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## Organized physical activity and cognitive development in 5- and 6-year-old schoolchildren: a correlational study

### Actividad física organizada y desarrollo cognitivo en escolares de 5 y 6 años: un estudio correlacional

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## Summary

Cognitive development during early childhood is a fundamental pillar for school learning. In this period, physical activity not only contributes to the strengthening of health, but has also been proposed as a potentially influential factor in essential neurocognitive processes, such as attention, memory, language or executive function. This study aims to analyze the relationship between the practice of organized physical activity and cognitive development in schoolchildren. The sample consisted of 30 schoolchildren between 5 and 6 years of age ( $M = 5.88$ ;  $SD = 0.29$ ). A quantitative, non-experimental, cross-sectional and correlational approach was used, applying the CUMANIN Questionnaire and the Physical Activity Questionnaire in infancy and childhood to collect information on the level of cognitive development and participation in sports activities. The results show that schoolchildren who practice organized physical activity obtain higher average scores, not statistically significant, in total development ( $M = 35.85$ ) and development quotient ( $M = 100.08$ ) compared to those who do not participate ( $M = 25.29$  and  $M = 96.24$ ). The statistical analysis also showed a significant association in the dimension of verbal fluency ( $p < .05$ ), suggesting that structured sports contexts could favor the development of language skills. These findings suggest that extracurricular sports practice may be linked to greater cognitive development in childhood, supporting the need to promote educational interventions and physical activity programs in schools.

**Keywords:** physical activity, cognitive development, childhood, CUMANIN, language; executive functions.

## Resumen

El desarrollo cognitivo durante la primera infancia es un pilar fundamental para el aprendizaje escolar. En este periodo, la actividad física no solo contribuye al fortalecimiento de la salud, sino que también se ha propuesto como un factor potencialmente influyente en procesos neurocognitivos esenciales, como la atención, la memoria, el lenguaje o la función ejecutiva. Este estudio tiene como objetivo analizar la relación entre la práctica de la actividad física organizada y el desarrollo cognitivo en los escolares. La muestra consistía en 30 escolares de entre 5 y 6 años ( $M = 5,88$ ;  $SD = 0,29$ ). Se utilizó un enfoque cuantitativo, no experimental, transversal y correlacional, aplicando el Cuestionario CUMANIN y el Cuestionario de Actividad Física en la infancia y la infancia para recopilar información sobre el nivel de desarrollo cognitivo y la participación en actividades deportivas. Los resultados muestran que los escolares que practican actividad física organizada obtienen puntuaciones medias más altas en desarrollo total ( $M = 35,85$ ) y cociente de desarrollo ( $M = 100,08$ ) en comparación con quienes no participan ( $M = 25,29$  y  $M = 96,24$ ). El análisis estadístico también mostró una asociación significativa en la dimensión de la fluidez verbal ( $p < 0,05$ ), lo que sugiere que los contextos deportivos estructurados podrían favorecer el desarrollo de habilidades lingüísticas específicas. Estos hallazgos sugieren que la práctica deportiva extracurricular podría estar vinculada a un mayor desarrollo cognitivo en la infancia, lo que apoya la necesidad de promover intervenciones educativas y programas de actividad física en las escuelas.

**Palabras clave:** actividad física, desarrollo cognitivo, infancia, CUMANIN, lenguaje; funciones ejecutivas.

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## Introduction

Cognitive development in early childhood is one of the central pillars for the acquisition of learning, socialization and the construction of skills necessary for future school and social adaptation. During the first years of life, fundamental processes such as language, memory, attention or perception are consolidated, which establish the basis on which more complex learning is based throughout formal education. Adequate stimulation at this early stage favors more balanced evolutionary trajectories, while the absence of enriching experiences can lead to persistent limitations in both academic performance and socio-emotional development. For this reason, the analysis of the factors that enhance these capacities constitutes a priority line of research in evolutionary psychology and education. (Welsh et al., 2010) ( Offer-Boljahn et al., 2022)

In this context, the practice of organised physical activity has progressively acquired a prominent role. The practice of organized physical activity is understood to be planned intervention sessions or programs, supervised by a professional in schools, clubs or centers and with physical-motor, social, cognitive and emotional objectives and benefits. There are different types of organised physical activity, including: school Physical Education, extracurricular sports activities, sports activities promoted by clubs and associations, therapeutic or rehabilitation programmes or physical activity programmes for adults. (Carson et al., 2014)

The scientific literature recognizes that physical exercise not only provides benefits in body health, reducing the risk of cardiovascular diseases, overweight or obesity, but also has cognitive and emotional implications of great relevance (Best, 2010; Rosa Guillamón et al., 2020), in addition to other improvements in different skills and motor (Arufe-Giráldez et al., 2021; Garcia- Line et al., 2022) abilities. This double effect, physical and mental, justifies the practice of physical activity being considered an educational element of the first order. The World Health Organization recommends that preschool children accumulate at least 180 minutes of physical activity daily at varying intensities. This orientation is supported by evidence that links motor practice with improvements in cognitive development, emotional regulation and integral well-being. The WHO defines physical activity as any body movement produced by skeletal muscles that involves energy expenditure above the baseline level, stressing that

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intensity, duration, frequency and type determine its effects. In contrast, a sedentary lifestyle is related to significant risks such as delays in motor development, difficulties in attention and emotional self-regulation problems. These international recommendations reinforce the importance of designing educational strategies that integrate movement into children's routine. (2021) ( World Health Organization, 2019)

Advances in neuroscience have made it possible to explain more precisely the relationship between physical activity and cognitive development. Exercise has been shown to promote the release of neurotrophic factors such as BDNF, improve neuroplasticity and stimulate angiogenesis and neurogenesis, processes closely linked to memory and learning. Other studies showed that both acute and sustained exercise produce benefits in executive functions, inhibitory control and working memory, essential components for academic performance at school age. These neuroscientific findings provide objective evidence supporting the role of exercise as a stimulus for brain and cognitive development in childhood. (de Sousa Fernandes et al., 2020; Gomez - Pinilla et al., 2008) ( Alvarez -Bueno et al., 2017; Sember et al., 2020; Zang et al., 2024)

Structured sports programmes also offer a social context where discipline, respect for rules and cooperation are reinforced, aspects that have an impact on the development of social and cognitive skills. Some recent theoretical and systematic reviews clearly show the connection between school sports practice, socialization processes and improvements in mental functions linked to academic performance. These studies indicate that school sport, beyond its effects on physical health, constitutes a formative context where social skills are developed, rules of discipline and respect are reinforced, and cognitive processes related to attention, decision-making and problem solving are enhanced. (Navarro Domínguez et al., 2021; Ramírez Silva et al., 2004)

Regarding the influence of sex on cognitive functions, some studies confirm partially differentiated evolutionary profiles between boys and girls, observing a slight female predominance in perceptual-motor tasks and a better male performance in spatial skills (Linn & Petersen, 1985). The analysis of these differences is especially relevant when studying the relationship between organized physical activity and cognitive

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development, since it allows us to assess whether participation in sports contexts contributes to reducing, maintaining or amplifying such contrasts.

For all these reasons, this study aimed to analyze the relationship between the practice of organized physical activity and cognitive development in schoolchildren, understanding that the practice of organized physical activity represents a complex and multidimensional context in which motor, cognitive and affective factors converge that can be favored by it.

## Methodology

This study is framed in a quantitative, non-experimental, cross-sectional and correlational design, aimed at analysing the relationship between the practice of organised physical activity and cognitive development in childhood.

## Participants

The sample consisted of a total of 30 schoolchildren belonging to a privately owned school in the Autonomous Community of Galicia (Spain), aged between 5 and 6 years ( $M = 5.88$ ;  $SD = 0.29$ ). The distribution by sex was relatively balanced: 13 girls (43.33%) and 17 boys (56.67%). For the selection of participants, a non-probabilistic sampling was used for convenience, taking as the unit of study a natural group from the center itself due to its accessibility and availability. This type of sampling is common in educational research and allows working with intact groups that meet the age and school stage criteria established for the objectives of the study.

Regarding participation in organized sports activities, it was found that 43.33% of the minors participated in activities offered by sports clubs or associations, while the remaining 56.67% did not participate in this type of context. The breakdown by sex showed that 41.18% of boys and 46.15% of girls played some sport in clubs, indicating a relatively similar distribution between the two groups. In terms of sports practiced, judo was the most represented discipline (53.85%), followed by taekwondo and swimming (23.08% each). In addition, there were cases of participation in football (7.69%), in the judo and football combination (7.69%) and in gymnastics (7.69%). This range of practices reflects the diversity of sports options to which children have access in

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organized contexts and offers an approximation to the variety of motor experiences present in the sample.

### ***Data collection instruments***

The Child Neuropsychological Maturity Questionnaire (CUMANIN), designed and validated by Portellano et al., was used to assess neuropsychological development. This instrument, widely used in the preschool population, allows multiple domains of cognitive and psychomotor development to be assessed. It includes these 12 subtests: (2006)

- **Sensorimotor development:** Attention; Psychomotor skills, Spatial structuring, Visual perception and Rhythm.
- **Memory and learning:** Iconic memory.
- **Language:** Articulatory language, Expressive language, Comprehensive language and Verbal fluency.
- **Additional tests:** Reading and writing

In addition to generating 4 indices: **verbal / non-verbal development / total development**

and development quotient.

The CUMANIN correction and grading procedure contemplates obtaining direct scores, which are later transformed into typified and centile scores in accordance with the manual. From these, four composite indicators were calculated: verbal development, nonverbal development, total development and the developmental quotient, which summarize in an integrated way the child's performance in the areas evaluated. The breadth of the instrument and the possibility of obtaining both specific and global measurements make it a particularly suitable tool for this study.

In addition, the Questionnaire on Physical Activity in Childhood and Childhood was administered, completed by the families in printed format. This instrument allowed recording information related to the frequency, duration and intensity of physical practice, distinguishing school, extracurricular, family and social contexts. It also collected data on membership of sports clubs or associations and the modalities practiced. This

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information was essential to classify the participants according to their level of organized practice and to contextualize the subsequent analyses.

### ***Procedure***

Data collection was carried out in the last quarter of the 2024/25 school year, under controlled conditions. The last term was chosen to guarantee continuity in the practice of organized physical activity of the schoolchildren who participated in the study. The application of CUMANIN was carried out individually, in a separate classroom free of distractions, in order to guarantee an adequate environment for evaluation. Each session lasted approximately 35 minutes, adjusting to the individual rhythm of each child. Two researchers with experience in the application of the test battery participated in the data collection. Special care was taken in the presentation of the tasks, trying to maintain a playful character that would facilitate collaboration and reduce possible tensions arising from the evaluation. The instructions were clear and standardized, rigorously following the guidelines of the CUMANIN manual. Once the application was completed, the tests were corrected and assessed, following the criteria established in the reference manual. At the same time, the questionnaires addressed to families were distributed in printed format and compiled once completed. This dual source of information – the child's direct performance in neuropsychological tests and the data provided by the families regarding sports practice – allowed for a more complete picture of each participant. (Portellano Pérez et al., 2006)

### ***Data collection and management***

The questionnaires of the families and the scores derived from the CUMANIN were organized in a database created in Microsoft Excel, which made it possible to centralize the information and reduce the risk of errors in processing. The database was then exported to SPSS for statistical analysis. Control measures were adopted in the transcription and revision of data in order to guarantee the reliability of the final database.

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### ***Statistical analysis***

The analysis of the data was carried out in several phases. First, descriptive statistics (means, standard deviations, minimums and maximums) were calculated both for the sample and for the cognitive indicators obtained through the CUMANIN and the physical activity variables. Secondly, correlational analyses were carried out with the aim of exploring initial associations between the practice of organized physical activity and scores in the different cognitive areas. Finally, a multivariate general linear model (GLM-MANOVA) was applied to examine the differences according to the factor participation in organized physical activities. This approach allowed several dependent variables to be analyzed together, which was ideal given the multidimensional nature of the CUMANIN scores. The level of statistical significance was established at  $p < .05$ , the criterion under which the results were interpreted.

### ***Ethical considerations***

The study followed the guidelines set out in the Declaration of Helsinki and the protocols and recommendations for ethics in educational research. Formal authorization was obtained from the educational center and the confidentiality and anonymity of the participants was guaranteed at all times. Likewise, the written informed consent of the families or legal guardians was obtained, who were previously informed about the objectives of the study, the procedures to be carried out and the voluntary nature of the participation. It was ensured that schoolchildren could leave school at any time without consequences for their academic activity. No intervention was carried out that implied physical or psychological risk for the minors, adjusting all activities to their age and developmental stage. (WMA, 2024) (Paz Maldonado, 2018)

### **Results**

The sample of this study was made up of a total of 30 schoolchildren, aged between 5 and 6 years ( $M = 5.88$ ;  $SD = 0.29$ ). The distribution by sex was composed of 13 girls (43.33%) and 17 boys (56.67%). Likewise, information was collected on the participation of organized physical activity programs, and it was found that 43.33% of the children were registered in sports clubs or associations, while 56.67% did not

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participate in this type of context. These two variables – sex and the practice of organized physical activity – constituted the main axes of analysis in relation to the scores obtained in the Child Neuropsychological Maturity Questionnaire (CUMANIN).

### ***Gender differences***

The results related to the global indicators of neuropsychological development are shown in **Figure 1**, where the average scores in Total Development and in Developmental Quotient between boys and girls are compared. As can be seen in the graphic representation, girls obtained slightly higher mean scores in both indicators 33 ( $\pm 21.7$ ) and 98.3 ( $\pm 12.33$ ) compared to 27.4 ( $\pm 24.35$ ) and 97.5 ( $\pm 16.70$ ) for boys, with no statistically significant differences.

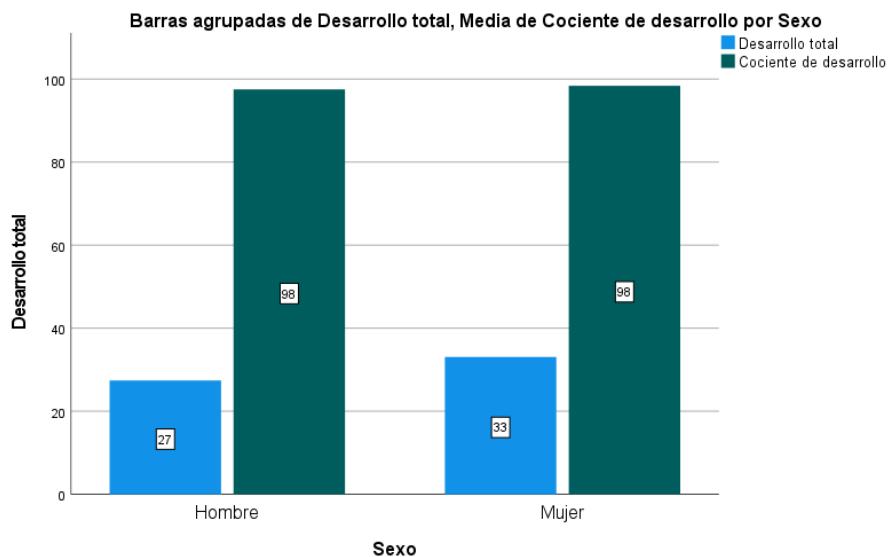


Figure 1. Results of the mean score in Total Development and the Developmental Quotient compared by sex.

### ***Differences depending on the practice of organized physical activity***

The detailed information on these results is included in **Table 1**, which presents the descriptive statistics of the different areas of CUMANIN according to participation in sports clubs or associations. It shows that schoolchildren who practice organized physical activity achieved higher average scores in most of the dimensions evaluated, especially in verbal fluency, articulatory language, comprehensive language, visuoperception, and

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iconic memory. In contrast, the non-participating group consistently scored lower in 10 of the 16 areas, although with a somewhat more homogeneous profile in certain tests. Although the differences were not significant in all cases, the direction of the results suggests a favorable trend for the group that performs physical activity, which reinforces the possible positive influence of sports practice on children's cognitive and linguistic development.

Table No. 1. Mean scores in the different variables of the CUMANIN according to the practice of organized physical activity

Do you engage in organized physical activity at least 3 days a week?	YES		NO	
	Media	DT	Media	DT
<b>Psychomotor skills</b>				
<b>L. Articulatory</b>	35,77	22,15	44,47	22,63
<b>L. Expressive</b>	<b>38,08</b>	26,02	23,53	13,20
<b>L. Understanding</b>	<b>63,85</b>	21,52	59,12	26,11
<b>Spatial structuring</b>	<b>52,15</b>	33,39	48,53	26,84
<b>VISUAL-PERCEPTION</b>	<b>58,62</b>	26,94	63,65	34,45
<b>Iconic memory</b>	<b>66,15</b>	16,35	59,53	24,22
<b>Rhythm</b>	<b>55,38</b>	36,02	41,18	23,15
<b>Verbal fluency*</b>	<b>45,38</b>	32,62	49,41	26,15
<b>Attention</b>	<b>87,38</b>	10,13	75,47	13,11
<b>Reading</b>	<b>32,38</b>	24,18	40,29	28,08
<b>Writing</b>	<b>60,00</b>	23,97	58,53	23,56
<b>Verbal Development</b>	<b>53,77</b>	30,57	56,41	31,87
<b>Nonverbal development</b>	<b>35,69</b>	29,95	25,71	21,34
<b>Total development</b>	<b>56,08</b>	27,79	56,18	23,88
<b>Developmental quotient</b>	<b>35,85</b>	28,88	25,29	16,90
	<b>100,08</b>	18,91	96,24	10,87

Note: In bold the averages where the physical activity group outperforms the non-physical activity practitioner. With \* the variables where there were statistical differences  $p < .05$

Figure 2 synthesizes these results by graphically representing the comparison between the averages of total development and development quotient according to participation in sports clubs.

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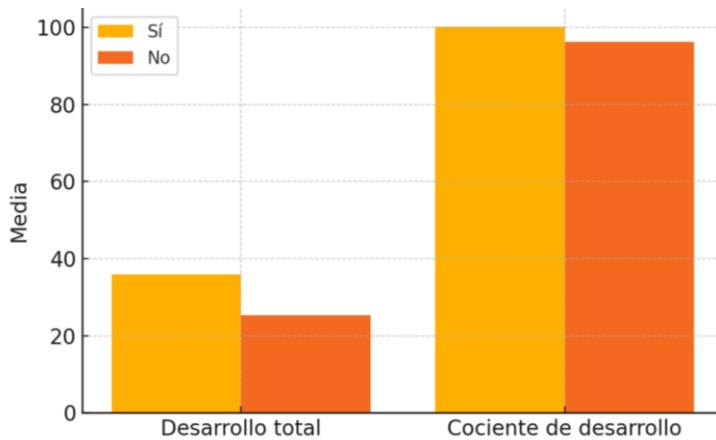


Figure 2. Grouped bar graph of the value of total development and development quotient as a function of the practice of organized physical activity

The results show that participants in organized sports activities obtained an average total development of 35.85, compared to 25.29 for non-participants. Similarly, the developmental quotient was higher in the athlete group ( $M = 100.08$ ) compared to the non-athlete group ( $M = 96.24$ ). These data reflect an advantage of the group that participates in structured sports contexts, although the statistical analysis did not find statistical significance.

The multivariate analysis carried out using a general linear model (MANOVA) did not show a significant overall effect of participation in organized physical activities on the set of cognitive and developmental variables evaluated (*Pillai's Trace* = 0.679;  $F(16, 13) = 1.72$ ;  $p = .165$ ). However, univariate analyses revealed a remarkable finding: verbal fluency showed significant differences between the groups ( $F(1, 28) = 7.35$ ;  $p = .011$ ;  $\eta^2 = .208$ ), indicating a moderate effect size and suggesting that structured sports participation could be associated with better performance on rapid verbal production tasks. The rest of the cognitive and developmental variables did not show significant differences (all  $p > .05$ ).

#### ***Analysis of different variables according to sex***

Figure 3 and Table 2 illustrate these differences in the mean scores of the main CUMANIN subtests in a comparative manner. It clearly shows that girls excel in variables related to rhythm, visual perception or psychomotor skills. On the other hand, children

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have higher values in spatial structuring ( $p < .05$ ), expressive language, reading and writing. These latter differences, although not statistically significant, are relevant in descriptive terms and point to the existence of a complementary pattern of cognitive strengths between both sexes.

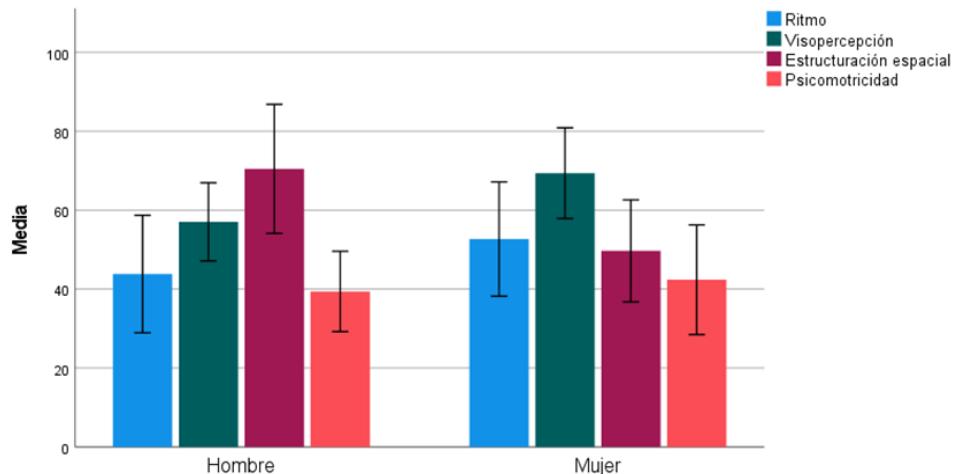


Figure 3. Grouped bar graph of some CUMANIN variables by sex

Table No. 2. Mean scores in the different variables of the CUMANIN according to sex

	Sex	Media	Desv. Standard
<b>Psychomotor skills</b>	Men	39,41	20,982
	Women	42,38	25,062
<b>L. Articulatory</b>	Men	25,88	18,811
	Women	35,00	22,730
<b>L. Expressive</b>	Men	66,47	22,828
	Women	54,23	24,482
<b>L. Understanding</b>	Men	49,06	30,053
	Women	51,46	29,613
<b>Spatial structuring</b>	Men	70,47	33,727
	Women	49,69	23,300
<b>Visoperception</b>	Men	57,06	20,391
	Women	69,38	20,714
<b>Iconic memory</b>	Men	40,00	28,668
	Women	56,92	29,407
<b>Rhythm</b>	Men	43,82	30,697
	Women	52,69	26,110
<b>Verbal fluency</b>	Men	80,29	12,398
	Women	81,08	14,620
<b>Attention</b>	Men	35,06	27,817
	Women	39,23	25,153
<b>Reading</b>	Men	62,35	22,647

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<b>Writing</b>	Women	55,00	24,495
	Men	56,06	33,075
<b>Verbal Development</b>	Women	54,23	28,856
	Men	29,00	26,351
<b>Nonverbal development</b>	Women	31,38	25,227
	Men	53,76	25,538
	Women	59,23	25,401

The convergence between the graphic information and the descriptive statistics confirms that, in this sample, children's cognitive development shows nuances linked to sex, although the limited statistical power derived from the sample size prevents definitive conclusions from being drawn. Univariate analyses showed no significant effects on any of the cognitive or developmental variables assessed (all  $p > .05$ ). The effect sizes were very small ( $\eta^2 \leq .114$ ), indicating that performance in the different areas of CUMANIN was comparable between boys and girls. Therefore, sex was not a determining factor in any of the domains analyzed. The identification of these trends is, however, a valuable contribution to future research with larger samples.

## Discussion

The results obtained in this research show that the practice of organized physical activity may be associated with better performance in children's neuropsychological development, especially with regard to language and verbal fluency. However, the small sample size limits the generalizability of the findings and points to the need for future research with longitudinal designs and a larger number of participants. Important patterns in the cognitive and psychomotor development of preschool children can be identified, considering participation in organized sports activities.

Schoolchildren who participate in organized physical activities performed better in most of the areas assessed, especially in language, perceptual and memory skills. It is noteworthy that verbal fluency was the only variable that showed a statistically significant difference, which indicates that sports practice can favor the development of communication skills. This result can be explained by the social and strategic demands implied by organized sports activities, which encourage expression and interaction. Other

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studies and authors have found that school sports practice facilitates socialization and the functional use of language.

In populations with autism spectrum disorder, a systematic review and meta-analysis documents positive effects of physical education on socialization and communication in children and preadolescents. In addition, a study of 120 schoolchildren aged 7–10 years showed significantly higher levels of communicative competence in those who play team sports, with a correlation between sports seniority and competence, as well as improvements in empathy and nonverbal expression. Research on extracurricular activities (basketball and volleyball) found significant increases in group cohesion and social integration after the intervention, and controlled trials of secondary school sports games reported significant increases in communication skills scores compared to non-intervened controls. Finally, pedagogical proposals that incorporate additional languages and sign language in Physical Education promote communicative practice, inclusion and the acquisition of motor vocabulary. For all these reasons, studies indicate that structured interaction, team practice and intentional teaching in school-based sports contexts favor socialization and the development of functional language; however, specific research on improving verbal fluency is required. ( Джолиев et al., 2024) (Eroglu & Demirel, 2018) ( Pomohaci & Sopa, 2017) (Acak et al., 2023) ( Niwitpong , 2023)

In this way, it can be concluded that within the multi-context strategies to promote the practice of physical activity in the school population are organized physical activities, which in addition to being an opportunity to enhance the health of the child and adolescent population, also improves different cognitive functions. (Arufe-Giraldez et al., 2024)

Although the small sample size limits the generalizability of the results, the observed trends and the significance found in verbal fluency support the idea that participation in organized sports activities has a positive effect on child development. Therefore, it is recommended to continue investigating this relationship with larger samples and through longitudinal designs that allow analyzing how these variables interact over time.

The results of our study align with the growing evidence supporting the positive influence of physical activity on cognitive performance throughout childhood,

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adolescence, and young adulthood. Previous meta-analyses show that, in schoolchildren aged 6 to 12 years, both acute interventions and longitudinal programs generate significant improvements in executive functions, attention and academic performance, especially highlighting the effects of continuous interventions over time. In addition, in adolescents and young adults, consistent benefits have been observed in processes such as processing speed, attention, inhibition, cognitive flexibility and working memory, with improvements both after specific exercise sessions and after longer duration programs. A relevant aspect is that the magnitude of the effects seems to depend on the cognitive subcomponent analyzed and, in some cases, on moderating variables such as the duration of the intervention or the percentage of male participants. These two meta-analyses reinforce the hypothesis that physical activity constitutes an effective stimulus to optimize different cognitive domains throughout development, suggesting that regular and structured participation in exercise could be a key educational strategy to enhance cognitive functions closely related to learning and academic performance. (de Greeff et al., 2018; Haverkamp et al., 2020)

Therefore, the available evidence reinforces the positive relationship between physical activity and cognitive and motor development during early childhood and primary education, although important methodological heterogeneities persist that limit the strength of the conclusions. Systematic reviews and *position stands* indicate that both physical fitness and acute sessions and structured physical activity programs are associated with improvements in central cognitive functions, especially inhibition, working memory, and attention, as well as functional adaptations in prefrontal regions involved in executive control. However, the effects on learning and academic performance are more inconsistent, in part due to the paucity of controlled trials and the diversity in the dose, type, and cognitive complexity of the interventions. In preschool ages, recent studies show that the daily composition of movement has a special influence on motor development, highlighting the priority role of moderate to vigorous physical activity, while specific interventions such as mini-trampoline exercises produce selective improvements in motor skills and specific executive functions. In addition, cognitively demanding school-based interventions show immediate and sustained benefits in inhibitory control and working memory, especially when implemented regularly and over

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several weeks. Along these lines, research focused on children with motor delays—with and without disabilities—shows that programs based on Mastery Climates, based on TARGET structures and accompanied by explicit instruction, feedback, and cognitive strategies, generate superior improvements in locomotor skills, object control, and verbal recall compared to interventions focused solely on vigorous play. These results underline that the pedagogical quality of the intervention, and not only the quantity of movement, is decisive to promote motor learning in the initial stages. With respect to gross motor skills, a recent study in a sample of Chinese schoolchildren found a weak association between gross motor level and each component of reading performance. (Donnelly et al., 2016) (Byambaa et al., 2025) (Ltfi et al., 2025) (Gonzalez-del-Castillo & Barbero-Alcocer, 2025) (Valentini et al., 2017) (Shao et al., 2025)

Likewise, the results of recent research in Secondary Education and Baccalaureate students coincide with this trend, showing that short active breaks applied regularly during the school day can significantly improve sustained attention. In a study of 1st year high school students, an eight-week physical activity program—based on two daily active breaks—produced clear improvements in attentional performance compared to a control group that received no intervention, reinforcing the evidence that even brief but systematic doses of exercise are sufficient to generate cognitive benefits. These findings are aligned with the literature reviewed, which highlights that the regular practice of physical activity, especially when integrated into the school context, can favor key executive processes for learning. (Fernández et al., 2020)

However, recurrent methodological limitations persist—lack of robust trials, absence of blinding, poor standardization of cognitive measures, and high variability between studies—requiring cautionary interpretation of the evidence. Even so, the literature agrees that physical activity never harms cognitive or academic performance and, on the contrary, constitutes a relevant stimulus to optimize psychological, motor and neurobiological functions essential for child development.

The implications of the results of this study are especially relevant for the educational field and for the design of physical activity programs in childhood. The observed trend—with better cognitive scores in students participating in organized physical activity and a significant improvement in verbal fluency—suggests that

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structured sports environments can act as enriched contexts for neurocognitive development. This reinforces the need for schools and families to encourage regular participation in planned sports activities from an early age, not only for their motor and health benefits, but also for their potential to stimulate language, attentional and social skills. In addition, these findings point to the convenience of incorporating policies and methodologies that integrate physical activity as a cross-cutting component of the children's curriculum, favoring quality motor experiences that complement the academic and emotional development of students.

## Conclusion

The aim of this study was to analyze the correlation between participation in organized physical activity programs of 5 and 6-year-old children and its influence on the values of different neuropsychological development variables. The data obtained confirm higher scores in most of the variables in favor of the group of schoolchildren who perform organized physical activity, however, no statistically significant differences have been found, only in the verbal fluency test, which may inform the important social value of school sports practice.

On the other hand, although the statistical analyses applied are adequate for the type of variables evaluated, the sample size ( $N = 30$ ) is limited in relation to the number of dependent variables considered. This reduces the statistical power of the model and increases the probability of not detecting real differences of small magnitude. The results should be interpreted with caution and it is suggested that future studies incorporate larger samples, since other studies suggest that it does favor the development of different variables linked to cognitive functions. It is important to continue working along these lines to learn more about these effects due to the great variability in the biological and psychological development of children in Early Childhood Education. These results should be communicated with prudence, clarity, and limited scope.

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