



STUDYING CHILDLESSNESS (FEMALE INFERTILITY) IN INDIA USING NATIONAL FAMILY HEALTH SURVEY DATA AND "AGE OF COUPLE'S MARRIED LIFE" AS A DETERMINANT

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ABSTRACT **Background:** Demographic definition of female infertility is a woman of reproductive age when fails to conceive even after five years of unprotected sexual intercourse. World Health Organization estimates overall prevalence of primary infertility in India between 3.9% and 16.8%. Present study was aimed at evaluating "Age of Couple's Married Life" (ACML) of a woman as a determinant of female infertility using National Family Health Survey data, India data as there is a very sparse previous literature is available in this context. **Materials And Methods:** National Family Health Survey-4 (2015-16) data of Indian married women who were yet to deliver or having no more than one child and experiencing their reproductive life (between 15-49 years) were included to evaluate female infertility. Chi-square statistics was applied to establish association of female infertility with its determinant "Age of Couple's Married Life". **Results:** Risk ratios of female infertility for "ACML1+", "ACML3+" and "ACML5+ years" groups were significantly higher for "30+ years" Chronological Age of a woman at the time of Marriage group (1.21%, 1.7% and 1.78% respectively) ($p < 0.05$) when standardized with Chronological Age of a woman at the time of Marriage "20-29 years" group. Women in rural area were at higher risk (RR of 1.18%, 1.2% and 1.33% respectively) ($p < 0.05$) for female infertility vs. urban population. Illiteracy, non-usage of contraceptives and MTPs carried higher risks of female infertility vs. literate women using contraceptive methods. **Conclusion:** Higher Chronological Age of a woman at the time of Marriage, rural residency, illiteracy, employment, poor wealth index and lower BMI increased risk of female infertility while use of contraception reduced it. The Cox regression highlights these determinants as key factors of female infertility and should be stressed upon for effective planning and implementation of reproductive health programs to reduce primary female infertility in India.

KEYWORDS : Female infertility, Age of Couple's Married Life, Chronological Age of a woman at the time of Marriage, Wealth index, Contraception.

INTRODUCTION

"Female infertility", is a reproductive system disorder in which a woman is unable to conceive a child even after twelve or more months of regular unprotected intercourse.¹ Demographers, on the other hand, define female infertility (childlessness) as women of reproductive age group (between 15-49 years) who are unable to conceive even after five or more years.² The World Health Organization (WHO) estimates worldwide prevalence of 8-10% of Couple's experience female infertility issues.³ World Health Organization estimates range of overall prevalence of primary female infertility in India between 3.9% and 16.8%.⁴ In 2019-20, the prevalence of female infertility in India was 18.7 per 1,000 among women who had been married for at least five years and were currently in union.⁵ literature reports female infertility is determined and affected by socio-demographic, cultural and biological factors such as; Chronological Age of a woman at the time of Marriage⁶, Religion⁷, Place of residence⁸, Level of Education⁹, Occupational Status⁶, Wealth Index⁸, Body Mass Index,^{9,10} Thyroid Disorder⁶. Female infertility, a growing concern in India, necessitating immediate action to raise awareness, increase access to treatment, and strengthen support networks to address both medical and social challenges faced by those affected.¹¹ Owing to diversity in culture, traditions, viability of health care systems, quality of living life, and biological make up of couple, in India, these determinants vary by region. To reduce female infertility, stakeholders must consider bonding between Couple's, which comes from their Age of Couple's Married Life experience. Age of Couple's Married Life can be helpful, to treat the female infertility at a larger scale. In major demographic studies, female infertility is analysed on the grounds of sociocultural and

demographic information. There is no study which has considered "Age of Couple's Married Life experience" of women as an affecting factor for female infertility. This can be helpful, to treat the female infertility issues among individual level. Hence, this study was designed to know the risk factors of primary female infertility in India and to improve the plan of action to tackle primary female infertility in India.

MATERIALS AND METHODS

Secondary data of National Family Health Survey-4 (NFHS- 4, 2015-16) of Indian married women with at most one child or yet to deliver, experiencing their reproductive life (15-49 years age) was used for the present study. For analytical purpose, the study variable Age of Couple's Married Life of a woman was grouped as "ACML 1+", "ACML 3+" and "ACML 5+" groups where "ACML 1+" represented Age of Couple's Married Life of 1 year, 3 years and 5 years respectively. Chi-square test statistics was used to study association of female infertility (childlessness) in different "Age of Couple's Married Life" groups with its determinants like Chronological Age of a woman at the time of Marriage, religion, place of residence, literacy status, wealth index, body mass index, employment status, thyroid disorder, use of contraception and history of pregnancy termination. Microsoft Excel 2019 ® (One Microsoft way, Redmond, Washington D.C, USA) and IBM SPSS 20 version software ® (SPSS Inc. Chicago, IL, USA) was used to analyse the data.

RESULTS

NFHS -4 2015-16 data of total 55161 married women with maximum

one child, married at least for 7 years constituted study material for the present study on female infertility (childlessness) with the determinant "Age of Couple's Married Life (ACML)". Amongst 55161 women, 31% did not deliver their first child for 1 or more years since their marriage, 17 % did not have a child even after 3 years of marriage and 15% did not conceive even after 5 years of their Age of Couple's Married Life.

Table No.1, depicts the analysis of female infertility in different "Age of Couple's Married Life" (ACML) groups by its Socio-economic and Health variates. a) Analysis of female infertility by Chronological Age of a woman at the time of Marriage reveals that in those women married when they were younger than 20 years, the childlessness rate decreased consistently from 32.0%, 18.2% to 16.1% in Age of Couple's Married Life "ACML 1+", "ACML 3+" and "ACML 5+" years groups. Those women married in age group of 20-29 years had a female infertility rate of 29.7%, 15.3% and 13.4% in Age of Couple's Married Life "ACML 1+", "ACML 3+" and "ACML 5+" years groups respectively. Those who were married at 30+ years had female infertility rates of 36%, 25.9% and 23.80% "ACML 1+", "ACML 3+" and "ACML 5+" years groups respectively. Furthermore, risk ratio for childlessness by Age of Couple's Married Life "ACML 1+", "ACML 3+" and "ACML 5+" groups increased from 1.08, 1.19 and 1.20 in "<20 years Chronological Age of a woman at the time of Marriage" group against "Chronological Age of a woman at the time of Marriage 20-29 years" group. Similar, increasing pattern was observed in "Chronological Age of a woman at the time of Marriage group 30+ years" group where RR were 1.21, 1.7 and 1.78 against "Chronological Age of a woman at the time of Marriage 20-29 years" group respectively.

Female infertility analysed in different Age of Couple's Married Life groups by Religion revealed that in "ACML 1+" years group, childlessness rate was higher in Muslims (33.6%) followed by Hindus (31.3%) and was least in Sikhs (22.8%). Similar observation was made in "ACML 3+" and "ACML 5+" years Age of Couple's Married Life groups. There was a decrease in percentage of childlessness against increasing Age of Couple's Married Life.

Childlessness analysed against Age of Couple's Married Life by its determinant, "Place of residence" revealed that in "ACML 1+" years urban women had higher childlessness rate (32.6%) as compared to rural women (27.6%). Similar pattern was observed for "ACML 3+" years (18.1% in urban vs. 15.0% in rural) and "ACML 5+ years" 16.6%

vs. 12.4 %) respectively.

Female infertility determinant, "Level of education" revealed that in "ACML 1+" years group the childlessness rate decreased from 33.5% in illiterate women to 30.3% in secondary and higher educated women. Similar observation was done in "ACML 3+" years group (24% vs. 14.9%) and in "ACML 5+" years group (23.4% vs. 12.2%) respectively.

Employed women had higher (31.1%) rate of female infertility as compared to unemployed women (30.0%) in "ACML 1+" years group. Similar, observations were made in "ACML 3+" and "ACML 5+" years groups where rates were 17.3% vs. 5.5% and 15.2% vs. 14.0% in employed vs. non-employed groups respectively. Women with Poor wealth index had higher female infertility rates (35.6% vs. 28.6%) in middle and rich wealth index group in "ACML 1+" years category. Similar pattern of female infertility was observed in "ACML 3+" and "ACML 5+" years groups (21.5% vs. 14.9% and 20.8% vs. 12.5%) respectively.

Women with a lower Body Mass Index (18.5-24.9) had higher childlessness rate (32.4%) as compared to 25.5% in women with BMI more than 25 in "ACML 1+" years group. In "ACML 3+" years and "ACML 5+" years groups, there was a decrease in female infertility rate to 17.9% and 18.1% respectively in women with BMI lower than 18.5 and 16.01% and 13.9% respectively in BMI more than 25 respectively.

Euthyroid/status unknow females had higher (31%) female infertility rates compared to a diagnosed hypo/hyperthyroid (27.7%) category in "ACML 1+" years group. "ACML 3+" and "ACML 5+" years groups had decreasing female infertility rates (17.0% vs. 19.2% and 16.3% vs. 15.0 %) in euthyroid/stats unknown group vs. hypo/hyperthyroid diagnosed category respectively.

Women with no history of medical termination of pregnancy had higher female infertility rates in "ACML 1+" years group (31.4%) compared to (28.5%) in those who had history of MTP. In "ACML 3+" and "ACML 5+" years groups female infertility rates were 18.8% vs. 16.6% and 15.1% vs. 15.0% in no MTP vs MTP group respectively.

Women with contraceptives use experienced higher female infertility rates (40.9 %) versus non-users (18.5 %) in "ACML 1+" years group. "ACML 3+" and "ACML 5+" years groups had female infertility rates of 25.4% vs. 9.05% and 24.8% vs. 6.4% in contraceptive users vs. non users respectively.

Table No.1: Infertility (Childlessness) Analysed By Age Of Couple's Married Life And Socio-economic And Health Determinants

Determinant of Female Infertility	Age of Couple's Married Life (ACML) (in years)					
	"ACML 1+" group		"ACML 3+" group		"ACML 5+" GROUP	
	n (Rate/100)	RR	n (Rate/100)	RR	n (Rate/100)	RR
Total	34884 (31.0)	-	13031 (17.0)	-	7246 (15.0)	-
a) Chronological Age of a woman at the time of Marriage						
<20	17415 (32.0)	1.08***	6911 (18.2)	1.19***	3840 (16.1)	1.20***
20-29	16392 (29.7)	1	5574 (15.3)	1	3063 (13.4)	1
30+	1077 (36.0)	1.21***	546 (25.9)	1.7***	343 (23.8)	1.78***
b) Religion						
Hindu	27086 (31.4)	1.00	10316 (17.4)	1.00	5703 (15.1)	1.00
Muslim	4614 (33.6)	1.07***	1572 (18.6)	1.07***	850 (18.3)	1.22***
Sikh	684 (22.81)	0.73***	205 (9.4)	0.54***	118 (7.8)	0.52***
Christian	1708 (26.4)	0.84***	628 (14.6)	0.84***	390 (14.5)	0.96***
Others	792 (26.0)	0.83***	310 (14.2)	0.82***	185 (12.6)	0.83***
c) Type of Place of Residence						
Urban	9893 (27.6)	1.00	3906 (15.0)	1.00	2221 (12.4)	1.00
Rural	24991 (32.6)	1.18***	9125 (18.1)	1.20***	5025 (16.6)	1.33***
d) Level of Education						
No Education	5909 (33.5)	1.1***	3173 (24.0)	1.61***	2178 (23.4)	1.92***
Primary	3661 (31.8)	1.05***	1653 (20.2)	1.35***	959 (18.3)	1.50***
Secondary & above	25314 (30.3)	1.00	8205 (14.9)	1.00	4109 (12.2)	1.00
e) Occupation Status						
Working	30231 (31.1)	1.04*	11448 (17.3)	1.11***	6378 (15.2)	1.09*
No working	4653 (30.0)	1.00	1583 (15.5)	1.00	868 (14.0)	1.00
f) Wealth Index						
Poor	13642 (35.6)	1.24***	5381 (21.5)	1.45***	3010 (20.8)	1.66***
Middle & Rich	21242 (28.6)	1.00	7650 (14.9)	1.00	4236 (12.5)	1.00
g) Body Mass Index						
<18.5	6531 (31.6)	0.98***	2326 (17.9)	1.05***	1194 (18.1)	1.22***
18.5-24.9	22340 (32.4)	1.00	7735 (17.0)	1.00	4098 (14.8)	1.00

25+	5350 (25.5)	0.79***	2697 (16.01)	0.94***	1800 (13.9)	0.94***
h) Thyroid Disorder Status						
Yes	648 (27.7)	0.9***	368 (19.2)	1.13*	244 (16.3)	1.09
No & DN	34236 (31.0)	1.00	12663 (17.0)	1.00	7002 (15.0)	1.00
i) Termination of Pregnancy						
Yes	4846 (28.5)	0.91***	2669 (18.8)	1.13***	1539 (15.1)	1.01
No	30038 (31.4)	1.00	10362 (16.6)	1.00	5707 (15.0)	1.00
j) Ever Used Any Contraception Method						
No	25703 (40.9)	1.00	9476 (25.4)	1.00	5599 (24.8)	1.00
Yes	9181 (18.5)	0.45***	3555 (9.1)	0.36***	1647 (6.4)	0.26***

Note: *, p<0.05, **, p<0.01, ***, p<0.001

DISCUSSION

Female infertility (childlessness) evaluated by its determinant; Age of Couple's Married Life (ACML) is an important measure of fertility. It is majorly affected by socio-demographic and cultural make up and practice of the community. Hence, present study was designed to evaluate Age of Couple's Married Life (ACML) and female infertility by their socio-demographic and cultural determinants using data obtained from 2015-2016 (NFHS-IV round) comprising of 55161 Indian women of reproductive age group (15-49 years).

The female infertility (childlessness) rate by Age of Couple's Married Life; ACML1+, ACML 3+, and ACML 5+ years groups were 31%, 17% and 15% respectively. Our findings are consistent with WHO 2021 report with 17.9% female infertility rate for India.¹² Similar observations are also made in Indian scenario by Purkayastha N et al where prevalence rate mentioned is 16.8%.⁸

Lower female infertility rates were observed in 20-29 yrs chronological Age of a woman at the time of Marriage category in "ACML1+", "ACML 3+" and "ACML 5+" years groups (29.7%, 15.3% and 13.4% respectively) verses higher (36.0%, 25.9% and 23.8% respectively) rates in 30+ Chronological Age of a woman at the time of Marriage category. Our findings were consistent with observations made in Indian scenario by Katole et al and Talwar et al.^{6,13,14,15} This observation emphasizes upon increased risk of female infertility in chronological Age of a woman at the time of Marriage being 30 + years and to have better fertility outcomes, the Chronological Age of a woman at the time of Marriage of woman should be 20-29 years.

When analysed by religion, the highest female infertility rates were observed in Muslims in all Age of Couple's Married Life groups i.e. "ACML 1+", "ACML 3+" and "ACML 5+" years (33.6%, 18.6% and 18.3% respectively), and least in Sikhs (22.8%, 9.4% and 7.8%) respectively. Our observations were consistent with Indian study done by Sheoran et al.⁷ The probable explanation to this observation can be differences in sociocultural practices amongst the different religions whose evaluation was beyond the scope of the present study.

Women staying in urban area had lesser female infertility rates in "ACML 1+", "ACML 3+" and "DMS 5+" years groups (27.6%, 15.0% and 12.4% respectively) as compared to women residing in rural areas. A decreasing trend was observed with increasing Age of Couple's Married Life experience of women. Our finding was in contrast with previous observation made by Shinde KP et al in south central railway hospital, Secunderabad in 2021.¹⁶ A study conducted by Manimekalai K et al in Tamil Nadu (India) in 2020 also contrasted our findings.¹¹ Both studies have reported higher female infertility rates in urban areas. Our observation stresses better reproductive health awareness, easy access to infertility clinics and higher educational standards in urban women as compared to rural population.^{16,11}

Illiterate women had higher childlessness rates (33.5%, 24% and 23.4% respectively) compared to a literate one in "ACML 1+", "ACML 3+" and "ACML 5+" years Age of Couple's Married Life groups with a decreasing trend. This finding was in coherence with studies by Katole et al and Purkayastha at on Indian population.^{6,8}

The infertility rate was higher (31.1%, 17.3% and 15.2% respectively) in working women and lower in (30.0%, 15.5% and 14.0% respectively) in nonworking women, in "ACML 1+", "ACML 3+" and "ACML 5+" years groups. Our findings were consistent with Katole et al⁶ in urban population of central India and by Boivin et al¹⁷ in less developing countries.

The infertility rate was higher (35.6%, 21.55% and 20.8%

respectively) in poor wealth index category and least (28.6%, 14.9% and 12.5% respectively) in middle and rich wealth index group in "ACML 1+", "ACML 3+" and "ACML 5+" years groups. The decrease in prevalence was seen consistently with increase in Age of Couple's Married Life. Our observation was consistent with studies done by Katole A et al⁶ in some parts of India, by Sheoran P et al⁷ in one pan India study and study done by Papreen N et al¹⁸ on urban slum population of Bangladesh.^{6,7,18}

The childlessness rates were lowest (25.5%, 16.0% and 13.9% respectively) in obese or overweight women (BMI >25) in "ACML 1+", "ACML 3+" and "ACML 5+" years Age of Couple's Married Life groups with a consistent decrease in rates. It was difficult to explain this phenomenon but similar observation has been made in previous studies by Purkayastha N et al and Grodstein F et al.^{8,19} Polycystic ovarian disease is a common association with obesity and can easily be diagnosed in pre-conceptual counselling. When treated, the issues of infertility are overcome drastically.

Women suffering from thyroid disorder had lower infertility rate (27.7%) as compared to those who were euthyroid or of unknown thyroid status. This observation was not consistent in other duration since of marriage groups. Our findings were consistent with studies done on Indian population by Purkayastha N et al⁸, Roupia Z et al²⁰, Singh K²² et al and Poppe K et al.²³ The probable cause of this phenomenon may be the positive effect of thyroid therapy on conception in diagnosed and treated women than those with unknown thyroid disease status.

In "ACML 1+" years group, women who have not had a documented evidence of pregnancy termination were more likely to be childless (infertile) than those who have had experienced at least one terminated pregnancy. Conversely, after increased Age of Couple's Married Life i.e. in "ACML 3+" and "ACML 5+" year groups, infertility rate was high in MTP group as compared to in non-MTP. Our findings were consistent with the study done by Cong J et al and Pike GK et al.^{24,25} The probable cause for this phenomenon is unknown and further clinical studies are needed to establish this causal association.

Contraception greatly reduced female infertility, with nonusers having far higher rates across all marriage durations. This conclusion emphasizes the importance of contraception in family planning because users are more likely to control their fertility, resulting in planned pregnancies. Our findings reemphasize the conclusion of Shamila S et al.²⁶

CONCLUSION

The study on female infertility (childlessness) among Indian women identifies significant socio-demographic and cultural factors influencing female infertility across different Age of Couple's Married Life groups. Childlessness rates decreased with increasing duration of marriage experience. Chronological Age of a woman at the time of Marriage between 20-29 years, Hindu religion, urban residency, higher level of education, employment, middle and rich wealth index, higher body mass index, diagnosed thyroid issues, evidence of pregnancy termination, and use of contraception favoured least female infertility rates. History of termination of pregnancy reduced risk of female infertility which was a novel finding of the study. A goal directed action taking these finding into account may help solve the female infertility issues and a better reproductive planning and their outcomes in Indian scenario.

Limitations

1. The study's data is cross-sectional, therefore causality between socio-demographic characteristics and primary female infertility cannot be established. Longitudinal research might be useful in determining causal linkages.
2. Much of the material is based on self-reports, which may result in

recall bias or inaccuracy in sensitive areas like pregnancy termination or contraception use.

3. The data lacks medical information on probable female infertility causes, such as genetics, reproductive health history, and other medical disorders, which could provide a more complete picture of female infertility determinants.

4. The study focuses entirely on female responders, ignoring the importance of male factors in female infertility. Future studies that include male partners may provide a more complete picture of infertility dynamics.

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