



## Contraceptive Practices among Married Women of Reproductive Age Group in Ogbomoso Metropolis, Nigeria

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### Authors' contributions

This work was carried out in collaboration between all authors. Author ORI designed the study, wrote the protocol and wrote the first draft of the manuscript. Author OSI reviewed the manuscript. Author POA performed the statistical analysis and managed the analyses of the study. All authors read and approved the final manuscript.

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### ABSTRACT

**Background:** Unplanned pregnancies are on the increase in Nigeria, and there is enough evidence that family planning can drastically reduce the incidence of unplanned/unwanted pregnancies which could invariably bring to the barest minimum the upsurge of maternal mortality and infant mortality rates worldwide, most especially in developing countries.

**Objective:** To assess the knowledge, attitude and practice of family planning among women in the reproductive age group (i.e., 15–49 years) within Ogbomoso Metropolis.

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**Materials and Methods:** A community-based cross-sectional study was conducted in Ogbomosho Metropolis using multi-stage sampling. The study subjects consisted of all married women in the age group of 15–49 years. Women who were divorced, widowed, single women, as well as those who refused to participate, were excluded from the study.

**Results:** It was observed that out of 400 respondents, 373 (93.2%) were aware a form of family planning or the other and source of information was mainly from health workers (93.8%). Three hundred and fifty (87.5%) approved the use of contraceptives by couples, 35 (8.8%) do not approve it and 15 (3.8%) were indifferent. Less than half 169 (42.2%) were currently using contraceptives out of which most of them were using IUCD 71(42.0%) followed by injectables 46 (27.2%). Test of dependency using Chi-Square revealed a significant association between the knowledge about contraceptives and religion, as well as with occupation of respondents.

**Conclusion:** Only two-fifths of respondents were currently on a family planning method, and the primary reason for non- usage was the fear of side effect. It is therefore recommended that family planning commodity researchers should work more in reducing the side effects associated with family planning usage.

*Keywords: Family planning; contraception; married.*

## 1. INTRODUCTION

Family Planning (FP) is a principal strategy in controlling population growth and promotion of maternal and child health through the adequate spacing of births as well as avoidance of unwanted pregnancy [1]. The current prevalence rate for contraceptive use in Nigeria is approximately 12%–15% [2].

FP enables couples to plan when to have children in such a way that couples could either space in- between pregnancies or limit the number of children, i.e. stop childbearing. This is achievable through the use of contraceptives which invariably help reduce the incidence of unplanned/ unwanted pregnancies [3]. A short inter-pregnancy interval is associated with adverse pregnancy outcomes such as preterm birth, low birth weight, small for gestational age and perinatal death [4]. To prevent these adverse pregnancy outcomes, birth spacing has been considered as an effective intervention.

Therefore, this study was to access the knowledge, attitude and practice of family planning methods among married women of age group [15-49] years living in Ogbomosho Metropolis.

## 2. METHODOLOGY

This study was a cross-sectional descriptive study conducted among married women in reproductive age group (15-49 years) in Ogbomosho Metropolis. Ogbomosho is the second largest town in Oyo state, the latter being one of the thirty six states in Nigeria. Ogbomosho has

five Local Government Areas, but only two are located within the Metropolis namely: Ogbomosho South and Ogbomosho North. These two LGAs have ten wards each.

A multi-stage sampling technique was used for this study. Two wards were selected from the two LGAs by simple random sampling making a total of four wards. Two settlements were selected from the four wards by balloting method making a total of eight settlements. A pen was spinned at the imaginary center of the settlements, and sampling started in the direction of the pen. Two houses were omitted in between the houses and sampling continued until the desired number for the settlement was reached. In a house with more than one households (a household for this study included a woman and her children), the interviewed respondents were selected by the use of table of random numbers.

Ethical clearance was received from the Ethical Review Committee of University of Ilorin Teaching Hospital. Informed consent was obtained from each participant after explaining the purpose of the study to them. The questionnaires were interviewer administered after been translated to the local language (Yoruba) and back translated to English Language in order to retain the intended meaning. Administered questionnaires were checked for errors and omissions at the end of each day. Data were entered and analyzed using Statistical Package for Social Sciences (SPSS) version 22. Summary statistics were presented using frequency tables, charts, means and rates. Chi Square was used to test for association between contraceptives practice of respondents

and the socio-demographic characteristics (Age, marital setting, educational status and occupation). Level of statistical significance was set at 5%.

### 3. LIMITATIONS OF THE STUDY

The issue of family planning could be very sensitive and confidential, making some of the respondents reluctant to participate in the study initially. However, participants were assured of confidentiality and thus they were encouraged to answer the questions to the best of their understanding.

### 4. RESULTS

Table 1 shows the socio-demographic characteristics of the respondents in which 23.5% of the respondents were within 30 and 34 years of age while the mean age was 32 years. Most of the respondents had secondary school level of education (244, 61.0%) and were semi skilled (256, 64.0%). Table 2 shows the respondents knowledge about contraception. 373 (93.2%) respondents had heard about contraception before and IUCD (69.7%) is the most known form of contraceptives, 247 (66.2%) pills 241 (6.6%) while the least known contraceptive method was the use of spermicides, 23 (6.2%). The main source of information was through the health workers 350 (87.1%). Three hundred and forty eight (93.3%) respondents knew Government hospitals to be a place where contraceptive methods could be obtained. Table 3 shows that three hundred and fourteen (78.5%) desired to know more about contraceptives if they have the opportunity, 65 (16.2%) are not willing to know more while 21 (5.2%) were indifferent. Three hundred and fifty (87.5%) approved the use of contraceptives by couples, 35 (8.8%) do not approve it and 15 (3.8%) were indifferent. One hundred and ninety three (48.2%) have discussed contraceptives with their spouses in the past one year before the study. Also, 198 (49.5%) of respondents' husbands were aware that their wives are using one form of contraceptives or the other, 106 (26.5%) did not inform their husband's while 96 (24.0%) were not sure if their husbands are aware about their use of contraception or not.

Fig. 1 shows that out of the 400 respondents, 169 (42.2%) are currently using contraceptives, 82 (20.5) had ever used and 149 (37.2%) had never used any form of contraceptive.

Table 4 shows that IUCD is the commonest used form of contraceptives among current users 71 (42.0%) followed by injectables 46 (27.2%), then pills, 29 (17.2%). The decision about the use of contraceptive was jointly made by respondents and their spouses in 40.8% of cases, husband's only 48 (28.4%), wife only 47 (27.8%) while 5 (3%) gave no response. Table 5 shows contraceptive practice among respondents who had used contraceptives at one point in time before, but are not currently on any method out of which 34 (41.5%) used injectables, 23 (28.0%) IUCD, 13 (15.9%) used pills, 6 (7.3%) used implants, 4 (4.9%) used condom and 2 (2.4%) natural methods. Fear of side effect, 46 (56.1%) was the topmost reason why ever used respondents discontinued the use of contraceptives, followed by the desire to have more children and little perceived risk of getting pregnant 13, (15.9%) respectively. Table 6 shows contraceptive practice for non user. Fear of side effect, 60 (40.3%) was the main reasons why they had never used any method, followed by the desire to have more children, 24 (16.1%), partner's refusal 20 (13.4%). Others were little perceived risk of pregnancy, 9 (6.0%), know no method, 9 (6.0%), health concern 5 (3.4%) and opposition from relative 1, (0.7%). It was shown in this study that the practice of contraception was statistically associated with the religion as well as occupation of respondents at p-value of less than 0.05 level as shown in Table 7.

### 5. DISCUSSION

Findings showed that the awareness about family planning methods was very high among the respondents as evidenced from the fact that more than nine in ten of the total respondents agreed to have heard about family planning, and majority of them claimed to know where to obtain. This finding is similar to a similar study in Pakistan [5]. The highest source of information about family planning as found in this study was through the health workers, followed by radio, television and friends. This is in congruent with similar other studies [6,7,8] where health personnel happened to be the greatest source of information. However, this is slightly different from that gotten from South- Eastern Nigeria where mass media happened to be the commonest source of information [9]. Such information from health-workers, if enhanced and encouraged, probably will allow women obtain more accurate and comprehensive information about various family planning methods which will invariably assist to dispel common health-myths

about contraceptives. Majority of the respondents knew Government hospitals as a place where contraceptives could be obtained, followed by health centers, then the private clinics. This could be due to vast number of government hospitals as well as health centers present in the study area. This finding is in consistence with another study done in Uganda where government hospitals were the widely known place to obtain family planning [10]. Most of the participants had knowledge of at least one modern contraceptive method which was similarly found in some other studies [11–13]. Surprisingly, in this study, most of the respondents (45.8%) do not know how pills are used. This is similar to the finding in a similar study in a Kenyan Referral Hospital where the understanding of how to use oral contraceptive pills was equally very low [14]. This could be a pointer to the fact that people no longer get interested in the services provided them. Could it be that many clients may not be using family planning commodities effectively which could be responsible for the increase failure rate which invariably can lead to increase level of unmet need for family planning.

In this study, knowledge about contraception was found to be associated with the religion of respondents. This is similar to another study done in Ghana where Catholics had the poorest knowledge of contraceptives [15]. However, this is different from a study carried out among married women in Ethiopia, where religion was not associated with the use of contraceptives [16]. The finding in this study as well as that from

Ghana may not be surprising as Catholics do not support the use of modern contraceptives by her members. Only natural method is advocated and permitted.

**Table 1. Socio-demographic characteristics of respondents**

<b>Variables n=400</b>	<b>Frequency n=400</b>	<b>Percentages (%)</b>
<b>Age</b>		
15-19	8	2.0
20-24	40	10.0
25-29	87	21.8
30-34	94	23.5
35-39	77	19.2
40-44	62	15.5
45-49	32	8.0
<b>Mean age</b>	<b>400</b>	<b>32+ 7.5</b>
<b>Marital setting</b>		
Monogamous	328	82.0
Polygamous	72	18.0
<b>Educational status</b>		
Illiterate	21	5.2
Primary	57	14.2
Secondary	244	61.0
Tertiary	78	19.5
<b>Occupation</b>		
Housewife	22	5.5
Unemployed	20	5.0
Unskilled	74	18.5
Semiskilled	256	64.0
Skilled	28	7.0

**Table 2. Respondents' knowledge about contraception**

<b>Variables</b>	<b>Frequency</b>	<b>Percentage (%)</b>
<b>Ever heard about contraception(n=400)</b>		
Yes	373	93.2
No	27	6.8
<b>Know a place to get contraception n=373</b>		
Yes	348	93.3
No	25	6.7
<b>Place where contraceptives could be gotten</b>		
Government Hospital	332	95.4
Health Center	242	69.5
Private clinic	73	18.2
Drug Vendors	21	6.0
<b>Source of information about contraceptives</b>		
Health workers	350	87.1
Radio	187	50.1
TV	123	33.0
Newspaper	39	10.5
Friends	75	20.1

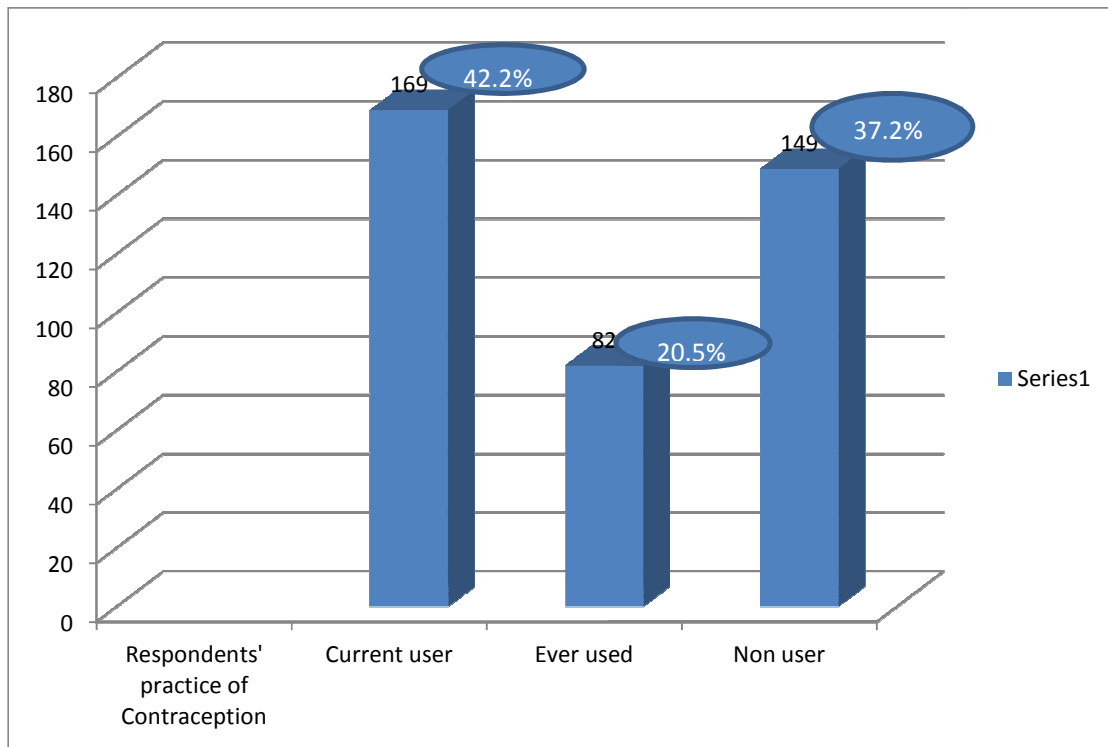
**Table 3. Respondents' attitude towards the use of contraceptives**

<b>Variables</b>	<b>Frequency (N=400)</b>	<b>Percentage</b>
<b>Desire to know more about contraceptives n=400</b>		
Yes	314	78.5
No	65	16.2
Indifferent	21	5.2
<b>View about couple using it</b>		
Approve	350	87.5
Disapprove	35	8.8
Indifferent	15	3.8
<b>If disapprove, why?**(n=35)</b>		
Respondents refusal	21	60.0
Husband refusal	8	22.9
Family disapproval	3	8.6
Religion prohibition	1	2.9
Cultural prohibition	2	5.7
Fear of side effect	9	25.7
<b>Discussion with spouse about contraceptives</b>		
Yes	193	48.2
No	180	51.8
<b>Frequency of discussion</b>		
Once	22	11.1
Twice	29	14.6
Three	42	21.2
Greater than three times	63	31.8
Can't remember	42	21.2
<b>Husband's attitude towards contraception</b>		
Approve	257	64.2
Disapprove	75	18.8
Indifferent	68	17.0
<b>Is your husband aware about your using contraceptives?</b>		
Yes	198	49.5
No	106	26.5
Not sure	96	24.0

\*\* Multiple responses allowed

**Table 4. Contraceptive usage by current users**

<b>Variables</b>	<b>Frequency (n=169)</b>	<b>Percentage %</b>
<b>Type of contraceptives used currently</b>		
Pills	29	17.2
IUCD	71	42.0
Injectables	46	27.2
implants	17	10.1
Condom	3	1.8
Female sterilization	2	1.2
Natural method	1	0.5
<b>How long you've been on contraceptives in years</b>		
0-4	107	63.3
5-9	46	27.2
10-14	13	7.7
15-19	3	1.8



**Fig. 1. Respondents' practice of contraception**

**Table 5. Practise of contraception by ever used respondents**

Variables	Frequency (n=82)	Percentage (%)
<b>Contraceptives used before</b>		
Pill	13	15.9
IUCD	23	28.0
Injectables	34	41.5
Implant	6	7.3
Condom	4	4.9
Natural methods	2	2.4
<b>Reason for discontinuing contraceptives</b>		
Fear of side effect	46	56.1
Fear of infertility	12	14.6
Medical problem	6	7.3
Preferred method not available	5	6.1
Desire to have more children	13	15.9
Little perceived risk of pregnancy	13	15.9
Unacceptable to my culture	1	1.2
Religion prohibition	1	1.2
Financial reasons	4	4.9

Also, more than half of the respondents have never discussed contraceptive use with their husbands. This is in consonance with another study done in Ethiopia where almost half of participants had never discussed family planning

or its use with their husbands [17]. This could be that they actually see no reason why they should discuss it with them or they are afraid their husbands might not support its use. When respondents were asked about what they think

**Table 6. Contraceptive practice for non-users**

<b>Variables</b>	<b>Frequency (n=149)</b>	<b>Percentage</b>
<b>Intention of delaying pregnancy</b>		
Yes	75	50.3
No	68	45.6
Undecided	6	5.0
<b>Why are you not on contraceptives</b>		
Partner refusal	20	13.4
Relative opposed	1	0.7
Know no method	9	6.0
Know no source	7	4.7
Health concern	5	3.4
Fear of side effect	60	40.3
Lack of access/too far	3	2.0
Little perceived risk	9	6.0
Too much cost	4	2.7
Inconvenient to use	2	1.3
To have more children	24	16.1

**Table 7. Association between practice of contraceptives and socio-demographic characteristics**

<b>Socio-demographic Characteristics</b>	<b>Using contraceptives</b>	<b>Not using contraceptives</b>	<b>Statistics</b>
<b>Religion</b>			
Catholic	44 (72.1)	17 (27.9)	$\chi^2= 28.053$ df= 3 *p-value<0.001 Fisher Exact Test= 27.727 p-value 0.000
Protestant	89 (39.2)	138 (60.8)	
Islam	34 (32.7)	70 (67.3)	
Traditionalist	2 (25.0)	6 (75.0)	
<b>Ethnicity</b>			
Yoruba	165 (42.4)	224 (57.6)	$\chi^2=3.762$ df=3 p-value=0.350 Fisher Exact Test=3.651 p-value =0.000
Igbo	2 (50.0)	2 (50.0)	
Hausa/Fulani	2 (66.7)	1 (33.3)	
Others	0 (0.4)	4 (100.0)	
<b>Respondents' level of education</b>			
No education	8 (38.1)	13 (61.9)	$\chi^2=0.544$ df=3 p-value=0.909
Primary	26 (45.6)	31 (54.4)	
Secondary	101 (41.4)	143 (58.6)	
Tertiary	34 (43.6)	44 (56.4)	
<b>Respondents occupation</b>			
House wife	6(27.3)	16 (72.7)	$\chi^2=37.510$ df=4 *p-value<0.001
Unemployed	10 (50.0)	10 (50.0)	
Unskilled	54 (73.0)	20 (27.0)	
Semi skilled	89 (34.8)	167 (65.2)	
Skilled	10 (35.7)	18 (63.3)	

\*Statistically significant

their husbands about sees to the use of contraceptives, about two- third of the respondents claimed that their husbands approve of its use. This finding is also in line with some other studies done in Nigeria [18,19] where

most of the husbands support the use of contraceptives. However, in this study, just about half of the participants' spouses knew whether their wives were using or not using any form of contraceptive which was also similar to a study

done in Kenya [20]. This actually revealed the poor communication between couples as regards contraceptive use.

Furthermore, about two-fifth of respondents were presently on a form of contraceptives. This is relatively lower than that in Kenya where more than two third of respondents were on contraceptives as at the time the study was carried out [20]. For the current users, IUCD happened to be the commonly used contraceptives among respondents which is different from that gotten in Asia where female sterilization is the widely used form of contraception [21]. But similar to another study done in Osogbo where IUCD also was the widely used form of contraceptives [22]. The difference gotten from the Asian country could actually be because of the socio-cultural and political view towards fertility in the country. Asian countries are known for low fertility which is presently legalised and so the permanent form of contraceptives will be more advocated.

In this study, it was observed that two third of Islamic respondents were not on any form of contraceptive, which was statistically significant. This is quite different from the outcome from another study done in another study where there was no significant difference in the practice of different religious groups to family planning [23]. The outcome of this study may be due to the fact that some muslims believed that family planning is unislamic [24].

## 6. CONCLUSION

The awareness and knowledge of family planning in Ogbomoso is good, and a majority had a good disposition toward its use. However, the practice of family planning was poor as less than half of respondents were currently using a form of contraception or the other.

It is therefore recommended that the benefits of family planning should continually be reiterated to women of reproductive age groups through all available means vis a vis during immunisation sections, antenatal visits as well as through mass media.

The primary reason why most of the respondents who are presently not any form of contraceptives were because of the fear of side effect. It is therefore recommended that family planning commodity researchers should scientifically find

ways to exonerate to the barest minimum side effects associated with family planning usage.

## CONSENT

As per international standard or university standard, patient's written consent has been collected and preserved by the authors.

## ETHICAL APPROVAL

As per international standard or university standard, written approval of Ethics committee has been collected and preserved by the authors.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

## REFERENCES

1. Gebre G. Prevalence and factors associated with unmet need for family planning among the currently married reproductive age women in Shire-Enda-Slassie, Northern West of Tigray, Ethiopia 2015: A community based cross-sectional study. *Pan African Med Journal*. 2016;23:195.
2. Essien EJ, Monjok E, Smesny A, Ekabua JE. Contraceptive practices in Nigeria: Literature review and recommendation for future policy decisions. *Open Access J Contracep*. 2010;1:9–22.
3. Amosu A, Moronkola OA, Ojediran MM. Reproductive health knowledge, beliefs and determinants of contraceptives among women attending family planning clinics in Nigeria. *Africa Heal Sci*. 2006;6(3):155–9.
4. Paulo LK, Sia M, Jim T, Chuki C, Mtuya TM, Mahande MJ. Determinants of modern contraceptive use among women of reproductive age in Tanzania: Evidence from Tanzania demographic and health survey data. *Adv Sex Med*. 2015;5:43–52.
5. Afreen U, Hashmi HA, Mustafa R. Contraceptive knowledge, attitude and practice among rural women. *J Coll Physi Surge Pakistan*. 2008;18(9):542–5.
6. Pegu B, Gaur BPS, Sharma N, Singh AS. Knowledge, attitude and practices of contraception among married women. *Int J Reprod Contraception, Obstet Gynecol*. 2014;3(2):385–8.



7. Nayak S, Sheilini. Knowledge, attitude, practice and preferences of contraceptive methods in Udupi District, Karnataka. *J Fam Plann Reprod Heal Care*. 2013;7(3):115–20.
8. Rahila I, Bahaa A. Knowledge about missed contraceptive pills among married women at King Abdulaziz University Hospital. *Patient Prefer Adherence*. 2015;9:401–11.
9. Obiajulu FN, Ikechebelu JI, Joe-Ikechebelu NN. Knowledge, attitude and practice of family planning among Igbo women of South-Eastern Nigeria. *J Obs Gynaecol*. 2005;25(8):792–5.
10. Hassard S, Henry N, Juliet N. Contraceptive use, knowledge, attitude, perceptions and sexual behavior among female university students in Uganda: A cross-sectional survey. *BMC Womens Health*. 2016;16(6).
11. Faturoti SO, Omolase CO, Omolase BO. Awareness of family planning amongst antenatal patients in a Nigerian community: An exploratory study. *Ann Ibadan Postgrad Med*. 2009;7(1):36–9.
12. Allen K, Jimmy RA, Robert W, Bruno O. Modern contraceptive use among women in Uganda: An analysis of trend and patterns. *Etude Popul Afr*. 2014;28(2): 1009–21.
13. Wazir F, Jabeen M, Gul F, Javed N. Knowledge, attitude and practices of contraception in women of reproductive age. *Gomal J Med Sci*. 2011;9(2):223–9.
14. Eric M, Guantai C, Nancy G, Nkonge, Sylvia A, Opanga. Knowledge of correct use among hormonal contraceptive users in a Kenyan Referral Hospital. *African J Pharmacol Ther*. 2014;3(4):105–11.
15. Catherine N, Everd M. Factors related to the uptake of natural family planning by clients of catholic health units in masaka diocese, Uganda. *Heal Policy Dev*. 2008;6(3):126–41.
16. Fikrewold H, Assefa H. Factors affecting unmet need for family planning in southern nations, nationalities and peoples region, Ethiopia. *Ethiop J Heal Sci*. 2011;21(2):77–89.
17. Fasil T, Feleke D, Degefa H. Assessment of husband-wife communication and practice of contraceptives in Angecha Woreda, Kembata Tembaro Zone, South Ethiopia: A cross sectional study. *Reprod Syst Sex Disord*. 2014;3:134.
18. Ayotunde L, Ogunjuyigbe P, Ojofeitimi EO. Spousal communication, changes in partner attitude, and contraceptive use among the yorubas of Southwest Nigeria. *Indian J Community Med*. 2009;34(2):112–6.
19. Elizabeth E, Ademola A, Philomena O. Male involvement in family planning: Challenges and way forward. *Int J Popul Res*. 2014;3(2):1–9.
20. Laili I, Ilene S, Speizer, Jean C. Couple characteristics and contraceptive use among women and their partners in Urban Kenya. *Int Perspect Sex Reprod Heal*. 2015;40(1):11–20.
21. Patel AA. Knowledge and practices of contraception among married females of rural Tamil Nadu. *Asian J Biomed Pharm Sci*. 2015;5(42):1–4.
22. Adeyemi AS, Adekanle DA. Factors influencing the choice of contraceptives among the married women in Osogbo, Western Nigeria. *Niger Med Pract*. 2009;55(4):5–9.
23. Olakojo OA. Knowledge, attitudes and practices of married women in Nigeria towards family planning. *J Sociol Psychol Anthropol Pract*. 2012;4(3):18.
24. Anyebe HR, Lawal SK, Olufemi EE. Knowledge and use of modern contraceptives among Muslim women in Zaria, Nigeria. *Res Humanit Soc Sci*. 2014;4(27):10–5.

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