

Reproductive Risk Factors Associated with Female Infertility in Sonapat District of Haryana: A Community Based Cross-Sectional Study

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ABSTRACT

Background: Infertility is a disease of the male or female reproductive system defined by the failure to achieve a pregnancy after 12 months or more of regular unprotected sexual intercourse. **Aims:** The aim of this study was to estimate the prevalence of infertility and its association with reproductive risk factors amongst women of reproductive age group (18–49 years) in district Sonapat, Haryana. **Settings and Design:** This observational community-based cross-sectional study was conducted amongst 444 reproductive age group (18–49 years) women residing in district Sonapat, from August 2021 to May 2022. **Materials and Methods:** A simple random sampling technique was used to select the study subjects. After taking written informed consent, all the participants were interviewed using a pre-designed, pre-tested semi-structured questionnaire for desired information. **Statistical Analysis Used:** Mean and standard deviation (SD) were calculated for quantitative data. Percentages and proportions were calculated for qualitative data. **Results:** Out of 444 study population, majority of women were fertile (88.7%), while 6.3% of women were secondary infertile and 5% of women were primary infertile. Most women were aged between 30 and 39 years. The difference of occurrence of infertility in relation to genital discharge ($P = 0.049$), genital ulcer/sores ($P \leq 0.001$), groin swelling ($P \leq 0.001$), warts ($P = 0.015$), menstrual cycle duration ($P \leq 0.001$) and menstrual flow amount ($P = 0.048$) was statistically significant. The mean age of menarche for the female with infertility was 14.34 years (standard deviation = 1.40). **Conclusion:** Almost all of the symptoms of sexually transmitted infection/reproductive tract infection were high amongst infertile females. Awareness generation about the preventable risk factors and provision of infertility care services at primary healthcare facilities will be of use in addressing infertility in Sonapat.

KEYWORDS: Female infertility, prevalence, reproductive age group, sexually transmitted infections

INTRODUCTION

Infertility is a disease of the male or female reproductive system defined by the failure to achieve a pregnancy after 12 months or more of regular unprotected sexual intercourse. Primary infertility is the inability to have any pregnancy, while secondary infertility is the inability to have a pregnancy after previously successful conception.^[1] In 2004, the World Health Organization's (WHO) first global strategy on reproductive health was presented.^[2]

Infertility is a global reproductive health problem, and the prevalence rate has increased by 0.37% per year for females resulting in the global disease burden of infertility steadily increasing from 1990 to 2017.^[3] The WHO estimates of primary infertility in India are 3.9% (age-standardised to 25–49 years) and 16.8% (age-standardised to 15–49 years). As per a study,

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published at the end of 2012 by the WHO, one in every four couples in developing countries had been found to be affected by infertility.^[4] In India, district-level household survey 3 reported an 8.2% prevalence of infertility amongst women, of which 6.3% is primary while 1.9% is secondary.^[5]

There are many causes of infertility such as ovulatory factors, utero-tubal peritoneal factor, infection, lifestyle factors, advancing maternal age, postponement in childbearing and occupational hazards.^[6,7] Sexually transmitted infections (STIs) are generally considered the leading preventable cause of infertility worldwide, especially in developing countries.^[8]

Infertility can have a serious impact on both the psychological well-being and the social status of women in the developing world. This becomes particularly traumatic with previous pregnancies that end in miscarriages, stillbirths and neonatal/infant deaths.^[4] Many of the risk factors for infertility are avoidable. Thus, considering the importance of fertility, we conducted this community-based cross-sectional study with the aim to find out the prevalence of infertility and its association with reproductive risk factors amongst women of reproductive age group (18–49 years) in district Sonapat, Haryana.

MATERIALS AND METHODS

Study design

This observational cross-sectional study was conducted amongst the reproductive age group women who were residents of district Sonapat, Haryana.

Study setting and location

The study was conducted in district Sonapat, Haryana, which is one of the 22 districts in Sonapat, Haryana, located in the northern zone of the country. The period of recruitment of study participants was between August 2021 and May 2022.

Study participants and eligibility criteria

Married reproductive age group (18–49 years) women who were residents of district in Sonapat, Haryana for at least 6 months were enrolled.

Inclusion criteria:

- Those who gave written consent were included in the study.

Exclusion criteria:

- Separated/divorced women
- Married women with marriage duration <12 months
- Menopausal (natural/artificial) women
- Those with any debilitating medical or related condition like mental illness (dementia or psychotic

illness), end-stage cancer and blindness rendering them unable to be interviewed were excluded from the study.

Sources and methods of selection of participants

The calculated sample size was collected equally from urban and rural areas of district in Sonapat, Haryana. For rural area sampling, one community health centre (CHC) was selected by simple random sampling. From the selected CHC, two primary health centres (PHCs) were selected randomly. For urban area sampling, two urban health centres (UHCs) were selected randomly from urban area of district in Sonapat, Haryana. One sub-centre from each PHC and one urban sub-centre from each UHC were selected randomly. A sampling frame containing a list of all reproductive age group women (18–49 years) was obtained from multi-purpose health worker (MPHW) (F) of the selected area. The study participants from the sampling frame were chosen randomly by the investigator herself.

Sample size

The sample size was estimated on the basis of reference studies which reported the prevalence of infertility to be 11.8%,^[8] with 3% absolute precision at 95% confidence interval. The sample size was calculated using the following formula: $n = ([Z^2 \times P \times q]/L^2)$, where n = sample size, $Z = 1.96$ (95% confidence interval), P = prevalence, $q = 1 - P$ and L = absolute precision. Hence, the total calculated sample size was 444 reproductive age group women.

Data collection tools and measurements

A semi-structured schedule was used after doing necessary modification based on a pilot study which was done on 40 study subjects (10% of the sample size) from a neighbouring district. The variables of the semi-structured schedule were finalised based on their coefficient of reliability calculated using Cronbach's alpha, whose scores were 0.80. The house visit was carried out during the time of the day when all household members are expected to be available. If an eligible candidate who was not found at home during at least 3 successive visits of investigator, then adjacent household was selected. After explaining the purpose of the study and taking informed written consent from the participant, a semi-structured schedule was used by the investigator through face-to-face interviews to collect information about general characteristics and sociodemographic profile, relevant medical, menstrual and gynaecological history. Interviews were conducted in the local language.

The primary focus was on quality of data collection. An attempt to minimise recall bias, associated with timing of a particular event, was made by asking questions about

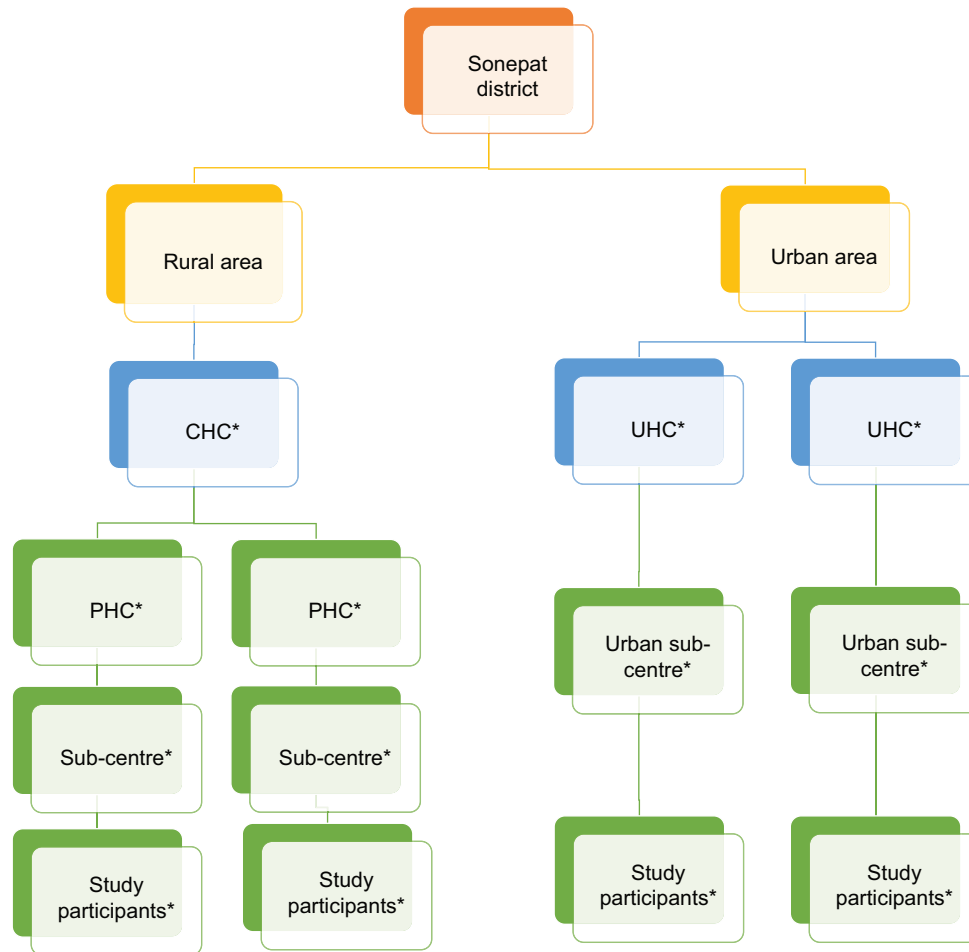


Figure 1: Flow chart showing the sampling technique of the study. *Selected by simple random sampling technique

the related important events in the respondent's life; for example, information about age at menarche was not remembered correctly by some of the respondents; in these cases, respondents' information was deduced by correlating age of menarche with any important event in past.

Operational definitions

Infertility is a disease of the male or female reproductive system defined by the failure to achieve a pregnancy after 12 months or more of regular unprotected sexual intercourse. Primary infertility is the inability to have any pregnancy, while secondary infertility is the inability to have a pregnancy after previously successful conception.

Statistical analysis

The collected data were entered into a Microsoft Excel spreadsheet. Mean and standard deviation (SD) were calculated for quantitative data. Percentages and proportions were calculated for qualitative data. The categorical data were analysed statistically using Chi-square test and odds ratio with 95% confidence interval. Continuous variables were analysed using independent *t*-test. All the analysis

was done using R software was created by Ross Ihaka and Robert Gentleman at the University of Auckland, New Zealand. $P < 0.05$ was considered statistically significant.

Ethical consideration

The ethical clearance for the study was taken from the Institutional Ethics Committee of Bhagat Phool singh Government Medical College for Women. Due approvals were also obtained from the Scientific Committee and University Ethics Committee (Approval number: BPSGMCW / RC 633 / IEC / 2021). The study adhered to the principles of the Helsinki Declaration (2013).

RESULTS

Prevalence of infertility

The prevalence of infertility is shown in Figures 1 and 2. Out of 444 study participants, majority of women were fertile (88.7%), while 6.3% of women had secondary infertility followed by 5% of women who had primary infertility. Participants were equally chosen from rural and urban areas. The prevalence of infertility was more common in the rural area (12.6%) as compared to the

urban area (9.9%), but the difference was not statistically significant ($P = 0.368$). Majority of the study population were in the age group of 30–39 years, followed by 20–29 years.

Menstrual history

About three-fourth of the study participants had their menarche at age more than 13 years. The mean age of menarche for the participants of the fertile group was 14.36 years (SD = 1.38) and for the infertile group was 14.34 years (SD = 1.40). The prevalence of infertility

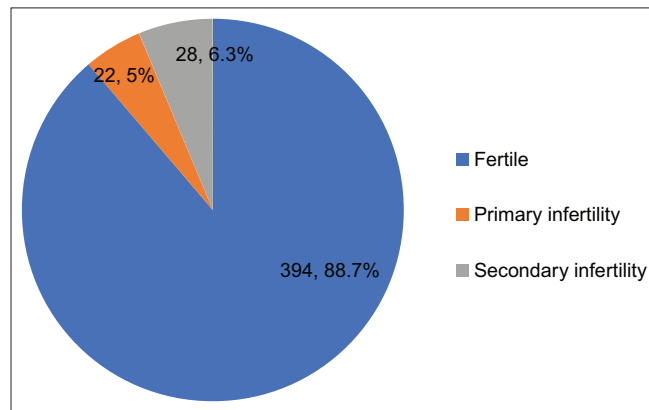


Figure 2: Distribution of study population by fertility status ($n = 444$)

was 38.7% amongst those who had their menstrual cycle duration of more than 50 days followed by 15.7% infertility amongst those who had their menstrual cycle duration of 18–25 days. Majority of study participants had an average amount of menstrual flow. Infertility was 16.9% amongst those who had a heavy amount of menstrual flow as compared to 8.8% who had a normal amount of menstrual flow. More than half of the study participants never had a history of pre-menstrual symptoms. 15.6% of the study participants who had a history of pre-menstrual symptoms sometimes were infertile as compared to 9.6% of participants who never had a history of pre-menstrual symptoms. The difference of occurrence of infertility in relation to menstrual cycle duration ($P \leq 0.001$) and menstrual flow amount ($P = 0.048$) was statistically significant [Table 1].

Problems associated with menstrual cycle

Most of the participants had no intermenstrual bleeding. The prevalence of infertility was 14.6% in those who had intermenstrual bleeding as compared to 10.9% in those who had no intermenstrual bleeding. The prevalence of infertility was 20.3% in those who had irregular menstrual cycle as compared to 8% in those with regular menstrual cycle ($P \leq 0.001$). More than half of the participants had no history of dysmenorrhea. 18.7% of

Table 1: Distribution of study population according to menstrual history

Variables	Fertile ($n=394$)	Infertile ($n=50$)	Total ($n=444$)	<i>P</i>
Menarche age (years)				
≤13	112 (86.8)	17 (13.2)	129	0.414
>13	282 (89.5)	33 (10.5)	315	
Mean±SD	14.36±1.38	14.34±1.40		0.922
Menstrual cycle duration (days)				
18–25	43 (84.3)	8 (15.7)	51	<0.001*
26–30	201 (92.2)	17 (7.8)	218	
31–50	131 (91)	13 (9)	144	
>50	19 (61.3)	12 (38.7)	31	
Menstrual flow days				
1–3	171 (89.1)	21 (10.9)	192	0.215
4–7	206 (89.6)	24 (10.4)	230	
≥8	17 (77.3)	5 (22.7)	22	
Menstrual flow amount				
Light	50 (83.3)	10 (16.7)	60	0.048*
Normal	280 (91.2)	27 (8.8)	307	
Heavy	64 (83.1)	13 (16.9)	77	
History of pre-menstrual symptoms				
Always	53 (86.9)	8 (13.1)	61	0.256
Sometimes	76 (84.4)	14 (15.6)	90	
Never	265 (90.4)	28 (9.6)	293	
Use of pad or cloth during periods				
Pad	351 (89.1)	43 (10.9)	394	0.515
Home cloth	43 (86)	7 (14)	50	

*Statistically significant

study participants who had a history of dysmenorrhea were infertile as compared to 7.5% of participants who had a history of dysmenorrhea ($P \leq 0.001$). Majority of women were not used to take medicines to start periods. The prevalence of infertility was 37.5% in those who were not used to take medicines to start periods as compared to 10.3% in those who usually took medicines to start periods ($P = 0.001$) [Table 2].

Symptoms of reproductive tract infection/sexually transmitted infection

Table 3 shows that all the symptoms of reproductive tract infection (RTI)/STI were more common amongst infertile study participants. The most common symptoms of RTI/STI were genital discharge, lower backache, itching and reddening. The difference of occurrence of infertility in relation to genital discharge ($P = 0.049$), genital ulcer/sores ($P \leq 0.001$), groin swelling ($P \leq 0.001$) and warts ($P = 0.015$) was statistically significant.

DISCUSSION

The prevalence of infertility has increased significantly in recent years, As per the WHO, the overall pooled lifetime prevalence of infertility was 17.5%, and the overall pooled period prevalence of infertility was 12.6%.^[9] In the present study, of 444 women of reproductive age group, 22 (5%) had primary infertility while 28 (6.3%) had secondary infertility. Hence, the prevalence of infertility is 11.3% in women of reproductive age group (18–49 years) in XXXX district of XXXX which was well comparable to the global data. However, it was less than some countries, for example, Canada (15.6%),^[10] China (14.2%)^[11] and Iran (21.1%),^[12] which may be due to different sociocultural factors in those countries.

Studies conducted in India by Kumar^[13] and Mittal *et al.*^[8] reported infertility rate of 14.2% and 11.98%, respectively, which is well comparable to the results of our study. In another study by Kaur *et al.*^[14] in Rajasthan, out of total

1000 women studied, 119 (11.9%) were found infertile.

In our study, the prevalence of infertility was more in the rural area (12.6%) as compared to the urban area (9.9%) which was concordant with the results of Mokhtar *et al.*^[15] who reported more infertility in rural areas. Investigators encountered a problem where persons had a tendency to conceal their infertility status, which may be one explanation for the less frequently reported prevalence of infertility in urban areas. Another explanation may be the fact that medical services continue to be lagged behind in these rural areas, self-care for women was relatively poor, therefore women were more prone to suffer from the infertility. In contrast to this, Kaur *et al.*,^[14] NFHS 2^[16] and NFHS 3^[17] reported that the infertility rate is higher amongst women in urban areas. DLHS 3 of XXXX (2007–08) reported that women who had primary or secondary infertility constitute 11.1% of ever-married women of reproductive age group, from which 10.6% of women belonged to the rural area while 12.5% of women belonged to the urban area. Thus, the prevalence of infertility varies between countries and in between the different parts of the same country.

In our study, 13.2% of infertile females had their menarche age 13 years while only 10.5% of infertile females who had their menarche age above 13 years. An early age at the first menstruation increases the incidence of disease such as pelvic inflammatory disease that can cause infertility and spontaneous abortion at later ages. In our study, there was no significant relationship between the age of the first menstruation and the prevalence of infertility. Similar results have been reported in the study of Adamson *et al.*^[18] and Gokler *et al.*^[19]

In the present study, it was observed that any form of menstrual irregularity in the form of any deviation

Table 2: Distribution of study population according to problems associated with menstrual cycle

Variable	Fertile (n=394), n (%)	Infertile (n=50), n (%)	Total (n=444; 100%)	P
Intermenstrual bleeding				
No	359 (89.1)	44 (10.9)	403	0.473
Yes	35 (85.4)	6 (14.6)	41	
Regularity of menstrual cycle				
Regular	300 (92)	26 (8)	326	<0.001*
Irregular	94 (79.7)	24 (20.3)	118	
History of dysmenorrhea				
No	272 (92.5)	22 (7.5)	294	<0.001*
Yes	122 (81.3)	28 (18.7)	150	
Took medicine to start periods				
No	384 (89.7)	44 (10.3)	428	0.001*
Yes	10 (62.5)	6 (37.5)	16	

*Statistically significant

Table 3: Distribution of study population according to symptoms of respiratory tract infection/sexually transmitted infection

Variables	Fertile (n=394)	Infertile (n=50)	Total (n=444)	P
Lower abdominal pain				
No	329 (89.6)	38 (10.4)	367	0.187
Yes	65 (84.4)	12 (15.6)	77	
Genital discharge				
No	246 (91.1)	24 (8.9)	270	0.049*
Yes	148 (85.1)	26 (14.9)	174	
Burning micturition				
No	310 (89.1)	38 (10.9)	348	0.665
Yes	84 (87.5)	12 (12.5)	96	
Lower backache				
No	227 (89)	28 (11)	255	0.828
Yes	167 (88.4)	22 (11.6)	189	
Genital ulcer/sores				
No	362 (90.5)	38 (9.5)	400	<0.001*
Yes	32 (72.7)	12 (27.3)	44	
Groin swelling				
No	353 (90.7)	36 (9.3)	389	<0.001*
Yes	41 (74.5)	14 (25.5)	55	
Itching				
No	291 (89.8)	33 (10.2)	324	0.239
Yes	103 (85.8)	17 (14.2)	120	
Reddening				
No	298 (90)	33 (10)	331	0.141
Yes	96 (85)	17 (15)	113	
Warts				
No	378 (89.6)	44 (10.4)	422	0.015*
Yes	16 (72.7)	6 (27.3)	22	
Skin rashes				
No	332 (89)	41 (11)	373	0.681
Yes	62 (87.3)	9 (12.7)	71	
Treatment taken				
No	356 (88.8)	45 (11.2)	400	0.936
Yes	38 (88.4)	5 (11.6)	44	

*Statistically significant

from normality like menorrhagia, hypomenorrhoea and menstrual cycle duration less or more than normal was significantly associated with infertility. The results of studies done by Manna *et al.*,^[20] Shamila and Sasikala^[21] and Mittal *et al.*^[8] also reported that oligomenorrhoea and hypomenorrhoea have a positive association with infertility. A study conducted by Dhont *et al.*^[22] also supports our study. In this study, it was observed that 14% of infertile women were using home cloth during menstruation as compared to 10.9% of infertile women who were using sanitary napkin/pad. Menstrual hygiene plays an important role in infertility. Unhygienic menstrual practices such as reusing cotton clothes, washing them without soap and with unclean water, social taboos and restrictions force drying indoors, away from sunlight and open-air predispose these women to lower RTIs, and ultimately infertility. A study conducted by Katole and

Saoji^[7] in 2019 in urban population of India also had results concordance with our study.

It was observed in our study that 18.7% of infertile women had history of dysmenorrhea as compared to only 7.5% of infertile women who had no history of dysmenorrhea. Dysmenorrhea is an important finding for many diseases such as polycystic ovary syndrome and endometriosis which are known to cause infertility. Studies done by Mittal *et al.*,^[8] Speroff *et al.*,^[23] and Gomathi *et al.*^[24] had similar results. However, another study conducted by Gokler *et al.*^[19] found no difference in the prevalence of infertility amongst women with and without a history of dysmenorrhea. This might be resulted from the small number of women in the study with a history of dysmenorrhea.

In our study, all RTI/STI symptoms were more prevalent in infertile women than in fertile women, and the

symptoms that were strongly linked to infertility were genital discharge, genital ulcers or sores, groin swelling, and warts. The rest of the symptoms such as lower abdominal pain, burning micturition, lower backache, itching, reddening and skin rashes were also more prevalent in the infertile females but not statistically significant association with infertility. The findings of our study were concordant with the results of studies done by Adamson *et al.*,^[18] Mittal *et al.*,^[8] Manna *et al.*,^[20] Cong *et al.*^[25] and Safarinejad.^[26]

Amongst women in our study, unprotected sex by infertile couples was significantly associated with infertility, possibly by increasing the likelihood of contracting a STI/RTI from their partner. However, it may also be possible that couples without children may be actively trying to conceive by increasing the number of unprotected sexual acts, which may account for this association. STIs (irrespective of the causative agents) or their sequelae such as tubal fibrosis and obstruction were extensively studied and proved in developed as well as in developing countries.

Limitations

In this study, the estimation of prevalence of infertility was based on questionnaire-based interview method. Despite extensive data seeking, the current study relied on women's response to these questionnaires; these assumptions may be inaccurate, as women may not reveal accurately on this sensitive topic. It only includes causes of infertility related to women; issues related to men in detail were neglected. As the current study was conducted entirely within Sonipat district, hence the results cannot be generalised.

CONCLUSION

A considerable percentage of women experience the problem of infertility in district Sonapat, Haryana. This study revealed significant potential determinants of infertility amongst the subject under study, indicating the existence of a positive relationship between genital discharge, genital ulcer/sores, groin swelling, warts and their infertility issues. We recommend focusing on programmes aiming at the reduction of the prevalence of STIs which are significant risk factors for infertility. Integration of STI programmes with other reproductive health programmes such as RMNCH, ARSH etc. and by providing these services with sufficient laboratory resources, competent labor, treatment, and counseling services, we can identify disorders early. Teenage girls could very well benefit from earlier education on variables like PCOD that can be changed, allowing them to more effectively plan their future. Regular health examinations, stress management, encouragement of a

healthy lifestyle to maintain a normal BMI, including adherence to a nourishing food and regular exercise should be encouraged.

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Conflicts of interest

There are no conflicts of interest.

Data availability statement

The data used in this study are available with the corresponding author who is willing to share it upon reasonable request.

REFERENCES

1. World Health Organization (WHO). International Classification of Diseases. 11th Revision (ICD-11). Geneva: World Health Organization; 2018.
2. World Health Organization. Strategy to accelerate progress towards the attainment of international development goals and targets related to reproductive health. *Reprod Health Matters* 2005;13:11-8.
3. Sun H, Gong TT, Jiang YT, Zhang S, Zhao YH, Wu QJ. Global, regional, and national prevalence and disability-adjusted life-years for infertility in 195 countries and territories, 1990-2017: Results from a global burden of disease study, 2017. *Aging (Albany NY)* 2019;11:10952-91.
4. Mascarenhas MN, Flaxman SR, Boerma T, Vanderpoel S, Stevens GA. National, regional, and global trends in infertility prevalence since 1990: A systematic analysis of 277 health surveys. *PLoS Med* 2012;9:e1001356.
5. District Level Household. Ministry of Health and Family Welfare Government of India. Available from: https://www.rchiips.org/pdf/india_report_dlhs-3.pdf. [Last accessed on 2020 Dec 28].
6. Kazemijaliliseh H, Ramezani Tehrani F, Behboudi-Gandevani S, Hosseiniapanah F, Khalili D, Azizi F. The prevalence and causes of primary infertility in Iran: A population-based study. *Glob J Health Sci* 2015;7:226-32.
7. Katole A, Saoji AV. Prevalence of primary infertility and its associated risk factors in urban population of central India: A community-based cross-sectional study. *Indian J Community Med* 2019;44:337-41.
8. Mittal A, Yadav S, Yadav SS, Bhardwaj A, Kaur R, Singh P. An epidemiological study of infertility among urban population of Ambala, XXXX. *Int J Interdiscip Multidiscip Stud* 2015;2:124-30.
9. World Health Organization. Infertility Prevalence Estimates: 1990-2021. World Health Organization; 2023.
10. Zegers-Hochschild F, Mansour R, Ishihara O, Adamson GD, de Mouzon J, Nygren KG, *et al.* International committee for monitoring assisted reproductive technology: World report on assisted reproductive technology, 2005. *Fertil Steril* 2014;101:366-78.
11. Meng Q, Ren A, Zhang L, Liu J, Li Z, Yang Y, *et al.* Incidence of infertility and risk factors of impaired fecundity among newly married couples in a Chinese population. *Reprod Biomed Online* 2015;30:92-100.
12. Rostami DM, Ramezani TF, Abedini M, Amirshakari G, Mehrabi Y. Prevalence of primary and secondary infertility among 18-49 years old Iranian women: A population-based study in four selected provinces. *Hakim Res J* 2014.p. 294-301.
13. Kumar D. Prevalence of female infertility and its socio-economic

- factors in tribal communities of central India. *Rural Remote Health* 2007;7:456.
14. Kaur M, Meena KK, Meena KL, Singh K, Tomar A, Saini L, *et al.* Burden of infertility and its associated factors: A cross sectional descriptive analysis of infertility cases reported at a tertiary level hospital of Rajasthan. *Int Multispecialty J Health* 2018;4:144-9.
 15. Mokhtar S, Hassan HA, Mahdy N, Elkhwsky F, Shehata G. Risk factors for primary and secondary female infertility in Alexandria: A hospital-based case-control study. *J Med Res Inst* 2006;27:251-61.
 16. International Institute for Population Sciences. National Family Health Survey (NFHS-2), 1998-99: India. Mumbai: International Institute for Population Sciences; 2000.
 17. International Institute for Population Sciences. National Family Health Survey (NFHS-3), 2005-06: India. Vol. I. Mumbai: International Institute for Population Sciences; 2007.
 18. Adamson PC, Krupp K, Freeman AH, Klausner JD, Reingold AL, Madhivanan P. Prevalence and correlates of primary infertility among young women in Mysore, India. *Indian J Med Res* 2011;134:440-6.
 19. Gokler ME, Unsal A, Arslantas D. The prevalence of infertility and loneliness among women aged 18-49 years who are living in semi-rural areas in Western Turkey. *Int J Fertil Steril* 2014;8:155-62.
 20. Manna N, Pandit D, Biswas S. Infertility and related factors: An experience from a rural community of West Bengal, India. *Indian J Prev Soc Med* 2014;45:5.
 21. Shamila S, Sasikala S. Primary report on the risk factors affecting female infertility in South Indian districts of Tamil Nadu and Kerala. *Indian J Community Med* 2011;36:59-61.
 22. Dhont N, van de Wijgert J, Coene G, Gasarabwe A, Temmerman M. 'Mama and papa nothing': Living with infertility among an urban population in Kigali, Rwanda. *Hum Reprod* 2011;26:623-9.
 23. Speroff L, Glass R, Kase N. *Clinical Gynaecologic Endocrinology and Infertility*. 7th ed. Baltimore: Lippincott Williams and Wilkins; 2005. p. 1135-74.
 24. Gomathi B, Biswal I, Nayak M, Sahoo S, Mohapatra S. Case-control study on risk factors of female infertility in the selected hospital, Bhubaneswar, Odisha. *Eur J Mol Clin Med* 2020;7.
 25. Cong J, Li P, Zheng L, Tan J. Prevalence and risk factors of infertility at a rural site of Northern China. *PLoS One* 2016;11:e0155563.
 26. Safarinejad MR. Infertility among couples in a population-based study in Iran: Prevalence and associated risk factors. *Int J Androl* 2008;31:303-14.