Research Article

Comparison of genital microbial isolates between intrauterine contraceptive device users and nonusers in Sokoto, Nigeria

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ABSTRACT

Background: In the past, the use of intrauterine contraceptive device (IUCD), in particular, Dalkon Shield was found to be associated with increased risk of pelvic infection. Recent literature illustrates that the risk of pelvic infection after insertion of an IUCD is low and that the risk peaks in the 1st month after insertion. We set out to determine the incidence of genital infection among IUCD users after the 1st and 3rd months of insertion compared to users of other contraceptive methods; to determine the risk of genital infections among IUCD users compared to users of other contraceptive methods and to determine the organisms associated with genital infection among the contraceptive users.

Materials and Methods: This was a cohort study involving new clients who chose various forms of contraceptives.

Results: The incidence of genital infection was 3 (8.5%) at 1 month and 4 (12.1%) at 3 months. The incidence in non-IUCD contraceptive users was 2 (5.9%) at 1 month and 3 (8.8%) at 3 months. The relative risk was 1.44 and 1.5 at 1 and 3 months, respectively. The observed difference in the rate of infection between IUCD users and other contraceptive users was not statistically significant. Bacteria vaginosis and *Trichomonas vaginalis* were commonly observed in the two groups.

Conclusion: The incidence of genital infection among IUCD users was relatively low compared to non-IUCD users. IUCD s do not significantly increase the of rate genital infection.

Key words: Contraceptives; genital; infection; intrauterine contraceptive device; Nigeria.

Introduction

The intrauterine contraceptive device (IUCD) is one of the most widely used long-acting contraceptive methods.[1-3] It offers effective protection from pregnancy and is effective for long-term use. The device can be inserted at anytime as long as pregnancy has been ruled out.[4,5] It is estimated that there are about 180 million users worldwide, with over 80% of these residing in Asia.[6] In Nigeria, the acceptance rate for IUCD ranges from 47% to 66% in different family planning centres.[3,5,7] Different studies have been conducted to explore the IUCD-related diseases particularly those associated with

infection. Some studies linked the infection-related diseases to the insertion method and technique. This is because the postinsertion pelvic infection is generally low but appears to be highest in the first 3 weeks' postplacement.[8,9] Despite the overall low risk documented in various places, it is prudent to determine the risk in the northwest subregion of Nigeria.

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We set out to determine the incidence of genital infection among IUCD users after the 1st and 3rd months of insertion compared to users of other contraceptive methods during the same period; to compare the incidence of common organisms isolated in the two groups and also to determine the risk of genital infections among IUCD users compared to users of other contraceptive methods.

Materials and Methods

Study area
The study was conducted at the two Family Planning clinics of the Usmanu Danfodiyo University Teaching Hospital, Sokoto.

Study design
This was a Cohort study.

Sample determination
The sample size of 35 in each group was obtained using the formula for group comparison and considering 10% attrition rate.

Study population
This includes women who presented to the family planning clinic for new method of contraception. Thirty-five new clients who chose IUCD and another 35 new clients who chose other forms of contraceptives and had no genital infection were recruited.

Sampling method
The patient who met the inclusion criteria were enrolled consecutively.

Inclusion criteria
Clients that chose IUCD for contraception and gave consent for the study were included as cohorts while those that chose other forms of contraceptives served as controls.

Exclusion criteria
Women with genital infections and contraindications to IUCD insertion such as gynecological cancers, pelvic inflammatory disease (PID), and pregnancy were excluded from the study.

Sampling method
The women were screened for genital infection, and eligible clients were recruited by convenience sampling method. A semi-structured questionnaire was used to obtain relevant information, and all clients were recruited from September 2015 to November 2015 and followed for 3 months.

Sample collection
Before insertion of the IUCD, clients in whom microbes were isolated from their vaginal and/or cervical swabs were excluded from the study. An endocervical specimen was collected for culture using a sterile cotton swab during vaginal examination to detect *Neisseria gonorrhoeae,* after inoculation into Thayer Martin and 5% blood agar. Thereafter, the endocervical swab was used to make smear to detect *Chlamydia trachomatis* inclusion body. Two different high vaginal swabs were taken to isolate for *Trichomonas vaginalis, Candida* species*, Gardnerella vaginalis*, and anaerobes. One of the high vaginal swabs was used to make wet mount and Gram staining, while the second swab was used for culture.

Three drops of physiological saline were added and mixed with the first high vaginal swab. A drop of the sample collected was transferred to a microscope slide, covered with a cover slide, labeled, and then delivered to the laboratory for immediate examination. A drop from the same sample was also transferred to another microscope slide and spread to make a thin smear. It was then allowed to air dry, labeled and transferred to the laboratory for Gram staining. The sample from the second swab was inoculated into MacConkey agar and 5% sheep blood agar. The cervix, vagina, and vulva were then cleaned with antiseptic solution. The IUCD was then inserted using "no touch technique" by the researcher. The same procedure was done for clients that chose other contraceptive methods. The endocervical and vaginal sampling were then repeated after 1 month and after 3 months by the investigators.

Specimen transport
The swab sticks had Amies medium which served as transport medium used for the transport of samples to the laboratory. Samples were also analyzed within 2 h of collection.

Study procedures
Wet saline preparation
This was carried out to detect *T. vaginalis* trophozoites, motile bacteria, *Candida* species, epithelial cells, and pus cells. The high vaginal swab was utilized to make the preparation. The preparation was examined using a microscope with the $10 \times$ and $40 \times$ magnification objectives. Trophozoites of *T. vaginalis* may measure about $10–20\,\mu$m, and they are round or oval and move by an aid of undulating membrane and four anterior flagella while the fifth flagellum forms an undulating membrane. These features were checked.

Direct Gram smear
The high vaginal swab was gently rolled onto a glass slide. The smear was allowed to air dry then fixed with methanol and stained by Gram's technique. Using the $40 \times$ and $100\times$ (oil immersion) objectives, the smear was examined for pus cells and bacteria. Pus cells containing Gram-negative diplococci denote *N. gonorrhoeae.* Large Gram-positive yeast

cells and pseudohyphae could be *Candida* species. In bacterial vaginosis, epithelial cells with adhering Gram-negative short bacilli and Gram-variable coccobacilli (*G. vaginalis*, *Mobiluncus*, or Anaerobes) may be visualized. The margin of the epithelial cells is often obscured (clue cells) by the adhering bacteria.

Giemsa staining for chlamydial inclusion body

The endocervical swab was used to make a smear on a glass slide. The smear was allowed to air dry, fixed and then stained with Giemsa stain. Chlamydial infection was suspected when blue-mauve colored inclusion bodies were seen in epithelial cells.

Culture and colonial morphology

The high vaginal swab was inoculated on two plates of 5% Sheep Blood agar and one plate of MacConkey agar. The MacConkey agar plate was incubated aerobically at 37°C for 18–24 h. The first plate of 5% Sheep Blood agar was incubated aerobically at 37°C for 18–24 h for aerobes and facultative organisms. The second plate of 5% Sheep Blood agar was incubated anaerobically in an anaerobic jar looking for obligate anaerobes.

Staphylococcus aureus produces yellow-cream colored colonies that are 1–2 mm in diameter and they are beta hemolytic on 5% Sheep blood agar. On MacConkey agar, the *Staphylococcus* colonies appear pinkish signifying lactose fermentation. *Streptococcus agalactiae* produce grey mucoid colonies about 2 mm in diameter surrounded by a beta hemolytic zone on Blood agar. *Escherichia coli* produce 1–4 mm in diameter colonies that appear pinkish signifying lactose fermentation. They are slightly mucoid and beta hemolytic on 5% Sheep blood agar. *Candida albicans* produces pale, creamy colored, pasty colonies on blood agar with a distinctive yeasty smell. *Actinomyces israeli* produces small creamy white colonies with a rough nodular surface that glistens on 5% sheep blood agar following anaerobic incubation.

The endocervical swab was inoculated in Thayer Martins medium looking for *N. gonorrhoeae*. The Thayer Martins medium was incubated in a moist carbon dioxide enriched atmosphere at 35°C–37°C for 18–24 h. This was then examined for growth after overnight incubation. *N. gonorrhoeae* produces small raised, gray shiny colonies.

Motility testing

E. coli is motile by means of peritrichous flagella. The motility test was demonstrated by using a fresh culture of suspected colonies of *E. coli* grown on MaConkey agar plate after inoculation in normal saline then transferred to a hanging drop slide. This was viewed using the 10 × objective.

Biochemical test

Oxidase and Sugar fermentation test was performed on suspected *N. gonorrhoeae* colonies. *N. gonorrhoeae* colonies are oxidase positive and ferment glucose but not lactose, maltose, or sucrose.

Catalase and coagulase test was employed to differentiate between the Gram-positive cocci. *S. aureus* is catalase and coagulase positive while *S. agalactiae* is catalase negative.

Candida species was further confirmed to their specie level by the use of Germ tube test and sugar assimilation test. *C. albicans* is germ tube positive, while other species are negative.

Data analysis

The results obtained were analyzed using Statistical Package for Social Sciences (SPSS) version 21.0 (Armonk, NY, IBM Corp). Data were presented using tables and Figures. Categorical data such as occupation of respondents were summarized using frequencies and percentages. Chi-square test was used to compare associations. $P < 0.05$ was considered statistically significant.

Ethical consideration

Ethical clearance was obtained from the Ethics and Research Committee of the University Teaching Hospital. Informed consent was also obtained from the respondents before data collection. Patients with infection were treated and their spouses and co-wives were referred to appropriate clinics.

Limitations

- The clients were followed-up for only 3 months; therefore, a long-term effect of IUCD could not be determined
- The effect of other copper-containing IUCDs other than copper T-380A could not be assessed as they are not commonly used in the study area.

Results

A total of 70 women were enrolled for this study. Sixty-eight clients returned for follow-up at 1 month and 67 were seen at the third contact, therefore, the response rate was 97% and 95% at 1 and 3 months, respectively. The mean age of the respondents with IUCD was 26.54 ± 2.1 years and that of the non-IUCD group was 26.30 ± 2.4 years. The age range was similar between the two groups which was 17–45 years. Eighteen (51.4%) of the respondents from each group were between 25 and 34 years of age.

The majority of the respondents were unemployed, 14 (40%) in the IUCD group and 25 (71.4%) in the control group were

homemakers. Only 1 (2.9%) of the respondents in the IUCD group was single, and all women in the control group were married. In the IUCD group, majority were the only wives of their husbands while 20 (56.1%) of the controls were in a polygamous family setting. Majority of the women were Muslims, 30 (85.7%) in the IUCD group and 34 (97.1%) in the control group. The respondents were mainly Hausa/Fulani, accounting for 24 (91.4%) in the IUCD group and 34 (97.1%) of the controls. Majority of the respondents were formally educated and only 3 (8.6%) in the IUCD group and 5 (14.2%) of the controls had no formal education. Most of the women had 1–5 previous deliveries and only 1 (1.4%) respondent was a nullipara [Table 1].

Of the 35 respondents who used IUCD, 24 (34.29%) used Copper T 380A and 11 (15.71%) used levonorgestrel intrauterine system containing IUCD. Thirty-five women used other forms of contraceptives during the same period. Twenty-six (37.14%) women used subdermal implants, 5 (7.14%) used injectable contraceptives, and 4 (5.71%) used combined oral contraceptive pills [Figure 1].

Following insertion of IUCD, the incidence of genital infection was 3 (8.5%) at 1 and 4 (12.1%) at 3 months. The incidence in other contraceptive users was 2 (5.9%) at 1 month and 3 (8.8%) at 3 months [Figure 2].

At 1 month, 34 women from each group came for follow-up. Three (8.5%) respondents among IUCD users had genital infection while 2 (5.9%) had genital infection in the non-IUCD group. Although more IUCD users had genital infection, the differences between the IUCD users and non-IUCD users was not statistically significant (χ^2 = 0.654, P = 0.464). At 3 months, 33 women among IUCD users came for follow-up while 34 of the non-IUCD users returned for follow-up. Among the IUCD users, 4 (12.1%) had genital infection while 3 (8.8%) had genital infection
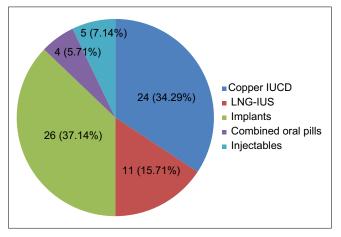
among non-IUCD users. The observed difference among the two groups was not statistically significant (χ^2 = 2.967, P = 0.085) [Table 2].

Table 1: Sociodemographic characteristics of respondents

Characteristic	Frequency (%)	
	IUCD users	Non-IUCD users
Occupation		
Housewife	14 (40.0)	25 (71.4)
Civil servant	11 (31.4)	4 (11.4)
Trader	8 (22.9)	5 (14.3)
Others	2 (5.7)	1 (2.9)
Marital status		
Single	1 (2.9)	0 (0)
Married	34 (97.1)	35 (100)
Husband's number of wives		
1	21 (60.0)	15 (42.9)
2	10 (28.6)	15 (42.9)
3	3 (8.6)	3 (8.6)
4	1 (2.9)	2 (5.7)
Religion		
Islam	30 (85.7)	34 (97.1)
Christianity	5 (14.3)	1 (2.9)
Tribe		
Hausa/Fulani	24 (68.6)	34 (97.1)
Igbo	1 (2.9)	1 (2.9)
Yoruba	3 (8.6)	0 (0)
Others	7 (20.0)	0 (0)
Educational status		
No formal education	3 (8.6)	5 (14.9)
Primary	5 (14.9)	4 (11.3)
Secondary	11 (31.4)	17 (48.6)
Tertiary	16 (45.7)	9 (25.7)
Parity		
0	1 (2.9)	0
1-5	26 (74.3)	30 (85.7)
6-10	8 (22.9)	5 (14.3)

IUCD - Intrauterine contraceptive device

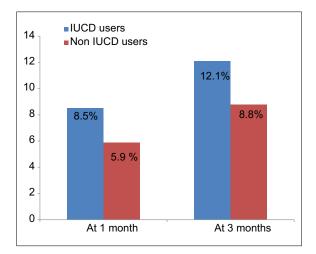**Figure 1: Types of contraceptives used**

Figure 2: Incidence of genital infection among intrauterine contraceptive device users compared to nonintrauterine contraceptive device users

The relative risk of IUCD causing genital infection was 1.44 at 1 month and 1.5 at 3 months while the attributable risk at 1 month was 26/1000 and 40/1000 at 3 months. However, the observed difference in the rate of infection between IUCD users and other contraceptive users was not statistically significant.

In the IUCD group, 2 (5.8) women had Bacteria vaginosis at 1 month and 2 (6%) had it at 3 months while 1 (2.9) had *T. vaginalis* at 1 month and 2 (6%) at 3 months. In the non-IUCD group, 1 (2.9%) woman had *T. vaginalis, Bacteria vaginosis* at 1 month while 1 (2.9%) woman had *T. vaginalis, Bacteria vaginosis, and Candida albican* at 3 months. Only 1 (3%) of the clients in the IUCD group had *N. gonorrhoeae* and it was at 3 months, but none had *C. trachomatis*. In the non-IUCD group, no participant had *N. gonorrhoeae* or *T. vaginalis* [Table 3].

Discussion

The incidence of genital infection among IUCD users was 8.5% at 1 month and 12.1% at 3 months following insertion of the devices. In the non-IUCD users, the incidence of genital infection was 2 (5.9%) at 1 month and 3 (8.8%) at 3 months. The relative risk was 1.44 and 1.5 at 1 and 3 months, respectively, however, the difference was not significant.

Table 2: Comparison of the association of genital infection between intrauterine contraceptive device and other contraceptive methods

	Infection, frequency (%)		Test of significance (χ^2, *P*)
	No	**Yes**	
1 month			
IUCD	31 (91.5)	3 (8.5)	0.654, 0.464
Non-IUCD	32 (94.1)	2 (5.9)	
3 months			
IUCD	29 (87.9)	4 (12.1)	2.967, 0.085
Non-IUCD	31 (67.6)	3 (8.8)	

IUCD - Intrauterine contraceptive device

Table 3: Incidence of specific organisms among intrauterine contraceptive device users compared to nonintrauterine contraceptive device users

Organism	1 month		3 months	
	IUCD, *n* (%)	**Non-IUCD, *n* (%)**	**IUCD, *n* (%)**	**Non-IUCD, *n* (%)**
Neisseria gonorrhoea	0	0	1 (3)	0
Chlamydia trachomatis	0	0	0	0
Bacterial vaginosis	2 (5.8)	0	2 (6)	1 (2.9)
Trichomonas vaginalis	1 (2.9)	1 (2.9)	2 (6)	1 (2.9)
Candida albicans	0	0	1 (3)	1 (2.9)
Actinomycetes species	0	0	0	0
Others	1 (2.9)	1 (2.9)	1 (2.9)	0

IUCD - Intrauterine contraceptive device

Most studies determined incidence of only pelvic inflammatory infection and not genital infections generally, this may be due to the fact that PID is associated with serious morbidities. The incidence of pelvic inflammatory infections among intrauterine device users is between 0 and 2.1%. The higher incidence in our study is not unexpected as both upper and lower genital infections were considered.

Recent studies consistently revealed that relative risk of PID in IUCD users compared to women using no method to be 1.5–2.6.[5] This increase is only for a few months after insertion. The relative risk from a study by Buchan *et al*. was 3.3 for copper IUCD and 1.8 for hormonal IUCDs when compared to noncontraceptive users.[6] The difference between the three groups was not significant. Similarly, Beerthuizen also found a relative risk of 1.8 in clients with copper-containing IUCD compared to noncontraceptive users.[7] The separation of copper and hormonal IUCDs may have influenced the overall result, more so the comparison in these two studies were with noncontraceptive users. The studies also assessed women with only upper genital tract infection and did not consider lower genital infection.

In the WHO IUCD clinical trial data to explore the incidence and pattern of PID risk with the use of IUCD, the overall rate of PID among 22,908 IUCD insertions and during 51,399 woman-years of follow-up was 1.6 cases/1000 woman-years of use.[8] Unlike in our study where genital infections were considered generally, only PID (upper genital tract infection) was considered in the WHO study. In a cohort study conducted in England, the incidence of acute of PID was 1.51/1000 woman-years while that of chronic PID was 0.54 per 1000 woman-years.[9] Like in the WHO study, only upper genital infection was considered. Rydén *et al*. found the incidence of gonorrhea among IUCD users to be 23.5% and 8.8% among hormonal contraceptive users and 15.1% in women using neither technique.[10] There was no significant difference demonstrated. In the United States, the incidence of Bacteria vaginosis was 37% among IUCD users, and the incidence among oral contraceptive users was 19.3%.[11] This was also a cohort study, but the clients were followed for 6 months. In addition, only Bacteria vaginosis was studied. Blum *et al*. found the incidence of *C. trachomatis* to be 16.7% in IUCD users, 38.6% among oral contraceptive users and 21.1% in other contraceptive users.[12] Avonts *et al*. found the incidence of Chlamydia to be 0.8/100-woman years among IUCD users and 7/100-woman years for oral contraceptive users yielding a relative risk of 0.11.[13] In the same study, the incidence of Bacteria vaginosis was 25/100-woman years among IUCD users and 9/100-woman years in oral contraceptive users with a relative risk of 2.8.[13] Only Bacteria

vaginosis and chlamydia were considered in the study unlike the study conducted where some other organisms were considered.

T. vaginalis and *G. vaginalis* were the most common isolated organisms among IUCD users. They were also isolated in the non-IUCD group hence IUCD may not be responsible for higher incidence of *T. vaginalis*. A similar finding was made in Antakya, Turkey.[14] In contrast, *Candida* species were the commonest isolated organisms in Benin,[15] Sudan[16] and Trabzon, Turkey.[17] Bacteria vaginosis was the most prevalent genital infection among IUCD users in studies conducted in Brazil[18] and Iran.[19] However, in addition to *T. vaginalis* and Bacteria vaginosis, *Candida* was also common among IUCD users in Basra, Iraq.[20] These studies were prevalence studies, the infection status of the clients were not known before commencement of the various methods. The different organisms isolated in these studies may be a reflection of the pattern of genital infections in the general population of the study areas. Although studies evaluating microbes in non-IUCD contraceptives as a group are few, some have studied different contraceptive methods. In the study by Shobeiri *et al*.; *Staph aureus* was the most common organism among other contraceptive users.[19] Avonts *et al*. found that *C. trachomatis* was the most common isolated microbe among users of oral pills.[13] Sharief found *G. vaginalis* among users of oral pills.[20]

The incidence of genital infection among IUCD users was relatively low. IUCDs do not significantly increase the rate genital infection when compared with other contraceptive methods. *T. vaginalis* and *G. vaginalis* were isolated in both groups.

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Conflicts of interest
There are no conflicts of interest.

References

1. Faúndes A, Telles E, Cristofoletti ML, Faúndes D, Castro S, Hardy E, *et al*. The risk of inadvertent intrauterine device insertion in women carriers of endocervical *Chlamydia trachomatis*. Contraception 1998;58:105-9.
2. Sinei SK, Schulz KF, Lamptey PR, Grimes DA, Mati JK, Rosenthal SM, *et al*. Preventing IUCD-related pelvic infection: The efficacy of prophylactic doxycycline at insertion. Br J Obstet Gynaecol 1990;97:412-9.
3. Skjeldestad FE, Halvorsen LE, Kahn H, Nordbø SA, Saake K. IUD users in Norway are at low risk for genital C. Trachomatis infection. Contraception 1996;54:209-12.
4. Pap-Akeson M, Solheim F, Thorbert G, Akerlund M. Genital tract infections associated with the intrauterine contraceptive device can be reduced by inserting the threads into the uterine cavity. Br J Obstet Gynaecol 1992;99:676-9.
5. Grimes DA. Intrauterine device and upper-genital-tract infection. Lancet 2000;356:1013-9.
6. Buchan H, Villard-Mackintosh L, Vessey M, Yeates D, McPherson K. Epidemiology of pelvic inflammatory disease in parous women with special reference to intrauterine device use. Br J Obstet Gynaecol 1990;97:780-8.
7. Beerthuizen RJ. Pelvic inflammatory disease in intrauterine device users. Eur J Contracept Reprod Health Care 1996;1:237-43.
8. Farley TM, Rosenberg MJ, Rowe PJ, Chen JH, Meirik O. Intrauterine devices and pelvic inflammatory disease: An international perspective. Lancet 1992;339:785-8.
9. Vessey MP, Yeates D, Flavel R, McPherson K. Pelvic inflammatory disease and the intrauterine device: Findings in a large cohort study. Br Med J (Clin Res Ed) 1981;282:855-7.
10. Rydén G, Fåhraeus L, Molin L, Ahman K. Do contraceptives influence the incidence of acute pelvic inflammatory disease in women with gonorrhoea? Contraception 1979;20:149-57.
11. Madden T, Grentzer JM, Secura GM, Allsworth JE, Peipert JF. Risk of bacterial vaginosis in users of the intrauterine device: A longitudinal study. Sex Transm Dis 2012;39:217-22.
12. Blum M, Pery J, Kitai E. The link between contraceptive methods and *Chlamydia trachomatis* infection. Adv Contracept 1988;4:233-9.
13. Avonts D, Sercu M, Heyerick P, Vandermeeren I, Meheus A, Piot P, *et al*. Incidence of uncomplicated genital infections in women using oral contraception or an intrauterine device: A prospective study. Sex Transm Dis 1990;17:23-9.
14. Ocak S, Cetin M, Hakverdi S, Dolapcioglu K, Gungoren A, Hakverdi AU, *et al*. Effects of intrauterine device and oral contraceptive on vaginal flora and epithelium. Saudi Med J 2007;28:727-31.
15. Egbe CA, Onwufor UC, Omoregie R, Enabulele OI. Female reproductive tract infections among vaginal contraceptive users in Benin City, Nigeria. Genomic Med Biomark Health Sci 2011;3:49-52.
16. Alawad A, Bashir ME. Association of infection among intrauterine contraceptive device users in family planning clinics in Sudan. Int J Health 2014;2:50-60.
17. Demirbag BC, Köksal I, Kaya S. Genitourinary infection prevalence among women who used an intrauterine device or oral contraceptives. Arch Gynecol Obstet 2013;288:911-6.
18. Ferraz do Lago R, Simões JA, Bahamondes L, Camargo RP, Perrotti M, Monteiro I, *et al*. Follow-up of users of intrauterine device with and without bacterial vaginosis and other cervicovaginal infections. Contraception 2003;68:105-9.
19. Shobeiri F, Nazari M. Vaginitis in intrauterine contraceptive device users. Health 2014;6:1218-23.
20. Sharief M. Genital infections among women using various contraceptive methods in Basra, Iraq. East Mediterr Health J 1998;4:487-92.