Original Article

The Impact of Mandala Coloring on Anxiety of Children with Cystic Fibrosis: A Randomized Trial

Abstract

Background: Mandala coloring is effective in reducing anxiety. However, it has received little attention as an adjunctive therapy to manage children's anxiety. This study aimed to explore the impact of mandala coloring on the anxiety of children with Cystic Fibrosis (CF). **Materials and Methods:** The participants in this clinical trial study were 120 children aged 6–18 years with CF with mild-to-moderate anxiety admitted to Mofid Hospital in Tehran. The children were randomly divided into two groups: intervention and control. The children in the intervention group performed mandala coloring exercises every evening for 30 minutes for 6 consecutive days. The level of anxiety in the children in both groups was measured using the Spielberger State-Trait Anxiety Inventory before the intervention and 6 days after the first measurement. The collected data were analyzed using the independent *t*-test. **Results:** An analysis of the mean anxiety scores before and after the intervention showed a significant decrease in the anxiety level in the Mandala group ($Z = -3.74$, $p < 0.05$). Moreover, a significant decrease was observed after the intervention between the children in the mandala and control groups in terms of average anxiety levels (U = 1206, $p < 0.05$). An intergroup comparison showed that state anxiety was significantly different between the two groups ($U = 1143$, $p < 0.05$), but no statistical difference was observed in terms of trait anxiety ($p > 0.05$). **Conclusions:** The results indicated that holding six mandala coloring sessions reduced the anxiety of children with CF. Thus, mandala coloring is recommended as a complementary non-pharmacological method to reduce children's anxiety.

Keywords: *Anxiety, art therapy, child, cystic fibrosis, mandala coloring*

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Introduction

Cystic Fibrosis (CF) is an autosomal recessive multisystem disorder[1] and is currently the most common fatal genetic disease, with a reported prevalence of excess of 72,000 worldwide.[2] The prevalence of CF in high-risk children in the European Union has been reported as 0.737/10,000, which is similar to the value of 0.797 in the United States, and in Iran has been reported as 17.6% of children.[3] CF affects many body systems[4] and is associated with physical, psychological, and social consequences.[5] Studies have found that children with CF develop psychological symptoms such as sleep disorders, depression, and anxiety, and anxiety has become an increasing concern in people with CF.[6] Despite major medical advances, there are not many findings about the management of psychological symptoms and the promotion of mental health of people with CF.[7] Recent studies on mental well-being in people with CF have shown a significant prevalence of anxiety in this population compared to the general population. Thus, anxiety symptoms among these people are reported to be two to three times more than the general population. An increased level of anxiety can lead to a decrease in lung function, lower treatment adherence,[7,8] lower health-related quality of life, an increase in hospitalization, sleep disorders, pain, and finally increase in health care costs.[9] As anxiety and other mental health consequences in patients with CF affect the prognosis of this disease, its identification and management are of great importance.[6]

One of the techniques for managing and controlling anxiety is art therapy. Art therapy is a subdiscipline of anthroposophic medicine; according to the American Art Therapy Association (AATA), art therapy is

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a creative process to improve physical and mental conditions and is a useful tool for coping with anxiety, increasing self-confidence, and controlling stress and anxiety.[10] Thus, given the increasing importance of such treatments and the increasing trust in integrative medicine, the simultaneous use of both types of medical treatment and complementary therapy has found a special place.[11] Mandala coloring is one of the branches of art therapy that can be effective in controlling anxiety. Mandala is a compound word in the Sanskrit language that includes the words "manda" (center) and "la" (success) and refers to people's connection with their core and nature, intimacy with themselves, and achieving an essence of peace. People's drawings in circles represent what they were thinking at the time of drawing, allowing them to forget their confusion by focusing on the act of drawing.[12] Coloring can be used as a non-verbal tool to reflect children's thoughts and feelings as well as their effective communication with the therapist,[13] reducing the level of anxiety in children.[14] Some studies that have addressed mandala coloring have demonstrated the effectiveness of this technique. Emanuela *et al*.[15] (2021) showed that mandala coloring is more effective in reducing students' anxiety than other forms of coloring. Moharamkhani *et al*.[11] (2023) showed holding mandala painting sessions reduced the anxiety of Iranian children with cancer, and mandala painting can be used as a complementary non-pharmacological treatment to reduce children's anxiety. Khademi *et al*.[16] (2021) also showed that mandala coloring for 30 minutes per day was an effective strategy to reduce anxiety in hospitalized adult patients with COVID-19. Singh *et al*.[17] (2023) showed that mandala coloring can improve the attention span and cognitive abilities of children by administering it at home.

Following previous studies, it is essential to investigate the effectiveness of mandala coloring in reducing anxiety in different patients. However, given the difference between the ability of different diseases to cause anxiety in affected patients, it is necessary to examine the impact of mandala coloring in populations with different diseases, especially children with CF. Given the importance and necessity of reducing anxiety in children with CF on the one hand, and the need to conduct more studies to find the most effective non-pharmacological methods of reducing anxiety in children on the other hand, the present study aims to measure the effect of mandala coloring on the anxiety of children with CF.

Materials and Methods

From December 10, 2022, to April 6, 2023, this interventional clinical trial (IRCT20211004052665N2) aimed to examine the effect of mandala coloring on the anxiety of children with CF. The study was conducted at Mofid Hospital, affiliated with Shahid Beheshti University of Medical Sciences in Tehran, the capital of Iran. Mofid Hospital is one of the referral centers for children with CF. The inclusion criteria were the willingness to participate in the study; age 6–18 years; ability to communicate verbally; and not suffering from cognitive, speech, and hearing disorders based on the medical records. Non-cooperation in the study, change of the hospitalization location, and death of the child were considered as exclusion criteria. The children who met the requirements for entering the study were selected using convenience sampling. The selected children were placed into two groups, namely intervention and control groups, through simple random allocation and flip-the-coin method. To do so, the intervention group was considered to be the heads (on the coin), and the control group was considered to be the tails (on the back of the coin). Based on the intended sample size, the same number of coins were tossed and the participants were placed in the two intervention and control groups (each with 60 children). Enrolling participants and assigning them to intervention and control groups were performed by the first author according to the guidance of the third author as the statistician. Following a similar study by Ghamarigivi,[18] the sample size with an accuracy of 5% and a confidence interval of 90% was estimated:

Finally, considering a 10% dropout probability, the sample size was determined to be 60 persons per group (120 persons in total). Figure 1 shows the sampling and allocation process.

The instruments used to collect the data in this study were the child's demographic and clinical information questionnaire that assessed the children's age, sex, duration of CF, and hospitalization frequency, as well as the Spielberger State-Trait Anxiety Inventory (STAI). STAI was developed by Spielberger in 1983 as a self-report tool to measure patients' state and trait anxiety.[19] The inventory consists of 20 items to measure the quality of stress, worry, anxiety, and anger on a 4-point Likert scale from 1 (very little) to 4 (very much). The total STAI score ranges from 20 to 80. The scores on the state anxiety subscale are interpreted as follows: 20–31 (mild anxiety), 32–42 (mild/moderate anxiety), 43–53 (moderate/severe anxiety), 54–64 (relatively severe), 65–75 (severe anxiety), and ≥76 (very severe anxiety).[20] This instrument was validated in 1994 for the Iranian community with an internal consistency reliability of $\alpha = 0.91$ for the whole instrument, $\alpha = 0.91$ for state anxiety, and $\alpha = 0.90$ for trait anxiety.[21] In the present study, Cronbach's alpha coefficient was estimated as $\alpha = 0.87$.

The children who met the inclusion criteria were selected based on the information in their medical records. The selected children were placed into two groups, namely intervention and control groups, through simple random allocation and flip-the-coin method. First, before conducting the intervention, the anxiety questionnaire was explained individually to the child (according to the child's age and child's understanding) and accompanying parent (both

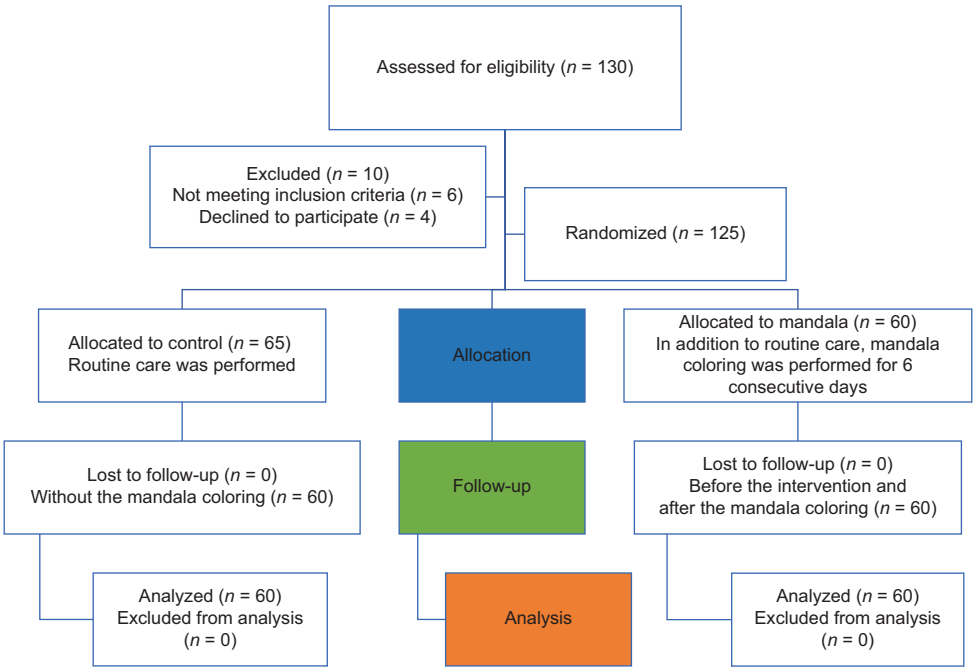

Figure 1: The sampling and allocation process

groups). Then, the level of anxiety of the children in both groups (intervention and control) was measured by STAI and through interviews with the children. Then, the children in the intervention group performed mandala coloring exercises for 30 minutes[16] in the evening for 6 consecutive days while hospitalized in the wards with the help of the first author.[16] He had been given the relevant professional training and was qualified to implement mandala coloring. To do so, at the beginning of the study, five different mandala coloring designs were printed separately on A4 (0.21 cm × 7.29 cm) paper, and a pack of 12 colored pencils was provided to each child. The children were asked to choose and complete as many parts of the mandalas as they could, while ensuring they spent 30 minutes on the activity. On the evening of the sixth day of the intervention, the level of anxiety of the children in both groups was measured using STAI through interviews with children aged 10–18 years old and children aged 6–10 years old. The level of anxiety was measured through interviews with the children and accompanying parents by the researcher. To minimize ethical problems and uniform intervention, the mandala coloring intervention was carried out in the ward's playroom and only with the presence of the child, accompanying parent, and researcher. There was a gap of 1 week between the selection of the control group and the intervention group. After completing the research, some mandalas and colored pencils were given to the control group to color at home.

In the control group, there was no intervention by the researcher for the children, and they received routine care such as encouraging the presence and participation of family members during hospital stays, providing age-appropriate information to children about their condition and the procedures they will undergo, and creating a child-friendly environment with colorful decorations, toys, and activities to make the hospital setting less intimidating according to the usual procedure. Children's anxiety was measured using STAI before routine ward care and 6 days after the first measurement by the researcher with the help of the accompanying parent. The steps taken to conduct the intervention are displayed in Figure 1.

The collected data were analyzed with IBM-SPSS software version 25 using descriptive and inferential statistics. Frequency, percentage, mean, and standard deviation were used to describe the data. Given the number of research variables, the analysis of variance was run to test the research hypothesis. Moreover, to determine the effect of the independent variable on the dependent variables, independent samples *t*-test and Pearson correlation were used. The level of significance in data analysis was considered to be less than 0.05 ($p < 0.05$).

Ethical considerations

The protocol used in this study was confirmed with code of ethics IR.SBMU.RICH.REC.1401.026 on October 13, 2022 from the Children's Health Research Institute of Shahid Beheshti University of Medical Sciences. Verbal and written consent was also obtained from all children and their parents. Moreover, the control group received the same intervention as the mandala group after the data were analyzed completely.

Results

Table 1 shows the demographic and clinical characteristics of the participants in the intervention and control groups. As can be seen, the average age of the children in the

intervention and control groups was 11.20 (4.20) and 11.33 (3.89) years, respectively, and out of 120 children in this study, 67 (55.83%) were girls. The results of the independent *t*-test and Chi-square test showed no statistically significant difference between the two groups in terms of age, gender, birth order, child's education, duration of disease, and frequency of admissions, and the two groups were identical in terms of demographic and clinical characteristics ($p > 0.05$). Table 2 shows a comparison of the state and trait anxiety in the participants in the two groups before and after the intervention. As displayed in the table, there was no significant difference between the children's anxiety and their demographic characteristics ($p > 0.05$).

The data from the Mann-Whitney U test showed no statistically significant difference between the two groups in terms of anxiety before the intervention ($p > 0.05$). However, after the end of the intervention, there was a statistically significant difference between the two groups, and the children in the mandala group reported a lower level of anxiety than the children in the control group ($U = 1206$, $p < 0.05$). Furthermore, there was no statistically significant difference between the two groups in terms of trait anxiety after the intervention ($p > 0.05$), but there was a significant difference between the two groups in terms of state anxiety ($U = 1143$, $p < 0.05$).

Discussion

In this study, which examined the effect of mandala coloring on the anxiety of children with CF, the findings showed the level of anxiety reported by the children in the intervention group decreased after performing mandala coloring exercises compared to the children in the control group who received only routine hospital care. The level of anxiety reported by the children in the intervention and control groups was not statistically significant before the intervention, but after the intervention, there was a significant intergroup difference in terms of anxiety. This indicates that mandala coloring for 6 days had a significant effect on reducing children's anxiety. Similarly, Gürcan (2021) confirmed the effectiveness of mandala painting in reducing the anxiety of hospitalized teenagers with cancer.[22] Moreover, Moharamkhani *et al*.[11] (2023) demonstrated the impact of 45 minutes of mandala coloring on reducing anxiety in children aged 9–14 years. These similar findings could be attributed to the fact that mandala as an art therapy technique can simulate mindfulness interventions to focus participants' attention on the here and now, away from worries and anxiety.[23] According to researchers, mandala painting is effective in reducing children's anxiety because it helps them overcome their fears, feel safe, and establish better social relationships.[11]

In contrast, Babaei (2021) and Al-Yateem (2016) did not find a significant difference in preoperative anxiety levels in children in the painting therapy group.[24,25] This inconsistency could be attributed to the difference in acute and chronic anxiety. Preoperative anxiety is temporary and intermittent anxiety, while anxiety in a chronic disease seems to be stable and permanent because of the permanent tensions caused by the disease. Furthermore, it seems that mandala coloring has a stronger impact than usual paintings in reducing anxiety.[26] Some studies have also confirmed the greater effect of mandala painting on reducing anxiety compared to other coloring activities.[27-29] According to Forkosh and Drake (2017), coloring a predesigned and printed design such as a mandala, instead of drawing a picture or design, leads to a state that does not require the use of cognitive skills and allows a person to focus on their coloring activity and immerse themselves in it.[30]

The data in this study also revealed a significant difference between the mandala group and the control group in terms of state anxiety after the intervention; there was no statistically significant difference between the two groups in terms of trait anxiety after the intervention, as reported in previous studies (e.g., Emanuela, 2021).[15] Accordingly, it can be argued that trait anxiety remains relatively stable and unchanged for a long period, while state anxiety fluctuates under the influence of environmental conditions. According to Härter, trait anxiety represents a stable personality trait, thus following a steady course.[31] In the present study, the children were engaged in mandala coloring activities only for 6 days. Thus, a longer timeframe may be needed for mandala coloring to reduce trait anxiety.

Table 1: The participant's demographic and clinical characteristics

Variables	Categories	Groups		Statistics
		Intervention group *n* (%)	Control group *n* (%)	
Gender	Female	36 (60)	31 (51.67)	Chi=0.84, df=1, *p*=0.358
	Male	24 (40)	29 (48.33)	
Education	Primary school	35 (58.33)	37 (61.67)	Chi=0.13, df=1, *p*=0.709
	High school	25 (41.67)	23 (38.33)	
Age (years)	6–10	31 (51.67)	31 (51.67)	Chi=0.27, df=2, *p*=0.871
	11–14	13 (21.66)	15 (25)	
	15–18	16 (26.67)	14 (23.33)	
Duration of disease (year)		9.58 (4.46)	9.10 (3.67)	*t*=0.64, *p*=0.519
Frequency of hospitalization		4.80 (3.10)	4.71 (3.02)	*t*=0.14, *p*=0.882

Table 2: Comparing the anxiety levels between the two groups

Anxiety	Groups Mean (SD)		Mann-Whitney *U* test
	Intervention	Control	
Pre-intervention	91.91 (19.5)	85.76 (18.46)	U=1479, p=0.092
Post-intervention	79.05 (13.16)	89.95 (20.67)	U=1206, p=0.002
Wilcoxon test	Z=−3.74, p=0.000	Z=−1.18, p=0.236	
State anxiety	40.61 (8.39)	47.83 (11.34)	U=1143, p=0.001
Trait anxiety	38.43 (10.24)	42.11 (12.36)	U=1485, p=0.098

The findings from this study showed no significant relationship between the children's demographic characteristics and anxiety. Similarly, Moharamkhani *et al*.[11] (2023) examined the effect of mandala on the anxiety of children with cancer and found no significant relationship between gender and education level with the level of anxiety. However, an extensive search in the databases found no study on the effect of mandala coloring on the anxiety of children with CF. Thus, it was not possible to compare the findings of the present study with the results reported in other studies. Therefore, further research in this field can provide more reliable findings.

As a limitation of this study, numerous factors that can influence the anxiety levels of children with CF were not examined as confounding variables. For example, the presence of an anxiety disorder might be a confounder that was overlooked due to contraindications for applying mandala therapy in this group and the lack of eligible participants.

Conclusion

The findings from this study revealed that mandala coloring, as a non-pharmacological method and art therapy intervention, reduces anxiety in children with CF. Moreover, state anxiety was reduced in children who did mandala coloring compared to children who did not receive this intervention, but mandala coloring did not affect children's trait anxiety. Accordingly, nurses and other healthcare professionals can use mandala coloring as a low-cost, practical, and complementary technique with other routine care to reduce and control anxiety in patients. Furthermore, future studies need to address the effect of this method on the anxiety of children with other chronic diseases and also on the anxiety of their parents.

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Conflicts of interest

Nothing to declare.

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