

## PEER REVIEW HISTORY

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### ARTICLE DETAILS

<b>TITLE (PROVISIONAL)</b>	Household cooking fuel type and childhood anaemia in Sub-Saharan Africa: analysis of cross-sectional surveys of 123,186 children from 29 countries
<b>AUTHORS</b>	Amadu, Iddrisu; Seidu, Abdul-Aziz; Afitiri, Abdul-Rahaman; Ahinkorah, Bright; Yaya, Sanni

### VERSION 1 – REVIEW

<b>REVIEWER</b>	Accinelli, Roberto Universidad Peruana Cayetano Heredia Instituto de Investigaciones de la Altura
<b>REVIEW RETURNED</b>	25-Feb-2021

<b>GENERAL COMMENTS</b>	<p>Dear authors,</p> <p>I have a good time reading your paper Household cooking fuel type and child anaemia in Sub-Saharan Africa: analysis of cross-sectional surveys of 95,056 children from 29 countries. It has only some minor corrections that I happen to detail them.</p> <p>29-31 The mechanism by which biomass fuels use could contribute to childhood anaemia are unknown. But it has been postulated by Accinelli et al that biomass fuel exposure causes lung inflammation with elevated levels of IL-6, which produces in the liver hepcidin, a negative regulator of iron stores .</p> <p>31-35 However, studies have shown that biomass fuel expels high carbon monoxide levels which bind with haemoglobin, form carboxyhaemoglobin and reduce the level of haemoglobin in the blood, which leads to anaemia. People with carboxyhemoglobin do not have anaemia. They could have functional anemia, with an adequate Hb level.</p> <p>31 The odds of suffering from anaemia decreased with the age of the child.</p> <p>13-19 Another major finding in our study was that the odds of suffering from anaemia decreased with the age of the child. This finding is supported by other studies conducted in Ethiopia [54, 42, 44, 55] Ghana [56], and Uganda [57]. The possible reason for this association is that in most cases as the children grow, they can eat varied foods which might be sufficient in iron and as a result could prevent the occurrence of anaemia [46]</p> <p>No, the reason is not for the foods they could be eating. In the entire world is the same. Between children under five years old, anemia level decreases with age, being higher in those less than one year and the least in those in the fourth year of live, as in this study. It is because children have their least Hb value at six month and they continue increasing their value in the next years. So,</p>
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	<p>when we use a flat cutoff level as 11 gm% of Hb we overestimate anemia in children.</p> <p>26-30 The pathways by which these causes anaemia include dysregulation of iron homeostasis, impaired erythropoietin response to reduced haemoglobin levels, and impaired marrow response to erythropoietin [15, 41]. No. IL-6 increases with alveolus inflammation related to biomass pollution and hepcidin goes down, that stop the movement of Fe, causing anemia by inflammation.</p> <p>46-49 This could be done by governments in various countries by enhancing access and subsidising the cost of natural and or, liquified petroleum gas [LPG] and cylinders. No. For countries as mine, Peru, and those of Africa with a lot of people leaving in rural areas, without roads and access to the market this solution is an illusion. One and half million LPG stoves with a gas balloon were given free to the same amount of Peruvian families and also a subvention for the gas recharge, but only 8% used and continues using them. So, the solution is the installation of improved biomass stoves.</p>
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<b>REVIEWER</b>	KC, Ashish Uppsala University Hospital, Department of Women's and Children's Health
<b>REVIEW RETURNED</b>	15-Mar-2021

<b>GENERAL COMMENTS</b>	<p>Thank you very much for inviting me to review this interesting research work on association between household cooking fuel type and childhood anemia. I have few major observation and recommendations to improve the paper for further consideration</p> <ol style="list-style-type: none"> <li>1. What is the conceptual model that has been used to associate household cooking fuel with childhood anemia. There is a commonly used UNICEF framework for under-nutrition (distal, intermediate and proximal). All these factors needs to be assessed in relation to anemia. Proximal factor links to infection, exclusive breast feeding, supplementary feeding; intermediate factor- maternal nutrition, birth weight, prematurity, cord clamping intervention; distal factors- wealth, education, residence. I could figure out how these factors has been assessed in table 4, but has not been explicit. There might be need of additional analysis. I suggest DHS provides the information based on the UNICEF multi-dimension conceptual framework.</li> <li>2. The heterogeneity on the data collected from the 29 countries has not been considered. As the information collected is done at different points, with different population framework, the adjustment of heterogeneity needs to be done. Other alternative would be pooling of the data on anemia by countries and presenting as pooled data as meta data.</li> <li>3. Data description, there is a need to elaborately define the key variables. For example, as air pollution data is mentioned. How is this assessed, which tracer is used PM 2.5, PM 10, NO.</li> </ol>
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<b>REVIEWER</b>	Dhimal, Meghnath Abt Associates
<b>REVIEW RETURNED</b>	16-Mar-2021

<b>GENERAL COMMENTS</b>	This is a nicely written interesting paper. I do not have any comments.
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### VERSION 1 – AUTHOR RESPONSE

Reviewer: 1 Dr. Roberto Accinelli, Universidad Peruana Cayetano Heredia Instituto de Investigaciones de la Altura

Comments to the Author:

3. Dear authors, I have a good time reading your paper Household cooking fuel type and child anaemia in Sub-Saharan Africa: analysis of cross-sectional surveys of 123,186 children from 29 countries. It has only some minor corrections that I happen to detail them.

Response: Thank you for your time and great suggestions.

4. 29-31 The mechanism by which biomass fuels use could contribute to childhood anaemia are unknown. But it has been postulated by Accinelli et al that biomass fuel exposure causes lung inflammation with elevated levels of IL-6, which produces in the liver hepcidin, a negative regulator of iron stores .

Response: Thank you for this. We have revised that sentence accordingly. See page 4.

5. 31-35 However, studies have shown that biomass fuel expels high carbon monoxide levels which bind with haemoglobin, form carboxyhaemoglobin and reduce the level of haemoglobin in the blood, which leads to anaemia. People with carboxyhemoglobin do not have anaemia. They could have functional anaemia, with an adequate Hb level.

Response: This section has been revised. See page 11.

6. The odds of suffering from anaemia decreased with the age of the child. 13-19 Another major finding in our study was that the odds of suffering from anaemia decreased with the age of the child. This finding is supported by other studies conducted in Ethiopia [54, 42, 44, 55] Ghana [56], and Uganda [57]. The possible reason for this association is that in most cases as the children grow, they can eat varied foods which might be sufficient in iron and as a result could prevent the occurrence of anaemia [46] No, the reason is not for the foods they could be eating. In the entire world is the same. Between children under five years old, anaemia level decreases with age, being higher in those less than one year and the least in those in the fourth year of live, as in this study. It is because children have their least Hb value at six month and they continue increasing their value in the next years. So, when we use a flat cut-off level as 11 grm% of Hb we overestimate anaemia in children.

Response: We have changed the reason to “This observation is expected due to the fact that children have their least Hb value at six month and they continue increasing their values as they age”

7. 26-30 The pathways by which these causes anaemia include dysregulation of iron homeostasis, impaired erythropoietin response to reduced haemoglobin levels, and impaired marrow response to erythropoietin [15, 41]. No. IL-6 increases with alveolus inflammation related to biomass pollution and hepcidin goes down, that stop the movement of Fe, causing anaemia by inflammation.

Response: We have revised the reason to read “The pathways by which these causes anaemia is that IL-6 increases with alveolus inflammation related to biomass pollution and hepcidin goes down, that stop the movement of Fe, causing anemia by inflammation” . See page 10.

8. 46-49 This could be done by governments in various countries by enhancing access and subsidising the cost of natural and or, liquified petroleum gas [LPG] and cylinders. No. For countries as mine, Peru, and those of Africa with a lot of people leaving in rural areas, without roads and access to the market this solution is an illusion. One and half million LPG stoves with a gas balloon were given free to the same number of Peruvian families and also a subvention for the gas recharge, but only 8% used and continues using them. So, the solution is the installation of improved biomass stoves.

Response: This is greatly appreciated. We have modified these. See page 12.

Reviewer: 2 Dr. Ashish KC, Uppsala University Hospital

1. Comments to the Author: Thank you very much for inviting me to review this interesting research work on association between household cooking fuel type and childhood anaemia. I have few major observation and recommendations to improve the paper for further consideration

Response. Thank you for your time and comments.

2. 1. What is the conceptual model that has been used to associate household cooking fuel with childhood anaemia. There is a commonly used UNICEF framework for under-nutrition (distal, intermediate and proximal). All these factors need to be assessed in relation to anaemia. Proximal factor links to infection, exclusive breast feeding, supplementary feeding; intermediate factor- maternal nutrition, birth weight, prematurity, cord clamping intervention; distal factors- wealth, education, residence. I could figure out how these factors has been assessed in table 4, but has not been explicit. There might be need of additional analysis. I suggest DHS provides the information based on the UNICEF multi-dimension conceptual framework.

Response: Thank you for the suggestion. Even though the DHS program captures variables cutting across these dimensions (distal, intermediate and proximal), the variables are not exhaustive of the UNICEF framework. Further, from our checks following this suggestion, we found that even though some variables were considered by the DHS, data on them exist for only a few countries. We therefore conducted additional analysis as suggested by obtaining the most recent data sets. Even new included new variables on maternal and child characteristics (BMI, Antenatal visits, and Postnatal visits), and perceived birth size of child, we still acknowledge that that the variables included are not exhaustive (see Strengths and limitations). In terms of the conceptual model used to associate household cooking fuel with childhood anaemia, our study dwelled on extensive evidence (see UNICEF, 2016; Baranwal, A., Baranwal, A., & Roy, N. (2014); Accinelli, R. A., & Leon-Abarca, J. A. (2017); Kyu, H. H., Georgiades, K., & Boyle, M. H. (2010) that point to the linkages. Further, evidence on the mechanisms including through birth weight of mother and child among others exist (see Mishra, Dai, Smith & Mika, 2004; Mishra & Retherford, 2007).

3. The heterogeneity on the data collected from the 29 countries has not been considered. As the information collected is done at different points, with different population framework, the adjustment of heterogeneity needs to be done. Other alternative would be pooling of the data on anaemia by countries and presenting as pooled data as meta data.

Response: We appreciate your suggestions. We have adjusted for heterogeneity by conducting multilevel analysis. This analysis technique adjusts for heterogeneity by discriminating the variations in the outcome at the individual-level and cluster-level (different locations/points, and with different population framework). The cluster-level variations adjusted for and estimated using the Interclass Correlation Coefficient (ICC), in this context, overall variations in child anaemia status explained by difference in data points and sampling frameworks (see Duncan, Jones & Moon, 1998; Austin, Stryhn, Leckie & Merlo, 2018).

4. Data description, there is a need to elaborately define the key variables. For example, as air pollution data is mentioned. How is this assessed, which tracer is used PM 2.5, PM 10, NO.

Response: Thank you. Our study did not experimentally assess air pollution directly using its indicators. Air pollution is mentioned in relation to the use of biomass (solid) cooking fuels in some households. These fuels are inefficient thereby release harmful air pollutants such as particulate matter (PM) of varying sizes and aerodynamic radius, carbon monoxide and oxides of nitrogen (NO<sub>x</sub>) among others (see Pathak, U., Gupta, N. C., & Suri, J. C. (2020) into the atmosphere during combustion. The WHO indicates that indoor air pollution is highest in Africa where over 95% of households use solid fuels. This is the rationale for relating unclean (biomass/solid) cooking fuels with air pollution. In this novel analysis, we present the combined effect of the type of household cooking fuel and urbanicity (rural-urban) on child anaemia.

Reviewer: 3 Dr. Meghnath Dhimal, Abt Associates

Comments to the Author:

1. This is a nicely written interesting paper. I do not have any comments.

Response: Thank you.