

# Schistosome Infections Affect on Hemoglobin in Ghana

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## Introduction

- Schistosomiasis is an infection caused by worms in the *Schistosoma* genus.
  - Adult worms reproduce while in the blood stream.
  - Different species of Schistosome live in different areas of the body.
  - Majority of symptoms from chronic infection are due to the immune response to eggs.
- Hemoglobin is used in red blood cells to carry oxygen.
  - Adult Schistosomes feed mainly across their body surface but, can digest erythrocytes (Skelly, Patrick J et al. 2014)
- Anemia is generally defined as hemoglobin levels that are less than the 5<sup>th</sup> percentile for age.
  - In the United States, the mean hemoglobin levels for children 2-12 years is 13 g/dL (Wang, 2016)
  - In Ghana, the mean hemoglobin levels for children 6 months to 12 years is 10.3 g/dL (Dosoo, David K et al. 2014)
- The community of Tomefa, Ghana is a marginalized fishing community near the capital Accra.

## Materials and Methods

- Data collection was done over the course of 6 years, *S. haematobium* eggs being counted in urine samples, *S. mansoni* eggs being counted in stool samples, and hemoglobin levels from blood samples.
- Data was analyzed using Shapiro-Wilk tests, variance tests and two-sample t-tests. Hemoglobin data was sorted only by schistosomal infection status.

## Literature Cited

Callister, A., Gautney, J., Aguilar, C., Chan, J., & Aguilar, D. (2020). Effects of Indigenous Diet Iron Content and Location on Hemoglobin Levels of Ghanaians. *Nutrients*, 12(9), 2710. <https://doi.org/10.3390/nu12092710>

Dosoo, D. K., Asante, K. P., Kayan, K., Adu-Gyasi, D., Osei-Kwakye, K., Mahama, E., Danso, S., Amenga-Etego, S., Bilson, P., Koram, K. A., & Owusu-Agyei, S. (2014). Biochemical and hematologic parameters for children in the middle belt of Ghana. *The American journal of tropical medicine and hygiene*, 90(4), 767–773. <https://doi.org/10.4269/ajtmh.13-0098>

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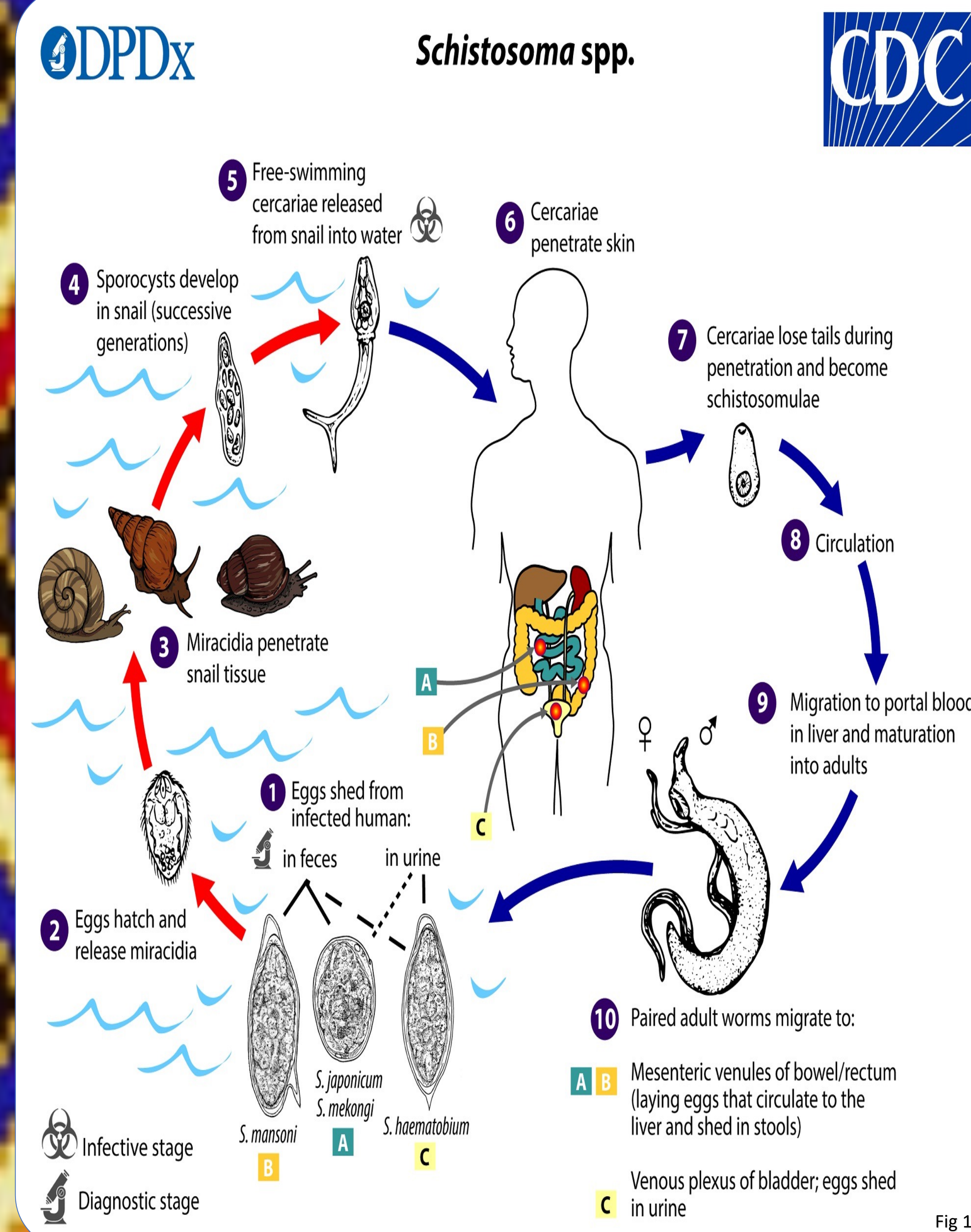
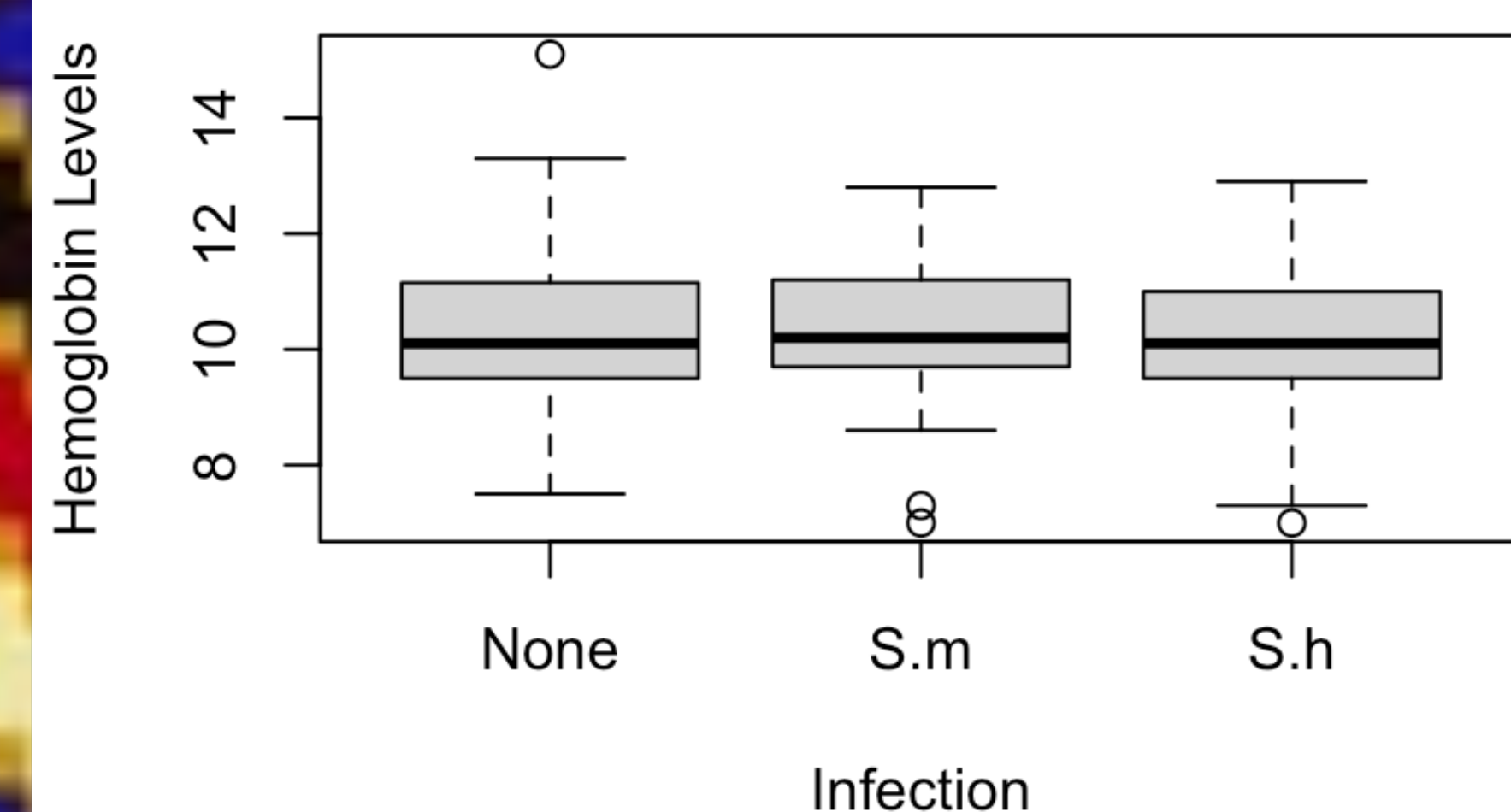


Fig 1.

## Discussion

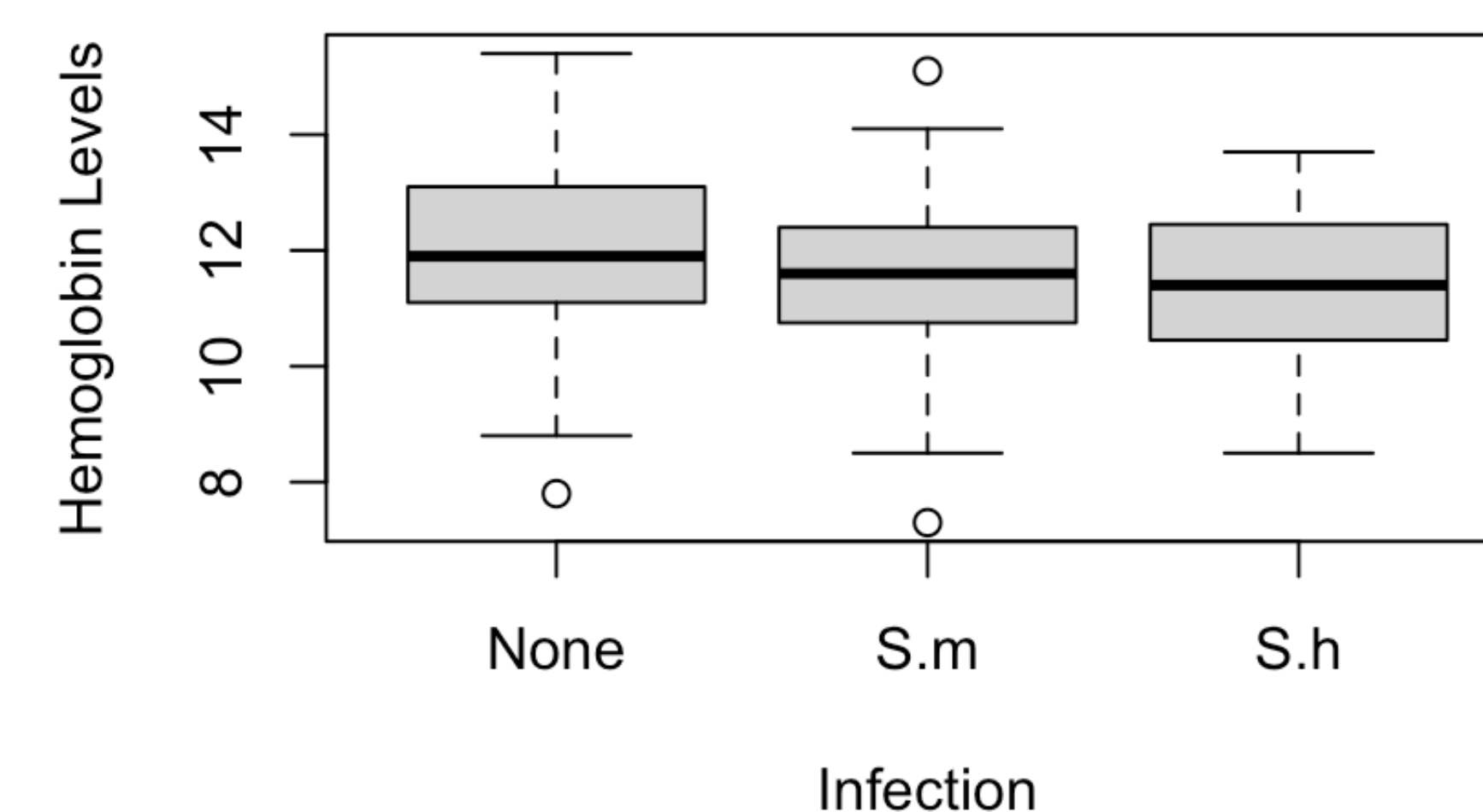
This study does not demonstrate a relationship between *Schistosoma* infections and observed hemoglobin levels, and there are several possible explanations for this. The foremost is the pathogenesis of the worm does not require the digestion of erythrocytes, along with the fact that serious infection is not directly related to the worm burden of an infection but instead more related to the number of eggs within the body. The number of eggs is based upon the worm burden but is more directly related to time frame of infection. This means that low numbers of adult worms may be responsible for the production of large numbers of eggs but as only the mature worms will account for loss of hemoglobin, the digestion of erythrocytes may not be significant to notice hemoglobin differences. This makes sense as even when we look at *Plasmodium* infections anemia is not truly prevalent until severe infection occurs which indicates that even with parasites that more directly involve erythrocytes in their life cycle do not cause severe change in hemoglobin levels until there is a high parasite burden. The other thing that may account for this lack of interaction of hemoglobin levels and *Schistosoma* infections is the normal hemoglobin levels for the region. The mean hemoglobin levels observed in Ghana is 10.3 g/dL for children aged 0.5-12 years and 12.2 g/dL for adolescents (Dosoo, David K et al. 2014) this is lower when compared to the same age ranges in the United States with mean hemoglobin levels of 12.7 g/dL and 14.3 g/dL respectively (Wang, 2016). There is a general trend observed in the region that anemia is prevalent within children and women. There are some factors outside of *Schistosoma* infections that account for this greater prevalence of anemia and low hemoglobin. The factors range from other parasites such as *Plasmodium* and hookworms, to the low iron diets due to poverty along with some of the cultural practices.

## Results



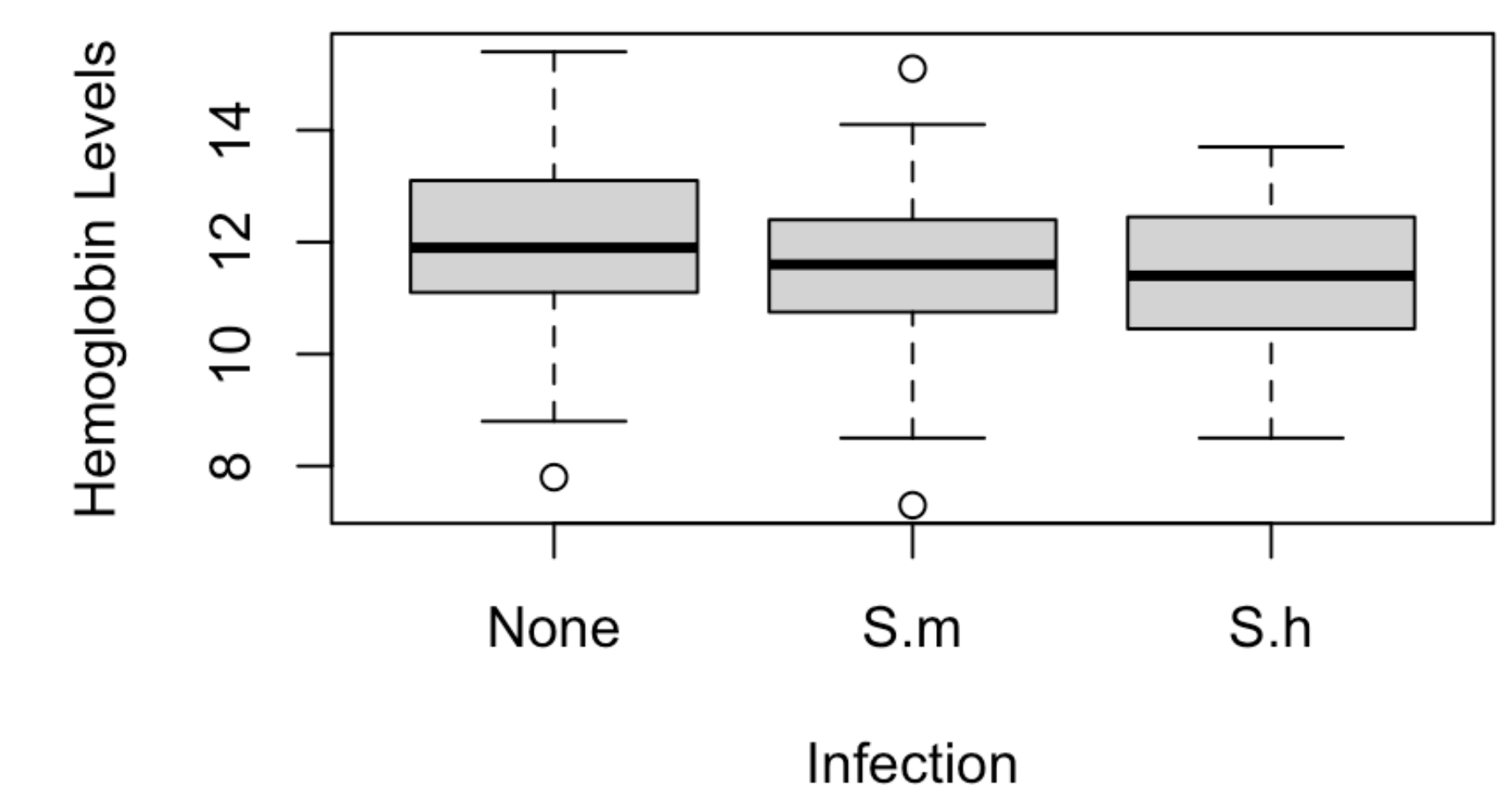
2015

Hemoglobin levels of non-infected individuals (M = 10.4, SD=1.67) compared to those from individuals infected with *S. haematobium* (M = 10.1, SD = 1.36) were not significantly different  $t(51) = 0.89, p = 0.38$ . Hemoglobin levels were also not significantly different,  $t(74) = 0.38, p = 0.70$ , between individuals infected with *S. mansoni* (M = 10.3, SD = 1.21) and non-infected individuals.



2018

Hemoglobin levels of non-infected individuals (M = 12.0, SD=1.63) compared to those from individuals infected with *S. haematobium* (M = 11.3, SD = 1.59) were not significantly different  $t(44) = 1.43, p = 0.16$ . Hemoglobin levels were also not significantly different,  $t(96) = 1.33, p = 0.19$ , between individuals infected with *S. mansoni* (M = 11.6, SD = 1.33) and non-infected individuals.



2019

Hemoglobin levels of non-infected individuals (M = 11.0, SD=1.64) compared to those from individuals infected with *S. haematobium* (M = 11.2, SD = 1.39) were not significantly different  $t(42) = -0.64, p = 0.53$ . Hemoglobin levels were also not significantly different,  $t(66) = 0.033, p = 0.97$ , between individuals infected with *S. mansoni* (M = 10.9, SD = 1.58) and non-infected individuals.