Dietary Iron Deficiency Impact Compared Across Anemia-Inducing NTDs

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Introduction

Anemia is the second most prolific cause of disability worldwide. Though the parasitic pathologies associated with iron deficiency are well documented, the relative NTD contributions on a **global level** remain unclear. The IHME classifies two instances of iron deficiency: **dietary iron deficiency (DID)** and hemolytic anemia or hemoglobinopathies. Of these factors, **iron deficiency is the biggest contributor** to anemia onset, and as such, the two are often used interchangeably. Four NTDs known to cause pathologies involving DID were evaluated:

- **Hookworm Infection** (*Anclyostoma duodenale/Necator americanus*)
- **Ascariasis** (*Ascaris lumbricoides*)
- **Trichuriasis** (*Trichuris trichiura)*
- **Schistosomiasis** (*Schistosoma mansoni/haemotobium*/etc).

Understanding how each of these NTDs correlates with anemia on a global scale could inform which parasite(s) are key drivers of the worldwide anemia burden.

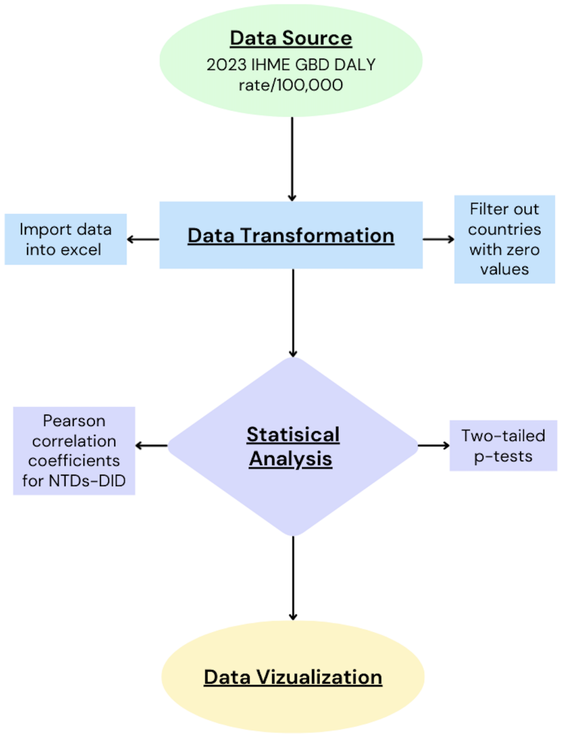
Research Question

At a global level, how strongly is dietary iron deficiency (DID) associated with each of the 4 NTDs: hookworm infection, ascariasis, trichuriasis, and schistosomiasis?

Hypothesis

Since hookworm feeds directly on human blood, infection with this parasite will have the strongest correlation with DID compared to the other NTDs examined

Methodology



Methods Rationale

- Malaria excluded due to differing anemic process
- IHME Schistosomiasis data is not species-specific

Results

☆ Ascariasis and schistosomiasis have the strongest correlations with DID

☆ Hookworm infection has a moderate correlation

☆ Trichuriasis has an insignificant correlation

Results

NTD	r	p-value
Ascariasis	0.555	5.96×10^{-18}
Schistosomiasis	0.517	2.11×10^{-15}
Hookworm Infection	0.323	2.27×10^{-6}
Trichuriasis*	0.102	0.144

Table 1. Pearson correlation coefficient (r) and corresponding p-value by NTD. Asterisk indicates the insignificant value.

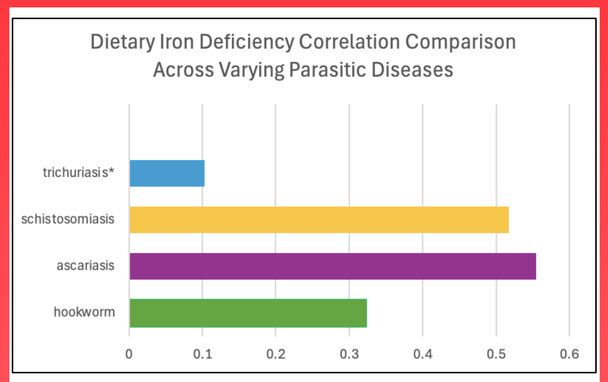


Figure 1. Displays the respective correlations of DID with 4 parasitic diseases (trichuriasis, schistosomiasis, ascariasis, and hookworm). The asterisk indicates an insignificant p-value.

Figure 3. Displays the Pearson correlation coefficient between DID and hookworm infection (green), schistosomiasis (gold), ascariasis (purple), and trichuriasis (blue)

Discussion

Ascariasis had the strongest correlation with DID, followed closely by schistosomiasis, **refuting the hypothesis** that hookworm infection would have the strongest relationship. These findings misalign with those of most previous studies done at the **local level**, which typically state hookworm infection as the main parasitic contributor to anemia. Hookworm's moderate correlation may be due to its more **restricted geographic range** compared to the widespread range of ascariasis and schistosomiasis. Filtering out zero values may have intensified this trend.

Trichuriasis was the only NTD to yield an **insignificant correlation with DID**, despite similar sample sizes across the four NTDs. This could be due to its high rate of **coinfection** and **low intensity infection pattern**, which makes isolating this disease's independent correlation with DID quite difficult. Future research should be done at a population level that can better eliminate confounding factors and utilize local-level studies.

Conclusion

Globally, **ascariasis** and **schistosomiasis** are more **strongly associated with DID** than **hookworm infection**, contradicting this study's hypothesis. These findings highlight that worldwide anemia management must consider both **global and local data** on NTD-anemia relationships, and **multiple NTDs**, not just hookworm infection, when assessing anemia burden.

Acknowledgments

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