

Author's response to reviews

Title: The Effect of Dams and Seasons on Malaria Incidence and Anopheles Abundance in Ethiopia

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Rebuttal letter to the editor-in-chief

Dear Professor

We authors would like to thank the reviewers for their valuable comments and suggestions which with no doubt would improve our paper. We addressed the comments and queries of the reviewers point-by-point as follows:

Reviewer's report

General comment: This publication is of great interest as it is the first longitudinal study to assess the impact of a dam on malaria epidemiology in Ethiopia. This work provides important data about this subject and I strongly recommend its publication once the authors are agreed to resolve some issues.

Major compulsory revision:

- Authors focus on *An. arabiensis* as the major malaria vector in the area. However, no data is provided regarding other potential malaria vectors that could play an important role on malaria transmission at the Gilgel-Gibe dam site, as *An. funestus* and *An. nili* species complex. Were these species collected during the two years entomological survey at all? In the conclusions, it is stated that the growth of aquatic vegetation at the lake shoreline could benefit other anopheline species and that could occur a vector shift prevalence. Do you mean *An. arabiensis* for *An. funestus*? That particular shift would be a risk factor for increasing malaria transmission?
 - o We collected over 10 anopheline species nearby the Gilgel-Gibe dam area during a two years entomological monitoring including the principal malaria vector, *An. arabiensis* together with secondary vectors, *An. pharoensis* and *An. funestus* and 7 other anopheline mosquito species whose role is not clearly

defined in the study setting. Anopheline species other than *An. arabiensis* comprised less than 12% of the collections. In this paper we considered only *An. arabiensis* as it is the predominant and the most important vector in Ethiopia in general and in the study area in particular it constituted over 88% of the collected anopheline species. Apart from mosquito abundance, dynamics and species composition, we measured other entomological parameters such as blood digestion stages, sporozoite rates, human blood index, as well as the resting and feeding behaviour of mosquitoes. We plan to report the entomological study in a separate paper in the near future. In the results section we have added a new paragraph (4th paragraph) which summarizes the findings of the entomological survey.

In the conclusion section, we wanted to express that at present, when the reservoir is receded, pockets of water are created nearby the shore. In these pockets, *An. arabiensis* breeds best. The low abundance of other vector species like *An. funestus* and *An. pharoensis* (not reported) may be due to the fact that the dam reservoir is young as it has become operational since 2004 only and a major ecological transformation didn't occur (yet). As a result, there is no significant growth of aquatic vegetation which better supports other malaria vectors such as *An. funestus* and hence there could be a vector shift in the study setting in future if major ecological transformations occur. In general, if such ecological transformation occurs in time, it could influence anopheline larval habitats, species diversity, abundance, and distribution and malaria transmission patterns in the study area.

- Mosquito collections were conducted monthly for two years. However, for each sampling effort, anophelines were only collected one day per month and only inside dwellings. Does malaria transmission exclusively occur indoors in the study area? One day per month may constitute a low sampling effort, because rain or unusual wind could have interfered with mosquito collections. Therefore caution on conclusions is advised.

- o Mosquitoes were collected monthly from inside 2 houses in each of the 16 study villages. Therefore, indoor mosquito collections were conducted from a total of 32 houses each month for two years which we believe is a fair mosquito sampling of the study area. As transmission doesn't exclusively occur indoors in the study area, we assessed outdoor mosquito density as well. Monthly outdoor mosquito collections were conducted from all potential outdoor resting sites during the 2 years entomological monitoring using hand capture in parallel with indoor

mosquito collections. As the density was low, we excluded it from the analysis. Yes, we agree with the reviewers' comment that unusual weather conditions may have influenced mosquito densities but this may affect especially outdoor night biting and outdoor light trap collections. Our data were based on indoor light trap catches.

Minor essential revisions:

- Page 2, 2nd paragraph and line 3: "A total of 2040 children from" by".

- o It is corrected as 'A total of 2080 children from...'

- Page 4, second paragraph and line 8: “malaria incidence” should not be in bold.
 - o It is corrected in the text
- Page 4, second paragraph and line 9: Review sentence: “dam reservoirs and climatic is also under reported”.
 - o It is corrected as ‘dam reservoirs and climate...’
- Page 5, first paragraph. Review sentence advised; “water bodies (hydropower dams) an influence on”.
 - o It is corrected as ‘To investigate whether distance from dam reservoirs has an influence on P. falciparum malaria incidence risk and/or on malaria vector abundance’.
- Page 7, first paragraph, sentence: “Traps were set in each selected house every evening by trained mosquito collectors and run from 1800 to 0600 hours”. This sentence contains redundant information already found in the same paragraph.
 - o Sentence removed from the text as per the suggestion of the reviewer
- Page 10, second paragraph and line 8: “did not” by “didn’t”.
 - o ‘Didn’t’ is corrected as did not as per the suggestion of the reviewer
- Page 11, first paragraph. It would be desirable to review the sentence: “All climatic factors (rainfall,) were strong predictors of mosquito density.
 - o It is corrected as ‘All climatic variables (rainfall, relative humidity and minimum temperature) were found to be strong predictors of mosquito density.’
- Page 11, fourth paragraph and line 5. Is elsewhere [19] the correct reference?
 - o It is corrected as ‘ Other studies from the rift valley of Ethiopia’
- Page 12, first paragraph and line 4. “they could be explained” by “The could be explained”.
 - o It is corrected as ‘This could be explained...’
- Page 12, third paragraph and 2 line. Review sentence.
 - o It is corrected
- In conclusions, Review sentence on line 8.
 - o It is corrected

Discretionary revisions:

- Almost the half of malaria cases in Ethiopia are due to Plasmodium vivax and this plasmodium species has a similar distribution than P. falciparum. There are some publications that describe malaria epidemiology of P. vivax in south-west Ethiopia. In the present publication the authors only focus on P. falciparum. Is the reason because P. vivax transmission does not occur in the study area? Otherwise, it would be desirable a clarification on this issue.
 - o Generally in Ethiopia, the prevalence of P. falciparum is 60% and that of P. vivax is 40%. However, their prevalence still varies according to locality and

season. In the current study area for instance, the prevalence of *P. vivax* is slightly higher than *P. falciparum* and both species are co-endemic. Though we have data on *P. vivax* for the two years study, we preferred to focus on

P. falciparum to measure malaria incidence longitudinally as *P. vivax* incidence could be confounded by relapses.

- In the present study, why were only children under 10 years included and not older people? What is the justification for such selection?

- o The reason for selecting children less than 10 years of age as study participants for our study was that in this age group, immunity is low, allowing obtaining a good idea of the malaria incidence. As mentioned above, malaria in the study area is endemic hence older age groups develop immunity and may remain asymptomatic. This may affect the results.

- Page 7, first paragraph. At the beginning of the mosquito sampling section is used the term 'Light Trap Catches' as the method chosen for anopheline collection. Later is used CDC light Traps. I would recommend to substitute "Light Trap catches" for "CDC light Traps", in order to use the same terminology.

- o The whole paragraph is rephrased and 'light trap catches' is substituted for 'CDC light traps' as per the suggestion of the reviewer.

- Authors use 4 months intervals to classify both years in three different MICS. I would suggest relating MICS with the seasons (meaning dry season, short and long rainy seasons as described in Yewhalaw et al [11]. In table 1, the terms dry and short and long rainy seasons are used in the multivariable frailty model.

- o We found it difficult to classify the malaria incidence climate season (MICS) as dry or wet and short or long rainy seasons. If we look at the high malaria incidence climate season (HMICS) it extends from August to November. In the study area, the wet season is from June to September but the HMICS includes October and November which are dry months. Similarly, the moderate malaria incidence climate season (MMICS) extends from April to July. Here again June and July are in the long rainy season. In the low malaria incidence climate season (LMICS) December and January are dry months while February and March are months of short rains. The difficulty to relate malaria incidence climate seasons to commonly recognized seasons is due to the lag time between the onset of rain and malaria transmission.

Reviewer's report

- However, methodology is not properly written. Adequate data has not been presented in the results. Detail remarks are given below.

- o We tried to clearly re-write the methodology for the longitudinal incidence study and entomological survey as per the recommendation of the reviewer. As we mention, the plan is to publish the entomological data in a separate paper.

- Discretionary Revisions (which are recommendations for improvement but which the author can choose to ignore) suggestion given in the text

- Minor Essential Revisions (such as missing labels on figures, or the wrong use of a term, which the author can be trusted to correct) suggestion given in the text

- Major Compulsory Revisions (which the author must respond to before a decision on publication can be reached) suggestion given in the text

All the three type of revision has been suggested in the text.

Major Compulsory Revisions

- K11. How many are closest village and how many are farthest village from the dam?
 - o The villages are located at different distance from the dam reservoir shore (range is 265 to 9046 meters) and hence there is distance gradient and the analysis was done based on the relative distance of each village from the reservoir.
- What is the malaria prevalence rate of the study villages? Baseline data are necessary for impact assessment.
 - o We assessed the malaria prevalence rate of the study area as 10.5% in a different study which aimed at having baseline data. In the current study, we didn't assess the malaria prevalence rate of individual villages but we have assessed malaria incidence longitudinally to measure the relative effect of dam reservoir and season. As it has been suggested, it would have been good to have malaria prevalence data of each village before dam construction to assess the impact of the dam. However, we tried to assess the impact by conducting a longitudinal malaria incidence study using comparable villages located at different distance from the dam reservoir.
- K14. Procedure for Identification of mosquitoes needs to be mentioned.
 - o Procedures of mosquito identification are provided in the Methods and Materials section, Paragraph 5, lines 14-18 as per the recommendation of the reviewer.
- K20. Clearly mention, out of the 2040 cases how may belongs to nearby village and farther village.
 - o Addressed in K11
- What is the malaria prevalence rate of these villages? Are all the fever cases were confirmed microscopically and all the slides were positive for only P. falciparum? What about P.vivax? Please mention these data clearly. All the data presented in the text is the cumulative ones (for 16 village) which does not reflect any comparison as mentioned in the objective
 - o We did a longitudinal malaria incidence study on a cohort of 2080 children. We didn't assess the malaria prevalence rates of individual villages (see also a previous response). Children found feverish were confirmed microscopically as mentioned in the text but there were cases positive for P. falciparum, P. vivax and with mixed infection. But, in the analysis we considered new cases with P. falciparum to measure incidence as P. vivax could be confounded by relapses and we excluded it from the analysis. The incidence data were analysed in aggregate but it was analysed considering distance of each village from the dam reservoir.

- K23 Mosquito density, what is the value? What are the species composition? Does it include any anophelines/ vector species? What are the vector species prevalent? Nothing has been mentioned neither in the text nor in the table. Provide all these data separately for closest village and farthest village from the dam

- o The value for mosquito density is number of mosquitoes per trap per house per month. Ten anopheline species were recorded over the two years entomological survey and the species composition includes: *An. arabienis*, *An. coustani*, *An. marshalli*, *An. demelloni*, *An. funestus*, *An. pharoensis*, *An. cinerus*, *An. squamosus*, *An. chrysti* and *An. gaharnami*. Of these, the most prevalent vector species is *An. arabiensis*, which has comprised over 88% of the collection. *An. funestus* and *An. pharoensis* which have a secondary role in malaria transmission in the study setting were also recorded but were few in numbers. In the results section we have added a new paragraph (4th paragraph) which summarizes the findings of the entomological survey. But, In this paper we focused only on *An. arabiensis* as it is the predominant and most important vector in the country in general and in the study area in particular It constituted over 88% of all the collected anopheline species. Since we measured other entomological parameters such as mosquito abundance, blood digestion stages, sporozoite rates, human blood index, resting & feeding behaviour, we plan to report the longitudinal entomological study data including the fauna, dynamics and trends of malaria vectors of the study area in a separate paper in the near future.

- K30. What about other anophelines. Is it that all the mosquitoes collected are *Anopheles arabiensis*? The vector survey data needs to be presented in detail giving total no of mosquitoes collected, types of species, seasonal prevalence. All these data needs to be mentioned .Entomological survey needs to be properly written giving all the above data.

- o As mentioned in responding to K23, 10 anopheline species were recorded over the 2 years entomological survey. But, *An. arabiensis* which is the principal vector constituted over 88% of the collections and hence we tried to focus on this species in this report. We plan to report the two years entomological survey data including abundance, species composition, seasonal dynamics and other entomological parameters in a separate paper.

Minor Essential Revisions

The minor essential revision is highlighted in the text.

- Abstract: K1-K6

- o In the abstract section, all the comments are addressed as per the suggestion of the reviewer

- Introduction: K7-K10

- o All the comments in the introduction section are addressed as per the suggestion of the reviewer

- Materials and method: K13-K18

o All the comments in the Materials & Methods section are addressed as per the suggestion of the reviewer

- Results: K19, K22, K23 and K26

o All the comments in the Results section are addressed as per the suggestion of the reviewer

- Discussion: K28-K30, K32-K38

o All the comments in the discussion section are addressed as per the suggestion of the reviewer

- Conclusion: K39, K40

o All the comments in the Conclusion section are addressed as per the suggestion of the reviewer

Discretionary Revisions

- Throughout the text, in many sentences there is no space between two words where a space should be given and also words where space should be deleted. The author should go through the text and make necessary change.

o We addressed the editorial problem and typo error in the text as per the suggestion of the reviewer.