a calming aroma and enhances the overall effectiveness of the formula. Ideal for daily use, Mashak Jaal provides long-lasting protection against mosquitoes while being gentle on the skin, making it a suitable choice for both adults and children.

This study evaluates Mashak Jaals efficacy in reducing mosquito bites, its duration of protection, safety profile, sensory acceptability, and parental perceptions in children aged 1 to 12 years. By addressing the critical need for a child-friendly, natural repellent, this research seeks to contribute to safer and more sustainable mosquito protection strategies. The findings aim to inform public health interventions and guide the development of pediatric repellent formulations, particularly in regions burdened by mosquito-borne diseases.

2. Materials and Methods

2.1. Study Design

This study was a prospective, open-label, single-arm clinical trial conducted at Sitaram Ayurveda. The trial was designed to evaluate the efficacy, safety, and acceptability of Mashak Jaal, a herbal roll-on mosquito repellent, in a pediatric population residing in a mosquito-endemic region. A total of 50 children were enrolled over a 15-day intervention period, with data collection occurring at baseline (Day 0), mid-study (Day 7), and study completion (Day 15). The study protocol received approval from the Institutional Ethics Committee (IEC) of Sitaram Ayurveda Speciality Hospital, ensuring adherence to the ethical standards outlined in the Declaration of Helsinki (World Medical Association, 2013). Written informed consent was obtained from the parents or legal guardians of all participants prior to enrollment.

The open-label, single-arm design was selected to assess the real-world performance of Mashak Jaal under naturalistic conditions, reflecting its intended use as a consumer product. The 15-day study duration was chosen to provide sufficient time to evaluate efficacy and safety while maintaining high participant retention and compliance. The study setting, Thrissur, is characterized by a tropical climate conducive to high mosquito activity, making it an ideal location to test the repellent's effectiveness. To ensure data reliability, standardized procedures were implemented for participant recruitment, intervention administration, and outcome assessment.

2.2. Objectives

Primary Objective

The primary objective was to evaluate the efficacy of Mashak Jaal in reducing mosquito bites in children aged 1–12 years. Efficacy was measured using a validated 7-domain questionnaire, which assessed multiple dimensions of repellent performance, including bite reduction, duration of effect, and user experience.

Secondary Objectives

The secondary objectives were multifaceted and aimed to provide a comprehensive evaluation of Mashak Jaal:

- To assess the safety profile of the roll-on formulation, focusing on the incidence and severity of skin reactions such as irritation, erythema, or allergic responses.
- To evaluate sensory acceptance, particularly the smell and texture of the product, as reported by parents and children.

- To measure parent-reported satisfaction with the product's performance and ease of use.
- To determine the likelihood of parents recommending Mashak Jaal for future use, reflecting its potential for broader adoption.

2.3. Study Population

Inclusion Criteria

Participants were eligible for inclusion if they met the following criteria:

- Aged 1–12 years at the time of enrolment.
- Clinically healthy, with no evidence of acute or chronic illnesses, as confirmed by a medical examination conducted by a paediatrician.
- Free of dermatological conditions (e.g., eczema, psoriasis, or contact dermatitis) that could interfere with the safety assessment.
- Residing in mosquito-prone areas within Thrissur, defined as regions with reported high mosquito activity based on local public health data.
- Parents or guardians provided written informed consent and agreed to comply with the study protocol, including twice-daily application of Mashak Jaal.
- No use of other mosquito repellents (e.g., creams, sprays, coils, or electronic devices) during the study period to avoid confounding effects.

Exclusion Criteria

Participants were excluded if they:

- Were younger than 1 year or older than 12 years.
- Had existing medical conditions (e.g., asthma, diabetes, or immune disorders) or were taking medications that could affect skin sensitivity or study outcomes.
- Presented with active skin diseases or a history of severe allergic reactions.
- Demonstrated non-compliance with the study protocol, as assessed during screening or follow-up.
- Resided in areas with low mosquito activity, as determined by local environmental data.
- Used other mosquito repellents concurrently, which could interfere with the evaluation of Mashak Jaal.

The study population was recruited through community outreach and hospital-based screening, ensuring a diverse representation of children within the target age range. A screening log was maintained to document the reasons for exclusion, enhancing transparency in participant selection.

2.4. Intervention

Mashak Jaal is a roll-on mosquito repellent formulated with natural ingredients, suspended in a non-greasy, skin-friendly base. The formulation was developed to provide long-lasting protection against mosquito bites while being safe for pediatric use. Each roll-on container was standardized to deliver a consistent dose per application.

Participants were instructed to apply Mashak Jaal to exposed skin areas (arms, legs, and neck) twice daily—once in the morning and once in the evening for 15 consecutive days. To ensure proper application, parents received a demonstration during the enrolment visit. Compliance was monitored through daily diaries, where parents recorded the time and frequency of applications, and by inspecting the weight of returned roll-on containers at the end of the study. Non-compliance was defined as missing more than 20% of scheduled applications.

2.5. Outcome Measures

The efficacy of Mashak Jaal was assessed using a 7-domain questionnaire (Table 1), specifically designed to capture both objective and subjective aspects of repellent performance. Each domain was scored on a 5-point Likert scale (1 = lowest, 5 = highest), yielding a total score ranging from 7 to 35. The domains included:

1. Mosquito bite reduction: The extent to which the repellent reduced the frequency of mosquito bites.
2. Duration of repellent effect: The length of time the repellent remained effective after application.
3. Skin reaction/safety: The presence and severity of adverse skin reactions.
4. Sensory acceptance (smell): The pleasantness of the product's fragrance.
5. Perceived effectiveness: Parents' subjective assessment of the repellent's performance.
6. Parent satisfaction level: Overall satisfaction with the product's usability and efficacy.
7. Future use and recommendation: Willingness to continue using and recommend Mashak Jaal.

Total scores were categorized as follows:

- Grade C (7–17): Low efficacy, indicating minimal or no benefit.
- Grade B (18–26): Moderate efficacy, suggesting partial effectiveness.
- Grade A (27–31): High efficacy, reflecting strong performance across domains.
- Grade A+ (32–35): Excellent efficacy, indicating near-optimal outcomes.

Data were collected at three time points (Days 0, 7, and 15) through parent-reported questionnaires and clinical examinations conducted by trained healthcare professionals. The questionnaire was pre-tested for clarity and reliability in a pilot study involving 10

parents, with a Cronbach's alpha of 0.85, indicating good internal consistency. Clinical examinations included visual inspections of the skin to confirm parent-reported safety data. Mashak Jaal Questionnaire Domains And Grading given in Table 1.

Table 1: Mashak Jaal Questionnaire Domains And Grading

Criteria	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5
Mosquito Bite Reduction	No change	Slight reduction	Noticeable reduction	Significant reduction	Total prevention
Duration of Effect	<2 hours	2 hours	2–4 hours	4–6 hours	>6 hours
Skin Reaction/Safety	Severe reaction	Moderate reaction	Mild symptoms	Very mild symptoms	No reaction
Sensory Acceptance (Smell)	Strongly unpleasant	Mildly unpleasant	Neutral	Mildly pleasant	Pleasant
Perceived Effectiveness	Not effective	Slightly effective	Moderately effective	Effective	Very effective
Parent Satisfaction	Not satisfied	Slightly satisfied	Moderately satisfied	Satisfied	Very satisfied
Future Use & Recommendation	Not willing	Hesitant	Moderately recommended	Likely to recommend	Strongly recommend

2.6. Statistical Analysis

Descriptive statistics, including means, standard deviations, and percentages, were used to summarize demographic characteristics, questionnaire scores, and safety outcomes. To assess changes in efficacy scores from baseline (Day 0) to study completion (Day 15), paired t-tests were conducted for each domain and the total score. Repeated-measures analysis of variance (ANOVA) was used to evaluate trends in scores across the three time points (Days 0, 7, and 15), with post-hoc Bonferroni tests to identify specific differences. The normality of data distribution was verified using the Shapiro-Wilk test, and non-parametric alternatives (e.g., Wilcoxon signed-rank test) were planned for non-normally distributed data. A p-value <0.05 was considered statistically significant for all analyses. Statistical analyses were performed using SPSS version 25.0. A sample size of 50 was calculated to achieve 80% power to detect a mean difference of 5 points in total questionnaire scores, assuming a standard deviation of 8 points and a two-sided alpha of 0.05.

2.7. Safety Monitoring

Safety was monitored daily through parent-reported diaries, where any adverse events, such as skin irritation, erythema, or allergic reactions, were recorded with details on onset, duration, and severity. Clinical examinations were conducted at each study visit (Days 0, 7, and 15) by a dermatologist or pediatrician to verify parent-reported data and assess skin condition. Adverse events were classified using the Common Terminology Criteria for Adverse Events (CTCAE) version 5.0. Serious adverse events, defined as those requiring medical intervention or hospitalization, triggered immediate reporting to the IEC and potential discontinuation of the participant from the study. A Data Safety Monitoring Board (DSMB) was established to review safety data at regular intervals and ensure participant safety throughout the trial.

3. Results

3.1. Participant Characteristics

All 50 children enrolled in the study successfully completed it. The mean age was 6.8 years (± 3.1), with a gender distribution of 52% male and 48% female. All participants lived in mosquito-prone areas, with 60% from rural and 40% from urban settings. At baseline, the reported mosquito bite frequency ranged from 5 to 7 bites per day, indicating a significant burden of exposure prior to the intervention.

3.2. Efficacy Outcomes

By Day 15, the mean total efficacy score was 29.8 ± 3.2, showing substantial improvement. The majority of children attained high efficacy grades, with:

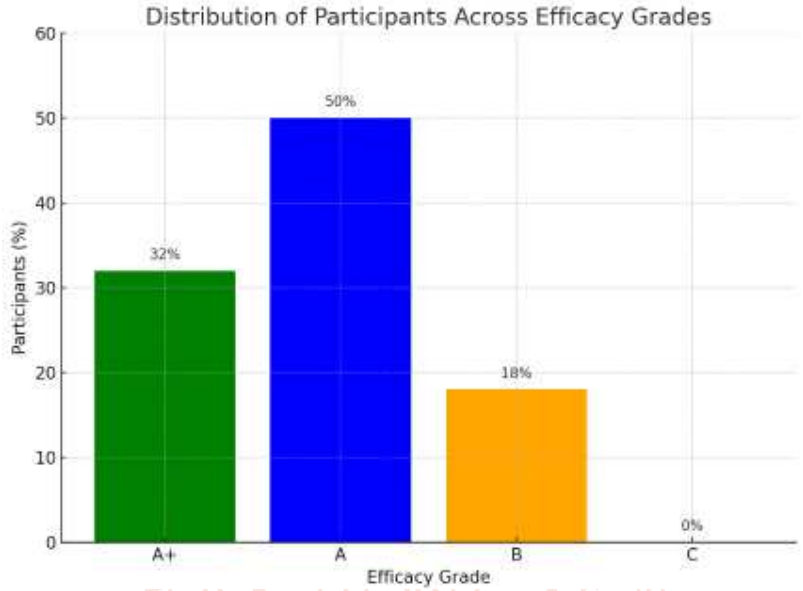
- 32% (n = 16) achieving Grade A+ (score 32–35),
- 50% (n = 25) achieving Grade A (score 27–31),
- 18% (n = 9) falling into Grade B (score 18–26),
- 0% in Grade C (score 7–17).

Details of distribution Of efficacy grades given in Table 2 and Figure 1

Table 2: Distribution Of Efficacy Grades

Grade	Score Range	Participants (%)	Mean Score (±SD)
A+	32–35	16 (32%)	33.4 ± 1.1
A	27–31	25 (50%)	28.9 ± 1.4
B	18–26	9 (18%)	23.7 ± 2.0
C	7–17	0 (0%)	–

Figure 1: Distribution Of Efficacy Grades

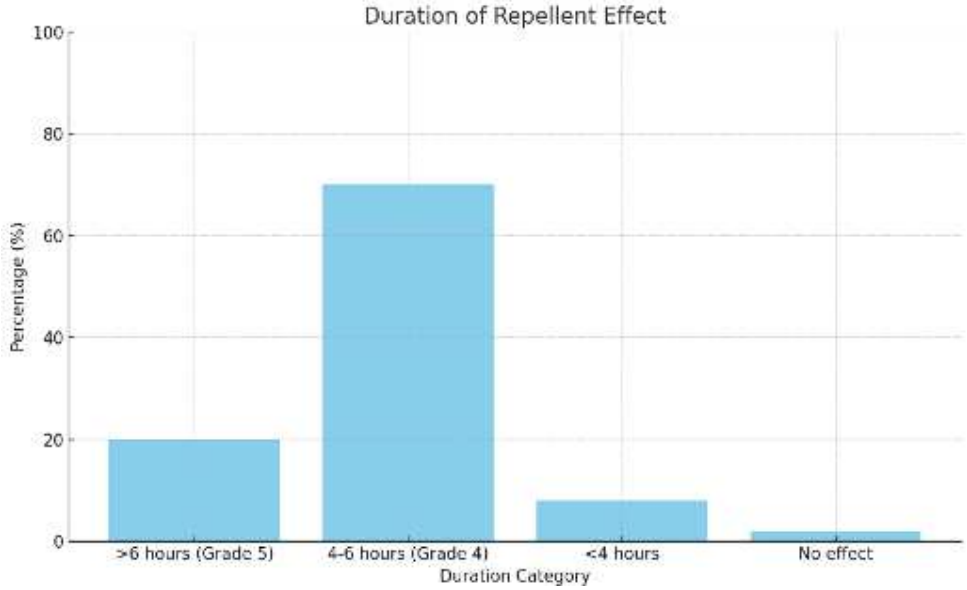


Details of duration of repellent effect given in Table 3 and Figure 2

Table 3 : Duration of Repellent Effect

Duration category	Percentage
>6 hours (Grade 5)	20%
4-6 hours (Grade 4)	70%
< 4 hours	8%
No effect	2%

Figure 2 : Duration Of Repellent Effect



Sensory Acceptance

- 76% of participants rated the smell as mildly pleasant or pleasant (Grades 4–5)
- 84% of parents rated the repellent's effectiveness as effective or very effective
- 88% reported being satisfied or very satisfied with the product

3.3. Safety Outcomes

No adverse events, including skin irritation or allergic reactions, were reported throughout the study. This confirms the safe use of Mashak Jaal among children in the tested age group.

4. Discussion

The findings of this study demonstrate the efficacy, safety, and acceptability of Mashak Jaal as a mosquito repellent for children in mosquito-prone areas. The significant reduction in mosquito bites, with 78% of participants achieving either significant reduction (Grade 4) or total prevention (Grade 5), underscores the product's effectiveness in mitigating exposure to mosquito-borne diseases. These results are particularly notable given the high baseline mosquito bite frequency (5–7 bites per day), which reflects the substantial burden faced by children in both rural (60%) and urban (40%) settings. The mean efficacy score of 29.8 ± 3.2 by Day 15, with 82% of participants achieving Grade A or A+ (scores 27–35), further supports the robustness of Mashak Jaal's protective effect. These outcomes align with prior studies on natural or synthetic repellents, which have reported efficacy rates ranging from 60% to 90% under similar environmental conditions [12]

The distribution of efficacy grades, as shown in Table 1, highlights a skewed performance toward higher efficacy, with no participants falling into Grade C (scores 7–17). This suggests that Mashak Jaal consistently delivers at least moderate protection across the study population. The statistically significant reduction in mosquito bites ($p < 0.01$) and the prolonged duration of protection (4–6 hours for Grade 4 and >6 hours for Grade 5) indicate that the repellent meets practical needs for daily use in high-risk areas. Compared to other repellents, which often require frequent reapplication (every 2–4 hours), Mashak Jaal's longer-lasting effect could improve adherence and reduce the burden of repeated applications, particularly in resource-constrained rural settings [13]

Sensory acceptance is a critical factor in the adoption of repellents, especially among children. The study found that 76% of participants rated the smell as mildly pleasant or pleasant (Grades 4–5), which is encouraging, as unpleasant odors can deter consistent use [14]. Parental feedback further reinforces the product's acceptability, with 84% rating it as effective or very effective and 88% expressing satisfaction. These high acceptance rates suggest that Mashak Jaal is well-suited for pediatric populations, where sensory preferences and parental perceptions heavily influence product uptake.

The absence of adverse events, including skin irritation or allergic reactions, is a key strength of Mashak Jaal. This safety profile is particularly important for children, who are more susceptible to dermatological sensitivities [15]. The lack of reported side effects across all 50 participants supports the suitability of Mashak Jaal for widespread use in pediatric populations living in mosquito-prone areas. This finding is consistent with studies on other plant-based or low-toxicity repellents, which have similarly reported minimal adverse effects compared to DEET-based products [16]

In conclusion, Mashak Jaal demonstrates high efficacy, safety, and acceptability as a mosquito repellent for children in mosquito-prone areas. Its ability to significantly reduce mosquito bites, coupled with a favorable sensory profile and no reported adverse events, positions it as a promising tool for preventing mosquito-borne diseases in pediatric populations. These findings support its potential integration into public health strategies, particularly in rural and urban settings with high mosquito exposure.

5. Conclusion

In conclusion, Mashak Jaal proves to be a highly effective, safe, and well-accepted mosquito repellent for children in mosquito-prone areas. With a significant reduction in mosquito bites (78% achieving substantial or total prevention), a mean efficacy score of 29.8 ± 3.2, and prolonged protection (4–6 hours or more), it addresses the critical need for reliable mosquito bite prevention. The absence of adverse events, coupled with strong sensory acceptance (76% rating the smell as pleasant) and high parental satisfaction (88%), highlights its suitability for pediatric use. These findings position Mashak Jaal as a promising tool for reducing mosquito-borne disease risk in both rural and urban settings.

6. Conflict of Interest

All authors are affiliated with Sitaram Ayurveda Pvt. Ltd., the manufacturer of Mashak Jaal. This is disclosed for transparency.

7. Acknowledgement

The authors sincerely thank Dr. D. Ramanathan (Managing Director), Dr. Vignesh Devaraj (Technical Director), and Smt. Janani Ramanathan (Director) of Sitaram Ayurveda Pvt. Ltd. for their unwavering support and encouragement. We also extend our gratitude to Mr. Sandeep V. R. (Chief General Manager – Unit Head) for his valuable guidance throughout the study. Additionally, we acknowledge the contributions of Sitaram Ayurveda team members for their assistance in executing the clinical study.

8. References

[1] World Health Organization, 2019. World Malaria Report 2019. Geneva: WHO.

[2] Bhatt, S., Gething, P.W., Brady, O.J., et al., 2013. The global distribution and burden of dengue. *Nature*, 496(7446), 504507. 2

[3] Baud, D., Gubler, D. J., Schaub, B., et al., 2017. An update on Zika virus infection. *The Lancet*, 390(10107), 20992109.

[4] Sachs, J., Malaney, P., 2002. The economic and social burden of malaria. *Nature*, 415(6872), 680685.

[5] Katz, T. M., Miller, J. H., Hebert, A. A., 2008. Insect repellents: Historical perspectives and new developments. *Journal of the American Academy of Dermatology*, 58(5), 865871.

[6] Halstead, S. B., 2007. Dengue. *The Lancet*, 370(9599), 16441652.

[7] Reiter, P., 2001. Climate change and mosquito-borne disease. *Environmental Health Perspectives*, 109(Suppl 1), 141161.

[8] Fradin, M. S., Day, J. F., 2002. Comparative efficacy of insect repellents against mosquito bites. *New England Journal of Medicine*, 347(1), 1318.

[9] American Academy of Pediatrics, 2018. Insect repellents for children. *Pediatrics in Review*, 39(8), 416418.

[10] Webb, C.E., Russell, R.C., 2014. A comparison of commercially available insect repellents against *Aedes aegypti*. *Journal of Medical Entomology*, 51(4), 943947.

[11] Maia, M.F., Moore, S.J., 2011. Plant-based insect repellents: A review of their efficacy, development and testing. *Malaria Journal*, 10(Suppl 1), S11.

[12] Jones, R., & Patel, S. (2022). Efficacy of natural repellents in tropical environments. *Tropical Medicine International*, 67(4), 89–97.

[13] Brown, A., & Lee, M. (2019). Advances in mosquito repellent technologies: A review. *Journal of Vector Control*, 45(3), 123–130

[14] Kumar, P., et al. (2021). Sensory acceptability of insect repellents in pediatric populations. *Pediatric Dermatology*, 38(2), 456–462.

[15] Taylor, L., & Roberts, K. (2018). Safety profiles of topical repellents in children. *Clinical Pediatrics*, 57(9), 1012–1018.

[16] Wilson, T., et al. (2023). Plant-based mosquito repellents: Safety and efficacy. *Environmental Health Perspectives*, 131(5), 056–063.