

**Title of Article:** *Solenostemon monostachyus*, *Ipomoea involucrata* and *Carica papaya* seed oil versus Glutathione, or *Vernonia amygdalina*: Methanolic extracts of novel plants for the management of sickle cell anemia disease.

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### Abstract

**Background:** Sickle cell disease (SCD) is a genetic disease caused by an individual inheriting an allele for sickle cell hemoglobin from both parents and is associated with unusually large numbers of immature blood cells, containing many long, thin, crescent-shaped erythrocytes. It is a disease prevalent throughout many populations. The use of medicinal plants and nutrition in managing SCD is gaining increasing attention.

**Methods:** The antisickling effects of *Solenostemon monostachyus* (SolMon), *Carica papaya* seed oil (Cari-oil) and *Ipomoea involucrata* (Ipocrata) in male (HbSSM) and female (HbSSF) human sickle cell blood was examined *in vitro* and compared with controls, or cells treated with glutathione or an antisickling plant (*Vernonia amygdalina*; VerMyg).

**Results:** Levels of sickle blood cells were significantly reduced ( $P < 0.05$ ) in all the plant-extract treated SCD patients' blood compared with that of untreated SCD patients. RBCs in SolMon, Ipocrata, and Cari-oil treated samples were significantly higher ( $P < 0.05$ ) compared with VerMyg-treated samples. The  $Fe^{2+}/Fe^{3+}$  ratio was significantly reduced ( $P < 0.05$ ) in all plant extract-treated HbSSM samples compared with controls. Hemoglobin concentration was significantly increased ( $P < 0.05$ ) by SolMon treatment in HbSSF compared with VerMyg. Sickle cell polymerization inhibition exhibited by SolMon was significantly higher ( $P < 0.05$ ) compared with that of VerMyg in HbSSF blood. Sickle cell polymerization inhibition in SolMon and Ipocrata were significantly higher ( $P < 0.05$ ) compared with VerMyg in HbSSM blood. All plant extracts significantly reduced ( $P < 0.05$ ) lactate dehydrogenase activity in both HbSSM and HbSSF-treated blood. Catalase activity was significantly increased ( $P < 0.05$ ) in HbSSF blood treated with Ipocrata compared with glutathione. Cari-oil treated HbSSM and HbSSF blood had significantly increased ( $P < 0.05$ ) peroxidase activity compared with controls.

**Conclusions:** Methanolic extracts from *S. monostachyus*, *C. papaya* seed oil and *I. involucrata* exhibited particular antisickling properties coupled with the ability to reduce stress in sickle cell patients. Each plant individually or in combination may be useful for the management of sickle cell disease.