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Effect of Plasmodium, Hookworm and *Schisosoma mansoni* Infections on Hemoglobin Level

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ABSTRACT

Plasmodium-helminths co-infection has detrimental effects on hemoglobin level. This study aimed to determine the effects of Plasmodium, hookworm and *S. mansoni* infections on hemoglobin level. A cross-sectional study was conducted among febrile children. Plasmodium, helminths infections and hemoglobin level were checked. From 333 children, 42.9%, 14.75% and 6.6% had Plasmodium, hookworm and *Schistosoma mansoni* infections, respectively. The prevalence of Plasmodium-hookworm and Plasmodium-*Schicstosoma mansoni* co-infection among children were 12.6% and 2.8%, respectively. Effect of Plasmodium, hookworm and *Schistosoma mansoni* on hemoglobin level was high. Therefore, children should be screened for Plasmodium helminths and anemia simultaneously in endemic areas.

Keywords: Plasmodium, Hookworm, S*chistosomia mansoni*, Hemoglobin

INTRODUCTION

Plasmodium, hookworm and *S. mansoni* infections cause a devastating effect among children especially in the developing world [1]. Approximately, there were an estimated 216 million cases and 445,000 deaths of malaria worldwide [2]. Of these mortalities, 90% occur in African children especially in Sub Saharan Africa [3]. More than 1 billion people become infected, and 450 million are ill due to helminths parasite infections [4].

In areas 2000 m below sea level, *Plasmodium*, hookworm and *S. mansoni* infections are co-endemic [5] and infections with *P. falciparum* [6], hookworm and *S. mansoni* parasites [7] cause severe anemia (hemoglobin level <11 g/dl) especially in children [8] since they affect the red blood cells.

The cumulative effects of *P. faciparum*, hookworm and *S. mansoni* infection causes severe anemia especially in children. Children having anemia as well as other parasitic infections are also a number of times more likely to be stunted and underweight [9]. Therefore, this study aimed to determine the synergetic effects of *P. falciparum*, hookworm and *S. mansoni* infections on hemoglobin level among children.

MATERIAL AND METHODS

A cross sectional study was conducted from April 2016 to August 2016 among febrile school-age children in Jawe Woreda, Amhara Regional State, Northwest Ethiopia. The altitude of the Woreda is between 648 and 1300 m. A total of 333 febrile (>37ºc) children from 6-14 years and willing to participate were randomly selected in Jawe Health Center and Workmeda Health Center. Children under taking antimalaria or/and anthelminthic drugs were excluded.

Socio-demographic information and environmental related factors were collected via face-to-face interview of the parents/guardian of the children. Fresh stool sample was collected using clean plastic cup from each child and processed using direct microscopy and formol ether concentration techniques to detect hookworm and *S. mansoni* parasites. Blood sample was also collected by finger prick from each study participant to detect malaria and to determine the hemoglobin level. The blood sides were stained by Giemsa stain solution whereas hemoglobin level was determined by Hemocue Hb 201 analyzer. Hemoglobin level below 11 g/dL for children is considered as anemia [8].

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RESULTS

From the total 333 children, *Plasmodium*, hookworm and *S. mansoni* prevalence accounted 143 (42.9 %), 49 (14.7 %) and 22 (6.6 %), respectively. The prevalence of *P. falciparum* infection accounted 137 (95.8 %). The prevalence of *P. falciparum*-hookworm and *P. falciparum*-*S. mansoni* co-infection among febrile children were 18 (12.6 %) and 4 (2.8 %), respectively. Triple infection with *P. falciparum*-hookworm-*S. mansoni* among children was 4.2 %.

The overall prevalence of anemia was 136 (40.8%) with 10.9 g/dL mean hemoglobin level. The prevalence of anemia among non-infected and co-infected children was 107 (35.8 %) and 29 (85.3 %), respectively. The mean hemoglobin level among non-infected, *P. falciparum*, hookworm and *S. mansoni* infected children was 10.79 g/dL, 9.84 g/dL and 11.33 g/dL, respectively. The mean hemoglobin level of *P. falciparum*-*S. mansoni, P. falciparum*-hookworm and *S. mansoni*-hookworm co-infected children was 9 g/dL, 9.20 g/dL and 9.67 g/dL, respectively. The mean level of hemoglobin among triple infected children (*P. falciparum*-hookworm-*S. mansoni)* was 8.67 g/dL.

DISCUSSION

The prevalence of *Plasmodium* infection 42.9 % was high and *P. falciparum* was the predominant species in this study. This finding is lower than a study done in Southern Ethiopia (82.84%) [10] and Zambia (50.6 %) [1], but higher than a study done in Malawi (31 %) [11]. This difference might be due to difference in data collection time, altitude and geography. In the present study, high hookworm 14.7 % prevalence is consistent with previous report 37.8 % in Southern Ethiopia [12], but lower than earlier reports 26.8 % in Southern Ethiopia [13] and 42.4 % in Zambia [1]. The difference might be due to the variation in shoes wearing habit and soil types. The prevalence of *S. mansoni* 6.6 % in the present study is low than previous result 11.7% in Southwest Ethiopia [14] and 49 % in Northwest Ethiopia [15]. This variation might be due to the difference in diagnoses methods of *S. mansoni.*

Prevalence of *Plasmodium*-hookworm (12.6 %) and *Plasmodium*-*S. mansoni* (2.8 %) co-infections in the present study are comparable with a previous prevalence report (11.8 %) and (2.7%) in Zambia, respectively [1]. However, triple infection 4.2 % prevalence in the current study is higher than previous report 2.7 % prevalence in Zambia [1]. The prevalence of *Plasmodium*-*S. mansoni* 2.8 % in the present study is comparable with earlier report 1.5 % in Kinshasa [16], but lower than previous findings 38.5 % in Southwest Ethiopia [14] and 19.5% in Northwest Ethiopia [17]. The current low prevalence might be due to method deference.

The prevalence of anemia 41.4 % among children in the presence study was comparable with previous report 41.6% in Kinshasa [16] but higher than a finding 23.66 % in Southeast Ethiopia [18]. This finding is also lower than earlier report 20.6 % in Southern Ethiopia [13], 46.0% in Yemen [19] and (59.3%) in Egypt [20]. Hemoglobin level among *P. falciparum*-helminths co-infected children in the current study was lower than the non-infected children which is consistent with earlier finding in Ethiopia [12].

CONCLUSION

Co-infection of *P. falciparum with* hookworm and *S. mansoni*, and their triple infection decreases the hemoglobin level among children. Therefore, *Plasmodium* and helminths diagnosis and hemoglobin determination should be conducted among febrile children in malaria-helminths endemic areas.

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