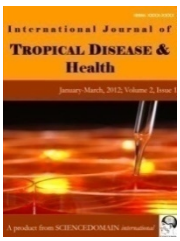

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Female Genital Schistosomiasis, Genital Tract Infections and HIV Co-infection in the Volta Basin of Ghana

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Authors' contributions

This work was carried out in collaboration between all authors. Authors DRYT, CMA, KAAK and KMB designed the study, wrote the protocol and participated in data collection with author MD. Authors KAAK and GL collected gynaecological samples and author LA worked on the bacteriological analysis. Authors DM, DRYT and KMB worked on the data analysis and drafted the manuscript. All authors read and approved the final manuscript.

Research Article

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ABSTRACT

Aims: This research is aimed to determine the occurrence of female genital schistosomiasis (FGS), *Candida albicans*, *Trichomonas vaginalis*, Bacteria vaginosis and HIV concomitant infections among women of reproductive age in schistosomiasis endemic communities in the Volta Basin of Ghana.
Study Design: Cross-sectional study.
Place and Duration of Study: Schistosomiasis endemic communities in the Volta Basin. July 2005 to June 2006.
Methodology: During the conduct of the study, 402 out of 420 women who volunteered to participate were screened for genital infections by collecting high vaginal swabs (HVS).

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These were analysed for *T. vaginalis* by wet mount, *C. albicans* by wet mount and culture and B. vaginosis by wet mount and Whiff test. HIV infection was diagnosed from venous blood using HIV1/2 immunochromatographic test. Also 395 of the women were screened for female genital schistosomiasis (FGS) using cervical biopsy which was analysed using the compressed biopsy technique.

Results: About one third, 24/402 (30. 9%) of women screened were positive for at least one of the genital infections assessed. *C. albicans* was the most frequently occurring infection, with a prevalence of 15. 6%. This was followed by B. vaginosis (13. 5%) and *T. vaginalis* (1. 5%). HIV prevalence rate found in this study was 7. 2% and FGS 10. 6%. Almost half (46.3%) of FGS positive women were diagnosed with at least one of the genital pathogens compared to 30% of the FGS negative women. *Candida albicans* infection was significantly associated with FGS (P=0. 005). As much as a third (31. 6%) of women with FGS were diagnosed with *C. albicans* infection.

Conclusion: This study revealed a positive association between FGS and *C. albicans* infection among study participants. The lack of association between FGS and HIV was not conclusive because of low sample size. Findings from this study provide baseline data for conducting further studies between FGS, *C. albicans* and HIV infection.

Keywords: Female genital schistosomiasis; genital infections HIV; Volta Basin; Ghana.

1. INTRODUCTION

The Neglected Tropical Diseases (NTDs) are mostly parasitic and bacterial chronic disabling infections affecting over 2.7 billion people worldwide mainly residing in remote rural areas, urban slums or conflict zones in Africa [1]. Among the core objectives of the Millennium Development Goals (MDGs) are improvement of maternal health (MDG 5) and reduction of diseases such as HIV/AIDS, Malaria and other diseases (MDG 6), which include the NTDs.

Examples of NTDs are schistosomiasis, onchocerciasis, trachoma and soil transmitted helminth infections [1]. Aside their negative health impacts, NTDs contribute to the cycle of poverty and stigma that leaves people with reduced capacity to work impairs cognitive ability in young children and affects general social life [1].

Female genital schistosomiasis (FGS) is a manifestation of schistosomiasis which occurs when adult worms or ova are deposited in any part of the female reproductive system [2]. Infection with FGS may have grave consequences on maternal health and HIV transmission [3,4]. Consequences of FGS include abortions, ectopic pregnancies, infertility and post coital bleeding [5,6]. Male genital schistosomiasis (MGS) may present as haemospermia and prostatic disease [7,8].

Polyparasitism is common among people living in poor areas of the tropics[9, 10]. Talaat et al (2008) reported co-infection of the *Wuchereriabancrofti* and HIV in Southern India [11] andKjetland et al (2006)reported co-infection of female genital schistosomiasis and HIV in rural Zimbabwe [4]. Here, we report the first study conducted in Ghana on concurrent infection of female genital schistosomiasis (FGS) with *Candida albicans, Trichomonasvaginalis,* Bacteria vaginosis and HIV among women living in communities along the Volta Lake in Ghana.

2. MATERIALS AND METHODS

2.1 Study Population and Area

This cross-sectional study was conducted in 2005, nested in a larger epidemiological study on female genital schistosomiasis. Some data has been reported previously. Briefly however, urinary schistosomiasis prevalence among general adult population was 46.5% [12]. Prevalence rates for adult males and females were 56.5% and 36.9% respectively. This study was conducted in the area extending from the Afram arm of the River Volta to communities below the Akosombodam (Figure 1). Sixteen communities from six local government administrative districts (Kwahu South, Afram Plains, Fanteakwa, Manya-Krobo, Asuogyaman and Dangme West) were covered. Enrolment of study subjects was voluntary and based on informed consent.Virgins, pregnant women, menstruating women, postnatal women, women who had undergone hysterectomy (including the removal of the cervix), and women with other health conditions were excluded from participating.

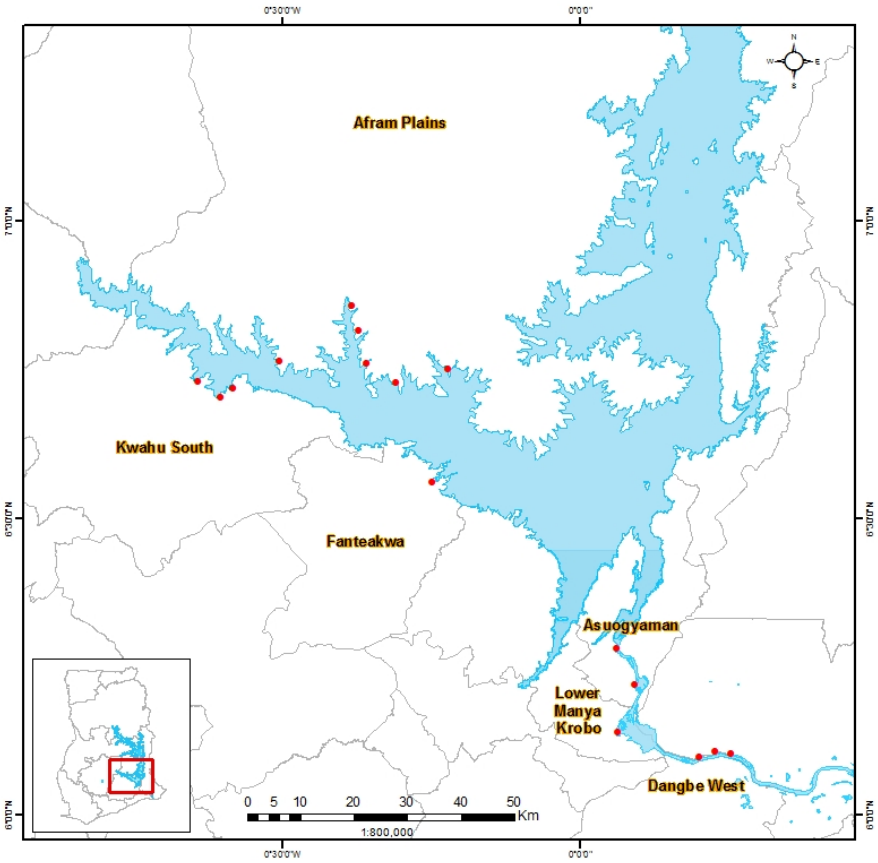

Figure 1. Map showing study communities

2.1.1 Ethical considerations

Prior to data collection, ethical approval was given by the Institutional Review Board (IRB) of the Noguchi Memorial Institute for Medical Research (NMIMR) to conduct the study and to

do anonymous testing for HIV. Women were informed that HIV testing would be done. Permission was also granted from the District Health Management teams. Meetings were held with community leaders and members to explain the study objective, address concerns and introduce investigators. Women who underwent biopsies for detection of *S. haematoboium* ova (FGS screening) were counselled to abstain from sex for about one week. Those who were diagnosed with schistosomiasis and any of the genital infections of interest to this study received treatment according to Ghana's standard treatment guidelines Subjects found to have other health conditions were informed and given referral notes for further health care at the nearest health facility.

2.1.1 Clinical and laboratory investigations

Women who gave consent to participate were recruited and examined medically by a gynaecologist. A structured questionnaire was administered to elicit information on demographics, urogenital symptoms, obstetric and gynaecological history (e. g number of births, sexual history, and contraception).

Only women who met the inclusion criteria for investigation were transported to the nearest district hospital for clinical sample collection which was done by a gynaecologist. Subject was placed in lithotomy position and cervix visually inspected for erythema, patches, nodules and erosions. Cervical biopsy was taken from health parts of the cervix using punch biopsy for the detection of genital schistosomiasis. Two high vaginal swabs (HVS) and one millilitre venous blood were collected for detection of genital infections, and HIV respectively.

C. albicans was diagnosed by the presence of multiple hyphae in wet mount and culture [13], *T vaginalis* was identified by its typical morphology and motility on the wet mount of vaginal secretion *and B. vaginosis* diagnosed by observation of clue cells in wet mount and Whiff test [13], Genital schistosomiasis was diagnosed using the compressed biopsy technique [5]. A single HIV test was performed using the Abbot Determine HIV-1/2 immunochromatographic test (Abbott Diagnostics, North Chicago, Ill).

2.1.2 Statistical analyses

All data collected were double entered in Microsoft excel (Microsoft corporation, Redmond, WA, USA) and later imported into SPSS version 18 for analysis. Chi square and Fisher exact tests (for numbers <5) were used to assess the association between variables. Those that were significantly associated by bivariate analysis were further analysed using logistic regression. The odds ratios including 95% confidence intervals and corresponding p values were reported for associations that remained significant after controlling for confounders.

Missing data and samples from which isolated pathogens were identified but not confirmed as pathogens of interest were not included in the analysis.

3. RESULTS

There were approximately 6,482 women in the selected villages and four hundred and twenty women consented to participate in the study (6.5 %). Figure 2 shows the age distribution of recruited women. Mean age of the study participants was 33.6 years.

All interviewed women acknowledged having engaged in sex. The age at first sexual intercourse varied among the women and ranged from 9 to 33 years.

The mean age at first intercourse was 17.9 years (95% CI, 17.67-18.25), mean number of sexual partners 0.98 (95% CI, 0.95-1.02) and mean number of birth was 3.6 children (95% CI, 3.39-3.9). Of the 420 respondents only 87 (20.7%) used contraceptives. Of these, 35 (40.2%) used oral contraceptive, 35 (40.2%) injectable, 4 (4.6%) implants and 7 (8.0%) used condoms. Only 2 (2.3%) used herbs as a contraceptive.

High vaginal swab was collected from 402 subjects and 395 of them were screened for FGS. In all, 124/402 (30.9%) of women screened for genital infection were positive for at least one of the genital infections. The prevalence of FGS, genital infections and HIV diagnosed are presented in Table 1 below.

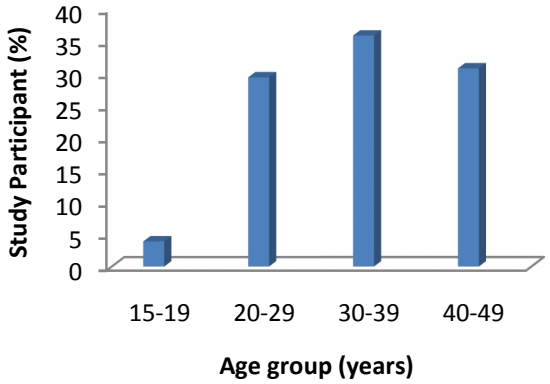

Figure2. Age distribution of study participants

Table 1. Occurrence of FGS, genital tract infections and HIV among the study population

Infection type	Samples assessed	Number Positive	Prevalence (%)
FGS	395	42	10.6
Candida albicans	377	59	15.6
Trichomonasvaginalis	392	6	1.5
Bacteria vaginosis	392	53	13.5
HIV	402	29	7.2

Table 2 presents co-infection status of women examined for FGS. This study revealed that 46.3% of the women diagnosed with genital schistosomiasis had a concurrent infection with at least one of the genital pathogens compared to 29.7% of FGS negative women. *C. albicans* infection was the only infection which was significant but weakly associated with FGS (Chi square =7.92, p=0. 005). It was also found that, out of 41 FGS positive cases, 4 of them (9. 8%) were found to be HIV seropositive whereas 25 out of 344 (7.3%) FGS negative women had HIV (p=0.6). There was no association between FGS and HIV.

Table 2. Association between FGS and genital tract infections, and HIV among study population

Infection type	* FGS-Positive		FGS-Negative		Chi square	Crude OR	p value	Adjusted OR	p value	95% (CI)
	N	(%)	N	(%)						
C. albicans	12/38	(31.6)	46/329	(14.0)	7.92	0.4	*0.005	0.4	***0.01**	0.2-0.8
T. vaginalis	0 /41	(0.0)	4/341	(1.2)	0.48	0.1	0.5	-	-	-
B. vaginosis	7/41	(17.1)	44/341	(12.9)	0.55	0.7	0.4	-	-	-
HIV	4/41	(9.8)	25/344	(7.3)	0.33	0.7	0.6	-	-	-
Subject diagnosed with at least one genital infection	19/41	(46.3)	102/344	(29.7)	4.73	0.5	*0.03	0.6	0.1	0.2-1.04

**FGS Positive = reference category in regression model*

N= numbers of subjects found with genital infection /number of FGS positive or negative casesexamined.

**significant p-value*

Only cases verified as significant by bivariate analysis were used in the regression model

Significant cases by bivariate analysis were adjusted for age, number of sexual partners and frequency of sex in the regression model

4. DISCUSSION

Almost half of the women diagnosed with FGS were co-infected with at least one genital tract infection. In this female adult population with a urinary schistosomiasis prevalence of about thirty seven percent, only ten percent were found to have *S. haematobium* ova in cervix biopses. About sixteen percent of the participants were found to be infected with *Candida albicans* and fourteen percent with B. vaginosis. Furthermore, this population living in a schistosomiasis endemic area seemed to have a higher HIV prevalence than the national estimates on rural women in Ghana at the time of collecting data for this study [14].*Candida albicans* the only genital tract infection that was positively but weakly associated with FGS.

FGS has been suggested to be a risk factor for HIV infection and transmission [15, 16]. Intra-vaginal inflammation may compromise the protective properties of the genital mucosa through the recruitment of polymorphonuclear leukocytes, T-cells and other immune components serving as potential targets for HIV establishment in the body [17, 18].However, in this population, the difference in the prevalence of HIV in women with FGS and without FGS was not significant.

The immune status of the HIV infected individuals was not known and the effect on candida uncertain. It is however worth noting that, the study did not have funding to do a second HIV test and the used test is known to be a sensitive screening test. As a result the observed prevalence may be overestimated.

Swai et al., (2006) have described the proportionate relationships between prevalence levels of genital and urinary schistosomiasis [19]. In this context, the prevalence of genital schistosomiasis is unusually low. Schistosomiasis is usually acquired during childhood reaching peak age of egg excretion in childhood or early teens [20]. It has been suggested that long term damages may be formed at an early age [15]

In a cross-sectional study it is not possible to determine the duration of the disease. Furthermore, the clinical manifestations of genital schistosomiasis are only visible by colposcopy by specifically trained individuals. Ova may have been missed also by the fact that ova are clustered, and it is very hard to make precise biopsies of these oft minute lesions [15]

Ghana contributes heavily to the burden of schistosomiasis in sub-Saharan Africa but has low endemicity for HIV. Nevertheless, public health literature identifies population mobility as a key driver to the HIV epidemic [21,22].

Members of this study population are known migrants from other fishing areas who moved into their present location during the fish boom that resulted from the creation of the Volta Lake [23]. They therefore move frequently to and from their hometowns for festivals, funerals and trading among others. Although our research did not study the migrant status and movements of the study population and the possible link with HIV, the HIV prevalence rate determined by this study may indicate that, the study population may be among high HIV risk groups and therefore should be considered in HIV research in the country.

4. CONCLUSION

To conclude, this study revealed a positive association between FGS and *C. albicans* infection among study participants. The findings also provide baseline data for conducting further studies between FGS and *C. albicans* infection. We also recommend future research on mobility and HIV transmission in the study area. The recent approach of integrating NTD management into the primary health care must be also promoted to enhance the management of schistosomiasis and other NTDs in Ghana.

CONSENT

All study participants provided informed consent to participate in the study. Informed consent was verbal mainly because of the low level of literacy among study community members and preference for anonymity. Verbal consent was witnessed by two community leaders.

ETHICAL APPROVAL

Ethical permission to undertake this study was granted by the Institutional Review Board of the Noguchi Memorial Institute for Medical Research (NMIMR); (reference identification: NMIMR-IRB CPN 026/04-05; IRB 0001276; IORG 0000908).

Before data collection started, permission was sought and granted from the District Health Management Teams and Community Leaders. Open fora were also held with community members to discuss the study, address their concerns and assure them of the right to withdraw participation from the study at any time.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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