www.jmscr.igmpublication.org
Impact Factor (SJIF): 6.379
Index Copernicus Value: 79.54
ISSN (e)-2347-176x ISSN (p) 2455-0450
crossrefDOI: https://dx.doi.org/10.18535/jmscr/v7i1.03

IGM Publication
Journal Of Medical Science And Clinical Research
An Official Publication Of IGM Publication

Effect of Behavioral and Biological Interventions on Malaria Control in Endemic areas of Rajasthan

Authors
Dr Anil Verma[1], Dr Manju Lata Sharma[2*], Shefali Sharma[3]
[1]BCMHO Kolayat Bikaner, [2]Surveillance Medical officer Bikaner, [3]Project Associate Milliman Gurgoan
Corresponding Author
Dr Anil Verma
BCMHO Kolayat Bikaner, India

Abstract
Background: *Malaria is one of the important public health problems of African and south east Asian countries including India which contributes to approximately 75% of malaria cases in South East Asia. Some areas of states such as Rajasthan, Gujrat, Karnataka, Jharkhand and Orissa have a very high incidence of malaria with an Annual parasite index more than 5. Behavioral interventions such as public awareness programs, rallies and educational camps are found to be very effective in decreasing the incidence of malaria. The biological interventions such as use of Gambusia fish have been found to be effective measures in decreasing the incidence of malaria.*
Materials and Methods: *Following Behavioral and biological interventions the incidence of malaria was analyzed over a period of 7 years from 2009-2016. During this period 600 natural water bodies and 72 hatcheries were made and Gambusia fishes were used to prevent the growth of mosquitoes in water bodies. Information, education and communication techniques such as rallies, demonstrations and information camps were organized. The purpose of these IEC activities was to make public aware about the personal prevention of mosquito bites. The reduction in cases and mortality due to malaria was analyzed. For Statistical Purposes SSPE 16 software was used.*
Results: *Following Behavioral and Biological Interventions such as allies, demonstrations and information camps and use of Gambusia fish as larvicidal there was a significant reduction in the incidence of Malaria in areas covered under Primary health care centers/community health care centers namely Gajner, Barsalpur, Diyatra, Godu and Kolayat, RD820, Bajju, Akkasar, Bikampur and Gadiyala. There was a statistically significant reduction in API in all the regions over a period of 7 years from 2009 to 2016.*
Conclusion: *IEC activities leading to behavioral modification and use of biological agents such as Gambusia fish as larvicidal are found to have a profound impact in reduction in incidence of malaria.*
Keywords: *Malaria, Annual Parasite Index, Behavior modification, Gambusia Fish.*

Introduction

Malaria is one of the important public health problems of African and south east Asian countries including India which contributes to approximately 75% of malaria cases in South East Asia. Though it can be effectively treated by

antimalarials, infection by plasmodium falciparum may be associated with complications such as cerebral malaria, intravascular hemolysis renal failure and in severe cases it may even prove fatal[1]. Though it has been mostly eradicated from western world it remains a major health problem of tropical countries. According to various WHO reports it is responsible for hundreds of thousands of deaths in sub-Saharan Africa. The risk of complications and fatalities is more in travellers who don't have immunity and children less than 5 years of age living in endemic areas[2].

In Indian perspective the health programs have been oscillating between malaria eradication to malaria control and again to eradication. It is an accepted fact that malaria eradication will have a profound positive impact on public health and improve quality of life of millions of individuals, reduce morbidity and mortality and reduce the spending on control and treatment of malaria. In this regard it is important to note that almost 70% of malarial deaths in south East Asia occur in India[3]. With widespread use of artemisinin derivatives in combination therapy and concentrated efforts at mosquito control the incidence and mortality associated with malaria is steadily going down since last 10 years. It is important to understand that some species of malaria particularly plasmodium vivax may be associated with asymptomatic infections, latent hepatic infection and intermittent parasitemia and hence these individuals may be responsible for spread of infection[4].

For the purpose of malaria elimination the districts have been divided into low, moderate and high annual parasite index districts. The efforts directed at elimination of malaria usually are undertaken at a district level. Biological control strategies, including use of Bacillus thuringiensis (a gram positive bacteria which produces crystal protein and produces endotoxin which is lethal for larva) or Gambusia fish which eats larva5. All these biological control methods have been found to have excellent results if used properly. It is important to select the locations for these biological measures carefully and these locations should be reviewed periodically. Various studies have confirmed the beneficial effects of Gambusia fish as larvicidal[6]. It has the distinct advantage of environment friendly as compared to insecticides such as dichloro diphenyl trichloroethane (DDT) and pyrethroids. Moreover it remains the only feasible alternative in places where insecticides cannot be used such as in lakes, pools, rice fields and stagnant water sources[7].

Another important aspect of malaria control is through behavioral changes of the population at risk. For this purpose Information, education and communication techniques such as rallies, demonstrations and information to make public aware about the personal prevention of mosquito bites can reduce the incidence of malaria. The use of personal protection such as mosquito nets, protective clothing and use of mosquito repellents can reduce the incidence of malaria to a considerable level[8].

We conducted this study to analyze the effect of behavioral and biological interventions on malaria control in endemic areas of Rajasthan.

Materials and Methods

This Study was done in Block Kolayat District Bikaner with an aims to control Malaria with the information, education and communication activities (IEC) in population and biological control by using existing water bodies and to control that for Gambusia fishes. Block Kolayat of Bikaner was endemic area till 2014 and was having death because of plasmodium vivax as well as plasmodium falciparum malaria. In 2006 a program launched to control Malaria by controlling mosquitoes by biological means and for this purpose 600 natural water bodies used and 72 hatcheries were made for Gambusiafish, was used as larvicidal to control Malaria. In other water sources where water was not being used for drinking purpose oil was used in place of Gambusia fishes. IEC activities was undertaken in all the schools, gatherings and in the community with an aim to create mass awareness about the

ways to control Malaria by controlling mosquitoes and personal protection at home by adopting simple measures and behavioral modification.
The incidence of malarial cases (vivax as well as falciparum), Annual parasite index, mortality due to malaria and plasmodium falciparum percentage (PF%) before and after interventions was studied with an aim, to find out the effectiveness of these interventions on studied parameters.

Results

The population under Kolayat block was 216703 in 2009 which increased to 276049 in 2013 and 305621 in 2016.

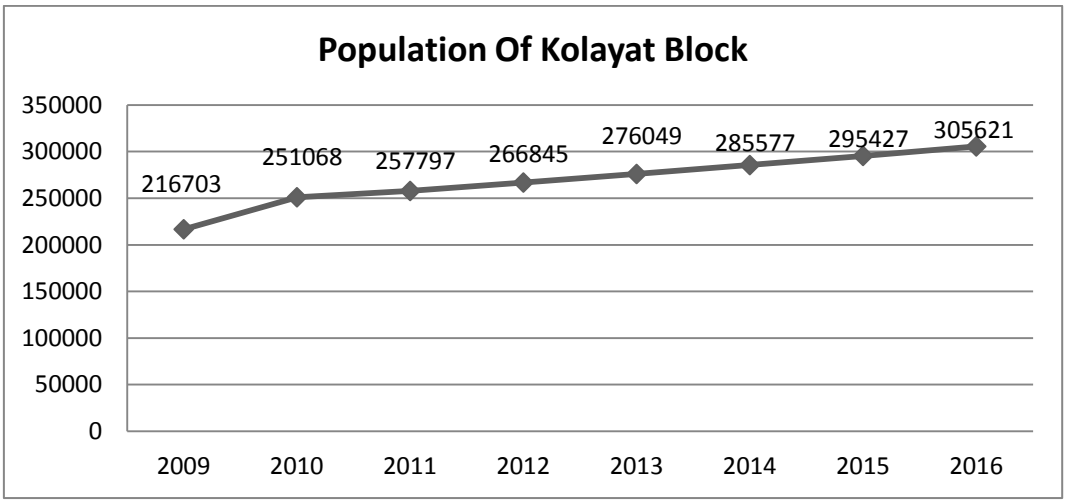

Figure 1: Population of Kolayat Block

The analysis of number of blood slides collected for peripheral smear examination showed that there was a decrease in blood slide collections over a period of 8 years from 2009 to 2016. This decrease in slide collection was mainly due to decreased numbers of patients with fever.

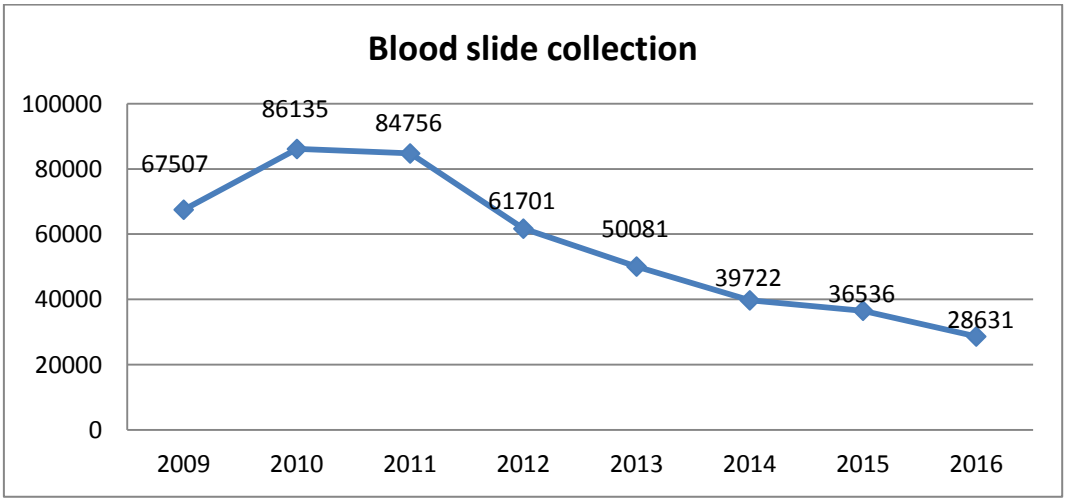

Figure 2: Blood slide collections in Kolayat Block

The annual parasite index also showed a decreasing trend from 2012 onwards and it dropped from 2.78 in 2009 to 0.91 in 2016.

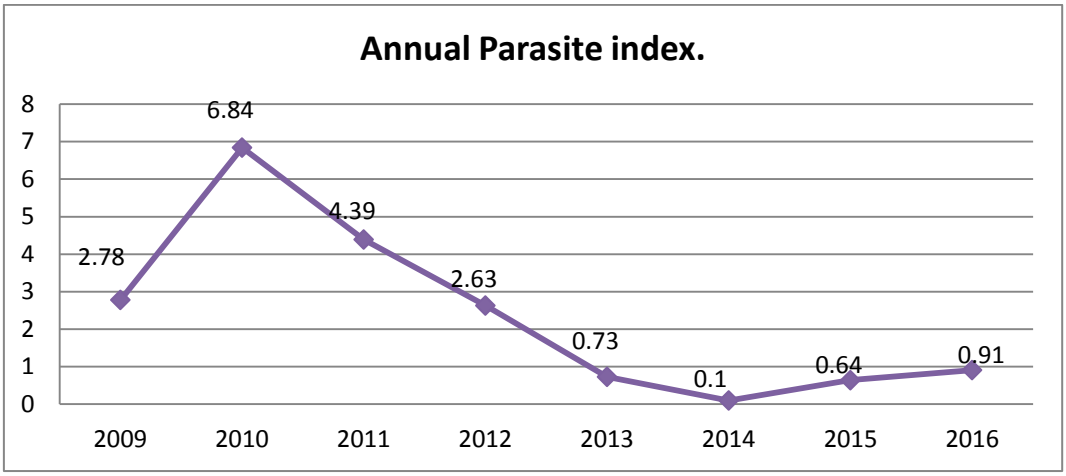

Figure 3: Annual parasite index in Kolayat Block

The cases of malaria diagnosed on the basis of peripheral blood examination showed that there was a steady increase in total malaria cases in 2009 to 2011 but from 2012 onwards there was a drastic decrease in confirmed malaria cases. This could be attributed to concentrated IEC activities and biological interventions such as Gambusia fish as larvicidal. Note the sharp decrease in malaria cases in Kolayat as well as Bikaner district from 2011 onwards.

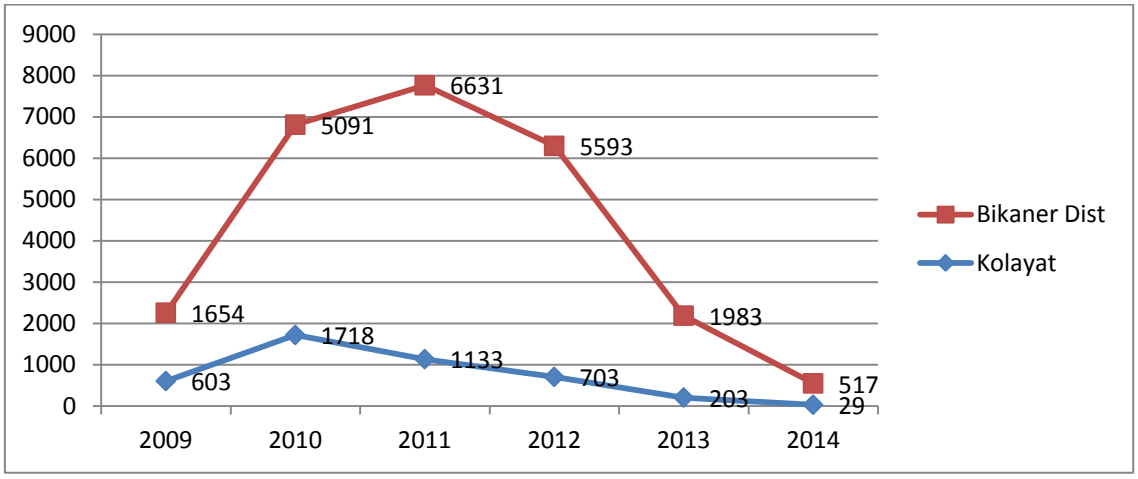

Figure 4: Malaria cases in Kolayat as well as Bikaner District

The analysis of plasmodium vivax and falciparum malaria showed that there was predominance of vivax malaria and falciparum malaria was relatively uncommon. There was a steady decrease in number of vivax as well as falciparum malaria 2012 onwards.

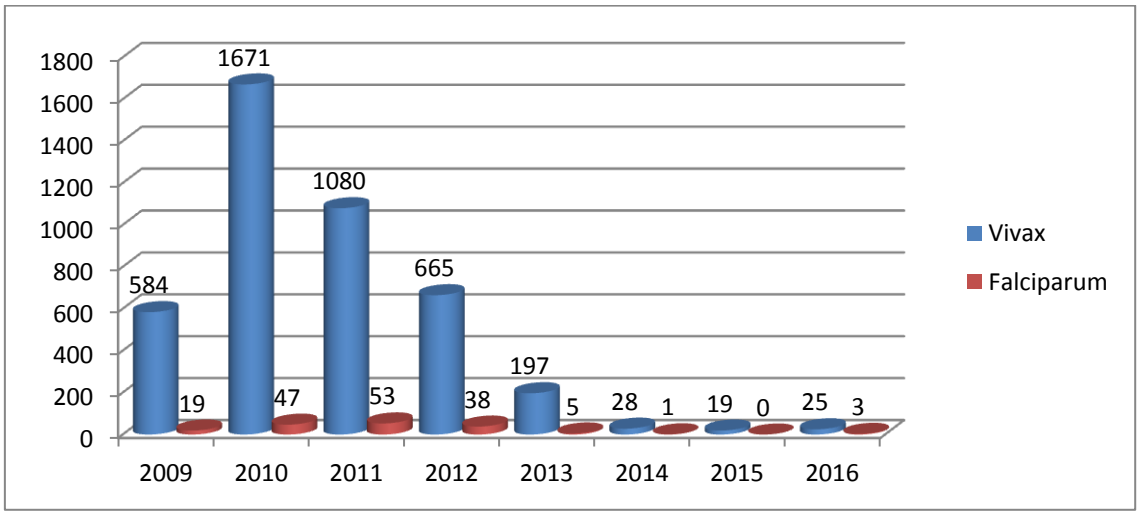

Figure 5: Confirmed Pl. Vivax and Pl. Falciparum cases in Kolayat Block

Plasmodium falciparum percentage (PF %) dropped from 3.15% in 2009 to 0 in 2015. But in the year 2016 again there were 3 cases of falciparum malaria bringing plasmodium falciparum percentage to 10.71% of overall malaria cases.

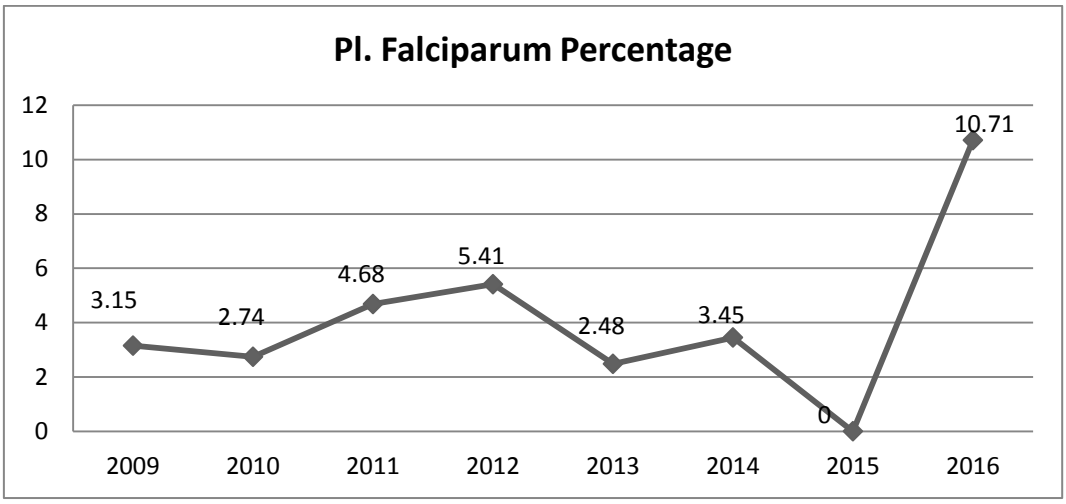

Figure 6: Pl. Falciparum percentage (PF %) cases in Kolayat

The analysis of mortality due to malaria over a period of 8 years showed that there was no mortality from 2009-2010 and 2013-2015. Whereas there 1 death in 2011 and 2012. There were 3 deaths due to malaria in 2016 all of them were falciparum malaria cases.

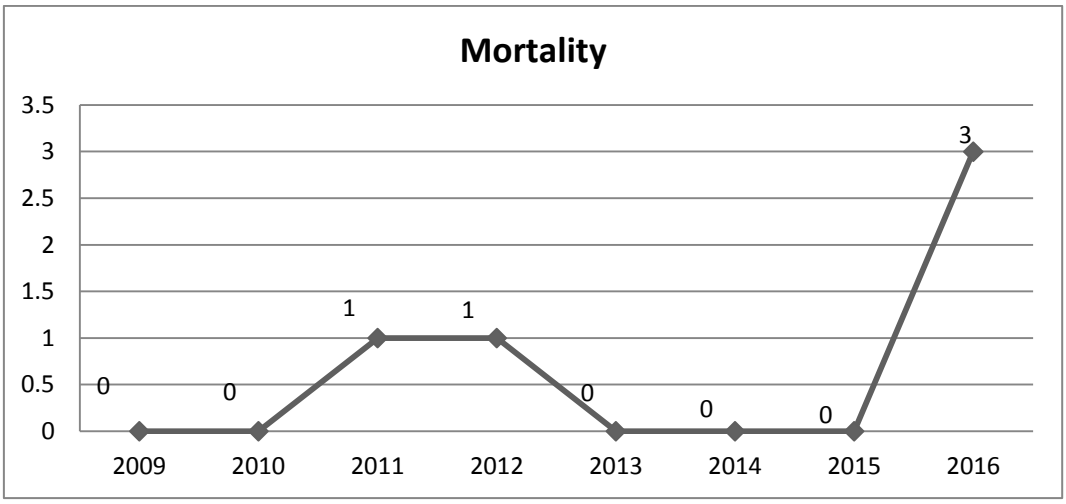

Figure 7: Mortality Due to Malaria in Kolayat Block

Discussion

The effect of IEC activities and biological interventions on the incidence of malaria has been the topic of immense interest amongst the epidemiologists since decades. The efficacy of IEC activities results into behavioral modification of the population and use of personal protections against the mosquito bite that in turn is responsible for considerable reduction in malaria cases. The use of biological agents such as Gambusia fish is responsible for reduction of larval population of mosquitoes thereby decreasing the population of mosquitoes. Various studies analyzing the effect of Gambusia fish have reported statistically significant reduction in malaria cases in areas where these measures have been employed. The Gambusia fish has the advantage of being environmental friendly and they are the only option available to be used as larvicidal in wells, ponds and other stagnant waters which may be used for drinking by population living nearby[9].

Howard AF et al[10] conducted a study to analyze the effects of Oreochromis niloticus *fish on* larval population. For this purpose the authors they introduced fish into abandoned fishponds at an

altitude of 1,880 m and the effect measured over six months on the numbers of mosquito immatures. For comparison an untreated control pond was used. During this time, all ponds were regularly cleared of emergent vegetation and fish re-stocking was not needed. Significant autocorrelation was removed from the time series data, and t-tests were used to investigate within a pond and within a mosquito type any differences before and after the introduction of O. niloticus. The authors found that after 15 weeks the fish caused a more than 94% reduction in both Anopheles gambiae s.l. *and* Anopheles funestus (Diptera: Culicidae) in the treated ponds, and more than 75% reduction in culicine mosquitoes. There was a highly significantly reduction in *A.* gambiae s.l. numbers when compared to pre-treatment levels. Similar larvicidal effects of Gambusian fish were reported by Walshe DP et al[11] and Tabibzadeh I et al[12].

The effects of behavior modification by IEC technique has resulted into considerable decrease in malaria cases. The use of mosquito nets and repellents was found to be associated with reduced number of malaria cases. For these IEC activities such as rallies, demonstrations and information camps were organized. Mugisa M et al[13] in their review paper discussed how African Medical and Research Foundation (AMREF) adopted community based approaches to improve malaria prevention. AMREF through a Malaria project (2007-2010) in Nakasongola district supported IEC activities through training, community mobilization, mass media, health promotion and advocacy. Program performance was measured through baseline and evaluation surveys in 2007 and 2010. The analysis of the impact showed that there was improvement from baseline values as follows: knowledge on prevention of malaria among school children from 76.6% to 90%, under five children sleeping under bed net the previous night from 51% to 74.7%, and from 24% to 78% among pregnant women. The authors concluded that Mobilization of malaria prevention interventions can be successful once BCC approaches are adequately planned and coordinated. Malaria prevention through IEC strategies is likely to be more effective with integration of other malaria interventions, and involvement of community based structures. Similar benefits of IEC activities were reported by Kishor J et al[14] and Tizifa T et al[15]

Conclusion

IEC activities leading to behavioral change and use of biological agents such as Gambusia fish as larvicidal are found to have a profound impact in reduction in incidence of malaria. This reduction in incidence of malaria is associated with decrease morbidity and mortality associated with complicated malaria. Use of Gambusia Fish is the only feasible larvicidal measure in wells and ponds which may be used as source of drinking water by the population living nearby.

Conflict of Interest: None

References

1. Trampuz A, Jereb M, Muzlovic I, Prabhu RM. Clinical review: Severe malaria. Crit Care. 2003;7(4):315-23.
2. Schumacher RF, Spinelli E. Malaria in children. Mediterr J Hematol Infect Dis. 2012;4(1):e2012073.
3. Kumar A, Chery L, Biswas C, et al. Malaria in South Asia: prevalence and control. Acta Trop. 2012;121(3):246-55.
4. Howes RE, Battle KE, Mendis KN, et al. Global Epidemiology of Plasmodium vivax. Am J Trop Med Hyg. 2016;95(6 Suppl):15-34.
5. Das MK, Prasad RN. Evaluation of mosquito fish Gambusia affinis in the control of mosquito breeding in rice fields. Indian J Malariol. 1991 Sep;28(3):171-7.
6. Fletcher M, Teklehaimanot A, Yemane G. Control of mosquito larvae in the port city of Assab by an indigenous larvivorous fish, Aphanius dispar. Acta Trop. 1992; 52:155–166.

7. Longnecker MP, Rogan WJ, Lucier G. The human health effects of DDT (dichlorodiphenyltrichloroethane) and PCBS (polychlorinated biphenyls) and an overview of organochlorines in public health. Annu Rev Public Health. 1997;18:211-44.
8. Louca V, Lucas MC, Green C, Majambere S, Fillinger U, Lindsay SW. Role of fish as predators of mosquito larvae on the floodplain of the Gambia River. J Med Entomol. 2009;46(3):546-56.
9. Wang Y, He W, Qin N, He QS, Kong XZ, Tao S, Xu FL. Distributions, sources, and ecological risks of DDT-related contaminants in water, suspended particulate matter, and sediments from Haihe Plain, Northern China. Environ Monit Assess. 2013 Feb;185(2):1777-90.
10. Howard AF, Zhou G, Omlin FX. Malaria mosquito control using edible fish in western Kenya: preliminary findings of a controlled study. BMC Public Health. 2007;7:199. Published 2007 Aug 9. doi:10.1186/1471-2458-7-199
11. Walshe DP, Garner P, Abdel-Hameed Adeel AA, Pyke GH, Burkot T. Larvivorous fish for preventing malaria transmission. Cochrane Database Syst Rev. 2013;(12):CD008090. Published 2013 Dec 10.
12. Tabibzadeh I, Behbehani G, Nakhai R. Use of gambusia fish in the malaria eradication programme of Iran. Bull World Health Organ. 1970;43(4):623-6.
13. Mugisa M, Muzoora A. Behavioral change communication strategy vital in malaria prevention interventions in rural communities: Nakasongola district, Uganda. Pan Afr Med J. 2012;13 Suppl 1(Suppl 1):2.
14. Kishore J, Gupta VK, Singh SV, Garg S, Kaur R, Ingle GK. Impact of health education intervention on knowledge and community action for malaria control in Delhi. J Commun Dis. 2008 Sep; 40(3):183-92.
15. Tizifa TA, Kabaghe AN, McCann RS, van den Berg H, Van Vugt M, Phiri KS. Prevention Efforts for Malaria. Curr Trop Med Rep. 2018;5(1):41-50.