Age- and sex- specific differences in haematological abnormalities associated with HBB gene polymorphisms among patients infected with Plasmodium falciparum

Abstract

Age and sex influence haematological abnormalities in *Plasmodium falciparum* malaria, but their link to Beta sub-unit genes (*HBB*) gene polymorphisms is unclear. This study examined these factors in infected patients. In this analytical cross-sectional study of 234 participants in Kenya (90 infected with malaria, 144 non-infected; 20 with HbSS, 214 with HbAS/HbAA), individuals aged ≥6 months with fever >37.5°C were recruited. Participants were stratified by infection status, HBB genotype, and age groups (6–59, 60–120, >120 months). *P. falciparum* was detected via microscopy, hematological parameters with Celtac G MEK-9100K, and HBB genotyping by real-time PCR. Statistical tests compared proportions, laboratory features, and associations between age/sex and hematological abnormalities. Haemoglobin (Hb) was lower (p=0.002), while Mean cell volume (MCV) (p=0.036) and platelet count (p=0.046) were higher in those infected and have carriage of HbSS relative to those infected and have carriage of HbAS/HbAA, respectively. White blood cell count (WBC) was comparable between the two groups with *p*=0.076. Participants of age >120 months had increased odds of anaemia as shown by low Hb [OR=13.362, 95% CI=2.742-65.119, p=0.001], low HCT [OR= 3.132, 95% CI= 1.783-24.694, *p*= 0.002] and low RBC [OR=7.888, 95% CI=1.691-36.791, *p*=0.009]. Additionally, older patients had reduced risk of agranulocytosis [OR=0.208, 95% CI=0.056-0.778, *p*=0.002]. With respect to sex, platelets were higher (*p*=0.007) in infected females relative to infected males; none of the abnormalities was associated with sex within the context of this study's population and sample size. *HBB* polymorphisms modulate haematological abnormalities and older age (>120 months) is strongly associated with increased risk of anaemia, which is more pronounced in *P. falciparum* infection. Anaemia and related abnormalities are most evident in HbSS carriers compared to HbAS/HbAA, while sex shows no association with these haematological changes.