An investigation into the antioxidant effects of plant-based oils, as a model for novel sickle cell anaemia treatments.

Introduction:
Sickle cell anaemia (SCA) is a recessively inherited red blood cell disorder. The main symptom is a vaso-occlusive crisis:
- A significant number of red blood cells form a crescent sickle shape.
- These sickle cells block blood vessels and adhere to the endothelium.
Antioxidants are believed to be potential treatments for SCA due to a link between the occurrence of vaso-occlusive crises and the significant presence of reactive oxygen species (ROS) in sickle blood (Wood and Granger, 2007). Tiger nut oil (Cyperus esculentus) and black seed oil (Nigella sativa) are anecdotally believed to reduce the symptoms of SCA. It is the aim of this in vitro study to evidence the success of tiger nut and black seed oils to increase the antioxidant capacity of HbS (sickle) blood samples.

Methodology:
Antioxidant assay
- HbS blood plasma samples incubated (1 hour and 24 hours, 37°C) with tiger nut oil and black seed oil, separately, and untreated controls.
- Protocol for antioxidant assay kit CS0790 followed (Sigma-Aldrich ©).
- Absorbance readings taken at 405nm on a Sunrise spectrophotometer.
- Antioxidant concentrations of samples determined from plasma absorbance, using Trolox standard curve.

Results:
- Following 1 hour of incubation, all samples treated with tiger nut oil, with the exception of sample 5 (0.04mM), induced antioxidant concentrations higher than that of the untreated control sample (0.23mM) (figure 4).
- Following 24 hours incubation, all samples treated with tiger nut oil, with the exception of sample 1 (0.11mM), produced antioxidant concentrations lower than that of the untreated control sample (0.09mM) (figure 4).
- Following 1 hour of incubation, all samples treated with black seed oil, with the exception of sample 1 (0.11mM) and sample 7 (0.22mM), induced antioxidant concentrations higher than that of the untreated control sample (0.23mM) (figure 5).
- Following 24 hours incubation, all samples treated with black seed oil, with the exception of sample 2 (0.06mM), induced antioxidant concentrations higher than that of the untreated control sample (0.09mM) (figure 5).
- The greatest antioxidant concentration produced by black seed oil treatment was 1.42mM which occurred post 1 hour incubation (figure 5); the greatest antioxidant concentration produced by tiger nut oil treatment was 0.79mM, which also occurred post 1 hour incubation (figure 4).
- On the whole, black seed oil extracts are able to increase the antioxidant concentration of HbS samples to higher values, compared to the ability of tiger nut oil (figure 4)(figure 5), particularly 1 hour after treatment compared to 24 hours after treatment.

Discussion:
Previous studies have confirmed that sickle cell blood samples contain lower levels of antioxidant concentration than non-sickle blood (Hundekar et al, 2010). An increase in the antioxidant presence in sickle erythrocytes, due to tiger nut oil or black seed oil supplementation, should result in a stronger defence against excessive ROS generation. Consequently, this could reduce oxidative stress and the HbS cell sickling it exacerbates. Therefore the symptoms associated with sickle cell anaemia, such as vaso-occlusive crises, would be alleviated.

Conclusion:
The results from this study encourage further investigation into the anti-sickling effects of both tiger nut oil and black seed oil, with a main point of focus on black seed oil, based on the greater success of increasing total antioxidant concentration in HbS samples. Future work will identify the efficacy of tiger nut oil and black seed in sickle cell patients in vivo, to strengthen the argument for the use of these natural antioxidant products as treatments.

References:


Antioxidant assay values for sickle samples treated with C. esculentus oil
Reference: 24 hours
Figure 4. The antioxidant concentrations of HbS samples incubated for 1 hour and 24 hours with tiger nut oil and black seed oil. The data is shown as means ± SD.

Antioxidant assay values for sickle samples treated with N. sativa oil
Reference: 24 hours
Figure 5. The antioxidant concentrations of HbS samples incubated for 1 hour and 24 hours with tiger nut oil and black seed oil. The data is shown as means ± SD.