Full Length Article

The impact of infertility on the mental health of women undergoing in vitro fertilization treatment

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ABSTRACT

Background & problem: Infertility affects a substantial number of couples, posing physical, emotional, and psychological challenges. Infertile women experienced a sense of loss of control and planning of life with high stress and anxiety and they must deal with the uncertainty of treatment. The evolution of assisted reproductive techniques has provided hope for couples that struggle with infertility. The implementation of questionnaires assessing the mental health of women with infertility before, during, and after the IVF procedure proved to be useful tool to evaluate women who needs psychological support.
Aim: This study aims to explore the impact of infertility on the mental health of women undergoing IVF treatment.
Methods: For the assessment of infertility on women's mental health, the CES-D Scale, the State-Trait Anxiety Inventory for Adults, and the Fertility Problem Inventory scale were given before or during the diagnostic evaluation of the infertility and before the initiation of infertility treatment (ovulation induction). To assess the effect of ART on the mental health of the participants, the fertility quality of life tool was applied at the end of the procedure.
Findings: The current study found that the greater age, the greater educational level and not having experienced a miscarriage were significantly associated with better quality of life and decreased stress during the IVF procedure.
Conclusions: The application of psychological interventions **can assist** all women undergoing infertility treatment as a way to cope with the challenges associated with infertility treatment. **IVF couples may need additional support during the procedure.**

Introduction

According to the latest definition by the World Health Organization [1], infertility is considered a disease of the male or female reproductive system. It is defined by the failure to achieve a pregnancy after at least 12 months of regular unprotected sexual intercourse [1]. Infertility can be classified as primary or secondary: a primary infertile female is a woman who has never achieved a clinical pregnancy and meets the criteria of being classified as having infertility, while when a woman has achieved a clinical pregnancy at some point, she is classified as a secondary infertile female [2]. This classification can also apply to males when considering their participation in the initiation of a pregnancy [3].

Infertility is a medical condition that can affect a substantial number of couples worldwide, posing physical, emotional, and psychological challenges. In recent years, the advent of assisted reproductive technologies such as in vitro fertilization (IVF) has provided hope for individuals struggling with infertility. While IVF offers a promising pathway to parenthood, the psychological toll it can take on the couple, and specifically on women undergoing treatment, remains a critical area of investigation. Couples are confronted with an unforeseen problem which puts them at a disadvantage compared to many other couples of their age [4]. They can experience a sense of loss of control and planning of life and must deal with the uncertainty of treatment since, even after following the procedure of assisted reproduction, the outcome remains

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uncertain. In many studies, patients have rated the anxiety of undergoing in vitro fertilization as greater than any other important life event.

A literature review on the prevalence of psychological symptoms in infertility found that 25 % to 60 % of infertile individuals report psychiatric symptoms, with significantly higher levels of anxiety and depression compared to fertile controls [5]. Women, in particular, are more psychologically susceptible to infertility, possibly due to societal pressures and stigmatization surrounding motherhood [5]. A study on infertile Turkish women undergoing IVF found that depression was significantly positively correlated with infertility stigma and negatively correlated with perceived social support, which in turn was negatively correlated with infertility stigma [4,6,7].

Other studies have explored how psychological disorders, such as depression, can impact the outcome of in vitro fertilization (IVF). Some researchers have found a clear relationship between anxiety, depression, and the probability of becoming pregnant after IVF/intra-cytoplasmic sperm injection (ICSI) treatment [8]. Similarly, other studies suggested that stress might reduce the chances of a successful IVF outcome [9]. In contrast, some research did not find any association between IVF clinical pregnancy rates and symptoms of anxiety, depression, and stress [10]. Additionally, a prospective study did not indicate any relationship between perceived psychological stress and psychological well-being before or during the first IVF treatment and its outcome [11]. The evidence on this relationship is contradictory.

Study goals

Given the demonstrated existence of psychological difficulties during the IVF process and the lack of studies focusing specifically on women's mental health, this study aims to examine the impact of infertility and the IVF process on the psychological status of women before and during IVF treatment. These goals will help clarify the specific factors that affect women's mental health and quality of life during IVF treatment, contributing to a better understanding of their psychological needs and potential interventions.

Methods

Participants and recruitment

Women undergoing their first IVF/ICSI or intrauterine insemination treatment in the Assisted Reproduction Unit at the Department of Obstetrics and Gynecology, Patras University Hospital, were eligible for this study. All participants completed their treatment, including embryo transfer. The recruitment period spanned from January 2021 to November 2023.

Consenting process

The study's aims and procedures were clearly explained by the first two authors, who were responsible for the recruitment and consenting processes. They assured participants that their decision to participate, or not, would have no impact on their medical care. This was emphasized to prevent any perceived coercion, particularly as no clinicians directly involved in the participants' care participated in the recruitment process. All participants and their spouses provided informed consent.

Data collection

Data collection was conducted in a self-reported manner. Participants completed the questionnaires in a peaceful and private setting within the clinic to ensure confidentiality and comfort. This setup facilitated the accurate collection of both psychological and sociolect-demographic data, crucial for the study's aims.

Ethical approval

Institutional Review Board approval was obtained (approval number 499/08.12.2020), ensuring all research protocols and ethical guidelines were strictly followed.

Measures

To assess the effect of assisted reproduction techniques on the mental health of the participants, the Fertility Quality of Life (FertiQoL) tool was applied [12]. The FertiQoL tool has been widely used in studies assessing the impact of fertility issues on quality of life in men and women with infertility. A recent systematic review indicated that the FertiQoL tool is reliable and valid even when considering individuals with many etiologies for infertility [13]. This 36-item questionnaire assesses core quality of life (24 items) and treatment-related quality of life (10 items), along with overall life and physical health (2 items) [14]. Each item is rated on a Likert scale, ranging from 0 to 100, where higher scores indicate better fertility and quality of life. The FertiQoL was administered at the end of the treatment, after the embryo transfer, as we aimed to explore the effect of the IVF treatment on women's quality of life. In our study population, the reliability of the FertiQoL was good, with a Cronbach's alpha of 0.77 for the overall score, 0.76 for the core quality of life and 0.76 for the treatment-related quality of life subscales.

For the assessment of infertility's impact on women's mental health, the Center for Epidemiological Studies Depression Scale (CES-D Scale) [15] was utilized. It is a commonly used tool for identifying depression symptoms in pregnant women and the general population [16]. This self-reported depression scale, widely used in general population research, includes 20 items scored on a 4-point Likert scale ranging from 0 to 3. This questionnaire assesses nine aspects of depression, such as sadness, loss of appetite, sleep patterns, concentration, and feelings of guilt, fatigue, agitation, and suicidal thoughts. Each item evaluates the frequency of depressive symptoms experienced over the past week. Scores on all items are totaled, with possible scores ranging from 0 to 60, indicating a higher level of depressed mood with higher scores. In our study, the CES-D demonstrated acceptable reliability with a Cronbach's alpha of 0.70 [15,17].

The State-Trait Anxiety Inventory for Adults (STAI-AD) was also used to measure anxiety [17]. This tool includes 40 items divided into two sub-scales: State Anxiety (20 items) and Trait Anxiety (20 items), each rated on a 4-point Likert scale. It assesses feelings of apprehension, tension, nervousness, and worry. Scores for each sub-scale range from 20 to 80, with higher scores indicating greater anxiety. State anxiety items include phrases such as "I am tense; I am worried" and "I feel calm; I feel secure" whereas trait anxiety items include phrases such as "I worry too much over something that really doesn't matter" and "I am content; I am a steady person." The Trait scale showed high reliability in our population, with a Cronbach's alpha of 0.85. The Cronbach's alpha for state scale was also high and equal to 0.81.

Additionally, the Fertility Problem Inventory (FPI) was used to measure perceived infertility-related stress. This 46-item scale requires participants to rate their agreement with various fertility-related concerns or beliefs on a Likert-type scale ranging from 0 (Strongly disagree) to 6 (Strongly agree). The total score can range from 0 to 276, with higher scores indicating greater perceived stress. The FPI demonstrated good reliability in this study, with a Cronbach's alpha of 0.76 [18].

Women's demographic characteristics, socio-economic status, and educational level were also collected and analyzed using a specific questionnaire designed for this study. All questionnaires, except for the FertiQoL, were administered during or before the diagnostic evaluation of infertility and before the initiation of infertility treatment (ovulation induction). The FertiQoL was administered after the treatment to assess the effect of the IVF process on the participants' quality of life.

Power and statistical analysis

It was calculated that with a sample of 120 participants, the study would have > 95 % power to perform linear regression at the 0.05 level of significance, for 15 independent variables and for effect sizes of 0.25 or greater. The R-squared was estimated from 0.1 to 0.22. The power analysis can be seen in Fig. 1 (Supplementary material) [19].

Quantitative variables were expressed as mean values (Standard Deviation) and as median (inter-quantile range), while qualitative variables were expressed as absolute and relative frequencies. Spearman correlations coefficients (rho) were used to explore the association of two continuous variables. Under study scales were compared between the two age groups, where participants were categorized as younger than or equal to 42 years and older than 42 years, using the Mann-Whitney test. Multiple linear regression analyses using a stepwise method (entry threshold: p = 0.05; removal threshold: p = 0.10) were performed with FERTI-QoL scores as the dependent variable. The regression equation included initially terms for participants' demographics, information from their obstetric history and scales Trait, CED-S and FPI. Adjusted regression coefficients (β) with standard errors (SE) were computed from the results of the linear regression analyses. Log transformations of the dependent variables were made before conducting linear regression analyses. Diagnostics for regression models were performed to check if the conditions for regression had been met with the residuals of each model being normally distributed and their variance being constant. Internal consistency reliability was determined by the calculation of Cronbach's α coefficient. Scales with reliability equal to or greater than 0.70 were considered acceptable. All reported p values are two-tailed. Statistical significance was set at $p < 0.05$ and analyses were conducted using SPSS statistical software (version 26.0).

Results

Demographic characteristics

The study population consisted of 128 women from 30 to 49 years old, with a mean age of 41.5 years (SD = 4.1 years). Their demographic characteristics are presented in Table 1. Most women were married (88.3 %), employed (81.3 %), and university alumni (53.9 %).

Obstetric history

Participants' obstetric history is presented in Table 2. A total of 16.4 % of the women had been pregnant at some point in their lives, 14.8 % had experienced a miscarriage, and 4.7 % had given birth. The mean number of years of trying to conceive was 2.6 (SD = 1.5 years), and 64.8 % of the participants had been examined or treated by a private obstetrician. The majority of participants (75.8 %) had undergone fertility treatment themselves or with their spouse, and 14.4 % had achieved pregnancy following treatment.

Table 1
Demographic data of the study's population.

	N (%)
Age, mean (SD)	41.5 (4.1)
Married	113 (88.3)
Years of marriage[1], mean (SD)	2.9 (1.0)
Educational level	
High school	59 (46.1)
University	69 (53.9)
Employed	104 (81.3)
Occupation	
Employee in private sector	54 (42.2)
Employee in public sector	27 (21.1)
Free-lancer	23 (18)
Household	24 (18.8)

Note. [1]refers to married women.

Table 2
Participants' obstetric history.

	N (%)
Ever have got pregnant	21 (16.4)
Ever given birth	6 (4.7)
Ever had a miscariage	19 (14.8)
Ever had an ectopic pregnancy	0 (0)
Ever adopted a child	0 (0)
Years of trying, mean (SD)	2.6 (1.5)
Location of examination or treatment	
Private obstetrician	83 (64.8)
Private fertility center	1 (0.8)
Public hospital or public fertility clinic	44 (34.4)
Results from examination	
Fallopian tube obstruction	23 (18)
There is no regular ovulation or no ovulation at all	14 (10.9)
Endometriosis	17 (13.3)
Decreased quality or quantity of my husband's sperm	38 (29.7)
No cause found	34 (26.6)
Something else	2 (1.6)
Ever you or your spouse had a fertility treatment	97 (75.8)
Years from first fertility treatment[1], mean (SD)	3.3 (1.5)
Type of treatment[1]	
Surgery on me (e.g. on the fallopian tubes)	6 (6.2)
Surgery on my spouse (e.g. varicocele)	9 (9.3)
Insemination with my husband's or donor's sperm	64 (66)
In vitro fertilization with my husband's or donor's sperm	41 (42.3)
Natural IVF cycle	2 (2.1)
Number of IVF's[2], median (IQR)	1 (1——2)
Ever got pregnant after fertility treatment[1]	14 (14.4)
Ever given birth after fertility treatment[3]	2 (14.3)
Current type of treatment	
Insemination with my husband's or donor's sperm	46 (35.9)
In vitro fertilization with my husband's or donor's sperm	35 (27.3)
Natural IVF cycle	7 (5.5)
Intracytoplasmic sperm injection (ICSI)	40 (31.3)

Note. [1]refers to women who had themselves or their spouse a fertility treatment.
[2] refers to women who had undergone IVF.
[3] refers to women who had gotten pregnant after a fertility treatment.

Correlations between instruments

The correlations between the FERTI-QoL, STAI, CES-D, and FPI scales are presented in Table 3. A positive correlation between the Emotional and Social scales (e.g., Rho = 0.12) suggests that emotional well-being may be linked to social well-being in the context of fertility. Conversely, negative correlations, such as those between the Trait scale and CES-D (e.g., Rho = -0.03), imply that personality traits may have a somewhat protective effect against depressive symptoms. Additionally, the FPI scale was significantly negatively correlated with the "Tolerability" and "Treatment" dimensions of the FERTI-QoL. Moreover, the FPI scale was significantly positively correlated with CES-D.

Age differences in instruments

Descriptive results of the FERTI-QoL, STAI, CES-D, and FPI scales are shown in Table 4 by age groups (formed by median age). No significant differences were found between the two age groups (p > 0.05).

Regression analysis

The results of the multiple regression analysis with FERTI-QoL scores as dependent variables are shown in Table 5. Having gotten pregnant after a fertility treatment was significantly associated with greater scores in the "Emotional" (β = 0.018; p = 0.050) and "Mind-Body" dimensions (β = 0.030; p = 0.002), indicating better quality of life. Additionally, participants who had undergone fertility treatment themselves or with their spouse had significantly greater scores in the "Relation" dimension (β = 0.011; p = 0.037). Married participants had significantly greater scores in the "Social" dimension (β = 0.019; p = 0.016), while participants who were scheduled for IVF/ICSI (β = -0.022; p = 0.050) or an

Table 3
Spearman's rho correlation coefficients among FERTI-QOL, STAI, CES-D, and FPI scales .

	Emotional	Mind-body	Relation	Social	Environment	Tolerability	Core	Treatment	Total FERTIQOL score	Trait	CES-D	FPI
Emotional	1.00	0.53***	0.30**	0.41***	0.17	0.10	0.80***	0.14	0.72***	0.12	0.10	0.00
Mind-body		1.00	0.17	0.36***	0.23**	0.04	0.72***	0.14	0.67***	−0.06	0.10	−0.01
Relation			1.00	0.25**	−0.01	0.05	0.56***	0.05	0.50***	0.02	−0.10	−0.12
Social				1.00	−0.02	0.09	0.69***	0.05	0.57***	0.01	−0.04	−0.06
Environment					1.00	0.37***	0.76***	0.12	0.45***	0.00	0.03	−0.07
Tolerability						1.00	0.83***	0.10	0.41***	−0.06	−0.09	−0.19*
Core							1.00	0.13	0.89***	0.01	0.05	−0.04
Treatment								1.00	0.53***	−0.05	−0.04	−0.18*
Total FERTIQOL score									1.00	0.02	0.02	−0.13
Trait										1.00	−0.03	−0.04
CES-D											1.00	0.21*
FPI												1.00

*p < 0.05 **p < 0.01 ***p < 0.001.

Table 4
FERTI-QOL, STAI, CES-D, and FPI scales by age group.[1]

	Age ≤42		>42		P Mann-Whitney test
	Mean (SD)	Median (IQR)	Mean (SD)	Median (IQR)	
Emotional	81.6 (6.8)	83.3 (79.2 − 85.4)	82.5 (5.9)	83.3 (79.2 − 87.5)	0.471
Mind-body	86.7 (6.5)	87.5 (83.3 − 87.5)	88.3 (6.9)	87.5 (87.5 − 89.6)	0.129
Relation	91.6 (5.6)	91.7 (87.5 − 95.8)	92.3 (4.6)	91.7 (91.7 − 95.8)	0.799
Social	87.3 (6.3)	87.5 (85.4 − 91.7)	88.5 (4.5)	87.5 (87.5 − 91.7)	0.695
Environmen.	92.9 (9.5)	95.8 (95.8 − 95.8)	94.2 (5.5)	95.8 (95.8 − 95.8)	0.922
Tolerability	86.5 (11)	87.5 (81.3 − 93.8)	89.4 (8.2)	87.5 (84.4 − 93.8)	0.290
Core	86.8 (4.7)	87.5 (84.4 − 89.6)	87.9 (4.1)	88.5 (85.9 − 89.6)	0.143
Treatment	90.3 (8.9)	92.5 (90 − 95)	92.3 (4.7)	92.5 (90 − 95)	0.744
Total FERTIQOL score	87.8 (4.6)	89 (86 − 91.2)	89.2 (3.3)	89.7 (87.5 − 91.2)	0.088
Trait	32.6 (5.8)	31 (28 − 36.5)	32 (5.9)	30.5 (27.5 − 34)	0.498
CES-D	8.8 (2.6)	8 (7 − 11)	8.6 (3.1)	8 (6.5 − 10)	0.495
FPI	55.3 (4.9)	54 (51 − 59)	54 (4.6)	53 (51 − 56)	0.130

[1] age groups were formed from divining the sample into two based on the median value.

insemination with my husband's or donor's sperm (β = -0.028; p = 0.018) had significantly lower scores in this dimension compared to those who were scheduled for a natural cycle of IVF treatment. University alumni had significantly greater scores in the "Environment" dimension (β = 0.011; p = 0.041), as did those who were scheduled for ICSI (β = 0.030; p = 0.046) compared to those scheduled for a natural cycle of IVF. More years of trying to conceive and higher FPI scores were significantly associated with lower "Tolerability" scores (β = -0.005; p = 0.050 and β = -0.002; p = 0.016 respectively). Furthermore, having experienced a miscarriage was significantly associated with lower "Core" scores (β = -0.012; p = 0.035). Being employed (β = -0.018; p = 0.042) and having higher FPI scores (β = -0.002; p = 0.022) were significantly associated with lower "Treatment" scores. Overall, greater age (β = 0.001; p = 0.043), higher educational level (β = 0.005; p = 0.041), and not having experienced a miscarriage (β = -0.007; p = 0.043) were significantly associated with better quality of life.

Discussion

The process of assisted reproduction can be a psychologically demanding period for couples that are confronted with infertility. Psychological disorders such as depression and anxiety are prevalent among infertile couples and studies have shown that women can be particularly vulnerable to these challenges.

The present study sought to examine the impact of infertility on the mental health of women undergoing IVF treatment. Results indicated that the FPI scale was significantly negatively correlated with the "Tolerability'' (−0.19*) and "Treatment'' (−0.18*) sub-scales of the FERTIQOL. This implies that the consequences of treatment as they are represented by "tolerability" and "treatment" had a potential negative relationship with the perceived-related stress of women undergoing IFV treatment. FPI scale was also significantly, positively correlated with CES-D (0.21*). Consequently, the positive correlation with depressive symptoms (CES-D) underscores the psychological toll of infertility issues. The multiple regression analysis provided valuable insights into factors influencing well-being in various dimensions. The association between getting pregnant after fertility treatment and improved emotional and mind–body well-being suggests the positive impact of successful treatments on these aspects.

Our findings also indicated that greater age, higher educational level, and not having experienced a miscarriage were significantly associated with better quality of life across multiple dimensions. These associations align with established trends observed in general populations, where higher education is often linked to better health outcomes through enhanced access to resources, greater health literacy, and better coping mechanisms [20–23]. However, it is important to consider how these general trends translate to the context of infertility, where additional stressors and challenges may influence these relationships uniquely. Similarly, older age is generally associated with greater emotional resilience and better coping abilities—research shows that stress management and emotional regulation would improve as people age [20,22]. Again, it is important to note that these demographic factors may have unique effects within infertility or might only reflect general patterns seen across normal populations, ensuring there is enough justification for their significance in this context to be investigated further.

The lack of significant differences between infertile people and the general population in these associations raises critical questions about their psychological meanings in the context of infertility. For example, while higher education might generally equip people with better problem-solving skills and more access to facilitating resources, whether education effectively buffers against stress specifically due to infertility requires further study [20,22]. Similarly, increasing age could bring along greater emotional maturity; on the other hand, it could specifically influence the perception of treatment outcomes for women

Table 5

Multiple regression analysis results with FERTI-QOL scores as dependent variables.

Dependent variable	Independent variables		β+	SE++	P
Emotional (R² = 0.04)	Ever got pregnant after fertility treatment	No (reference)			
		Yes	0.018	0.009	0.050
Mind-body (R² = 0.10)	Ever got pregnant after fertility treatment	No (reference)			
		Yes	0.030	0.009	0.002
Relation (R² = 0.03)	Ever you or your spouse had a fertility treatment	No (reference)			
		Yes	0.011	0.005	0.037
Social (R² = 0.06)	Married	No (reference)			
		Yes	0.019	0.008	0.016
	Current type of treatment	Natural IVF cycle (reference)			
		Insemination with my husband's or donor's sperm	−0.028	0.011	0.018
		In vitro fertilization with my husband's or donor's sperm	−0.021	0.012	0.073
		Intracytoplasmic sperm injection (ICSI)	−0.022	0.012	0.050
Environment (R² = 0.01)	Educational level	High school (reference)			
		University	0.011	0.005	0.041
	Current type of treatment	Natural cycle IVF (reference)			
		Insemination with my husband's or donor's sperm	0.019	0.017	0.280
		In vitro fertilization with my husband's or donor's sperm	0.022	0.018	0.225
		Intracytoplasmic sperm injection (ICSI)	0.030	0.014	0.046
Tolerability (R² = 0.06)	Years of trying		−0.005	0.003	0.050
	FPI		−0.002	0.001	0.016
Core (R² = 0.04)	Ever had a miscariage	No (reference)			
		Yes	−0.012	0.006	0.035
Treatment (R² = 0.07)	Employed	No (reference)			
		Yes	−0.018	0.009	0.042
	FPI		−0.002	0.001	0.022
Total FERTIQOL score (R² = 0.05)	Age		0.001	0.0005	0.043
	Educational level	High school (reference)			
		University	0.005	0.002	0.041
	Ever had a miscariage	No (reference)			
		Yes	−0.007	0.003	0.043

Note. Logarithmic transformation was used for these analyses + regression coefficient ++Standard Error.

undergoing assisted reproductive technologies. This is corroborated by the fact that older adults often show better emotional regulation and more constructive adaptive coping behaviors [20,22]. These considerations underscore the need for future research to determine whether demographic variables bear different interactions with psychological outcomes among infertile populations compared with normative populations. Such work may serve to elucidate whether infertility involves specific moderating effects or amplifies general trends. Future research can use longitudinal or comparative analyses in diverse populations to determine the extent to which these factors diverge between infertile populations and normative populations.

The association between getting pregnant after fertility treatment and improved emotional and mind–body well-being underscores the positive impact of successful treatments on these aspects. Marital status was linked to greater social well-being, highlighting the importance of social support during fertility challenges. However, experiencing a miscarriage and higher FPI scores were associated with lower scores in specific well-being dimensions, indicating the need for tailored support for individuals facing these challenges.

In addition, our study found that marital status was linked to greater social well-being, underscoring the importance of spousal support during fertility challenges. Nonetheless, the experience of a miscarriage and high FPI scores were related to lower scores in specific dimensions of well-being, pointing out the complex interrelationship between personal experiences and psychological health in assisted reproduction. These findings underline the need for tailoring psychological support in view of the unique and diverse needs of people and couples experiencing infertility. The overall results indicated that greater age, greater educational level and not having experienced a miscarriage were significantly associated with better quality of life.

The findings of this study align with previous research that has documented the psychological difficulties associated with infertility and IVF treatment. Moreover, as indicated in Table 2, nearly one-third of the women underwent insemination; however, the type of treatment did not significantly influence their psychosocial outcomes about IVF. While women undergoing IVF may have been more anxious during the period between oocyte pick-up and fertilization, that is, 16–18 h later, this was not reflected in the results. For instance, Greil et al. [24] found that infertility-related stress significantly impacts the mental health of women, corroborating the correlations observed in this study between the FPI scale and both depressive symptoms and treatment-related stress. Similarly, another study demonstrated that women undergoing fertility treatments often experience heightened levels of anxiety and depression, particularly when treatments are unsuccessful [25]. Conversely, our results diverge from studies such as De Berardis et al. [6], which suggested a more pervasive impact of infertility on mental health, potentially due to differences in study design, population characteristics, or measurement tools.

The negative correlations of the FPI scale with the "Tolerability" and "Treatment" subscales of the FertiQoL further illuminate how treatment-related stress shapes women's perceptions about their IVF experience. Such findings emphasize the need for treatment-related stress-alleviating interventions to improve general well-being during assisted reproduction. Moreover, the positive relationship of higher levels of education to good quality of life tallies with what was suggested in previous research by Smeenk et al. [8] that access to knowledge and resources reinforces coping strategies, in cases of infertility where such resources would help in managing the unique psychosocial stressors brought about by assisted reproduction. This corroborates findings by Martins et al. [26] when looking at marital status in relation to social well-being, proving that spousal support serves a protective purpose.

It is crucial to help the women undergoing this treatment to feel secure, without shame and resilient to continue this journey of assisted reproduction. For example, a recent *meta*-analysis of 19 qualitative research studies found that there is a personal reproductive trauma during IVF treatment as well as an impact on their relationships, and finally they feel failed by the healthcare system and society [27]. These issues from this large qualitative study on women's experiences during IVF treatment show that there are unmet needs both in a psychological level and in a healthcare system level. The latter *meta*-analysis additionally suggested that partner relationships either presented conflicts or grew more solid after the treatment. This was also reflected in our study, where participants who had undergone fertility treatment, either individually or with their spouse, demonstrated significantly higher scores in the 'Relation' dimension, suggesting a closer bond between the two.

The possible implementation of psycho-social interventions within the healthcare system might facilitate and aid women undergoing this procedure. For example, in a systematic review and *meta*-analysis, the authors claimed that psycho-social interventions for couples in treatment for infertility and particularly CBT, could be effective in reducing psychological distress as well as in in improving clinical pregnancy rates [28].

Strengths and Limitations

This study has several notable strengths. Firstly, its high statistical power ensures robust and reliable results, enhancing the study's credibility. Secondly, all women in the study were able to complete the IVF procedure, ensuring comprehensive data collection without the biases that might arise from incomplete treatment cycles. The study also employed a comprehensive approach, using well-validated instruments and including a diverse participant sample, which enhances the generalization of the findings. These strengths collectively contribute to the robustness and validity of the study's conclusions.

One limitation of this study is that most participants (75.8 %) had previously undergone fertility treatment elsewhere, potentially leading to reduced anxiety levels due to their familiarity with the procedure. This familiarity might have influenced their responses, introducing a bias in the study. Another limitation is the absence of follow-up for women who did not achieve pregnancy. This lack of follow-up prevented the exploration of their experiences and psychological impact after an unsuccessful IVF treatment, which could have provided valuable insights into the full spectrum of patient experiences. Future research should consider longitudinal designs to capture long-term psychological impacts.

Conclusion

The current results add to the emerging evidence by showing distinct relationships of age, educational level, and not having experienced a miscarriage with better quality of life in women undergoing IVF treatment. These results again point out the importance of considering both universal and context-specific factors in fertility care. Future studies will be required to point out the concrete psychological dynamics distinguishing infertile populations from norm groups, hence contributing to a deeper understanding of these relationships. Also, programs of information, education, and support will highly contribute to building resilience and promoting well-being among couples facing challenges of infertility in the course of assisted reproduction.

PRECIS: The current study propose a clear relationship between age, educational level and not having experienced a miscarriage which were associated with better quality of life in women with infertility.

CRediT authorship contribution statement

Aggeliki Moutzouroulia: Writing – review & editing, Writing – original draft, Visualization, Validation, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Zoi Asimakopoulou:** Validation, Software, Methodology, Investigation, Formal analysis, Data curation. **Chara Tzavara:** Validation, Software, Formal analysis, Data curation. **Konstantinos Asimakopoulos:** Writing – review & editing, Visualization, Validation, Supervision, Conceptualization. **Georgios Adonakis:** Visualization, Validation, Supervision, Conceptualization. **Apostolos Kaponis:** Writing – review & editing, Writing – original draft, Visualization, Validation, Methodology, Investigation, Data curation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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