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# Structural Equation Modeling of Infertility Stress Based on Cognitive Emotion Regulation, Mindfulness, Basic Psychological Needs mediated by Psychological Hardiness in infertile women and men

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## Abstract

**Introduction**: This study was conducted to evaluate structural patterns based on cognitive regulation of emotion, mindfulness, and basic psychological needs with the role of psychological Hardiness as a mediator of infertility stress in infertile men and women.

**Methods**: The method of the present study is descriptive-correlational modeling of structural equations. The statistical population includes all infertile men and women in Tehran. For this purpose, 200 women and 200 men with primary and secondary infertility diagnosed referring to infertility centers in Tehran in 2018 were selected by multi-stage random sampling. To collect the data, the Depression, Anxiety, Stress Scale (DASS), Cognitive Emotion Regulation questionnaire, Five Facet Mindfulness Questionnaire (FFMQ), Basic Needs Satisfaction in General Scale (BNSG-S) and Psychological Hardiness were used. Then, the data were analyzed using SPSS and Amoss software and confirmatory factor analysis and structural equation modeling.

**Results**: The results showed that all variables have a significant direct coefficient with the main dependent variable, but considering the significance of indirect and direct coefficients in the female model, it can be said that Hardiness mediates the relationship between these variables in detail. However, in the male model, the role of Hardiness mediation was not confirmed due to the lack of significant indirect coefficients.

**Conclusions**: According to the results of this study, according to the indirect effect of Hardiness on infertility stress, it can be said that not all people react properly to stressful conditions. Faced with different social situations, they feel more empowered and committed. They are confident that they will be able to fight and overcome various barriers to life by

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adopting the right methods and taking advantage of social relationships and support, so it is recommended that health teams be aware of these issues. Think of better measures to treat and improve the stress of these infertile people.
**Keywords**: Basic Psychological Needs, Cognitive Emotion Regulation, Infertility Stress, infertile men and women, Mindfulness, Psychological Hardiness,

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**Introduction**:

Infertility is one of the most complex life crises that pose a psychological threat and emotional stress (1). Couples trying to conceive will no doubt endure feelings of frustration and despair if the pregnancy does not go smoothly. In the event that the problems continue and the doctor diagnoses infertility for a man or a woman, this result can even lead to a decrease in the sense of femininity and masculinity. Fertility techniques are accepted therapies that are used to help people who experience infertility and have achieved good results. So, every year the number of babies born with these treatments is increasing. While the successful results of these methods have been confirmed (2), systematic studies show that there is still a lot of anxiety among infertile couples when using these treatments. Research also shows that psychological distress during pregnancy has a negative effect on treatment outcomes (3).

In the last two decades, infertility has increased by about 50 percent, so that one in six couples of childbearing age suffers from infertility (4). In the population of childbearing age between 9 to 15 percentages of them have experienced infertility (5) and 55% of infertile couples have requested treatment using assisted reproductive technology (6). This issue is known as an important issue in life that threatens the stability of individual and social relationships (5). The World Health Organization (WHO) has identified infertility as a health problem worldwide. An international study at the Institutes of Health in Belgium, France and the Netherlands found that infertility due to the severity of the stress among the list of 12 important events ranked fourth in stressful life experiences, the first three are the death of mother, father and infidelity (7).

Sabanegh and Agarwal (8) in their study concluded that infertility affects about 15 percent of all couples of childbearing age, about 50% of which are associated with mental disorders in men. A new study for assessing the prevalence of infertility found that 9 to 14 percent of American men of childbearing age (e.g., 15 to 44 years old) have infertility related problems (9). On the other hand, according to international interpretations, the prevalence of infertility is about 9 to 15 percent, of which 9 percent is related to current international infertility, while 10 to 15 percent is related to its lifelong prevalence in Western societies (5). In Iran, prevalence of primary infertility seems to be higher than the global average. The latest study conducted in Iran on infertility in a study by Akhundi, Kamali, Ranjbar, Shirzad and Shafeqhati (10) was

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conducted on 17,000 women aged 20 to 40 years. In this study, the rate of primary infertility was reported to be 20.2%, although not all reproductive age groups were studied and only primary infertility was obtained. In 2009, Vahidi reported an infertility rate of 24.9% in Iranian couples. Fisher (11) states that this difference between the statistics given about infertility is due to the difference between point prevalence data and lifelong prevalence and the difference between the definitions of infertility (primary, secondary, etc.) which can affect estimates.

On the other hand, researchers such as Wiweko , Anggraheni, Detri, and Lobis (12) believe that since infertility is a stressful event for couples, it is basically a very emotional phenomenon. One of the important dimensions of emotion is emotional cognitive regulation, which includes the regulation of emotional experiences through the use of cognitive components. As Garnefski, Kraaij and Spinhoven (13) point out, people use a variety of strategies when faced with stressful situations. Emotional cognitive regulation is a basic principle in initiating, evaluating and organizing adaptive behavior as well as preventing negative emotions and maladaptive behaviors (14). So that emotional cognitive regulation takes place in two forms, positive and negative. So if people are not able to manage it, it can be seen in the form of various pathological patterns such as psychological distress in the person. Emotional cognitive regulation involves actions by which individuals manage stressful situations or traumatic events. In this method, through emotional cognitive regulation strategies, they change information that is emotion-based (15). In other words, emotional cognitive regulation includes all cognitive styles that individuals use to increase, decrease, or maintain emotional experiences (16). Therefore, since research confirms that emotion regulation skills can play a role in mental health, it can also be an important factor in the hardiness of individuals (17). Hardiness is defined as a structure composed of three components: commitment, control, and challenge, which help manage stress by turning a stressful situation into an opportunity for growth. To turn stress into an opportunity, one must engage with the issue (commitment), try to influence the situation (control) and be ready to learn at all times, not complain about one's fate (challenge). Hardiness reflects mental health and in the background of research in this field is known as a shield against the adverse consequences of stress; therefore, it is consistent with positive psychology. The three components of hardiness are thought to affect the two basic mechanisms that promote a person's health and performance under stressful conditions. The first mechanism involves evaluating and perceiving stressful events with a positive outlook, so that they are viewed as enjoyable and interesting. The second mechanism is to place the stressful situation in a broader context, so that a deeper understanding of the problem is achieved and the requirements of the situation become apparent. This leads to more interventionist decision-making than avoidance, until the problem is resolved and there is no more stress (18).

Another variable that can affect infertility is the structure of mindfulness. Mindfulness is considered as a multidimensional structure that includes paying attention to (observing and expressing) the experiences of the current moment, naming it with words and doing it with awareness or refusing to start it automatically. Special features of attention is very important (19). Kabat-Zinn (20) one of the central founders of mindfulness defined mindfulness as “the

awareness that emerges through paying attention on purpose, in the present moment, and non-judgmentally to the unfolding of the experience moment by moment."

Bishop quotes Didona (19), they unanimously defined the definition of mindfulness: mindfulness is the personal control of attention that remains over instantaneous experience, thus allowing Increase recognition and understanding of mental events in the present time. In other words, in the last 25 to 30 years, Western medical sciences have paid much attention to the relationship between body and mind (21). Bishop, quoting Didona (19), came up with a unanimous definition of mindfulness: Mindfulness is the personal control of attention that rests on immediate experience, thus allowing increased recognition and understanding of mental events in the present time. In other words, in the last 25 to 30 years, Western medical sciences have paid much attention to the relationship between body and mind (21). According to Segal, Teasdale and Williams, The focus in mindfulness exercises is on the experiences that arise, while at the same time, the curiosity situation allows the person to see what is happening without falling into the trap of judgment or sudden reactions. They state that mindfulness is the opposite of automatic behaviors and unconscious actions and behaviors that are automatic. Therefore, according to the above, if a person can learn to be mindful, that is, to pay attention to the present purpose and moment, he can redirect the other areas of his mind, and this will help him to be aware and thus the desire to experience in him will be revived (23).

As mentioned, the experience of infertility for some people can even overshadow their whole life and affect their perception and experience of physical, mental, emotional and sexual well-being (24). Research has also shown that medical interventions to treat infertility cause psychological and social stress in a person's life. The aim of this study was to investigate the prediction of infertility stress based on cognitive emotion regulation, mindfulness, and basic psychological needs mediated by psychological hardiness in infertile men and women. Therefore, in light of the above, there is little research on cognitive emotion regulation, mindfulness, basic psychological needs, and infertility stress mediated by psychological hardiness among infertile men and women; so, this field still needs further research. This study pursues several multiple goals, including determining the relationship between cognitive emotion regulation and infertility stress, determining the relationship between mindfulness and infertility stress, determining the relationship between basic psychological needs and infertility stress, and determining the relationship between psychological hardiness and infertility stress, determining the mediating role of psychological hardiness in the relationship between cognitive emotion regulation, mindfulness, basic psychological needs and infertility stress.

**Method:**

The method of the present study is an advanced correlation design based on structural equation modeling. In this study, the variables of cognitive emotion regulation, mindfulness and basic psychological needs were considered as predictor variables, infertility stress variable as predicted variable and psychological hardiness variable as mediator variable. The statistical population of this study consists of all infertile men and women who had filed cases to treat infertility in infertility centers in Tehran in 2018. Participants were selected using multi-stage sampling method, according to inclusion and exclusion criteria. Inclusion criteria included

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diagnosis of primary infertility, complete consent to participate in the study and literacy, and exclusion criteria included diagnosis of major chronic physical and debilitating physical illness and disease, major psychiatric disorder, and use of psychiatric medications. Howitt and Cramer (25) have proposed a special solution for determining the sample size for studies using structural equation modeling. According to them, for each variable 20 to 40 people should be selected as a research sample. Considering that this study includes 5 variables, 40 people were selected as a sample group for each variable. Finally, 200 infertile women and 200 infertile men were selected as the sample group. The research sampling method of this research was multi-stage random sampling. So that infertility centers in Tehran were divided into 4 categories of centers north, south, east and west. Then, from each of these centers, two centers were randomly selected and a total of 8 centers were selected. Then, sampling was performed in medical centers. From the centers' files, all of which were coded, 400 files were randomly selected and questionnaires were administered to each individual. To evaluate the research variables, Depression, Anxiety, Stress Scale (1995), Cognitive Emotion Regulation Questionnaire (2001), Five-Facet Mindfulness Questionnaire (2006), Basic Needs Satisfaction in General Scale (2000) and Psychological Hardiness Scale (2003) were used, which are described in detail below.

**Depression, Anxiety, Stress Scale (DASS):** A set of three self-report scales to assess negative emotion states in depression, anxiety, and stress. An important application of this scale is to measure the severity of the main symptoms of depression, anxiety and stress. To complete the questionnaire, one must determine the status of a symptom during the past week. Because this scale can provide a comparison of symptom severity over different weeks, it can be used to assess treatment progress over time. Anthony, Billing, Cox, Enns, and Swinson (26) factor analysis the scale, and their findings again indicate the existence of three psychological factors: depression, anxiety, and stress. The results of this study showed that 68% of the total variance of the scale is measured by these three factors. The eigenvalues of stress, depression and anxiety in the study were 9.07, 2.89, 1.23 and alpha coefficient for these factors respectively was 0.97, 0.92 and 0.95. Also, the results of calculating the correlation between factors in the study of Anthony et al. (26) showed a correlation coefficient of 0.48 between the two factors of depression and stress, a correlation coefficient of 0.53 between anxiety and stress and a correlation coefficient of 0.28 between anxiety and depression. The validity and reliability of this questionnaire in Iran have been examined by Samani and Jokar (27). Cronbach's alpha coefficient was used to measure the internal consistency of the questionnaire, which was reported to be 0.85 for depression, 0.87 for stress and 0.75 for anxiety. The correlation coefficients of the scores of a number of participants were calculated twice with an interval of three weeks to assess the validity of the retest, which was 0.81 for the depression subscales, Stress 0.80, Anxiety 0.77; and the whole scale was reported to be 0.82 that these coefficients were significant at the level of 0.0001. The convergent and divergent validity of the questionnaire was also calculated through the simultaneous implementation of the Depression Anxiety, Stress and Mental Health Questionnaire. The high correlation coefficients indicate the convergent validity of this scale or similar tests. In contrast, the low correlation coefficients between the three factors of this scale with factors such as social actions in the General Health

Questionnaire (GHQ) and obsession in the Mental Health Questionnaire (MHQ) indicate the divergent validity of this scale. To determine the discriminant validity of the scale, a group of students who had experienced a traumatic event during the past month or two were compared with students who did not. The results showed that students with bad experience scored higher on anxiety, depression and stress.

**Cognitive Emotion Regulation Questionnaire (CERQ):** This questionnaire was designed by Garnefski et al. (13) to evaluate different cognitive emotion strategies, which includes 18 items, and measures cognitive emotion regulation strategies in response to life-threatening and stressful events on a five-point scale from (1) never to (5) ever in nine subscales: self-blame, other-blame, acceptance, refocus on planning, positive refocusing, rumination, positive reappraisal, perspective, and catastrophizing. Psychometric properties of the Cognitive Emotion Regulation Questionnaire have been confirmed in foreign studies (13). In a preliminary study of psychometric properties of this questionnaire in a sample of the general population, Cronbach's alpha coefficients for subscales from 0.67 to 0.89 were calculated, which confirm the internal consistency of the Cognitive Emotion Regulation Questionnaire (28). In Besharat and Bazazian (28) research, the correlation coefficients of the scores of a number of participants were calculated twice with an interval of two to four weeks to assess the validity of the retest, which is 0.70 for the self-blame subscales, other-blame 0.80; rumination 0.74; catastrophizing 0.72; perspective 0.78; positive refocusing 0.77; positive reappraisal 0.76; acceptance 0.81; refocusing on planning was reported to be 0.83, which were significant at the level of 0.0001. Cronbach's alpha coefficient was used to measure the internal consistency of the questionnaire, which was first used for self-blame scales; other-blame; rumination; catastrophizing; perspective; positive refocusing; positive reappraisal; acceptance; refocus on planning are 0.76, 0.89, 0.79, 0.87, 0.79, 0.80, 0.83, 0.89 and in the second turn respectively 0.73, 0.87, 0.75, 0.90, 0.80, 0.86, 0.83, 0.87, 0.87 were reported. The convergent and divergent validity of the questionnaire was also calculated through the simultaneous implementation of the Depression Anxiety, Stress Scale and Mental Health Questionnaire. The validity of the questionnaire was obtained by examining the correlation between the negative strategies of this questionnaire and the scores of the 28-item General Health Questionnaire, Coefficients of 0.35 and 0.37 were obtained, both of which are significant at the level of 0.0001.

**Five-Facet Mindfulness Questionnaire (FFMQ):** It is a 39-item self-assessment scale developed by Baer, Smith, Lykins , Button, Krietemeyer, Sauer et al. (29) by combining items from the Freiburg Mindfulness Inventory (FMI), Mindful Attention Awareness Scale (MAAS), and Kentucky Inventory of Mindfulness Skills (KIMS) and it has evolved using the factor analysis approach. Awareness is measured as observation (8 items), description (8 items), aware action (8 items), non- judgment inner experiences (8 items) non-reactivity to internal experiences (7 items). Baer et al. (29) used Cronbach's alpha coefficient to measure the internal consistency of the questionnaire which was reported to be 0.75 for non-reactivity, 0.91 for description, 0.83 for observation, 0.87 for aware action and 0.87 for non-judgment. They assessed the construct validity and concurrence of this questionnaire with the constructs of emotional intelligence, openness, extroversion, neuroticism, psychological symptoms, thought suppression, emotion regulation problems, alexithymia, and empirical avoidance. The results

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showed a positive correlation between mindfulness, openness, emotional intelligence and a negative correlation between mindfulness and alexithymia, breakdown, psychological symptoms, neurosis and thought suppression. Also, Neuser; According to Ahmadvand, Heydarinasab and Shairi (30) reported the correlation between factors as moderate and significant in all cases and in the range 0.15 to 0.34. In the study of Ahmadvand et al. (30), the Cronbach's alpha coefficient was used to measure the internal consistency of the questionnaire, which was 0.55 for non-reactivity, 0.83 for description, 0.83 for observation, 0.81 for aware action and 0.73 for non-judgment and the whole questionnaire was reported to be 0.80. Split-half reliability for non-reactivity was 0.43, description was 0.76, observation was 0.60, aware action was 0.78 and non-judgmental was 0.57 and the whole questionnaire was 0.64. In the field of the retest validity, the correlation coefficient between the first and second performance in a period of 2 weeks for non-reactivity was 0.71, description 0.83, observation 0.84, aware action 0.68 and non-judgmental 0.57 and the total Questionnaire was reported to be 0.80. The correlation coefficients between the participants' scores in two shifts were between r = 0.57 (related to non-judgmental factor) and r = 0.84 (observation factor). In the field of validity of the questionnaire, the results showed that there was a positive and significant correlation between the questionnaire of five factors of personality and five aspects of mindfulness except psychotic factor and there was a positive correlation between all dimensions of psychological well-being and five aspects of mindfulness; Whereas, negative correlations were observed between the five aspects of mindfulness with all the symptoms of obsession-compulsion examined in SCL-25, which indicates the criterion and divergent validity of the questionnaire.

**Basic Needs Satisfaction in General Scale (BNSG-S):** It is consists of 21 items and measures basic psychological needs satisfaction at the general level. The items measure the three subscales of autonomy, competence, and relatedness in seven likert scales from a score of one (not true at all) to a score of seven (absolutely true). The Psychometric properties of the basic needs satisfaction scale have been confirmed preliminarily in foreign research (31). In the Besharat and RanjbarKalagari study (32), the internal consistency of the basic needs satisfaction scale was calculated in terms of Cronbach's alpha coefficient. In the first case for the subscales of autonomy, competence and relatedness, respectively 0.77, 0.75 and 0.86 and in the second case, 0.76, 0.75 and 0.83 were calculated, which are signs of good internal consistency of the scale. The results of exploratory factor analysis, in addition to the general factor of satisfying basic psychological needs, confirmed three factors of autonomy, competence and relatedness for the scale of basic psychological needs satisfaction. Convergent and diagnostic (discriminant) validity of the basic psychological needs satisfaction Scale was examined by calculating the correlation coefficients of its subscales with the dimensions of extraversion and neuroticism of personality, positive and negative emotions, and mental health indicators of the subjects. The results of Pearson correlation coefficients showed that there was a significant positive correlation between the scores of the subjects in the subscales of basic psychological needs satisfaction scale with the indicators of extraversion, positive emotion and psychological well-being and there is a significant negative correlation with the indicators of neuroticism, negative emotion and psychological helplessness. These results confirm the convergent and divergent validity of the basic psychological needs satisfaction scale.

Correlation coefficients between the scores of 127 participants were calculated twice with an interval of two to four weeks to assess the validity of the basic psychological needs satisfaction scale. These coefficients for autonomy, competence and relatedness were 0.77, 0.71 and 0.67, respectively.

**Psychological Hardiness Scale:** It is a self-report scale consisting of 42 questions, based on the conceptual definition of the structure of psychological hardiness and designed to assess this variable in specific and stressful situations by Lang and Goulet (33) Which includes three subscales of control, commitment and challenge. Lang and Goulet (33) reported Cronbach's alpha of 0.84 for this scale. In Roshan and Shakeri research (34), Cronbach's alpha for the whole scale was 0.82, control subscale was 0.83, commitment was 0.33 and challenge was 0.69. Criterion validity using Bartone hardiness questionnaire quoted by Roshan and Shakeri (34) showed that the correlation between the components of Bartone and Lang and Goulet psychological hardness scale in the whole scale was 0.64, control 0.61, commitment 0.38 and the challenge was 0.32 and with the scale of problem solving coping of Hooman coping questionnaire equal to 0.21 and with divergent validity of 0.25 and 0.43 in the subscales of less useful and ineffective coping responses. The results of factor analysis showed three distinct factors that explain a total of 30% of the total variance of the scale. In the field of the retest validity, the correlation coefficient between the first and second performance at 2-week intervals for the whole scale was 0.71, the control subscale was 0.86, the commitment was 0.75 and the challenge was 0.61, all of which were statistically at a significant level. Split-half reliability in the total sample of 550 people was 0.76.

Data analysis in this study was performed using SPSS software for descriptive statistics and using Amoss software for inferential statistics and structural equation method was used; That is, the structural equation modeling method, Pearson correlation coefficient and standardized regression coefficients obtained from structural equations were used. In addition, for all questionnaires, internal consistency was calculated for each scale, including Cronbach's alpha for all scales and subscales.

**Results:**

Demographic findings in this study showed that out of 200 men and 200 infertile women, 70% were housewives and 30% were employees. 89% of men were employed and 11% did not state their job. 60% of the participants had equal income and expenditure income, 20% had less income than expenditure and 10% had more income than expenditure. Also, 62% of the participants were tenants and 38% were homeowners. 35% of the participants were literate, 45% had a diploma or lower, 20% had a bachelor's degree and 10% had a master's degree or higher. Table 1 presents the descriptive indicators of men and women separately in the research variables.

Table 1. Descriptive indicators of infertile men and women

| Variable | | Mean | Standard deviation | kurtosis | Skewness |
|---|---|---|---|---|---|
| Infertility stress | Infertility stress | 21.93 | 10.92 | 0.47 | -0.15 |

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| | | | | | |
|---|---|---|---|---|---|
| Cognitive emotion regulation | Adaptive strategies | 27.30 | 6.84 | -0.23 | 0.49 |
| | Maladaptive strategies | 25.39 | 5.47 | -0.18 | -0.39 |
| Psychological Hardiness | hardiness | 138.97 | 17.90 | -0.31 | 0.13 |
| | control | 54.15 | 7.01 | -.048 | -0.65 |
| | commitment | 49.60 | 6.94 | -0.31 | 0.02 |
| | challenge | 35.21 | 5.98 | -0.39 | -0.01 |
| Mindfulness | Mindfulness | 102.85 | 17/90 | 0.39 | 1.09 |
| | observation | 25.30 | 5/08 | 0.12 | 0.17 |
| | description | 15.18 | 3/56 | 0.11 | -0.14 |
| | aware action | 21.25 | 5/79 | 0.24 | 0.09 |
| | non- judgment | 21.26 | 4/92 | 0.36 | -0.15 |
| | non-reactivity | 19.85 | 4/92 | 0.50 | 0.25 |
| basic psychological needs satisfaction | basic psychological needs | 51.36 | 11.57 | 0.34 | -0.98 |
| | autonomy | 10.91 | 4.73 | 0.38 | 0.23 |
| | competence | 14.42 | 4.74 | 0.19 | -0.53 |
| | relatedness | 26.01 | 7.13 | 0.06 | -0.61 |

As Table 1 shows, the research variables had a distribution close to normal. The indices of skewness and kurtosis are in the range of -1and +1, and this finding indicates that the distribution of variables is not out of the normal state. In the present study, it was hypothesized that the relationship between infertility stress and cognitive emotion regulation, mindfulness, and basic psychological needs is formed not directly, but through the mediating role of psychological hardiness. Accordingly, it is expected that the cognitive emotion regulation, mindfulness, and basic psychological needs (independent or exogenous variables) will lead to the formation of psychological hardiness (mediating variable), and this is a psychological hardiness that reduces the stress of infertility.

Testing this hypothesis requires fitting the conceptual model of the research with the data so that it is possible to examine the direct and indirect effects of the research variables. In the conceptual model of research, cognitive emotion regulation (with indicators of adaptive and maladaptive strategies), mindfulness (with indicators of observation, description, aware action, non-judgment, non-reaction) basic psychological needs (with indicators of autonomy, Competence, relatedness) and psychological hardiness (with indicators of control, commitment, and challenge) were measured with multiple indicators.

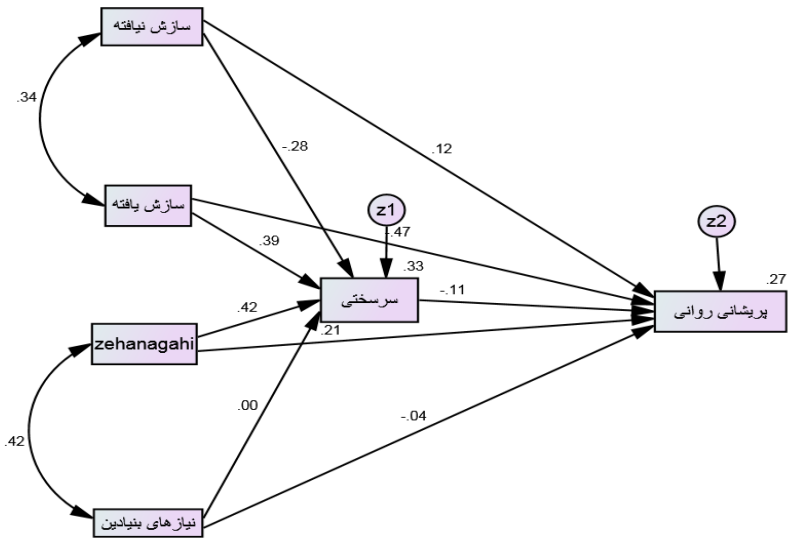


**Figure 1: Structural equations model of infertility stress based on cognitive emotion regulation, mindfulness, basic psychological needs and the role of mediating psychological hardiness in the standardized state**

The fitness diagram of the research model can be seen in Figure 1. As shown, all path coefficients and structural factor loads on the markers are statistically significant. In the following, indicators of model fitness, direct and indirect effects are reported. As can be seen in the hypothesized research model, there are six variables, four of which are observational and two of which are latent (two errors z1 and z2). Of these six variables in the model, four are exogenous or independent and two cases are considered as endogenous or dependent variables. Table 3 shows the indicators of model fitness for men and women separately:

**Table2. The indicators of the research model fitness**

| Structure fitness indicators | Model | Estimated value | Approximate range of acceptance |
|---|---|---|---|
| Chi square to degrees of freedom (CMIN/DF) | women | 1.18 | <3.00 |
| | men | 2.40 | <3.00 |
| Goodness of fit index (GFI) | women | 0.99 | >0.8 |
| | men | 0.99 | >0.8 |
| Modified goodness of fit index (AGFI) | women | 0.95 | >0.8 |
| | men | 0.91 | >0.8 |
| Root Mean Square of Estimated Error (RMSEA) | women | 0.03 | <0.1 |
| | men | 0.084 | <0.1 |
| Adaptive fit index (CFI) | women | 0.99 | <0.9 |
| | men | 0.98 | <0.9 |

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Table 2 shows indicators of model fitness including chi-square to degree of freedom (women CMIN / DF = 1.18), (men CMIN / DF = 2.40), Goodness of fit index (women GFI = 0.99), (men / 99 GFI = 0), Modified goodness of fit index (women (AGFI = 0.95), (men AGFI = 0.91), Root Mean Square of Estimated Error (women RMSEA = 0.03), (men RMSEA = 0.084) and Adaptive fit index (women CFI = 0.99), (men CFI = 0.98) which are optimal and show a very good fitness of the hypothetical model with the experimental data. Table 3 shows the structural model coefficients of mediating the role of psychological hardiness in the relationship between cognitive emotion regulation, mindfulness and basic psychological needs with infertility stress with standardized values and coefficient of determination.

**Table 3: Results of path coefficients, p-value statistics for model fitness of women and men**

| Independent variable | Dependent variable | Direct effects | Indirect effects | Total effect | ($R^2$) |
|---|---|---|---|---|---|
| Maladaptive strategies | Hardiness | -0.173**<br>-0.356** | - | -0.173**<br>-0.356** | |
| Adaptive strategies | | 0.357**<br>0.391** | - | 0.357**<br>0.391** | 0.33<br>0.35 |
| Mindfulness | | 0.340**<br>0.542** | - | 0.340**<br>0.542** | |
| basic psychological needs | | 0.198**<br>0.174* | - | 0.198**<br>0.174* | |
| Maladaptive strategies | Infertility stress | 0.179*<br>0.122 | 0.047**<br>0.007** | 0.226**<br>0.116* | |
| Adaptive strategies | | -0.231**<br>-0.612** | -0.096**<br>-0.007 | -0.428**<br>-0.605** | |
| Mindfulness | | -0.236**<br>-0.161* | -0.092**<br>-0.010 | -0.144**<br>-0.171* | 0.28<br>0.38 |
| basic psychological needs | | -0.203**<br>-0.234* | -0.053**<br>-0.003 | -0.150*<br>-0.238* | |
| hardiness | Infertility stress | -0.270*<br>-0.018 | - | -0.270*<br>-0.018 | |

*** p<0.0001

According to the data in Table 3, the direct and total coefficients between the independent variables, that is, adaptive and maladaptive emotion regulation strategies, mindfulness and basic psychological needs with the intermediate dependent variable, namely psychological hardiness in both women and men model are statistically significant. The two direct path coefficients between maladaptive strategies and hardiness with the main dependent variable, infertility stress, were not significant in the male model, but other direct path coefficients were significant in both models. Interestingly, all indirect coefficients of these variables were significant on the main dependent variable, infertility stress, through the mediating variable, hardiness in the female model, but no indirect coefficients were significant in the male model.

Finally, all total path coefficients except the total coefficient between hardiness and infertility stress, which is not significant in the male model, other total coefficients are significant in both female and male models. The coefficient of determination of the main endogenous variable of the model, namely infertility stress through four independent variables and hardiness variables in the model of men and women are equal to 0.28 and 0.38 percent, respectively, i.e. about 28 and 38% of the variance of the main dependent variable determine by the existing variables in the model and 68 and 62% of its variance is related to variables outside the model. Also, 33% and 35% of the variance of the hardiness variable is determined through four independent variables defined in the male and female model.

Bootstrapping was used to determine whether the hardiness can mediated the relationship between cognitive emotion strategies (adapted and maladaptive), mindfulness, and basic psychological needs. The mediating role of a variable occurs when the direct relationship between the variable and the main dependent variable is significant. As can be seen from the reported results, all variables have a significant direct coefficient with the main dependent variable, but due to the significance of indirect and direct coefficients in the female model, it can be said that hardiness mediates the relationship between these variables in partial. But in the male model, the role of hardiness mediator is not confirmed due to the lack of significance of indirect coefficients.

Overall, the results of the evaluation of indicators of fitness showed that the final research model in both women and men fits the collected data acceptably and the conceptual models of the research are confirmed. This means that the relationships of these variables can be better examined through the present research model. Comparison of chi-square values for both male and female models shows that there is no significant difference between the two models. But the comparison of other fitness indicators shows that in general, the model proposed in the research is better in the sample of women than the sample of men.

**Discussion and conclusion:**

The aim of this study was to investigate the mediating role of psychological hardiness in the relationship between cognitive emotion regulation, mindfulness, and basic psychological needs with infertility stress. The findings of the present study showed that cognitive emotion regulation, mindfulness and basic psychological needs indirectly increases the incidence of infertility stress through psychological hardiness. This indirect effect suggests that maladaptive cognitive emotion regulation strategies reduce psychological hardiness and, consequently, increase infertility stress. In other words, the results showed that maladaptive and adapted cognitive emotion regulation strategies had a negative and a positive relationship with infertility stress, respectively. Evidence from the research literature in this area has also examined the pairwise relationship of variables. For example, Hammerli, Znoj and Berger (35) in their study of infertile women concluded that the inability to regulate emotion leads to Psychological problems such as stress and anxiety, in other words, emotions play an essential role in the experience of infertility stress, therefore, one of the basic factors in dealing with the experience of infertility is cognitive emotion regulation. Also, the results of this study are in line with the studies of Besharat and Shahidi (36) and Asberg (37). They also showed that

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people, who are not able to regulate their emotions when faced with stressful events such as infertility experience, are not able to regulate their emotions and in these situations use more maladaptive cognitive emotion regulation strategies. Excessive use of these maladaptive strategies reduces a person's control over life events, reduces a person's ability to solve problems and deal with problems, and leads to more stress in the person. Regarding the mediating role of this model, Florin, Mikulincer and Taubman (38) have confirmed the role of psychological hardiness in the occurrence of psychological stress. Research records show that psychological hardiness can be a predictable measure of mental health. The results of this study are in line with the findings of Aldao, Nolen-Hoeskema and Schweizer (39). They also found in their studies that emotion regulation has important implications for health, especially among people with chronic illnesses such as infertility.

Also, in explaining this finding, it can be said that cognitive emotion regulation skills are the most effective individual factor in mental health and the amount of feeling of control over the inside and outside (15). Applying maladaptive cognitive emotion regulation strategies in infertile men and women can cause them to lose control of their inner and outer worlds, resulting in psychological problems such as infertility stress. While those who use adaptive cognitive emotion regulation techniques positively re-evaluate the unpleasant life events that experience infertility, the negative emotions are less and less. As a result, they experience less stress (40).

The results showed that mindfulness has a positive effect on psychological hardiness. In other words, it can be said that with the increase of mindfulness, the level of psychological hardiness of the person increases. The indirect effect of mindfulness mediated by psychological hardiness on infertility stress was negative and significant. Therefore, by increasing mindfulness, the experience of infertility stress decreases. The results of this study are consistent with the findings of Weinstein, Brown and Ryan (41), Guz, Ozkan, Sarisoy, Yanik and Yanik (42), and Morone, Lynch, Losasso, Liebe and Greco (43). They also showed in their studies that mindfulness plays a role in reducing infertility stress. Jalali , and Pourhosein (44) also emphasized the effect of mindfulness on stress in a meta-analysis. To this end, in a review of Iranian and foreign studies conducted between 2010 and 2019 on the effect of mindfulness on stress, they showed that the most important effect of mindfulness-based therapy is to reduce the experience of stress. Therefore, they concluded that mindfulness enables people to manage stress more successfully in everyday life. In explaining the relationship between mindfulness and infertility stress, it can be said that mindfulness frees the mind by increasing the person's awareness of current experiences and focusing attention on the cognitive system and more efficient processing of information and reduces physiological anxiety and stress in the individual. In other words, mindfulness leads to a reduction of stress, because due to the mechanisms hidden in it, it takes the person out of the state of war and strife and brings him to a state of calm with complete peace of mind and in reducing clinical signs of stress are effective (45). In explaining the relationship between mindfulness and psychological hardiness, it can be said that psychological hardiness is a personality trait that resists unpleasant life events. So that stubborn people look more at positive events and instead of ignoring problems, they

actively face and solve them. Because of psychological hardiness consists of three components: commitment, control, and challenge, and includes a set of beliefs about oneself and the world, stubborn people have a greater ability to control their behavior and with their high commitment, they do not give up in the face of life's problems and suffer less from psychological stress (45).

The results showed that basic psychological needs have a negative and significant relationship with infertility stress. Also, the indirect effect of basic psychological needs mediated by psychological hardiness on infertility stress was negative and significant. Findings of the present study with the results of Lynch, Salikhova and Eremeeva studies (46); Uzman (47); and Quested, Bosch, Burns, Cumming, Ntoumanis, Duda (48) align. Explaining this finding, it can be said that according to the theory of self-determination, human beings inherently try to meet their needs and if these efforts are not fruitful, they become situations that threaten mental health. They cause inefficient emotional responses, including stress (47). The results of previous studies show that dissatisfaction with any of the psychological needs endangers mental health. Traditionally, after a person marries, society expects he or she to have children, the issue of infertility distorts the common perception, and as a result, its experience can affect significant impact on biological, psychological, and social factors of couples (49). There is evidence that men and women who experience infertility respond differently and manage the crisis differently. Many women perceive infertility as one of the most distressing events in their lives and tend to express their emotional reactions more clearly than men. This perception is even more important in cultures where motherhood is highly valued or where motherhood is the only chosen role for women. She believes that her natural ability as a woman and her main role is to have children. This can become a major characteristic of the individual and shape the self-concept of women who grow up in this culture, and this is formed in them from adolescence. Facing infertility in these women increases guilt and makes a person vulnerable to frustration and stress. Infertility changes a person's perception of themselves and their sense of identity. Because of the strong link between femininity and motherhood, women may experience an identity crisis in the conflict between the ideal self of being able to become a mother and the real self of being infertile (50). In this regard, the results showed that there is a positive and significant relationship between basic psychological needs and psychological hardiness. This finding is consistent with the findings of Chen, Vansteenkiste, Beyers, Boone, Deci, Van der Kaap-Deeder and Venstinksit (51). Considering the components of basic psychological needs that include relatedness, autonomy and competence, it can be said that people who have the ability to establish a warm and intimate relationship with others use communication methods. In order to maintain their value and dignity, and as a result, they increase their hardines and perform better in the face of challenges. On the other hand, people with high autonomy in the face of stressful events such as infertility stress by using the component of autonomy try different problem-solving solutions and use it best when faced with stressful situations. They improve their hardiness and therefore, when they can master the tasks, they feel more competent, and as a result, their hardiness increases.

In fact, infertility is a complex life crisis that poses a psychological threat and emotional stress. Couples trying to conceive will no doubt endure feelings of frustration and despair if the pregnancy does not go smoothly (6). Therefore, it seems that it is important to study and

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identify the factors related to infertility stress. In this study, the variables related to infertility stress in infertile men and women were studied and a model based on these variables was presented. The results of this study indicated that the final model fits acceptably with the collected data. Overall, the results of evaluation of indicators of fitness in this study showed that the final research model in both women and men fits the collected data acceptably and the conceptual models of the research are confirmed. This means that the relationships of these variables can be better investigated through the present research model. Comparison of both male and female models also shows that there is no significant difference between the two models. But the comparison of other fitness indicators shows that in general, the model proposed in the research is better in the sample of women than the sample of men. In the female model, hardiness partially mediates the relationship between these variables, but in the male model, the mediating role of hardiness was not confirmed.

Each study inevitably has limitations that it is necessary to interpret the results in the context of these limitations. One of the limitations of this study is that the sample of this study included infertile men and women who were seeking treatment. Therefore, caution should be exercised in generalizing the results to infertile men and women who are not seeking treatment. On the other hand, most infertility studies, such as the present study, are Cross-sectional study rather than longitudinal, which does not allow generalization to the long-term results of infertility or the duration of infertility stress. According to the results of this study, it is suggested that programs be adopted to increase the awareness of infertile men and women and their families, and groups working in health centers and policy makers in this field. The cooperation of infertility specialists with psychologists in infertility treatment centers and the establishment of psychological counseling centers in these centers are recommended in order to improve the psychological problems of these patients.

**Application of research:**

Since the findings of the present study have confirmed the relationship between cognitive emotion regulation, mindfulness, basic psychological needs and infertility stress, it is possible in the educational programs of these people; include programs for infertility stress reduction and mindfulness training programs. Also, the significance of the mediating role of psychological hardiness and its key role in reducing infertility stress highlights the need to pay attention to this structure in treatment and education programs. In the end, it is hoped that the results of the present study can be used and effective in infertility clinics and treatment centers.

**Ethical considerations:**

In the present study, the participation of individuals was completely voluntary and their privacy was considered.

**Conflict of interest**:

The authors of the article state that there is no conflict of interest in writing this article.

**Appreciation:**

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