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Brief research report

School Readiness Classes and Sports Classes: The Association with Inhibition in 5 to 6 Year-Old Boys

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Abstract. The aim of this study was to compare the development of cognitive inhibition and motor inhibition in older preschool children participating either in school readiness classes or in sports classes as extracurricular activities. A questionnaire for mothers was used to collect data on extracurricular activities of children. NEPSY-2 subtests were used to assess cognitive inhibition and motor inhibition in children. The sample consisted of 118 boys aged 5–6 years. There were three groups of boys: 38 boys attending only in school readiness classes for at least six months, 40 boys participating only in sports classes for at least six months, and 40 boys in the control group, who did not participate in any extracurricular activities. Girls were not included in the sample since 90 % of children who participated only in sports were boys. The results showed that boys participating only in sports had higher levels of cognitive inhibition than the boys from two other groups. No differences were found between the groups in levels of motor inhibition. The results indicate that participation in sports may be beneficial for the development of inhibition in boys aged 5 to 6 years. These findings indicate that participation in sports may be beneficial for the development of inhibition in boys aged 5–6 years. At the age of 5 to 6, inhibition naturally develops through structured physical activities that incorporate cognitive challenges of increasing difficulty.

Key words: preschool age, boys, cognitive inhibition, motor inhibition, school readiness classes, sports classes, extracurricular activities

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Introduction

Executive functions “refer to a family of top-down mental processes needed when you have to concentrate and pay attention, when going on automatic or relying on instinct or intuition would be ill-advised, insufficient, or impossible” (Diamond,

2013, p. 136). One of the core executive functions is inhibition. Inhibition allows a person to consciously suppress impulsive reactions that are not consistent with current objectives or circumstances (Diamond, 2013; Veraksa et al., 2023). It facilitates faster responses to relevant stimuli, by ignoring irrelevant stimuli to concentrate only on those that are really important. Inhibition can be cognitive, i.e. directed aimed at controlling cognitive processes, or motor, i.e., aimed at controlling movements (Diamond, 2013). It develops most intensively between the ages of 3 and 6 years (Liu et al., 2015) and underlies the cognitive development of children (Davidson et al., 2006). Inhibition is a central component of school readiness and is positively associated with academic achievement (Cortés Pascual et al., 2019; Potanina & Morosanova, 2023). Parents enroll their preschool-age children in extracurricular activities in the hope that such classes will foster sufficient levels of inhibition to ensure a smooth transition to school. Ensuring school readiness is one of the main tasks of parents of children aged 5–7 years (Joukova et al., 2023). Therefore, identifying the most effective extracurricular activities for the development of inhibition in preschoolers remains an important research task (Soldatenko & Averin, 2024).

School readiness classes are a type of extracurricular activity designed to develop developing basic components of school readiness. These are writing, counting, and reading skills, together with inhibition skills. School readiness classes are one of the most attended extracurricular classes among older preschool children (Lubovsky, 2019). School readiness classes can enhance the development of inhibition. Firstly, in these courses, great attention is paid to the development of concentration and inhibiting inappropriate behaviours (Semenova, 2020; Vitiello et al., 2017). Secondly, mastering writing, counting, and reading skills can contribute to inhibition development in preschool children. Many studies have shown a positive relationship between successful mathematical problem solving and inhibition in preschool and primary school children (Allan et al., 2014; Emslander & Scherer, 2022; Zhu et al., 2025). Similarly, some studies have shown that there is a positive relationship between the ability to suppress irrelevant information and the level of proficiency in children's reading and writing skills (Allan et al., 2014; Gandolfi et al., 2021). These associations are explained by the fact that at the first stage of learning skills of reading, writing, and calculation, preschoolers need additional efforts to integrate information related to the task before the acquired skills become automatic (Spiegel et al., 2021). Therefore, participation in school readiness classes may support the development of inhibition.

Sports classes are another popular type of extracurricular activity[1]. Numerous studies have shown that participation in sports supports the development of inhibition in children (Formenti et al., 2021; Koepp & Gershoff, 2022; Veraksa et al., 2021). For example, Lakes and Hoyt (2004) found that children who practiced martial arts four times a week for three months performed better on the cognitive

[1] VCIOM. (23.08.2023). *Children's sports: opportunities and barriers*. Retrieved April 23, 2025, from https://wciom.ru/analytical-reviews/analiticheskii-obzor/detskii-sport-vozmozhnosti-i-barery

self-regulation task compared to the control group. Similarly, Koepp and Gershoff (2022) reported that participation in team sports at preschool age promotes the development of inhibition. At the same time, this effect persists into elementary school (Koepp & Gershoff, 2022). In sports classes, children must strictly follow the coach's instructions, without being distracted by irrelevant stimuli and communication, and must suppress their immediate desires. They must also keep in mind the necessary information about the exercise to be performed, ignoring extra information. Based on the available evidence, sports classes appear to be at least as effective as school readiness classes in supporting the development of inhibition.

Despite the widespread popularity of school readiness classes and sports classes for preschoolers, there are no studies comparing the effectiveness of these extracurricular activities in the development of inhibition. Therefore, the ***aim of this study*** was to compare the development of inhibition in three groups of older preschool children. There were firstly, those children participating in school readiness classes. Secondly, those children participating in sports, and thirdly, those children who do not participate in any extracurricular activities (a control group). All children, regardless of group, attended the general preschool kindergarten program (Veraksa et al., 2019). To address this aim, we formulated the following research questions:

1) Which group of children demonstrates higher levels of cognitive inhibition — those participating in school readiness classes or those participating in sports?

2) Which group of children demonstrates higher levels of motor inhibition — those participating in school readiness classes or those participating in sports?

Methods

Diagnostic Tools

Two subtests from the NEPSY-II neuropsychological assessment battery (Korkman et al., 2007), previously validated in a Russian sample (Veraksa et al., 2020), were used to measure inhibition.

Cognitive inhibition was assessed using the *Inhibition* subtest. Children were presented with 40 geometric shapes (squares and circles). In the first stage, they were asked to name the shapes as quickly as possible. In the second stage, they performed an inhibition task, naming each shape in reverse (e.g., saying "circle" when shown a square). A brief training session preceded each stage. The following parameters were recorded: time to complete the task, number of errors, and number of self-corrections. A combined score ranging from 0 to 20 was then calculated.

The "Statue" subtest was used to assess motor inhibition. In this subtest, children were required stand still for 30 seconds, with their eyes closed, silently, without reacting to sounds except the command to complete the task. In this case, the psychologist makes distracting sounds during the procedure (coughing, knocking, falling pen sound). Errors were coded every five seconds and included three categories: movement, eye opening, and vocalization. A total score from 0 to 30 was calculated based on the number of errors.

Information about children's extracurricular activities (school readiness classes or sports classes) was collected via a parental questionnaire completed by mothers. The questionnaire included questions about the type of extracurricular activities, duration of participation (in months), frequency (times per week), and length of each session (minutes). In addition, it contained socio-demographic questions about the child's sex and age, as well as family income and mother's education, the latter two variables being used to describe the sample.

Procedure

Prior to the study, approval was obtained from the Ethics Committee of the Federal Scientific Center for Psychological and Interdisciplinary Research. Written informed consent was collected from parents or legal guardians. Written informed consent was collected from parents or legal guardians. In addition, meetings were held with the administration of the kindergartens to inform them about the procedure and objectives of the study. All personal data of children and parents were anonymized. Feedback on the research results was provided individually to parents interested in it.

Inhibition tests were conducted in the morning in a well-known, bright and quiet room in the kindergarten (e.g., in the group room). Each child was tested individually, with the session lasting approximately 10 minutes. Participation was voluntary, and children were free to refuse or discontinue the procedure at any time. Upon completion, each child received a sticker as a token of appreciation.

At the same time, mothers of participating children completed an online questionnaire. The link to the survey was distributed via email and parent chat groups in kindergartens and schools. Completion time was approximately 10 minutes. At the same time, mothers of participating children completed an online questionnaire. The link to the survey was distributed via email and parent chat groups in kindergartens and schools. Completion time was approximately 10 minutes.

After data collection, the questionnaires were analyzed to identify three groups of children from the initial total sample of 650: (1) those who had participated only in school readiness classes for at least six months, (2) those who had participated only in sports classes for at least six months, and (3) those who had not participated in any extracurricular activities. Since 90% of children attending only sports classes were boys, girls were excluded from all three groups. Consequently, the final sample consisted solely of boys.

Participants

The sample consisted of 118 boys aged 5–6 years who attended senior groups of public kindergartens in Kazan, Moscow, and Sochi. All children were neurotypical and understood Russian well.

The participants were divided into three groups:

1) The school readiness group — boys attending only school readiness classes for at least six months ($N = 38$);

2) The sports group — boys attending only sports classes for at least six months ($N = 40$);

3) The control group — boys not engaged in any extracurricular activities ($N = 40$).

In the school readiness group, 36 boys attended classes focused on developing numeracy, writing, and reading skills, while 2 boys attended English language classes. In the sports group, participation was distributed as follows: 16 boys attended martial arts classes (sambo, taekwondo, hand-to-hand combat, or boxing), 12 attended football classes, and 7 attended swimming classes. Additionally, 2 boys attended both football and martial arts, 2 attended both football and swimming, and 1 attended both football and tennis. Thus, all boys in this group were engaged in martial arts, football, or swimming.

Children from all three groups attended similar free classes offered by kindergartens educational program (Veraksa et al., 2019): for 5–6-year-olds, the program included 30-minute classes in physical education (three times per week), music (twice per week), drawing (once per week), clay modeling (once per week), mathematics (twice per week), science (once per week), and writing and reading (twice per week).

Data analysis strategy

Statistical analysis was performed using the Jamovi 2.0.0.0 program. The Shapiro — Wilk *W*-test was used to check whether a data set has a normal distribution. Since the data distribution was normal for the "Inhibition" tool, Student's *t*-test was used to compare the groups according to the data from this instrument, and the Cohen's *d* was used to measure the effect size. The effect size was as follows: $d < 0.20$ very small effect, $d = 0.20$-0.49 small effect, $d = 0.50$-0.79 moderate effect, and $d \geq 0.8$ large effect (Cohen, 2013). For the "Statue" tool and age, the data distribution was not normal, so the Mann — Whitney *U*-test was used to compare the groups according to these indicators; the Rank biserial correlation (r_b) was used to measure the effect size. The effect size was as follows: $r_b < 0.10$ very small effect, $r_b = 0.10$-0.29 small effect, $r_b = 0.30$-0.49 moderate effect, and $r_b \geq 0.5$ large effect (Cohen, 2013). The three groups were compared pairwise instead of using the Kruskal — Wallis *H*-test, since this test is non-parametric and the data distribution for the "Inhibition" instrument was normal. Then, two groups of boys who participated in extracurricular activities were compared according to the frequency and duration of the classes to see if this parameter could affect the results of the comparison of groups in inhibition.

Results

Table 1 presents the means, standard deviations, and ranges for cognitive and motor inhibition in each of the three groups, as well as the Shapiro — Wilk test results for normality. Table 2 summarizes the results of pairwise group comparisons. As a result, cognitive inhibition was significantly higher in the sport group than in the school preparation group (moderate effect size) and in the control group (small effect size). At the same time, the last two groups did not differ in terms of cognitive inhibition. All three groups did not differ in terms of motor inhibition. These groups

also had no age differences, with the children in all groups aged on average 5 years and 10 months.

Table 1

Descriptive statistics for cognitive inhibition, motor inhibition, and age in three groups of boys

Group	Cognitive inhibition			Motor inhibition			Age, months		
	Mean ± SD	Min – Max	*W; p*	Mean ± SD	Min — Max	*W; p*	Mean ± SD	Min — Max	*W; p*
School preparation group, *N* = 38	9.87 ± 3.44	4–16	0.953; 0.112	25.9 ± 3.89	15–30	0.832; <0.001	70.26 ± 3.53	65–80	0.958; 0.169
Sport group, *N* = 40	11.6 ± 3.30	5–19	0.975; 0.519	26.9 ± 3.33	16–30	0.779; <0.001	69.50 ± 3.40	64–77	0.951; 0.082
Control group, *N* = 40	10.0 ± 3.43	2–16	0.968; 0.319	25.2 ± 4.99	10–30	0.816; <0.001	70.40 ± 3.72	65–80	0.932; 0.019

Table 2

Pairwise comparisons for cognitive inhibition, motor inhibition, and age in three groups of boys

Groups comparisons	Cognitive inhibition			Motor inhibition			Age		
	Student's test		Effect size	Mann — Whitney test		Effect size	Mann — Whitney test		Effect size
	t	*p*	*d*	*U*	*p*	r_b	*U*	*p*	r_b
School preparation group vs Sport group	2.27	0.026	0.514	590	0.085	0.224	656	0.296	0.137
School preparation group vs Control group	0.169	0.866	0.038	725	0.725	0.047	750	0.920	0.014
Sport group vs Control group	–2.12	0.037	–0.475	618	0.078	0.228	689	0.324	0.128

A comparison of extracurricular activity characteristics was conducted between the school readiness and sports groups. In both the school preparation group and the sport group, classes lasted on average 50 minutes: respectively, M±SD = 48±14 min, M±SD = 52±23 min, $U = 438$, $p = 0.982$, $r_b = 0.005$ (the Mann – Whitney *W*-test was used, since the data did not follow a normal distribution: $W = 0.896$, $p < 0.001$). In addition, the frequency of classes was higher in the sport group than in the school preparation group: respectively, M±SD = 2.88±0.939 times a week, M±SD = 2.43±1.20 times a week, $U = 315$, $p = 0.026$, $r_b = 0.316$ (the Mann – Whitney *W*-test was used, since the data did not follow a normal distribution: $W = 0.863$, $p < 0.001$).

Discussion

The purpose of this study was to compare the development of inhibition among children who participated only in school readiness classes, children who participated only in sports and children who did not participate in any extracurricular activities. Only boys were included in the sample as girls comprised only 10 % of the initial total sample of children who attended at least six months of sports classes and no other extracurricular activities. The findings of this study are therefore valid for boys and may not generalize to girls.

Regarding the first research question—whether cognitive inhibition is higher in children attending school readiness classes or those attending sports — it was found that boys in the sport group had higher levels of cognitive inhibition than the boys in the school preparation group and the boys in the control group. These results may be explained by the fact that sports classes at the age of 5–6 years are more consistent with the needs of the child than school readiness classes. In fact, at this age, movement is a primary mode of exploring and understanding the world, unlike the sedentary learning format inherent in school readiness classes (Karabanova, 2005; Klopotova & Yaglovskaya, 2024). It can be assumed that sports classes promote the functional maturation of the prefrontal cortex of the brain, which is involved in cognitive inhibition (Brydges et al, 2012). Moreover, most boys in the sports group participated in football or martial arts, which have been shown to effectively enhance cognitive inhibition (Becker et al., 2018). These activities require children to respond rapidly to numerous unpredictable external stimuli, thereby training the ability to focus on relevant information and suppress inappropriate responses (Becker et al., 2018). Based on these results, sports may represent an optimal type of extracurricular activity for preschoolers, supporting the development of skills related to selective attention and inhibitory control.

The higher levels of cognitive inhibition observed in boys from the sports group may not be solely attributable to the effects of sports. The results may be associated with the initial level of inhibition when parents choose extracurricular activities. It can be assumed that boys in the school preparation group initially had a lower level of cognitive inhibition compared to boys in the other two groups. In other words, perhaps parents of children with low levels of cognitive inhibition compared to their peers choose school readiness classes for their children, expecting these courses to help develop this cognitive function. After all, school readiness classes are presented to parents as developing, among other things, concentration and not only reading, writing and counting skills. As the initial level of cognitive inhibition at the time of starting sports or school readiness classes is unknown it is impossible to draw conclusions about the effect of these extracurricular activities on cognitive inhibition. However, the results obtained in this study suggest that sports can be effective in promoting the development of cognitive inhibition in preschool boys.

We have checked whether motor inhibition was higher in children who participate only in school readiness classes or in those who participate only in sports. As a result, no significant differences in the level of motor inhibition were found among the three groups of boys. Although previous research has shown that large amounts of empirical data show that athletes have a higher level of motor inhibition (Simonet et al., 2023). However, in this study, the absence of higher levels of motor inhibition in boys of the sport group can be associated with the initial level of motor inhibition. We can assume that parents involve boys with lower levels of motor inhibition in sports. A low level of motor inhibition can manifest itself in restlessness and increased mobility, as well as in clumsiness and lack of coordination. In both cases, parents can decide to involve a boy in sports to

teach him to control his movements and manage his impulsive reactions. Thus, the obtained result is probably explained by the fact that the boys of the sport group, thanks to sports classes, are equal in terms of motor inhibition with the children of the other two groups, who are initially more assiduous and able to suppress their impulses.

Regarding the second research question, no significant differences in motor inhibition were observed among the groups. However, descriptive statistics show that the highest level of motor inhibition was in the sport group and the lowest level was in the control group. Based on these descriptive data, it is possible that both sports and school readiness classes contribute to the development of motor inhibition. Sports classes involve activities that require coordination of body movements, which inherently depend on motor inhibition (Simonet et al., 2023). School readiness classes mean that a child sits at a desk for a long time, without talking about subjects that are not related to the subject of the lesson, without being distracted by external stimuli. In other words, the requirements imposed on the child during school readiness classes, in some sense, correspond to the requirements of the "Statue" tool (stay still, do not speak, do not get distracted). Thus, the results obtained can indicate a certain trend that shows that school readiness classes and sports classes improve motor inhibition in preschool children. However, more research is needed to determine the conditions under which the effectiveness of these courses in the development of motor inhibition in children aged 5–6 years will be statistically significant.

The present study has ***limitations***. To understand how extracurricular activities affect the development of inhibition, longitudinal data are needed. However, in preschool age, children often change extracurricular activities or attend several types of extracurricular activities at the same time, making it almost impossible to assess the longitudinal effect of sports or school readiness classes. A limitation of the study is that the sample was composed only of boys and no answers to research questions about girls were received. At the same time, inhibition is sometimes found to be higher in preschool girls than boys (Ribeiro et al., 2021), which may lead to different patterns of its development. Also, inhibition development through extracurricular activities in girls may differ from boys, as the structure of play and activity of boys and girls have different characteristics (Sobkin & Skobeltsina, 2015). Another limitation of the study is that the overwhelming majority of children in our study were from families with an average or high socio-economic status. That is, the children participated in a limited number of sports classes types on the one hand, and they did not attend one type of sports classes, on the other hand. Therefore, we cannot make conclusions about any specific sport, nor can we generalize the results to all sports. Hence, further research with other sports classes is required.

The strengths of the study include the fact that both cognitive and motor parameters of inhibition were taken into account. Furthermore, three groups of children participated in the study, which enabled to inspect the contribution of the courses to be assessed directly.

Conclusion

The study showed that boys who participated only in sports for at least six months had higher levels of cognitive inhibition than boys who only participated in school readiness classes for at least six months and boys who did not participate in any extracurricular activities. No statistically significant differences were found between the groups in terms of motor inhibition, but its level was higher in the group of boys who only participated in sports for at least six months. The results indicate that participation in sports may be beneficial for the development of inhibition in boys aged 5 to 6 years. Parents may believe that school readiness classes may better develop their male child's inhibition skills. However, at the age of 5 to 6 years inhibition is formed more naturally in the process of structured physical activity, which includes cognitive tasks of increasing complexity.

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Краткое сообщение

Занятия по подготовке к школе и занятия спортом: связь со сдерживающим контролем у мальчиков 5–6 лет

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Аннотация. Цель исследования — сравнение уровня развития когнитивного и физического сдерживающего контроля у детей старшего дошкольного возраста, посещающих дополнительные занятия по подготовке к школе и занятия спортом. Для оценки когнитивного и физического сдерживающего контроля были использованы субтесты диагностического комплекса NEPSY-2. Для сбора данных о посещении детьми дополнительных занятий был использован опросник для матерей. Выборка включала в себя 118 мальчиков 5–6 лет и состояла из трех групп: 1) 38 мальчиков, посещавших не менее полугода только дополнительные занятия по подготовке к школе; 2) 40 мальчиков, посещавших не менее полугода только дополнительные занятия спортом; 3) 40 мальчиков, не посещающих никаких дополнительных занятий помимо основной программы детского сада (контрольная группа). Девочек пришлось исключить из выборки, так как в группе детей, посещающих только дополнительные занятия спортом, 90% были мальчиками. Показано, что мальчики, которые посещали не менее полугода только дополнительные спортивные занятия, имеют более высокий уровень когнитивного сдерживающего контроля, чем мальчики из двух других групп. При этом различий по уровню развития физического сдерживающего контроля между группами не выявлено. Полученные результаты вносят вклад в понимание роли занятий спортом в развитии сдерживающего контроля у мальчиков 5–6 лет. В частности, у мальчиков 5–6 лет занятия

спортом могут быть более эффективными для развития сдерживающего контроля, чем занятия по подготовке к школе. Таким образом, можно полагать, что в этом возрасте для развития сдерживающего контроля благоприятна структурированная физическая активность, содержащая в себе возрастающую когнитивную нагрузку.

Ключевые слова: дошкольный возраст, мальчики, когнитивный сдерживающий контроль, физический сдерживающий контроль, подготовка к школе, спорт, дополнительные занятия

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