

Table S1. Primers used in this study

Gene		primers	Reference	
<i>pfkelch13</i>	<i>kelch13</i>	FWD	TATAACAAGGCGTAAATATTCGTG	1
		REV	TGTGCATGAAAATAAATATTTAAAGAAG	
<i>pfert</i>	crt-nest1	FWD	CCGTTAATAATAAATACACGCAG	2
		REV	CGGATGTTACAAAACCTATAGTTACC	
	crt-nest2	FWD	TGTGCTCATGTGTTTAAACTT	
		REV	CAAACTATAGTTACCAATTTTG	
<i>pfmdr1</i>	mdr1(1)-nest1	FWD	TTAAATGTTTACCTGCACAACATAGAAAATT	3
		REV	CTCCACAATAACTTGCAACAGTTCTTA	
	mdr1(1)-nest2	FWD	TGTATGTGCTGTATTATCAGGA	
		REV	CTCTTCTATAATGGACATGGTA	
	mdr1(2)-nest1	FWD	AATTTGATAGAAAAGCTATTGATTATAA	
		REV	TATTTGGTAATGATTTCGATAAATTCATC	
	mdr1(2)-nest2	FWD	GAATTATTGTAAATGCAGCTTTA	
		REV	GCAGCAAACCTACTAACACG	
<i>pfdhfr</i>	dhfr-nest1	FWD	GCGGGATCCATGATGGAACAAGTCTGCGAC	4
		REV	GCGAAGCTTTTAAGCAGCCATATCCATTGAAA	
	dhfr-nest2	FWD	GCGGGATCCATGATGGAACAAGTCTGCGAC	
		REV	GCGAAGCTTACACCTACTCCCGTTTCGATC	
<i>pfdhps</i>	dhps-nest1	FWD	GCGGAGCTCATGGAACTATAACAAGAACTAAT	4
		REV	GCGAAGCTTGTATATAAACATCTGATGGTAT	
	dhps-nest2	FWD	GCGGAGCTCATGATACCCGAATATAAGCATA	
		REV	GCGAAGCTTTTACACTTGGTCTATTTTTGTTA	
<i>pfgch1</i>	<i>gch1</i>	FWD	ATGAAACACATAATATGGAAGAAAAA	5
		REV	TCCTTTTCATCTATCACAACAAGG	
	seryl-tRNA	FWD	AAGTAGCAGGTCATCGTGGTT	
		REV	TTCGGCACATTCTTCCATAA	

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- 2 Zhou, R. M. *et al.* Molecular mutation profile of *pfert* in *Plasmodium falciparum* isolates imported from Africa in Henan province. *Malar J* **15**, 265, doi:10.1186/s12936-016-1306-6 (2016).
- 3 Li, J. *et al.* Molecular mutation profile of *Pfprt* and *Pfmdr1* in *Plasmodium falciparum* isolates from Bioko Island, Equatorial Guinea. *Infect Genet Evol* **36**, 552-556, doi:10.1016/j.meegid.2015.08.039 (2015).
- 4 Garg, S. *et al.* Novel point mutations in sulfadoxine resistance genes of *Plasmodium falciparum* from India. *Acta Trop* **110**, 75-79, doi:10.1016/j.actatropica.2009.01.009 (2009).
- 5 Osei, M. *et al.* Amplification of GTP-cyclohydrolase 1 gene in *Plasmodium falciparum* isolates with the quadruple mutant of dihydrofolate reductase and dihydropteroate synthase genes in Ghana. *PLoS One* **13**, e0204871, doi:10.1371/journal.pone.0204871 (2018).

Table S2. The *gch1* gene copy number of Ghanaian isolates and the standard laboratory strains Dd2 and 3D7

Sample	<i>gch1</i> Copy number
Dd2	2.62
3D7	3.22
16-59	0.55
16-60	3.04
16-62	0.80
16-91	0.47
16-97	2.85
16-99	2.88
16-104	0.63
16-105	0.72
16-113	0.42
16-114	0.63
16-129	0.35
16-136	0.31
16-137	0.62
16-140	0.87
16-148	0.85
16-166	1.01
17-30	0.95
17-53	0.31
17-89	1.07
17-107	3.15
17-108	0.60
17-132	0.72
18-3	0.81
18-11	0.31
18-12	0.97
18-14	0.67
18-15	0.77
18-28	0.99
18-60	3.05

Table S3. Comparison between the IC₅₀ values (nM) of parasites with *pfmdr1* Y184 or 184F for 11 antimalarial drugs

Drugs	IC ₅₀ values in nM (Mean±SD)		P values
	Y184 (N=8)	184F (N=21)	
Dihydroartemisinin	1.0±0.5	1.0±0.4	0.9305 ^c
Artemether	2.5 (1.6-3.4) ^a	1.6 (1.3-2.1) ^a	0.0724 ^b
Artesunate	4.3 (2.6-5.6) ^a	4.1 (2.4-4.6) ^a	0.3737 ^b
Lumefantrine	2.7±0.7	2.6±1.1	0.8678 ^c
Mefloquine	17.9±3.1	17.0±4.8	0.6139 ^c
Quinine	49.2 (37.6-55.9) ^a	51.7 (34.3-80.6) ^a	0.7326 ^b
Piperaquine	4.3±1.1	4.7±1.2	0.3742 ^c
Naphthoquine	7.7 (5.8-9.0) ^a	7.5 (5.5-11.8) ^a	0.8051 ^b
Pyronaridine	8.9±2.2	8.1±2.7	0.4724 ^c
Chloroquine	14.7 (11.9-25.8) ^a	15.1 (13.5-18.1) ^a	0.7124 ^b
Pyrimethamine	9976 (265.5-21269) ^a	7292 (2379-23619) ^a	0.4999 ^b
PSA(%)#	1.9 (1.7-2.0) ^a	2.0 (1.6-3.1) ^a	0.4934 ^b
RSA(%)#	0.8±0.3	0.8±0.2	0.6060 ^c

^a These data are not normally distributed and shown as median (IQR). Data were compared using Mann-Whitney U test (^b) or t-test (^c).

RSA and PSA values are percentages (%).

Table S3. Comparison between the IC₅₀ values (nM) of parasites with *pfk13* K189 (wild-type) or 189T/N (mutant) for artemisinin derivatives

Drugs	IC ₅₀ values in nM (Mean±SD)		P values
	K189 (N=6)	189T/N (N=23)	
Dihydroartemisinin	0.8±0.5	1.1±0.4	0.2148 ^c
RSA(%)	0.7±0.3	0.8±0.2	0.1413 ^c
Artemether	2.3 (1.5-3.3) ^a	1.6 (1.4-2.2) ^a	0.2833 ^b
Artesunate	3.5 (1.6-5.0) ^a	4.2 (3.2-4.6) ^a	0.5911 ^b

^a These data are not normally distributed and shown as median (IQR). Data were compared using Mann-Whitney U test (^b) or t-test (^c).