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A Case-Control Study of Risk Factors for Male Infertility in Southern Nigeria

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Abstract

Aim: The purpose of this study was to evaluate the association between selected potential socio-demographic and behavioural risk factors and infertility in Nigeria males.
Methods: The study consisted of cases and controls. The cases were 150 males with proven male infertility, while the controls were 150 fertile males with normal semen parameters. Both cases and controls were matched for age places of residence, and were similar in key socio-demographic variables. They were compared for sexual history, past medical and surgical history, past exposures and treatment of symptoms of sexuality transmitted diseases, past and current use of drugs and history of smoking and alcohol intakes.
Results: The results showed infertile men to be significantly more likely than fertile men to report having experienced penile discharge, painful micturition and genital ulcers. Infertile men were less likely to seek treatment for these symptoms, and to seek treatment with informal sector providers rather than formal sector providers in private, district and referral hospitals. Multivariate analysis showed that male infertility was also significantly associated with bacteria in semen cultures, self-reporting of previous use of traditional medications and moderate to heavy alcohol intake. By contrast, infertility was not significantly associated with smoking and occupational types.
Conclusion: We conclude that infertility is associated with various proxies of sexually transmitted infections (STIs) and poor healthcare-seeking behaviour concerning for STIs in Nigeria men. Efforts to address these problems will likely contribute to reducing the prevalence of male infertility in Nigeria.

Key Words: Male infertility, Benin City, Nigeria, semen analysis, genital infection, smoking, alcohol

Introduction

Available evidence suggests that male infertility is an important but neglected reproductive health issues in Nigeria. Published studies indicate that the male factor accounts for between 20 and 50% of the causes of infertility in different parts of the country [1,2,3]. Despite this, very little has been done to identify the root causes of male infertility in the country, with several reports indicating that the major part of male infertility is unexplained [2,3] Ojengbede et al[4] screened infertile men in Ibadan with the alpha-glycosidase test and found cases where occlusion of the vas deferens may have been responsible for infertility. Similar studies found high rates of hyperprolactinaemia[5,6], anti-sperm antibodies[7], and genital infections[8] in Nigeria males presenting with infertility. However, these studies failed to explore the background causes of these abnormalities, and the absence of a control group also made it difficult to interpret the findings.

Studies form several populations around the world indicate that smoking[9], types of occupation[10,11], alcohol and coffee intake[11], and nutritional factors[9] are risk factors for male infertility. To date, there is lack of substantive information on the importance of these and other related conditions as risk factors for male infertility in Nigeria. Such information is critical, as it would enable the design of programs to prevent male infertility in the country. Ibeh et al [12] first reported higher concentrations of aflatoxin in infertility Nigerian men than in fertile controls and concluded that the consumption of native containing this contaminant may predispose to male infertility. Although the results of this study are yet to be confirmed, it nevertheless points to the possibility that locally endemic factors may be important in the causation of male infertility in Nigeria.

Important local factors that may be important risk factors male infertility in Nigeria include infections such as tuberculosis and mumps, which can directly or indirectly damage the male reproductive system. Sexually transmitted infection (STI) is another common problem that has been poorly investigated for its association with male infertility in Nigeria. Several sexually transmitted bacteria such as *Neisseria Gonorrheae* and *Chlamydia trachomatis* are highly prevalent in Nigeria[13], and these are known to damage the male genital tract resulting in male infertility. Indeed, there are reports indicating high rates of infertility among males attending STI clinics in Nigeria[14]. Therefore, it would be relevant to measure the relationship between previous exposures to STIs and infertility in Nigerian males. Since the pattern of sexual behaviour has direct connection with the

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prevalence of sexually transmitted infections, it would be relevant to determine the impact of polygamy and use of multiple sexual partners, both being common phenomena in Nigeria.

Other factors with high prevalence in Nigeria that are equally important to investigate for their association with male infertility include previous exposures to drugs, smoking and alcohol, concurrent medical illnesses, surgical procedures such as hernia repairs and the use of native medications.

The objective of this study was to evaluate the association between infertility and selected socio-demographic and behavioural factors in Nigerian males. In the absence of currently effective methods for treating a large proportion of men suffering from infertility, the results of this study are expected to prove useful for identifying relevant interventions for preventing male infertility in Nigeria.

Materials and Methods

Patients

The study was a case-control conducted at the Reproductive Health Clinic of the Women's Health and Action Research Center, Benin City, Nigeria, between January 1, 1999 and December 31,2003. The cases were 150 males, whose wives presented for investigation and treatment of infertility in the clinic, and who were found to have abnormal semen parameters. The controls were 150 males, whose spouses were pregnant at the time of the study, and who had normal semen parameters.

All cases of male infertility were identified from among couples presenting to the Clinic requesting investigation and treatment of infertility. A detailed history of infertility was elicited from the couples, and physical and special investigations were carried out. The latter included semen analysis, hysterosalpingography and/or laparoscopy to evaluate tubal factor, hormone assay for ovulation assessment and trans-vaginal ultrasound scan as part of ovulation assessment to exclude uterine and endometrial abnormalities. Only those who were identified as having semen anomalies as the only cause of their infertility, and who consented to participate in the fully explained protocol were included as cases in the study. Among the 150 couples identified with male-factor only infertility, 89 (59.3%) had primary infertility, while 61 (40.7%) had secondary infertility, and had infertility duration ranging between 3 and 15 years (median=8.5 years). Thus, all had definite evidence of infertility as defined by the WHO[15].

By comparison, the controls were selected from among men proven fertility. These were men whose wives recently pregnant, or who delivered within six months of the study. Such women were identified in the Reproductive Health Clinic and the study was explained to them. The women were asked to inform their partners and to request them to present in the clinic to participate in the study. Among the men who presented, the study was further explained to them in great detail and only those who gave consent were included in the study. Once a case of male infertility was identified, he was matched for age and place of residence as a fertile control.

Semen Analysis

Semen analysis was conducted in both cases and controls after at least three days of abstinence, established WHO protocols (WHO, 1999)[16]. Semen analyses were done twice at least two weeks apart, in both cases and controls, to eliminate the possibility of a diurnal variability in the reported semen results. Only those with consistent results were included as either cases or controls. Using the WHO criteria[16], normal sperm concentration was accepted as being greater than 20 million/ml; 5-20 million/ml represented oligozoospermia, while less than 5 million/ml was identified as severe oligozoospermia. Motility was described as normal if 50% or more of the sperms were progressively motile within 60 minutes of ejaculation. Sperm morphology describes the number of normal spermatozoa that have an ovoid head, stainable acrosome head and a normal mid-piece and tail. Although the WHO previously accepted 30% as normal, Kruger et al[17] have described strict criteria where less than 14% normal morphology would be abnormal. The 4th edition of the WHO manual in use at the time of the study [16] did not specify a value for morphology and thus, we have not included this in the assessment. All semen samples from both cases and referents were cultured using standard procedures, to determine the presence of pathogenic organisms in the samples.

Study Protocol

Following these initial assessments, a three-part study protocol was designed to document the findings uniformly in both cases and controls. In the first part of the protocol, we documented detailed information on the socio-demographic characteristics of the respondents their age, marital status and type of marriage, occupation, religion, and educational background. The second part of the protocol obtained information on the respondents' sexual behavior and their previous symptoms suggestive of STIs, genital tract infections and other medial/surgical illnesses. If they had experienced these symptoms, we then asked how long the symptoms had lasted and where and how they had been treated.

In the second part of the protocol, we also asked whether or not the respondents smoked or took alcohol, and if so the types, duration and amount taken over time. In

particular, we distinguished between cigarettes and marijuana smoking, in order to identify possible independent effects of these practices on male fertility. We also asked questions on their use of medications, either routinely or for the indicated medical conditions. In the final part of the protocol, we recorded the results of physical examination and laboratory tests conducted in both cases and controls. In particular, we recorded the presence of the testicles within the scrotal sac in both cases and controls, and whether or not the subjects had varicocoele and urethral discharge at the time of the study. We also recorded the results of semen analysis carried out in both cases and controls.

Specially trained nurses completed all protocols in private, and the subjects were assured of confidentiality of information obtained. All infertile men received appropriate treatment and counselling as part of the infertility work-up and treatment in the clinic. The Human Ethics Committee of the University of Benin Teaching Hospital approved the study protocol.

Data Analysis

Data analysis consisted of calculation of responses to the questions for both cases and controls, and results of any differences were compared by ANOVA, X^2, test or X^2 test to trends as appropriate. Odds ratios and confidence intervals were calculated to measure the independent effects of the variables. A multivariate logistic regression carried out to determine the pooled effects of the various variables. This latter method enabled us to rank the factors regarding their possible relative as risk factors for male infertility

Table 1:
Results of semen analysis by fertility status

Variables	Fertile N=150	Infertile N=150	*p-value*
Semen Concentration			
More than 20million/ml	145 (96.7)	12 (8.0)	
More than 10 to 20 million/ml	5 (3.3)	15(10.0)	
More than 5 to 10million/ml	-	17(11.3)	
Less than 5 to 10million/ml	-	64(42.7)	
Azoospermia	-	42(28.0)	0.000
Motility			
>50%	147 (98.0)	26 (17.3)	
30 50%	3 (2.0)	23 (15.3)	
<30%	-	59 (39.4)	
Azoospermia	-	42 (28.0)	0.000
Viable form			
0	-	13 (8.7)	
>50%	132 (88.0)	25 (16.7)	
30 50%	17 (11.3)	35 (23.3)	
<30%	1 (0.7)	35 (23.3)	
Azoospermia	-	42 (28.0)	0.000
Semen culture			
No growth	113 (75.3)	82 (55.0)	
Positive bacterial growth	37 (24.7)	68 (45.0)	0.000

Results

The results of semen analysis performed on fertile men are shown in Table 1. As expected, infertile men had lower sperm concentration, poorer sperm motility and lower percentage of viable forms of spermatozoa than fertile referents. Twelve (8.0%) infertile men had sperm counts above 20 million, but these also had lower sperm motility (<50%) and lower percentages of viable form (<30%). Thus, poor motility and abnormal sperm morphology were present as the sole abnormalities in 8.0% of infertile men. Similarly, infertile men were significantly more likely to have bacterial organisms in semen cultures than referents. Sixty-eight of 150 infertile men (45.0%) grew various bacterial organisms in their semen compared to 37/150 (24.7%) fertile referents (P<0.001). The most common organisms grown were *Staphylococcus aureus, Streptococcus fecalis, Trichomonas vaginalis* and *Candida albicans.*

Table 2:
Socio demographic characteristics by fertility status

Variables	Frequencies (%) Fertile N=150	Infertile N=150	*p*
Age			
30	11 (7.4)	11 (7.4)	
31- 35	26 (17.3)	28 (18.7)	
36- 39	28 (18.7)	25 (16.7)	
40- 45	59 (39.3)	58 (38.7)	
46- 49	19 (12.7)	20 (13.3)	
Over 50	7 (4.7)	8 (5.3)	ns
Educational level completed			
None	11 (7.4)	8 (5.3)	
Primary	14 (9.3)	19 (12.7)	
Secondary	40 (26.7)	41 (27.3)	
Tertiary	85 (56.7)	82 (54.7)	ns
Marital status			
Single	4 (2.7)	6 (4.0)	
Married	138 (92.0)	136 (90.7)	
Separated	4 (2.7)	3 (2.0)	
Divorced	2 (1.3)	3 (2.0)	
Cohabiting	2 (1.3)	2 (1.3)	ns
Types of family			
Monogamy	116 (77.3)	122 (81.3)	
Polygamy	28 (18.7)	21 (14.0)	
Not stated	6 (4.0)	7 (4.7)	ns
Ethnic group			
Urhobo	12 (8.0)	12 (8.0)	
Etsako	4 (2.7)	9 (6.0)	
Yoruba	14 (9.3)	13 (8.7)	
Bini	41 (27.3)	39 (26.0)	
Ishan	20 (13.3)	27 (18.0)	
Igbo	39 (26.0)	28 (18.7)	
Itshekiri/Isoko	7 (4.7)	7 (4.7)	
Others **	13 (8.8)	15 (10.0)	

** Kwale, Hausa, Ijaw, Owan, Idoma, Rivers, Jukun

The socio-demography characteristics of cases and controls are presented in Table 2. Fertile and infertile men were similar in all respects including age, educational backgrounds, marital status, and types of family, and they were from identical ethnic groups. Their religious and occupational backgrounds were also similar (results not shown). The mean (SD) age of infertile men was 37.3 (4.8) years, whereas fertile men were aged 37.5 (6.1) years, the results were not statistically significant. The reported pattern of sexual activity in cases and referents are presented in Table 3. As shown, there were no significantly differences between fertile and infertile men in their reported patterns of sexual activity. The reported numbers of sexual episodes in the preceding week, the current number of sexual partners and the number of sexual partners ever had, were also similar between cases and referents.

Table 3:
Experiences of sexual activity in fertile and infertile men

Variables	Fertile N=150	Infertile N=150	*p*
No of sexual intercourse per week			
0-1	32 (21.3)	33 (22.0)	
2-4	111 (74.0)	98 (65.3)	
5-10	2 (1.3)	13 (8.7)	
Not sexually active	2 (1.3)	2 (1.3)	
Not stated	3 (2.0)	4 (2.7)	ns
No of current sexual partners			
One	70 (46.7)	83 (55.3)	
Two	52 (34.7)	31 (20.7)	
3 - 4	23 (15.3)	28 (18.7)	
5 6	4 (2.7)	4 (2.7)	
Greater than 7	1 (0.7)	4 (2.7)	ns
No of lifetime sexual partners			
0	5 (3.3)	7 (4.7)	
1- 10	116 (77.3)	102 (68.0)	
11 20	23 (15.3)	30 (20.09)	
21 25	5 (3.3)	7 (4.7)	
Over 26	1 (0.7)	4 (2.7)	ns

The frequencies of self-reporting of symptoms of STIs and the pattern of health seeking for reported STI symptoms are presented in Table 4 for cases and referents. Infertile men were significantly more likely than fertile men to report recurrent penile discharge, painful urination, genital ulcer and testicular pain. However, there were no significant differences between the two groups in their rates of self-reporting of recurrent itching in the genital area and testicular and testicular swelling. The number of episodes and duration of each episode did not differ significantly between cases and referents (results not shown).

The patterns of treatment seeking for reported symptoms of STIs in both groups are also shown in Table 4. In this community, different forms of treatment of STI symptoms have been reported. These include self-treatment, informal sector treatment with traditional medicines and patent medicine dealers and formal sector treatment in hospitals and certified health providers. However, only those reporting treatment with formal health providers have been presented here as "receiving treatment", while those reporting informal treatments were categorized as "not treated", since the latter have not be proven to be evidence-based. Overall, infertile men were more likely than fertile men to report treatment with informal sector providers (results not shown). By contrast, as shown in Table 4, fertile men were significantly more like to report that they received treatment with formal sector providers for their reported penile discharge, painful urination. Itching genital area, genital ulcer and testicular pain.

Table 4:
Number and percentages reporting symptoms and treatment of STIs by fertility status

Variables	Fertile N=150	Infertile N=150	*p* [χ^2 test]
Penile discharge	24 (16.0)	63 (42.0)	0.0003
Treated	23 (95.8)	35 (55.6)	
Not treated	1 (4.2)	28 (44.4)	0.0005
Painful urination	51 (34.0)	74 (49.3)	0.05
Treated	50 (98.0)	45 (60.8)	
Not treated	1 (2.0)	29 (39.2)	0.004
Itching in genital area	48 (32.0)	59 (39.3)	ns
Treated	45 (93.8)	33 (55.9)	
Not treated	3 (6.2)	26 (44.1)	0.0001
Genital ulcer	2 (1.3)	27 (18.0)	0.00003
Treated	2 (100)	20 (74.0)	
Not treated	0	7 (26.0)	0.005
Testicular swelling	0 (0.0)	7 (4.7)	ns
Treated	0	3	
Not treated	0	4	ns
Testicular Pain	6 (4.0)	18 (12.0)	0.002
Treated	6 (100)	12 (66.7)	
Not treated	0	6 (33.3)	0.005

Regarding past histories of medical and surgical conditions, there were no differences between the two groups in their self-reporting of mumps, diabetes, hypertension, hypothyroidism, hyperthyroidism, cancer, and their use of drugs known to depress testicular function such as antihypertensives, antidepressants, cimetidine, nitofurantoin and sulphasalazine (results not shown). However, 4.1% of fertile men reported native medications repeatedly in th past, compared to 33.8% of infertile men ($p<0.002$). Eleven infertile and four fertile men reported that they had previous surgical operations in their genital areas. The differences between the groups are not statistically significant. The types of surgical operations (inguinal herniorrhaphies, testicular biopsy, and repair of testicular maldescent, and varicocoelectomy) were not statistically different between cases and referents.

Finally, we compared the pattern of smoking and alcohol intake in fertile versus infertile men (Table 5). There were no significant differences between fertile and infertile men in the proportions reporting that they had ever smoked; however, infertile men were more likely than fertile referents to report longer duration of smoking. The types of smoking (cigarettes or marijuana) and the frequency of smoking did not differ between the two groups. Both groups also did not differ in the proportions reporting use of alcohol. However,

Table 5:
History of smoking and alcohol in fertile and infertile men

Variables	Fertile N=150	Infertile N=150	*p*
Ever smoking	52 (34.7)	69 (46.0)	ns
Duration of smoking (yrs)			
1 - 5	37 (71.2)	22 (31.9)	
6 - 10	11 (19.2)	24 (34.8)	
11 - 15	1 (1.9)	13 (18.8)	
16	5 (9.6)	10 (14.5)	0.02
What did you smoke?			
Cigarette	41 (78.8)	46 (66.7)	
Marijuana	6 (11.5)	3 (4.3)	
Cigarette and Marijuana	4 (7.7)	20 (28.9)	
Cocaine	1 (1.9)	-	ns
Frequency of smoking			
Daily	31 (59.6)	55 (79.7)	
Weekly	10 (19.2)	4 (5.8)	
Monthly	2 (3.8)	1 (1.4)	
Occasionally	9 (17.3)	6 (8.7)	
Stopped	-	3 (4.3)	ns
No (%) Taking Alcohol	116 (77.3)	116 (77.3)	ns
Amount of alcohol consumed			
1 - 2 glasses a day	15 (12.9)	49 (42.2)	
1 - 2 glasses a week	14 (12.1)	24 (20.7)	
1 - 2 glasses a month	12 (10.3)	6 (5.2)	
Occasionally	75 (64.7)	35 (30.2)	
Stopped	-	2 (1.7)	0.002

infertile men were more likely to be heavy drinkers as compared to fertile controls. Nearly 42.2% of infertile men reported that they drink one to two glasses of alcohol a day compared to only 12.9% of fertile men ($p < 0.002$).

The results of the multivariate logistic regression of the risk factors for male infertility are presented in Table 6. The model identified 18 variables as possible predictive factors for male infertility in this population. However, after multivariate analysis, the following variables turned out to be important: poor sperm motility and low percentage of viable forms, lack of paternity of current wife or another partner, penile discharge, painful micturition, genital ulcer, use of referral hospital and chemists for treatment of STIs, use of native medications, and excessive intake of alcohol (one or two glasses of alcohol/day). Men who reported having had recurrent penile discharge were nearly eight times more likely to be infertile than those with no such history (OR 7.8; CI 2.9-21.5). Also, men who reported having had recurrent pain on micturition were (OR 2.2; CI: 02-4.71, $P<0.04$) more likely to be infertile than men who did not give such histories.

Table 6:
Adjusted odds ratios and confidence intervals for predictors of male infertility

Variables	Odds ratios	CI (95%)
Age (rc 46 49)		
28 - 30	1.03	0.28 - 3.77
31 - 35	1.24	0.40 - 3.86
36 - 39	0.96	0.31 - 3.01
40 - 45	0.77	0.26 - 2.27
Over 50	0.42	0.11 - 1.50
Marital status (rc Cohabiting)		
Single	1.50	0.15 - 15.46
Married	0.98	0.13 - 7.09
Separated	0.75	0.06 - 8.83
Divorced	1.50	0.10 - 21.31
Religion (rc Anglican)		
Moslem	825.6	0.00 - 1.32
Pentecostal	0.61	0.23 - 1.65
Catholic	0.52	0.18 - 1.48
Jehovah witness	825.6	0.00 - 9.63
Type of marriage (rc Polygamy)		
Monogamy	1.05	0.33 - 9.63
Number of yrs trying to impregnate (rc 1 4)		
5 - 10	0.95	0.47 - 1.93
11 - 15	0.18	0.03 - 0.90
Over 15 years	3.30	0.35 - 30.97
Semen count (rc >20 million)		
10 - 20 million	1.000	0.000 - 0.011
5 - 10 million	0.000	0.005 - 0.44
<5million	1.000	5.01 - 112.08
Motility (rc >50%)		
<50%	59.98	7.92 - 453.89
Viable form (rc > 50)		
<50%	4.94	2.26 - 10.81
Culture (rc no growth)		
Positive bacteria growth	0.94	0.058 - 15.43
Paternity with present with (rc Yes)		
No	2.69	1.38 - 5.26
Paternity with another wife (rc Yes)		
No	4.21	2.09 - 8.49
Smoking (rc No)		
Yes	1.496	0.75 - 2.96
Native herb (rc Yes)		
No	11.89	3.41 - 41.45
Frequency of smoking (rc occasionally)		
Daily	1.90	0.75 - 7.44
Weekly	0.25	0.11 - 2.56
Monthly	0.70	0.05 - 9.19
Alcohol (rc No)		
Yes	1.15	0.58 - 2.26
Quantity of alcohol (rc occasionally)		
>1 - 2 glasses daily	7.14	2.27 - 22.41
>1 - 2 glasses a week	3.33	1.18 - 9.37
>1 - 2 glasses a month	0.47	0.04 - 4.73

RC: reference category

Other significant association in the results are presented in Table 6. Previous genital ulcers and native medications increased the odds of being infertile nine times, and nearly 12 times respectively. Also, men who drank more than 1-2 glasses of alcohol a day were more likely to be infertile than those who drank less quantities of alcohol (OR 6.05; CI 1.81-22.3). With respect to healthcare-seeking behavior for STIs, our result show than men who reported that they used a referral hospital (teaching hospital) for treatment of their symptoms were at least 83% less likely to be infertile than those using other forms of treatment (OR=0.17; CI0.02-0.86). By contrast, those who reported that they used chemists (patent medicine sellers) were more likely to be infertile than those using other forms of treatment (OR=8.2; CI 2.1-36.6). The other relationships in the logistic regression model were not statistically significant.

Discussion

The study was designed to identify potential risk factors for male infertility in southern Nigeria. The results showed significant associations between male infertility and previous exposures to sexually transmitted diseases, native medications and moderate to heavy alcohol intake. Men who reported having had repeated episodes of penile discharge, painful micturition, genital ulcers and testicular pain were significantly more likely to be infertile than those not reporting such episodes. As these are recognized to be important proxies for STIs in this population, it suggests greater exposures to STIs in infertile men than in fertile controls. However, contrary to our prediction, there were no significant differences in the patterns of reported sexual behavior (i.e. number of sexual partners and sexual frequency) between cases and controls, which suggests than the increased prevalence of STIs in infertile men may be due to other mechanisms rather than through increased sexuality. A possible mechanism could be that infertile men may be less likely to practice protective sex (e.g. use of condoms) than fertile men, a relationship that was not explored in this study.

The results of this study also show that bacterial colonies were more likely to be grown in the semen of infertile men than fertile controls. Thus, there is substantial evidence that both present and past genital tract infections are more prevalent in infertile men than fertile controls. Several reports have documented significant associations between STIs, genital tract infections and male infertility in Nigeria [8,13]. However, the strength of this association has not hitherto been determined because of difficulties in establishment a causal relationship between prior exposures to genital tract infections and male infertility. Indeed, there have been questions raised in other populations[18] as to

whether STIs and genital infections are a cause of male infertility due to the early recognition and prompt treatment of these infections in these populations. However, it is well known that sexually transmitted organisms such as *Neisseria gonorrheae* and *Chlamydia trachomatis* can cause epididymitis, inflammation of the vas dererens, prostatitis and urethritis[19] conditions which can all predispose to male infertility. Since *Neisseria gonorrheae* and *Chlamydia trachomatis,* make significant contributions to the burden of STIs in Nigeria[20], there can be no doubt that they would equally contribute to male infertility through this causal pathway. However, further studies are warranted, especially longitudinal studies, that document the fertility history of men treated for various forms of STIs, as well as those that use more robust markers of sexually transmitted diseases as endpoints for comparison.

Apart from the increased prevalence of STIs, another determinant of male fertility in our sample was the pattern of healthcare-seeking behavior for reported symptoms of STIs. It is well known that early and appropriate treatment of STIS can reverse the symptoms and prevent long-term complications. However, if treatment is delayed or carried out using inappropriate methods and drugs, the chances of development of major complications are increased. The results of this study indicate that infertile men were significantly more like than fertile men to self-treat or to report using informal sector providers (traditional healers, chemists and patent medicine sellers) to treat their STI symptoms, and less likely to use formal providers (doctors, health centers and hospitals). Our early study [21] had shown that informal sector providers offer poor and ineffective treatment for STIs in Nigeria as compared to formal sector providers. Thus, the results of this study suggest poor treatment of STI symptoms to be strongly associated with male infertility in Nigeria. Clearly, any efforts to reduce the prevalence of male infertility in Nigeria must focus not only on the primary and secondary prevention of STIs, but also on improving the skills of health providers to offer quality treatment.

This study also showed that infertile men were likely to report having used native medications. However, the direction of this effect is presently not known. Some men are known to use native medications as a form of treatment of male infertility, whereas others use native drugs as a habit, or for treatment of some other illnesses. To date, it is not known to what extent native medications suppress or improve spermatogenesis. Thus, the results of out study may be an artifact indicating either that infertile males use native medications to treat their infertility or that native medications may predispose to male infertility. Further studies are warranted to determine the direction of these relationships.

Contrary to published findings in other populations[11] smoking of cigarettes and marijuana were not found to be significantly associated with male infertility in this population. By contrast, moderate to heavy alcohol consumption significantly increased the odds of male infertility in the sample. This confirms the results from other populations[9], which show a link between moderate to heavy alcohol intake and male infertility. However, the mechanism underlying this relationship is presently unclear. It may reflect the fact that males remaining infertile become depressed and begin to drink as a consequence rather than there being a direct relationship between alcohol intake and male infertility. Nevertheless, the results of our study suggest that any program to prevent male infertility in Nigeria should include measures to reduce the level of alcohol consumption in the country.

This case-control study could be criticized on the basis that its results are based on self-reporting of events rather on more robust indicators. However, such indicators especially those that relate to STIs are difficult to find in our population as they represent past events that are often poorly investigated and reported in official data. We consider that out cautions interviewing, coupled with a detailed explanation of the study protocol to the participants limited the chances of recall bias in both cases and controls. Furthermore, syndromic management of STI which rely on the elicitation of symptoms is currently the method recommended by the Nigerian Federal Ministry of Health for the treatment of STIs in health facilities.

In conclusion, the results of this study show a significant association between male infertility and various proxies of sexually transmitted diseases and poor healthcare-seeking behavior for STIs among men in Nigeria. Other significant risk factors for male infertility include use of native medications and moderate to heavy alcohol intake. Efforts to address these problems will make significant contributions to reducing the prevalence of male infertility in Nigeria.

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