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A case–control study on the association between female genital mutilation and sexually transmitted infections in Sudan

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Objective To assess whether the extent of female genital mutilation (FGM) influences the risk of acquiring sexually transmitted infections (STIs).

Design Hospital-based case–control study.

Setting Two obstetric/gynaecological outpatient clinics in Khartoum, Sudan, 2003–2004.

Population A total of 222 women aged 17–35 years coming to antenatal and gynaecological clinics.

Methods Women recruited for the study were divided into cases with seropositivity for *Neisseria gonorrhoeae* (gonococcal antibody test), *Chlamydia trachomatis* (enzyme immunoassay) or *Treponema pallidum* (*Treponema pallidum* haemagglutination assay) ($n = 26$) and controls without antibodies to these species ($n = 196$). Socio-demographic data were obtained and physical examination including genital examination was performed in order to classify the form of FGM. Cases and controls were compared using logistic regression to adjust for covariates.

Main outcome measures Extent of FGM and seropositivity for *C. trachomatis*, *N. gonorrhoeae* or *T. pallidum*.

Results Of the cases, 85% had undergone the most severe form of FGM involving labia majora compared with 78% of controls (n.s.). Thus, there was no association between serological evidence of STIs and extent of FGM. The only factor that differed significantly between the groups was the education level, cases with STIs having significantly shorter education ($P = 0.03$) than controls.

Conclusions There is a little difference between cases and controls in regard to FGM. Having in mind the relatively small sample size, the results still indicate that FGM seems neither to be a risk factor for nor protective against acquiring STIs. This is important as argument against traditional beliefs that FGM protects against pre/extramarital sex.

Keywords *Chlamydia trachomatis*, female circumcision, female genital mutilation, *Neisseria gonorrhoeae*, sexually transmitted infections, Sudan, *Treponema pallidum.*

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Introduction

Female genital mutilation (FGM, also called as female genital cutting or female circumcision) refers to any practice that involves total or partial removal of any part of the female external genitals without medical indication. FGM is widely practised in Africa in more than 28 countries, mainly in the north-east, but also in some areas in west Africa.[1] The prevalence ranges from 5% in the Democratic Republic of Congo and Uganda to more than 90% in Egypt, Eritrea, Mali and Sudan,[2] and it is estimated that 18 African countries have a prevalence of more than 50%.[3] World Health Organization (WHO) has classified the practice into four types[4] (Table 1). Type III, also called infibulation, the severest form of FGM, is most common in north-east Africa,[5] predominantly in northern Sudan and Somalia. The distribution of different forms varies widely in different countries, type I being most prevalent in Ethiopia, Eritrea and Nigeria and type II in Sierra Leone, Gambia and Guinea.[6] Types I and II constitute 85% of all operations, while around 15% are type III.[7] FGM is known among all socio-economic classes, different ethnic groups and different religions.[8]

The practice carries many positive meanings for those who follow it, and it is reinforced by traditional beliefs that it enhances marriageability, safeguards hygiene, ensures virginity and thus maintains family dignity and honour. The latter

Table 1. The WHO classification of FGM

Type I	Excision of the prepuce and part or all the clitoris
Type II	Excision of the prepuce and clitoris together with partial or total excision of the labia minora
Type III	Infibulation. Excision of part or all the external genitalia and stitching/narrowing of the vaginal opening
Type IV	Pricking, piercing, incision, stretching, scraping or other harming procedures on clitoris and/or labia

is of great importance for many groups practising FGM since removal of the clitoris is believed to reduce promiscuity and risk of pre- and extramarital sex.[9]

FGM carries the risk of a number of complications,[10] but very few studies relate the frequency and the severity of these complications to the extent of operation.[11] Obermeyer's review of the evidence on FGM has shown that research on its consequences for reproductive health and sexuality is insufficient.[11] FGM has been said to lead to increased risk of acquiring sexually transmitted infections (STIs) and their complications, such as pelvic inflammatory diseases (PID),[12] but still little is known about the relation of this practice and STIs.

STIs are an important public health problem worldwide. The global incidence of STIs is estimated by the WHO to be in excess of 125 million per year, mainly affecting developing countries.[13,14] The most common bacterial cause of STIs is *Chlamydia trachomatis*.[15] Studies in Africa have shown a seroprevalence of chlamydial antibodies ranging from 8 to 91%.[14,16] *Neisseria gonorrhoeae* is highly prevalent in much of sub-Saharan Africa. As many as 59% of women attending antenatal clinics (ANC) and family planning clinics in Ethiopia were seropositive for gonoccocal antibodies,[17] but still little is known about the situation in Sudan. Studies on syphilis in Africa have shown different figures. In Tanzania, a 2.5% prevalence was found among women attending ANC.[18] Various studies in Mozambique, where FGM is generally not practised, have shown prevalences ranging from 4 to 18%.[14]

PID has been said to be one of the complications of FGM.[10] A study in Sudan has shown that the incidence of PID in patients with type III FGM was more than three times higher than in patients with type I FGM.[12] Another study among women attending family planning and antenatal care clinics at three hospitals in Nigeria has shown that women with FGM were significantly more likely to have experienced repeated symptoms of reproductive tract infections.[19] FGM has been shown to lead to increased risk of primary infertility among women in Sudan.[20] This association, however, was not related to STIs.

To our knowledge, there has not been any study relating FGM to chlamydia, gonorrhoea or syphilis. The objective of the present study was to assess whether the extent of FGM influences the risk of acquiring *C. trachomatis*, *N. gonorrhoeae* and *Treponema pallidum*.

Methods

The study was conducted in Khartoum between March 2003 and June 2004. Women were recruited from obstetric and gynaecology outpatients' clinic in Soba University Hospital and Khartoum Teaching Hospital as part of another study looking into the association between FGM and infertility. The inclusion criteria for infertile women were 1. seeking medical care for primary infertility, 2. less than or equal to 35 years of age, 3. regular sexual intercourse during 2 years, 4. normal menstrual cycle for the past 1 year, 5. never been pregnant, 6. normal semen analysis, 7. no previous abdominal surgery and 8. never used intrauterine device or hormonal contraceptives. The inclusion criteria for fertile women were 1. nullipara expecting first delivery and 2. no prior problems in getting pregnant.

In all, 101 infertile and 180 pregnant women were recruited. In the beginning of the study, we lost blood samples due to misunderstandings between data collectors and the laboratory, which means that sera is only available from 222 women. These were then grouped either as cases with positive serology for *N. gonorrhoeae*, *C. trachomatis* or *T. pallidum* or as controls negative for antibodies to these species.

Demographic data were obtained and full physical examination was performed by gynaecologists, followed by genital inspection to verify the anatomical extent of genital mutilation. Clitoris, labia minora and labia majora were described as either untouched, partially removed or totally removed, respectively. Additionally, it was described whether the two sides had been stitched together, and at what level. The anatomical classification describes the maximal anatomical extent of the operation. A patient classified as labia minora has undergone an operation involving clitoris and labia minora (partially or totally removed, with or without stitching) but not extending to labia majora. All the women classified as labia majora also had damage to the clitoris and labia minora, but not all had the sides stitched. Afterwards, the type of FGM was classified according to the WHO classification as well. According to this classification, all forms where the two sides have been stitched together, independent at what level, correspond to type III.

Blood samples were taken by venepuncture after obtaining an informed consent. The women were assured that they would receive the same medical care even if they did not consent to take part. Samples were centrifuged and the sera were then kept frozen at –60°C to be sent to the microbiology department laboratory in Khartoum for *C. trachomatis* enzyme immunoassay (EIA) and Syphilis *T. pallidum* haemagglutination assay (TPHA), and to Statens Serum Institut,

Table 2. Social characteristics of respondents

	Cases (seropositive for one or more STIs)	Controls (seronegative for all three STIs)	Respondents without sera
Age, median (range)	26 (20–34)	25 (17–38)	25 (17–36)
Socio-economic level, *n* (%)			
Low	14 (54)	106 (55)	34 (58)
Medium	12 (46)	80 (42)	24 (42)
High	—	6 (3)	—
Years in school, median (range)	10 (0–18)	12 (0–19)	12 (0–18)
Duration of marriage (in months), median (range)	36 (5–120)	13 (3–168)	12 (4–180)
Religion			
Muslim	26	194	55
Christian	—	2	4

Copenhagen, Denmark, where the gonococcal antibody test (GAT) for infection with *N. gonorrhoeae* was performed.

Sera were tested for *C. trachomatis* using the immunoglobulin IgG EIA species-specific method (Ani Labsystems Ltd Oy, Helsinki, Finland). Cutoff points were determined according to the manufacturer's instructions.

TPHA test is a specific antitreponemal antibodies test. It detects human serum antibodies to *T. pallidum* by means of an indirect haemagglutination method.

Antibodies to *N. gonorrhoeae* were detected by the GAT[21] (Statens Serum Institut, Copenhagen, Denmark). The GAT is an indirect haemagglutination test using gonococcal pilus as an antigen.

Chi-square test was used to analyse differences between proportions, with a value corresponding to $P < 0.05$ for significance unless otherwise stated. Continuous variables were analysed by a nonparametric test, Mann–Whitney *U* Test. In the multivariate analysis, cases and controls were compared by the extent of FGM (forms involving labia majora versus other forms or no FGM) using logistic regression controlling for age, education and duration of marriage (treated as continuous variables), whether infertile or not and socio-economic level (low versus medium and high).

The study has been approved by the ethics committees of the University of Khartoum, Sudan and the Karolinska Institutet, Sweden.

Results

A total of 281 women were recruited. Due to logistical problems, it was only possible to obtain blood samples from 222 women. The social characteristics of respondents are described in Table 2. Data from women without sera do not differ significantly from the others regarding clinical or socio-economic aspects.

The prevalence of *C. trachomatis*, *N. gonorrhoeae* and *T. pallidum* among the different forms of FGM is shown in Table 3. The seroprevalence was relatively low for all three infections, and only 12% had evidence of any of these infections. In Table 4, we outline the anatomical extent of FGM among cases and controls. Of cases positive for any STI, 85% had FGM extending to labia majora compared with 78% of negative controls, which is not a significant difference ($P = 0.58$ when controlling for the covariates whether infertile or not, age, years in school, socio-economic level and duration of marriage, Table 5).

Table 3. The prevalence of antibodies against STIs among the different forms of FGM

The anatomical extent of FGM (*n* respondents)	*C. trachomatis*		*N. gonorrhoeae*		*T. pallidum*		Seropositivity for any STIs	
	n	%	*n*	%	*n*	%	*n*	%
No FGM (3)	0	—	0	—	0	—	0	—
Clitoris (15)	3	20	0	—	1	6.7	4	27
Labia minora (29)	0	—	0	—	0	—	0	—
Labia majora (175)	13	7.4	5	2.9	8	4.6	22	13
Total (all respondents, 222)	16	7.2	5	2.3	9	4.1	26	12

Table 4. The anatomical extent of FGM among cases and controls

	No FGM		Clitoris		Labia minora		Labia majora		Total
	n	%	*n*	%	*n*	%	*n*	%	
Cases (seropositive for any STI)	0	—	4	15	0	—	22*	85	26
Controls (seronegative for all three STIs)	3	1.5	11	5.6	29	15	153**	78	196
Total	3		15		29		175		222

*One case had labia majora partially removed but not stitched.
**Five controls had labia majora partially removed but not stitched.

There were no differences between those who were seropositive for STIs and those who were not regarding age or socio-economic level. Duration of marriage seemed to play a role ($P = 0.02$), but this significance disappeared after controlling for covariates. Those with seropositivity had shorter education ($P = 0.03$).

Classifying FGM according to the WHO classification instead of the anatomical extent does not change the results (data not shown).

Discussion

This study shows that the extent of FGM was not associated with increased risk of serological signs of having acquired infection with *C. trachomatis*, *N. gonorrhoeae* or *T. pallidum*. It also shows, on the other hand, that having undergone FGM does not protect against acquiring STIs.

It might be argued that the study does not have power enough to allow firm conclusions from the results. When planning the study, we based power calculations on assumptions of higher prevalence figures of STIs and bigger difference concerning FGM between cases and controls. We found, however, only a small difference between cases and controls, cases with STIs having severe forms of FGM slightly more often than controls without STIs (85% compared with 78%). Even if these proportions would remain the same in a larger material, we would need to include thousands of women to get significance on the association between FGM and increased risk of acquiring STIs. At that level, it would be questionable if a statistically significant association would be clinically relevant. In any case, there is no evidence in this study that FGM is protective against STIs, which, from a public health perspective, is the most important finding.

The results of this study are not representative of women in Khartoum or in Sudan. Infertile women, as has been shown in previous studies in Africa, constitute a group that carries a higher risk of acquiring STIs.[22,23] The other group of respondents were pregnant women, which is the healthiest group coming to hospital, where we can justify the need for genital examination and taking blood samples. It is the least bad alternative group that can be used as a proxy for the normal population. The prevalence of STIs in the study population is low compared with similar studies in other African countries,[22] but it is comparable with the previous

Table 5. The association between STIs and the extent of FGM

Cases (seropositive for any STI) vs controls (seronegative for all three STIs)	Univariate		Multivariate*	
	OR (95% CI)	*P*	OR (95% CI)	*P*
Extent of FGM (labia majora vs other forms or no FGM)	1.55 (0.49–6.49)	0.611	1.13 (0.73–1.77)	0.58
Age			0.88 (0.50–1.56)	0.66
Infertility			0.88 (0.25–3.04)	0.83
Education			0.89 (0.79–0.99)	0.03
Socio-economic level			1.27 (0.52–3.08)	0.60
Duration of marriage			1.01 (0.99–1.03)	0.24

*Adjusting for age, infertility, education, socio-economic level and duration of marriage.

Sudanese studies that showed a low prevalence.[24] However, the difference in methods used to test for different STIs makes it difficult to compare between studies. This study shows a prevalence of FGM that is consistent with the latest figures from Khartoum.[25] Status and form of FGM were verified by genital inspection since a previous study in Sudan has shown that self-reporting of form is not reliable.[26] To conclude, our sample is comparable with previous data regarding both STIs and FGM prevalence.

In Sudan, early in the eighties among women coming to a STIs clinic in Khartoum, the prevalence of *C. trachomatis* antibodies was 12.9%.[27] Another study among women presenting with vaginal discharges to a gynaecology clinic in Khartoum showed that *N. gonorrhoeae* antibodies were present in 1.4% of cases.[10] Among suburban women attending ANC, *N. gonorrhoeae* was found to be in 1.2% of women and syphilis in 0.9%.[28] Another study performed among women attending ANC in Khartoum in 1999 showed a prevalence of *C. trachomatis* of 20%, *N. gonorrhoeae* of 2% and syphilis of 7%.[24] In the latter two studies, serological tests were used to diagnose the presence of syphilis antibodies. Cervical swabs culture was used to diagnose chlamydia and gonorrhoea. Thus, the figures probably underestimate the prevalence. Even if the prevalence of STIs in Sudan seems to have increased during the past few decades, it is still relatively low compared with other sub-Saharan African countries.

Health complications are usually used as arguments against FGM, although clinical studies of the complications are few. Most of the studies about the health consequences are based on women reporting their experiences and symptoms resulting from it.[11]

A similar study in Gambia has shown that being circumcised was associated with lower risks of having acquired recent syphilis or chlamydial infection and significantly higher risk of bacterial vaginosis and herpes simplex virus infection (HSV).[7] The association between FGM and bacterial vaginosis was also shown in Tanzania.[29]

A study from Nigeria showed that FGM did not attenuate sexual feelings among women. It may, however, predispose women to adverse outcomes.[19] Women with types I and II FGM in that study had significantly more episodes of lower abdominal pain than women without FGM, which, according to the authors, indicates a higher prevalence of PID among women who have undergone FGM. Vaginal discharge was also more common among circumcised women than among uncircumcised women. Reproductive tract infections were assessed based on women's self-reporting of symptoms, which is less accurate than using standardised laboratory testing methods.

Consistent with our findings, a study in Tanzania showed a similar prevalence of STIs among women who had undergone FGM and those who had not.[30] The same study showed that age of sexual debut and number of sexual partners did not differ between women with or without FGM. It is important to not relate sexual behaviour and the risk of acquiring STIs to women only. FGM is known to cause sexual problems not only for women subjected to the practice but also to their husband,[31] which theoretically could make him prone to go for extramarital sex.

Conclusions

One of the main motives for those who still practice FGM is that it protects against pre/extramarital sex and it maintains virginity.[32] This is also the main reason why FGM continues to be practised in Europe.[33,34] Having in mind the limitations of the study, we can still conclude that FGM does not seem to be protective against acquiring STIs. If seroprevalence for STIs is used as a proxy for pre/extramarital sex, it can be concluded that FGM does not seem to affect such sexual behaviour. Bearing in mind the traditional motives for practising FGM, this information would be useful in campaigns targeting community awareness and changing attitudes to prevent the practice.

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References

1 World Health Organization. *Female Genital Mutilation: An Overview*. Geneva, Switzerland: World Health Organization, 1998.
2 Rahman A, Toubia N. *Female Genital Mutilation: A Guide to Laws and Policies Worldwide*. London: Zed, 2000.
3 Izett S. *Learning about Social Change: A Research and Evaluation Guidebook Using Female Circumcision as a Case Study*. New York: RAINBO (Research Action & Information Network for Bodily Integrity of Women), 1999.
4 Female Genital Mutilation: Report of a WHO Technical Working Group, 17–19 July 1995, Geneva. Geneva, Switzerland: World Health Organization, 1996.
5 Gruenbaum E. *The Female Circumcision Controversy: An Anthropological Perspective*. Philadelphia, PA: University of Pennsylvania Press, 2001.
6 Nour NM. Female genital cutting: clinical and cultural guidelines. *Obstet Gynecol Surv* 2004;59:272–9.
7 Morison L, Scherf C, Ekpo G, Paine K, West B, Coleman R, *et al*. The long-term reproductive health consequences of female genital cutting in rural Gambia: a community-based survey. *Trop Med Int Health* 2001;6:643–53.
8 Toubia N. Female circumcision as a public health issue. *N Engl J Med* 1994;331:712–16.
9 Lockhat H. *Female Genital Mutilation: Treating the Tears*. London: Middlesex University Press, 2004.
10 Rushwan H. Etiologic factors in pelvic inflammatory disease in Sudanese women. *Am J Obstet Gynecol* 1980;138:877–9.
11 Obermeyer CM. Female genital surgeries: the known, the unknown, and the unknowable. *Med Anthropol Q* 1999;13:79–106.

12 Shandall A. Circumcision and infibulation of females. *Sudan Med J* 1967;5:178–212.

13 Adler MW. Sexually transmitted diseases control in developing countries. *Genitourin Med* 1996;72:83–8.

14 Machungo F, Zanconato G, Persson K, Lind I, Jorgensen B, Herrmann B, *et al.* Syphilis, gonorrhoea and chlamydial infection among women undergoing legal or illegal abortion in Maputo. *Int J STD AIDS* 2002;13: 326–30.

15 Paavonen J, Eggert-Kruse W. Chlamydia trachomatis: impact on human reproduction. *Hum Reprod Update* 1999;5:433–47.

16 Duncan ME, Jamil Y, Tibaux G, Pelzer A, Mehari L, Darougar S. Chlamydial infection in a population of Ethiopian women attending obstetric, gynaecological and mother and child health clinics. *Cent Afr J Med* 1996;42:1–14.

17 Duncan ME, Reimann K, Tibaux G, Pelzer A, Mehari L, Lind I. Seroepidemiological study of gonorrhoea in Ethiopian women. 1. Prevalence and clinical significance. *Genitourin Med* 1991;67:485–92.

18 Gertig DM, Kapiga SH, Shao JF, Hunter DJ. Risk factors for sexually transmitted diseases among women attending family planning clinics in Dar-es-Salaam, Tanzania. *Genitourin Med* 1997;73:39–43.

19 Okonofu FE, Larsen U, Oronsaye F, Snow RC, Slanger TE. The association between female genital cutting and correlates of sexual and gynaecological morbidity in Edo State, Nigeria. *BJOG* 2002;109:1089–96.

20 Almroth L, Elmusharaf S, El Hadi N, Obeid A, El Sheikh MA, Elfadil SM, *et al*. Primary infertility after genital mutilation in girlhood in Sudan: a case-control study. *Lancet* 2005;366:385–91.

21 Reimann K, Odum L, Larsen SO, Lind I. Indirect haemagglutination test using gonococcal pilus antigen—how useful to diagnose gonorrhoea. *Genitourin Med* 1987;63:250–5.

22 Samucidine M, Barreto J, Lind I, Mondlane C, Bergstrom S. Serological evidence of gonorrhoea among infertile and fertile women in rural Mozambique. *Afr J Reprod Health* 1999;3:102–5.

23 Samucidine M, Barreto J, Folgosa E, Mondlane C, Bergstrom S. Infertile women in developing countries at potentially high risk of HIV transmission. *Afr J Reprod Health* 1999;3:98–102.

24 Ortashi OM, El Khidir I, Herieka E. Prevalence of HIV, syphilis, Chlamydia trachomatis, Neisseria gonorrhoea, Trichomonas vaginalis and candidiasis among pregnant women attending an antenatal clinic in Khartoum, Sudan. *J Obstet Gynaecol* 2004;24:513–15.

25 Sudan Demographic and Health Survey 1989/1990. Khartoum, Sudan: Department of Statistics, Ministry of Economic and National Planning and Columbia, MD: Institute for Resource Development/Macro International Inc, 1991.

26 Elmusharaf S, Elhadi N, Almroth L. Female genital mutilation: A clinical study on the reliability of reported form and the WHO classification. *BMJ* In press 2006.

27 Omer EE, Forsey T, Darougar S, Ali MH, el-Naeem HA. Seroepidemiological survey of chlamydial genital infections in Khartoum, Sudan. *Genitourin Med* 1985;61:261–3.

28 Kafi SK, Mohamed AO, Musa HA. Prevalence of sexually transmitted diseases (STD) among women in a suburban Sudanese community. *Ups J Med Sci* 2000;105:249–53.

29 Klouman E, Manongi R, Klepp KI. Self-reported and observed female genital cutting in rural Tanzania: associated demographic factors, HIV and sexually transmitted infections. *Trop Med Int Health* 2005;10: 105–15.

30 Msuya SE, Mbizvo E, Hussain A, Sundby J, Sam NE, Stray-Pedersen B. Female genital cutting in Kilimanjaro, Tanzania: changing attitudes? *Trop Med Int Health* 2002;7:159–65.

31 Almroth L, Almroth-Berggren V, Hassanein OM, Al-Said SS, Hasan SS, Lithell UB, *et al*. Male complications of female genital mutilation. *Soc Sci Med* 2001;53:1455–60.

32 Almroth L, Almroth-Berggren V, Hassanein OM, El Hadi N, Al-Said SS, Hasan SS, *et al*. A community based study on the change of practice of female genital mutilation in a Sudanese village. *Int J Gynaecol Obstet* 2001;74:179–85.

33 Morison LA, Dirir A, Elmi S, Warsame J, Dirir S. How experiences and attitudes relating to female circumcision vary according to age on arrival in Britain: a study among young Somalis in London. *Ethn Health* 2004;9:75–100.

34 Ahlberg BM, Krantz I, Lindmark G, Warsame M. 'It's only a tradition': making sense of eradication interventions and the persistence of female 'circumcision' within a Swedish context. *Crit Soc Policy* 2004;24: 50–78.