A Study on the Emotion Regulation and Executive Function Skills of 48-60 Month-Old Children

AUTHORS

Pınar HATAŞ, Research Assistant (Corresponding Author)

Akdeniz University, Kumluca Health Sciences Faculty, Child Development Department, pinarhatass@gmail.com, +90 5071267872

Aynur BÜTÜN AYHAN, Prof. Dr.

Ankara University, Faculty of Health Sciences, Child Development Department,

Tepebaşı, Fatih Cd. No:197/A, PK: 06290, Keçiören, Ankara, Türkiye, a_butun@yahoo.com

Declaration Statements

Ethical approval: All procedures performed in studies involving human participants were conducted in accordance with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. The study was submitted to, and approved by Social Sciences and Humanities Scientific Research and Publication Ethics Committee of (blinded for review).

Informed consent: Informed consent was obtained from all individual participants included in the study.

Availability of data and materials: Data is available as an electronic file upon request.

Competing interests: On behalf of all authors, the corresponding author states that there is no conflict of interest.

Funding: The authors received no financial support for the research, authorship, and/or publication of this article.

Abstract

This study aimed to examine the emotion regulation and executive function skills of children aged 48-60 months. The study is a descriptive research in a correlational survey model. The study group consisted of 250 children aged 48-60 months attending preschool education institutions in the centre of Ankara. In order to obtain information about the children's sociodemographic characteristics, an 'Individual Information Form' developed by the researchers was used. To assess the children's emotion regulation skills, the 'Emotion Regulation Scale' developed by Shields and Cicchetti (1997) was used, while the 'Childhood Executive Functioning Inventory' developed by Thorell and Nyberg (2008) was utilized to examine the children's executive function skills. The study revealed significant differences in children's emotional regulation skills based on their family's perceived socioeconomic status and the frequency of reading to the child, but no statistically significant differences based on the child's gender and age. The research results also showed significant differences in children's executive function skills based on the child's gender and the frequency of reading to the child, but no statistically significant differences based on the child's age and the family's perceived socioeconomic status. The study found a positive and statistically significant relationship between children's emotion regulation skills and executive function skills. Recommendations are made to educators, parents, and researchers based on the findings of the study.

***Keywords**; Emotion regulation, executive function, cognitive development*

Introduction

Early childhood is a critical period characterized by rapid changes in emotional regulation and executive functioning skills (Fernandes et al., 2022). During this period, children experience significant changes in the organization of cognitive functions, encompassing the most fundamental skills necessary for cognitive and socio-emotional well-being (Diamond, 2020). To understand complex skills such as emotional control, delaying gratification, focusing and controlling attention, and emotional-cognitive interactions, it is first necessary to examine the brain structure and connections (Dias and Seabra, 2015).

The development of the brain's higher cortical regions, which are responsible for emotional experiences and cognitive processes, continues during the pre-school period, indicating that the brain must be approached holistically (Brown, 2012). Studies suggest that emotion regulation and executive functions may share neural mechanisms in the brain (Carlson and Wang, 2007; Shackman et al., 2011). An fMRI study reported that the same brain regions contribute to both emotion regulation and inhibitory control, one of the components of executive function (Tabibnia et al., 2011). The prefrontal cortex, one of the most important regions of the brain that is particularly associated with emotion and cognition, encompasses various emotion processing mechanisms. The dorsolateral region of the prefrontal cortex is associated with cognitive functions such as problem solving and abstract thinking, while the orbitofrontal region is associated with the coordination of cognition and emotions (Ardila, 2008; Xia et al., 2021). The anterior cingulate region is responsible for the coordinated functioning of information involving cognitive, emotional, and motor processes (Bush et al., 2000). Structures such as the amygdala, hippocampus, thalamus, and hypothalamus, which form the limbic system in the brain, are regions related to emotional states such as excitement, distress, and sadness (Uzbay, 2004). The maintenance, enhancement, and control of these emotions, which develop as the brain matures, have given rise to the concept of emotion regulation (Santrock, 2017).

Emotion regulation refers to an individual's ability to monitor, adjust, and evaluate emotional responses in order to adapt to social environments and achieve their goals (Shao et al., 2023). According to Gross (1998), emotion regulation is defined as the skills that encompass recognising one's emotions, controlling negative emotions, exhibiting goal-oriented behaviour, and using situationally appropriate strategic methods. During the pre-school period, significant changes occur in emotional development, including the ability to recognise and regulate emotions, due to the development of brain structures related to emotional processes such as the amygdala (Schaan et al., 2019). From this period onwards, the development of attention, memory, visual-motor skills, language development, and executive function skills has been linked to the speed of emotion regulation (Köseler Özen and Acar, 2024). From this perspective, emotion regulation skills are seen as an integral part of cognitive development (Rowland et al., 2023). Emotion regulation skills are noted to be effective in regulating social interaction, functioning as a protective factor by supporting psychological and behavioural well-being in children (Daniel et al., 2020; Wagner et al., 2025). Studies indicate that emotional regulation skills facilitate the school adjustment process by promoting academic success (Harrington et al., 2020; Khan and Jameel, 2024). It is noted that deficiencies in emotional development cause

difficulties in the functional use of emotional responses and that challenges in managing emotional states create an environment conducive to generalised anxiety disorder (Roemer et al., 2009). It is therefore crucial that children's emotion regulation skills are supported during the preschool period when they begin to regulate their emotions internally rather than relying on external support (Alamos et al., 2022). The capacity for these skills involves the ability to use cognitive strategies to manage internal emotional states and external behavioural responses and is closely related to advanced executive function skills (Lincoln et al., 2017).

Executive functions that guide goal-directed behaviour are defined as a set of multidimensional higher-level cognitive skills (Reilly et al., 2021). According to Ackerman and Friedman-Krauss (2017), executive functions are skills that begin to develop early in life, involving problem solving by determining appropriate strategies as well as directing and sustaining attention. Children show remarkable development in higher-order cognitive skills associated with the prefrontal cortex, particularly between the ages of three and five (Cuevas et al., 2012). These skills generally consist of three main components: working memory, inhibitory control, and cognitive flexibility (Eberhart et al., 2023). Working memory involves retaining multiple pieces of information in mind to achieve a specific goal, updating new or changing information, and analysing and planning alternative options (Ribner et al., 2022). Inhibitory control, which is involved in regulating internal and external attention, helps to control intense impulses and focus on the relevant stimulus, thereby facilitating attempts to achieve the goal (Yue et al., 2024). Inhibitory control has been reported to support emotion regulation skills in early childhood (Alamos et al., 2022). The final component of the developmental process is cognitive flexibility, defined as the ability to adapt to changing demands in different situations and environments (Diamond et al., 2020). Cognitive flexibility is a necessary component of emotion regulation due to the need to adjust emotional responses and behaviours to changing emotional environments and stimuli (Pruessner et al., 2020). Based on this, executive functions contribute to emotion regulation skills by coordinating many cognitive processes (Schmeichel and Tang, 2015). It has been noted that children with advanced executive function skills have higher levels of emotion regulation and social competence (Zhang et al., 2022). Weak executive functions have been reported to negatively affect emotion regulation, which has been associated with internalisation and externalisation problems in early childhood (Carlson and Wang, 2007; Holmes et al., 2016).

During the pre-school period, especially between 48 and 60 months, significant developments occur in children’s executive function and emotion regulation skills (Harrington et al., 2020). Studies report notable improvements in task performance and emotional development, including regulation and recognition, in this age range (Carlson, 2005; Schaan et al., 2019). These findings highlight both the close relationship between emotion regulation and executive functions and the importance of supporting these skills. However, research on the interaction between emotion and cognition in this period remains limited. Therefore, this study aims to examine the emotion regulation and executive function skills of children aged 48–60 months.

Method

This study, which examined the emotion regulation and executive function skills of children aged 48-60 months, was conducted using a descriptive correlational survey model. The most significant advantage of this model is that it presents data obtained from very large samples aimed at determining the characteristics of a specific group (Büyüköztürk et al., 2021).

Participants

The study group consisted of 250 typically developing children aged 48–60 months attending public kindergartens and nursery schools in central Ankara during the 2023–2024 academic year. A minimum sample size of 191 was determined through G*Power analysis (80% power); however, to account for potential data loss, at least 250 participants were included. The children's mean age was 4.57±0.51. Schools were selected using data from the Provincial Directorate of National Education and TÜİK, with two schools randomly chosen from each socio-economic level (low, middle, high), resulting in a total of six schools. Data on children's emotion regulation and executive function skills were collected from parents, and demographic characteristics are presented in Table 1.

Table 1. *Frequency and Percentage Values of Children and Parents in the Study Group According to Sociodemographic Characteristics*

		n	%
Children	Female	138	55.2
	Male	112	44.8
	4 years	104	41.6
	5 years	146	58.4
	No siblings	104	41.6
	One sibling	85	34.0
	Two siblings	45	18.0
	Three or more siblings	16	6.4
	First child	150	60.0
	Middle child	24	9.6
	Last Child	76	30.4
Mother	30 years and below	11	4.4
	31–40 years	147	58.8
	41 years and above	92	36.8
	Primary education	21	8.4
	High school	80	32.0
	University	132	52.8
	Postgraduate	17	6.8
Family	Nuclear family	218	87.2
	Extended family	19	7.6
	Single-parent family	13	5.2
	Low income	37	14.8
	Middle income	201	80.4
	High income	12	4.8

Table 1 shows that of the children aged 48-60 months participating in the study, 55.2% were girls and 44.8% were boys. In terms of age, 41.6% were four years old and 58.4% were five years old. Of the mothers participating in the study, 4.4% were aged 30 and under, 58.8% were aged 31-40, and 36.8% were aged 41 and over. It was determined that 87.2% of the families participating in the study were nuclear families, 7.6% were extended families, and 5.2% were single-parent families.

Instruments

The instruments used in the study included an Individual Information Form, developed by the researchers to determine the sociodemographic characteristics of children and parents in the study, the Emotion Regulation Scale, developed by Shields and Cicchetti (1997) to assess children's emotion regulation skills, and the Childhood Executive Functioning Inventory, developed by Thorell and Nyberg (2008) to examine children's executive function skills.

Individual Information Form

The Individual Information Form prepared by the researchers contains questions regarding the sociodemographic information of the children and their parents, including age, gender, birth order, and level of education. The personal information form was completed by the parents of children aged 48-60 months.

Emotion Regulation Scale (ERS)

The Emotion Regulation Scale, developed by Shields and Cicchetti (1997) and adapted into Turkish by Batum and Yağmurlu (2007), measures children's emotion regulation skills. It consists of 24 items on a four-point Likert scale with two subscales: emotion regulation control (8 items) and variability/negativity (15 items), with one item excluded from scoring. The scale, completed by parents of children aged 3–6, assesses appropriate emotional expression and the tendency to display negative emotions. Original internal consistency coefficients were .96 (variability/negativity) and .83 (emotion regulation control), while the Turkish adaptation reported .73 and .75, respectively. In this study, coefficients were .63 for emotion regulation control, .69 for variability/negativity, and .75 overall.

Childhood Executive Functioning Inventory (CHEXI)

The scale, developed by Thorell and Nyberg (2008) and adapted into Turkish by Arslan Çiftçi et al. (2020) for children aged 4–6, measures executive function skills. It includes 24 items on a five-point Likert scale with two subscales: working memory (13 items) and inhibitory control (11 items), and can be completed by parents or teachers. Original reliability coefficients were .75 (working memory) and .86 (inhibitory control), while the Turkish version reported .95 and .91, respectively. In this study, the coefficients were .88 for working memory, .79 for inhibitory control, and .91 overall.

Procedure

Ethical approval was obtained from the Ankara University Health Sciences Scientific Research and Publication Ethics Committee, along with permission to use the scales and approval from the Ministry of National Education. School administrators and teachers were informed about the study, which was conducted in line with the 1964 Helsinki Declaration, ensuring participant anonymity through coded responses. Data collection tools were sent to добровuntary parents in sealed envelopes via teachers and later collected from schools. Of 300 distributed forms, 262 were returned, and 12 were excluded due to incomplete data, resulting in 250 forms included in the analysis.

Data Analysis

Items requiring reversal for the purpose of analysing the data obtained within the scope of the research were reversed and loaded into the SPSS programme. A preliminary analysis was conducted by performing the Kolmogorov-Smirnov test to examine the normality of the data distribution. The analysis revealed that the data did not show a normal distribution ($p<0.05$). Accordingly, the Mann-Whitney U Test was applied for binary independent groups such as gender and age, and the Kruskal-Wallis H test was applied to determine whether there were significant differences between three or more independent groups, such as socioeconomic status. Spearman's correlation coefficient was considered to determine the relationship between the total and subscale scores of the *ERS and CHEXI* for children aged 48-60 months.

Results

The mean scores for the *ERS and CHEXI* according to gender, along with the results of the Mann-Whitney U Test, are presented in Table 2.

***Table 2**. Mean Scores for ERS and CHEXI by Gender and Mann-Whitney U Test Results*

	Sub-scales	Gender	n	Rank Average	U	p
Emotion Regulation Scale	ER Control	Girls	138	132.1	6811.5	0.10
		Boys	112	117.3		
	Variability/Negativity	Girls	138	121.1	7126.5	0.28
		Boys	112	130.8		
	ERS Total	Girls	138	124.5	7592.5	0.81
		Boys	112	126.7		
Childhood Executive Functioning Inventory	Working Memory	Girls	138	132.1	6811.0	0.10
		Boys	112	117.3		
	Inhibitory Control	Girls	138	134.4	6491.5	0.02*
		Boys	112	114.4		
	CHEXI Total	Girls	138	133.5	6613.5	0.05*
		Boys	112	115.5		

*Note: ER; Emotion Regulation, ERS; Emotion Regulation Scale, CHEXI; Childhood Executive Functioning Inventory, *p<0.05*

The results presented in Table 2 indicate that there was no statistically significant difference between the mean scores of the ERS subdimensions, namely emotion regulation control, variability/negativity, and total scores, according to gender. No statistically significant difference was observed between the mean working memory scores of children on the CHEXI sub-dimensions according to gender, while a significant difference was observed between the mean inhibitory control ($U=6613.5$, $p<0.05$) and total ($U=6613.5$, $p<0.05$) scores.

The mean scores for the *ERS and CHEXI* according to age, along with the results of the Mann-Whitney U Test, are presented in Table 3.

***Table 3**. Average Scores for the ERS and CHEXI by Age and Mann-Whitney U Test Results*

	Sub-scales	Age	n	Rank Average	U	p
Emotion Regulation Scale	ER Control	4 Years	104	124.6	7502.5	0.87
		5 Years	146	126.1		
	Variability/Negativity	4 Years	104	133.4	6761.0	0.13
		5 Years	146	119.8		
	ERS Total	4 Years	104	134.2	6683,5	0.10
		5 Years	146	119.2		
Childhood Executive Functioning Inventory	Working Memory	4 Years	104	121.6	7196.0	0.48
		5 Years	146	128.2		
	Inhibitory Control	5 Years	104	121.6	7398.5	0.73
		4 Years	146	128.2		
	CHEXI Total	5 Years	104	121.6	7192.0	0.47
		4 Years	146	128.2		

Note: ER; Emotion Regulation, ERS; Emotion Regulation Scale, CHEXI; Childhood Executive Functioning Inventory

Table 3 indicates that there are no statistically significant differences between the mean scores of children across age groups in terms of emotion regulation (control, negativity, variability, and total scores) on the ERS. Similarly, no statistically significant differences were found between age groups in working memory, inhibitory control, and total scores on the CHEXI.

The mean scores on the *ERS and CHEXI* as well as the results of the Kruskal-Wallis H Test, according to the perceived socioeconomic status of the family, are presented in Table 4.

Table 4. *Mean Scores on the ERS and CHEXI According to the Family's Perceived Socioeconomic Status and Results of the Kruskal-Wallis H Test*

	Sub-scales	Perceived Socioeconomic Status of the Family	n	Rank Average	H	p	
Emotion Regulation Scale	ER Control	Low Income [a]	37	106.3			
		Middle Income [b]	201	126.5	6.62	0.03*	**c>a, c>b**
		High Income [c]	12	166.8			
	Variability/Negativity	Low Income	37	121.6			
		Middle Income	201	128.2	2.99	0.22	
		High Income	12	91.8			
	ERS Total	Low Income	37	103.1			
		Middle Income	201	130.1	4.56	0.10	
		High Income	12	116.6			
Childhood Executive Functioning Inventory	Working Memory	Low Income	37	107.6			
		Middle Income	201	127.5	3.44	0.17	
		High Income	12	146.8			
	Inhibitory Control	Low Income	37	115.6			
		Middle Income	201	125.8	2.07	0.35	
		High Income	12	149.9			
	CHEXI Total	Low Income	37	109.9			
		Middle Income	201	127.1	2.83	0.24	
		High Income	12	146.6			

*Note: ER; Emotion Regulation, ERS; Emotion Regulation Scale, CHEXI; Childhood Executive Functioning Inventory, *p<0.05*

Table 4 shows a significant difference in emotion regulation control scores by socioeconomic status, with higher scores in high-income families, while no significant differences were found in working memory, inhibitory control, or total executive functioning scores.

The mean scores for the *ERS and CHEXI*, as well as the results of the Mann-Whitney U test, according to whether their parents read to them regularly, are presented in Table 5.

Table 5. *Average Scores on the ERS and CHEXI Mann-Whitney U Test Results According to Whether Parents Read Books to Their Children Regularly*

	Sub-scales	Regular Book Reading by Parents	N	Rank Average	U	p
Emotion Regulation Scale	ER Control	Yes	153	133.1	6742.0	0.03*
		No	97	113.4		
	Variability/Negativity	Yes	153	115.4	5887.0	0.00*
		No	97	141.3		
	ERS Total	Yes	153	128.8	6902.0	0.35
		No	97	120.1		
Childhood Executive Functioning Inventory	Working Memory	Yes	153	134.6	6027.0	0.01*
		No	97	111.1		
	Inhibitory Control	Yes	153	130.2	6696.0	0.19
		No	97	118.0		
	CHEXI Total	Yes	153	133.4	6207.5	0.02*
		No	97	112.9		

*Note: ER; Emotion Regulation, ERS; Emotion Regulation Scale, CHEXI; Childhood Executive Functioning Inventory, *p<0.05*

Table 5 shows no significant difference in ERS total based on parents reading regularly, but significant differences were found in emotion regulation control and variability/negativity, favoring children who are read to. Similarly, no difference was found in inhibitory control, while working memory and CHEXI total were significantly higher in these children.

The Spearman Correlation Coefficient results for the relationship between the total and subscale scores of the Emotion Regulation Scale and the Childhood Executive Functioning Inventory for the children included in the study are presented in Table 7.

Table 6. *Spearman Correlation Coefficient Results for the Relationship between the Total and Subscale Scores on the ERS and CHEXI*

	ER Control	Variability/Negativity	ERS Total
Working Memory	.382*	-.478*	.243*

Inhibitory Control	.196*	-.534*	.426*
CHEXI Total	.317*	-.549*	.359*

*Note; ER; Emotion Regulation, ERS: Emotion Regulation Scale; CHEXI; Childhood Executive Functioning Inventory; *p<.01*

When examining the results in Table 6, a positive correlation is observed between the CHEXI total scores and the emotion regulation control subscale (r=.317, p<0.01) and ERS (r=.359, p<0.01) scores, while a very high positive correlation was determined between the working memory subscale (r=.932, p<0.01) and inhibitory control subscale (r=.891, p=0.01) scores. A moderately significant negative correlation was found between the total scores of the CHEXI and the variability/negativity subscale (r=-.549, p<0.01).

Discussion

This study aimed to examine the emotion regulation and executive function skills of children aged 48-60 months. The findings indicated that gender did not lead to any statistically significant differences in mean scores for emotion regulation control, variability/negativity, or the total scores on the emotion regulation scale. This finding of the study reveals that gender does not create a difference in emotion regulation skills in children. It is thought that emotion regulation skills may be influenced by many factors, including biological, psychological, and social environments, such as parental attitudes, culture, temperament, and attachment style. In Turkish society in particular, where gender-based stereotypes exist, girls are generally expected to express their feelings freely, while boys crying or openly expressing their feelings in response to a situation or event is not well received. Based on the findings of our study, it is thought that the way emotions are expressed according to gender is beginning to change in society. As a result of education, the internet and social media, parents' increasing awareness of emotional development may have provided opportunities for their children to express their emotions regardless of gender, supporting them in regulating their emotions in an appropriate manner. Furthermore, although it is known that brain structure and function differ according to gender, the difference in emotion regulation skills may stem from neurological processes in emotional development. In a meta-analysis conducted by Wager et al. (2003), it was found that there were no gender differences in emotional processing in terms of brain activation. A review of the literature reveals that research on brain structures related to emotion regulation processes according to gender has been conducted primarily with adult samples (Cahill et al., 2001; Welborn et al., 2009; Duan et al., 2023), where studies on early childhood remain limited.

The study indicated that there was no significant difference between girls and boys in working memory scores across the subdimensions of the CHEXI. However, there was a significant difference in inhibition control and total scores; girls' average scores in these areas were found to be higher than boys. According to previous studies, girls perform better in executive functioning skills (Unterrainer et al., 2013; Balıca, 2024). It is thought that differences in children's executive functioning skills based on gender may stem from the culture in which they live. Cultural experiences can influence many skills in children, such as problem solving, attention, and perception, and can affect how boys and girls are raised differently according to social expectations (Yılmaz Tam and Deniz 2022). Furthermore, it is believed that children's

attention control skills may also influence executive functioning. Studies have indicated that girls have higher attention control skills than boys (Bull et al., 2011; Mileva-Seitz et al., 2015). Accordingly, boys tend to approach situations and events in a more impulsive and active manner, whereas girls act in a more careful, controlled, and emotion-regulating manner. Parental attitudes may also be an effective factor in children's executive functioning skills according to gender. Parents' different attitudes towards their male and female children, as well as their different expectations in response to events and situations, may affect children's executive functioning skills. Indeed, when solving a problem, boys are expected to approach it with more assertive and courageous behavior than girls. In contrast, girls' development of various strategies for solving problems, in addition to their tendency to consider events from different perspectives, may positively influence their cognitive development processes.

The study found no statistically significant differences in the mean scores for emotional regulation control, variability/negativity, and total scores of the children's emotional regulation scale subdimensions according to age. Although brain structures related to emotional states are expected to develop as children age, the narrow age range of the sample group included in the study may have contributed to the lack of differentiation in emotion regulation skills according to age. However, emotion regulation skills show rapid development between 36 and 60 months in the preschool period, reaching a certain equilibrium after 48 months (Harrington et al., 2020). Therefore, in children aged 48-60 months, it can be considered normal that age-related changes do not create a significant difference at the behavioral level. Additionally, it is thought that the development of emotion regulation skills may be influenced not only by the biological maturation process but also by many environmental factors, such as the family environment and parental attitudes, as well as individual differences. A review of the literature revealed that other studies supported these research findings (Arslan Özkılıç, 2021; Dağlı and Dağlıoğlu, 2021).

The study revealed no significant differences in working memory and inhibitory control and total score averages of the CHEXI sub-dimensions according to age. Rapid changes occur in executive function skills, which involve higher-level cognitive processes and the coordination of various abilities, during the pre-school period (Fernandes et al., 2022). Increased functional connectivity between the medial temporal region, which supports the conscious recall of personal experiences, and the prefrontal cortex is associated with improvements in both encoding and retrieval processes in the brain (Leventon et al., 2014). It is believed that these changes experienced during the cognitive development process could be observed more clearly by comparing different age group samples; however, due to the children in the sample group all being in the same age group, there was no significant differentiation. Indeed, in a study conducted by MacDonald et al. (2014), 80 children aged from 5 to 8 were included in the research for the purpose of examining age-related changes in inhibitory control skills. The study found that the error rates in tasks requiring inhibitory control decreased from the age of 5 to 8. Espy et al. (2001) noted the difficulty in detecting maturation in executive functions unless it is broken down into smaller units of approximately three months. However, executive functions are not only influenced by chronological age but also by environmental factors such as the variety of stimuli and level of cognitive stimulation in the child's environment, as well as socio-

economic conditions. A review of the literature reveals that some studies did not observe age-related differences in executive function skills (Öğütcen, 2020; Tuncer, 2021).

The study found no statistically significant differences in the mean scores for variability/negativity and total scores of the child's emotion regulation scale subdimensions according to the family's perceived socioeconomic status. However, a significant difference was found in the mean scores for the emotion regulation control sub-dimension. It was determined that children from higher-income families had better emotion regulation control skills. As family income increases, children's ability to express their emotions appropriately in different contexts increases. An increase in socioeconomic status may support the positive development of emotion-related structures in the brain as children grow up in a stimulating environment. Kim et al. (2013) stated that children raised in economically deprived environments showed less activation in the ventrolateral and dorsolateral prefrontal cortex regions of the brain, which are responsible for emotion regulation. However, an increase in socioeconomic status may positively influence children's emotional expression processes by providing them with more emotional support and modelling opportunities from their parents. Conversely, low socioeconomic status increases stress within the family, and economic pressures and limited resources can negatively affect parents' emotional sensitivity. Another study reported that children from higher socioeconomic backgrounds demonstrated higher average emotion regulation scores compared to those from lower socioeconomic backgrounds (Razman and Hoesni, 2023). Accordingly, it can be said that the family's socioeconomic status is an influential factor in children's emotional development.

The study revealed there were no significant differences in working memory, inhibitory control, and total score averages of the Childhood Executive Functioning Inventory sub-dimensions according to the family's socioeconomic status. Low socioeconomic status can be a risk factor for all areas of child development, as it can lead to malnutrition, lack of stimulation, and stress. The family's socioeconomic status encompasses multiple factors in the child's environment and constitutes a multidimensional structure that affects executive functioning skills in various ways. However, family functioning may act as a protective mechanism for a child's cognitive development. Despite difficult economic conditions, high parenting quality and the creation of an environment enriched with available materials may support children's executive functioning skills. A review of the literature shows that socioeconomic status does not cause differences in children's executive functioning skills, supporting the research findings (Vrantsidis et al. 2020; Öğütcen, 2020).

The study found there was no statistically significant difference in the total mean total scores on the emotion regulation scale between children whose parents read to them regularly and those whose parents did not read to them. However, significant differences were found in the mean scores for the emotion regulation control and variability/negativity sub-dimensions. Children whose parents read books to them regularly had higher emotion regulation control skill scores and lower variability/negativity skill scores. In other words, these children had an increased ability to express their emotions according to the situation and a decreased tendency to display negative ones. Reading books has been reported to have positive effects on children's emotional development (Hutton et al., 2017). Additionally, when parents read books with their

children, discussing the emotions of the characters in the book provides an opportunity for the child to express their feelings in response to different events and situations. Another study indicated that parents who read books with their children and refer to the thoughts, feelings, and situations in the book help their children understand emotions, develop empathy, and engage in prosocial behavior (Schapira and Aram, 2019). Parents who read books regularly with their children and discuss the emotions associated with the characters or situations in the book may therefore support the development of children's emotional understanding.

The findings indicate that there were no statistically significant differences in the mean scores for inhibitory control on the CHEXI subscales based on the regularity with which parents read books to their children. However, significant differences were found in the mean scores for the working memory subscale and total score. Children whose parents read books to them regularly were found to have higher working memory and total score averages. This finding demonstrates that regular reading by parents supports children's executive functioning skills. However, it is emphasized that the quality of reading is more important than quantity (Towson et al., 2021). Cooper et al. (2014) found that mothers who received interactive book-reading training were more responsive to their children, and that their children had higher levels of attention and vocabulary than children of mothers who did not receive such training. It has been reported that children whose parents read regularly also experience long-term educational benefits in their academic skills (Gottfried, 2015). A cohort study conducted by Brown et al. (2022) found that reading to children from an early age predicted academic success in later years. The study conducted by Brown et al. (2022) involved a large sample group of 3,547 infants and their parents. The results showed that infants whose parents read to them daily between 12 and 24 months of age had positively affected academic skills at 8–11 years of age. A quasi-experimental study by Yurdakul et al. (2025) also reported that interactive book-reading programmes support children's perspective-taking skills. Interactive book reading may positively affect executive functioning by enabling children to identify with the characters in the book, develop their imagination, and support their creativity skills. Making reading a routine, particularly by establishing bedtime reading sessions, may be effective for executive functioning development by enabling children to recall events experienced during the day.

The study found a positive and significant relationship between the emotional regulation and executive functioning skills of children aged 48-60 months. Accordingly, as children's executive functioning skills increase, their emotional regulation skills also increase. An experimental study conducted by Koay and Meter (2023) aimed to examine the effects of emotional regulation on executive functioning. Participants were asked to perform tasks requiring the use of executive functioning skills under four different emotion regulation conditions. The results of this study confirmed our research findings, establishing a bidirectional relationship between emotion regulation skills and executive functioning. To regulate emotions, individuals must first recognize their emotions and then use certain strategies to adjust and modify the intensity of such emotions according to various situations and environments, enabling them to transition flexibly between different events. For these strategies to be implemented, it is important for the executive functions of attention, planning, memory, and control to be well developed. In this regard, a study conducted by Hoorelbeke et al. (2016) examined the effect of cognitive control

on emotion regulation strategies used in daily life and found a positive relationship between cognitive control and emotion regulation skills. It is evident that the effective use of cognitive processes is crucial for maintaining positive emotions and coping with negative emotions during the emotion regulation process. The effective use of cognitive processes is linked to the presence of an effective executive functioning network. Consequently, it can be said that the development of executive functioning may predict the development of emotion regulation skills.

Conclusion

The findings derived from the study indicate a linear relationship between the executive functioning and emotion regulation skills of children aged 48-60 months. Accordingly, as children's executive functioning skills increase, their emotion regulation skills also increase. As these skills form the basis of developmental areas, it is crucial that they are developed and supported from early age. The present study provides important findings regarding the possible underlying reasons for individual differences in executive functioning and emotion regulation skills among preschool children. Given that numerous factors influence children's executive functioning skills and emotion regulation abilities, this study highlights the importance of understanding these factors. Future studies should examine children's emotion regulation and executive functioning skills in relation to different variables, such as daily screen time and frequency of daily play. As this study took parental views into account, future studies could involve one-to-one interviews with children. Subsequent studies could be planned with different age groups to examine age-related changes in emotion regulation and executive functioning skills. Culture and cultural values influence all areas of development, particularly emotional development and emotion expression. Therefore, future research should examine the impact of different cultural structures on emotion regulation and executive functioning skills. Furthermore, modifying or adjusting the preschool curriculum can be particularly effective in supporting children's emotional and cognitive development from early childhood onwards. The findings are expected to have important implications for educators, parents, and preschool educational settings.

References

Ackerman, D. J., & Friedman-Krauss, A. H. (2017). Preschoolers' executive function: importance, contributors, research needs and assessment options. *Educational Testing Service Research Report Series*, 1-24. https://doi.org/10.1002/ets2.12148

Alamos, P., Williford, A.P., Downer, J.T., & Turnbull, K., L., P. (2022). How does inhibitory control predict emotion regulation in preschool? the role of individual children's interactions with teachers and peers. *Developmental Psychology*, 58(11), 2049–2063. https://doi.org/10.1037/dev0001415

Ardila, A. (2008). On the evolutionary origins of executive functions. *Brain and Cognition,* 68(1), 92-9. https://doi: 10.1016/j.bandc.2008.03.003.

Arslan Çiftçi, H., Uyanık, G., & Acar, B.H. (2020). Reliability and validity study of childhood executive functions inventory Turkish form for 48-72 months old children. *Journal of Early Childhood Studies,* 4(3), 762-787. https://doi:10.24130/eccd-jecs.1967202043260

Arslan-Özkılıç, S. (2021). The relationship between preschool children's relationships with their mothers and mothers' interest in their children and their emotion regulation skills (*Unpublished Master's Thesis).* Hacettepe University, Ankara.

Balıca, E. (2024). *The relationship of executive functions and reasoning skills with emotional understanding levels in early childhood* (Order No. 31653590). Available from ProQuest Dissertations & Theses Global.

Batum, P. & Yagmurlu, B. (2007). What counts in externalizing behaviors? the contributions of emotion and behavior regulation. *Current Psychology: Developmental Learning Personality Social,* 25(4), 272-294. https://doi:10.1007/BF02915236

Brown, M.I., Wang, C. & McLeod, S. (2022). Reading with 1–2 year olds impacts academic achievement at 8–11 years. *Early Childhood Research Quarterly*, 58, 198-207. https://doi:10.1016/j.ecresq.2021.09.008

Brown, T.T. & Jernigan, T.L. (2012). Brain development during the preschool years. *Neuropsychology Review,* 22, 313–333. https://doi:10.1007/s11065-012-9214-1

Bull, R., Espy, K.A., Wiebe, S.A., Sheffield, T.D., & Nelson, J.M. (2011). Using confirmatory factor analysis to understand executive control in preschool children: sources of variation in emergent mathematic achievement. *Developmental Science,* 14(4), 679-92. https://doi: 10.1111/j.1467-7687.2010.01012.x.

Bush, G., Luu, P. & Posner, M. I. (2000). Cognitive and emotional influences in the anterior cingulated cortex. *Trends in Cognitive Science*, 4(6), 215–222. https://doi:10.1016/s1364-6613(00)01483-2

Büyüköztürk, Ş., Kılıç Çakmak, E., Akgün, Ö.E., Karadeniz, Ş. & Demirel, F. (2021). Scientific research methods in education. Pegem Academy: Ankara.

Cahill, L.R., Haier, R.J., White, N.S., Fallon, J., Kilpatrick, L., Lawrence, C., Potkin, S.G. & Alkire, M.T. (2001). Sex-related difference in amygdala activity during emotionally influenced memory storage. *Neurobiology Learning Mem*ory, 75, 1–9. https://doi: 10.1006/nlme.2000.3999

Carlson, S.M. & Wang, T.S. (2007). Inhibitory control and emotion regulation in preschool children. *Cognitive Development*, 22, 489–510. https://doi.org/10.1016/j.cogdev.2007.08.002

Carlson, S.M. (2005). Developmentally sensitive measures of executive function in preschool children. *Developmental Neuropsychology*, 28(2), 595–616. https://doi: 10.1207/s15326942dn2802_3

Cooper, P.J., Vally, Z., Cooper, H., Radford, T., Sharples, A., Tomlinson, M., & Murray, L. (2014). Promoting mother-infant book sharing and infant attention and language development in an impoverished South African population: a pilot study. *Early Childhood Education Journal*, 42, 143–152. https://doi:10.1007/s10643-013-0591-8

Cuevas, K., Hubble, M., & Bell, M.A. (2012). Early childhood predictors of post-kindergarten executive function: behavior, parent-report, and psychophysiology. *Early Education and Development,* 23(1), 59–73. https://doi:10.1080/10409289.2011.611441.

Dağlı, H. & Dağlıoğlu, H.E. (2021). Examining the relationship between emotion regulation skills and problem-solving skills in pre-school children. Cumhuriyet International Journal of Education, 10(3), 1020-1046. http://dx.doi.org/10.30703/cije.799698

Daniel, S. K., Abdel-Baki, R., & Hall, G. B. (2020). The protective effect of emotion regulation on child and adolescent wellbeing. *Journal of Child and Family Studies,* 29(7), 2010–2027. https://doi:10.1007/s10826-020-01731-3

Diamond, A. (2020). Executive functions. *Handbook of Clinical Neurology,* 173, 225–240. https://doi:10.1016/B978-0-444-64150-2.00020-4

Dias, N.M., & Seabra, A.G. (2015). Is it possible to promote executive functions in preschoolers? a case study in brazil. *International Journal of Child Care and Education Policy*, 9(6). https://doi:10.1186/s40723-015-0010-2

Duan, D., Zhong, W., Hu, F., Ye L. & Zhang, Q. (2023). Exploring gender differences in emotion recognition with electroencephalography. *15th International Conference on Advanced Computational Intelligence (ICACI)*, 1-6. https://doi:10.1109/ICACI58115.2023.10146194.

Eberhart, J., Paes, T.M., Ellefson, M.R & Marcovitch, S. (2023). Executive functions and play. *Trends in Neuroscience and Education,* 30, 100198. https://doi:10.1016/j.tine.2023.100198.

Espy, K. A., Kaufmann, P. M., Glisky, M. L., & McDiarmid, M. D. (2001). New procedures to assess executive functions in preschool children. *The Clinical Neuropsychologist*, *15*(1), 46–58. https://doi:10.1076/clin.15.1.46.1908

Fernandes, C., Santos, A.F., Fernandes, M., Veríssimo, M. & Santos, A.J. (2022). Caregivers' responses to children's negative emotions: associations with preschoolers' executive functioning. *Children*, 9, 1075. https://doi:10.3390/children9071075

Gottfried, A. W., Schlackman, J., Gottfried, A. E. & Boutin-Martinez, A. S. (2015). Parental provision of early literacy environment as related to reading and educational outcomes across the academic lifespan. *Parenting*, *15*(1), 24–38. https://doi:10.1080/15295192.2015.992736

Gross, J. J. (1998). The emerging field of emotion regulation: an integrative review. *Review of General Psychology,* 2, 271– 299. https://doi:10.1037/1089-2680.2.3.271

Harrington, E.M, Trevino S.D., Lopez S, & Giuliani N.R. (2020). Emotion regulation in early childhood: implications for socioemotional and academic components of school readiness. *Emotion*, 20(1), 48–53. https://doi:10.1037/emo0000667

Holmes, C.J., Kim-Spoon, J., & Deater-Deckard, K. (2016). Linking executive function and peer problems from early childhood through middle adolescence. *Journal of Abnormal Child Psychology,* 44(1), 31–42. https://doi:10.1007/s10802-015-0044-5

Hoorelbeke, K., Koster, E. H., Demeyer, I., Loeys, T., & Vanderhasselt, M. A. (2016). Effects of cognitive control training on the dynamics of (mal)adaptive emotion regulation in daily life. *Emotion*, 945–956. https://doi:10.1037/emo0000169

Hutton, J.S., Phelan, K., Horowitz-Kraus, T., Dudley, J., Altaye, M., Dewitt, T., & Hollan, S.K. (2017). Shared reading quality and brain activation during story listening in preschool-age children. *The Journal of Pediatrics,* 191, 204-11. https://doi: 10.1016/j.jpeds.2017.08.037

Khan, M. & Jameel, H.T. (2024). Impact of emotional regulation on academic achievement of students at secondary school level. *International Journal of Innovation in Teaching and Learning (IJITL),* 10(2). https://doi: 10.35993/ijitl.v10i2.3334

Kim, P., Evans, G.W., Angstadt, M., Ho, S.S., Sripada, C.S. & Swain, J.E. (2013). Effects of childhood poverty and chronic stress on emotion regulatory brain function in adulthood. *Proceedings of the National Academy of Sciences*, 110(46), 18442- 18447. https://doi:10.1073/pnas.1308240110

Koay, J. M., & Meter, A. V. (2023). The effect of emotion regulation on executive function. *Journal of Cognitive Psychology*, 35(3), 315–329. https://doi:10.1080/20445911.2023.2172417

Köseler Özen, B. & Acar, İ.B. (2024). Children's emotions in the context of parental emotional socialisation. In A. Kapucu & F.C. Pala (Eds.), *Emotion and Cognition from Childhood to* Adulthood (pp. 68–85). Nobel Publishing.

Leventon, S.J., Stevens, S.J., Bauer, J.P. (2014). Development in the neurophysiology of emotion processing and memory in school-age children. *Developmental Cognitive Neuroscience,*10, 21-33. https://doi:10.1016/j.dcn.2014.07.007

Lincoln, C.R., Russell, B.S., Donohue, E.B., & Racine, L.E. (2017). Mother-child interactions and preschoolers' emotion regulation outcomes: nurturing autonomous emotion regulation. *Journal of Child and Family Studies,* 26, 559-573. https://doi:10.1007/s10826-016-0561-z

MacDonald, J.A., Beauchamp, M.H., Crigan, J.A. & Anderson, P.J. (2014). Age-related differences in inhibitory control in the early school years. *Child Neuropsychol,* 20(5), 509-26. https://doi: 10.1080/09297049.2013.822060.

Mileva-Seitz, V.R., Ghassabian, A., Bakermans Kranenburg, M.J., Van Den Brink, J.D., Linting, M., Jaddoe, V.W., & Van Ijzendoorn, M.H. (2015). Are boys more sensitive to sensitivity? parenting and executive function in preschoolers. *Journal of Experimental Child Psychology*, 130, 193-208. https://doi:10.1016/j.jecp.2014.08.008. PMID: 25462041

Öğütcen, A. (2020). An investigation of executive function skills and geometric shape perception in pre-school children. Master's Thesis. Hacettepe University.

Pruessner, L., Barnow, S., Holt, D. V., Joormann, J., & Schulze, K. (2020). A cognitive control framework for understanding emotion regulation flexibility. *Emotion, 20*(1), 21-29. https://doi:10.1037/emo0000658

Razman, M.O.I. & Hoesni, S.M. (2023). Socioeconomic factors and its role in emotion regulation in children from a socio-ecological perspective: a systematic literature review. *Journal of Social Sciences & Humanities*, 20(4), 242-257.

Reilly, S.E., Downer, J.T. & Grimm, K.J. (2021). Developmental trajectories of executive functions from preschool to kindergarten. *Developmental Science,* 25(5), e13236. https://doi: 10.1111/desc.13236

Ribner, A., Devine, R.T., Blair, C., & Hughes, C. (2022). Mothers' and fathers' executive function both predict emergent executive function in toddlerhood. *Developmental Science*, 25, e13263. https://doi:10.1111/desc.13263

Roemer, L., Lee, J. K., Salters-Pedneault, K., Erisman, S. M., Orsillo, S. M., & Mennin, D. S. (2009). Mindfulness and emotion regulation difficulties in generalized anxiety disorder: Preliminary evidence for independent and overlapping contributions. *Behavior Therapy*, *40*(2), 142-154. https://doi:10.1016/j.beth.2008.04.001

Rowland, G., Hindman, E., & Hassmen, P. (2023). Do group mindfulness-based interventions improve emotion regulation in children? a systematic review. *Journal of Child and Family Studies,* 32,1294-1303. https://doi:10.1007/s10826-023-02544-w

Santrock, J.W. (2017). Lifespan Development. (G. Yüksel, Trans. Ed.). Ankara: Nobel Publishing.

Schaan, L., Schulz, A. Nuraydin, S., Bergert, C., Hilger, A., Rach, H., & Hechler, T. (2019). Interoceptive accuracy, emotion recognition, and emotion regulation in preschool children. *International Journal of Psychophysiology*, 138, 47-56. https://doi: 10.1016/j.ijpsycho.2019.02.001

Schapira, R. & Aram, D. (2019). Shared book reading at home and preschoolers' socio-emotional competence. *Early Education and Development*, 31(2). https://doi:10.1080/10409289.2019.1692624

Schmeichel, B.J., & Tang, D. (2015). Individual differences in executive functioning and their relationship to emotional processes and responses. *Current Directions in Psychological Science,* 24(2), 93–98. https://doi:10.1177/0963721414555178

Shackman, A.J., Salomons, T.V., Slagter, H.A., Fox, A.S., Winter, J.J. & Davidson, R.J. (2011). The integration of negative affect, pain and cognitive control in the cingulate cortex. *Nature Reviews Neuroscience,* 12(3), 154-67. https://doi:10.1038/nrn2994.

Shao, R., Liu, S., Coplan, R. J., Chen, X., & Liu, J. (2023). Examining a complex model linking maternal reflective functioning, maternal meta-emotion philosophies, and child emotion regulation. *Children,* 10(7), 1161. https://doi:10.3390/children10071161

Shields, A., & Cicchetti, D. (1997). Emotion regulation among school-age children: The development and validation of a new criterion Q-sort scale. *Developmental Psychology,* 33, 6, 906-916. https://doi:10.1037//0012-1649.33.6.906

Tabibnia, G., Monterosso, J.R., Baicy, K., Aron, A.R., Poldrack, R.A., Chakrapani, S., Lee, B. & London, E.D. (2011). Different forms of self-control share a neurocognitive substrate. *Journal of Neuroscience*, 31(13), 4805-10. https://doi:10.1523/JNEUROSCI.2859-10.2011.

Thorell, L. B., & Nyberg, L. (2008). The childhood executive functioning inventory (chexi): a new rating instrument for parents and teachers. *Developmental Neuropsychology, 33*(4), 536–552. https://doi:10.1080/87565640802101516

Towson, J., Akemoğlu, Y., Watkins, L., & Zeng, S. (2021). Shared interactive book reading interventions for young children with disabilities: a systematic review. *American Journal of Speech-Language Pathology,* 30(6), 2700-2715. https://doi:10.1044/2021_AJSLP-20-00401.

Tuncer, N. (2021). Adaptation of the childhood executive function ınventory-parent form for children aged 48-72 months and examination of ıts predictive power in terms of certain

variables. *OPUS International Journal of Society Researches,* 17(35), 2052-2081. https://doi:10.26466/opus.832602

Unterrainer J.M., Ruh N., Loosli S.V., Heinze K., Rahm B., & Kaller C.P. (2013). Planning steps forward in development: in girls earlier than in boys. *PLoS One*, 8(11), e80772. https://doi.org/10.1371/journal.pone.0080772

Uzbay, T. (2004). The neurobiology of anxiety and depression. *Clinical Psychiatry*, 4, 3–11.

Vrantsidis, D.M., Clark, C.A.C., Chevalier, N., Espy, K.A. & Wiebe, S.A. (2020). Socioeconomic status and executive function in early childhood: Exploring proximal mechanisms, *Developmental Science*, 23(3). https://doi:10.1111/desc.12917

Wager, T. D., Phan, K. L., Liberzon, I., & Taylor, S. F. (2003). Valence, gender, and lateralization of functional brain anatomy in emotion: A meta-analysis of findings from neuroimaging. *NeuroImage*, 19, 513–531. https://doi:10.1016/s1053-8119(03)00078-8

Wagner, K.N., Johnson, L.N. & Bradford, A.B. (2025). Emotion regulation in parent–child relationships: a decade (2013–2023). *Contemporary Family Therapy: An International Journal.* Advance online publication. https://doi:10.1007/s10591-025-09742-2

Welborn, B.L., Papademetris, X., Reis, D.L., Rajeevan, N., Bloise, S.M.& Gray, J.R. (2009). Variation in orbitofrontal cortex volume: relation to sex, emotion regulation and affect. *Social Cognitive and Affective Neuroscience,* 4(4), 328-39. https://doi:10.1093/scan/nsp028.

Xia, X., Li, Y., Wang, Y., Xia, J., Lin, Y., Zhang, X., Liu, Y. & Zhang, J. (2021). Functional role of dorsolateral prefrontal cortex in the modulation of cognitive bias. *Psychophysiology*, 58(10). https://doi:10.1111/psyp.13894.

Yılmaz Tam, H. B. & Çelik, Ü. (2022). Environmental Foundations of Cognitive Development, in A. Bütün Ayhan and U. Beyazıt (Eds.), *Psychosocial Support Studies for Children and Families in Hospitals* (pp. 55–72). Ankara: Pelikan Publishing House.

Yue, T., Liu, L., Nitsche, M.A., Kong, Z., Zhang, M., & Qi, F. (2024). Effects of high-intensity interval training combined with dual-site transcranial direct current stimulation on inhibitory control and working memory in healthy adults. *Human Movement Science*, 96,103240. https://doi:10.1016/j.humov.2024.103240

Yurdakul, Y., Beyazıt U. & Bütün Ayhan, A. (2025). The effect of dialogic book reading on preschool children's perspective taking skills. *Early Childhood Education Journal*, 53(1), 49-62. https://doi:10.1007/s10643-023-01567-8

Zhang, Q., Wang, L., Dong, S., Cao, L., Wu, C. & Liu, S. (2022). Exploring proximal mechanisms behind intergenerational association between maternal childhood abuse and

Chinese preschool children's executive function. *Child Abuse & Neglect,* 134. https://doi:10.1016/j.chiabu.2022.105931