Journal of Midwifery & Reproductive Health

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The Effect of Training Based on Pender's Health Promotion Model on Infertile Women's Lifestyle and Self-Efficacy in the Preconception Period: A Quasi-Experimental Study

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ARTICLE INFO

Article type:
Original article

Article History:
Received: 05-Nov-2023
Accepted: 22-Jun-2024

Key words:
Pender's Health Promotion Model
Infertility
Preconception Care
Lifestyle
Self-Efficacy

ABSTRACT

Background & aim: Infertility treatment provides a good opportunity for implementing preconception care. The current study aimed to evaluate the impact of training based on Pender's health promotion model on infertile women's lifestyle and self-efficacy in the preconception period.

Methods: This is a quasi-experimental study using a non-randomized, pre-test and post-test design with a control group. It was conducted in the in vitro fertilization unit of a teaching hospital in Istanbul, Turkey in 2022. Three training sessions were provided to the intervention group (n=57) using Pender's health promotion model at the beginning and weeks 4 and 8 following intervention. The control group (n=57) was provided routine standard care without any training. Data were collected at the beginning (pre-test) and week 8 (post-test) using the demographic questionnaire, Healthy Lifestyle Behavior Scale, and Infertility Self-Efficacy Scale–Short Form. Data were analyzed with SPSS version 24 using independent t-test, analysis of covariance, chi-square, and paired t-test.

Results: After training, the average post-test HLSBS-II score of the intervention group (152.71±22.61) was revealed to be significantly higher than that of the control group (133.17±20.78) ($F= 18.718$, $P<0.05$). While the average pre-test and post-test TISE-SF scores did not differ in the intervention group after the training ($t= 0.526$, $p>0.05$), the average post-test score of the control group decreased significantly in comparison with the pre-test score ($t= 2.951$, $P<0.05$).

Conclusion: It was found that training based on Pender's health promotion model positively affects infertile women's lifestyle. Further studies are needed to examine self-efficacy following training in infertile women.

► Please cite this paper as:
Uncu B, Yilmaz T. The Effect of Training Based on Pender's Health Promotion Model on Infertile Women's Lifestyle and Self-Efficacy in the Preconception Period: A Quasi-Experimental Study. Journal of Midwifery and Reproductive Health. 2025; 13(3): 4840-4853. DOI: 10.22038/JMRH.2025.76038.2246

Introduction

According to the World Health Organization (WHO), infertility is described as a "reproductive system disease characterized by the failure to achieve a clinical pregnancy following 12 months or more of regular unprotected sexual intercourse." Infertility is a common problem with serious consequences for individuals, families, and society. In line with estimates, 48 million couples and 186 million people globally have infertility problems (1). In Turkey, about 1.5 to 2 million couples have fertility problems (2).

The preconception period covers the period before pregnancy occurs. Preconception care is pre-pregnancy health care that aims to gradually improve the health of an infant that a woman and man will have in the future during their reproductive period (3).

The literature indicates that preconception care is a good opportunity to raise awareness of fertility in the infertility treatment process and

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to develop a healthy lifestyle (body mass index, healthy diet, regular physical activity, and/or smoking counseling) (4).

The effects of lifestyle changes on reproductive ability increase daily with evidence (5). Some studies also show that lifestyle changes in the preconception period may reduce the risk of adverse pregnancy outcomes (6). To obtain positive outcomes during and after pregnancy, it is recommended to start care in the pre-pregnancy period. Studies have stated that lifestyle changes positively affect infertility treatment and affect the treatment process positively in financial terms (7).

Nola J. Pender developed Pender's health promotion model in 1982. It is a comprehensive model that guides caregivers and contributes to understanding the processes that encourage people to alter their behaviors and improve their health (8-9).

Pender's health promotion model can ensure the development of individualized or group care through the planning, intervention, and assessment of care interventions. Pender's health promotion model aims to assess human behaviors concerning health promotion and improvement via three components. These components are 1) personal characteristics and experiences (past behaviors and individual factors), 2) certain behaviors (perceived benefits for the action, perceived barriers to the action, perceived self-efficacy, behavioral feelings, interpersonal impacts, affecting the situations), and 3) the consequence of behavior (urgent demands and health promotion behavior) (9). The literature indicates a health-promoting lifestyle as a multidimensional model of self-initiated feelings and behaviors that aim to ensure the health and self-actualization of a person. Accordingly, many studies have been conducted to reveal the dimensions of health-promoting behaviors, including health responsibility, spiritual growth, nutrition, interpersonal relations, physical activity, and stress management, using Pender's health promotion model (10-11).

The concept of self-efficacy ensures that a healthy lifestyle is adopted, and it is also important for infertile women. It has been observed that infertile women with high self-efficacy have successfully adopted a healthy lifestyle and developed positive feelings during treatment (12-13). Supporting this, a study conducted among infertile women in Pakistan demonstrated that higher self-efficacy was significantly associated with lower levels of depression, anxiety, and stress. Moreover, self-efficacy was found to mediate the relationship between social support and psychological distress, highlighting its central role in emotional resilience during infertility treatment (14). In light of its importance, several studies have also emphasized that self-efficacy can be enhanced through training. For example, it has been shown that self-efficacy influences individuals' motivation and learning strategies, which in turn impact their performance (15). In addition, simulation-supported education (16) and multidimensional teaching strategies have been found to positively affect self-efficacy (17). These findings suggest that well-structured educational interventions may play a key role in strengthening self-efficacy. In this respect, we did not encounter a study on the impacts of education on the basis of Pender's health promotion model in infertile women in the pre-pregnancy period. Hence, we believe that the current study will benefit caregivers and contribute to the knowledge in this regard.

This study aimed to evaluate the impact of training based on Pender's health promotion model on infertile women's lifestyle and self-efficacy in the preconception period.

Materials and Methods

The present research was a quasi-experimental study using a non-randomized, pre-test and post-test design with a control group and followed the Transparent Reporting of Evaluations with Non-randomized Designs (TREND) reporting guideline (18).

The research population comprised infertile women receiving healthcare services from the IVF unit of a teaching and research hospital in Istanbul, Turkey between February and August 2022. The sample size was computed by utilizing the program G*Power (3.1.9.2) with a margin of error of 0.05 and a power of 80%. Assuming that evaluations in dependent groups would have a medium effect size (d=0.5), it was determined that the groups should include at least 55 people according to the calculation made using the t-test (Figure 1).

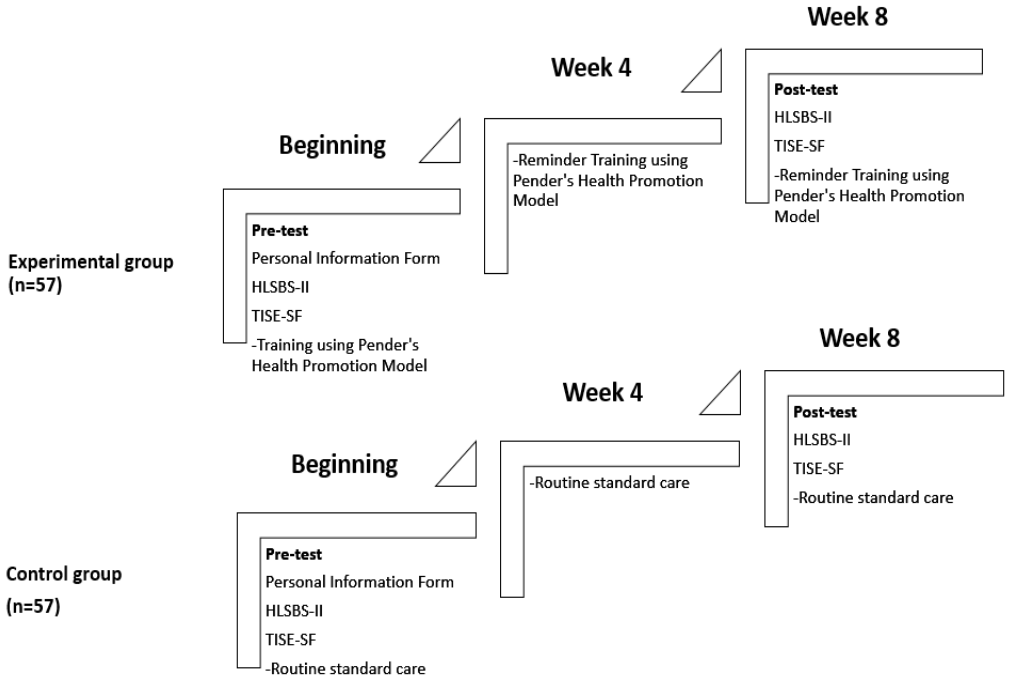

Figure 1. Stages of study in experimental and control groups

Considering possible drop out in the sample group, each group was increased by 10% through convenience sampling. One hundred and twenty infertile women meeting the inclusion criteria were enrolled in the research. Six participants, two of whom finished the treatment during the follow-up, and four of whom did not continue and left the study. Therefore, the research was completed with 114 women, 57 in the intervention group and 57 in the control group. In the last case, a 5 percent drop rate was seen. women aged 20 years and older with primary infertility, undergoing infertility treatment, who had at least a primary school education, and were first-time registrants in the hospital's in vitro fertilization (IVF) unit. Women who had received training on healthy living behaviors, had infertility with male factor only, and did not come to the clinic with their husbands were not included in the research.

The researchers prepared the demographic questionnaire by reviewing the literature (19). The questionnaire consisted of 18 items covering both demographic (e.g., age, education level, height, weight, smoking status) and clinical characteristics (e.g., duration and type of infertility treatments). Healthy Life Style Behavior Scale II (HLSBS-II) was developed by Walker et al. in 1987 on the basis of Pender's health promotion model to assess health-promoting behaviors of individuals (20). In 1996, the scale was revised and named the Healthy Lifestyle Behavior Scale II (HLSBS-II) (21). Bahar et al. conducted a study to measure the scale's validity and reliability in Turkish language in 2008 (22). The scale has 52 items and six dimensions: spiritual growth, interpersonal relations, physical activity, nutrition, stress management, and health responsibility. All scale items are positive, and no item is scored reversely. On the four-point Likert scale, "Never" is scored as 1, "Sometimes" is scored as 2, "Often" is scored as 3, and "Regularly" is scored as 4. The lowest and highest scores on the scale are 52 and 208, respectively. An increase in the scores on the scale shows an increase in a person's positive health behaviors. According to the previous research, Cronbach's alpha coefficient was 0.92

(33). The present study found Cronbach's alpha coefficient to be 0.93.

Infertility Self-Efficacy Scale–Short Form (TISE-SF) developed by Cousineau et al. in 2006 (23). Arslan-Özkan et al. conducted the scale's validity and reliability study in Turkish in 2014 (24). The scale includes 8 positive items. No item is scored reversely. On the four-point Likert scale, "Not applicable to me at all" is scored as 1, "Applicable to me a bit" is scored as 2, "Applicable to me very well" is scored as 3, and "Completely applicable to me" is scored as 4. The lowest and highest scores on the scale are 8 and 32, respectively. A high score refers to high perceived self-efficacy. According to the previous research, Cronbach's alpha coefficient was 0.78 (24). The current work found Cronbach's alpha coefficient to be 0.71.

Content of training program included the domains of nutrition, physical activity, stress management, health responsibility, spiritual growth, and interpersonal relations of Pender's health promotion model formed the basis for the content of the training provided in the present research. This model is essential for enhancing quality of life (25). In the model, emotions related to health behavior, including perceived self-efficacy, perceived advantages and barriers, and effective interpersonal resources, have a direct impact on behavior. The current study provided patient education with a strong focus on the aforesaid factors. For example, in the domain of physical activity, the health behavior's advantages (physical activity that supports fertility), perceived self-efficacy (utilizing a person's abilities), perceived barriers (cost-cutting strategies), and effective interpersonal resources (receiving support from husbands, family, friends, and other women in the group) were explained to infertile women. These factors were taken into account in all domains, and women were requested to follow a behavior change program at the end of each session according to the items described (26). This content was evaluated and approved by two gynecologists and one infertility clinic nurse (Table 1).

To collect data, women who attended the outpatient clinic on two specific days (Monday and Tuesday) and met the inclusion criteria were informed about the study. Pre-test measurements were made for women who wanted to take part in the research. In order to ensure the participants' comfort and avoid interruptions when completing the questionnaires, the pre-test was carried out in a room with a quiet and comfortable atmosphere in the in vitro fertilization center's clinic. Patients interviewed on Monday were included in the intervention group, and patients interviewed on Tuesday were included in the control group. Afterward, the content of the training was prepared based on the valid resources and Pender's health promotion model. The content was created following the research objectives and strategies for improving the domains in Pender's model (6, 9).

The prepared training was tested on two infertile women in terms of applicability and comprehensibility, and deficiencies were eliminated. Thus, the training on the basis of Pender's health promotion model was finalized (Table 1).

Afterward, the content prepared was presented to patients in the intervention group who received training. The intervention group was divided into subgroups of women recruited every Monday (n = 5 in each subgroup) in order to increase the effectiveness of the intervention, increase the participation of patients, avoid disorganization, and manage the training sessions better. Each subgroup received three one-hour sessions (first interview, after 4 weeks, and after 8 weeks). The question-answer method was used to understand the training content better and avoid one-way teaching. PowerPoint slides were used to increase the effectiveness of the training. During the period in question, the control group was provided routine standard care without training on the basis of Pender's health promotion model. After the data collection phase was completed, the control group was given the opportunity to receive training on the basis of Pender's health promotion model after the post-test (Table 1).

Table 1. Training on the basis of Pender's health promotion model

Session	Content of the training based on dimensions	Goals on the basis of model constructs	Educational materials	Teaching method
1	Introduction of the patients and educator, assess the needs of patients and inform them about their health status (definition, causes, signs and symptoms, and complications of infertility)	(a) Research the previous related behavior and the causes of previous success (b) Increase perceived benefits (c) Decrease perceived barriers	PowerPoint slides	Group discussion, lecture, question & answer
2	Review the previous session's content, enumerate modifiable and non-modifiable risk factors for infertility, and make a presentation on healthy and unhealthy behaviors that affect infertility Review the role of regular physical activity and nutrition Review the role of interpersonal relations and stress management Review the role of health responsibility and spiritual growth	(d) Increase perceived self-efficacy (e) Increase understanding of social support (f) Enhance behavior-related feelings (g) Analyze the conditions and living environment (h) Commitment to the action plan and its maintenance	PowerPoint slides	Group discussion, lecture, question & answer
3	Review and summarize the content of previous sessions and respond to patients' questions	(i) Raise awareness of urgent competitive preferences and strategies to cope with them	PowerPoint slides	Group discussion, lecture, question & answer

The first data were obtained in February 2022. The data collection phase was completed in June 2022.

The data were analyzed using the program Statistical Package for the Social Sciences (SPSS) Version 24. The Kolmogorov-Smirnov (K-S) test first examined the data normality, and a normal distribution was achieved. Frequencies and percentages were given for categorical variables, while mean and standard deviation were given for continuous variables.

The independent t-test, analysis of covariance (ANCOVA), and chi-square test were used to compare differences between the intervention and control groups. The paired t-test was performed to determine differences before and following the training in both groups. The level of significance was considered <0.05 in all analyses.

Results

One hundred fourteen participants completed this study. Table 2 contains the comparative statistical analysis results for the characteristics of the intervention and control groups. When the two groups were compared concerning their characteristics, no statistically significant difference was identified between them, except for physical activity (P>0.05). The two-way ANOVA results for the physical activity variable showed that the post-test average scores of the intervention and control groups did not depend on the difference in physical activity before training (F = 0.043; P = 0.837).

No statistically significant difference was seen between the intervention (145.49±24.37) and control (137.26±21.95) groups in the pre-test in terms of the average Healthy Life Style Behavior Scale II (HLSBS-II) scores (t= 1.894; P≥0.05).

Table 2. Comparison of demographic characteristics of the intervention and control groups (N= 114)

Variables	Intervention Group (N=57) Mean±SD (Min-Max)	Control Group (N=57) Mean±SD (Min-Max)	Test	P-Value
Age	32.05± 6.01 (23- 46)	33.10±5.89 (21-47)	t= -0.944	0.347
Husband's Age	34.63±5.52 (25-46)	35.92±5.60 (25-50)	t= -1.246	0.215
Marriage Duration (years)	6.15±4.45 (1-22)	6.75±5.22 (1-28)	t= -0.656	0.513
Time of Infertility Diagnosis (years)	2.68±2.17 (1-9)	3.01±2.66 (1-13)	t= -0.732	0.465
Variables	**N (%)**	**N (%)**	**X²**	**P-Value**
Educational Status				
Elementary School	21(37)	26 (46)		
High School	20 (35)	19 (33)	1.129	0.569
University and above	16 (28)	12 (21)		
Employment Status				
Employed	20 (35)	18 (32)	0.158	0.691
Unemployed	37 (65)	39 (68)		
Income Status				
Income does not cover expenses	6 (10)	11 (19)		
Income equals expenses	48 (85)	44 (77)	1.845	0.398
Income more than expenses	3 (5)	2 (4)		
Kinship with the Husband				
Yes	10 (18)	11 (19)	0.058	0.809
No	47 (82)	46 (81)		
Cause of Infertility				
Female	34 (60)	22 (39)		
Both	10 (16)	16 (28)	7.320	0.062
Unexplained	13 (24)	19 (33)		
Current Treatment Method				
Intrauterine Insemination (IUI)	4 (7)	6 (11)	0.438	0.508
In vitro fertilization (IVF)	53 (93)	51 (89)		
Presence of Chronic Disease				
Yes	14 (25)	14 (25)	0.000	1.000
No	43 (75)	43 (75)		
Smoking				
Yes	10 (18)	9 (16)	0.063	0.802
No	47 (82)	48 (84)		
Coffee Consumption				
Yes	27 (48)	25 (44)	0.141	0.707
No	30 (52)	32 (56)		
Drug Use				
Prescribed	20 (35)	19 (33)		
Unprescribed	1 (2)	--	2.095	0.553
Supplementary food	6 (11)	10 (18)		
No	30 (52)	28 (49)		
Physical Activity				
Yes	11 (19)	23 (40)	6,035	**0.014**
No	46 (81)	34 (60)		
Nutritional Status				
Good	21 (37)	23 (40)		
Moderate	34 (60)	30 (53)	1.008	0.604
Poor	2 (3)	4 (7)		
Immunization				
Influenza	6 (11)	4 (7)	0.438	0.508
COVID-19	47 (83)	42 (74)	1.281	0.258

P<0.05: there is a statistically significant difference of 0.05.
SD: Standard Deviation; Min.: Minimum; Max.: Maximum; t= Student's t-test; χ2: Chi-square test

The average HLSBS-II score of the intervention group (152.71±22.61) was significantly higher in the post-test following the training compared to the control group (133.17±20.78) (t= 4.804; P<0.05) (Table 3). Upon comparing the average sub-dimension scores of the Healthy Lifestyle Behavior Scale II (HLSBS-II), no statistically significant difference was detected between the intervention and control groups in the pre-test in the physical activity, spiritual growth, interpersonal relations, and stress management sub-dimensions (P≥0.05). A statistically significant difference was identified between the intervention and control groups in the pre-test concerning the HLSBS-II nutrition and health responsibility sub-dimensions (P<0.05). The difference between the groups' post-test average scores was analyzed using analysis of covariance (ANCOVA). In the post-test, the average scores of the intervention group in all HLSBS-II sub-dimensions were significantly higher in comparison with the control group (P<0.05) (Table 3).

Table 3. Comparison of the average HLSBS-II sub-dimension scores of the intervention and control groups (N= 114)

Variables	HLSBS-II Pre-test Mean± SD	HLSBS-II Post-test Mean± SD	Test	P-Value
Physical Activity				
Intervention Group (n=57)	15.21±5.05	17.73±4.30	t*=-3.925	P= 0.000
Control Group (n=57)	15.63±4.75	15.67±5.13	t*=--0.066	P= 0.948
Test	t**= -0.459	F***= 9.918		
P-Value	P= 0.647	P= 0.021		
Nutrition				
Intervention Group (n=57)	25.01±5.41	25.29±5.20	t*=--0.349	P= 0.728
Control Group (n=57)	22.70±4.50	22.61±3.87	t*=-0.155	P= 0.877
Test	t**= 2.480	F***= 5.050		
P-Value	P= 0.015	P= 0.027		
Health Responsibility				
Intervention Group (n=57)	25.12±5.78	26.59±4.64	t*=--1.753	P= 0.085
Control Group (n=57)	22.85±4.83	22.43±4.55	t*=-0.695	P= 0.490
Test	t**= 2.266	F***= 17.396		
P-Value	P= 0.025	P= 0.000		
Spiritual Growth				
Intervention Group (n=57)	29.38±4.65	30.07±3.66	t*=--1.025	P= 0.310
Control Group (n=57)	28.24±4.93	26.98±4.47	t*=-2.066	P= 0.043
Test	t**= 1.268	F***= 14.511		
P-Value	P= 0.207	P= 0.000		
Interpersonal Relations				
Intervention Group (n=57)	28.77±5.21	28.77±4.61	t*=-0.000	P= 1.000
Control Group (n=57)	27.01±4.93	25.45±3.88	t*=-2.264	P= 0.027
Test	t**= 1.846	F***= 13.946		
P-Value	P= 0.068	P= 0.000		
Stress Management				
Intervention Group (n=57)	21.98±4.48	24.24±4.62	t*=--3.230	P= 0.002
Control Group (n=57)	20.80±4.37	20.01±4.48	t*=-1.343	P= 0.185
Test	t**= 1.417	F***= 22.376		
P-Value	P= 0.159	P= 0.000		
HLSBS-II				
Intervention Group (n=57)	145.49±24.37	152.71±22.61	t*=--1.931	P= 0.059
Control Group (n=57)	137.26±21.95	133.17±20.78	t*=-1.525	P= 0.133
Test	t**= 1.894	F***= 18.718		
P-Value	P= 0.061	P= 0.000		

P<0.05; there is a statistically significant difference of 0.05. t*= Paired t-test; t**= Independent t-test , F***= ANCOVA

The average post-test HLSBS-II score of the intervention group after the training (152.71±22.61) was significantly higher than the average pre-test score (145.49±24.37) (t= -1.931; P<0.05). Furthermore, the average post-test scores on the physical activity and stress management sub-dimensions of the HLSBS-II in the intervention group after the training (17.73±4.30, 24.24±4.62, respectively) were significantly higher in comparison with the average pre-test scores (15.21±5.05, 21.98±4.48, respectively) (t= -3.925; t= -3.230; P<0.05, respectively) (Table 3).

The average post-test scores on the spiritual growth and interpersonal relations sub-dimensions of the HLSBS-II in the control group (26.98±4.47, 25.45±3.88, respectively) were significantly lower compared to the average pre-test scores (28.24±4.93, 27.01±4.93, respectively) (t= 2.066, t= 2.264; P<0.05, respectively) (Table 2).

No statistically significant difference (t= 0.155, F= 2.913, respectively; p≥0.05) was determined between the intervention and control groups in the pre-test (24.19±4.77, 23.84±4.54, respectively) and the post-test (24.05±4.88, 22.47±5.08) in terms of the average Infertility Self-Efficacy Scale–Short Form (TISE-SF) scores (Table 4). The average post-test TISE-SF score of the control group (22.47±5.08) was significantly lower in comparison with the average pre-test score (23.84±4.54) (t= 2.951; P<0.05) (Table 4).

Table 4. Comparison of the average TISE-SF sub-dimension scores of the intervention and control groups (N= 114)

Variable	TISE-SF Pre-test Mean± SD	TISE-SF Post-test Mean± SD	t*	P-Value
Intervention Group (n=57)	24.19±4.77	24.05±4.88	0.526	0.601
Control Group (n=57)	23.84±4.54	22.47±5.08	2.951	0.005
Test	t**=0.155	F***=2.913		
P-Value	P=0.877	P=0.091		

P<0.05; there is a statistically significant difference of 0.05. t*= Paired t-test; t**= Independent t-test, F***=ANCOVA

The average pre-test and post-test HLSBS-II and TISE-SF scores of the intervention and control groups were significantly and positively correlated (r=.521, P<0.05; r=.556, P<0.05, respectively) (Table 5).

Table 5. Correlation of the average HLSBS-II and TISE-SF sub-dimension scores of the intervention and control groups (N= 114)

TISE-SF	Pre-test	Post-test
HLSBS-II	r= .521	r= .556
	P= .000	P= .000

r: Pearson's Correlation; P<0.05

Discussion

This quasi-experimental study showed that training based on Pender's health promotion model helped to maintain self-efficacy and improve healthy lifestyle in infertile women. Although no significant difference was found between groups in self-efficacy, the decrease in the control group's self-efficacy suggests a protective effect of the intervention. The health promotion model aims to explain the factors that underlie the motivation to engage in health-promoting behaviors and focuses on individuals' interactions with their physical and interpersonal environments during health-promoting attempts (27). The research by Rastegari et al. (2019) demonstrated the effectiveness of the training provided to pregnant women with preeclampsia using the health promotion model. The training aimed to maintain and enhance the health of mothers and infants by considering their socio-cultural characteristics (28). Care was taken to ensure that the socio-cultural characteristics of the women in the current work were similar. Therefore, data were collected from a single center to ensure that the training provided was not affected by socio-cultural characteristics. According to the model, if individuals perceive the health behavior they need to acquire as a positive effect supporting their health, they can decide to initiate and continue the behavior. Additionally, infertile women are more likely to exhibit health-promoting behavior when the

behaviors that are important to them are adopted by other people (29).

The current work compared the average post-test scores of the HYBS-II and all sub-dimensions after the training and determined that the average score of the intervention group was significantly higher in some sub-dimensions than in the control group. Hence it can be said that the training on the basis of Pender's health promotion model has a limited positive impact on lifestyle. According to the model, individual characteristics, experiences, and behavior-specific perceptions are effective in the formation of behavioral change (30). Therefore, the scale's sub-dimensions were discussed accordingly.

Studies have shown that as a result of pre-pregnancy care training given to women of childbearing age, pregnancy preparation training given in the pre-pregnancy period causes positive behavioral changes in women. The findings of our research are similar to the results in the literature (19, 31).

Considering the physical activity habits of the participants, women in the control group engaged in physical activity at a higher rate. Upon examining the scale's physical activity sub-dimension, the pre-test scores were similar between the groups. The model mentions that past experiences affect behavior development. Accordingly, a person who exercises regularly is more likely to continue exercising than a person with a sedentary lifestyle (27). After the training, women in the intervention group obtained higher results in the physical activity sub-dimension average scores, which shows that the training affects the continuity of physical activity. Although it is reported in the literature that inadequate physical activity leads to the development of infertility, it is stated that research must be continued to identify the optimal dosage, frequency, and duration of physical activity to effectively decrease the risk of infertility (32). Additionally, being diagnosed with infertility causes individuals to experience difficulties in the treatment process. A study mentioned the negative impact of being diagnosed with infertility on women's mental health (33). It is assumed that the reduction in the average physical activity scores of women in the control group in the present work may have been adversely affected by being diagnosed with infertility. Furthermore, the fact that intervention was not performed on women in the control group may explain the aforesaid situation.

The average post-test score on the physical activity sub-dimension of the HLSBS-II in the intervention group was significantly higher in comparison with the average pre-test score, indicating that physical activity increased after the training. It is also known that regular physical activity significantly reduces the risk of infertility (32, 34). In this case, it can be said that an increase in physical activity may benefit participants.

The groups had a similar nutritional status ($p>0.05$). However, the average initial scores on the scale's nutrition sub-dimension were statistically higher in the intervention group. Exposure to the educational intervention increased average scores; the nutrition sub-dimension average scores decreased in the group where the intervention was not performed. The findings showed that the difference in the nutrition sub-dimension average scores between the two groups following the intervention was not statistically significant. It is seen that a change in this sub-dimension is slightly challenging for infertile patients, and more intervention is needed (35). In the health promotion model, the environment-human interaction is considered among the important factors that affect the behavioral change of individuals (27). Women in the intervention group contacted each other because they were in the same WhatsApp group, which positively supported their motivation. In the literature, nutritional interventions and training on weight control among infertile women have positively affected their participation in treatments. This has had positive effects on fertility (36-37). Accordingly, more awareness of nutrition should be raised among infertile women.

The health responsibility sub-dimension average score was high in the first measurements in the intervention group; this score continued to increase after the intervention, but the result was not found to be statistically significant. The concept of perceived self-efficacy mentioned in the model is related to

health responsibility. If participants believe that life change can be effective in treating infertility, they can act more actively and effectively (30,38). In line with this, the increase in scores of women who have high health responsibility average scores with the educational intervention explains this situation. Studies have been conducted on developing healthy living for infertile couples in the pre-pregnancy period with a mobile application. There are deficiencies in the study results in the literature concerning the regular use of the mobile application by individuals (39-40). In the present study, the researchers contacted infertile women and continued their training in a face-to-face online environment. This explains the increase in the scale sub-dimension score of the statement, "Healthcare professionals are a part of the interpersonal environment and direct individuals to interact with each other," which is one of the model's assumptions (30,38). The reason for the unstable effect of training on health responsibility in the intervention group can be found in the lifestyles of infertile women and factors, e.g., socio-economic status, affecting this.

Women's experiences, feelings, and thoughts during infertility treatment play an essential role in the treatment outcomes. A biomedical approach instead of a holistic approach is usually adopted for women undergoing infertility treatment, which directs infertile women to changes in their psychological and social lives (41). The literature review concluded that spiritual growth in individuals was supported in studies conducted on different patient groups that integrated individuals' support mechanisms into care and provided training on spiritual growth (42-43). Issues regarding spiritual growth were mentioned in the training provided during the study, and this was discussed with participants (44-45). The fact that intervention was not performed in the control group, that women in the intervention group were in the same communication group, and the lack of support in the control group caused a reduction in spiritual growth scores in the control group. A significant decrease in the scores in the control group in the post-test measurements explains this situation.

The pre-test results in the interpersonal relations sub-dimension were similar between the groups. The women included in the research comprised those who came to the infertility clinic with their husbands. Thus, the lack of spousal support was taken under control. Results in favor of the intervention group were obtained after the educational intervention. Women present in the same session in the intervention group also supported each other. According to Pender, thoughts, beliefs, and attitudes of people in the individual's surroundings support the person's behavioral development. Furthermore, the status and role of infertile women in society and their interactions with healthcare professionals are factors in interpersonal influences (38). Developing interpersonal interaction has positive effects on treatment processes (46). Interpersonal relations scores decreased in the control group compared to pre-test scores. Hence, it can be said that the training based on Pender's health promotion model positively affects interpersonal relations.

The literature review found that stress management sessions given to women undergoing IVF treatment lowered stress levels. In addition, when infertility-related variables are taken under control, it is thought that pregnancy will occur in women who have succeeded in stress management (47). The current study found a significant increase in the stress management scores of women in the intervention group, showing that the training based on the model was effective. This study also measured the overall average score for health-promoting behaviors and did not find the difference between the two groups to be statistically significant following the intervention. Namely, the overall average score for health-promoting behaviors in the intervention group was higher compared to that in the control group, but the result was not significant. In the literature review, some studies have shown that educational intervention on the basis of Pender's health promotion model positively impacts the domains of health-promoting behavior (48). It is thought that the difference in our study results arises from the difference in the characteristics of the sample on which the research was

conducted. It is recommended that future studies identify barriers and facilitators to health-promoting behaviors in infertile women.

As expressed by Bandura (1977), self-efficacy refers to a person's perception of one's capacity to perform at various levels (49). The intervention group was trained on how to overcome infertility. Additionally, the participants were supported in developing health-promoting behaviors by explaining case examples of healthy pregnancies by developing healthy lifestyle behaviors. The work determined that the training based on the theory of self-efficacy and health literacy strategies positively affected breastfeeding in mothers, and self-efficacy scores increased (50). Women in the intervention group were undergoing treatment for infertility for an average of 2.68±2.17 years. According to the health promotion model, the success or failure of the previous behavior impacts the outcome of the next behavior. Therefore, the lack of an increase in women's self-efficacy scores may be related to their previous experiences. It is also stated that if the outcome of the developed behavior is positive, self-efficacy will increase (30, 38). The fact that the participants could not achieve pregnancy during treatment is thought to be the reason for the absence of change in their self-efficacy scores. There is a need for in-depth interviews with infertile women and advanced studies on this issue. The present research found a significant positive relationship between lifestyle and self-efficacy. In the studies conducted by Shabannezhad et al. to examine the predictors of health promotion lifestyles in pregnant women on the basis of Pender's health promotion model, the results were similar to the current study (51).

The present work has some limitations. The current study used a small sample size and was limited to infertile women presenting to a teaching and research hospital's in vitro fertilization unit in Istanbul. The data collection tools were filled out based on the participants' statements. It was difficult to recruit subjects for this study; most women did not want to take part in the study and therefore did not fulfill the inclusion criteria. There are limitations arising from the nature of the non-randomized study. It is recommended that future studies conduct in a randomized controlled design and infertile women should be supported with practical training in addition to the training to be provided. There is a need for longitudinal studies on the effects of training provided to infertile women on pregnancy. Despite these limitations, this study provides valuable insights into the potential role of Pender's health promotion model in improving lifestyle behaviors and maintaining self-efficacy among infertile women during the preconception period. The inclusion of a control group and use of validated measurement tools strengthen the study's internal validity. This research lays important groundwork for developing targeted educational interventions to support infertile women in clinical settings.

Conclusion

The research results showed that the training provided in the preconception period using Pender's health promotion model positively impact the health-promoting behaviors of infertile women. To increase the fertility chance of infertile women, it is recommended to provide a certain standardization in preconception counseling in future studies. Implementing this standardization based on Pender's health promotion education model will increase the positive effect. In addition, effective models should be identified by trying different education models and research methods (e.g., qualitative study) in the future studies. In line with these results, it can be suggested that midwives and nurses working in the field of assisted reproductive techniques should collect data on healthy lifestyle behaviors of women before conception and, accordingly, provide training on healthy lifestyle behaviors.

Declarations

Acknowledgements

The authors would like to express their gratitude to all women who agreed to take part in the research.

Conflicts of interest

Authors declared no conflicts of interest.

Ethical considerations

All study stages were performed following the Declaration of Helsinki. Informed consent was received from all participants.

Code of Ethics

Ethical approval for the current research was obtained from the Clinical Research Ethics Committee of the hospital where the study was carried out (Decision No: 23, Date: 01.14.2022).

Use of Artificial Intelligence (AI)

No artificial intelligence tools or software were used in the design, data collection, or analysis phases of this research.

Funding

The current work did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Authors' contribution

BU Conceptualization, Data curation, Formal Analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing original draft, Review & editing. TY Conceptualization, Data curation, Formal Analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing original draft, Review & editing. All authors contributed to editorial amendments in the manuscript. All authors read and approved the manuscript final version.

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