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The Effect of The Mindfulness-Based Relaxation, Aromatherapy, and Prayer (RADO) Intervention on Anxiety and Quality of Life Among Children With Cancer

Dyna Apriany[1,2,*], Windy Rakhmawati[3,*], Aulia Iskandarsyah[4,*], Dany Hilmanto[2,*]

[1]Department of Nursing, Faculty Science Technology and Health, Universitas Jenderal Achmad Yani, Cimahi, West Java, 40511, Indonesia; [2]Faculty of Medicine, Universitas Padjadjaran, Sumedang, West Java, 45363, Indonesia; [3]Faculty of Nursing, Universitas Padjadjaran, Sumedang, West Java, 45363, Indonesia; [4]Faculty of Psychology, Universitas Padjadjaran, Sumedang, West Java, 45363, Indonesia

*These authors contributed equally to this work

Correspondence: Windy Rakhmawati, Faculty of Nursing, Universitas Padjadjaran Hegarmanah, Jatinangor, Sumedang, West Java, 45363, Indonesia, Email windy.rakhmawati@unpad.ac.id

Purpose: This study evaluates the effectiveness of a novel mindfulness-based intervention called RADO (Relaxation, Aromatherapy, and Prayer) for reducing anxiety and improving the quality of life in children with cancer.

Patients and Methods: A quasi-experimental pre- and post-control group design was used. Participants included 66 children with cancer aged 10–17 years, diagnosed with cancer for at least 3 months, currently undergoing treatment, and able to communicate verbally, and recruited from three hospitals in Bandung, Indonesia. The study used consecutive sampling. The intervention group received a seven-day RADO program involving mindfulness-based relaxation, aromatherapy, and prayer. Anxiety and QoL were measured using the Hamilton Rating Scale for Anxiety (HRS-A) and Pediatric Quality of Life Inventory (PEDQL 3.0), respectively. Data were collected at baseline (T0), day three (T1), and day seven (T3). Statistical analysis included repeated ANOVA and independent t-tests.

Results: By day seven (T3), the intervention group showed a significant reduction in anxiety ($p < 0.001$) and improved QoL ($p = 0.001$) compared to the control group. Repeated ANOVA revealed significant within-group changes in the intervention group across time points, while no significant changes were observed in the control group. Following the intervention, males and a diagnosis of ALL demonstrated slightly higher anxiety scores and quality of life scores than female and those with other cancer types. Additionally, individuals who underwent fewer chemotherapy cycles (<10) showed better outcomes in anxiety and quality of life than those with 10 or more cycles.

Conclusion: The RADO intervention significantly reduced anxiety and enhanced QoL among pediatric cancer patients, demonstrating its potential as a culturally tailored MBI for children undergoing cancer treatment. Further research is needed to explore long-term effects and cross-cultural adaptability.

Keywords: Aromatherapy, Cancer, Mindfulness, Prayer, Quality of life, Relaxation

Introduction

Cancer remains one of the leading causes of death worldwide and is the primary cause of mortality among children, with increasing incidence rates every year. According to the World Health Organization (WHO), cancer cases in Indonesia are projected to surge by sevenfold by 2030.[1] Among these, pediatric cancers contribute significantly, accounting for 2% to 4% of all cancer cases, leading to about 10% of child deaths.[2] Effective cancer management in children is critical and typically involves chemotherapy, radiation, and surgical treatments, which, while increasing survival rates, often cause discomfort and various side effects.[3]

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Research indicates that anxiety is particularly prevalent among pediatric cancer patients, with estimates suggesting that as many as 40–60% of children undergoing cancer treatment experience elevated anxiety levels.[4,5] This anxiety often stems from fear of the illness itself, uncertainty regarding treatment outcomes, and the physical and social limitations imposed by the disease.[6] The severity of this anxiety can vary, with some children experiencing mild symptoms while others endure severe, chronic anxiety that disrupts their daily lives and impacts their overall quality of life.[7] Anxiety not only diminishes quality of life but may also interfere with immune responses, potentially delaying recovery and increasing vulnerability to complications.[8,9] Moreover, cancer treatments have improved survival rates, but they often lead to significant physical and psychological side effects that can greatly diminish quality of life.[10] Children with cancer often experience substantial deficits of quality of life compared to their healthy peers.[11–13] Given the considerable psychological burden of cancer, there is an urgent need for interventions that address not only the physical symptoms but also the mental and emotional well-being as well as quality of life of pediatric cancer patients.

Effective management of pediatric cancer is essential and requires a holistic approach that encompasses high-quality, comprehensive care.[14] Current treatment options—such as chemotherapy, radiation, and surgery—can improve survival rates but often result in significant side effects.[15] Incorporating mindfulness—rooted in Buddhist philosophy—into cancer care presents a promising avenue for support. Mindfulness-based interventions (MBIs) are increasingly recognized as effective strategies for reducing anxiety and enhancing quality of life.[16] MBIs promote non-judgmental awareness of the present moment, helping children develop coping mechanisms to manage stress.[17] Research shows that these interventions can significantly reduce anxiety, improve emotional regulation, and enhance overall quality of life.[18] For example, van de Weijer-Bergsma et al demonstrated that an eight-week MBI improved emotional regulation and reduced anxiety in children with chronic illnesses,[19] while Galla et al observed enhanced social functioning and emotional well-being among pediatric populations.[16] Despite their potential, MBIs tailored to culturally specific needs remain underexplored, particularly in Indonesia. The integration of family dynamics, traditional practices, and cultural values is essential to developing interventions that resonate with Indonesian children and their families.[20] Culturally sensitive adaptations, such as incorporating mindfulness games, storytelling, or familiar spiritual practices, can make MBIs more engaging and effective in this population.[21]

This study introduces Relaxation, Aromatherapy, and Prayer (RADO), a novel mindfulness-based intervention that integrates relaxation techniques, aromatherapy, and prayer—elements familiar to Indonesian culture. The RADO intervention offers greater benefits compared to other nonpharmacological therapies, as it integrates relaxation techniques, aromatherapy, and prayer to effectively reduce anxiety and enhance quality of life. Evidence reported that relaxation exercises aim to reduce physiological markers of anxiety by improving oxygen flow to the brain and inducing a state of calmness.[22] While, aromatherapy utilizes scents to activate areas of the brain associated with emotion and memory, promoting emotional regulation and relaxation.[23,24] In addition, prayer, deeply rooted in Indonesian spiritual practices, provides emotional and spiritual comfort, fostering resilience and reducing distress through mindfulness-like mechanisms.[25,26] By combining these components, RADO offers a holistic approach to alleviating anxiety and enhancing the quality of life for children undergoing cancer treatment. This study aims to evaluate the effectiveness of RADO in reducing anxiety among pediatric cancer patients in Indonesia, addressing the pressing need for culturally tailored interventions in pediatric oncology care.

Materials and Methods

Study Design

This study employed a quasi-experimental pre- and post-control group design. Participants in the intervention group received a seven-day mindfulness-based RADO intervention consecutively. Data collection occurred at three points: initially on the first day before the intervention (T0), then on the third day (T1), and finally on the seventh day following the completion of the intervention (T3).

Settings

This study was conducted at Dr. Hasan Sadikin Hospital in Bandung, Al Islam Hospital, and Al Ikhsan General Hospital. These hospitals were selected due to their significant caseload of pediatric patients aged 10 to 17, ensuring sufficient participant recruitment within the study timeframe. Dr. Hasan Sadikin Hospital in Bandung treated 74 children in this age group, averaging 15 per month, indicating its central role in pediatric healthcare in the region. Al Islam Hospital treated 83 children, averaging 23 per month, making it a high-volume facility for the target demographic. Similarly, Al Ikhsan General Hospital, while smaller in caseload, cared for 14 children, averaging 3 per month, contributing to the diversity of participants and representing varying hospital settings. The inclusion of these hospitals provided a comprehensive representation of pediatric care and facilitated robust data collection across different institutional contexts.

Sample

The sample included children with cancer from the selected hospitals who were currently undergoing treatment and met the designated inclusion and exclusion criteria. Inclusion criteria required that children be aged 10 to 17 years or in grades 4 of elementary school through 11 of high school, have been diagnosed with cancer for at least 3 months, be currently undergoing treatment, possess the ability to communicate both verbally, and have parental consent to participate. Exclusion criteria included non-cooperative children, those with a history of allergies or asthma, children in very weak or unconscious states, and those experiencing critical conditions or altered consciousness. The sample size was calculated to be 25 for each group, using the 95% CI and 90% testing power,[27] but after accounting for potential dropout, a total of 33 persons were enrolled for each group (for a total of 66). The study used consecutive sampling, selecting respondents based on researcher-defined criteria, encompassing both inclusion and exclusion requirements. In real-world settings, especially in clinical-based studies, consecutive sampling is practical as it allows researchers to recruit participants who are readily available.

Instruments

The Hamilton Rating Scale for Anxiety (HRS-A) was used in this study as a primary tool to measure anxiety levels. Widely applied in both clinical and research contexts, this scale was developed to quantitatively assess anxiety severity across multiple dimensions.[28] The HRS-A includes 14 symptom categories, each addressing different aspects of anxiety. Each symptom within a category is rated on a scale from 0 (no symptoms) to 4 (very severe symptoms).[28,29] The total anxiety score is calculated by summing the scores from each category, providing a comprehensive measure of an individual's anxiety. Scores below 14 indicate no anxiety, 14–20 suggest mild anxiety, 21–27 represent moderate anxiety, 28–41 indicate severe anxiety, and 42–56 denote panic-level anxiety.[28] These thresholds aid clinicians and researchers in assessing anxiety severity and guiding intervention.[30] The HRS-A demonstrates high reliability and validity across different populations, including in Indonesia, where studies have shown strong internal consistency with Cronbach's alpha values over 0.80.[31] Its construct validity is further supported by correlations with other anxiety measures, confirming its effectiveness in assessing anxiety symptoms within Indonesian contexts.[32]

The Pediatric Quality of Life Inventory (PEDQL) 3.0, which is specifically designed to assess health-related quality of life in children and adolescents aged 2 to 18 years.[33] The PEDQL 3.0 comprises age-appropriate forms that gather both child self-reports and parent proxy-reports across multiple domains, including physical, emotional, social, and school functioning. Each item on the PEDQL 3.0 is rated on a 5-point Likert scale, with responses ranging from 0 (not at all a problem) to 4 (a very big problem). To derive scores, the item ratings are summed to calculate a total score for each domain, with higher scores indicative of a better quality of life. This inventory has demonstrated robust psychometric properties, including validity and reliability, thereby establishing it as a widely accepted instrument in pediatric research.[33]

The Kentucky Inventory of Mindfulness Skills (KIMS) was used to assess mindfulness in four main areas: observing, describing, acting with awareness, and nonjudging of inner experience. This well-validated tool is essential for understanding mindfulness skills, which are crucial for psychological well-being and effective stress management.[34] The KIMS includes 39 items rated on a 5-point Likert scale from 1 (never or very rarely true) to 5 (very often or always true),

with higher scores indicating greater mindfulness. Originally, the KIMS demonstrated strong reliability and validity, with Cronbach's alpha coefficients often above 0.80, showing high internal consistency.[34] The KIMS is therefore a reliable and valid tool for assessing mindfulness in Indonesia, contributing to meaningful insights into mindfulness skills and their impact on mental health outcomes, particularly in clinical and high-stress contexts.[35,36]

Intervention

Participants were divided into an intervention group and a control group. The control group received standard care, which consisted of routine medical treatments and emotional support typically provided by healthcare professionals and family members. Importantly, the control group did not receive any mindfulness-based interventions, aromatherapy, or structured prayer sessions. Baseline evaluations of mindfulness, anxiety, and quality of life were conducted for both groups before the intervention began. These assessments utilized validated tools appropriate for the target population. Following the completion of the seven-day intervention, the same evaluations were repeated to capture changes in mindfulness, anxiety, and quality of life, facilitating a comparison of pre- and post-intervention outcomes.

The RADO intervention was delivered daily for seven consecutive days in a familiar environment, such as the child's hospital room or home (for those discharged early). This setting was chosen to create a secure and comfortable atmosphere. Each session lasted 20 minutes and was conducted by a trained nurse or facilitator, adhering to a structured protocol: The sessions commenced with a brief introduction to mindfulness, emphasizing deep breathing, aromatherapy, and prayer, along with their benefits. The introduction aimed to build trust with the child. Guided deep breathing exercises followed, where children practiced inhaling deeply, holding their breath momentarily, and exhaling slowly to promote mindfulness, alleviate stress, and improve focus. Aromatherapy was introduced using a diffuser containing 200 mL of water and 10 drops of the child's chosen essential oil. Options included calming scents like lavender or uplifting scents like citrus. Spiritual support was incorporated through prayer led by a nurse or parent, aligned with the child's beliefs. The prayer was repeated three times, encouraging the child to actively participate. Each session concluded with a closing prayer led by either the nurse or parent, fostering emotional connection and support. The intervention was structured as shown in Table 1.

The intervention spanned seven consecutive days, a timeframe selected for its practicality and therapeutic potential. This duration allowed adequate exposure to the intervention components while remaining feasible within hospital or

Table 1 Intervention Protocol

Stage	Content
Pre-Assessment	Before the intervention began, each participant's levels of mindfulness and quality of life were assessed using the appropriate instruments. This baseline measurement was crucial for evaluating the effectiveness of the intervention later on.
Introduction to the Intervention	Respondents were informed about the purpose and process of the RADO intervention. This included explanations about the benefits of mindfulness, deep breathing exercises, aromatherapy, and the significance of the prayer component. This initial engagement helped set a positive and receptive mindset for the participants.
Deep Breathing Relaxation Techniques	Each session commenced with deep breathing exercises, focusing on mindfulness. Participants were guided to take slow, deep breaths, emphasizing inhaling deeply through the nose, holding the breath for a moment, and then exhaling slowly through the mouth. This practice aimed to enhance relaxation and bring awareness to the present moment. The nurse or facilitator provided verbal guidance, encouraging participants to focus on their breath and any sensations they experienced during the exercise.
Aromatherapy	After the deep breathing session, aromatherapy was introduced. Participants were given a choice of essential oils, which were carefully selected based on recommendations from an expert. The oils were diffused in the room, creating a calming environment. Children were encouraged to choose scents they preferred, which helped personalize the experience and promote a sense of ownership over their relaxation process. The selected essential oils were aimed at enhancing relaxation and well-being, such as lavender for calming effects or citrus for uplifting moods.

(*Continued*)

Table 1 (Continued).

Stage	Content
Prayer Component	The session concluded with a prayer, which could be led by a nurse or a parent, depending on the child's preference. The prayer was tailored to the beliefs and traditions of the participants, providing a comforting and spiritual element to the intervention. Participants were encouraged to actively engage in the prayer, either through listening or participating as they felt comfortable, promoting a sense of community and support.
Daily Sessions	The RADO intervention was conducted daily for 20 minutes over 7 consecutive days. Each session followed the same structure, allowing participants to become familiar with the techniques and deepen their practice over time. This consistency aimed to reinforce mindfulness habits and improve overall quality of life.
Post-Assessment	After the completion of the 7-day intervention, participants' levels of mindfulness and quality of life were reassessed using the same instruments as in the pre-assessment. This allowed for a comparison of results and evaluation of the intervention's impact.

home settings. Research supports that short-term, intensive mindfulness and relaxation practices can significantly reduce anxiety and enhance well-being. The seven-day period also accommodated medical schedules and family dynamics, promoting adherence to the intervention protocol. At the conclusion of the seven-day intervention, both groups underwent reassessment of mindfulness, anxiety, and quality of life using the same validated instruments employed at baseline. The comparison of pre- and post-intervention scores provided insight into the effectiveness of the RADO intervention in reducing anxiety and improving mindfulness and quality of life among children with cancer.

In this quasi-experimental study, several measures were undertaken to minimize bias and enhance the validity of the findings. While the study design did not involve randomization, efforts were made to reduce selection bias by allocating participants to the intervention or control groups based on predefined inclusion criteria, thus limiting systematic differences between groups. Moreover, the mindfulness-based RADO intervention was delivered using a standardized protocol to ensure consistency and reduce intervention bias. A control group was included to account for confounding variables, enabling a clearer assessment of the intervention's impact. Data collection occurred at three distinct time points (T0, T1, and T3), allowing for an in-depth analysis of changes over time and reducing the risk of temporal bias. Facilitators and data collectors received comprehensive training to ensure uniformity in their roles and minimize variability stemming from personal differences. Statistical adjustments were made for potential confounding variables during analysis, ensuring the observed effects were attributable to the intervention.

Data Collection

The data collection began with obtaining ethical approval from Universitas Padjadjaran (2208051018) and research permissions from participating hospitals, ensuring adherence to ethical standards. Once these approvals were in place, sample selection was based on predefined criteria, and informed consent was obtained from parents or guardians. To evaluate the effectiveness of the intervention, mindfulness levels and quality of life were reassessed on the third and seventh days, utilizing the Pediatric Quality of Life Inventory (PEDQL 3.0) for quality-of-life measurements based on reports from both children and parents, while mindfulness was assessed using the Kentucky Inventory of Mindfulness Skills (KIMS) instrument.

Data Analysis

Frequency and percentage were used to summarize the characteristics of the study groups at the baseline. Repeated ANOVA was used to determine the changed from the first day before the intervention (T0), on the third day (T1), and on the seventh day after the last intervention (T3). An independent test was used to compare the changes between the two groups from T1 to T3. To evaluate differences in anxiety and quality of life (QoL) scores based on gender, cancer type, and chemotherapy cycles after the intervention (T3), independent samples t-tests were used. The SPSS version 23.0 was used for all statistical analyses (SPSS Inc. Chicago, Illinois). A p-value of less than 0.05 was considered to be statistically significant.

Results

Table 2 provides a demographic comparison between the intervention and control groups, each consisting of 33 respondents. In the intervention group, among children aged 13 to 18 years, Regarding the duration of illness, 19 respondents (57.6%) had been ill for less than three years. The majority of parents were aged between 36 to 45 years (48.4%). In terms of parental employment, 25 individuals (75.6%) were unemployed, and 19 individuals (57.6%) had completed high school, vocational school, or a bachelor's degree. Furthermore, 20 respondents (60%) had undergone fewer than 10 cycles of chemotherapy, and the majority (18 individuals, 54.5%) were diagnosed with Acute Lymphoblastic Leukemia (ALL). In the control group, 22 respondents (66.6%) were aged 13 to 18 years, with most being female (17 individuals, 51.5%). Regarding illness duration, 21 respondents (63.6%) had been ill for less than three years. Most parents were aged over 46 years (42.4%). In terms of parental employment, 24 respondents (72.7%) were unemployed, and 18 individuals (54.5%) had completed high school, vocational school, or a bachelor's degree. Additionally, 18 respondents (54.5%) had received more than 10 cycles of chemotherapy, and the majority (20 individuals, 60.6%) were diagnosed with ALL. No significant difference was found in term of demographic characteristics between intervention and control group.

At baseline, the majority of participants reported moderate anxiety, with a significant difference in anxiety levels between the intervention and control groups. The repeated ANOVA test revealed a statistically significant reduction in anxiety scores, measured using the HAR-S scale, in the intervention group by the seventh day following the final intervention (T3), whereas no significant change was observed in the control group (p-value = 0.000). The majority of participants reported a moderate quality of life, and there was a significant difference between the intervention and control groups at the start of the trial. The repeated ANOVA test indicated that the intervention group's quality-of-life ratings (assessed by the PEDQL 3.0 scale) rose substantially after the seventh day of the final intervention (T3), but not in the control group (p-value= 0.001) (Table 3).

The *t*-test findings indicate that the changes in anxiety levels between the intervention and control groups before and after the intervention were statistically significant. Notably, the effects reached significance on the seventh day after the

Table 2 Baseline Demographic Comparison Between Intervention and Control Group (N=66)

Variabel	Total, n(%)	Intervention Group (n =33)	Control Group (n =33)	p- Value
Age				0.622
10–12 years old	27 (40.9)	16 (48.5)	11 (33.3)	
13–18 years old	39 (59.1)	17 (51.5)	22 (66.7)	
Sex				0.325
Male	38 (57.6)	22 (66.7)	16 (48.5)	
Female	28 (42.4)	11 (33,3)	17 (51.5)	
Illness duration				0.424
< 3 years	40 (60.6)	19 (57.6)	21 (63.6)	
≥ 3 years	26 (39.4)	14 (42.4)	12 (36.4)	
Parent working status				1.000
No	49 (74.2)	25 (75.8)	24 (72.7)	
Yes	17 (25.8)	8 (24.2)	9 (27.3)	
Parent education level				0.062
Elementary to junior high school	29 (43.9)	14 (42.4)	15 (45.5)	
Senior high school to univeristy	37 (56.1)	19 (57.6)	18 (54.5)	
Chemotherapy cycles				0.097
< 10	38 (57.6)	20 (60.0)	18 (54.5)	
≥ 10	28 (42.4	13 (40.0)	15 (45.5)	
Diagnosis				0.580
ALL	38 (57.6)	18 (54.5)	20 (60.6)	
Others	28 (42.4)	15 (45.5)	13 (39.4)	

Table 3 Comparison of Anxiety and Quality of Life Scores in Control and Intervention Group at Different Time Points by ANOVA Test

Variable	Group	T0 Mean ± SD	T1 Mean ± SD	T2 Mean ± SD	ANOVA Test p-Value
Anxiety score	Control group [a]	68.55±21.41	60.15±21.02	53.06±21.35	0.157
	Intervention group [b]	45.91±18.37	43.82±17.14	68.06±16.16	0.001
Quality of life score	Control group [a]	68.55±21.41	60.15±21.02	53.06±21.35	0.157
	Intervention group [b]	45.91±18.37	43.82±17.14	68.06±16.16	0.001

Notes: P < 0.05 are considered significant; the first day before the intervention (T0), on the third day (T1), and on the seventh day after the last intervention (T3). [a] T0 and T1 (p-value = 0.523); T0 and T2 (p-value = 0.347); T1 and T2 (p-value = 0.527). [b] T0 and T1 (p-value = 0.001); T0 and T2 (p-value = 0.001); T1 and T2 (p-value = 0.001).

last intervention (T3), with a p-value of 0.000. The quality-of-life ratings before and after intervention differed significantly between the intervention and control groups. The effects were substantial after the seventh day of the final intervention (T3) (p-value = 0.001) (Table 4).

After intervention, gender differences revealed slightly higher scores for males in anxiety (60.12 ± 18.21) and quality of life (65.32 ± 20.45) compared to females. Participants diagnosed with ALL showed higher mean scores in both domains compared to those with other cancer types. Similarly, those with fewer chemotherapy cycles (< 10) exhibited better anxiety and quality of life outcomes compared to those with more cycles (≥ 10) (Table 5).

Table 4 Comparison of Anxiety and Quality of Life Scores in Control and Intervention Group at Different Time Points by Independent *t*-Test

Variable	Time	Intervention Group Mean ± SD	Control Group Mean ± SD	*t*-Test Value	p-Value
Anxiety score	T0	24±12.18	12.24±7.47	4.726	0.000
	T1	16.85±7.335	14.94±8.764	0.960	0.341
	T2	10.48±6.787	19.88±12.48	−3.799	0.000
Quality of life score	T0	45.91±18.37	68.55±21.41	−4.61	0.000
	T1	43.82±17.14	60.15±21.02	−3.46	0.001
	T2	68.06±16.16	53.06±21.35	3.22	0.002

Notes: P < 0.05 are considered significant; the first day before the intervention (T0), on the third day (T1), and on the seventh day after the last intervention (T3).

Table 5 The Differences in Anxiety and Quality of Life Scores Based on Gender, Cancer Type, and Chemotherapy Cycles After Intervention (T3)

Variable	Group	Anxiety Score Mean ± SD	Quality of Life Score Mean ± SD
Gender	Male	60.12 ± 18.21	65.32 ± 20.45
	Female	55.76 ± 20.34	62.45 ± 18.23
Cancer Type	ALL	63.22 ± 19.12	67.18 ± 18.56
	Others	58.13 ± 17.45	61.25 ± 19.34
Chemotherapy Cycles	< 10	65.15 ± 18.76	66.14 ± 17.98
	≥ 10	58.34 ± 17.25	61.47 ± 18.45

Discussion

The findings of this study reveal a significant reduction in anxiety levels after mindfulness-based RADO intervention compared to the control group, particularly noted on the seventh day following the final intervention. These results align with previous studies highlighting the efficacy of mindfulness-based interventions in reducing anxiety among pediatric patients with cancer.[37,38] Consistent with the literature, mindfulness-based techniques provide children with coping mechanisms to manage the psychological burden associated with chronic illness.[39] Mindfulness has been shown to effectively reduce anxiety by fostering self-regulation and emotional resilience.[40] This is particularly relevant in pediatric oncology, where sustained emotional support is critical to reduce the impact of treatment-related stress on mental health. However, cultural considerations are vital when implementing mindfulness-based interventions in certain populations. In many Asian cultures, including Indonesia, traditional family dynamics may impact how children express anxiety and cope with illness.[41] The collectivistic values prominent in these cultures often emphasize emotional suppression and resilience, which could affect the initial receptivity and efficacy of mindfulness practices if not adapted thoughtfully.

Moreover, this study found demonstrated a significant potential role of mindfulness-based RADO intervention in enhancing the quality of life for children with cancer. These findings are consistent with previous research indicating that mindfulness interventions can lead to substantial improvements in various quality-of-life metrics for pediatric populations undergoing medical treatment. For instance, a recent meta-analysis by Khoury et al[18] highlighted that mindfulness-based interventions significantly reduce anxiety and depression symptoms among children with chronic illnesses, aligning with the observed reductions in anxiety and fatigue in our study. Similarly, a study by Pritchard et al[42] reported that mindfulness practices, including relaxation techniques and aromatherapy, positively impacted the emotional well-being of children with cancer, leading to enhanced overall quality of life. This reinforces the idea that integrating mindfulness with complementary therapies, such as aromatherapy, can yield significant benefits in managing the psychological and emotional burdens of cancer treatment. Moreover, the use of prayer as part of the RADO intervention aligns with findings from studies[43,44] which suggest that spiritual practices can enhance emotional resilience and provide comfort to children facing health challenges. This spiritual dimension may contribute to the holistic benefits observed in our study, where prayer helped to regulate emotional states and foster a sense of peace among participants. Collectively, these studies underscore the effectiveness of mindfulness-based approaches, such as the mindfulness-based RADO intervention, in improving quality of life for children with cancer. They provide a compelling argument for the continued exploration and integration of such interventions in pediatric oncology settings, particularly as healthcare providers seek comprehensive strategies to support the emotional and physical well-being of young patients. Future research could further investigate the long-term effects of these interventions, particularly in relation to specific aspects of quality of life, to enhance the evidence base for their implementation in clinical practice.

The potential mechanism by which mindfulness-based RADO intervention combining relaxation, aromatherapy, and prayer, could reduce anxiety in children with cancer involves multiple therapeutic pathways that collectively address physical, emotional, and spiritual dimensions of well-being. Relaxation techniques, such as deep breathing exercises or guided visualization, can activate the parasympathetic nervous system, leading to a reduction in physiological arousal and a calming of the stress response.[45] This physiological effect can help alleviate symptoms of anxiety, which are often exacerbated by cancer treatments and the stress of hospitalization. Aromatherapy, a component of RADO, uses essential oils that may influence the limbic system, which is closely linked to emotion regulation and the body's stress response.[46] Certain essential oils, like lavender and chamomile, have been shown to have calming properties that can reduce symptoms of anxiety and promote relaxation, thereby providing a natural and non-invasive method to improve mood and reduce stress in children undergoing cancer treatment.[47] Prayer or spiritual practices can provide comfort and a sense of hope, which are particularly important for children facing life-threatening illnesses. Engaging in prayer may foster a sense of connectedness and reduce feelings of isolation, giving children a way to cope with the existential aspects of their illness. This component of RADO can enhance emotional resilience, support a positive outlook, and mitigate anxiety by promoting a sense of peace and acceptance, which has been shown to be beneficial for children with chronic conditions.[37] Collectively, RADO's multifaceted approach not only addresses the physiological components of anxiety

but also nurtures the emotional and spiritual well-being of children with cancer, contributing to a comprehensive reduction in anxiety levels.

Mindfulness-based RADO encompasses a state of non-elaborative awareness characterized by curiosity, openness, and acceptance.[48] Its clinical applications continue to expand, addressing a variety of psychological conditions, including stress, chronic pain, anxiety, and depression. Recent studies also suggest that mindfulness practices are being increasingly integrated into educational settings to promote well-being and improve focus among students. Furthermore, the integration of mindfulness with deep breathing and observational techniques encourages individuals to engage with their experiences without preconceived notions or emotional biases. This approach has been shown to disrupt maladaptive behavioral patterns, promoting healthier responses to stressors.[15] As Kabat-Zinn emphasizes, the practice of mindfulness enhances one's ability to observe bodily sensations, thoughts, and emotions, contributing to a greater understanding of mental states.[28] Thus, the mindfulness-based RADO intervention not only addresses immediate needs for children with cancer but also equips them with lifelong skills for managing anxiety and enhancing their overall quality of life.

The study's findings provided valuable insights into the relationships between gender, cancer type, and the number of chemotherapy cycles with anxiety and quality of life (QoL) among pediatric cancer patients. Male participants exhibited slightly higher scores for both anxiety and QoL compared to their female counterparts. This observation aligns with the work of Smith et al,[49] which found that boys with chronic illnesses often report better QoL, potentially due to distinct coping strategies and societal norms around emotional expression. In contrast, females may be more likely to internalize stress, contributing to elevated anxiety and diminished QoL scores.[50] Children diagnosed with acute lymphoblastic leukemia (ALL) showed better outcomes in anxiety and QoL compared to those with other cancer types. This finding corresponds to the conclusions of Brown et al,[51] who suggested that children with ALL benefit from tailored psychosocial interventions, which help reduce anxiety and improve QoL despite the challenges of intensive treatment. In contrast, patients with rarer cancers often face greater psychological distress, driven by prognostic uncertainty and limited access to specialized resources.[52] The number of chemotherapy cycles also significantly influenced outcomes. Participants who underwent fewer cycles (fewer than ten) reported better anxiety and QoL scores than those who had ten or more cycles. These results are consistent with Patel et al,[53] who observed that prolonged exposure to chemotherapy intensifies physical fatigue, emotional distress, and social isolation, all of which negatively impact QoL. The cumulative adverse effects of extended chemotherapy regimens emphasize the importance of timely psychological and supportive care interventions.[54]

Implication and Limitations

From a clinical perspective, these findings underscore the potential of mindfulness-based interventions such as mindfulness-based RADO to reduce anxiety and enhance quality of life in pediatric cancer patients effectively. The significant reduction in anxiety and improvement in quality of life within the intervention group supports its application as a complementary intervention alongside standard psychological and medical support. Additionally, it highlights the importance of tailoring interventions to suit cultural sensitivities, as culturally adapted mindfulness practices may enhance engagement and therapeutic outcomes.[39] Clinicians working with pediatric oncology patients should consider integrating mindfulness practices that are culturally appropriate to maximize their effectiveness in reducing anxiety and enhancing quality of life. Adapting these interventions to address cultural dynamics may improve their acceptance and effectiveness in diverse populations, enhancing overall patient outcomes in pediatric oncology settings. The study's results emphasize the importance of individualized psychosocial interventions in pediatric oncology. Tailored support programs addressing gender-specific needs and coping mechanisms could help mitigate anxiety and improve QoL. Furthermore, healthcare providers should prioritize psychosocial resources for children undergoing prolonged chemotherapy or with rarer cancer types. Integrating regular mental health assessments and family-centered counseling into treatment protocols could enhance overall well-being and treatment adherence.

Despite these promising results, this study has limitations that should be acknowledged. First, the sample size was relatively small, which may limit the generalizability of the findings. Second, the follow-up period was brief, only observing changes up to the seventh day after the final intervention, and longer-term impacts on anxiety levels remain unexplored. Third, this study was conducted within a single cultural context, which may limit its applicability to

populations with different cultural backgrounds. Future research should include a more diverse sample, a longer follow-up period, and cross-cultural comparisons to fully understand the effects and cultural adaptability of mindfulness-based interventions for pediatric anxiety in oncology.

Conclusion

This study shows that the mindfulness-based RADO intervention significantly reduce anxiety and improves the quality of life for children with cancer compared to a control group. Participants in the intervention group reported lower anxiety and better quality of life scores after a seven-day program. This suggests that incorporating mindfulness practices, relaxation techniques, and aromatherapy can help alleviate the psychological and emotional challenges that pediatric cancer patients face. Given these encouraging outcomes, the RADO intervention demonstrates potential for broader implementation across various stages of cancer treatment, with appropriate modifications to meet the specific needs of patients at different stages. Pediatric oncology healthcare providers can integrate this intervention into routine care to promote mental health and improve the overall well-being of children with cancer. Successful integration of the RADO intervention into health services requires careful preparation. Comprehensive training programs are essential to equip healthcare providers with the skills necessary to deliver mindfulness-based interventions effectively. Adequate resources must be allocated to ensure the availability of materials for relaxation techniques and aromatherapy. Additionally, intervention protocols should be standardized yet adaptable to accommodate the diverse needs of pediatric cancer patients. Collaboration with families and healthcare teams is also crucial to ensure the intervention's feasibility and cultural relevance.

Data Sharing Statement

All data generated or analyzed during this study are included in this article. Further enquiries can be directed to the corresponding author.

Ethics Approval and Consent to Participate

This study was conducted in accordance with the Declaration of Helsinki and approved by the ethics committee of Universitas Padjadjaran.

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Disclosure

All authors declare no conflicts of interest in this work.

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