

Prevalence of Helminth and malaria co-infection among pregnant women in Battor and Adidome districts of the Volta region of Ghana

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ABSTRACT

Introduction: In sub-Saharan Africa, approximately 40 million pregnant women are exposed to parasitic diseases such as malaria caused by *Plasmodium falciparum*, Schistosome parasites, and soil-transmitted helminth (STH) infection. When parasitic diseases share the same habitat and overlap in distribution then high rates of co-infection occur.

Methods: The objective of the study was to determine the nature and extent of coinfection from 100 samples collected from the Battor (50) and Adidome (50) districts of Ghana.

Results: In the Adidome district, *P. falciparum* evaluated by RDT, Malaria PAN, and Malaria Pf kit, 39 were true positive (TP), 8 were true negative (TN), and 30 were false negatives (FN). For Battor, 19 were TP, 12 TN, and 20 FN. For *S. mansoni* in Adidome via polymerase chain reaction (PCR) and loop-mediated isothermal amplification (LAMP), 21 positive, and 29 negatives (52.5% sensitivity, 100% specificity). For *S. haematobium*, 28 were positive and 22 negative using PCR (70% sensitivity, 100% specificity). In LAMP, 28 positives and 22 negatives (70% sensitivity, 100% specificity). In Battor PCR for *S. mansoni*, 28 were positive and 22 negative (68.3% sensitivity, 100% specificity). In LAMP, 32 positive and 18 negatives (80% sensitivity, 100% specificity). For *S. haematobium*, PCR showed 30 positive and 20 negative (73.2% sensitivity, 100% specificity). With LAMP, 21 positive and 29 negatives (51% sensitivity, 100% specificity).

Conclusion: The results will be utilized as part of the continuous surveillance for future research aiming at gathering nationally representative data in Ghana on the prevalence of coinfection and propose intervention based on that for the vulnerable pregnant women population.

INTRODUCTION

- ❑ **Malaria** is the deadliest parasitic disease in the world, caused mainly by *Plasmodium falciparum* in sub-Saharan Africa.
- ❑ Both Pregnant women and newborns sometimes have coinfection.
 - **Consequences:** intrauterine growth retardation, low birth weight, pre-term delivery, and neonatal mortality.[2]
- ❑ Women with intestinal helminth infection(s) were five times more likely to have malaria infection. [3]
- ❑ In the subtropics, over a third of the world's population is infected with soil-transmitted helminths (STHs) and *Plasmodium* species. [4]
- ❑ About 40 million pregnant women are infected with schistosomes or STHs, the top Neglected Tropical Diseases. [4]
- ❑ There is no study to address the prevalence and impact of *Schistosoma mansoni*, *S. haematobium*, and *Strongyloides stercoralis* on pregnant women.

OBJECTIVE

Determining prevalence of co-infection among Pregnant women of Ghana by amplifying species-specific DNA from a single filtered urine sample (total 100 samples).

MATERIALS and METHODS

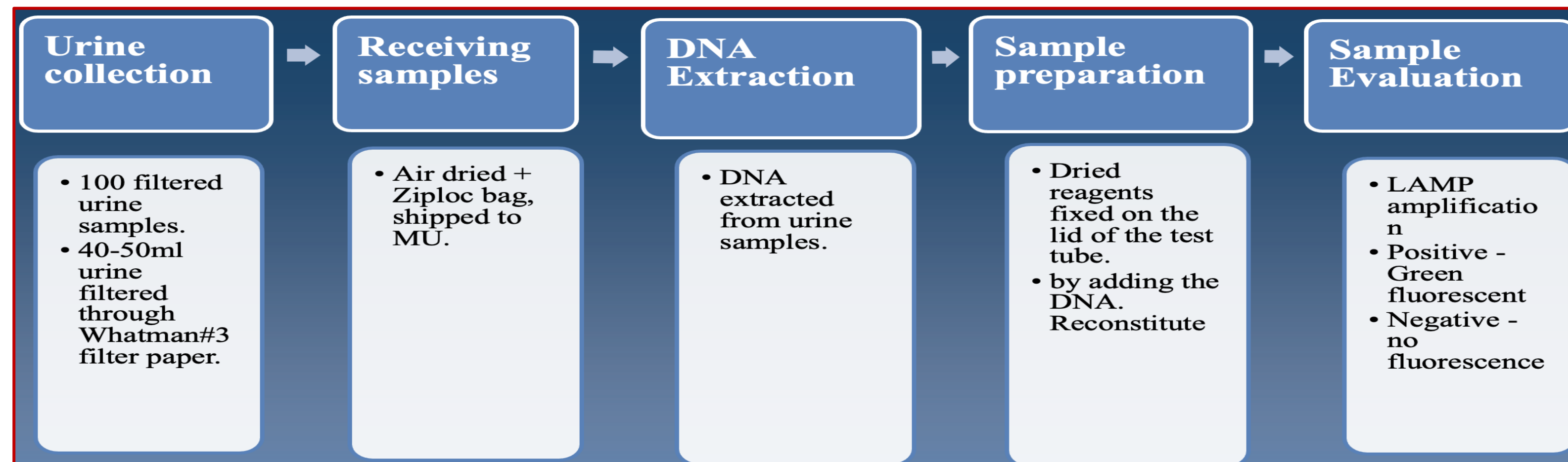
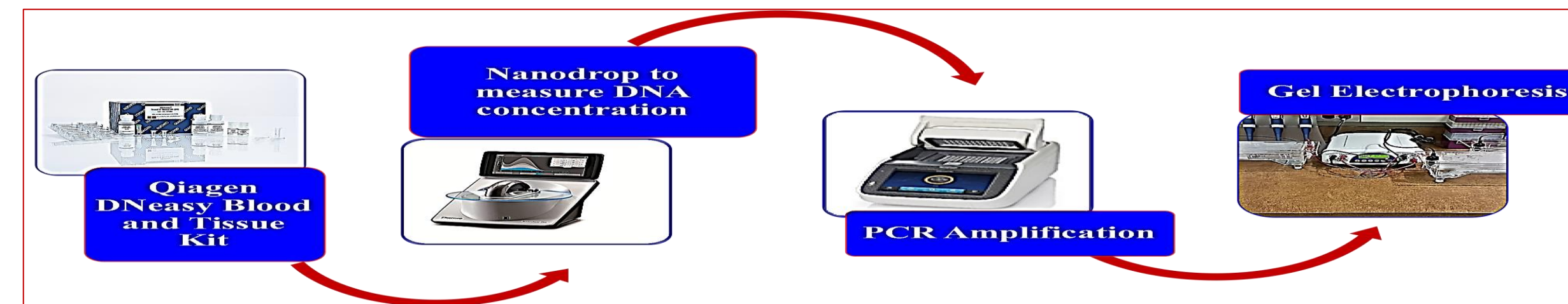


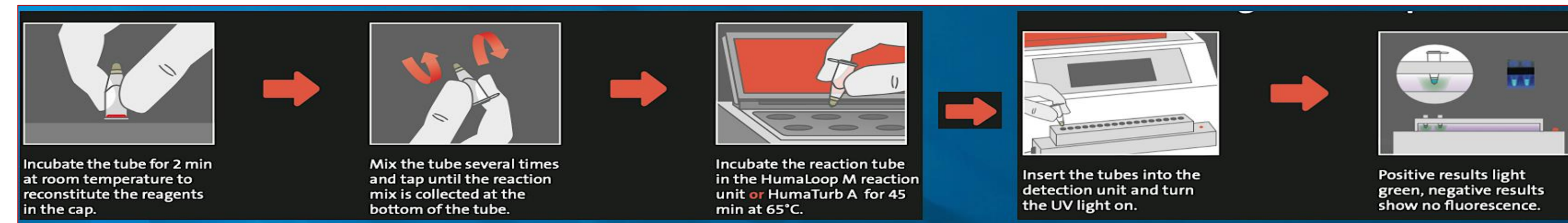
Figure 1: Collection, transportation, and evaluation of urine samples collected from pregnant women in Ghana.

MATERIALS and METHODS CONT.

LAMP and PCR workflow



LoopAmp Malaria PAN and LoopAmp Malaria Pf workflow



LoopAmp Malaria PAN	LoopAmp Malaria Pf
LoopAmp Malaria PAN for detection of <i>Plasmodium</i> genus	LoopAmp Malaria for detection of <i>P. falciparum</i> only
Four species: <i>P. falciparum</i> , <i>P. vivax</i> , <i>P. ovale</i> , <i>P. malariae</i>	<i>Plasmodium falciparum</i>



RESULTS

Table 1. Distribution of *Schistosoma mansoni*, *S. haematobium*, and *Strongyloides stercoralis* infection detected by PCR, LAMP. Total samples = 100.

Variables	Battor District					Adidome District				
	<i>S. mansoni</i>		<i>S. haematobium</i>		<i>S. stercoralis</i>	<i>S. mansoni</i>		<i>S. haematobium</i>		<i>S. stercoralis</i>
	PCR	LAMP	PCR	LAMP		PCR	LAMP	PCR	LAMP	
Test conducted	50	50	50	50	50	50	50	50	50	50
Positive	28 (56%)	25 (50%)	30 (60%)	21 (42%)	12 (24%)	21 (42%)	32 (64%)	28 (56%)	28 (56%)	3 (6%)
Negative	22 (44%)	25 (50%)	20 (40%)	29 (58%)	38 (76%)	29 (58%)	18 (36%)	22 (44%)	22 (44%)	47 (94%)
Sensitivity	68.3%	61%	73.2%	51%	100%	52.5%	80%	70%	70%	100%
Specificity	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Infection prevalence ^a (95% CI)	82% (68.6% - 91.4%)	82% (68.6% - 91.4%)	82% (68.6% - 91.4%)	82% (68.6% - 91.4%)	24% (13.1% - 38.2%)	80% (66.3% - 90%)	80% (66.3% - 90%)	80% (66.3% - 90%)	80% (66.3% - 90%)	6% (1.3% - 16.6%)

- In the Adidome district, LAMP detected the highest positives for *S. mansoni* with moderate sensitivity. In the Battor district, PCR detected the highest positives in *S. mansoni* with low sensitivity.

RESULTS CONTD.

Table 2. Detailed numerical distribution of single and mixed parasitic infection among pregnant women in two districts of Ghana.

Infection type	Battor district	Adidome district
Sm only	12	11
Sh only	11	33
Ss only	4	0
Sm + Sh	22*	18
Sm + Ss	2	1
Sh + Ss	2	2
Sm + Sh + Ss	4	0

- In the Battor district, the disease prevalence of co-infection with both *S. mansoni* and *S. haematobium* was found to be the highest (22 cases).

Table 3. Detailed numerical distribution of single and mixed parasitic infection among pregnant women in two districts of Ghana in the age group of 20-30-year-olds.

Species	Adidome	Battor
	Group B (20-30 yrs.)	Group B (20-30 yrs.)
<i>Plasmodium</i> spp.	24 (54.6%)*	14 (48.3%)*
<i>P. falciparum</i>	21 (51%)*	10 (50%)*
<i>Schistosoma mansoni</i>	16 (36.4%)*	8 (28%)*
<i>Schistosoma haematobium</i>	15 (34.1%)	11 (38%)*
<i>Strongyloides stercoralis</i>	3 (6.8%)	7 (24%)

- The age group of 20-30 years in group B was found to be the most susceptible to all parasitic infections.
- *Plasmodium* species is the most prevalent organism in the Adidome district (54.6%).
- Both *P. falciparum* (51%) and *S. mansoni* (36.4%) are the most prevalent in the Adidome district.

CONCLUSIONS

- ❑ ***Plasmodium* spp. had been detected successfully via LoopAmp Malaria PAN from DNA extracted from filtered urine samples.**
- ❑ Previous studies successfully identified malaria-specific DNA in the urine samples along with blood and saliva samples via Polymerase Chain Reaction (PCR) and not by LoopAmp Malaria.
- ❑ **LAMP detected both Schistosome species with high sensitivity and specificity.**
- ❑ LAMP proved to be a more efficient, sensitive, and specific diagnostic test for co-infection among a vulnerable group of the population.
- ❑ The results will be utilized as a part of the continuous surveillance for future research aiming at gathering nationally representative data in Ghana on the prevalence of coinfection and proposing interventions based on that for the vulnerable pregnant women population.

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