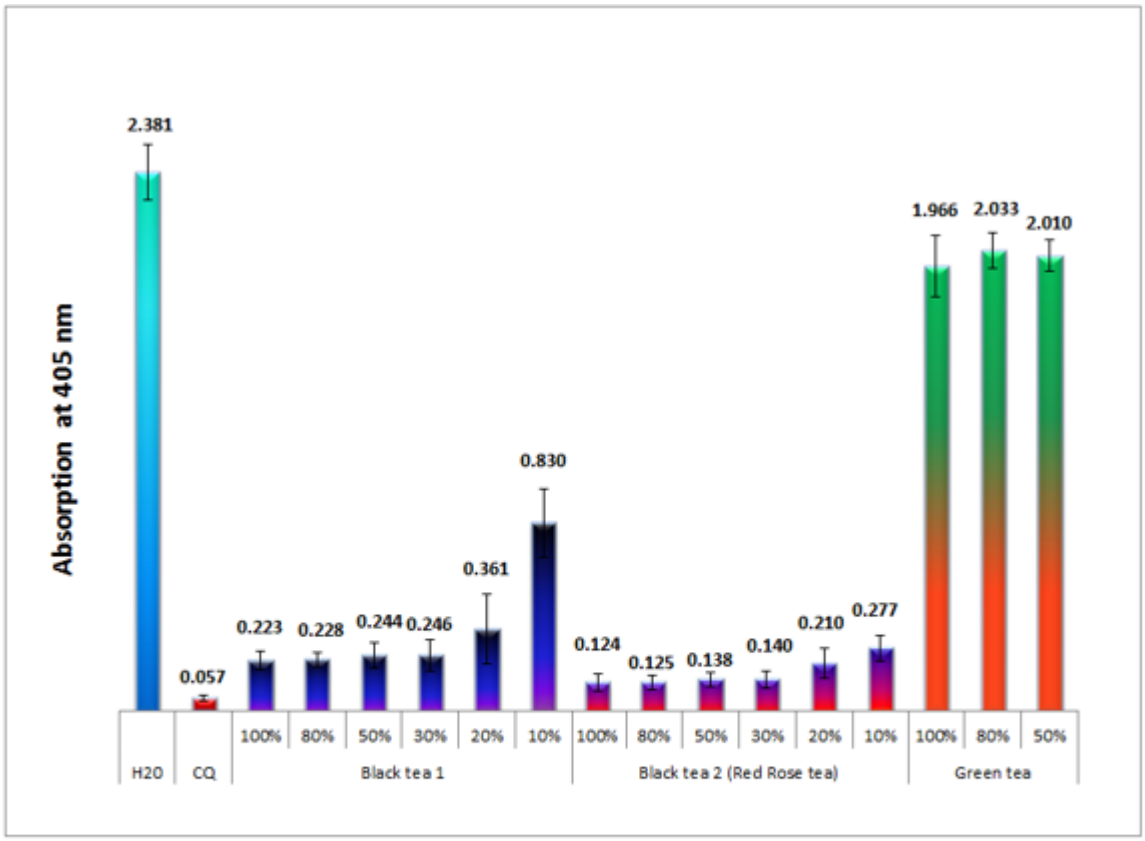
Green tea and white wine, in case of malaria infection abstain!

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



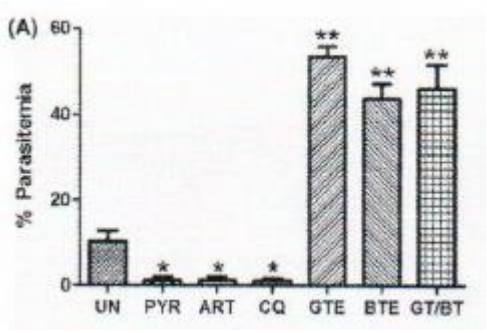
Column diagram representing the efficacy of TEA –black and green water infusion, compared to the negative control; ultra-pure H2O and positive controls: CQ 0.1 mg/ml, showing the absorption values of dissolved β-hematin (alkaline hematin) at 405 nm using ELISA reader.

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.

PB Disler, SR Lynch, F Mayet. The effect of tea on iron absorption. Gut, 1975, 16. 193-200

Camellia sinensis tea may even enhance malaria.



Antimalarial effect against P bergei 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.

L Kunlawong, N Ponwiang, V Somsak. Anti-hemolytic effects of green and black tea aqueous extracts on plasmodium berghei infected mice. Adv Nat Products, 2014, vol 1. 1-6.

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

U Jaihan, J Niljan, L Kunlawong, V Somsak. Effect of green tea extract on Plasmodium berghei growth. Concerence paper 2015

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.

WD Ratnasooriya, PV Udagam-Rendeiya, An investigation of in vivo antimalarial activity of black tea of Camellia sinensis in mice. SLJ Tea Sci 2007, 72, 9-15.

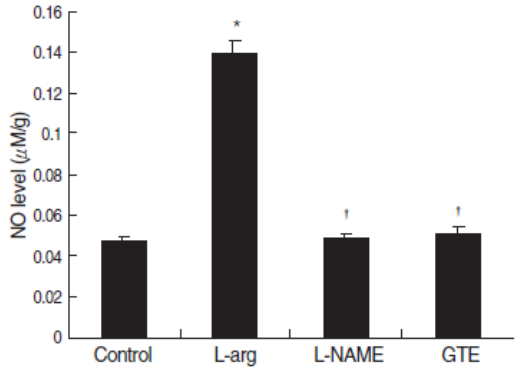


Fig. 5. Concentration of NO (nitric oxide). Mesangial cell pretreated with L-arginine (50 μM/L) were cultured with iNOS inhibitor (L-NAME, 5 mM) or GTE (30 μL) and were analyzed by NO ELISA

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

Byung Chul Shin, Hyun Ho Ryu, Jong Hoon Chung, Byoung Rai Lee , and Hyun Lee Kim The Protective Effects of ***Green Tea Extract (GTE)*** *against L-arginine J Korean Med Sci 2009; 24. S204-9 ISSN 1011-8934 DOI:*

10.3346/jkms.2009.24.S1.S204

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.

Brahma N, Singh, Sharmila Shankar. Green tea catechin EGCG: mechanisms, perspectives and clinical applications: Biochen Pharmacol 2011 Dec 15 82, 1807-1821.

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.

ZM Wang, CL Tidrick, D Stuehr, Green tea polyphenols decrease enzyme activity of nitric oxide synthase. The FASEB J, 27, Suppl 790.

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.

RJ Naftali, I Afzal, P Cunningham, M Halai, S Milligan. Interaction of androgens, green tea catechins and glucose transporter. Brit J Pharmacol 2003, 140, 487-499

Ksenija Slavic, Elvira T. Derbyshire, Richard J. Naftalin, Comparison of effects of green tea catechins on apicomplexan hexose transporters and mammalian orthologues. Mol Biochem Parasitol. 2009 Nov; 168(1-10): 113–116. doi: 10.1016/j.molbiopara.2009.06.008

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

Y Hilal, U Engelhardt, Characterization of white tea- Comparison to green and black tea. J Verbraucherschutz und Lebensmittelsicherheit, 2007, 2, 414-421

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 ben 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.

GG Teng, CS Tan KG Saag, W Koh. Serum urate levels and consumption of common beverages. Arthritis Care Res. 2013, 65, 1432-1440.

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.

Min-Jun Kim and Chi-Ho Lee, The effects of extracts from Mugwort on the Blood Ethanol level and Liver Function. Korean J Food Sci Ani Resour 1998, 18,4, 348-357

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

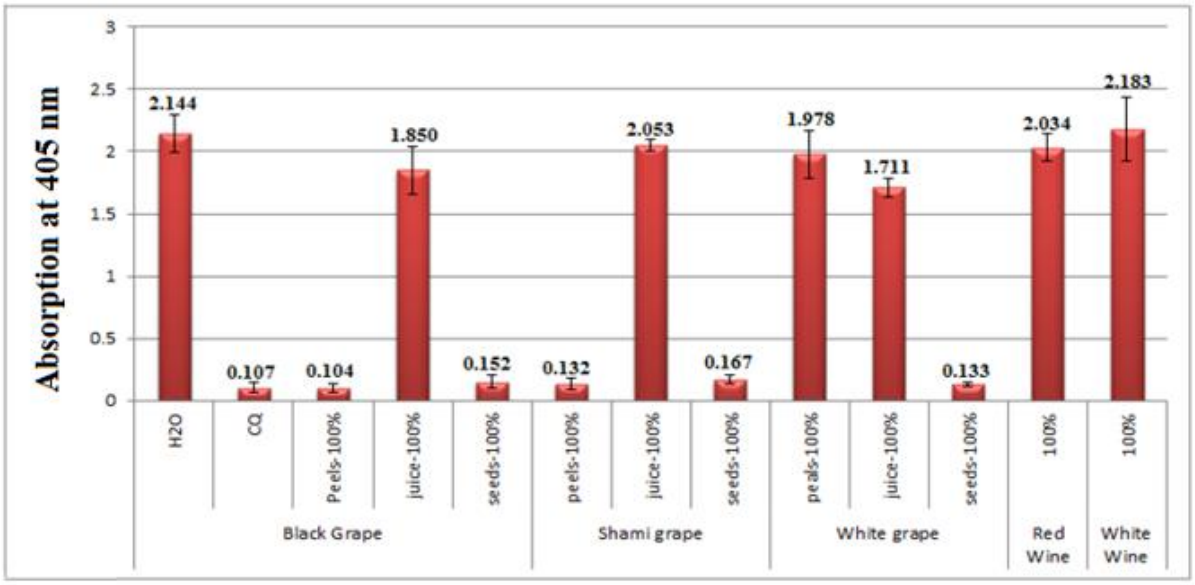
Moringa oleifera is indeed extremely rich in catechins.

R Devisetti, Y Sreerama, S Bhattacharya, Processing effects on bioactive compounds and functional properties of moringa leaves. J Food Sci Technol 2016, 53, 649-657.

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.

GRAPE JUICE and WINE



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 gape peels always do. Anthocyanins may be metabolized into gallic acid.

Jun Yang, T Martinson, R Liu, Phytochemical profiles and antioxidant activities of wine grapes. Food Chemistry. 2009, 116, 332-339

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.

J Sparwel, M Vantler, S Rosenkranz. Differential effects of red and white wines on inhibition of the platelet-derived growth factor receptor: impact of the mash fermentation. Cardiovascular Research, 2009 81, 758-770.

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.

Herman JD, Rice DP, Ribacke U, Silterra J, Deik AA, Moss EL, Broadbent KM, Neafsey DE, Desai MM, Clish CB, Mazitschek R, Wirth DF. A genomic and evolutionary approach reveals non-genetic drug resistance in malaria. Genome Biol. 2014;15(11):511

Green tea catechins also inhibit glucose exit from erythrocytes.

R Naftalin, I Afzal, SR Milligan, Interactions of androgen, green tea catechinswith 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