Prevalence of Infertility and its Associated Factors among the Eligible Couples of Central Kerala

Austoria A J[1], Sobha A[2], Manjula V D[3], Binu Areekal[3]

[1]Assistant Professor, Community Medicine Department, Trichy SRM Medical College Hospital and Research Centre, Trichy, Tamilnadu, India,
[2]Professor and Head, [3]Retired Professor and Head, Community Medicine Department, Government Medical College, Ernakulam, Kerala, India,
[4]Professor and Head, Community Medicine Department, Government Medical College Idukki, Kerala, India
Correspondence : Dr Binu Areekal, Email:drbinu840@rediffmail.com

Abstract:

Introduction: Infertility is a personal tragedy for millions of couples world-wide and has very definite physical, psychological and social implications. **Objectives:** To find the prevalence of infertility and to explore the association between selected clinical and socio demographic factors with infertility in Arpookara Panchayat, Kottayam, Kerala. **Method:** A community based cross-sectional study was conducted among 860 eligible couplesselected using simple random sampling technique, from all the 4 subcentre areas. Sociodemographic and medical/surgical details of both male and female partner were collected by semi-structured interview schedule. The couples were said to have infertility when they had either primary or secondary infertility. Pearson Chi-square test / Fisher's Exact test was used to find the association of various factors with infertility. **Results:** The prevalence of infertility was 10.3%, with 5.6% primary infertility and 4.7% secondary infertility. Factors that were found significantly associated with infertility were couples belonging to lower socioeconomic status, joint family, women marry at age ≥35 years, diabetes mellitus in women, pelvic inflammatory diseases, uterine fibroids, polycystic ovarian syndrome, abdominal pelvic surgeries in women, varicocele, mumps in men, oligospermia, men with education level less than high school, smoking, alcohol and family history of infertility in men. **Conclusion:** One tenth of the population included in the study had infertility. Thepredictors for infertility were lower socio-economic class, number of years after marriage (5-9 years), smoking in men, oligospermia, varicocoele, mumps in men, age at marriage (≥35 years) in women, polycystic ovary syndrome, pelvic inflammatory disease and diabetes mellitus in women.

Key words : Alcoholism, Infertility, Oligospermia, PCOS, Smoking

Introduction:

The arrival of a baby into this world is celebrated and the womanhood is praised since time immemorial. Childlessness in India, where joint family system is still followed in many families, leads to comparison of couples and end up in strained relationships. In most of the cases, women are blamed for infertility and the men neither supports his spouse nor co-operates with investigations for infertility, for the fear of being criticized about his manhood. Of the various definitions put forward for infertility, World Health Organization (WHO) use the epidemiological definition for infertility to know the prevalence, i.e., Women of reproductive age (15-49 years) at risk of becoming pregnant (not pregnant, sexually active, not using contraception and not

lactating) who report trying unsuccessfully for a pregnancy for two years or more.[1]

WHO estimated that more than 186 million ever-married women of reproductive age in developing countries were affected by infertility, in developing countries, translating it into one in every four couples.[2] The WHO estimates the overall prevalence of primary infertility in India to be between 3.9 and 16.8 percent. Estimates of infertility vary widely among Indian states. Moreover, the prevalence of primary infertility has also been shown to vary across tribes and castes within the same region in India.[3]

According to District Level Household Facility Survey - 3 done in Kerala, about 11% of ever married women aged between 15-49 years in Kerala had Infertility. One in every ten ever married women have infertility, in almost all districts of Kerala.[4] There are no or only a few published studies on infertility and its risk factors in Kottayam district of Kerala, India. Hence this study was designed with the objective of estimating the prevalence of infertility and its associated factors among the eligible couples of Arpookara Panchayat, Kottayam, Kerala.

Method:

This community based cross-sectional study was carried out during June 2014 to May 2015, after the approval from Institutional Review Board (No.37/2014), in Arpookara Panchayat of Kottayam district whichis located in the central part of Kerala. According to DLHS-3 (District Level Household and Facility Survey 2007-08), prevalence of Infertility among the ever-married women aged between 15-49 years in Kerala was 11%.[4] With α error at 5% and 20% relative precision, the sample size was calculated using the formula n= $Z^2_{1-\alpha/2}$ pq/ d^2, n=777. Eligible couples (currently married couple wherein the wife is in the age group of 15-49 years) who were married for 2 or more than 2 years, registered in the 4 subcentres (Villooni, Karuppa, Karipputhattu and Maniaparambu) of Arpookara panchayat as per the updated eligible couple register, were included in the

study. A compiled list of eligible couples, total of 2999, from the four subcentres was used as the sampling frame and a total of 860 eligible couples were included in the study using simple random sampling technique. Couples who were staying in the study setting for duration less than 6 months and those not willing to participate in the study were excluded.

Women were interviewed at their home, and for informationon male partners, regarding socio-demographic characteristics, menarche, menstrual abnormality, marital history, sexual details, child birth, infertility investigation and treatment, comorbidities, surgical history smoking and alcoholism, exercise and family history of infertility were collected using a pre-tested semi-structured interview schedule. Socioeconomic status was assessed using Modified KuppuswamyScale 2014.[5]The couples were said to have infertility when they had either primary or secondary infertility. No investigation of any kind was done in this study to find the cause of infertility and the hospital records maintained at home was used to collect data on infertility management.

Operational Definitions:

Epidemiological definition of Infertility: Women of reproductive age (15–49 years) at risk of becoming pregnant (not pregnant, sexually active, not using contraception and not lactating) who report trying unsuccessfully for a pregnancy for two years or more.[1] In the present study, the term infertility includes both the primary infertility and secondary infertility.

Primary infertility: When a woman is unable to ever bear a child, either due to the inability to become pregnant or the inability to carry a pregnancy to a live birth she would be classified as having primary infertility. Women whose pregnancy spontaneously miscarries, or whose pregnancy results in a still born child without ever having a live birth would present with primarilyinfertility.[6]

Secondary infertility: When a woman is unable to bear a child, either due to the inability to become pregnant or the inability to carry a pregnancy to a live birth following either a previous pregnancy or a previous ability to carry a pregnancy to a live birth, she would be classified as having secondary infertility. Thus, those who repeatedly spontaneously miscarry or whose pregnancy results in a stillbirth, or following a previous pregnancy or a previous ability to do so, are then not unable to carry a pregnancy to a live birth would present as secondarily infertile.[6]

Data Analysis

Data were appropriately coded, entered in Microsoft Excel and analyzed using Statistical Package for Social Studies version 16.0. Quantitative variables were expressed as mean and standard deviation and qualitative variables were counts and percentages. Chi Square test, Fishers's Exact test and independent sample t-test were done for bivariate analysis and a p value of less than 0.05 was taken as statistically significant. Binary logistic regression was done to find the independent predictors of infertility.

Results:

Socio-demographic characteristics

Among the 860 eligible couple, the mean age of men was 40.34 ± 6.829 years and the mean age of women was 35.51 ± 6.656 years. The population consisted of 59% Hindus, 39.7% Christians and 1.4% Muslims. The literacy rate was 99.7% in men with 53.5% educated up to high school and literacy rate among women was 99.9% with 42.9% completed high school education. Employed men were involved in unskilled (32.9%) and skilled (34.5%) occupation, whereas 2/3rd women (66.7%) were unemployed. The study participants belonged to lower middle class (45.30%) followed by upper middle class (41.60%), upper lower class (12.10%) and upper class (0.90%).

Burden of Infertility

Total number of couples with infertility was 89, hence the prevalence of infertility was 10.3% with 5.6% primary infertility and 4.7% secondary infertility. For further analysis, couples with both primary and secondary infertility were considered as infertile. Among the infertile couples, 51.7% did not do any investigation to find the cause of infertility and among those who were investigated, 24.7% of infertility was due to male factor followed by female factor 13.5%, both male and female factors 4.5% and unexplained infertility (cause was not found with the investigations) constituted 5.6%.

Among the couples with infertility, majority of the women belonged to the age group of 35-39 years (27%), followed by 30-34 years (22.5%), 25-29 years (21.3%), 40-44 years (14.6%), 20-24 years (7.9%) and 45-49 years (6.7%). In men, majority belonged to the age group of 35-39 years (30.3%) followed by 40-44 years (25.8%), 30-34 years (20.2%), 45-49 years (12.4%), more than or equal to 50 years (7.9%) and 25-29 years (3.4%). Among the women with infertility, 52.8% had education up to high school certificate and 47.2% had schooling post high school certificate and in men with infertility, 73% had schooling till high school and 27% had schooling post high school. The association of education and infertility was statistically significant for men (Chi-square value 4.246, p = 0.039) but not in women (Chi-square value 1.319, p = 0.251). There was increase in prevalence of infertility with decrease in socioeconomic status, with no infertile couples in upper class, 6.7% in upper middle class, 12.1% in lower middle class and 17.3% in upper lower class (Chi-square value for trend = 12.66, p <0.001). Prevalence of infertility was more in joint family (12.6%) when compared to nuclear family (7.7%) and was found to have statistically significant association (Chi-square value = 5.551, p = 0.018). No significant association found between religion and infertility.

Menstrual and marital characteristics

The mean age at menarche in women with infertility was 13.6 ± 1.6 years and 13.7 ± 1.4 years in others, this difference in mean age at menarche was not statistically significant with independent sample T-test, t value of -0.72 and p value 0.5. The rate of infertility increased with increase in age at marriage and was found to be statistically significant. Association of menstrual and marital characteristics with infertility were described in the Table 1.

Medical history and life style characteristics

The details of past medical and surgical diseases of both the partners and their lifestyle characteristics and their association with infertility were shown in Table 2 and Table 3 respectively. Presence of diabetes mellitus, pelvic inflammatory diseases (PID), uterine fibroids, polycystic ovary syndrome (PCOS), history of abdominal pelvic surgeries in women were found to have statistically significant association. History of varicocele, mumps, oligozoospermia, smoking, alcohol and family history of infertility were found to have association in men.

Binary logistic regression analysis

The factors found associated with infertility in bivariate analysis were analyzed using binary logistic regression with infertility as dependent variable. Independent predictors of infertility found were shown in Table 4. This model had the Nagelkerke R^2 value of 0.353.

Table 1: Association of Menstrual and Marital characteristics of Women with infertility (N=860)

Variables	Infertility		Chi Square	p value
	Present n (%)	Absent n (%)		
Menstrual disorders Present	29 (14.9%)	165 (85.1%)	5.71	**0.017***
Absent	60 (9.0%)	606 (91.0%)		
Age at marriage (Completed years)				
≤ 19	5 (4.7%)	101 (95.3%)	26.87	**<0.001***
20 -24	35 (8.0%)	402 (92.0%)		
25 – 29	35 (12.5%)	245 (87.5%)		
30 – 34	10 (35.7%)	18 (64.3%)		
≥ 35	4 (44.4%)	5 (55.6%)		
Years of married life (Completed years)				
≤ 4	19 (14.7%)	110 (85.3%)	27.53	**<0.001***
5 – 9	39 (17.7%)	181 (82.3%)		
10 – 14	15 (8.6%)	159 (91.4%)		
≥ 15	16 (4.7%)	321 (95.3%)		

*Statistically significant with p value < 0.05

Table 2: Medical history and Lifestyle Characteristics of Women versus infertility (N=860)

Variables	Infertility		Statistical test	p value
	Present n (%)	Absent n (%)		
Diabetes Mellitus				
Present	4 (28.6%)	10 (71.4%)	Fisher's Exact test	**0.048***
Absent	85 (10.0%)	761 (90.0%)		
Thyroid disorders				
Present	14 (14.6%)	82 (85.4%)	Pearson chi-square value 2.088	0.148
Absent	75 (8.8%)	689 (90.2%)		
PID				
Present	6 (24.0%)	19 (76.0%)	Fisher's Exact test	**0.036***
Absent	83 (9.9%)	752 (90.1%)		
Uterine fibroids				
Present	7 (25.0%)	21 (75.0%)	Fisher's Exact test	**0.019***
Absent	82 (9.9%)	750 (90.1%)		
Endometriosis				
Present	1 (14.3%)	6 (85.7%)	Fisher's Exact test	0.536
Absent	88 (10.3%)	765 (89.7%)		
PCOS				
Present	10 (32.3%)	12 (67.7%)	Fisher's Exact test	**0.001***
Absent	79 (9.5%)	750 (90.5%)		
Tuberculosis				
Present	3 (21.4%)	11 (78.6%)	Fisher's Exact test	0.169
Absent	86 (10.2%)	760 (89.8%)		
Abdominal Pelvic surgeries				
Present	3 (50%)	3(50%)	Fisher's Exact test	**0.017***
Absent	86 (10.1%)	768 (89.9%)		
BMI				
Underweight	6 (11.1%)	48 (88.9%)	Pearson chi-square value 2.874	0.411
Normal weight	39 (9.3%)	381 (90.7%)		
Over-weight	38 (12.5%)	266 (87.5%)		
Obese	6 (7.3%)	76 (92.7%)		
Waist hip ratio				
< 0.85	35 (9.7%)	324 (90.3%)	Pearson chi-square value 0.239	0.625
$\geq$ 0.85	54 (10.8%)	447 (89.2%)		
Family history of infertility				
Present	4 (5.1%)	75 (94.9%)	Pearson chi-square value 2.619	0.1
Absent	85 (10.9%)	696 (89.1%)		

Note: PID – Pelvic Inflammatory Disease, PCOS – Polycystic ovary syndrome.

*Statistically significant with p value < 0.05

Table 3: Medical and Surgical Details in Men versus Infertility (N=860)

Variables	Infertility		Statistical test
	Present	Absent	p value
	n (%)	n (%)	
Diabetes Mellitus			
Present	4(12.9%)	27 (87.1%)	Fisher's Exact Test
Absent	85 (10.3%	744 (89.7%)	0.552
Varicocele			
Present	5 (62.5%)	3 (37.5%)	Fisher's Exact Test
Absent	84 (9.9%)	768 (90.1%)	**<0.001***
Mumps			
Present	8 (28.6%)	20 (71.4%)	Fisher's Exact Test
Absent	81 (9.7%)	751 (90.3%)	**0.005***
Tuberculosis			
Present	2 (28.6%)	5 (71.4%)	Fisher's Exact Test
Absent	87 (10.2%)	766 (89.8%)	0.158
Oligozoospermia			
Present	11 (68.8%)	5 (31.2%)	Pearson chi-square value 59.934
Absent	78 (9.2%)	766 (90.8%)	**<0.001***
Abdominal Pelvic surgeries			
Present	3 (6.7%)	42 (93.3%)	Fisher's Exact Test
Absent	86 (10.6%)	729 (89.4%)	0.613
Smoking			
Present	56(17.02%)	273(82.98%)	Pearson chi-square value 25.5695
Absent	33 (6.2%)	498 (93.8%)	**<0.001***
Alcoholism			
Present	72 (12.4%)	510 (87.6%)	Pearson chi-square value 7.9363
Absent	17 (6.1%)	261 (93.9%)	**0.0048***
Family history of infertility			
Present	18 (17.6%)	84 (82.4%)	Pearson chi-square value 6.644
Absent	71 (9.4%)	687 (90.6%)	**0.01***

 *Statistically significant with p value < 0.05

Discussion:

Among the study population, 89 couples (10.3%) had infertility (5.6% primary and 4.7% secondary infertility). When compared to the DLHS-3 Kerala [4] (8.7% primary infertility and 1.8% secondary infertility), the prevalence of primary infertility was lower but secondary infertility was higher. The result was higher when compared to the studies done in West Bengal (2.04% primary infertility and 0.11% secondary infertility)[7] and Bangalore (primary infertility 4.5%)[8] and lower

Table 4: Binary logistic regression analysis of factors associated with infertility (N=860)

Independent variable	B	S.E.	p value	OR	95% CI
Socio economic status (lower middle class)	0.669	0.194	0.001	1.952	1.334 – 2.856
Age at marriage in women (≥35 years)	0.584	0.165	0.001	1.730	1.253 – 2.389
Number of years after marriage (5 – 9 years)	0.453	0.142	0.001	1.573	1.191 – 2.078
Oligozoospermia	2.562	0.649	< 0.0001	12.958	3.633 – 46.219
Mumps in men	1.258	0.514	0.014	3.518	1.284 – 9.636
Varicocoele	3.567	0.821	< 0.0001	35.399	7.080 – 177
Smoking in men	1.072	0.298	< 0.0001	2.922	1.630 – 5.238
PCOS	1.781	0.522	0.001	5.933	2.131 – 16.520
PID	1.518	0.578	0.009	4.562	1.468 – 14.175
Diabetes mellitus in women	2.114	0.751	0.005	8.285	1.903 – 36.078
Constant	-35.901	4.555	< 0.0001	0.000	

Note: B- regression coefficient; OR –Odds ratio; S.E –Standard error; CI – Confidence interval.

when compared to a Mysore study (primary infertility 12.5%).[9] According to a systematic review, the global trends in infertility were similar in 1990 and 2010, with 0.1% decrease in primary infertility and 0.4% increase in secondary infertility.[6] Researchers, based on census of India, opine that childlessness in India has risen by 50 per cent since 1981.[10]

The age group of 35-39 years had more proportion of infertile men and womenand infertility was found more among couples who were married for 5 – 9 years (17.7%) in the current study. According to DLHS-3 Kerala, majority of infertile couples belonged to the age group of 30 -34 years (12.2%) followed by the age group of 35 – 39 years (11.2%) and the percentage of infertility was more among those married for 5-9 years (12.4%).[4] Aging has a significant impact on male sexual function, sperm parameters, and fertility.[11] Reproductive system of women has peak efficiency in the early 20's and steadily decline there after. The percentage of married women remaining childless increased with age and age at marriage.[12]

The percentage of infertility was more in couples who had education up to high school level and similar findings were observed by other studies.[7,8,10] Majority of the women and men among the infertile couples were unemployed and skilled workers respectively and this finding was consistent with a previous study.[10] Among the infertile couples, majority of them were Hindus followed by Christians and Muslims. Data from DLHS-3[4] and other studies[7,10] showed this trend. The current study showed association of infertility with joint family. It was reported that 65.2% of infertile couples lived in joint family.[8] Socioeconomic status and infertility were inversely related, with majority belonging to upper lower class (17.3%) followed by lower middle class (12.1%) and then upper middle class (6.6%). In Kerala, most of the infertile couples belonged to lowest wealth index category (18.5%)[4] correspondingly previous studies reported that the couples of higher classes had more children, better parameters in semen analysis and better ovarian reserve.[13] Menstrual disorders was found to have association with infertility and the result was consistent to the report by another study.[7]

Tubal infertility is a complication with PID with its incidence reported to be 8%, 19.5% and 40% after one, two and three episodes of PID respectively.[12] The current study also found statistically significant association with PID. Fibroids was found to be associated with infertility. Fibroids with a submucosal or an intracavitary component are associated with decreased reproductive outcomes.[14] Endometriosis causes anatomic distortion from adhesions or fibrosis and the known presence of inflammatory mediators exert toxic effects on gametes, embryos, tubal fimbria and ectopic endometrium.[12] Though 14.3% of women with endometriosis and 10.3% of women without endometriosis had infertility, the association was not statistically significant. One of the long-term complications of PCOS is anovulatory infertility.[15] The current study found statistically significant association with PCOS. The association of diabetes and infertility in women could be because diabetes reduces fertility in women due to menstrual abnormalities.[12]

Oligozoospermia refers to semen with low concentration of sperm, abnormalities in sperm morphology, motility, and is a common finding in male infertility and the current study finding was consistent with previous report.[16] Orchitis is the most common complication of mumps and bilateral mumps orchitis was reported to experience infertility.[17] In the current study, 28.6% of men with history of mumps had infertility and was statistically significant. Varicocele was found to have significant association with infertility and a previous study reported lower semen parameters among infertile men with varicocele.[18] Alcohol consumption leads to progressive deterioration of semen quality and quantity.[19] In the present study, 12.4% of alcoholic men had infertility and the association was statistically significant. Smoking was found to have association with infertility, as reported, heavy smoking may have a detrimental effect on the motility of sperm and is associated with decreased sperm count.[20] Around 50% of the women with previous history of pelvic/abdominal surgeries had

infertility and the association was statistically significant as abdominal surgeries may lead to adhesions and infertility in some cases.[21] The role of genetic/inherited disease and specific abnormalities in the Y chromosome are found to cause male infertility.[22] Around 17.6% of men with family history of infertility had infertility and this association was found to be statistically significant. The study couldn't find such association in women and this result contradicts the finding by a previous study.[10]

Conclusion:

The prevalence of infertility was 10.3% with primary infertility of 5.6% and secondary infertility of 4.7%. Socio economic status (lower middle class), age at marriage in women ($\geq$35 years), number of years after marriage (5 – 9 years), smoking in men, oligozoospermia, mumps in men, varicocoele, PCOS, PID and diabetes mellitus in women were found as independent predictors of infertility.

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