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Effect of Sociodemographic Characteristics on Knowledge of Assisted Reproductive Technology in Infertile Individuals

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ABSTRACT

Aims The treatment for infertility is a multifaceted process in which both the healthcare team and the clients actively participate. Therefore, having sufficient knowledge of assisted reproductive technologies among infertile individuals is essential for achieving successful treatment. This study aimed to assess the understanding of assisted reproductive technologies among infertile individuals and identify the factors affecting it.

Instrument & Methods This cross-sectional study was done on individuals who visited the infertility treatment center at Qazvin University of Medical Sciences between June and September 2024. A structured questionnaire designed to assess knowledge of assisted reproductive technologies was completed by the participants. Data were analyzed using SPSS software, with a significance level set at $p<0.05$.

Findings Of the 237 participants, 93.2% were female and 6.8% were male. The overall knowledge of assisted reproductive technologies was reported to be 42.9%. Women demonstrated a higher level of knowledge compared to men. There was a direct relationship between educational level and knowledge of general assisted reproductive technology information. Employees had less knowledge of assisted reproductive technologies compared to other occupational groups ($p=0.010$). No significant relationship was found between age, duration of infertility, and knowledge level.

Conclusion Individuals' knowledge of assisted reproductive technologies is below 50% and education level, gender, and occupation are significantly associated with knowledge levels.

Keywords Knowledge; Infertility; Assisted Reproductive Technologies (ART); In Vitro Fertilization (IVF); Gender

CITATION LINKS

[1] Worldwide trend analysis of primary and secondary infertility ... [2] The modest impact of assisted reproductive technology on the second birth ... [3] Fertility-awareness knowledge, attitudes and practices of women ... [4] Socio-demographic determinants of infertility ... [5] In vitro ... [6] Knowledge of infertility among infertile women in Bauchi ... [7] Knowledge of male infertility and acceptance of ... [8] What do women undergoing in vitro ... [9] Knowledge of infertile couples about assisted reproductive ... [10] Knowledge, attitude, and practice of embryo transfer among ... [11] Low fertility awareness in United States reproductive-aged ... [12] Assessment of knowledge and attitude of infertile ... [13] The impact of religion and culture on medically assisted ... [14] Effect of an educational package on ... [15] Effect of health education program on knowledge, stress, and satisfaction among infertile ... [16] Influence of a patient education and care program on women undergoing non-assisted ... [17] Effect of an educational intervention for infertile women regarding ... [18] Awareness, knowledge, and psycho-emotional aspect of ... [19] Awareness, perceived efficacy, and utilization of assisted ... [20] Knowledge and attitude of infertile people ... [21] A study to assess the awareness of assisted reproductive technology among infertile ... [22] The effect of age, ethnicity, and level of education ... [23] The other side of the fertility coin ... [24] Attitudes toward assisted reproductive technology ... [25] Infertility around the globe ... [26] Iran-educational attainment, at least ... [27] Knowledge, attitude and acceptability of assisted ... [28] Knowledge regarding assisted reproductive technology ... [29] Learning from online video education (LOVE) improves confidence ... [30] Effectiveness of a video intervention on fertility knowledge among ... [31] The need for a training software among Iranian infertile couples ...

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Introduction

Infertility is defined as the failure to conceive after at least 12 months of regular sexual intercourse without the use of contraceptive methods. It is recognized as the fifth most serious global disability, adversely affecting the self-esteem of those affected. Beyond the personal and relational consequences for infertile couples, there are considerable economic and social effects. Consequently, infertility is the subject of extensive demographic discussions and is a national concern. According to available data, the prevalence of infertility in Iran is increasing and has been reported to be between 3% and 20% [1-4].

In vitro fertilization (IVF) is a type of assisted reproductive technology (ART) that is widely used as an infertility treatment. This approach involves a complex series of steps that necessitate the stimulation of the ovaries to facilitate ovulation, the retrieval of mature oocytes, and their subsequent fertilization with sperm in a controlled laboratory setting. A few days after fertilization, the resulting embryo is transferred to the uterus, and if implantation is successful, pregnancy occurs. Prior to the initiation of IVF treatment, couples are required to undergo a comprehensive medical assessment and fertility evaluations. Throughout the treatment course, a variety of medications are typically administered, some of which are taken orally while others are delivered via injection or vaginal insertion. Compliance with the timing and dosage of medications, as well as adherence to treatment protocols by couples, is crucial for the ultimate success of the treatment [5]. However, research indicates that infertile couples possess an unsatisfactory level of knowledge about the IVF process, the necessary medications, post-operative care, and potential complications associated with IVF. The challenges of infertility and the complex steps of IVF can lead to confusion and frustration for individuals [6-10].

Fertility rates can be improved by increasing couples' awareness of scientific information, including the reproductive process, ovulation timing, the effect of age on fertility, and types of infertility treatments. Research has demonstrated that educational programs positively affect knowledge, stress levels, and satisfaction among infertile women undergoing IVF. In different societies, understanding and knowledge of health issues, such as infertility, vary based on levels of development, as well as socio-cultural and economic conditions [9, 11-13]. Consequently, it is essential for each society to evaluate the knowledge level of its infertile individuals regarding infertility and available treatment options and to develop and implement educational interventions aimed at mitigating the adverse effects of this knowledge gap on the reproductive potential of the population [14-18]. This study aimed to assess the understanding of ART among infertile individuals and identify the factors affecting it.

Instrument and Methods

This cross-sectional study was done on couples who visited the infertility center at Qazvin University of Medical Sciences (QUMS) during a three-month period from June to September 2024. Out of these, 237 participants agreed to take part by completing the questionnaire. The sample size was determined to be 226 participants, considering μ1=13.77, μ2=14.41, SD1=4.40, SD2=3.50, α=0.05, and β=0.80, using the formula below. The final sample size was adjusted to accommodate a 10% dropout, resulting in a total of 249 participants.

$$n = \frac{\left(z1 - \frac{\alpha}{2} + z1 - \beta\right)^2 (\sigma_1^2 + \sigma_2^2)}{(\mu_1 - \mu_2)^2}$$

Data were collected using a two-part questionnaire. The first part covered demographic characteristics such as age, gender, education, occupation, and duration of infertility. The second part consisted of 26 questions: the first 9 assessed general knowledge related to ART, the next 6 addressed knowledge of female infertility treatments, and the final 6 pertained to male infertility treatments. According to a study by Pourmasumi *et al.*, the questionnaire was prepared by specialists and professors from the Yazd Research & Clinical Center for Infertility. Its validity was verified by three members of the expert board and research council. The reliability of the questionnaire was evaluated through the test-retest method, which included 30 patients, and was validated with a Cronbach's alpha of 0.81. Responses were scored using a binary classification system ("know" or "do not know") [9].

Participants were assured that their responses would remain confidential and that they could remain anonymous.

Statistical analysis of the collected data was conducted using SPSS 24 software, employing Chi-square tests, T-tests, and regression analysis.

Findings

A total of 237 individuals participated in this study, of whom 221 (93.2%) were women and 16 (6.8%) were men. The mean age of participants was 33.08±7.08 years and the mean duration of infertility was 51.34±47.42 months. The majority of participants held a high school diploma (34.2%) and were housewives (68.4%; Table 1).

The mean level of knowledge (positive responses) regarding ART among individuals attending the infertility treatment center was 42.9%. Participants demonstrated a greater understanding of the reasons for hepatitis and AIDS testing, with 94.4% responding positively.

Table 1. Demographic characteristics of the participants

Parameter		Frequency (%)
Gender	Female	221 (93.2)
	Male	16 (6.8)
Education	Elementary school	51 (21.5)
	Diploma	81 (34.2)
	Associate degree	16 (6.8)
	Bachelor's degree	65 (27.4)
	Postgraduate degrees	15 (6.3)
	Unknown	9 (3.8)
Occupation	Housewife	162 (68.4)
	Self-employed	22 (9.3)
	Employee	41 (17.3)
	College student	3 (1.3)
	Unknown	9 (3.8)

Only 3% of participants had previously read informational booklets related to infertility treatment, and just 13.1% considered these materials to be useful. On average, 52.2% of participants were knowledgeable about medication administration and storage, as well as sperm sample collection and preservation (Table 2). The difference in knowledge between female and male participants was statistically significant in the areas of general information about assisted reproductive treatments (p=0.004) and knowledge related to female infertility treatments (p=0.0001; Table 3).

Table 2. Frequency of participants' knowledge about assisted reproductive technologies (ART)

Item	Yes	No
1. Do you have knowledge about methods used for reproduction?	156 (65.8)	81 (34.2)
2. Are you familiar with the in vitro fertilization (IVF) method?	148 (62.4)	88 (37.1)
3. Are you aware of intracytoplasmic sperm injection (ICSI)?	15 (6.3)	222 (93.7)
4. Do you know about the zygote intrafallopian transfer (ZIFT) technique?	146 (61.6)	91 (38.4)
5. Are you informed about the preconception testing procedures?	138 (58.2)	99 (41.8)
6. Have you ever reviewed educational booklets on ART?	7 (3.0)	230 (97.0)
7. In your opinion, were the ART informational booklets useful?	31 (13.1)	206 (86.9)
8. Are you aware of the purpose of undergoing phlebotomy during treatment?	0 (0.0)	237 (100.0)
9. Are you informed about the rationale for testing for Hepatitis and HIV/AIDS?	117 (94.4)	120 (5.6)
10. Do you understand the function and role of reproductive hormones?	52 (21.9)	185 (78.1)
11. Are you aware of why hormone tests are conducted during infertility evaluation?	99 (41.8)	138 (58.2)
12. Are you informed about the necessity of hormonal assessments in fertility treatment?	98 (41.4)	139 (58.6)
13. Are you familiar with the process of stimulating the ovaries to retrieve eggs?	106 (44.7)	131 (55.3)
14. Are you aware of the correct storage conditions for fertility medications?	135 (57.0)	102 (43.0)
15. Are you knowledgeable about how to properly inject or take your fertility drugs?	131 (55.3)	106 (44.7)
16. Are you familiar with the correct procedure for sperm sample collection?	121 (51.1)	116 (48.9)
17. Are you aware of the optimal time frame for submitting a sperm sample to the laboratory?	131 (55.3)	106 (44.7)
18. Are you informed about the appropriate temperature at which sperm samples should be kept?	83 (35.0)	154 (65.0)
19. Are you aware of the required abstinence period prior to sperm sample collection?	141 (59.5)	96 (40.5)
20. Do you know what testicular sperm extraction (TESE) involves?	53 (22.4)	184 (77.6)
21. Do you have any knowledge of fertility treatment methods?	115 (48.5)	122 (51.5)

Table 3. Mean participants' knowledge level

Knowledge	Female (n=221)		Male (n=16)		Total (n=237)		p-value
	Mean	Average score out of 100	Mean	Average score out of 100	Mean	Average score out of 100	
General knowledge	11.29±1.79	41.12	9.93±1.98	24.12	11.19±1.83	39.87	0.004
Women-related knowledge	8.73±1.97	45.50	7.00±1.26	16.67	8.62±1.98	43.67	0.000
Men-related knowledge	8.76±2.08	46.00	8.06±2.35	34.33	8.71±2.10	45.17	0.198
Total knowledge	44.20±2.68		25.04±8.86		42.90±2.73		-

Table 4. Results of multivariate regression analysis

Parameter		General knowledge	Women-related knowledge	Men-related knowledge
Gender	Female	1	1	-
	Male	-1.36 (0.34, 2.38)	-1.88 (0.70, 3.05)	-
	p-value	0.009	0.002	-
Education	Elementary school	1	1	-
	Diploma	1.36 (0.74, 1.99)	0.76 (0.03, 1.50)	-
	p-value	<0.001	0.042	
	Associate degree	1.96 (0.91, 3.01)	0.66 (0.60, 1.92)	-
	p-value	<0.001	0.302	-
	Bachelor's degree	1.56 (0.85, 2.27)	0.93 (0.09, 1.78)	-
	p-value	<0.001	0.031	-
	Postgraduate degrees	1.70 (0.58, 2.83)	1.12 (0.22, 2.46)	-
	p-value	<0.001	0.102	-
	Unknown	1.24 (0.08, 2.57)	0.98 (0.57, 2.53)	-
	p-value	0.066	0.214	-
Job	Housewife	1	1	-
	Self-employed	-0.23 (-0.67, 1.12)	-0.25 (-0.81, 1.30)	-
	p-value	0.618	0.644	-
	Employee	0.98 (-1.72, -0.23)	0.09 (-0.97, 0.78)	-
	p-value	0.010	0.833	-
	College student	-0.20 (-1.90, 2.30)	0.84 (-3.31, 1.62)	-
	p-value	0.848	0.500	-
	Unknown	1.42 (-3.05, 0.20)	0.62 (-2.39, 1.14)	-
	p-value	0.086	0.488	-
Duration of infertility	-	0.01 (-0.01, 0.01)	-0.01 (-0.01, 0.01)	-
	p-value	0.461	0.819	-

There was a significant relationship between individuals' level of knowledge and their gender. Additionally, knowledge of general information about ART was associated with participants' educational attainment, with those holding an associate degree or higher demonstrating greater knowledge compared to individuals with a high school diploma or lower. An inverse relationship was observed between employment status and knowledge of general ART information (p=0.010). No significant relationships were found between age, duration of infertility, and the level of knowledge (Table 4).

Discussion

This study aimed to assess the understanding of assisted reproductive technologies among infertile individuals and identify the factors affecting it. The level of knowledge regarding ART among individuals attending the infertility treatment center was 42.9% after standardization. Most comparable studies conducted in Iran and other parts of the world have reported higher levels of knowledge about ART techniques. It is important to note that this research exclusively involved first-time patients seeking treatment for infertility through ART, which may explain the lower knowledge compared to other studies where participants had prior experience with these techniques [9, 18-22]. On the other hand, these findings may genuinely reflect the low level of knowledge among visitors to this center and underscore the necessity of implementing educational interventions.

Regarding general knowledge about assisted reproductive treatments and information related to female infertility treatment, a significant difference was observed between genders, with women demonstrating higher levels of knowledge. While the average knowledge level among men was 25.04%, with their highest knowledge observed in male infertility treatment at 34.33%, women's average knowledge across the three domains was 44.20%. Some studies have reported no significant association between gender and knowledge levels [9], whereas others have found lower knowledge among men [23, 24]. This discrepancy may be attributed to the historical and social consequences of infertility predominantly affecting women, as well as their active role and engagement in infertility treatments (even in cases where infertility is due to male factors), which may contribute to their greater awareness. In certain regions of the world, limited access to infertility clinics and inadequate awareness contribute to severe gendered consequences of infertility, particularly for women. Conversely, in areas with greater availability of infertility clinics, such as the Middle East, the negative gendered impacts of infertility tend to diminish over time, with men increasingly acknowledging their infertility and seeking treatments like intracytoplasmic sperm injection (ICSI) [25]. Therefore, improving men's knowledge about different types and causes of infertility, along with enhancing their access to infertility treatments, could reduce delays in seeking care. Consequently, fertility support programs are more likely to be effective if educational interventions target both women and men.

Several studies have demonstrated that higher educational attainment is associated with greater knowledge of infertility treatments [4, 18, 22]. Consistent with these findings, we also revealed a significant relationship between participants' education levels and their knowledge of infertility treatments. Knowledge of general information about ART was higher among individuals with university-level education (including associate degrees and above) compared to those without such educational backgrounds. In our study, 55.7% of participants had a high school diploma or lower, 40.5% had an associate degree or higher, and 3.8% had unspecified education levels. Therefore, 75% of the participants had at least a high school diploma. According to reports from 2022, 44.95% of individuals over 25 years old in Iran hold at least a high school diploma [26]. Although this estimate may have shifted slightly over the past two years, the education level of the study participants does not appear to be lower than that of the general population. Nonetheless, given the higher knowledge levels among those with university education regarding general ART information, it is particularly important to develop targeted educational programs for individuals with lower educational attainment to promote infertility prevention and treatment.

Employees had significantly lower knowledge than homemakers. This may be attributed to employees' confidence in their existing knowledge, which might lead them to spend less time studying and acquiring new information. Alternatively, employed women generally have less free time, reducing their opportunities to seek relevant information through sources such as the internet or social media. Pourmasumi *et al.* report a significant difference in average knowledge scores based on participants' occupations, similarly finding that employees have less knowledge than workers and self-employed individuals [9]. No significant relationship was observed between knowledge and either age or duration of infertility. Since our study focused on individuals seeking infertility treatment for the first time, increases in age or duration of infertility did not correspond to higher knowledge levels. In contrast, studies without this limitation have reported that knowledge may increase with age due to greater exposure and more learning opportunities. However, findings in the literature are inconsistent: several studies have reported a positive association between knowledge and age [9, 22, 27], while others have found inverse relationships [20] or no significant

relationship [12, 28]. Similarly, the relationship between knowledge and duration of infertility is inconclusive; consistent with our results, Pourmasumi *et al.* and Dreamly & Jini report no association [9, 28], whereas Eladle *et al.* report a positive correlation [27].

Only a very small percentage of participants (3%) had read the informational booklets routinely provided by the infertility treatment center, and just 13.1% found these booklets useful. This suggests that using these booklets is neither an engaging nor an effective method for increasing patients' awareness. On average, approximately half of the participants responded "yes" to questions related to their involvement in the treatment process, including those concerning proper medication use and the collection and storage of sperm samples. Since adherence to these procedures is critical for successful infertility treatment outcomes, the lack of knowledge among about half of the participants may negatively impact their chances of achieving the desired results. Furthermore, many patients experience high levels of anxiety during visits to infertility centers, which can hinder their ability to retain explanations provided by specialists. Combined with the low rate of booklet readership, this underscores the need to explore alternative educational methods, such as training software, social media, and online video education, to effectively enhance patient knowledge [21, 29-31].

One limitation of this study was the low participation rate of men (6.8%). It appears that men still tend to believe in minimal intervention in fertility treatment. However, since successful treatment requires active involvement from both partners, increasing men's knowledge in this field is essential.

Overall, individuals' knowledge of ART as a treatment option for infertility was below 50%. This limited knowledge can lead to improper medication use, avoidance of certain treatment steps, and, in some cases, discontinuation of treatment altogether. Furthermore, higher education levels and female gender were directly associated with greater knowledge. Accordingly, it is necessary to design and implement educational interventions tailored to individuals' baseline knowledge, gender, occupation, and educational background.

Conclusion

Individuals' knowledge of assisted reproductive technologies is below 50% and education level, gender, and occupation are significantly associated with knowledge levels.

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