Malaria fever is a prevalent disease in endemic sub-Saharan African Countries like Nigeria, where it poses life-threating complications, especially to children and pregnant women. It is caused by Plasmodium parasites and transmitted through infected female Anopheles mosquito bites. Research and development have produced several clinical synthetic drugs, while a variety of indigenous plants have also found applications as antimalarials; an example is Andrographis paniculata. It is popularly known as “ewe meje meje” in Southeastern Nigeria, the “King of Bitters” in English, and it belongs to the Acanthaceae family. Studies have shown that the extracts of this plant can even inhibit the growth of drug-resistant plasmodium parasite strains. Therefore, this research was aimed at identifying the phytochemicals present in the extracts of the aerial parts of the plant that inhibit the growth and development of the malaria parasite.

The aerial parts (stem and leaves) of Andrographis paniculata were locally sourced, identified, thoroughly rinsed, air-dried, and pulverized. Cold extraction was carried out on the pulverized aerial parts using absolute dichloromethane, ethyl acetate, and methanol. The extracts were characterized using preliminary phytochemical screening, Fourier-transform infrared (FTIR) spectroscopy, and Gas Chromatography coupled with Mass Spectrometry (GC-MS) techniques. In silico studies (molecular docking and pharmacokinetic predictions) were then carried out on the phytochemicals identified feom the GC-MS characterization.

The phytochemical screening showed the presence of alkaloids, terpenoids, steroids, phenols, and fatty acids, which were explicitly confirmed by the GC-MS characterization, which identified 46 pytochemicals. The FTIR analysis of the three extracts revealed the presence of OH, C-H, C=O and CH2 vibrations bands. The C=N vibrational bands overlapped with those of C=C, likewise, the C-N vibration bands overlapped with those of C-O. The 46 identified phytochemicals were docked against the enzyme, Dihydroorotatedehydrogenase (DHODH), an enzyme that aids the development of the malaria parasite in the host organism. This was done in comparison to a reference ligand (DSML), a known inhibitor, and their binding affinity was estimated in Kcal/mol, as a potential for their inhibition of the enzyme. Only 4 out of the 46 study compounds (referred to as ligands 1, 2, 3, and 4) showed a higher binding affinity of -12.1 kcal/mol, -13.8 kcal/mol, -14.4 kcal/mol, and -12.1 kcal/mol, respectively as compared to the reference ligand -11.6 kcal/mol. This suggests that these 4 study would have better inhibitory activities as compared to the reference ligand. Ligands 1, 3, and 4 showed better pharmacokinetic profiles as compared to the known inhibitor (DSMI), thus appear to be better drug candidates.

From the in silico study ligands 1, 3, and 4 (naturally occurring compounds) were observed to be more promising drug candidates against DHODH as compared to its known inhibitor (DSMI), which is a synthetic compound. This makes them potential candidates for orally administered medications, further studies, and medicinal implications.