Forced Vaginal Sex is Associated with Genital Immune Changes that may Increase HIV Susceptibility

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Background

Forced vaginal sex, a form of sexual assault, increases HIV risk through **epidemiological** pathways, however the **biological** consequences of forced sex exposure on HIV susceptibility are poorly understood[1].

Trauma to mucosal tissues can increase HIV susceptibility in two ways:

- **Proinflammatory cytokines** promote tissue remodeling and recruit immune cells, including phagocytes and lymphocytes (HIV target cells).
- **Epithelial barrier disruption** allows for the penetration of pathogens into the submucosa.



Genital inflammation is not always well-defined, though a 2015 study of South African women developed a composite score of 9 **proinflammatory cytokines** that was associated with HIV seroconversion in that cohort[2].

Since women physically forced to have sex often undergo vaginal injury, we hypothesize that forced vaginal sex exposure has a **biological** effect on HIV susceptibility through these two mechanisms.

Objectives

Here we examine whether recent forced vaginal sex exposure is associated with:

1) **Genital inflammation**, as defined by the same composite score of proinflammatory cytokines used by the 2015 South African study, and
2) Elevated vaginal levels of soluble E-cadherin (sE-cad), a novel biomarker of **epithelial barrier disruption**.

Results

Table 1. Baseline sociodemographics of Maisha Fiti participants without HIV.

Variable	No recent forced sex (n = 702)	Forced sex, past 7 days (n = 44)	p-value
Age (mean, range)	32 (18 – 45)	32 (20 – 45)	0.99
Low socioeconomic status (SES)	216 (31%)	25 (57%)	**<0.01**
9 or more adverse childhood experiences (ACEs)	103 (15%)	17 (39%)	**<0.01**
Number of clients, past 7 days (mean, range)	5.13 (0 – 70)	5.34 (0 – 30)	0.82
Street-based client solicitation	198 (28%)	20 (45%)	0.08
Hormonal contraceptive use	138 (20%)	11 (25%)	0.57
Vaginal cleaning (soap)	415 (59%)	29 (66%)	0.76
Depression	151 (22%)	24 (55%)	**<0.001**
Anxiety	68 (10%)	9 (20%)	0.11
PTSD	90 (13%)	15 (34%)	**0.01**
High risk substance use	76 (11%)	21 (48%)	**<0.001**
Clinical			
Bacterial STI (chlamydia, gonorrhea, syphilis)	81 (11%)	5 (11%)	0.69
Bacterial vaginosis (BV)	125 (18%)	2 (4%)	**<0.01**

Welch's t-test, chi-square test, Fisher's exact test

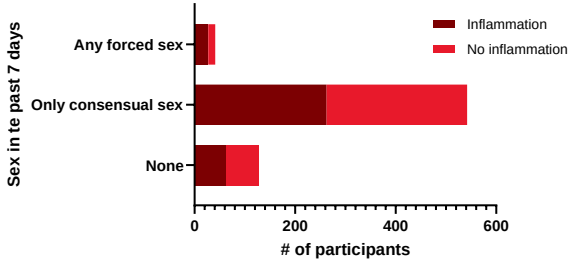


Figure 2. Proportions of genital inflammation in participants that have recently had sex.

Consensual vaginal sex was not associated with genital inflammation (aOR = 0.94, 95% CI: 0.63 – 1.40; p = 0.76).

Forced vaginal sex exposures over 6 months ago (p=0.11) or in the past 6 months (p=0.70) were not associated with genital inflammation.

Table 2. Mixed effects logistic regression modeling of the effect of recent forced sex exposure on genital inflammation.

Variable	Fixed effect estimate	Adjusted OR	95% CI	p-value
Forced vaginal sex exposure	1.01	2.74	1.33 - 5.68	**0.006**
Age	0.002	1.00	0.98 - 1.02	0.82
Low SES	-0.09	0.91	0.62 - 1.33	0.63
High SES	-0.09	0.92	0.63 - 1.33	0.64
Intermediate Nugent score	0.63	1.89	1.33 - 2.67	**0.0004**
High Nugent score (BV)	-0.30	0.74	0.48 - 1.14	0.17
Vaginal cleaning (soap)	-0.29	0.75	0.42 - 1.35	0.34
Bacterial STI	0.61	1.85	1.14 - 3.00	**0.01**
Medium risk substance use	-0.19	0.83	0.59 - 1.15	0.26
High risk substance use	-0.71	0.49	0.29 - 0.82	**0.007**

n = 711

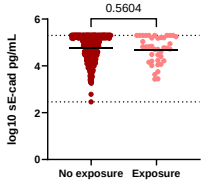


Figure 1. Log-transformed sE-cad levels in women recently exposed and not recently exposed to forced vaginal sex.

Welch's t-test, n = 690

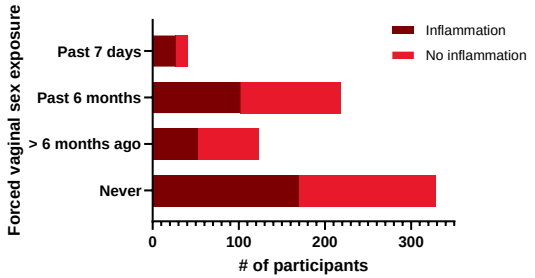
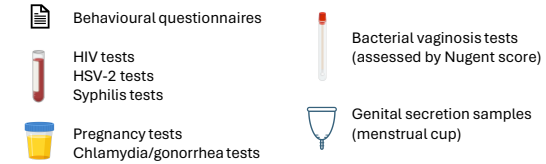


Figure 3. Proportions of genital inflammation in participants that have been forced to have sex.

Methods

This study is nested within Maisha Fiti, a longitudinal mixed-method study that investigates violence and HIV susceptibility in female sex workers in Nairobi, Kenya.

746 HIV-uninfected participants visited a local clinic up to three times from 2019 to 2021 and completed/provided:



Genital secretion samples were centrifuged, frozen, and shipped to Toronto, where they were used to quantify soluble immune factor concentrations using a multiplex electrochemiluminescent assay (MSD).



Participants indicated recent forced vaginal sex exposure in the behavioural questionnaire by answering "YES" to "Have you been physically forced to have sex in the past 7 days?".

Conclusions

In this study, recent forced vaginal sex exposure is associated with **genital inflammation**, but not a marker of **epithelial barrier disruption**.

44 participants were recently forced to have vaginal sex, and were more likely to experience poverty, depression, and high risk substance use, but less likely to experience bacterial vaginosis compared to women not recently exposed.

The **inflammatory** effect of forced sex does not persist beyond 7 days after exposure and is not observed in participants only having consensual sex.

Participants that are forced to have sex continue to meet with multiple clients during this period of enhanced HIV susceptibility, highlighting the need for effective gender-based violence (GBV) interventions and post-assault care options.

References

1) Dunkle, K. L., & Decker, M. R. (2013). Gender-Based Violence and HIV: Reviewing the Evidence for Links and Causal Pathways in the General Population and High-risk Groups. *American Journal of Reproductive Immunology*, *69* (SUPPL.1), 20–26.

2) Masson, L., *et al.* (2015). Genital Inflammation and the Risk of HIV Acquisition in Women. *Clinical Infectious Diseases: An Official Publication of the Infectious Diseases Society of America*, *61*(2), 260.

Acknowledgments

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