




## The Effectiveness of Brain-Based Parenting Training on Parenting Adaptability and Parenting Orientation in Mothers of Children Aged 6 to 10 Years with Anxiety Symptoms

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### ABSTRACT

**Objective:** This study aimed to examine the effectiveness of brain-based parenting training on enhancing parenting adaptability and parenting orientation among mothers of children aged 6 to 10 years who exhibit anxiety symptoms.

**Methods and Materials:** The study employed a quasi-experimental design with a pretest–posttest–follow-up structure and a non-equivalent control group. The statistical population consisted of all mothers of children with anxiety symptoms in Isfahan during the 2023–2024 academic year. Based on inclusion and exclusion criteria, 40 mothers were selected through purposive sampling and randomly assigned to an experimental group ( $n = 20$ ) and a control group ( $n = 20$ ). The experimental group received eight 90-minute sessions of brain-based parenting training, while the control group was placed on a waiting list. All participants completed the Parenting Adaptability Questionnaire (Yousefi, 2021) and the Parenting Orientation Questionnaire (Yousefi, 2021) at pretest, posttest, and a 45-day follow-up. Data were analyzed using repeated-measures ANOVA and Bonferroni post hoc test in SPSS 26, with significance set at  $p < .05$ .

**Findings:** The results revealed significant time  $\times$  group interaction effects for both parenting adaptability ( $F = 161.84, p < .001, \eta^2 = .850$ ) and parenting orientation ( $F = 111.84, p < .001, \eta^2 = .797$ ). Post hoc comparisons showed that the experimental group had significantly higher posttest and follow-up scores than the control group on both variables ( $p < .001$ ). These findings indicate that brain-based parenting training produced sustained improvements in mothers' adaptability and orientation.

**Conclusion:** Brain-based parenting training is an effective intervention for improving mothers' parenting adaptability and orientation, which may contribute to reducing anxiety risk and fostering healthier parent–child relationships.

**Keywords:** Brain-based parenting, Parenting adaptability, Parenting orientation, Anxious children, Parenting intervention

## 1. Introduction

Parenting is one of the most influential environmental factors in children's emotional, behavioral, and social development, and it plays a pivotal role in shaping their mental health outcomes. Effective parenting practices not only foster secure attachment and emotional regulation but also mitigate the risk of anxiety disorders, which are among the most prevalent mental health issues in childhood. Evidence suggests that anxiety symptoms during early childhood, if left unaddressed, can persist into later life and negatively affect psychosocial functioning, academic engagement, and interpersonal relationships (Jewell et al., 2022; Taheri et al., 2021). Consequently, the design and implementation of evidence-based parenting interventions has become a crucial focus in psychological research and clinical practice. Among these, brain-based parenting—an approach rooted in the integration of neuroscientific principles into parenting strategies—has recently gained considerable attention as a means to enhance parenting adaptability and orientation (Karimi et al., 2024; Lyle, 2013).

Brain-based parenting emphasizes the alignment of parenting practices with the neurodevelopmental processes of both parents and children, fostering the integration of different brain regions to promote emotional regulation, problem-solving, and social connectedness (Ataran et al., 2024; Hossein Karimi et al., 2024). This approach is grounded in the understanding that the brain's architecture and functions—such as the interplay between the limbic system, prefrontal cortex, and mirror neuron systems—shape responses to stress, emotional attunement, and relational behaviors (Lyle, 2013). Integrating knowledge about brain physiology enables parents to respond more effectively to their children's emotional cues, manage their own stress, and cultivate secure attachment bonds, which serve as protective factors against the emergence and escalation of anxiety symptoms (Babore et al., 2023; Khani et al., 2024).

Empirical studies underscore the strong link between parenting styles, children's self-regulation, and anxiety-related outcomes. For example, research shows that maladaptive or inconsistent parenting can heighten children's vulnerability to emotional dysregulation and anxiety, whereas supportive, structured, and emotionally attuned parenting fosters resilience and adaptive coping mechanisms (Becker et al., 2019; Li et al., 2023). Parenting orientation—encompassing parents' attitudes, goals, and

expectations regarding their parenting roles—has been identified as a critical determinant of how parents respond to their children's emotional and behavioral needs (Meng et al., 2023; Rathore et al., 2015). Positive parenting orientation is associated with greater parental involvement, warmth, and sensitivity, which in turn enhance children's emotional security and stress regulation (Becker et al., 2019; Saadati et al., 2020). However, parents of anxious children often experience heightened parenting stress, which can disrupt their adaptability and orientation, reinforcing negative interaction cycles and maintaining children's anxiety symptoms (Babore et al., 2023; Mirzaei et al., 2022).

In this regard, training programs aimed at improving parental adaptability—defined as parents' ability to flexibly adjust their strategies in response to children's changing developmental and emotional needs—are of particular significance. Parental adaptability is considered a dynamic construct that supports constructive responses to children's distress, promotes emotional co-regulation, and facilitates the establishment of secure parent-child attachments (Abbaszadeh Arzoo et al., 2021; Aliakbari & Aslezaker, 2022). Studies have shown that enhancing parental adaptability leads to reductions in parenting stress and improvements in parent-child relationships, even in families facing psychological or developmental challenges (Ataran et al., 2024; Sadeghi Dehkordi et al., 2023). For mothers of anxious children, who often face chronic stress and uncertainty, interventions that target adaptability and orientation may be particularly beneficial for interrupting maladaptive cycles of anxiety transmission (Jewell et al., 2022; Mirzaei et al., 2024).

Brain-based parenting training is especially suited for this purpose because it explicitly incorporates strategies to strengthen parents' emotional self-regulation, reflective functioning, and neurobiological attunement to their children. This model emphasizes the integration of left and right hemispheric processing, the coordination of lower and upper brain regions, and the alignment of implicit and explicit memory systems to support responsive and regulated caregiving (Hossein Karimi et al., 2024; Karimi et al., 2024). Such neurodevelopmentally informed practices enable parents to remain emotionally available during their children's distress, provide consistent boundaries without rigidity, and create emotionally safe environments that buffer against anxiety (Khani et al., 2024; Lyle, 2013). Furthermore, brain-based parenting highlights the importance of social brain systems—such as mirror neurons—in shaping children's emotional contagion,

empathy, and social competence, reinforcing the parent's role as a neurobiological co-regulator (Ataran et al., 2024; Babaei Motlaq & Tanha, 2023).

Recent studies conducted in diverse cultural contexts support the efficacy of brain-based and related parenting programs in improving parental outcomes and reducing children's anxiety-related symptoms. For example, training mothers in mindful and brain-based parenting techniques has been shown to decrease parenting stress and increase parental self-efficacy in mothers of socially anxious children (Aliakbari & Aslezaker, 2022; Hossein Karimi et al., 2024). Similarly, interventions incorporating choice-theory and positive parenting approaches have improved mothers' life satisfaction and the quality of parent-child interactions (Abbaszadeh Arzoo et al., 2021; Nili Ahmad Abadi et al., 2019). Evidence also indicates that mindfulness-based parenting can enhance social adjustment and emotional regulation among at-risk adolescent girls, highlighting the broader benefits of such approaches in promoting resilience across developmental stages (Khani et al., 2024; Maleki Farab et al., 2024). Moreover, combining brain-based strategies with mentalization-focused or positive parenting approaches can strengthen mother-child attachment relationships and foster long-term emotional security (Ataran et al., 2024; Sadeghi Dehkordi et al., 2023).

In addition to improving parental functioning, these interventions appear to positively influence children's emotional competencies. For instance, parenting styles that emphasize emotional attunement and self-regulation skills are associated with better emotion management, greater self-control, and more positive peer interactions in children (Li et al., 2023; Meng et al., 2023). Conversely, parenting marked by high stress, low adaptability, or negative orientation tends to undermine children's emotional regulation capacities and contribute to internalizing symptoms such as anxiety (Babore et al., 2023; Jewell et al., 2022). Therefore, enhancing parents' brain-based understanding of their children's behavior may serve as a preventive mechanism against the intergenerational transmission of anxiety and related emotional difficulties (Becker et al., 2019; Mirzaei et al., 2024).

Given this evidence, the integration of brain-based principles into parenting interventions represents a promising advancement in the field of child and family psychology. Such approaches are not only theoretically grounded in contemporary neuroscience but are also empirically supported as effective means of reducing parenting stress, improving parental adaptability and

orientation, and ultimately mitigating anxiety symptoms in children (Hossein Karimi et al., 2024; Karimi et al., 2024; Saadati et al., 2020). However, despite growing support for brain-based parenting, research specifically examining its effects on the parenting adaptability and orientation of mothers of anxious children remains limited, particularly in non-Western contexts. Considering the cultural and contextual variations in parenting practices and parental role expectations, further empirical investigation is warranted (Mirzaei et al., 2022; Rathore et al., 2015).

In light of these gaps, the present study aims to evaluate the effectiveness of brain-based parenting training on parenting adaptability and parenting orientation among mothers of children aged 6 to 10 years with anxiety symptoms.

## 2. Methods and Materials

### 2.1. Study Design and Participants

This study aimed to examine the effectiveness of brain-based parenting training on adaptability and parenting orientation among mothers of children aged 6 to 10 years who exhibited anxiety symptoms. A quasi-experimental design (pretest-posttest with a non-equivalent control group) with a follow-up stage (conducted one month to 45 days after the posttest) was employed.

The statistical population consisted of all children aged 6 to 10 years in the city of Isfahan during the 2023–2024 academic year who had visited counseling centers for anxiety-related concerns. For the quantitative part, children with anxiety were selected based on inclusion and exclusion criteria. Three urban districts in Isfahan were randomly selected, and after advertising in the counseling centers of these districts, 40 mothers who met the inclusion and exclusion criteria and whose children had been diagnosed with anxiety were selected purposefully from among the volunteers. These mothers were then randomly assigned to three groups (20 participants in each group).

The inclusion criteria were as follows: having a daughter, the mother's ability to attend the sessions, receiving an anxiety diagnosis from a specialist, having only one child with anxiety, and the absence of severe neuropsychological disorders (such as major depression) in the mother. The exclusion criteria were: starting another psychotherapy simultaneously, being absent from more than two sessions, and expressing a desire to withdraw from the program.

For the quantitative phase, after obtaining the necessary approvals from the university, the researchers visited

counseling centers and advertised educational programs specifically designed for mothers of children aged 6 to 10 years with anxiety. From among the registrants, 40 mothers were purposefully selected based on the inclusion and exclusion criteria and were then randomly assigned to two experimental groups and one control group (20 participants per group). Mothers in the experimental groups received brain-based parenting training. All selected mothers were assessed using the research instruments at three stages: pretest, posttest, and follow-up.

## 2.2. Measures

The Parenting Adaptability Questionnaire was developed by Yousefi et al. (2021, as cited in Heidari et al., 2024). It consists of five subscales—concern, control, curiosity, trust, and commitment—with four items in each subscale, rated on a five-point Likert scale ranging from strongly agree (5) to strongly disagree (1). Face and content validity were confirmed by Yousefi (2021), and convergent validity was shown through its positive and significant correlation with parenting orientation. In a study by Mirzaei et al. (2025), the items were adapted to parenting contexts. After this adaptation, internal consistency was re-examined using Cronbach's alpha, yielding 0.90. Test-retest reliability was also assessed, yielding  $r = .45$ ,  $p = .001$ , indicating acceptable stability. Confirmatory factor analysis supported the five-factor structure, confirming construct validity. The questionnaire's scores showed positive correlations with parenting self-efficacy and negative correlations with parenting stress, indicating convergent validity. In the present study, internal consistency was again assessed using Cronbach's alpha and was found to be above .80.

Parenting orientation was measured using the Parenting Orientation Questionnaire developed by Yousefi (2021, as cited in Mirzaei et al., 2024). This instrument contains 15 items and evaluates optimism toward parenting. Items are rated on a five-point Likert scale from strongly agree (5) to strongly disagree (1), and all items are scored directly. Face and content validity were confirmed by Yousefi (2021), and convergent validity was shown through its positive and significant correlation with parenting adaptability. Confirmatory factor analysis also supported the construct validity of this questionnaire. Internal consistency was reported as  $\alpha = .85$ , and concurrent validity was confirmed by its positive and significant correlation with the Life Orientation Test (Carver & Scheier, 2004). Moreover, all item scores were positively and significantly correlated with

the total score, further supporting construct validity. In studies by Mirzaei et al. (2024) and Sadeghi et al. (2022), internal consistency was reassessed and found to be above .80. In the present study, Cronbach's alpha was calculated again and yielded .91.

## 2.3. Intervention

The brain-based parenting training program, adapted from Karimi et al. (2024), was delivered over eight weekly sessions, each lasting 90 minutes, and aimed to enhance mothers' understanding and application of neurodevelopmental principles in parenting. Session 1 focused on the importance of effective parenting and provided an overview of the goals of brain-based parenting. Session 2 introduced the structure and physiology of the brain, the roles of the parent's and child's brains, the concept of brain integration, and the effects of chaos versus rigidity in parent-child interactions. Session 3 addressed the functions of the left and right hemispheres, their integration for problem-solving, and strategies for enhancing hemispheric integration in both parents and children. Session 4 explored the upper and lower brain regions, their roles in emotional regulation and reasoning, and their integration in parenting challenges. Session 5 covered explicit and implicit memory systems, their daily functions, and strategies to integrate these memory types in both parents and children. Session 6 clarified the distinction between "feeling" and "being," introduced focused attention and the concept of "mindsight," and provided techniques to strengthen mindsight in both parents and children. Session 7 examined the social brain, including mirror neurons, and offered strategies to foster positive mental models and social connectedness in children. Session 8 reviewed all previous content, consolidated learning, and administered the posttest assessment.

## 2.4. Data Analysis

Data were analyzed using SPSS version 26. Descriptive statistics, including means and standard deviations, were calculated to summarize the data. To examine the effects of the intervention over time, a repeated-measures analysis of variance (ANOVA) was conducted, followed by the Bonferroni post hoc test for pairwise comparisons. Assumptions of normality, homogeneity of variances, and sphericity were assessed using the Shapiro-Wilk test, Levene's test, and Mauchly's test of sphericity, respectively. The Greenhouse-Geisser correction was applied when the

sphericity assumption was violated. The significance level was set at  $p < .05$ .

### 3. Findings and Results

To answer the research question “Is there a significant difference in the effectiveness of brain-based parenting training on adaptability and parenting orientation among

mothers of children with anxiety symptoms?”, descriptive statistics (mean and standard deviation) and inferential statistics (repeated-measures analysis of variance) were used.

Table 1 presents the means and standard deviations of parenting adaptability and parenting orientation in the research groups at the pretest, posttest, and follow-up stages.

**Table 1**

*Means and Standard Deviations of Parenting Adaptability and Parenting Orientation in the Research Groups at Three Time Points*

Variable	Time	Brain-Based Parenting Group		Control Group	
		M	SD	M	SD
Parenting Adaptability	Pretest	56.60	5.09	54.05	4.14
	Posttest	65.40	5.43	53.95	3.89
	Follow-up	69.15	4.91	54.00	4.05
Parenting Orientation	Pretest	27.65	4.52	27.20	3.98
	Posttest	35.65	4.96	27.35	3.97
	Follow-up	39.90	5.17	27.29	3.74

As shown in Table 1, for the variables of parenting adaptability and parenting orientation, the brain-based parenting group showed changes at the posttest and follow-up stages compared with the control group.

Table 2 presents the results of the Shapiro–Wilk test (for the normality of distributions), Levene’s test (for

homogeneity of variances), Box’s M test (for the equality of variance–covariance matrices), and Mauchly’s test of sphericity for parenting adaptability and parenting orientation.

**Table 2**

*Results of Shapiro–Wilk, Levene’s, Box’s M, and Mauchly’s Tests for Parenting Adaptability and Parenting Orientation*

Variable	Time	Shapiro–Wilk (Stat, p)	Levene’s (Stat, p)	Box’s M (Stat, p)	Mauchly’s (Stat, p)
Parenting Adaptability	Pretest	.115, .057	1.18, .315	1.27, .107	.660, .000
	Posttest	.093, .200	1.40, .253	—	—
	Follow-up	.107, .087	.498, .610	—	—
Parenting Orientation	Pretest	.251, .575	2.70, .076	.131, .109	.779, .001
	Posttest	.351, .621	1.76, .180	—	—
	Follow-up	.421, .711	.799, .455	—	—

As seen in Table 2, except for the equality of variances in the three repeated measurements of the dependent variables—which was not met according to Mauchly’s test—all other assumptions for using repeated-measures ANOVA were satisfied. When Mauchly’s test is significant,

the Greenhouse–Geisser correction is reported in the repeated-measures ANOVA table.

Table 3 presents the results of the repeated-measures ANOVA for parenting adaptability and parenting orientation.

**Table 3**

*Results of Repeated-Measures ANOVA for Parenting Adaptability and Parenting Orientation*

Variable	Source of Variance	SS	df	MS	F	p	$\eta^2$	Power
Parenting Adaptability	Within-group: Time	2434.87	1.49	1631.38	632.10	.000	.917	1.000
	Time $\times$ Group	1246.88	2.98	417.71	161.84	.000	.850	1.000
	Error (Time)	219.56	85.07	2.58	—	—	—	—
	Between-group: Group	3338.87	2	1669.43	23.87	.000	.456	1.000



Parenting Orientation	Error	3985.43	57	69.92	—	—	—	—
	Within-group: Time	2210.17	1.63	1349.78	468.61	.000	.892	1.000
	Time × Group	1054.98	3.27	322.14	111.84	.000	.797	1.000
	Error (Time)	268.83	93.33	2.88	—	—	—	—
	Between-group: Group	2391.94	2	1195.97	22.93	.000	.446	1.000
	Error	2972.11	57	52.14	—	—	—	—

As shown in Table 3, for parenting adaptability, in the within-group effects section, the interaction of time and group was significant ( $F = 161.84$ ,  $df = 2.98$ ,  $p < .000$ ). This indicates a significant difference in parenting adaptability over time and in the interaction of time and group (between the two research groups). The application of the independent variable explained 85% of the variance in mean differences between the experimental and control groups for parenting adaptability ( $\eta^2 = .850$ ) with 100% statistical power. These results show that in the experimental group, the mean increased from pretest to posttest and follow-up.

Also, as shown in the between-group effects section of Table 3, for parenting adaptability, the group effect was significant ( $p < .000$ ), indicating that 45.6% of the variance in parenting adaptability was explained by the parenting training provided to mothers, with 100% statistical power. Brain-based parenting training was effective in improving parenting adaptability compared with the control group.

As shown in Table 3, for parenting orientation, in the within-group effects section, the interaction of time and

group was significant ( $F = 322.14$ ,  $df = 3.27$ ,  $p < .000$ ). This indicates a significant difference in parenting orientation over time and in the interaction of time and group (between the two research groups). The application of the independent variable explained 79.7% of the variance in mean differences between the experimental and control groups for parenting orientation ( $\eta^2 = .797$ ) with 100% statistical power. These results show that in the experimental group, the mean increased from pretest to posttest and follow-up.

Also, as shown in the between-group effects section of Table 3, for parenting orientation, the group effect was significant ( $p < .000$ ), indicating that 44.6% of the variance in parenting orientation was explained by the parenting training provided to mothers, with 100% statistical power. Brain-based parenting training was effective in improving parenting orientation compared with the control group.

Table 4 presents the results of the Bonferroni post hoc test for pairwise comparisons of the experimental and control groups in parenting adaptability and parenting orientation.

**Table 4**

*Results of Bonferroni Post Hoc Test Comparing the Research Groups Across Three Measurements for Parenting Adaptability and Parenting Orientation*

Variable	Time	Reference Group	Comparison Group	Mean Difference	SE	p
Parenting Adaptability	Pretest	Brain-Based Parenting	Control	2.55	1.59	.116
	Posttest	Brain-Based Parenting	Control	11.45	1.58	.000
	Follow-up	Brain-Based Parenting	Control	15.15	1.51	.000
Parenting Orientation	Pretest	Brain-Based Parenting	Control	.45	1.24	.719
	Posttest	Brain-Based Parenting	Control	8.30	1.39	.000
	Follow-up	Brain-Based Parenting	Control	13.85	1.47	.000

The results of the post hoc test show that at the posttest and follow-up stages, there were significant differences in the means of parenting adaptability and parenting orientation between the experimental and control groups. This indicates that the brain-based parenting training method was effective in improving both parenting adaptability and parenting orientation.

#### 4. Discussion and Conclusion

The findings of the present study demonstrated that brain-based parenting training significantly improved both parenting adaptability and parenting orientation in mothers of children aged 6 to 10 years with anxiety symptoms. The repeated-measures ANOVA revealed significant differences over time and between groups, indicating that mothers who received brain-based parenting training showed notable increases in their ability to adapt their parenting strategies to

their children's changing emotional and developmental needs. Additionally, these mothers displayed a more positive orientation toward their parenting role, encompassing greater optimism, confidence, and goal-directedness in their approach to caregiving. These improvements persisted from the posttest through the follow-up stage, suggesting that the benefits of the intervention were stable and enduring rather than transient. The results support the central hypothesis of this research and align with the theoretical proposition that integrating neuroscientific principles into parenting practices enhances parental functioning and contributes to more supportive parent-child relationships (Hossein Karimi et al., 2024; Karimi et al., 2024).

The significant improvements observed in parenting adaptability can be understood through the neurodevelopmental framework that underpins brain-based parenting. This model emphasizes the integration of different brain regions—particularly the prefrontal cortex and limbic system—to facilitate emotional regulation, impulse control, and reflective decision-making in parenting contexts (Lyle, 2013). Mothers who participated in the training were likely better able to regulate their own emotional responses, remain calm during their children's distress, and respond flexibly rather than rigidly. This neurobiological self-regulation may have enabled them to shift away from reactive or inconsistent parenting toward more attuned and responsive caregiving behaviors, thereby enhancing their adaptability. Such an interpretation aligns with evidence showing that interventions aimed at strengthening parents' self-regulation capacities improve their responsiveness and reduce coercive or emotionally dysregulated parenting patterns (Khani et al., 2024; Saadati et al., 2020). Furthermore, enhanced adaptability may have been reinforced by the explicit training components focusing on the integration of left and right hemispheric processing and upper and lower brain regions, which are designed to foster more balanced and regulated parenting responses (Hossein Karimi et al., 2024; Karimi et al., 2024).

The observed gains in parenting orientation—encompassing parents' attitudes, expectations, and emotional investment in their parenting role—are also consistent with the theoretical foundations of brain-based parenting. By providing mothers with a clear understanding of how their behaviors influence their children's brain development and emotional regulation, the program may have increased their sense of purpose, competence, and efficacy in parenting. A more positive parenting orientation is associated with greater warmth, sensitivity, and

involvement, which are key protective factors against child anxiety (Becker et al., 2019; Rathore et al., 2015). Previous studies similarly found that interventions which enhance parents' understanding of child development and emotional processes can shift their parenting orientation from control-focused to support-focused, resulting in more constructive parent-child interactions (Li et al., 2023; Meng et al., 2023). These results also echo findings that brain-based and mindful parenting training can significantly improve mothers' optimism and reduce feelings of helplessness in managing socially anxious children (Aliakbari & Aslezaker, 2022; Hossein Karimi et al., 2024). Therefore, it appears that the neurodevelopmental knowledge and reflective skills cultivated through the training strengthened mothers' motivation and commitment to their caregiving role, thereby enhancing their parenting orientation.

Moreover, the study's results resonate with broader empirical evidence showing that parenting-focused interventions can reduce parenting stress and improve relational dynamics, especially in families facing psychological challenges. For instance, previous research reported that positive parenting and mentalization-based interventions led to substantial improvements in mother-child relationship quality and emotional attunement (Ataran et al., 2024). Similarly, programs rooted in mindfulness and choice theory principles have been shown to foster more adaptive parenting attitudes and reduce conflict in families with children experiencing emotional or behavioral difficulties (Babaei Motlaq & Tanha, 2023; Nili Ahmad Abadi et al., 2019; Sadeghi Dehkordi et al., 2023). The current findings extend this literature by demonstrating that brain-based parenting—which integrates emotional, cognitive, and neurobiological dimensions—can produce comparable benefits specifically in mothers of anxious children. This suggests that targeting parents' neurocognitive understanding of emotional regulation processes may be a particularly potent approach to breaking cycles of stress and maladaptive parenting behaviors that exacerbate child anxiety (Babore et al., 2023; Mirzaei et al., 2022).

Another important implication of the present findings is their relevance for preventing the intergenerational transmission of anxiety. Research has shown that parental anxiety, stress, and negative parenting orientations can heighten children's vulnerability to anxiety disorders by impairing their emotional regulation, social competence, and self-control (Jewell et al., 2022; Li et al., 2023). Conversely, when parents display emotional attunement, flexible

responses, and supportive engagement, they model adaptive regulation strategies and create emotionally secure environments that buffer against anxiety development (Becker et al., 2019; Khani et al., 2024). The marked improvements in adaptability and orientation observed in this study suggest that brain-based parenting training may help interrupt these maladaptive transmission pathways by equipping mothers with the neurocognitive and emotional tools necessary to respond to their children's anxiety with calmness and consistency. This aligns with evidence showing that parental self-regulation and positive parenting orientation serve as mediators linking parenting interventions to reductions in child anxiety (Maleki Farab et al., 2024; Saadati et al., 2020). Therefore, by reinforcing mothers' sense of control and competence in handling their children's emotional challenges, the intervention likely contributed to a more supportive relational climate that mitigates the perpetuation of anxiety.

It is also noteworthy that the improvements in adaptability and orientation were sustained during the follow-up stage, indicating that the effects of the intervention were not merely short-term gains but reflected deeper, more stable changes in parental functioning. This durability could be attributed to the program's emphasis on experiential learning, self-reflection, and the integration of neuroscientific knowledge into daily caregiving practices. Sustained behavioral change is more likely when interventions address parents' underlying beliefs, perceptions, and emotional responses, rather than solely focusing on surface-level behavioral techniques (Abbaszadeh Arzoo et al., 2021; Mirzaei et al., 2024). Furthermore, the collaborative and supportive nature of the training sessions may have enhanced mothers' engagement and motivation, which are known predictors of long-term adherence to new parenting practices (Ataran et al., 2024; Hossein Karimi et al., 2024). These findings underscore the potential of brain-based parenting training as a sustainable intervention for promoting positive parenting changes in high-stress contexts.

The present results also contribute to addressing a gap in the existing literature, which has been criticized for overrepresenting Western samples and underexamining parenting interventions in culturally diverse settings. Most prior studies on brain-based or mindful parenting have been conducted in Western or high-income countries, raising questions about the generalizability of their findings to other cultural contexts. By demonstrating the effectiveness of brain-based parenting in mothers of anxious children within

a non-Western setting, this study adds culturally relevant evidence to the field and suggests that the core neurodevelopmental principles underlying this approach may be universally applicable, even as their implementation may require cultural adaptation (Mirzaei et al., 2022; Rathore et al., 2015). This cross-cultural applicability is promising given the global prevalence of childhood anxiety disorders and the urgent need for scalable, effective interventions that can be adapted to diverse cultural and socioeconomic contexts (Babore et al., 2023; Taheri et al., 2021).

In sum, the findings support the efficacy of brain-based parenting training as a multifaceted intervention that simultaneously enhances mothers' adaptability and orientation—two foundational components of effective parenting. By helping mothers understand the neural underpinnings of emotional regulation, stress responses, and relational attunement, the program empowered them to shift from reactive to reflective caregiving. This transformation likely created more emotionally supportive and predictable family environments, which in turn can foster children's resilience and reduce their risk of developing or maintaining anxiety symptoms. The results align with previous research on the benefits of brain-based, mindful, and positive parenting approaches and extend this knowledge by specifically highlighting their impact on mothers of children with anxiety symptoms (Aliakbari & Aslezaker, 2022; Hossein Karimi et al., 2024; Karimi et al., 2024; Sadeghi Dehkordi et al., 2023).

## 5. Suggestions and Limitations

Despite its contributions, this study has several limitations that warrant consideration. First, the sample size was relatively small, which may limit the statistical power and generalizability of the findings. Although the results were statistically robust, larger samples are needed to confirm the stability and replicability of the observed effects. Second, the participants were all mothers, which means the findings cannot be generalized to fathers or other caregivers who may have different parenting dynamics and stress responses. Third, the study relied on self-report questionnaires to assess parenting adaptability and orientation, which may be influenced by social desirability bias or inaccuracies in self-perception. Fourth, the follow-up period was relatively short (approximately 45 days after the posttest); longer-term follow-ups are necessary to determine the durability of the intervention's effects over several



months or years. Finally, the study did not directly assess changes in children's anxiety symptoms following the intervention, which limits conclusions about its downstream effects on child outcomes.

Future studies should aim to replicate these findings with larger and more diverse samples to enhance their generalizability. Including fathers and other primary caregivers would provide a more comprehensive understanding of how brain-based parenting training affects different caregiving roles and family dynamics. Researchers should also employ multi-method assessment strategies, incorporating observational measures and reports from teachers or other informants, to reduce the reliance on self-report data and improve the validity of the findings. Extending the follow-up period to several months or even a year would help determine whether the observed improvements in parenting adaptability and orientation are sustained long-term. Moreover, future research should investigate the mediating and moderating mechanisms underlying the intervention's effects, such as parental stress reduction, emotional regulation, and reflective functioning. Finally, studies should include direct measures of children's anxiety symptoms and emotional functioning to establish the extent to which improvements in parental variables translate into positive child outcomes.

Practitioners designing interventions for parents of anxious children should consider integrating brain-based principles into their programs, as this approach appears to effectively enhance both adaptability and orientation. Tailoring the training to include culturally relevant examples, interactive exercises, and opportunities for self-reflection may further improve its engagement and impact. It may also be beneficial to combine brain-based parenting with complementary approaches such as mindfulness and mentalization training to address both the neurocognitive and emotional aspects of parenting. Schools, community centers, and healthcare institutions could incorporate such training into their parent education initiatives to provide early preventive support for families at risk. Furthermore, offering booster sessions and ongoing peer support groups may help maintain parents' motivation and sustain the positive effects over time. By equipping parents with the knowledge and skills to regulate their emotions, understand their children's behaviors neurodevelopmentally, and respond with empathy and structure, practitioners can help create family environments that support children's psychological resilience and reduce the intergenerational transmission of anxiety.

## 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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