Green tea and white wine, in case of malaria infection abstain!

This research is based on the critical role several antimalarial drugs, like chloroquine, play in the inhibition of beta-hematin and hemozoin formation.

GREEN and BLACK TEA

Column diagram representing the efficacy of TEA –black and green water infusion, compared to the negative control; ultra-pure H2O and positive controls: CQ 0.1 mg/ml, showing the absorption values of dissolved β-hematin (alkaline hematin) at 405 nm using ELISA reader.

Results communicated by Mutaz Akkawi, AlQuds University.

There are already some indications in the literature that *Camellia sinensis* tea absorbs non-haeme iron by the formation of complexes, but that it is unable to form complexes with haem.


Camellia sinensis tea may even enhance malaria.
Antimalarial effect against P. berghei infected blood cells by green tea (GTE) and black tea extracts (BTE), by distilled water (UN), pyrimethamine (PYR), artesunate (ART), chloroquine (CQ), GTE/BTE mixture.


The same assays were repeated in vivo and the results are worrisome. Treated orally during 4 days with a dose of 15 g/kg green tea extract GTE in Plasmodium infected mice parasite growth was significantly enhanced 3-5 times


Similar results had already been obtained in 2007. Mice treated in vivo against Plasmodium yoelii by black tea brew Camellia sinensis showed no significant schizonticidal activity either on early infection or established malaria infections. The authors conclude that black tea brew may not be effective against Plasmodium falciparum human malaria contrary to the beliefs of traditional medicines and folklore.


Camellia sinensis tea infusions are very poor in the antimalarial arginine.

Furthermore the catechins of green tea inhibit NO production with the same efficiency as the strong inhibitor L-NAME

EGCG is one of the strongest antioxidants, comparable to vitamin E and it is known that this strong antioxidant inhibits the defense system of the human organism by interfering with ROS and hydrogen peroxide. Most of the antimalarial drugs kill the parasites by oxidation.


Another study found that all catechins from green tea greatly reduced NO production from three different NOS isoforms (nNOS, iNOS, eNOS) suggesting the gallate structure plays an important role in the inhibition.


Catechins have a strong influence on glucose metabolism and homeostasis; glucose is a key element during malaria infections with ambivalent activities. Green tea catechins inhibit glucose exit from erythrocytes.. EGCG seems to be more potent than ungallated catechins and binds to glucose transporter GLUT1.


In *Camellia sinensis* it is the fermentation process which transforms the catechins from green tea into gallic acid.


A study from Thailand shows that in green tea the concentration of gallic acid is 1.67, in oolong tea 1.92 and in some black teas it is up to 21.98 mg/g. In black teas some catechins like EGC, EGCG have almost vanished.

T Kongpichitchoke, M Chiu, J Hsu, Gallic acid content in Taiwanese teas at different degrees of fermentation. Molecules 2016, 21, 134
At the rupture of the schizonts, uric acid precipitates are released into the blood stream and produce the well-known inflammatory reaction and repetitive fever peaks. The control and reduction of uric acid during malaria infection is important.

Most flavonoids like luteolin, quercetin, anthocyanins, proanthocyanidins inhibit xanthine oxidase, a precursor of uric acid, and reduce serum uric acid levels, but catechins do not. They are all strong antioxidants, including the catechins. In a dogmatic way the antioxidant power of polyphenols has been linked to antimalarial properties. A recent paper from Indonesia on catechins does not confirm this relationship. To the contrary. They have astronomically high IC50 against Plasmodium falciparum: 5.6833 µM for EGCG and 88.145 for EGC for example.

I Budiman, F Rahardja, N Fauziah. Antioxidant and antimalarial properties of catechins. BJMMR, 2015 5(7), 895-902 ISSN: 2231-0614

In a Singapore study uric acid rose in tandem with more consumed green tea, but not with black. But black tea did not lower uric acid. Green tea is very rich in catechins.


Artemisia plants are void of or very poor in catechins. Except Artemisia vulgaris and this the only plant known lacking antimalarial properties in the large Artemisia family and it contains sizeable quantities of EGC and EGCG like green tea.


Mixing Artemisia infusions with other plants (moringa, green tea) might have catastrophic effects during a Malaria infection.

Moringa oleifera is indeed extremely rich in catechins.


Green tea more than any other plant and is able to enhance malaria infections.

The scarcity of scientific papers, except some in vitro studies, responding to the keywords malaria, Camellia sinensis would thus be logical. Probably all attempts to find antimalarial effects for green tea have failed.
Another series of results from Mutaz Akkawi, AlQuds University, on beta hematin inhibition. CQ is chloroquine. The biggest surprise in these results is the absence of antimalarial properties of red and white wine, used in these assays.

The difference between red and white (green) grape peel may be related to the fact that peel of white grapes does not contain anthocyanins and red grape peels always do. Anthocyanins may be metabolized into gallic acid.


Grape peels are also rich in tannins and gallic acid but the process of white wine making barely extracts any of these, red wine does. White wines contain very low amounts of gallic acid (4 mg/L) but red wines contain up to 20 times more.

Grape juices and wines are also very rich in proline, predominant over all other amino acids. The proline concentration increases in parallel with the maturity of the grapes.

*CS Ough, Proline content of grapes and wines. Vitis, 1968, 7, 321-331.*

The amino-acid proline is known to be fuel for parasites, worms, bacteria, fungi.

The attachment of merozoites to erythrocytes is receptor-mediated. Specific proteins mediate this attachment.

*M E Perkins. Surface proteins of Plasmodium falciparum merozoites binding to the erythrocyte receptor, glycophorin. J. ExP. MED. Volume 160 September 1984 788-798*

An interesting observation is that in the case of *Plasmodium falciparum* resistance to certain antimalarials this resistance is accompanied by a 30fold increase of proline in the food vacuole, the concentration of all other amino acids remaining constant.


Green tea catechins also inhibit glucose exit from erythrocytes.

*R Naftalin, I Afzal, SR Milligan, Interactions of androgen, green tea catechins with the human erythrocyte glucose transporter GLUT1. Bri J Pharmacol, 2003 140, 487-499*

In summary, the molecules which probably play the major role in beta-hematin inhibition in wines and teas are anthocyanins, catechins and tannins. Either synergistic or antagonistic

*E.C Bate-Smith, Royal Botanic Gardens, Kew, 1957*