Research article

Depressive symptoms and quality of life among women experiencing infertility: The moderating effect of perceived social support

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ARTICLE INFO	ABSTRACT
	Background: Infertility constitutes a leading reproductive health problem with profound psychosocial outcomes, including elevated depressive symptoms that compromise quality of life (QoL). While the literature has suggested social support as a protective psychological mechanism, its role in depressive symptoms and QoL among women with infertility remains underexplored. This study aimed to examine the moderating effect of perceived social support on the relationship between depressive symptoms and QoL among South Korean women experiencing infertility. *Methods:* Utilizing a cross-sectional design, this study analyzed a secondary dataset comprising 186 South Korean women with infertility. Participants were asked to complete the online survey which included the following scales: The Korean adaptation of the Patient Health Questionnaire-9 (PHQ-9), the Multidimensional Scale of Perceived Social Support (MSPSS), and the Fertility Quality of Life (FertiQoL) tool. Moderation analysis was conducted using Hayes' PROCESS Macro 4.1 Model 1. Statistically significant effects were identified if the confidence intervals did not include zero. Depression acted as the predictor, social support as the moderator, and QoL as the dependent variable. *Results:* Depressive symptoms exhibited a moderate negative relationship with fertility QoL (r = −.41, p < .001). When stratified by PHQ-9 severity, correlations between depressive symptoms, social support, and fertility QoL were only significant for the group with mild or no depressive symptoms. In this group, depressive symptoms negatively predicted fertility QoL (ß = −.92, p < .05), and a significant interaction effect between depressive symptom severity and social support on fertility QoL was observed (ß = −1.24, p < .05). *Conclusion:* Perceived social support has a moderating effect on the relationship between depressive symptoms and fertility QoL only for women with mild or no depressive symptoms. Consequently, nursing interventions for South Korean women with infertility should focus on emotional and social support, which include enhancing individual coping skills and facilitating community-based support networks. These can be implemented through specialized educational initiatives and expert-moderated online forums, aiming to enhance the emotional well-being of women experiencing infertility.

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1. Introduction

Infertility is defined as the inability to become pregnant within one year despite attempts to conceive or the inability to maintain a pregnancy that ends with the birth of a surviving child. It impacts 8–12 % of all couples worldwide [1]. Infertility is recognized as one of the leading reproductive health problems in the world. Globally, 48 million couples and 186 million individuals are affected by infertility [2]. According to the South Korean government, infertility is estimated to affect 10–17.2 % of all married South Korean women aged 19–49 years, and this number is expected to increase [3]. A wide range of factors can cause infertility; one-third of the causes are related to the uterus and ovaries, another one-third to the penis and testicles, and the remaining third involving both partners or being unexplained [4]. The most common causes of female infertility are ovulation disorders such as polycystic ovary syndrome (PCOS), thyroid disorders, and premature ovarian failure [5]. Men's infertility is often linked to poor-quality semen, which accounts for a significant proportion of cases, although many male infertility cases remain unexplained [5]. Risk factors for infertility include advanced age (especially for women in their late 30s or 40s), eating disorders, excessive alcohol use, smoking, tobacco use, exposure to environmental toxins, radiation or chemotherapy, sexually transmitted infections, obesity, and chronic diseases [4].

Korean society, rooted in Confucianism, values familial bonds, and childbearing and raising a child has traditionally been viewed as a natural and essential responsibility for women [6]. Infertility has a substantial impact on the psychological, social, and economic well-being of couples in South Korea. Although women in South Korea are more educated and have a higher rate of employment than in the past, gender equality in child-rearing and caregiving roles still lags behind Western Europe [7]. Women undergoing infertility treatment often experience significant psychological distress, including higher levels of depression and anxiety [8]. The social stigma associated with infertility exacerbates these mental health issues, leading to societal isolation, and reduced quality of life [6]. When infertility arises, it can lead to both family and individual difficulties. Even in cases where infertility stems from the man, the emotional and interpersonal challenges faced by women with infertility can be severe [6].

The South Korean government has implemented various policies for women with infertility, focusing on financial support for medical procedures [9], as the costs of infertility treatments are high, despite national health insurance coverage [9,10]. However, the emotional and psychological effects of infertility on women in South Korea have largely been neglected at the policy level. This underscores the need for comprehensive support systems, including psychological counseling and societal awareness, are crucial for mitigating these effects for South Korean women facing infertility.

Infertility is associated with adverse psychological outcomes. More than half of women with infertility experience depressive symptoms and 59 % have a high level of stress, which can lead to a poor quality of life (QoL) [11]. Depressive symptoms are an explanatory variable in predicting QoL [12], and infertility-related stress reduces the QoL of infertile women [13]. Among women experiencing infertility, high levels of depressive symptoms may threaten their QoL. In a study by Bakhtiyar et al. (2019), 180 women with infertility, the physical, mental, and environmental health scores in QoL were lower than those of a control group of 540 women with fertility [8]. Given the burden of depressive symptoms and stress among women with infertility, it is necessary to explore the factors affecting their QoL and strategies to improve it.

Social support refers to various types of assistance, including emotional and physical support from social networks, which may be formal or informal [14]. The literature highlights that social support systems serve as vital protective factors for individuals in stressful situations [14] and are positively associated with emotional health [15]. Studies have shown that social support influences the relationship between depressive symptoms and mental health or QoL among older adults with chronic disease [16]. In the context of infertility, social support significantly reduces depressive symptoms and enhances QoL [17–20]. Shin et al. [21] reported that social support positively affects in Korean women experiencing infertility, emphasizing its importance in alleviating depressive symptoms associated with infertility.

Social support encompasses the actual assistance provided by social networks, while perceived social support refers to an individual's subjective evaluation of how supportive their social environment is [18]. Findings of previous studies indicate that perceived social support can be more influential on psychological well-being and life satisfaction than actual support because it shapes emotional responses and coping mechanisms [18,22]. Recent studies have demonstrated that perceived social support can significantly influence the relationship between psychological distress and QoL. According to Wang et al. [24], perceived social support acted as a buffer against posttraumatic stress, thereby enhancing overall well-being. Similarly, Uchino et al. [25] identified that perceived social support mitigates the adverse effects of stress on mental health. For women with infertility, when social support is perceived as insufficient or inappropriate, negative effects of social support, such as increased stress and emotional distress, can occur [23]. Mismatched support or insensitive comments from well-meaning individuals can exacerbate feelings of inadequacy and pressure. Therefore, understanding the distinction between actual and perceived social support is crucial for effectively addressing the emotional needs of infertile individuals.

Perceived social support is known to be a factor involved in alleviating depressive symptoms [20,26]. However, previous studies have not investigated perceived social support as a factor that affects QoL and have mainly reported the levels of depressive symptoms and QoL in infertile women and analyzed the factors that affect QoL [12,27–29]. Iordachescu et al. [23] reported that perceived social support moderated the impact of infertility-related stress on QoL, with higher levels of support associated with better outcomes. These findings underscore the importance of considering perceived social support as a moderating variable in the relationship between depressive symptoms and QoL among women with infertility. However, there are few such studies on women in South Korea. Understanding the dynamics between depressive symptoms, perceived social support, and QoL is essential as cultural factors influence the perception and impact of perceived social support for South Korean women. Therefore, this study examines the moderating effect of perceived social support on the relationship between depressive symptoms and QoL among South Korean women experiencing

infertility.

2. Method

2.1. Design and participants

This secondary data analysis utilized online survey data to assess the QoL of South Korean women experiencing infertility. This research adhered to the guidelines of STROBE (the Strengthening the Reporting of Observational Studies in Epidemiology) to ensure that readers could comprehensively grasp and critically evaluate the study. Data collection for this study took place from July to August 2019. Participants were recruited from a large online community in South Korea, where members shared their experiences related to pregnancy and parenthood. The sample size was determined using G Power 3.1, resulting in a requirement of 163–181 respondents. Although a total of 191 participants completed the survey, we excluded five individuals who had children, as they failed to meet the specified inclusion criteria. A total of 186 women participated in the study. In the primary study, permission was sought and granted from the online community administrators to recruit participants. Subsequently, an advertisement containing a survey link and informed consent information was posted. The informed consent ensured that respondents understood the study's purpose and their rights, in accordance with ethical research principles.

In the parent study [21], women diagnosed with primary infertility by an obstetrician were invited to participate. Women were eligible if they were ≥19 years, had not given birth, and had received treatment for infertility more than once. The exclusion criterion was current pregnancy at the time of the survey. Data were collected after the participants had received infertility treatment. This secondary analysis was reviewed and exempted by Ewha Womans University (#202206-0011-01). The participants' mean age was 34 years (SD = 3.75), and the mean length of marriage was 43.37 months (SD = 24.61). Most participants (79.6 %) were employed, and most women (72.1 %) had less than 2 years of infertility treatment experience. Most of the participants (74.2 %) were university or college graduates. The most common reason for infertility was unknown, with 29.6 % attributed to female factors, and less than 10 % resulting from combined factors involving both partners. Nearly half of the participants were undergoing IVF treatment. The participants were categorized into two groups: one group exhibiting no or mild symptoms of depression, and the other group with depression (displaying moderate to severe symptoms of depression), as determined by their scores on the depressive symptoms assessment. A total of 186 participants from the primary study were included in the secondary data analysis.

2.2. Measures

2.2.1. General characteristics

In the parent study, participants provided sociodemographic data including their age, partner's age, marriage duration, education level, occupation, household income, and religion. Additionally, following information was collected: pregnancy and abortion history, reasons for infertility, duration since infertility diagnosis, types and recent treatments received, treatment cost burden, and daily life disruptions due to infertility treatment using fixed-choice items.

2.2.2. Depressive symptoms

The validated Korean version of the Patient Health Questionnaire-9 (PHQ-9) [30] was used to assess the severity of depressive symptoms. Participants reported how often they were bothered by problems such as "feeling down, depressed, or hopeless" using a scale from 0 (not at all) to 3 (nearly every day). The total score ranged from 0 to 27: a total score greater than 10 indicated a moderate depressive disorder that required clinical evaluation [31]. In this study, women with a PHQ-9 score of 10 or higher were considered to have depression (moderate to severe depressive symptoms), while women with a PHQ-9 score of less than 10 were considered to have mild or no depressive symptoms. Cronbach's alpha for the Korean version of the PHQ-9 was .88, and that for the present study was .89.

2.2.3. Perceived social support

The validated Korean version of the Multidimensional Scale of Perceived Social Support (MSPSS) [32] was used to assess perceived social support. Participants reported the perceived adequacy of social support from family, friends, and significant others on a scale ranging from 1 (very strongly disagree) to 5 (very strongly agree). The total score ranged from 12 to 84: the higher the score, the greater the perceived social support. Cronbach's alpha for the Korean version of the MSPSS was .89, and that for the present study was 0.94.

2.2.4. Fertility Quality of life

The Korean version of the Fertility Quality of Life (FertiQoL) scale [33] was used to assess the participants' QoL related to fertility problems. The original FertiQoL scale consists of 36 items to assess the impact of fertility problems on QoL: two items of overall life and physical wellness; 24 items of mind-body, emotional, social, and relational quality ("Core FertiQoL"); and 12 items of treatment environments and tolerability of treatment ("Treatment FertiQoL"). Participants rated the FertiQoL items on a 5-point Likert-type scale, and higher scores were associated with higher fertility-related QoL. The present study used only the 24-items from the Core FertiQoL subscale. The total score of the 24-item Core FertiQoL scale ranged from 0 to 100. The Cronbach's alpha coefficient of the Korean version of the FertiQoL with 24 items was 0.90 in this study. This article uses QoL to describe the FertiQoL.

2.2.5. Statistical analysis

Data were analyzed using SPSS software (version 27.0; IBM Corporation, Armonk, NY, USA). Descriptive statistics, including

means, standard deviation (SD), and ranges were computed to summarize participants' characteristics and survey scores. Participants were classified into groups based on depressive symptoms, resulting in a group with depression and a group with no or mild depressive symptoms, with a PHQ9 score of 10 as the cutoff [30]. Pearson's correlation coefficients were calculated to examine the bivariate relationships between depressive symptoms, perceived social support, and QoL. All statistical tests were two-sided ($p = 0.05$).

The moderating effect of perceived social support on the relationship between depressive symptoms and QoL was analyzed for the entire sample and for groups stratified by depressive symptoms. The potential moderating effect of perceived social support on the depression–QoL relationship was evaluated using SPSS PROCESS Macro 4.1 developed by Hayes [34]. Hayes' Model 1 was used to analyze moderation. In this analysis, effects were assessed using bias-corrected bootstrap confidence intervals (CIs). A 95 % bias-corrected CI was generated using bootstrapping (random sampling with replacement) with 5000 resamples. If the upper and lower bounds of the bias-corrected 95 % CI did not include zero, the indirect effect was considered significant. To evaluate the moderation effect, the following relationships were considered significant: (1) direct effect of the predictor on the dependent variable, (2) direct effect of the moderator on the dependent variable, and (3) direct interaction effect (predictor × moderator) on the dependent variable. Depression was the predictor, perceived social support was the moderator, and QoL was the dependent variable.

3. Results

3.1. Characteristics of participants

Of the 186 participants, 87 were classified into the mild or no depressive symptoms group and 99 into the moderate to severe depression group (Table 1). The average age of the participants was 33.9 years in the group with mild or no depressive symptoms and 34.2 years in the group with depression. No statistical differences in age, monthly household income, and time from diagnosis of infertility to the present between groups were observed, but statistically significant differences were found in the cost burden of treatment ($p < .001$) and degree of daily life inhibition ($p < .001$) with burdens higher in those with depression. The degree of daily life inhibition was measured by participants' self-reported perceptions of how their condition and treatment affected their ability to perform daily activities.

3.2. Depressive symptoms, fertility quality of life, and perceived social support

The mean score for depressive symptoms in all groups was 10.82 (SD = 6.02) in the parent study [21]. The mean score for depressive symptoms using the PHQ-9 was 5.53 (SD = 2.95) in the group with no or mild depressive symptoms and 15.42 (SD = 3.78) in the group with depression (Table 2). Among participants in the group with no or mild depressive symptoms, the mean perceived social support was 4.05 (SD = 0.77), and the mean fertility QoL was 60.99 (SD = 11.22). A statistically significant difference was observed in the PHQ-9, Fertility QoL, and MSPSS scores between the group with no or mild depressive symptoms and that with depressive symptoms ($p < .001$).

3.3. Relationships among depressive symptoms, fertility quality of life, and perceived social support

Table 3 presents a correlation matrix for the study variables. Statistically significant correlations between depressive symptoms, fertility QoL, and perceived social support were observed in the entire sample (n = 186). Depressive symptoms had a moderate

Table 1
Characteristics of participants (N = 186).

Characteristics	Group with mild or no depressive symptoms (n = 87)	Group with depression (n = 99)	x^2 or Fisher's exact/t	p
	n(%) or Mean ± SD	n(%) or Mean ± SD		
Age (years)	33.85 ± 3.97	34.15 ± 3.56	−0.55	0.59
Monthly household income (KRW)				
<4,000,000	27 (24.5)	28 (15.0)	1.78	0.62
4,000,000–6,000,000	35 (18.8)	49 (26.3)		
>6,000,000	25 (13.4)	22 (11.8)		
Time from diagnosis of infertility to the present (years)				
<1	32 (17.2)	36 (19.4)	6.65	0.16
1–2	34 (18.3)	32 (17.2)		
2–4	17 (9.1)	22 (11.8)		
≥4	4 (2.2)	9 (4.8)		
Cost burden of treatment				
Not at all	11 (5.9)	7 (3.8)	17.58	<.001
A little burdensome	50 (26.9)	32 (17.2)		
Very burdensome	26 (14.0)	60 (32.3)		
Degree of daily life inhibition				
Not at all	9 (4.8)	4 (2.2)	19.32	<.001
A little bit	53 (28.5)	35 (18.8)		
Very much	25 (13.4)	60 (32.3)		

Table 2

Degree of depressive symptoms, fertility quality of life, and perceived social support among participants by depression status.

Variables	Group with no or mild depressive symptoms (n = 87)		Group with depression (n = 99)		t(p)
	Mean (SD)	Range	Mean (SD)	Range	
PHQ-9	5.53 (2.95)	0–9	15.42 (3.78)	10–27	−19.73(<.001)
Fertility QoL	60.99 (11.22)	39.17–100.00	52.71 (11.14)	30.83–85.00	5.04(<.001)
MSPSS	4.05 (0.77)	1.58–5	3.39 (0.82)	1.17–5.00	5.64(<.001)

Note. SD: standard deviation, PHQ-9: Patient Health Questionnaire-9, MSPSS: Multidimensional Scale of Perceived Social Support, FertiQoL: Fertility Quality of Life.

negative relationship with fertility QoL (r = −.41, p < .001). After stratifying the sample by PHQ-9 scores, among participants with no or mild depressive symptoms, depressive symptoms were associated with both fertility QoL (r = −.41, p < .001) and perceived social support (r = −.28, p = .01). However, in the depression group, no statistically significant correlations were identified between the variables.

3.4. Moderating effect of perceived social support

Table 4 presents the findings of the moderating analysis to examine whether perceived social support moderate the relationship between depressive symptoms and QoL. After stratifying participants into groups by severity of depressive symptoms, the moderating effect analysis was conducted for the whole sample, for the group with mild or no depressive symptoms (PHQ-9 score less than 10), and for the group with depression (PHQ-9 score of 10 or more). Moderation analyses for the entire sample and the group with depression were not significant, and the findings are not reported here. Among participants in the group with mild or no depressive symptoms, depressive symptom severity was a significant negative predictor of fertility QoL (ß = −.92, p < .05) for depressive symptoms. Depressive symptom severity was found to be an independent variable, explaining 37 % of the variance in fertility QoL. In addition, the interaction effect of depressive symptoms severity and perceived social support was significant on fertility QoL (ß = −1.24, p < .05).

The Beta coefficients of depression symptom severity showed a significant and negative relationship with fertility QoL when perceived social support was one standard deviation (SD) above the mean and at the mean (Table 5). These findings indicate that the negative effect of depressive symptoms on fertility QoL decreases as the level of perceived social support increases. The results showed the moderating effect of perceived social support in the relationship between depressive symptoms and QoL only in women who were experiencing no or mild depressive symptoms.

4. Discussion

We examined the moderating effect of perceived social support on the relationship between depressive symptoms and QoL among women with infertility. Perceived social support among infertile women moderated the relationship between depressive symptoms and fertility QoL in groups with mild or no depressive symptoms. In this group, the negative effect of depressive symptoms on fertility QoL decreased as perceived social support increased. This suggests that perceived social support can play a buffering role, mitigating the adverse impact of depressive symptoms on fertility QoL for these women. In contrast, no significant association was observed between depressive symptoms, fertility QoL, and perceived social support among women in the group with moderate to severe depression or in the sample as a whole. This discrepancy may be due to the overwhelming nature of depression, which could overpower the protective effects of perceived social support. For women experiencing moderate to severe depression, their depressive symptoms may be too great for perceived social support alone to significantly impact their QoL.

The findings of this study show perceived social support from friends, families, or other significant persons may protect South Korean women with infertility who have no or mild depressive symptoms from the impact of depressive symptoms on their QoL. Given the limited number or previous studies analyzing the moderating effects of perceived social support on infertile women, it was challenging to directly compare our findings. This study's finding underscores the importance of perceived social support for women with infertility in South Korea. Providing appropriate social support can be particularly vital in a culture such as that of South Korea,

Table 3

The relationships among depressive symptoms, fertility quality of life, and perceived social support.

Subjects	variables	Depressive symptoms	Fertility quality of life	Perceived Social support
Total sample	Depressive symptoms	1		
	Fertility quality of life	−0.412 (<.001) ***	1	
	Perceived social support	−0.391 (<.001) ***	0.260 (<.001) ***	1
Group with no or mild depressive symptoms (n = 87)	Depressive symptoms	1		
	Fertility quality of life	−0.406*** (<.001)	1	
	Perceived social support	−0.277 (.009)**	0.206 (0.056)	1
Group with depression (n = 99)	Depressive symptoms	1		
	Fertility quality of life	−0.120 (.238)	1	
	Perceived social support	−0.059 (.564)	0.097 (.339)	1

Table 4

Moderating effects of perceived social support in relationships between depressive symptoms and fertility quality of life in a group with mild or no depressive symptoms.

Categories	ß	S.E.	T	LLCI	ULCI
Constant	54.491	2.092	26.042***	50.326	58.655
Depressive symptoms	−0.923	0.375	−2.461*	−1.669	−0.177
Perceived social support	0.108	1.423	0.076	−2.725	2.941
Depressive symptoms[a] Perceived social support	−1.244	0.480	−2.590*	−2.201	−0.288
	$F = 6.666***, R^2 = 0.371, \Delta R^2 = 0.005*$				

*$p < .05$, **$p < .01$, ***$p < .001$.

S.E. = Standard Error, LLCI = boot Low Limit Confidence Interval of 95 %, ULCI = boot Upper Limit Confidence Interval of 95 %.

[a] interaction effect.

Table 5

Effect of depressive symptoms on fertility quality of life.

Perceived social support	effect	S.E.	t	LLCI	ULCI
−.870 (one SD below mean)	0.159	0.615	0.259	−1.064	1.382
.204 (at the mean)	−1.177	0.368	−3.196**	−1.909	−0.444
.784 (one SD above mean)	−1.900	0.476	−43.992***	−2.845	−0.952

*$p < .05$, **$p < .01$, ***$p < .001$.

SD = Standard deviation, S.E. = Standard Error, LLCI = boot Low Limit Confidence Interval of 95 %, ULCI = boot Upper Limit Confidence Interval of 95 %.

where societal expectations place significant pressure on women to fulfill traditional roles of childbirth and child-rearing [3,6]. The inability to meet these expectations can lead to negative emotions and social isolation. For South Korean women with infertility, limited social support from spouses, family, friends, or health professionals can exacerbate self-stigma, leading to negative self-perceptions and reduced self-efficacy [35]. This highlights the importance of early intervention and enhancement of social networks for women with infertility who are experiencing mild depressive symptoms, as these can be crucial in improving their QoL.

One intervention to consider implementing is teaching women with infertility coping behaviors. Studies indicate most infertile women use avoidant coping characterized by disengaging behavior [36,37], joke about their infertility, and hide their fertility [35,38]. These negative coping strategies may lead to more severe depressive symptoms in women experiencing infertility [35,38]. In contrast, women who receive adequate social support are more likely to actively seek help for physical and mental health and relational issues [39]. Women with adequate social support tend to have active confrontational and meaning-based coping strategies, which result in them actively seeking information or emotional support to overcome difficulties surrounding infertility [38,40]. Therefore, fostering strong social support networks and encouraging positive coping strategies can play a pivotal role in mitigating the psychological impact of infertility.

While perceived social support had a moderating effect on the relationship between depression and QoL among women with no or mild depressive symptoms, it did not affect the relationship between depression and QoL among women with moderate to severe depression in this study. Our findings suggest that perceived social support alone is inadequate for altering the depression–QoL relationship in women with moderate or severe depressive symptoms. These women likely require targeted interventions to specifically address their depressive symptoms. Given that more than 50 % of the study participants exhibited moderate to severe depressive symptoms, it is crucial to carefully screen women with infertility for depression so that they can receive appropriate treatments.

Our findings indicate that perceived social support significantly moderates the relationship between depressive symptoms and fertility QoL for women with mild or no depressive symptoms. This suggests that enhancing social support can mitigate the negative impact of depressive symptoms on the QoL in these women. In particular, helping individual women develop positive coping strategies, such as positive reframing, acceptance, and venting, may be beneficial. For this, customized counseling from health professionals with expertise in infertility care is crucial. These interventions should consider individual coping behaviors [35,40,41], the stage of infertility treatment [38,42], and previous experience with unsuccessful attempts for conception. Additionally, other useful strategies should be considered, such as group interventions [43] and public awareness campaigns about the natural causes of infertility and avoidance of stigma to women with infertility [44].

The results of this study should be interpreted and applied cautiously due to the following limitations. First, this study is the secondary analysis research design. The secondary analysis is restricted by the original study's data, which was not designed to investigate the moderating effect of perceived social support on the relationship between depression and quality of life (QoL). Furthermore, the lack of comprehensive financial information in the parent study, which could influence depression and QoL, prevents it from being examined in this analysis. As a result, some relevant variables may have been omitted, potentially restricting the comprehensiveness of the analysis. Also, the cross-sectional design of the original study involved collecting data at a single point in time. This temporal limitation prevents the observation of change over time and hinders the ability to determine the directionality of the relationship between perceived social support, depression, and QoL. Employing a longitudinal study design would be necessary to address these dynamic aspects. Next, the measures used in the original study were self-reported via online survey, which can introduce biases such as social desirability and recall bias. These biases might affect the accuracy and reliability of the reported levels of

depression, perceived social support, and QoL. Future research should consider incorporating objective and validated multi-method measures to enhance the robustness of the findings. Lastly, the measure used to capture perceived social support in this study, MSPSS, did not include items about support from healthcare professionals. For women undergoing continuous infertility treatments, the healthcare providers they regularly encounter can become significant sources of support. Therefore, future research should investigate the impact of how these women perceive the support provided by healthcare professionals.

5. Conclusion

This study demonstrates the significant moderating effect of perceived social support on the relationship between depressive symptoms and QoL in infertile women with no or mild depressive symptoms. More than 53 % of the women in this study had moderate-to-severe depressive symptoms. Therefore, women with infertility should be screened for depression, and those with mild or no depression symptoms will likely benefit from improved perceived social support. Nurses and other health care providers should promote interventions to enhance perceived social support. Interventions could include teaching personal coping mechanisms and enabling spouses, families, friends, and society to provide adequate support through education. Healthcare providers can also offer support in hospitals and online settings by developing expert-moderated online forums. This approach can enhance perceived social support and thereby mitigate the impact of depressive symptoms on QoL. Further studies are needed to evaluate the role of health professionals in providing social support to women with infertility and to determine which interventions aimed at increasing perceived social support are most impactful.

CRediT authorship contribution statement

Minjeong Jo: Writing – review & editing, Writing – original draft, Methodology, Data curation, Conceptualization. **Hyewon Shin:** Writing – review & editing, Writing – original draft, Validation, Supervision, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Conceptualization. **Angela Kabbe:** Writing – review & editing, Writing – original draft, Investigation, Formal analysis. **Shin-Jeong Kim:** Writing – review & editing, Resources, Investigation.

Ethics approval and consent to participate

The current study, utilizing secondary data, was reviewed and exempted by Ewha Womans University (#202206-0011-01).

Consent for publication

Not applicable.

Availability of data and materials

The data will be made available on request.

Ethics statement

We declare that this study has not been published and is not under consideration for publication elsewhere. All authors have approved the article, and we confirm that, once accepted, it will not be submitted to any other journal.

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.

List of abbreviations:

QoL = quality of life.
PHQ-9 = Patient Health Questionnaire-9.
MSPSS = Multidimensional Scale of Perceived Social Support
FertiQoL = Fertility Quality of Life.
SD = standard deviation.
CI = confidence interval.

References

[1] M. Vander Borght, C. Wyns, Fertility and infertility: definition and epidemiology, Clin. Biochem. 62 (2018) 2–10, https://doi.org/10.1016/J. CLINBIOCHEM.2018.03.012.

[2] World Health Organization, 1 in 6 People Globally Affected by Infertility, WHO, 2023. https://www.who.int/news/item/04-04-2023-1-in-6-people-globally-affected-by-infertility. (Accessed 10 November 2023).

[3] J. Park, J.Y. Lim, E. Kim, S.J. Byoun, S.-Y. Lee, I. Chang, S. Cho, S. Choi, H. Lee, J.E. Song, The 2021 national family and fertility, Survey (2021), https://doi.org/10.23060/kihasa.a.2021.50.

[4] Cleveland clinic, infertility, Cleveland clinic. https://my.clevelandclinic.org/health/diseases/16083-infertility, 2023. (Accessed 22 July 2024).

[5] NHS, Infertility, Cause, the national health service. https://www.nhs.uk/conditions/infertility/causes/, 2023. (Accessed 22 July 2024).

[6] R.H. Hwang, Self-esteem, body image and factors influencing on depression of infertile women, Journal of Digital Convergence 15 (2017) 537–549, https://doi.org/10.14400/JDC.2017.15.10.537.

[7] K. Schwab, R. Samans, S. Zahidi, T. Leopold, V. Ratcheva, R. Hausmann, Insight Report: the Global Gender Gap Report 2017, 2017. Geneva.

[8] K. Bakhtiyar, R. Beiranvand, A. Ardalan, F. Changaee, M. Almasian, A. Badrizadeh, F. Bastami, F. Ebrahimzadeh, An investigation of the effects of infertility on Women's quality of life: a case-control study, BMC Wom. Health 19 (2019) 114, https://doi.org/10.1186/s12905-019-0805-3.

[9] Medical Korea, Infertility-ART: Trend of the number of patients by year of infertility treatment (2024).

[10] S.R. Yang, J.H. Yeo, Effects of irrational parenthood cognition, post traumatic stress disorder and spousal support on quality of life of infertile women, Korean J Women Health Nurs 23 (2017) 145–153, https://doi.org/10.4069/kjwhn.2017.23.2.145.

[11] K.L. Rooney, A.D. Domar, The relationship between stress and infertility, Dialogues Clin. Neurosci. 20 (2018) 41–47, https://doi.org/10.31887/DCNS.2018.20.1/klrooney.

[12] Y.J. Jung, H.Y. Kim, Factors influencing infertility-related quality of life in women undergoing assisted reproductive techniques: focusing on depression and resilience, Korean J Women Health Nurs 23 (2017) 117–125, https://doi.org/10.4069/kjwhn.2017.23.2.117.

[13] G. Casu, P. Gremigni, Screening for infertility-related stress at the time of initial infertility consultation: psychometric properties of a brief measure, J. Adv. Nurs. 72 (2016) 693–706, https://doi.org/10.1111/jan.12830.

[14] H. Zhang, Q. Zhao, P. Cao, G. Ren, Resilience and quality of life: exploring the mediator role of social support in patients with breast cancer, Med. Sci. Mon. Int. Med. J. Exp. Clin. Res. 23 (2017) 5969–5979, https://doi.org/10.12659/MSM.907730.

[15] O. Harasemiw, N. Newall, C.S. Mackenzie, S. Shooshtari, V. Menec, Is the association between social network types, depressive symptoms and life satisfaction mediated by the perceived availability of social support? A cross-sectional analysis using the Canadian Longitudinal Study on Aging, Aging Ment. Health 23 (2019) 1413–1422.

[16] L.N. Kong, P. Hu, Y. Yao, Q.H. Zhao, Social support as a mediator between depression and quality of life in Chinese community-dwelling older adults with chronic disease, Geriatr. Nurs. 40 (2019) 252–256, https://doi.org/10.1016/J.GERINURSE.2018.10.014.

[17] S.S. Bhamani, N. Zahid, W. Zahid, S. Farooq, S. Sachwani, M. Chapman, N. Asad, Association of depression and resilience with fertility quality of life among patients presenting to the infertility centre for treatment in Karachi, Pakistan, BMC Publ. Health 20 (2020), https://doi.org/10.1186/s12889-020-09706-1.

[18] X. Chu, Y. Geng, R. Zhang, W. Guo, Perceived social support and life satisfaction in infertile women undergoing treatment: a moderated mediation Model, Front. Psychol. 12 (2021), https://doi.org/10.3389/fpsyg.2021.651612.

[19] K.R. Steuber, A. High, Disclosure strategies, social support, and quality of life in infertile women, Hum. Reprod. 30 (2015) 1635–1642, https://doi.org/10.1093/humrep/dev093.

[20] A.A. Abadsa, M. Tal-Yazori, The social support as a mediator between the infertility stress and depression among infertile female in the Gaza Strip, IUG Journal of Educational and Psychological Sciences Peer-Reviewed Journal of Islamic University-Gaza 25 (2017) 14–15.

[21] H. Shin, J. Lee, S.J. Kim, M. Jo, Associations of symptoms of depression, social support, and quality of life Among Korean women who experience infertility, J. Obstet. Gynecol. Neonatal Nurs. 50 (2021) e1–e12, https://doi.org/10.1016/j.jogn.2021.06.007.

[22] A. Ozturk, Y.A. Aba, B.A. Sik, The relationship between stigma, perceived social support and depression in infertile Turkish women undergoing in vitro fertilization-embryo transfer, Arch. Psychiatr. Nurs. 35 (2021) 434–440, https://doi.org/10.1016/j.apnu.2021.05.009.

[23] D.A. Iordachescu, C. Gica, E.O. Vladislav, A.M. Panaitescu, G. Peltecu, M.E. Furtuna, N. Gica, Emotional disorders, marital adaptation and the moderating role of social support for couples under treatment for infertility, Ginekol. Pol. 92 (2021) 98–104, https://doi.org/10.5603/GP.a2020.0173.

[24] Y. Wang, M.C. Chung, N. Wang, X. Yu, J. Kenardy, Social support and posttraumatic stress disorder: a meta-analysis of longitudinal studies, Clin. Psychol. Rev. 85 (2021), https://doi.org/10.1016/j.cpr.2021.101998.

[25] B.N. Uchino, K. Bowen, R. Kent de Grey, J. Mikel, E.B. Fisher, Social support and physical health: models, mechanisms, and opportunities, in: E.B. Fisher, L. D. Cameron, A.J. Christensen, U. Ehlert, Y. Guo, B. Oldenburg, F.J. Snoek (Eds.), Principles and Concepts of Behavioral Medicine: A Global Handbook, Springer New York, New York, NY, 2018, pp. 341–372, https://doi.org/10.1007/978-0-387-93826-4_12.

[26] H. Li, J. Lei, F. Xu, C. Yan, M. Guimerans, H. Xing, Y. Sun, D. Zhang, A study of sociocultural factors on depression in Chinese infertile women from Hunan Province, J. Psychosom. Obstet. Gynecol. 38 (2017) 12–20, https://doi.org/10.1080/0167482X.2016.1265500.

[27] Y.M. Kim, J.-H. Nho, Factors influencing infertility-related quality of life in infertile women, Korean J Women Health Nurs 26 (2020) 49–60, https://doi.org/10.4069/kjwhn.2020.03.08.

[28] A. Namdar, M.M. Naghizadeh, M. Zamani, F. Yaghmaei, M.H. Sameni, Quality of life and general health of infertile women, Health Qual Life Outcomes 15 (2017), https://doi.org/10.1186/s12955-017-0712-y.

[29] Y. Ni, C. Tong, L. Huang, W. Zhou, A. Zhang, The analysis of fertility quality of life and the influencing factors of patients with repeated implantation failure, Health Qual Life Outcomes 19 (2021), https://doi.org/10.1186/s12955-021-01666-3.

[30] C. Han, S.A. Jo, J.H. Kwak, C.U. Pae, D. Steffens, I. Jo, M.H. Park, Validation of the patient health Questionnaire-9 Korean version in the elderly population: the ansan geriatric study, Compr. Psychiatr. 29 (2008) 218–223, https://doi.org/10.1016/j.comppsych.2007.08.006.

[31] K. Kroenke, R.L. Spitzer, J.B. Williams, The PHQ-9: validity of a brief depression severity measure, J. Gen. Intern. Med. 16 (2001) 606–613, https://doi.org/10.1046/j.1525-1497.2001.016009606.x.

[32] J.S. Shin, Y.B. Lee, The effects of social supports on psychosocial well-being of the unemployed, Korean Journal of Social Welfare 37 (1999) 241–269.

[33] J. Boivin, J. Takefman, A. Braverman, The fertility quality of life (FertiQoL) tool: development and general psychometric properties, Hum. Reprod. 26 (2011) 2084–2091, https://doi.org/10.1093/humrep/der171.

[34] A.F. Hayes, Introduction to Mediation, Moderation, and Conditional Process Analysis: A Regression-Based Approach, Guilford Publications, 2017.

[35] M. Taebi, N. Kariman, A. Montazeri, H.A. Majd, Infertility stigma: a qualitative study on feelings and experiences of infertile women, Int J Fertil Steril 15 (2021) 189–196, https://doi.org/10.22074/ijfs.2021.139093.1039.

[36] S.U.N. Hassan, A. Zahra, N. Parveen, N. Iqbal, S. Mumtaz, A. Batool, Quality of infertility care services and emotional health of South Asian women, Psychol. Res. Behav. Manag. 15 (2022) 1131–1146, https://doi.org/10.2147/PRBM.S357301.

[37] A. Swift, P. Reis, M. Swanson, Infertility stress, cortisol, coping, and quality of life in U.S. women who undergo infertility treatments, J. Obstet. Gynecol. Neonatal Nurs. 50 (2021) 275–288, https://doi.org/10.1016/j.jogn.2020.12.004.

[38] F. Andrei, P. Salvatori, L. Cipriani, G. Damiano, M. Dirodi, E. Trombini, N. Rossi, E. Porcu, Self-efficacy, coping strategies and quality of life in women and men requiring assisted reproductive technology treatments for anatomical or non-anatomical infertility, Eur. J. Obstet. Gynecol. Reprod. Biol. 264 (2021) 241–246, https://doi.org/10.1016/j.ejogrb.2021.07.027.

[39] J. Boivin, R. Vassena, M. Costa, E. Vegni, M. Dixon, B. Collura, M. Markert, C. Samuelsen, J. Guiglotto, E. Roitmann, A. Domar, Tailored support may reduce mental and relational impact of infertility on infertile patients and partners, Reprod. Biomed. Online 44 (2022) 1045–1054, https://doi.org/10.1016/j.rbmo.2022.01.015.

[40] L.Q. Truong, T.B. Luong, T.H. Tran, N.H. Dang, L.H. Nguyen, T.T. Nguyen, P.T.H. Nguyen, Infertility-related stress, social support, and coping of women experiencing infertility in Vietnam, Health Psychol. Rep. 10 (2022) 129–138, https://doi.org/10.5114/hpr.2022.113437.

[41] A. Galhardo, J. Alves, M. Moura-Ramos, M. Cunha, Infertility-related stress and depressive symptoms–the role of experiential avoidance: a cross-sectional study, J. Reprod. Infant Psychol. 38 (2020) 139–150, https://doi.org/10.1080/02646838.2019.1612046.

[42] T. Kato, M. Sampei, K. Saito, N. Morisaki, K.Y. Urayama, Depressive symptoms, anxiety, and quality of life of Japanese women at initiation of ART treatment, Sci. Rep. 11 (2021), https://doi.org/10.1038/s41598-021-87057-6.

[43] F. Yazdani, F. Elyasi, S. Peyvandi, M. Moosazadeh, K. Samadaee Galekolaee, F. Kalantari, Z. Rahmani, Z. Hamzehgardeshi, Counseling-supportive interventions to decrease infertile women's perceived stress, A systematic review, Electron Physician 9 (2017) 4694–4702, https://doi.org/10.19082/4694.

[44] D. Ofosu-Budu, V. Hanninen, Living as an infertile woman: the case of southern and northern Ghana, Reprod. Health 17 (2020), https://doi.org/10.1186/s12978-020-00920-z.