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Effectiveness of Preventive Measures against Malaria in Children

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ABSTRACT

Malaria was a significant global health challenge, particularly affecting children under five years of age in endemic regions. This review examined the effectiveness of various preventive measures against malaria in children, including insecticide-treated nets (ITNs), preventive chemotherapy, intermittent preventive treatment in infants (IPTi), and health education interventions. A systematic literature search across multiple databases to collate and analyze studies assessing the impact of these preventive measures on malaria outcomes in children was carried out and utilized in compiling this review paper. The findings indicated that a combination of these strategies can substantially reduce malaria incidence and associated morbidity in children. ITNs have been shown to provide a protective barrier against mosquito bites, while IPTi effectively reduces malaria cases in infants through timely administration of antimalarial drugs during immunization visits. Additionally, health education interventions have proven effective in increasing awareness and promoting the use of preventive measures among caregivers and communities. Despite the progress made, challenges such as insecticide resistance and access to healthcare services remain critical barriers to achieving optimal malaria control.

Keywords: Malaria prevention, Insecticide-treated nets (ITNs), Preventive chemotherapy, Intermittent preventive treatment (IPT), Childhood malaria.

INTRODUCTION

Malaria remains a significant public health challenge, particularly in sub-Saharan Africa, where children are disproportionately affected [1]. The World Health Organization (WHO) estimates that malaria accounts for a substantial percentage of morbidity and mortality in children under five, with school-aged children (5-15 years) increasingly recognized as a critical demographic in the transmission dynamics of plasmodium falciparu, the most lethal malaria parasite [2,3]. Recent data indicate that this age group harbors a high prevalence of malaria infections, often leading to severe health consequences such as anemia, cognitive impairment, and increased school absenteeism [4]. Despite advances in malaria control strategies over the past two decades, progress has stagnated since 2014, with some regions experiencing a resurgence in cases [5]. This stagnation underscores the urgent need for effective preventive measures tailored to school-aged children [6]. Current interventions primarily target younger children and pregnant women, leaving a gap in strategies specifically designed for older children who contribute significantly to the transmission cycle [7,8]. Preventive measures such as insecticide-treated nets (ITNs), intermittent preventive treatment (IPT), and health education initiatives have shown promise in reducing malaria incidence among children [9]. ITNs have been widely adopted and are effective in decreasing child mortality rates. IPT has been proposed as a viable strategy to reduce malaria prevalence and related complications among asymptomatic school-aged children [10]. Furthermore, health education interventions can enhance awareness and usage of preventive measures, thus improving overall community health outcomes [11]. This review aims to synthesize current evidence on the effectiveness of various preventive measures against malaria in children. By examining recent studies and meta-analyses, we will explore the impact of these interventions on malaria incidence, morbidity, and transmission dynamics.

The findings will inform future public health strategies aimed at reducing the burden of malaria among this vulnerable population and contribute to global efforts toward malaria elimination.

INSECTICIDE-TREATED NETS (ITNS)

Insecticide-treated nets (ITNs) have emerged as a cornerstone in the global fight against malaria, particularly in regions where the disease poses a significant threat to children under five years of age [12]. These nets serve a dual purpose: they provide a physical barrier against mosquito bites while also delivering an insecticidal effect that repels or kills mosquitoes upon contact. The widespread adoption of ITNs has been associated with substantial reductions in malaria morbidity and mortality rates, making them a critical intervention in malaria-endemic areas [13].

i. **Effectiveness of ITNs:** Numerous studies have demonstrated the effectiveness of ITNs in reducing malaria incidence [14]. For instance, a systematic review indicated that ITNs can decrease child mortality by approximately 17% and significantly lower the prevalence of plasmodium falciparum infections. Specifically, children sleeping under ITNs experienced a 37% reduced risk of infection and a 38% lower incidence of clinical malaria compared to non-users. The community-wide benefits of high ITN coverage extend beyond individual protection, contributing to a decrease in overall malaria transmission rates [15,16].

ii. **Challenges and Resistance:** Despite their effectiveness, the increasing prevalence of insecticide resistance among malaria vectors poses a significant challenge to ITN efficacy [17]. Resistance to pyrethroid insecticides the primary class used in ITNs has been reported in numerous countries, raising concerns about the long-term viability of this intervention [18]. However, evidence suggests that even in areas with high levels of resistance, ITNs continue to provide considerable protection against malaria [19]. The need for ongoing monitoring and adaptation of vector control strategies is essential to maintain the effectiveness of ITNs in combating malaria.

iii. **Recommendations for Improvement:** To enhance the impact of ITNs, strategies must focus on increasing coverage and ensuring proper usage [20]. This includes targeted distribution campaigns that prioritize households with children under five and pregnant women, who are particularly vulnerable to malaria. Additionally, integrating health education initiatives can improve knowledge about the importance of ITN use and maintenance, further bolstering their protective benefits [21].

PREVENTIVE CHEMOTHERAPY

Preventive chemotherapy is the use of antimalarial medicines, either alone or in combination, to prevent malaria infection and its consequences in vulnerable populations. It involves administering a full treatment course of antimalarial drugs to individuals at designated time points during the period of greatest malarial risk, regardless of whether they are infected with malaria [22,23].

WHO-recommended preventive chemotherapy strategies for malaria include:

a. Intermittent preventive treatment in pregnancy (IPTp) for women at risk of malaria
b. Perennial malaria chemoprevention (PMC) for infants and young children at high risk of severe malaria living in areas with moderate-to-high year-round transmission
c. Seasonal malaria chemoprevention (SMC) for children at high risk of severe malaria living in areas with seasonal transmission
d. Intermittent preventive treatment of malaria in school-aged children [24]

These safe and cost-effective strategies are intended to complement other malaria control activities, such as vector control measures, prompt diagnosis, and treatment of confirmed cases. Preventive chemotherapy has been shown to be effective in reducing the malaria burden and saving lives when given to the most vulnerable populations [25]. For example, SMC has been implemented in 13 countries in the Sahel subregion of Africa in 2021. However, the efficacy of preventive chemotherapy can be compromised by increasing drug resistance. Strategies to mitigate resistance include using different drugs for chemoprevention and treatment, combining drugs with different resistance mechanisms, and ensuring a pipeline of new malaria drugs [26].

INTERMITTENT PREVENTIVE TREATMENT IN INFANTS (IPTI)

Intermittent Preventive Treatment in Infants (IPTi) is an effective malaria prevention strategy aimed at reducing the incidence of malaria and its associated complications in infants, particularly in sub-Saharan Africa, where the burden of malaria is highest [27]. Recommended by the World Health Organization (WHO) since 2010, IPTi involves administering antimalarial drugs, specifically sulfadoxine-

pyrimethamine (SP), during routine immunization visits, regardless of the infant's infection status. This approach allows for the timely delivery of preventive treatment at critical developmental stages [28].

i. **Efficacy:** Clinical trials have demonstrated that IPTi can reduce clinical malaria cases by approximately 30% and anemia by about 21% in infants under one year of age. A meta-analysis encompassing multiple studies indicates that IPTi significantly lowers the risk of hospital admissions due to malaria and reduces all-cause mortality among infants in high-transmission areas. Although IPTi has shown substantial protective effects, concerns regarding increasing drug resistance, particularly to SP, have emerged, necessitating ongoing evaluation of alternative regimens and combinations [29,30].

ii. **Implementation Challenges:** Despite its proven effectiveness, IPTi has not been widely adopted across many African countries [31]. Barriers to implementation include limited access to healthcare services, insufficient awareness among healthcare providers and caregivers, and logistical challenges in integrating IPTi into existing immunization programs. Recent initiatives aim to enhance IPTi delivery by increasing the number of doses administered and extending coverage beyond the first year of life to include children up to two years old [32].

iii. **Cost-Effectiveness:** From a cost-effectiveness perspective, IPTi presents a favorable option for malaria prevention [33]. The low cost of antimalarial medications combined with the significant health benefits achieved makes it an economically viable intervention. Estimates suggest that IPTi can avert substantial healthcare costs associated with treating malaria cases and its complications [34].

HEALTH EDUCATION INTERVENTIONS

Health education interventions play a crucial role in malaria prevention, particularly in sub-Saharan Africa, where the disease burden is highest. These interventions aim to enhance community knowledge about malaria transmission, prevention strategies, and the importance of using protective measures such as insecticide-treated nets (ITNs). Through tailored educational programs, health education seeks to empower individuals and communities to adopt behaviors that mitigate the risk of malaria infection [35,36].

i. **Effectiveness of Health Education Interventions:** Numerous studies have demonstrated that health education interventions significantly improve malaria-related knowledge and increase ITN usage among target populations [37]. A systematic review and meta-analysis found that participants who received health education were 30% more likely to report better knowledge about malaria and 53% more likely to use ITNs compared to those who did not receive such interventions [38]. For example, a community-based trial in Yemen showed a marked increase in knowledge about malaria symptoms and prevention methods among school children following health education campaigns, leading to improved attitudes and practices regarding malaria prevention.

ii. **Tailored Approaches:** The effectiveness of health education interventions often hinges on their design and delivery methods [39]. Programs that utilize participatory approaches, such as engaging community leaders or involving school children as health messengers, have shown promising results [40]. These strategies not only enhance the reach of educational content but also foster community ownership of malaria prevention efforts. Moreover, interventions that incorporate practical demonstrations on the proper use and maintenance of ITNs further reinforce learning and encourage behavioral change [41].

iii. **Addressing Knowledge-Practice Gaps:** Despite improvements in knowledge and attitudes towards malaria prevention, challenges remain in translating this knowledge into consistent protective behaviors [42. Studies indicate a persistent knowledge-practice gap, where increased awareness does not always lead to higher ITN usage or adherence to preventive measures [43]. This underscores the need for comprehensive strategies that combine health education with other interventions, such as providing access to ITNs and ensuring community engagement in malaria control efforts [44,45].

CONCLUSION

The effectiveness of preventive measures against malaria in children is critical for reducing the disease's burden, particularly in high-risk regions such as sub-Saharan Africa. This review highlights the significant impact of various interventions, including insecticide-treated nets (ITNs), preventive chemotherapy, intermittent preventive treatment in infants (IPTi), and health education initiatives. ITNs have consistently demonstrated strong protective effects, significantly lowering malaria incidence and child mortality rates. Preventive chemotherapy, particularly through seasonal malaria chemoprevention (SMC) and IPTi, has shown promise in reducing clinical malaria cases and anemia among vulnerable populations. Health education interventions have also played a vital role by enhancing community awareness and promoting the use of preventive measures, thereby improving overall health outcomes. Despite the progress made, challenges such as insecticide resistance, access to healthcare, and the need for sustained funding and political commitment remain barriers to achieving optimal malaria control. Therefore, a multifaceted approach that combines these preventive measures with ongoing research and community engagement is essential for effectively combating malaria in children. Future strategies should focus on integrating these interventions into broader health systems while addressing the unique needs of children in endemic areas to ensure a substantial reduction in malaria morbidity and mortality.

REFERENCES

1. Eboh, A., Adebayo, A.O. Addressing malaria incidence in Africa through health care expenditure and access to basic sanitation services. *Discov Health Systems* **2**, 37 (2023). https://doi.org/10.1007/s44250-023-00052-8
2. Helen Bamikole T. Confronting Malaria – Addressing a Critical Health Crisis among Vulnerable Groups in Nigeria [Internet]. Neglected Tropical Diseases - Unsolved Debts for the One Health Approach. IntechOpen; 2024. Available from: http://dx.doi.org/10.5772/intechopen.1002999
3. Kayiba, N.K., Nitahara, Y., Tshibangu-Kabamba, E. *et al.* Malaria infection among adults residing in a highly endemic region from the Democratic Republic of the Congo. *Malar J* **23**, 82 (2024). https://doi.org/10.1186/s12936-024-04881-7
4. Ssemata, A.S., Nakitende, A.J., Kizito, S. *et al.* Association of severe malaria with cognitive and behavioural outcomes in low- and middle-income countries: a meta-analysis and systematic review. *Malar J* **22**, 227 (2023). https://doi.org/10.1186/s12936-023-04653-9
5. Hollowell, T., Sewe, M.O., Rocklöv, J. *et al.* Public health determinants of child malaria mortality: a surveillance study within Siaya County, Western Kenya. *Malar J* **22**, 65 (2023). https://doi.org/10.1186/s12936-023-04502-9
6. Kamya MR, Nankabirwa JI, Arinaitwe E, Rek J, Zedi M, Maiteki-Sebuguzi C, et al., Dramatic resurgence of malaria after 7 years of intensive vector control interventions in Eastern Uganda. medRxiv [Preprint]. 2024 Mar 16:2024.03.15.24304352. doi: 10.1101/2024.03.15.24304352. Update in: PLOS Glob Public Health. 2024 Aug 29;4(8):e0003254. doi: 10.1371/journal.pgph.0003254. PMID: 38559091; PMCID: PMC10980127.
7. Melissa A. Penny, Flavia Camponovo, Nakul Chitnis, Thomas A. Smith, Marcel Tanner, Future use-cases of vaccines in malaria control and elimination, Parasite Epidemiology and Control, 2020; https://doi.org/10.1016/j.parepi.2020.e00145.
8. Nalinya, S., Musoke, D. & Deane, K. Malaria prevention interventions beyond long-lasting insecticidal nets and indoor residual spraying in low- and middle-income countries: a scoping review. *Malar J* **21**, 31 (2022). https://doi.org/10.1186/s12936-022-04052-6
9. Onyinyechi OM, Ismail S, Nashriq Mohd Nazan AI. Prevention of malaria in pregnancy through health education intervention programs on insecticide-treated nets use: a systematic review. BMC Public Health. 2024 Mar 11;24(1):755. doi: 10.1186/s12889-024-17650-7. PMID: 38468243; PMCID: PMC10929229.
10. Geofrey Makenga, Vito Baraka, Filbert Francis, Swabra Nakato, Samwel Gesase,

George Mtove, Rashid Madebe, Edna Kyaruzi, Daniel T.R. Minja, John P.A. Lusingu, Jean-Pierre Van geertruyden, Effectiveness and safety of intermittent preventive treatment for malaria using either dihydroartemisinin-piperaquine or artesunate-amodiaquine in reducing malaria related morbidities and improving cognitive ability in school-aged children in Tanzania: A study protocol for a controlled randomised trial, Contemporary Clinical Trials Communications, 2020; 17, 100546. https://doi.org/10.1016/j.conctc.2020.100546.

11. Emmanuel Ikechukwu Nnamonu., Ogonna Christiana Ani., Felix Joel Ugwu., Simeon Ikechukwu Egba., Ifeanyi Oscar Aguzie., Obiageli Panthe Okeke., Christian Enyi Dialoke., Lilian Obinna Asogwa and Solomon Ikechukwu Odo (2020) Malaria Prevalence in Rice Farm Settlements South East Nigeria. *IJTDH*, 2020; 41(9): 64-74
12. Scott, J., Kanyangarara, M., Nhama, A. *et al.* Factors associated with use of insecticide-treated net for malaria prevention in Manica District, Mozambique: a community-based cross-sectional survey. *Malar J* **20**, 200 (2021). https://doi.org/10.1186/s12936-021-03738-7
13. Ekpono, E. U., Aja, P. M., Ibiam, U. A., Alum, E. U., & Ekpono, U. E. Ethanol Root-extract of Sphenocentrumjollyanum Restored Altered Haematological Markers in Plasmodium berghei-infected Mice. *Earthline Journal of Chemical Sciences*. 2019; *2*(2): 189-203. https://doi.org/10.34198/ejcs.2219.189203.
14. Egwu, C. O., Aloke, C., Chukwu, J., Agwu, A., Alum, E., Tsamesidis, I, et al. A world free of malaria: It is time for Africa to actively champion and take leadership of elimination and eradication strategies. Afr Health Sci. 2022 Dec;22(4):627-640. doi: 10.4314/ahs.v22i4.68.
15. Shah, M.P., Steinhardt, L.C., Mwandama, D. *et al.* The effectiveness of older insecticide-treated bed nets (ITNs) to prevent malaria infection in an area of moderate pyrethroid resistance: results from a cohort study in Malawi. *Malar J* **19**, 24 (2020). https://doi.org/10.1186/s12936-020-3106-2
16. Barker TH, Stone JC, Hasanoff S, Price C, Kabaghe A, Munn Z. Effectiveness of dual active ingredient insecticide-treated nets in preventing malaria: A systematic review and meta-analysis. PLoS One. 2023 Aug 16;18(8):e0289469. doi: 10.1371/journal.pone.0289469. PMID: 37585420; PMCID: PMC10431665.
17. Steve W Lindsay, Matthew B Thomas, Immo Kleinschmidt, Threats to the effectiveness of insecticide-treated bednets for malaria control: thinking beyond insecticide resistance, The Lancet Global Health, 2021; 9(9): e1325-e1331. https://doi.org/10.1016/S2214-109X(21)00216-3.
18. Egwu, C.O., Aloke, C., Chukwu, J., Nwankwo, J.C., Irem, C., Nwagu, K.E., Nwite, F., Agwu, A.O., Alum, E., Offor, C.E. and Obasi, N.A. Assessment of the Antimalarial Treatment Failure in Ebonyi State, Southeast Nigeria. J Xenobiot. 2023 Jan 3;13(1):16-26. doi: 10.3390/jox13010003.
19. Kungu, E., Inyangat, R., Ugwu, O.P.C. and Alum, E. U. Exploration of Medicinal Plants Used in the Management of Malaria in Uganda. NEWPORT INTERNATIONAL JOURNAL OF RESEARCH IN MEDICAL SCIENCES 2023;4(1):101-108.https://nijournals.org/wp-content/uploads/2023/10/NIJRMS-41101-108-2023.docx.pdf
20. Obeagu, E. I., Alum, E. U. and Ugwu, O. P. C. Hepcidin's Antimalarial Arsenal: Safeguarding the Host. NEWPORT INTERNATIONAL JOURNAL OF PUBLIC HEALTH AND PHARMACY. 2023;4(2):1-8. https://doi.org/10.59298/NIJPP/2023/10.1.1100
21. Obeagu, E. I., Alum, E. U. and Ugwu, O. P. C. Hepcidin: The Gatekeeper of Iron in Malaria Resistance NEWPORT INTERNATIONAL JOURNAL OF RESEARCH IN MEDICAL SCIENCES. 2023;4(2):1-8. https://doi.org/10.59298/NIJRMS/2023/10.1.1400
22. Taremwa IM, Ashaba S, Ayebazibwe C, Kemeza I, Adrama HO, Omoding D, Yatuha J, Hilliard R. Mind the gap: scaling up the utilization of insecticide treated mosquito nets using a knowledge

translation model in Isingiro district, rural south western Uganda. Health Psychol Behav Med. 2020 Sep 1;8(1):383-397. doi: 10.1080/21642850.2020.1814782. PMID: 34040878; PMCID: PMC8130719.

23. Alum EU, Ugwu OPC, Egba SI, Uti DE, Alum BN. Climate Variability and Malaria Transmission: Unraveling the Complex Relationship. INOSR Scientific Research, 2024;11(2):16-22. https://doi.org/10.59298/INOSRSR/2024/1.1.21622
24. Greenwood, B., Cairns, M., Chaponda, M. *et al.* Combining malaria vaccination with chemoprevention: a promising new approach to malaria control. *Malar J* **20**, 361(2021). https://doi.org/10.1186/s12936-021-03888-8
25. Greenwood B, Cairns M, Chaponda M, Chico RM, Dicko A, Ouedraogo JB, Phiri KS, Ter Kuile FO, Chandramohan D. Combining malaria vaccination with chemoprevention: a promising new approach to malaria control. Malar J. 2021 Sep 6;20(1):361. doi: 10.1186/s12936-021-03888-8. PMID: 34488784; PMCID: PMC8419817.
26. Emmanuel Ifeanyi Obeagu, Getrude Uzoma Obeagu, Simeon Ikechukwu Egba and Obioma Raluchukwu Emeka Obi (2023) Combatting Anaemia in Paediatric Malaria: Effective management strategies Int. J. Curr. Res. Med. Sci. (2023). 9(11): 1-7
27. Esu EB, Oringanje C, Meremikwu MM. Intermittent preventive treatment for malaria in infants. Cochrane Database Syst Rev. 2021 Jul 17;7(7):CD011525. doi: 10.1002/14651858.CD011525.pub3. PMID: 34273901; PMCID: PMC8406727.
28. Carneiro I, Smith L, Ross A, Roca-Feltrer A, Greenwood B, Schellenberg JA, Smith T, Schellenberg D. Intermittent preventive treatment for malaria in infants: a decision-support tool for sub-Saharan Africa. Bull World Health Organ. 2010 Nov 1;88(11):807-14. doi: 10.2471/BLT.09.072397. Epub 2010 May 10. PMID: 21076561; PMCID: PMC2971505.
29. Pierre A. Buffet, Valérie Briand, Laurent Rénia, Marc Thellier, Martin Danis, Dominique Mazier, Intermittent preventive antimalarial treatment to children (IPTc): firebreak or fire trap? Trends in Parasitology, 2008; 24(11): 482-485. https://doi.org/10.1016/j.pt.2008.07.007.
30. Fombah, A.E., Chen, H., Owusu-Kyei, K. *et al.* Coverage of intermittent preventive treatment of malaria in infants after four years of implementation in Sierra Leone. *Malar J* **22**, 145 (2023). https://doi.org/10.1186/s12936-023-04575-6
31. 31 Greenwood B, Schellenberg D. Chemoprevention for the Populations of Malaria Endemic Africa. Diseases. 2022 Nov8;10(4):101.doi: 10.3390/diseases10040101. PMID: 36412595; PMCID: PMC9680511.
32. Irene N. Nkumama, Wendy P. O'Meara, Faith H.A. Osier, Changes in Malaria Epidemiology in Africa and New Challenges for Elimination, Trends in Parasitology, 2017; 33(2): 1471-4922. https://doi.org/10.1016/j.pt.2016.11.006.
33. Conteh L, Shuford K, Agboraw E, Kont M, Kolaczinski J, Patouillard E. Costs and Cost-Effectiveness of Malaria Control Interventions: A Systematic Literature Review. Value Health. 2021 Aug;24(8):1213-1222.doi: 10.1016/j.jval.2021.01.013. Epub 2021 May 18. PMID: 34372987; PMCID: PMC8324482.
34. White, M.T., Conteh, L., Cibulskis, R. *et al.* Costs and cost-effectiveness of malaria control interventions - a systematic review. *Malar J* **10**, 337 (2011). https://doi.org/10.1186/1475-2875-10-337
35. Lesong Conteh, Kathryn Shuford, Efundem Agboraw, Mara Kont, Jan Kolaczinski, Edith Patouillard, Costs and Cost-Effectiveness of Malaria Control Interventions: A Systematic Literature Review, Value in Health, 2021; 24(8): 1213-1222. https://doi.org/10.1016/j.jval.2021.01.013.
36. Hutton G, Schellenberg D, Tediosi F, Macete E, Kahigwa E, Sigauque B, Mas X, Trapero M, Tanner M, Trilla A, Alonso P, Menendez C. Cost-effectiveness of malaria intermittent preventive treatment in infants (IPTi) in Mozambique and the United Republic of Tanzania. Bull World Health Organ. 2009 Feb;87(2):123-9. doi: 10.2471/blt.08.051961. PMID: 19274364; PMCID: PMC2636201.
37. Sicuri, E., Biao, P., Hutton, G. *et al.* Cost-effectiveness of intermittent preventive

treatment of malaria in infants (IPTi) for averting anaemia in Gabon: a comparison between intention to treat and according to protocol analyses. *Malar J* **10**, 305 (2011). https://doi.org/10.1186/1475-2875-10-305

38. Conteh L, Sicuri E, Manzi F, Hutton G, Obonyo B, Tediosi F, et al. (2010) The Cost-Effectiveness of Intermittent Preventive Treatment for Malaria in Infants in Sub-Saharan Africa. PLoS ONE 5(6):e10313. https://doi.org/10.1371/journal.pone.0010313
39. Ross A, Maire N, Sicuri E, Smith T, Conteh L (2011) Determinants of the Cost-Effectiveness of Intermittent Preventive Treatment for Malaria in Infants and Children. PLoS ONE 6(4): e18391. https://doi.org/10.1371/journal.pone.0018391
40. Maude RJ, Lubell Y, Socheat D, et al. The role of mathematical modelling in guiding the science and economics of malaria elimination. International Health. 2010 Dec;2(4):239-246. DOI: 10.1016/j.inhe.2010.09.005. PMID: 21270957; PMCID: PMC3004029.
41. Flatie BT, Munshea A. Knowledge, Attitude, and Practice towards Malaria among People Attending Mekaneeyesus Primary Hospital, South Gondar, Northwestern Ethiopia: A Cross-Sectional Study. J Parasitol Res. 2021 Dec 23; 2021:5580715. doi: 10.1155/2021/5580715. PMID: 34976405; PMCID: PMC8718288.
42. Singh R, Musa J, Singh S, Ebere UV. Knowledge, attitude and practices on malaria among the rural communities in aliero, northern Nigeria. J Family Med Prim Care. 2014 Jan;3(1):39-44. doi: 10.4103/2249-4863.130271. PMID: 24791235; PMCID: PMC4005199.
43. Hanna, T.A., Ahmed, A., Vincent, R. *et al.* Gaps in knowledge and practices of malaria prevention in Francophone African immigrants in Metropolitan Edmonton. *Malar J* **21**, 197 (2022). https://doi.org/10.1186/s12936-022-04210-w
44. Adum, P., Agyare, V.A., Owusu-Marfo, J. *et al.* Knowledge, attitude and practices of malaria preventive measures among mothers with children under five years in a rural setting of Ghana. *Malar J* **22**, 268 (2023). https://doi.org/10.1186/s12936-023-04702-3
45. Munisi DZ, Nyundo AA, Mpondo BC (2019) Knowledge, attitude and practice towards malaria among symptomatic patients attending Tumbi Referral Hospital: A cross-sectional study. PLoS ONE 14(8): e0220501.https://doi.org/10.1371/journal.pone.0220501

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