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RESEARCH ARTICLE

The Development of Inhibitory Control in Boys Aged 5 to 9 Years: A Concurrent Assessment with Flanker and Stop-Signal Tasks

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ABSTRACT

Inhibitory control, as a fundamental component of executive functions, plays a crucial role in children's cognitive, behavioral, and social development. This non-experimental study aimed to examine the developmental trajectory of inhibitory control in boys aged 5 to 9 years from Babol city. The sample comprised 175 boys (aged 5 years to 9 years 11 months), selected from the population of boys in Babol's kindergartens and elementary schools using a multistage cluster sampling procedure. The assessment battery included the Child Behavior Checklist (CBCL), the Flanker task (measuring interference control), and the Stop-Signal Task (measuring response inhibition). Multivariate Analysis of Variance (MANOVA) was used for data analysis. The results indicated that children's performance on both inhibitory tasks improved gradually with age. However, post-hoc comparisons revealed significant developmental improvements in the Stop-Signal Task specifically between the 5–6 and 7–8 year age groups. Polynomial trend analyses showed a partially nonlinear trajectory for stop-signal reaction time (SSRT), suggesting that the maturation of motor inhibition may not follow a strictly linear pattern. Overall, the findings demonstrate a clear developmental progression in inhibitory control while indicating that its different domains may follow distinct maturational trajectories. The results underscore the importance of using multiple, domain-specific measures in assessment and highlight the need to consider developmental characteristics when designing cognitive and self-regulatory interventions.

Introduction

Inhibitory control, as an important component of executive functions, plays a significant role in other functions including planning, decision-making, and problem-solving (De Cerqueira et al., 2025; Kloo & Sodian, 2017). Inhibition is the fundamental ability to restrain impulses and suppress automatic responses, enabling children to regulate their behavior, emotions, and thoughts by resisting distracting stimuli, which serves as a basis for cognitive and socio-emotional development and is associated with positive outcomes in academic and social domains (Aïte et al., 2018; Farbiash & Berger, 2016; Sadeghi et al., 2022; Strömbäck et al., 2020). In comparing inhibitory control and self-control, it can be said that inhibition is a cognitive process and a part of executive functions that allows an individual to momentarily stop a dominant or interfering response; in contrast, self-control is a broader, multidimensional construct that refers to an individual's ability to regulate behavior, emotion, and desires in line with long-term goals. Self-control also includes motivational, emotional, and decision-making processes beyond inhibition and is often considered a stable behavioral trait (Wennerhold & Friese, 2020).

Proper functioning of the inhibitory component plays a very important role in daily functioning. In the academic domain, inhibitory control contributes to better academic achievement by helping maintain focus, follow instructions, and complete tasks effectively (Bryce et al., 2011; De Cerqueira et al., 2025). Research evidence shows that children with higher levels of inhibition demonstrate better performance in the school environment and achieve greater success in core subjects such as mathematics, reading, writing, and science (Borst, 2021; Palmer et al., 2025). This skill is also vital for success in social interactions. Inhibition, by providing the ability to manage impulsive behaviors, creates a foundation for forming positive social relationships (Hassan et al., 2019; Kloo & Sodian, 2017). Children who possess this ability face fewer behavioral problems and are more successful in managing social environments and establishing peer relationships (Hassan et al., 2019). Furthermore, inhibitory performance is significantly associated with adaptive behavior (including practical, conceptual, and social skills necessary for daily functioning). Especially in children with mild intellectual disability, this skill is a strong predictor of behavioral outcomes and leads to improved well-being by facilitating the management of daily affairs (Gligorović & Buha Durović, 2014). Inhibitory deficits are closely associated with various developmental and psychiatric disorders. For example, deficient inhibitory control is a core feature of Attention-Deficit/Hyperactivity Disorder leading to clinical manifestations such as impulsivity and hyperactivity (Bonham et al., 2021; Pang et al., 2025). This deficit has also been reported in Oppositional Defiant Disorder, Conduct Disorder, and Autism Spectrum Disorder (Bonham et al., 2021; Schmitt et al., 2018). Thus, inhibitory deficit can be introduced as one of the shared neuro-cognitive mechanisms in the etiology of these disorders.

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Research literature indicates that inhibitory control does not have a uniform structure but encompasses two relatively distinct subsystems: motor inhibition and cognitive inhibition (Friedman & Miyake, 2017). Motor inhibition refers to the ability to stop or prevent the execution of a dominant or ongoing motor response. In contrast, cognitive inhibition refers to the ability to suppress irrelevant or interfering information at the level of mental processing (Montgomery et al., 2022). In cognitive neuroscience, motor inhibition performance is generally assessed using paradigms that require managing dominant responses (Aron, 2011), such as the stop-signal task, go/no-go, flanker, and Stroop tasks (Uhre et al., 2022). Tasks like the stop-signal task are considered standard tools for assessing motor inhibition, as they measure a child's ability to suddenly stop a motor reaction and provide precise temporal indices such as mean reaction time. Also, the Flanker task, as one of the most common tests for assessing cognitive inhibition, requires selecting the correct response in the presence of distracting and conflicting stimuli, providing an index of an individual's efficiency in controlling interference (Montgomery et al., 2022).

It is believed that inhibitory control develops considerably in early childhood, with significant advancements in this ability primarily observed between the ages of 2.5 and 6.5 years (Geeraerts et al., 2021). This developmental trend continues into the early school years, and performance improvement can be observed in the age range of 5 to 7 years (Macdonald et al., 2014). Studies show that this ability improves with age, with notable progress particularly in the first two years of school (Sadeghi et al., 2022). Some research suggests a nonlinear growth pattern for this ability, with growth spurts occurring mainly between the ages of 3.5 to 5 years, followed by more gradual improvements in later stages. During the preschool years, the growth of inhibitory performance increases markedly. This time is recognized as a critical period for the development of self-regulation skills (Caffarena-Barcenilla & Rojas-Barahona, 2024; Farbiash & Berger, 2016). In late childhood (9 to 12 years), children show signs of inhibitory control networks similar to patterns observed in adults (particularly in cortico-basal ganglia pathways) (Cai et al., 2019). The development of inhibitory function seems to continue into adolescence, with different components of this system maturing at different speeds (Aïte et al., 2018; Vuillier et al., 2016).

The nonlinear growth of inhibitory performance makes its assessment and measurement challenging. One of the significant challenges in evaluating and studying inhibitory development is the use of standardized tools and tasks to measure this component at different developmental stages. Inhibition assessment tools must be age-appropriate and consider individual differences in cognitive abilities (Schulz et al., 2024; Schulz et al., 2023). The use of tasks not linked to inhibition assessment in infancy, toddlerhood, and early childhood raises the concern of whether a cognitive function is being measured validly and reliably across different ages (Holmboe et al., 2021).

Despite the extensive emphasis in the scientific literature on the fundamental role of inhibitory control in children's cognitive, social, and academic development, there are still significant gaps in the concurrent investigation of the two distinct domains of motor and cognitive inhibition in the early childhood and early school years. Most studies have focused on only one task or one aspect of inhibition, and another portion of studies has examined limited or inappropriate age ranges. It is also necessary to note that studies conducted in Iran regarding inhibitory development and cognitive functions in general are few and far between (e.g., Sadeghi et al., 2022). Accordingly, the present study aims to comprehensively examine their development in the early childhood age range by assessing two distinct types of inhibitory control (resistance to irrelevant stimuli and control of dominant responses) in different age groups. Selecting this age range is of particular importance due to the emergence of the most significant developments in inhibitory function. Furthermore, greater cognitive flexibility at younger ages and the increasing influence of cognitive interventions during this period are other key reasons for choosing this age range.

This comprehensive examination, in addition to clarifying the developmental pathway of inhibitory control, will provide the necessary ground for designing and implementing targeted and effective intervention programs. A more precise understanding of the developmental course of inhibition and its relation to various aspects of development allows professionals and educators to design educational and intervention programs in a way that is more aligned with the developmental needs of children at different ages and ultimately leads to the enhancement of their cognitive abilities and social adaptation. Based on this, the present study, using two valid and complementary tasks, seeks to investigate and compare the development of these two components in children aged 5 to 9 years.

The main objective of this research is to delineate the pattern of developmental changes in inhibitory control in early childhood and explain the differences or simultaneity of progress in these two domains. Accordingly, the central research question is whether cognitive inhibition and motor inhibition follow similar developmental patterns in these age periods or whether differences are observed in their speed, range, or slope of changes. Answering this question can provide a deeper understanding of the organization of executive systems and create a basis for designing targeted interventions in the early years of development.

Method

This study employed a non-experimental, descriptive design. The population consisted of all boys attending kindergartens and elementary schools in Babol county during the 2024-2025 academic year. For sample selection, multi-stage cluster sampling was used; first, the county was divided into four regions, in each region four boys' schools were randomly identified, and then five classes were selected from each school. In the first step, 188 individuals were selected as the research sample. After applying the inclusion and exclusion criteria, 13 individuals were excluded from the study due to non-compliance with the specified conditions, and the final sample size was reduced to 175. For balanced distribution, 35 participants were included in each of the age groups: 5 to 5.11 years, 6 to 6.11 years, 7 to 7.11 years, 8 to 8.11 years, and 9 to 9.11 years.

The inclusion criteria for the study were: having intelligence quotient within the normal range based on reports from comprehensive assessment centers or educational records, absence of diagnosable clinical problems based on the Child Behavior Checklist, and absence of significant academic problems for the school-age children group. The exclusion criterion was considered as the child's lack of consent and cooperation to continue the assessment process. In conducting the research, ethical principles including obtaining informed consent, maintaining confidentiality of information, and observing participants' rights were considered. The research tools included the Flanker task and the Stop-Signal task, which were administered individually to each child in a completely quiet room. The statistical analysis comprised two main steps. First, multivariate analysis of variance (MANOVA) was conducted. Subsequently, Tukey's post-hoc test and polynomial trend analysis were employed to examine between-group differences and developmental patterns. All analyses were performed using SPSS version 27.

Measures

Child Behavior Checklist- Parent Form (CBCL-P): The CBCL-P was introduced and developed by Achenbach (2001). This Checklist is used to assess behavioral and emotional problems in children and its completion usually takes 20 to 25 minutes. Responses to the questionnaire items are on a 3-point Likert scale, ranging from 0 to 2. A score of "0" is assigned to items that are never present in the child's behavior; a score of "1" is assigned to states and behaviors that are sometimes observed in the child, and a score of "2" is assigned to items that are present most of the time or always in the child's behavior. This checklist assesses areas such as emotional problems, anxiety/depression, somatic complaints, withdrawal, attention problems, and aggressive behavior. In this study, considering the age range of the participants, two versions related to preschool and school age were used. Achenbach (2001) reported the instrument's validity to be between .44 and .70 and Cronbach's alpha to be between .78 and .98. In a study examining the validity of the Persian version of this test, it was found that the obtained results were consistent with international literature, meaning that this questionnaire is also usable for research in the Iranian population (Shahrivar et al., 2011). Also, Minaei (2007) reported the internal consistency coefficient of this tool to be between .73 and .87. In the present study, using Cronbach's alpha, a coefficient of .81 was calculated for this tool, indicating its appropriate internal consistency.

Flanker Task: This task, first designed to assess interference control (Ridderinkhof et al., 1997), consists of one practice block and one main block (Figure 1). In each trial, after displaying a "+" sign for 1000 milliseconds, five arrows are displayed simultaneously for 1750 milliseconds, and the participant must press the corresponding key according to the direction of the central arrow with maximum speed and accuracy. The practice block includes 8 trials, and upon achieving at least 75% correct responses, the participant proceeds to the main block (40 trials). During practice, immediate feedback is provided. In the main test, half of the trials are congruent and the other half are incongruent, presented randomly to the participant. In this task, reaction time for each type of trial is recorded separately, and finally the mean reaction time (RT) for congruent and incongruent trials is calculated. Success rate in congruent and incongruent conditions is calculated as a percentage by dividing the number of correct responses in each trial type by 20. The concurrent validity of the Flanker task has been found to range from .44 to .70 (Lee & Pitt, 2024). The reliability of this test has been reported between .70 and .81 (Bogdanov et al., 2025). According to Ghayerin et al. (2021), this task is not culture-dependent and its test-retest reliability coefficient is .66. The reliability of this task in the present study, using the test-retest method, was reported as .76.

Stop-Signal Task: This task is designed to assess dominant response inhibition performance (Verbruggen et al., 2019) (Figure 1). The task includes one practice block (32 trials) and three main blocks (each 72 trials). Each trial begins with the display of a circle (250 milliseconds) and then an arrow with a random left or right direction appears. In trials without a stop signal (75% of trials), the participant must respond by pressing the corresponding key. In 25% of the trials in each block, selected randomly, a beep sound (stop signal) with a variable delay is played after the main stimulus, and the participant must withhold their response. In this study, the initial delay is 250 milliseconds, decreasing by 50 ms after each inhibition failure and increasing by 50 ms after each success. In the tool standards, the possibility of changing stop-signal delays within a range of approximately 50 to 1150 milliseconds is provided. The main index of the test is the Stop-Signal Reaction Time (SSRT), which is obtained from the difference between the mean reaction time in no-stop trials and the mean stop-signal delays (SSD). A lower number in the reaction time index and a higher number in stop-signal delays indicate better performance in motor inhibition. The success rate in the test is calculated as a percentage by dividing the number of correct responses in conditions without and with a stop signal by the maximum number of trials for each condition (162 no-stop trials and 54 trials for conditions with a signal) in the entire test. The validity of this test is in the moderate range (.50 to .72) (Verbruggen et al., 2019). It should be noted that in the present study, using the test-retest method, a reliability coefficient of .82 was reported for this tool.

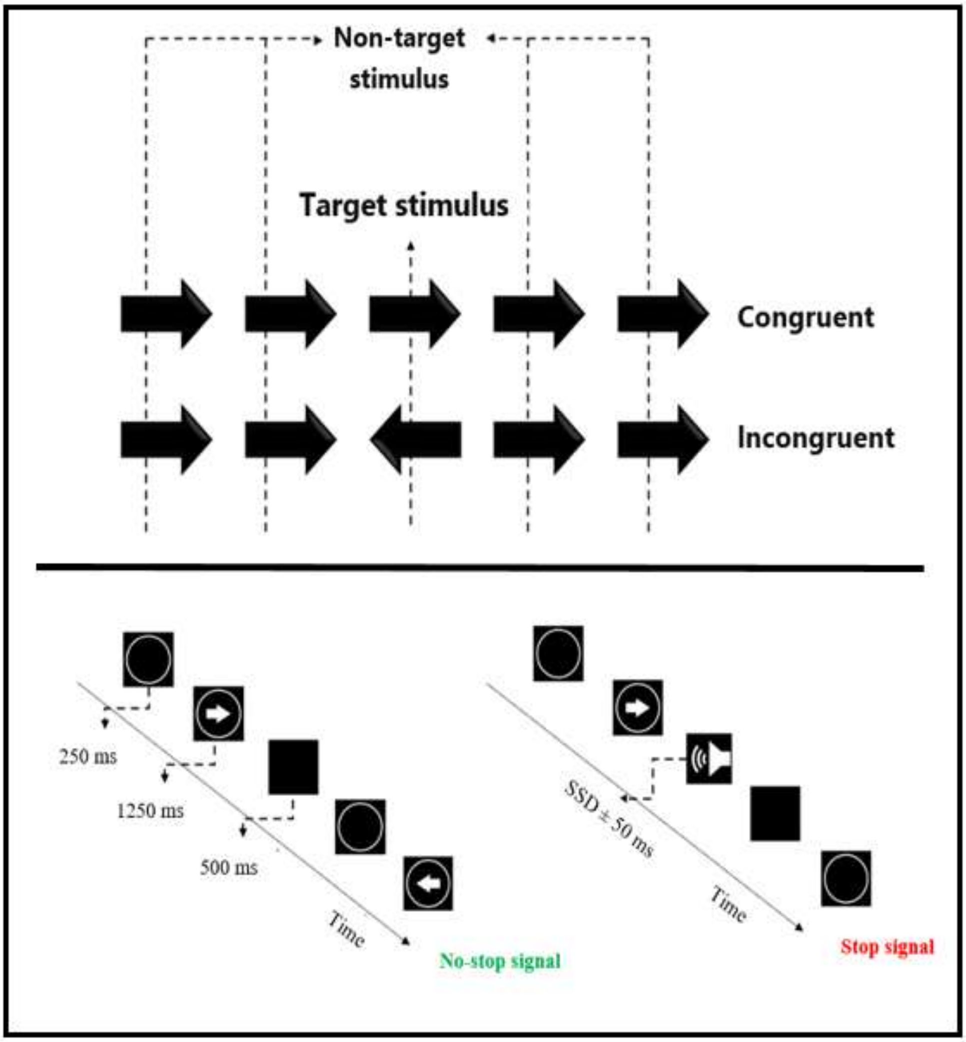

Figure 1: *Details of inhibitory control tasks*

Results

Table 1 shows descriptive information of the participants based on age groups 5 to 9 years.

Table 1: *Demographic data of the participants*

Age Group	Frequency	Mean	SD	Min	Max
5 years	35	5.05	0.03	5.02	5.11
6 years	35	6.05	0.04	6.00	6.11
7 years	35	7.05	0.03	7.00	7.11
8 years	35	8.05	0.03	8.00	8.11

Table 2: *Descriptive statistics of the inhibitory control tasks*

Tasks	Variables	Age Groups (Years and Months)				
		5 to 5.11 Mean (SD)	6 to 6.11 Mean (SD)	7 to 7.11 Mean (SD)	8 to 8.11 Mean (SD)	9 to 9.11 Mean (SD)
Flanker Task	Congruent RT	819 (123.27)	813.77 (165.07)	753.23 (137.48)	700.17 (117.55)	661.37 (113.94)
	Incongruent RT	913.63 (119.95)	889.31 (185.57)	858.09 (143.61)	806.20 (103.01)	726.66 (93.47)
Stop-Signal Task	SSRT	530.71 (118.29)	433.31 (126.47)	410.79 (95.71)	375.46 (43.42)	368.86 (66.85)
	SSD	277.40 (88.65)	332.06 (151.19)	335.17 (96.86)	422.06 (98.63)	419.49 (113.22)

There were 35 children in each age group. Also, the standard deviation (SD) was low and relatively constant in all groups (.03 to .04), indicating low age dispersion of participants within each age group. In the next step, the scores obtained from the tests were examined. Table 2 shows the mean and standard deviation.

As evident from the data, scores on both Flanker task subscales—Congruent RT and Incongruent RT—showed a gradual decreasing trend. This indicates improved performance with age. Similarly, on the Stop-Signal task, scores decreased gradually from the 5- to the 9-year-old group, reflecting better performance in older children. The SSRT also exhibited a steady decline across age groups. For the SSD, where higher values denote better performance, scores increased up to age 8, with a slight decrease noted at age 9. These developmental trends are illustrated in Figure 2 and Figure 3.

Figure 2: *Trend of flanker task score changes across five age groups*

Figure 3: *Trend of stop signal task score changes across five age groups*

As evident in the Figure 2, performance improvement in all age groups occurred gradually and according to a linear pattern. However, in the Figure 3, especially in the 8 and 9-year-old groups, this linear pattern has changed somewhat.

Subsequently, MANOVA was used to examine statistical differences between groups (Table 3). Before conducting the analysis of variance, the assumptions of normality of score distribution using the Kolmogorov-Smirnov test and homogeneity of variances using Levene's test were examined and confirmed ($p > .05$).

Table 3: *Results of MANOVA for comparing differences between groups*

Source	Variables	SS	df	MS	F	sig	Effect Size
Age Groups	Flanker Task						
	Congruent RT	671122.251	4	167780.563	9.52	p < .001	.18
	Incongruent RT	775660.37	4	193915.093	10.92	p < .001	.20
	Stop-Signal Task						
	SSRT	596618.03	4	149154.508	16.39	p < .001	.28
	SSD	544999.51	4	136249.878	10.87	p < .001	.20

The results presented in Table 3 show that there are significant differences between groups in all subscales (p < .05). Considering the reported means, this difference is evident between high and low age groups. However, in this research, pairwise comparison between adjacent age groups was of interest. Therefore, using Tukey's post-hoc test, comparisons were made between the groups of 5 and 6 years, 6 and 7 years, 7 and 8 years, and 8 and 9 years (Table 4).

Table 4: *Results of Tukey's test for pairwise comparisons among age groups*

Subscale	Group Comparison		Difference	Sig	Subscale	Group Comparison		Difference	Sig
	Group 1	Group 2				Group 1	Group 2		
Congruent RT	5 yr	6 yr	5.23	1.000	SSRT	5 yr	6 yr	97.40	p < .001
		7 yr	65.77	.243			7 yr	119.93	p < .001
		8 yr	118.88	p < .001			8 yr	155.26	p < .001
		9 yr	157.63	p < .001			9 yr	161.86	p < .001
	6 yr	7 yr	60.54	.322		6 yr	7 yr	22.53	.860
		8 yr	113.66	.010			8 yr	57.86	.090
		9 yr	152.40	p < .001			9 yr	64.46	.040
	7 yr	8 yr	53.06	.452		7 yr	8 yr	35.33	.530
		9 yr	91.86	.030			9 yr	41.93	.350
	8 yr	9 yr	38.80	.740		8 yr	9 yr	6.60	.990
Incongruent RT	5 yr	6 yr	24.31	.940	SSD	5 yr	6 yr	-54.66	.250
		7 yr	55.54	.410			7 yr	-57.77	.200
		8 yr	107.43	.010			8 yr	-144.66	p < .001
		9 yr	186.97	p < .001			9 yr	-142.09	p < .001
	6 yr	7 yr	31.23	.860		6 yr	7 yr	-3.11	1.000
		8 yr	83.11	.070			8 yr	-90.00	.010
		9 yr	162.66	p < .001			9 yr	-87.43	.010
	7 yr	8 yr	51.89	.480		7 yr	8 yr	-86.89	.020
		9 yr	131.43	p < .001			9 yr	-84.31	.020
	8 yr	9 yr	79.54	.090		8 yr	9 yr	2.57	1.000

Based on the results in Table 4, there was no significant difference between adjacent age groups in either of the two subscales of Congruent RT and Incongruent RT under the Flanker task. However, differences were reported in the examination of scores from the Stop-Signal task. Analyses showed that in the SSRT, there was a significant difference between the 5 and 6-year-old age groups (p < .001). This difference was not observed in other age pairs. Additionally, in examining the SSD, it was found that there was a significant performance difference between the 7 and 8-year-old age groups (p = .02). This means that 8-year-old children showed considerably better performance compared to 7-year-old children. Subsequently, polynomial trend analysis was used to examine the pattern of inhibitory changes (Table 5).

Table 5: *Results of polynomial trend analysis for examining the change pattern*

Subscale	Trend	Sig	95% Confidence Interval	
			Lower Bound	Upper Bound
Congruent RT	Linear	p < .001	-179.92	-91.31
	Degree 2	.484	-60.24	28.36
	Degree 3	.333	-22.30	66.30
Incongruent RT	Linear	p < .001	-189.00	-100.10
	Degree 2	.120	-79.51	9.42
	Degree 3	.770	-51.03	37.91
SSRT	Linear	p < .001	-152.49	-88.83
	Degree 2	.010	13.28	76.94
	Degree 3	.370	-46.23	17.24
SSD	Linear	p < .001	80.97	155.67
	Degree 2	.660	-45.55	29.15
	Degree 3	.530	-49.34	25.36

Based on the observed results, in all four subscales, the linear trend is significant. This means the subscales have a linear developmental pattern. However, in the SSRT, the degree 2 trend is also reported as significant. This finding indicates that despite linear growth in early ages, these developments appear in a nonlinear form at older ages. According to Figure 3, this nonlinear pattern is related to the ages of 8 to 9 years.

Discussion

The present study was conducted with the aim of assessing inhibitory control in children from preschool to early elementary school years (ages 5 to 9). The use of two distinct assessment tools—the Flanker task for cognitive inhibition and the Stop-Signal task for motor inhibition—as one of the innovations of this research, made it possible to investigate whether different components of inhibition have a similar developmental pattern or follow independent developmental pathways.

The results from administering the Flanker task in the two subscales of Congruent RT and Incongruent RT showed that the pattern of score changes improved with a similar and approximately linear trend in both cases (Figure 2). Although pairwise comparisons between adjacent age groups using the post-hoc test showed no significant difference, the greatest difference in Congruent RT was observed between the ages of 6 and 7 years. In this comparison, there was about a 61-point difference between these two age groups, indicating better performance by 7-year-old children. Some studies have reported that the decrease in Congruent RT observed in a similar age range is associated with the start of formal education and increased experience with structured activities (Hill et al., 2022; Richardson et al., 2018).

In the Incongruent RT, the greatest difference was also seen between the 8 and 9-year-old age groups. The mean performance of 9-year-old children shows a decrease of about 80 points, indicating their better performance compared to the 8-year-old group. Research literature associates significant progress in interference control and suppression of distracting information in this age range with greater maturation of neural networks (Hill et al., 2022; Yeung et al., 2020). The findings of the present study are consistent with similar studies indicating linear and gradual growth of cognitive inhibition and processing speed in the 5 to 9-year-old age range (Di Chiaro & Holmes, 2024; McDermott et al., 2007). This gradual trend indicates the continuous maturation of prefrontal cortical networks and improvement of functions related to interference control, selective attention, and response monitoring, without observing sudden spurts (Richardson et al., 2018). This means that as children age, their ability to resist interfering stimuli and maintain focus improves continuously. This trend is particularly evident in tasks like Flanker that assess cool inhibitory control (Aïte et al., 2018).

This study also examined and evaluated the functional developments of children in the Stop-Signal task. This task measures another aspect of inhibition, namely motor inhibition. As can be seen in Figure 3, despite performance improvement in the two subscales of SSRT and SSD, this improvement also shows a somewhat nonlinear pattern. In children, motor inhibition, unlike cognitive inhibition, follows a stage-like and nonlinear pattern and is accompanied by specific growth spurts at particular ages. This growth depends on the gradual and heterogeneous maturation of frontal-subcortical networks, especially the right prefrontal cortex, basal ganglia (particularly the subthalamic nucleus), and cortico-spinal motor pathways (Constantinidis & Luna, 2019). From ages 5 to 8, performance changes are observed relatively continuously, but this trend is somewhat different from 8 to 9 years. Given that the maximum age of the sample group in the present study is reported as 9.11 years, it was not possible to examine changes in older age periods, but what is clear is that these changes have a slower slope at older ages (Fosco et al., 2019; Sadeghi et al., 2022). Pairwise comparison of adjacent age groups showed that in the SSRT, there is a significant difference between the 5 and 6-year-old age groups. Also, in examining the SSD, the 8-year-old age group reported a significant performance difference compared to the 7-year-old group. These results indicate faster development of inhibitory abilities in preschool and early elementary school ages (Caffarena-Barcenilla & Rojas-Barahona, 2024; Farbiash & Berger, 2016; Ruddock et al., 2016). fMRI and fNIRS evidence shows that in children, activation of frontal and subcortical areas during motor inhibition tasks gradually increases with specific spurts. These activations reach a stable level in adulthood (Mehnert et al., 2013). The dependence of motor inhibition on subcortical structures causes motor inhibition, unlike cognitive inhibition, to have a spurt-like growth pattern (Constantinidis & Luna, 2019). Overall, children with typical development show rapid improvement in inhibitory control until mid-childhood, and thereafter experience a slower rate of improvement until the end of childhood and early adolescence (Ruddock et al., 2016).

Generally, the development of inhibitory control in children is a complex and variable phenomenon. Although performance improvement is observed in most age groups, this performance enhancement in inhibitory control can have a linear or nonlinear trend depending on the type of inhibition and the tasks used for measurement. This is because the differing patterns obtained from the two tasks indicate that inhibitory control is not a unitary and homogeneous construct but consists of two relatively independent components, cognitive and motor inhibition. This result is consistent with theoretical models such as Friedman and Miyake's (2017) model, which emphasizes the distinction between types of inhibition; therefore, children's improvement in one type of inhibition does not necessarily mean their progress in the other type, and this point highlights the necessity of using multiple tools in developmental and clinical assessments. These findings emphasize the importance of considering the specific type of inhibitory control, using standardized and age-sensitive tasks, and considering the individual's developmental stages when assessing this ability. A full understanding of these developmental processes requires the use of multidimensional and longitudinal assessment methods that can comprehensively record the complexity of developmental pathways.

The development of inhibitory ability may also be influenced by various factors including socio-economic factors and health-related factors. For example, it has been found that in low-income samples, different patterns of change in inhibitory control are observed; such that some children show low and stable levels of inhibitory performance, while others possess increasing levels of this ability (Pacheco et al., 2018). This is an important issue that, due to the limitations of the present study, could not be examined. Also, clinical issues can influence inhibitory performance developments. For instance, children with Developmental Coordination Disorder show slower and often linear developments in inhibitory control compared to typically developing children (Ruddock et al., 2016). Also, there is evidence indicating that children's motor competence has a positive relationship with accuracy of performance and a negative relationship with reaction time. This finding suggests that as children's motor skills improve, their inhibitory performance also improves linearly (Zhang et al., 2024). Finally, another point that should be considered is individual differences and methodological factors that can influence results and must be considered in data interpretation (Simmering et al., 2023). In addition, the level of neural maturity, not just chronological age, plays an important role in cognitive inhibitory performance which should be taken into account (Liu et al., 2022).

Understanding the development of inhibitory control during childhood and adolescence, which is accompanied by significant neural and behavioral changes, is crucial for identifying at-risk individuals and designing targeted interventions. This ability, a key subset of executive functions, directly impacts academic performance, mental health, and social skills, and deficits in it can lead to problems such as hyperactivity, conduct disorders, or other health-related issues; therefore, its continuous monitoring and strengthening through educational programs, cognitive games, and related exercises not only facilitates adaptive development but also serves as a powerful protective factor, preventing future psychological harm and providing a foundation for long-term health.

The present study, like any research, faced limitations which can be pointed out as follows: limitations related to reaction time-based inhibition tasks that may be influenced by child's fatigue, excitement, motivation, or momentary attention; uncontrolled differences in education, parenting styles, and children's environmental experiences—these factors can influence processing speed, attention control, and response inhibition; not directly assessing children's intelligence and relying on existing records in assessment centers and schools; and finally, the cross-sectional nature of the present study makes it impossible to determine the real individual growth trajectory of children over time, which limits the generalizability of the findings. To develop future research, it is suggested that investigating the role of gender in inhibitory control development, as well as studying this construct in clinical groups including individuals with Attention-Deficit/Hyperactivity Disorder and Autism Spectrum Disorder should be prioritized. Also, practical suggestions include multidimensional assessment prior to intervention, use of multi-faceted interventions, and targeting interventions based on sensitive developmental periods.

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