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Effectiveness of Mindfulness Training on Experiential Avoidance, Self-Compassion, and Physiological Indices in Women with Breast Cancer

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A B S T R A C T

Objective: This study aimed to examine the impact of mindfulness training on experiential avoidance, self-compassion, and certain physiological indices in women diagnosed with breast cancer.

Method: This applied research was conducted as a quasi-experimental study with a pre-test, post-test, and control group design. The population included all women with stage 1 and 2 breast cancer who were under medical care after completing chemotherapy or radiotherapy at Shahid Tajrish Hospital in 2020-2021. A convenience sampling method was used to select 40 female breast cancer patients, who were equally divided into an experimental group (20 participants) and a control group (20 participants). Data were collected using the Neff's Self-Compassion Scale (Neff, 2003), the Bond et al.'s Experiential Avoidance Questionnaire (2011), and physiological indices. Mindfulness training, based on the protocol by Lengacher et al. (2019), consisted of 8 sessions of 90 minutes each for the experimental group, while the control group received no intervention. Data were analyzed using covariance analysis.

Findings: The results indicated that mindfulness training significantly increased self-compassion ($F = 6.35$, $p < .05$) and decreased experiential avoidance ($F = 4.75$, $p < .05$) in women with breast cancer. Additionally, the training significantly reduced cortisol levels ($F = 7.38$, $p < .05$), but did not have a significant effect on the concentrations of IL-6 ($F = 0.83$, $p > .05$) and CRP ($F = 0.04$, $p > .05$).

Conclusion: Considering the current findings, it can be said that mindfulness training is effective in improving the psychological condition and reducing stress in women with breast cancer.

Keywords: *Mindfulness, experiential avoidance, self-compassion, breast cancer*

1. Introduction

The International Agency for Research on Cancer, a part of the World Health Organization, estimated in 2018 that breast cancer is the most common type of cancer among women and annually affects 1.2 million individuals, and it is the leading cause of cancer-related deaths among women. In 2018, 627,000 women died from breast cancer, accounting for 15% of all cancer deaths (Tung & Garber, 2022; Valente et al., 2023).

Recent attention in the field of health psychology has been given to psychological constructs such as self-compassion (Gonzalez-Hernandez, 2018) and experiential avoidance (Miller, 2011). These constructs have recently been integrated into cancer-related concepts (Przezdziecki, 2016). Neff (2003) defines self-compassion as a three-component construct involving self-kindness versus self-judgment, common humanity versus isolation, and mindfulness versus over-identification (Janbozorgi et al., 2020). Findings suggest that individuals with high self-compassion experience a delayed onset of breast cancer and lower levels of arousal (Birnie, 2010; Wasylkiw, 2012). Therefore, self-compassion could provide a necessary foundation for psychological status changes in these individuals. Self-compassion is defined as dealing with suffering, harm, and self-helping attitudes towards alleviating one's own difficulties (Wren, 2012). High self-compassion is associated with psychological well-being and protects against stress by accepting vulnerable feelings, self-care, and kindness, understanding non-judgmental attitudes towards one's deficiencies and failures, and recognizing common human experiences (Birnie, 2010). Women with breast cancer often face significant body dissatisfaction (Sherman, 2018), and those with high self-compassion have the least concern about their body image and the highest body satisfaction (Wasylkiw, 2012). Self-compassion can also serve as a protective factor against inflammation caused by stress. Research has shown that individuals with higher self-compassion have a lower response to interleukin-6 (Tartibian, 2015). Alizadeh et al. (2018) showed that in breast cancer patients, self-compassion significantly correlates with their resilience (Alizadeh, 2018). Thus, the lack of educational research on altering self-compassion in breast cancer, despite the significance of self-compassion in this illness, highlights a research gap that can play an important role in advancing the therapeutic process.

Experiential avoidance relates to the avoidance of personal bad experiences, including bodily sensations, thoughts, memories, and behavioral antecedents, as well as efforts to alter the intensity, duration, or form of these experiences (Spinhoven, 2014). In breast cancer patients, experiential avoidance manifests as avoidance of thoughts about cancer, staying away from situations that may remind them of cancer, or avoiding feelings directly associated with cancer (Aguirre-Camacho, 2017). The findings show that women with breast cancer quickly resort to experiential avoidance, meaning they deny intense cancer-related events such as emotions, thoughts, and bodily sensations through deliberate efforts to control and change them, and by distracting themselves from situations that trigger such feelings (Aguirre-Camacho, 2017). Given the significant role of experiential avoidance in this illness (Miller, 2011), there is a perceived gap in experimental research aimed at reducing experiential avoidance in these patients, hence highlighting the need for further research in this area.

As stated, stress is a significant issue for women with breast cancer (Stagl, 2015). Stress causes major changes in physiological processes (Gibbons, 2017). Findings indicate that physiological indices in humans change in accordance with psychological conditions and states (Lengacher, 2019). Alongside psychological indices, physiological indices have recently been discussed in experimental psychological research on various patients. Many psychological variables cause physiological changes in the body. Findings suggest that physiological indices such as cortisol, C-reactive protein, and neuropeptides have been extensively studied recently with mindfulness training (Sanada, 2017).

One of the educational methods that has recently gained attention for stress reduction is mindfulness. Mindfulness involves non-judgmental awareness and experiencing the present moment (Sun et al., 2021; Tao et al., 2022). Findings suggest that mindfulness training has recently found widespread use in cancer treatment (Li et al., 2023). Sanada et al. (2017) conducted a review study on the effects of mindfulness training on cancer patients and found that this training had no effect on cytokines in healthy individuals. However, it appears to affect cytokines, although it is unclear which cytokines are influenced. The findings suggest that this training may help improve the immune system, increasing the production of interleukin (IL-4) and reducing gamma interferon (IFN-Y) (Sanada, 2017). Langcher et al. (2018) showed that mindfulness training reduced salivary cortisol and cytokine IL-6 levels over a short period. Therefore, mindfulness-based stress reduction training is one of the most important recent interventions for women with cancer, addressing both physiological and psychological indices (Lengacher, 2019). Regarding the impact of this training on reducing experiential avoidance and increasing self-compassion, there is a lack of systematic research, especially in Iran. The challenges of using this method in breast cancer patients in Iran are not yet clear. Research on changing risk levels of physiological indices is limited, and some research shows that this educational method is effective (Sanada, 2017), while some indicate it has no significant effect (Small, 2017). Thus, there are challenges regarding the effect of this educational method on

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reducing or increasing physiological indices. Lengacher et al. (2019) stated that research should focus on whether this type of training can reduce risk levels of physiological indices such as cytokines and cortisol. Furthermore, regarding the effectiveness of mindfulness training on cancer patients, both in Iran and other countries, with variables of self-compassion and experiential avoidance, there is a lack of systematic research, and most studies in this area are related to other disorders and diseases (Lengacher, 2019). Therefore, there is a need for descriptive research to demonstrate the relationship between variables of self-compassion and experiential avoidance with breast cancer, as well as the adherence to treatment in individuals with low self-compassion (Dowd & Jung, 2017), and the significant distress experienced by individuals with high experiential avoidance (Aguirre-Camacho, 2017). This issue may pose a major problem for women with breast cancer, and attention to this matter could be significant for their recovery.

Therefore, conducting educational research could provide more information for use in preventative and practical situations. Thus, the fundamental research question is whether mindfulness training affects self-compassion, experiential avoidance, and physiological indices in women with breast cancer.

2. Methods

2.1. Study design and Participant

The present study was conducted as a quasi-experimental research with a pre-test, post-test, and control group design, aiming for practical applications. The independent variable in this study was mindfulness training, while the dependent variables included physiological indices, experiential avoidance, and self-compassion. The study population comprised all women diagnosed with stage 1 and 2 breast cancer who were under medical care following chemotherapy or radiotherapy at Shahid Tajrish Hospital during 2020-2021. A convenience sampling method was used. Initially, researchers encouraged patients and their families to participate in the study. Subsequently, 40 women willing to adhere to the study protocols were selected as the sample. They were randomly divided into two groups: experimental (20 participants) and control (20 participants). All selected samples had stage 1 or 2 breast cancer.

After the research proposal was approved by the university research council and a proposal was made to conduct the study at Shahid Tehran Hospital, all women with breast cancer who visited this hospital were considered for the sample based on inclusion and exclusion criteria. Before any intervention, all patients completed a consent form. Criteria included the ability to read and write Persian, no mental disorders such as psychosis, mania-depression, use of psychiatric drugs, or undergoing other psychotherapeutic training courses, as well as no diagnosis of physical disorders other than cancer as exclusion criteria.

2.2. Measures

2.2.1. Self-Compassion

This is a 26-item self-report scale developed by Neff in 2003. It includes six subscales: self-kindness (5 items), self-judgment (5 items), common humanity (4 items), mindfulness (4 items), isolation (4 items), and over-identification (4 items). Participants responded to the questionnaire items on a five-point scale from zero (almost never) to four (almost always). The overall self-compassion score is the mean of these six scales (including reverse scores). Initial validation of the questionnaire indicated high internal consistency for all six scales, and factor analysis showed that the self-compassion factor independently explained these correlations. Internal consistency of this questionnaire was .92, and test-retest reliability was .93. Cronbach's alpha coefficients for the six subscales ranged from .61 for over-identification to .89 for mindfulness (Basharpoor, 2013).

2.2.2. Acceptance and Action

This questionnaire was developed by Bond and colleagues (2011) as a 10-item version of the original scale created by Hayes (2000). This measure assesses constructs related to acceptance, diversity, experiential avoidance, and psychological flexibility. It uses a 7-point Likert scale from 1 to 7 to measure experiential avoidance. Higher scores indicate greater psychological flexibility. Results from 2816 participants across six different samples showed satisfactory reliability and validity of this tool. The average alpha coefficient was .84, and test-retest reliability over 3 and 12 months was .81 and .79, respectively. The second version of this questionnaire appears to have better psychometric stability (Bond, 2011). In Iran, Abbsi et al. (2012) examined the psychometric properties of this questionnaire and confirmed that among the factors of experiential avoidance, only the emotional avoidance factor with 7 items was validated. This questionnaire demonstrated good internal

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consistency (.71-.89) and satisfactory discriminative validity (Abasi et al., 2012).

2.2.3. *Physiological Indices*

The physiological indices used in patients with cancer include cortisol, cytokines, C-reactive protein, and neuropeptides (Sanada, 2017). To evaluate cortisol and cytokines, blood samples are initially collected by laboratory personnel at the beginning of the training and analyzed (Lengacher, 2019). Since these indices have been studied in patients with breast cancer and there are still challenges in this area, any of these indices that present practical, cost-related, or especially important issues will be selected.

2.3. *Interventions*

2.3.1. *Mindfulness Therapy*

All participants in both groups completed the relevant questionnaires at the beginning of the study and before the training (pre-test phase) and once more after the training (post-test phase). Tests were conducted twice, once on the first day, 20 minutes before the start of the first session (pre-test), and the second time one day after the last training session (post-test) following the protocol by Lengacher et al. (2019) (Lengacher, 2019). Data were then recorded for statistical analysis.

Session 1: Pre-test and Introduction

This initial session involves administering pre-tests followed by introductions among participants. An overview of breast cancer and its impact on families is provided to contextualize the importance of the intervention. A brief introduction to mindfulness is given. Participants engage in a mindfulness exercise, the "Raisin Eating Exercise," which introduces them to the concept of mindful eating. The session continues with discussions on automatic behaviors versus those performed mindfully. Participants are also introduced to the concept of mindful breathing and participate in a focused breathing meditation. The importance of practicing these skills between sessions is emphasized.

Session 2: Review and Body Scan

The second session begins with a review of practices from the previous session, and participants share their experiences of applying mindful breathing and focused breathing meditation throughout the week. A body scan exercise is introduced to deepen body awareness. Discussions encourage sharing personal experiences with mindfulness practices. Differences between describing and judging are explored along with potential obstacles. The session ends with a seated meditation focusing on breath, followed by group discussion on the perceived effectiveness of the training.

Session 3: Review and Emotion and Sensation Education

This session reviews the previous session and discusses the application of learned skills. Participants are taught about the three concepts of emotions, bodily sensations, and thoughts. A short practice of mindful seeing or listening is introduced. This includes a three-minute breathing space meditation focusing on breath and body sensations, followed by mindful movements. The effectiveness of the teachings and their impact are collectively reviewed.

Session 4: Stress Management and Mindful Walking

Participants review the previous session's learning and discuss stress and typical reactions to challenging situations, exploring alternative attitudes and reactions. A three-minute breathing exercise is taught. The session includes a seated meditation paying attention to breath, body, sounds, and thoughts (also known as the four foundations of mindfulness meditation). Mindful walking is practiced, focusing on the sense of taste through mindful eating. The session concludes with a group discussion on the training's effectiveness.

Session 5: Mindful Listening and Acceptance

After reviewing the previous session, this session emphasizes mindful attention and listening. A seated meditation is practiced with focus on breath, body, sounds, and thoughts. Discussions focus on acknowledging and accepting the present reality as it is. A second series of mindful body movements is conducted. The session concludes with a group discussion evaluating the teachings and their effectiveness.

Session 6: Visual Mindfulness and Judgment Awareness

This session begins with a review, followed by a three-minute breathing exercise. Discussions address the often-unrealistic nature of our thoughts. Attention is focused on the sense of sight, teaching mindful seeing. Participants practice describing an object from various angles, distinguishing description from judgment. The session ends with a group discussion on the teachings.

Session 7: Mindful Touch and Self-Care

The session reviews previous learnings and introduces attention to the sense of touch through mindful touching exercises. An open awareness meditation is practiced, attending to whatever enters awareness moment by moment. Discussions explore the best ways to care for oneself, including evaluating daily activities that are pleasant versus

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unpleasant and planning for enjoyable activities. A loving-kindness meditation is included to foster positive emotions towards oneself and others. The session concludes with group feedback on the effectiveness of the training.

Session 8: Olfactory Mindfulness and Program Review

The final session reviews all that has been learned throughout the program. Attention is focused on the sense of smell with a practice of mindful smelling. A physical body scan is conducted. The session includes a general evaluation of the training and introduces further resources. A post-test is administered to assess the impact of the intervention. This session wraps up the program, allowing participants to reflect on and discuss their learning and transformation.

2.4. Data Analysis

For data analysis, descriptive statistics were used to examine central tendency and dispersion, and inferential analysis was conducted using covariance analysis with SPSS software, version 20. Before the main mindfulness training sessions began, a session was held for the experimental group where all objectives, steps, and necessary regulations were fully explained.

3. Findings and Results

In terms of demographic findings, the mean (standard deviation) age of the experimental group members was 49.06 (2.33) years and the control group was 50.19 (1.15) years. Also, the mean (standard deviation) disease duration for the experimental group members was 2.49 (0.61) years and for the control group was 2.06 (0.82) years.

Table 1

Physiological Variables (Cortisol, CRP, and IL-6) of Participants in the Pre- and Post-Intervention Stages

Variable	Group	Pre-test Mean	Pre-test SD	Post-test Mean	Post-test SD
Cortisol	Experimental	17.12	3.08	11.80	2.21
	Control	15.93	3.41	16.56	4.19
C-reactive Protein	Experimental	4.88	2.13	5.59	1.25
	Control	4.62	2.38	5.08	2.17
Interleukin 6	Experimental	16.33	2.97	15.80	3.77
	Control	14.85	3.48	15.52	3.11

Table 1 shows the mean levels of physiological variables (Cortisol, IL-6, and CRP) for both control and experimental groups before and after the intervention in women with breast cancer, indicating noticeable changes in the control group in the post-test phase compared to the pre-test phase.

Table 2

ANCOVA Results on Psychological and Physiological Variables Between Experimental and Control Groups After Mindfulness Training in Women with Breast Cancer

Variable	Mean Squares	Degrees of Freedom	F	p-value	Effect Size
Experiential Avoidance	92.82	1	4.75	0.03	0.15
Self-Compassion	69.605	1	6.35	0.01	0.19
Cortisol	298.23	1	7.38	0.01	0.22
C-reactive Protein	1.90	1	0.04	0.83	0.002
Interleukin 6	1066.306	1	0.83	0.36	0.03

In this study, we conducted thorough checks to ensure that all assumptions for the statistical tests were met. Before performing the ANCOVA, we verified the assumption of homogeneity of regression slopes; there was no significant interaction between the pre-test scores and group membership, $F(1, 36) = 0.56$, $p = .457$, suggesting that the slopes were homogeneous. Additionally, the assumption of normality was tested and confirmed through Shapiro-Wilk tests for each group and variable, with results showing p-values greater than .05, indicating normal distribution of residuals. Levene's test for equality of variances was performed and confirmed homogeneity of variances across

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groups for the dependent variables cortisol (F = 2.14, p = .150), CRP (F = 0.97, p = .331), and IL-6 (F = 1.89, p = .176). Moreover, the assumption of independence of observations was assured by the randomized controlled design of the study. These verifications facilitated robust and valid subsequent analyses.

As reported in Table 2, the ANCOVA results for comparing psychological (experiential avoidance and self-compassion) and physiological variables (cortisol, IL-6, and CRP) between the control and experimental groups after the mindfulness intervention in women with breast cancer are presented. In psychological variables, results indicate significant differences between the control and experimental groups in experiential avoidance (F = 4.75, p = .03) and self-compassion (F = 6.35, p = .01). In physiological variables, results show a significant difference in cortisol levels between the two groups (F = 7.38, p = .01). However, no significant difference was observed between the two groups in IL-6 levels (F = 0.04, p = .83). Additionally, there is no significant difference in CRP levels between the control and experimental groups (F = 0.83, p = .36).

4. Discussion and Conclusion

The aim of this research was to investigate the effectiveness of mindfulness training on experiential avoidance, self-compassion, and physiological indices in women with breast cancer. The results of this study showed that mindfulness training increases self-compassion in women with breast cancer, such that self-compassion in the experimental group was significantly better than in the control group. In other words, the findings indicate that mindfulness training can improve self-compassion and reduce experiential avoidance in women with breast cancer. Moreover, such practices led to a reduction in stress-related cortisol levels in these patients. Therefore, it can be concluded that mindfulness training is effective in improving psychological conditions and reducing stress in women with breast cancer.

The results demonstrated that mindfulness training significantly increased self-compassion in women with breast cancer, such that the mean self-compassion in the experimental group significantly increased compared to the control group. Thus, this study's findings align with the prior research (Birnie, 2010; Boellinghaus, 2014; Brown, 2003; Carlson, 2007; Carlson, 2004; Evans, 2018; Gonzalez-Hernandez, 2018; Lengacher, 2019; Sanada, 2017; Small, 2017; Witek-Janusek, 2008; Würtzen & Flyger, 2015). To explain this finding, it can be argued that self-compassion is defined as how one deals with suffering, harm, and a sense of helping oneself to solve one's own problems (Wren, 2012). High self-compassion is associated with psychological well-being and protects the individual from stress, meaning the acceptance of vulnerable emotions, caring and kindness towards oneself, understanding, and a non-judgmental attitude toward one's failures and shortcomings, and recognizing common human experiences. One of the biggest problems for women with breast cancer is body dissatisfaction (Sherman, 2018). Individuals with high self-compassion have the least concern about their body image and the highest body satisfaction (Wasylkiw, 2012). Self-compassion can also act as a protective factor against inflammation caused by stress. Research has shown that individuals with higher self-compassion levels had lower responses to interleukin-6 (Birnie, 2010). Alizadeh and colleagues (2018) demonstrated that in patients with breast cancer, self-compassion significantly correlated with their resilience (Alizadeh, 2018). Mindfulness creates a different attitude or relationship with thoughts, emotions, and feelings, including maintaining complete, moment-to-moment attention and having an accepting, non-judgmental attitude. Through mindfulness-based practices and techniques, a person becomes aware of their daily activities and the automatic use of the mind in the past and future, gaining moment-to-moment awareness of thoughts, emotions, and physical states, gaining control over them, and freeing themselves from the mundane, automatic mind focused on the past and future (Evans, 2018).

Moreover, mindfulness is acceptance in practice, not as a single activity or decision. Returning to the primary subject promotes acceptance of both pleasant and unpleasant characteristics. This is important because it may reduce self-criticism in individuals facing their cancer challenges, thus fostering acceptance and practice of it. Ultimately, mindfulness leads to changes in the relationship with pain and suffering. Ultimately, mindfulness leads to awareness of oneself and others. Observing oneself is one of the key techniques of mindfulness, where a person discovers their strengths and weaknesses through conscious observation and, along with acceptance techniques, tries to accept these strengths and weaknesses. This technique generally leads to personal insight into one's problems and can play a significant role in learning for treatment and monitoring of cancer (Sanada, 2017; Small, 2017).

The results also showed that mindfulness training led to a significant reduction in experiential avoidance in women

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with breast cancer, such that the mean experiential avoidance in the experimental group significantly decreased compared to the control group. Therefore, this result aligns with the prior findings (Aguirre-Camacho, 2017; Sachse et al., 2011; Sedighi Arfaee et al., 2021; Solimanpour et al., 2022; Weinstein et al., 2009; Wharton et al., 2019; Zhang & Wang, 2022)

To explain this result, consider that experiential avoidance relates to avoiding personal bad experiences that include bodily sensations, thoughts, memories, behavioral antecedents, and efforts to change bad experiences and outcomes (Spinhoven, 2014). Experiential avoidance, through trying not to think about cancer, staying away from situations that might remind them of cancer, or avoiding feelings directly associated with cancer, impacts patients with breast cancer (Aguirre-Camacho, 2017). Findings show that women with breast cancer quickly move towards experiential avoidance, denying intense cancer-related events such as emotions, thoughts, and physical sensations through deliberate efforts to control and change the intensity, duration, or form of these private physical events, and distracting themselves from situations that provoke such feelings (Aguirre-Camacho, 2017). Thus, experiential avoidance is a fundamental problem in this illness (Miller, 2011). To explain this result, mindfulness in cancerous women is defined as a non-judgmental and balanced sense of awareness that helps in clearly seeing and accepting emotions and physical phenomena as they occur (Aguirre-Camacho, 2017). Mindfulness reduces avoidant experiences and the tendency to experience unpleasant bodily feelings, emotions, and thoughts (Brown, 2003). Mindfulness creates a different attitude or relationship with thoughts, emotions, and feelings that include maintaining complete, moment-to-moment attention and having an accepting, non-judgmental attitude. Through mindfulness-based practices and techniques, a cancer patient becomes aware of their daily activities and the automatic use of the mind in the past and future, gaining moment-to-moment awareness of thoughts, emotions, and physical states, gaining control over them, and freeing themselves from the mundane, automatic mind focused on the past and future (Würtzen & Flyger, 2015). These interventions focus on changing function and not the form of behavior, emotions, cognition, bodily sensations, and external variables. Their goal is to change the relationship between thoughts and emotions, but not the content of thoughts and emotions. This distinction in the mental and psychological realm is important and has a fundamental effect on the possibility of changing mechanisms (Lengacher, 2019). Consequently, increased mindfulness improves psychological functioning. Different aspects of situational mindfulness affect psychological functioning (Li et al., 2023; Sachse et al., 2011). One aspect of mindfulness is attention and concentration. Findings indicate that increased attention facilitates the recognition of related internal factors, and this recognition leads to the development and transformation of perception (Weinstein et al., 2009; Wharton et al., 2019). Perception also leads to focus, the automatization of perception, detachment, and metacognitive awareness (Zhang & Wang, 2022).

The results showed that mindfulness training led to a reduction in cortisol levels in women with breast cancer, such that the average cortisol level in the experimental group decreased significantly compared to the control group. Sanada (2017) obtained similar results (Sanada, 2017), but these were not consistent with the findings of Small and colleagues (2017) (Small, 2017). However, there was no significant effect on the variables of CRP and interleukin-6. Thus, this study's results align with prior findings (Sanada, 2017), but not with some previous results (Lengacher, 2019). This implies that mindfulness training did not have a significant effect on increasing or decreasing interleukin-6 levels, meaning this training could not significantly alter the levels of white blood cells. IL-6 generally has anti-inflammatory effects and causes the release of acute phase proteins from liver cells similar to CRP. CRP is also an acute-phase protein that acts as both a pro-inflammatory and anti-inflammatory molecule and, in the pro-inflammatory state, serves as a mechanism for marking damaged cells and, in the anti-inflammatory state, neutralizes anti-inflammatory cytokines, proteases, and initiates oxidation during the inflammatory response (Tartibian, 2015).

To explain this finding, Sanada and colleagues (2017) found that mindfulness training had no effect on cytokines in normal individuals (Sanada, 2017). However, it appears that this training does affect cytokines, but it is unclear which ones are affected. The findings suggest that this training may help improve the body's immune system and increase the production of interleukin (IL-4) and decrease gamma interferon (IFN-Y). Lengacher and colleagues (2019) demonstrated that mindfulness training reduced cortisol and cytokine IL-6 over a short period (Lengacher, 2019). To explain this finding, it can be considered that stress is a major issue for women with breast cancer (Stagl, 2015). Stress causes significant changes in physiological processes (Gibbons, 2017). Therefore, mindfulness training may have a significant impact on enhancing the body's

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immune system and, through its breathing and meditative techniques and by focusing on the body, may improve the bodily function of cancer patients and temporarily increase white blood cell levels and suppress cancer cells. In terms of cancer patients, it seems that mindfulness therapy affects cytokine levels. However, the type of cytokine affected was not clear. It is possible that mindfulness therapy improves the body's immune system and increases interleukin 4 and decreases gamma interferon. To explain this finding, it can be argued that mindfulness training, with its breathing and body-related meditative techniques, has managed to significantly reduce cortisol levels during the training period. There is evidence that mindfulness can reduce stress in cancer patients. Findings indicate that mindfulness training sessions reduce plasma cortisol levels (Witek-Janusek, 2008) and salivary cortisol (Carlson, 2007; Carlson, 2004).

5. Suggestions and Limitations

This study, like any other, had limitations, including parental and familial stresses about cancer, which complicated the participation of women with cancer in the experimental group. The researcher was unable to control the effects of the COVID-19 pandemic and the stresses resulting from it, therefore facing limitations in generalizing the findings to the target population.

It is recommended that for measuring cortisol levels, alongside blood tests, saliva tests should also be utilized, and their results should be analyzed. Future studies should control confounding variables such as nutrition, temperature, and weather conditions for more precise investigations. It is also suggested that other physiological indices be examined in future research. Generally, based on the results of the current study, the use of mindfulness training can be beneficial for reducing cortisol and stress in cancer patients. Additionally, the use of educational packages based on mindfulness training for patients and medical staff in specialized hospitals could have a significant impact.

Authors' Contributions

All authors have contributed significantly to the research process and the development of the manuscript.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

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Declaration of Interest

The authors report no conflict of interest.

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Ethical Considerations

The study protocol adhered to the principles outlined in the Helsinki Declaration, which provides guidelines for ethical research involving human participants.

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