

Linguistic alterations in children with and without ADHD by clinical subtype evaluated with the BLOC-S-R test

Alteraciones lingüísticas en niños con y sin TDAH según subtipo clínico evaluado con la prueba BLOC-S-R

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Palabras clave:

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Abstract

Introduction: acquisition and development of language are complex processes that rely on the chronological development of the child, as well as environmental and social factors. The American Speech-Language-Hearing Association (ASHA) defines the term «language disorder» as the «impaired comprehension and/or use of spoken, written, and/or other symbol systems, including morphology, syntax, semantics, and pragmatics». **Objective:** to compare the speech alterations in children with ADHD by clinical subtype against healthy children with the BLOC-S-R test. **Material and methods:** the design was observational comparative cross-sectional study. A sample of 156 schoolchildren with ADHD and 111 schoolchildren without ADHD, aged between 7 and 12 years old, from seven public educational institutions, was studied. Prior authorization from the school administrators and signed informed consent from their parents were obtained. A screening test based on the DSM-V was applied to teachers and parents, and those children suspected of having ADHD were further confirmed through neuropsychology, child psychiatry, and psychology services. A group without ADHD was formed with the schoolchildren who were found to not have the condition and met the inclusion criteria. All participants underwent the BLOC-S-R test, and the results were analyzed using SPSS v. 19 software, applying descriptive statistics and χ^2 for comparisons. **Results:** a total of 267 schoolchildren were studied, of whom 156 were identified as having ADHD and 111 without ADHD. The diagnosed subtypes were 73 (27%) with the combined subtype, 39 (15%) with the inattentive subtype, and 44 (17%) with the hyperactive-impulsive subtype. Out of these, 186 were male and 81 were female, with an average age of 8.2 ± 1.7 . Linguistic skills in morphology, syntax, and semantics showed a «T» level of low proficiency, and pragmatics showed an «E» level of very low proficiency in the ADHD group compared to the group without ADHD, who obtained an «S» level of proficiency in all skills. Significant differences were found in all four linguistic skills. **Conclusions:** school children with ADHD present a greater alteration in the pragmatic language skill, followed by syntax. The scores on linguistic skills of schoolchildren with ADHD evaluated with the BLOC-S-R test are lower compared to the group without ADHD.

Resumen

Introducción: la adquisición y el desarrollo del lenguaje son procesos complejos que dependen del desarrollo cronológico del niño, así como de factores ambientales y sociales. La American Speech-Language-Hearing Association (ASHA) define el término «trastorno del lenguaje» como la «alteración

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de la comprensión y/o el uso del lenguaje hablado, escrito y/u otros sistemas de símbolos, incluyendo la morfología, la sintaxis, la semántica y la pragmática». **Objetivo:** comparar las alteraciones del habla en niños con TDAH por subtipo clínico frente a niños sanos con la prueba BLOC-S-R. **Material y métodos:** el diseño fue de estudio transversal comparativo observacional. Se estudió una muestra de 156 escolares con TDAH y 111 escolares sin TDAH, con edades comprendidas entre los siete y 12 años, procedentes de siete centros educativos públicos. Se obtuvo la autorización previa de los administradores escolares y el consentimiento informado firmado de sus padres. Se aplicó una prueba de cribado basada en el DSM-V a profesores y padres, y los niños con sospecha de TDAH se confirmaron mediante servicios de neuropsicología, psiquiatría infantil y psicología. Se formó un grupo sin TDAH con los escolares que no presentaban la afección y cumplían los criterios de inclusión. Todos los participantes se sometieron a la prueba BLOC-S-R y los resultados se analizaron mediante el programa SPSS v. 19, aplicando estadística descriptiva y χ^2 para las comparaciones. **Resultados:** se estudió a un total de 267 escolares, de los cuales 156 fueron identificados con TDAH y 111 sin TDAH. Los subtipos diagnosticados fueron 73 (27%) con el subtipo combinado, 39 (15%) con el subtipo inatento y 44 (17%) con el subtipo hiperactivo-impulsivo. De ellos, 186 eran varones y 81 mujeres, con una edad media de 8.2 ± 1.7 años. Las habilidades lingüísticas en morfología, sintaxis y semántica mostraron un nivel «T» de competencia baja y la pragmática mostró un nivel «E» de competencia muy baja en el grupo con TDAH en comparación con el grupo sin TDAH, que obtuvo un nivel «S» de competencia en todas las habilidades. Se encontraron diferencias significativas en las cuatro habilidades lingüísticas. **Conclusiones:** los escolares con TDAH presentan una mayor alteración en la habilidad lingüística pragmática, seguida de la sintaxis. Las puntuaciones en las habilidades lingüísticas de los escolares con TDAH evaluados con la prueba BLOC-S-R son inferiores en comparación con el grupo sin TDAH.

INTRODUCTION

Acquisition and development of language are complex processes that rely on the chronological development of the child, as well as environmental and social factors.¹

The American Speech-Language-Hearing Association (ASHA) defines the term «language disorder» as the «impaired comprehension and/or use of spoken, written, and/or other symbol systems, including morphology, syntax, semantics, and pragmatics».²

The DSM-V includes communication disorders within neurodevelopmental disorders. It changed its classification of this type of disorder compared to the DSM-IV-TR and divides communication disorders into the following categories: 1. language disorder, 2. speech sound disorder, 3. childhood-onset fluency disorder (stuttering), 4. social (pragmatic) communication disorder, and 5. unspecified communication disorder.³

According to this classification, speech sound disorders refer to difficulty in phonological production, i.e., problems with articulation and sound production. Thus, the disorder is limited to a motor or praxis issue. Language disorders, on the other hand, encompass the child's problems in language acquisition and use, as well as comprehension and production not associated with a simple motor or articulation problem. Pragmatic communication disorder refers to problems in the social use of both verbal and non-verbal communication.

ADHD, as a childhood neurodevelopmental disorder, has a worldwide prevalence estimated between 5.9 and 7.1% in children and adolescents, being more common in boys than in girls, in a 3:1 ratio.⁴ Its etiology is not entirely known, although it is understood to be multifactorial, involving a combination of genetic, biological, and environmental factors. To date, there are no specific neurobiological tests or physiological markers that can definitively establish the diagnosis. Therefore, it is currently diagnosed based on specific clinical criteria.⁵

We find that linguistic tasks are significantly affected in children with ADHD because their proper acquisition and development require an adequate level of attention and inhibitory control. Additionally, it is likely that they may develop learning problems in the future, especially in reading and writing. In early childhood, difficulties in auditory attention and motor control of speech are aspects that interfere with verbal development.⁶ Schoolchildren with ADHD present difficulties in learning processes acquired during childhood, such as reading, where around 50% of children diagnosed with ADHD have problems effectively developing this learning process.⁷ According to the literature, language difficulties related to ADHD are a relatively underexplored topic, despite evidence that children with ADHD have deficient psycholinguistic skills, especially in the pragmatic aspect and in language form and content. It is important for mental health professionals, especially psychologists

and speech therapists, to be trained to detect these difficulties early on and design an effective intervention that addresses the specific needs of patients with ADHD in the realm of language and communication.⁸

The attention, planning, organization of information, and interference control difficulties presented by children with ADHD negatively affect communicative acts. Likewise, pragmatic difficulties are evident in most cases, especially in conversational uses. The delayed language acquisition and pragmatic difficulties are inherent to ADHD and are related to cognitive characteristics that continuously interfere with the processing of relevant data during communication situations.⁹

Furthermore, responses related to impulsivity, disregard for conversational turns, interruptions in ongoing conversations without appropriate communicative resources, inappropriate responses to questions, context-inadequate changes in conversation, and hyperactivity, excessive speech in situations requiring modulation of communicative interactions, significantly impact the severity of the condition.¹⁰

Children with ADHD also show deficiencies in syntax regarding the structuring of phrases and sentences and have difficulties at a semantic level recognizing and relating lexical elements in a sequence and extracting meaning, leading to problems in reading comprehension.¹¹

Additionally, the schoolchildren with ADHD present difficulties in pragmatic language, which are likely related to the general alteration of attention and hyperactivity.¹²

To evaluate language impairments, different tests are available, including the BLOC-S-R test. The revised screening version of the BLOC test is intended to identify difficulties in language components (morphology, syntax, semantics, and pragmatics). This test allows us to assess the risk of language problems at the morphological, syntactic, semantic, and pragmatic levels. The modules have been designed to verify the level of proficiency based on a 70% accuracy threshold. This instrument provides a raw score related to the items, a percentile score, and a transformed score based on development curves. A percentile score of 70-100 (upper level) indicates that the student has mastered the psycholinguistic skill and can use it correctly; a percentile between 60-70 (transition level); a percentile of 30-60 (emergency level); and if it is below the 25-30 percentile (alarm level). The battery has proven to be effective in evaluating linguistic development in different populations. This test has been validated and is used for the Latin American population with a Cronbach's alpha of 0.81. It allows the detection of language disorders and is individually applicable to schoolchildren aged 5 to 14 years. It has been used in various publications and was utilized in the present study.¹³

Objective: to compare the speech alterations in children with ADHD by clinical subtype against healthy children with the BLOC-S-R test.

MATERIAL AND METHODS

The design was an observational comparative cross-sectional study, a sample was taken from children enrolled in official basic schools, aged between 7 to 12 years both sexes and with ADHD diagnosed by paidopsychiatry. Informed consent was obtained from parents and teachers.

Inclusion criteria

ADHD group: subjects between 7 and 12 years old, enrolled in official basic schools with attention and/or behavior problems, and/or low performance that meet the criteria for ADHD according to the DSM-V.

Control group: school children aged between 7 to 12 years both sexes enrolled in the same schools.

Exclusion criteria for both groups: school children with neurological or psychiatric disorders or irregular school attendance.

Instruments

- Criteria of the Diagnostic and Statistical Manual of Mental Disorders (DSM-V) for ADHD diagnosis.
- Questionnaire Diagnostic Criteria for Attention Deficit Hyperactivity Disorder adapted from the DSM-IV, one to be filled out by the teacher and another by the parents, in relation to the child's behavior at home and at school. In order to classify ADHD, it is necessary that both questionnaires coincide, since one of the parameters established by the DSM-V is that the symptoms are present in two or more environments.
- BLOC-S-R or Bloc Screening Test Revised, by M. Puyuelo (2002) for the detection of linguistic disorders. It is a test for individual application, aimed at children between 5 and 14 years of age. The BLOC-S-R assesses these four language components: Morphology, Syntax, Semantica, and Pragmatica.

1. **Morphology** is composed of 15 sections; in total 32 items. Each section or block evaluates a different morphological skill, referring to the study of the structure of word formation.
2. **Syntax** is composed of 10 sections; in total 35 items. Each block evaluates a different syntactic skill, referring to rules for combining words to form sentences and establishing their grammaticality. Each block evaluates

a different syntactic skill, referring to aspects of meaning, sense or interpretation of words.

3. **Semantics** is made up of 10 sections; 22 items in total. Each block evaluates a different syntactic ability, referring to aspects of the meaning, meaning or interpretation of words.
4. **Pragmatics** consists of 1 section; in total 19 items. Each block evaluates a different syntactic skill, referring to the use of language, ways of speaking in different situations of communication and social interaction.

The administration of each of the modules requires about one hour, but in cases that may present specific problems of various kinds, the time may be extended, especially when perceptual difficulties, attention difficulties, etc. occur.

For the scoring of the BLOC-S-R test, the raw score of each module was converted to a centile score, in order to place the population in the corresponding level and interpret the results.

Procedure

1. Being present in the school facilities, and with prior authorization from the authorities of the schools, as well as with a previous informed consent from the parents and/or guardians of the students, a screening test for ADHD based on the diagnostic criteria of the DSM-V was administered.
2. Students with suspected ADHD were evaluated in the institution where the present study took place by a child psychiatrist, a neuropsychologist, and a psychologist to confirm the clinical diagnosis and classify them into clinical subtypes.
3. In order to compare the linguistic abilities of students with ADHD, a control group was formed consisting of those students who were ruled out for this condition and met the inclusion and exclusion criteria mentioned above. This group was referred to as the group without ADHD.
4. Both groups were individually evaluated using the BLOC-S-R test in a stimulus-free classroom. The test was administered and scored by an expert psychologist.
5. The results were recorded in a database, and the analysis was conducted using the statistical software SPSS V.19.

Statistics

Statistical analysis was performed, descriptive statistics were obtained and χ^2 was employed for the

Table 1: Population distribution by gender and clinical subtype.

Gender	Clinical subtype, n (%)				Total
	Combined	Inattention	Hyp-Imp	Without ADHD	
Male	55 (75.3)	14 (35.0)	33 (75.0)	45 (40.5)	147
Female	18 (24.7)	25 (64.1)	11 (25.0)	66 (59.5)	120
Total	73	39	44	111	267

Hyp-Imp = hyperactive impulsive. ADHD = attention deficit hyperactive disorder.

comparison between groups. It was performed with the software SPSS V.19.

RESULTS

The sample consisted of 267 subjects 186 boys (69.7%) and 81 girls (30.3%) aged 7 to 12 years, with 8.2 ± 1.7 (mean \pm SD).

Of this total 156 ADHD-ADC-H, distributed in the clinical subtypes: 73 (27.3%) children of the combined type, 39 (14.6%) inattentive; 44 (16.5%) hyperactive-impulsive; and 111 (41.6%) in TDAH (*Table 1*).

In the present study, when investigating the frequency of ADHD subtypes according to gender, the ADHD-C type was the most frequent subtype in boys than in girls (36% and 64%, respectively) being significantly ($p < 0.001$).

Likewise, the inattentive subtype was more frequent in girls than in boys (28.4% versus 10.5%, $p = 0.003$).

The results of the BLOC-S-R test showed that the group with ADHD had a low proficiency in morphology, syntax, and semantics, and a very low proficiency in pragmatics, with an overall average of 62.5, interpreted as low proficiency in linguistic skills. On the other hand, the group without ADHD achieved a higher level in all linguistic skills, with a final average of 84 (*Table 2*).

In the comparison between the groups with and without ADHD, all four linguistic skills in the BLOC-S-R test showed significant differences with a p-value of 0.05%.

In the BLOC-S-R test, specifically in the pragmatic level, all three subtypes of ADHD (combined, inattentive, and hyperactive-impulsive) scored at an emergency level, indicating the need for speech therapy support. In the semantics item, the three subtypes of ADHD scored at a transitional level. In the syntax item, subjects with inattentive and combined ADHD scored at a transitional level, indicating the need for assistance to fully master

language skills. On the other hand, subjects with hyperactive-impulsive ADHD scored at a higher level, indicating mastery and correct utilization of language skills (Table 3).

DISCUSSION

Children with ADHD, according to various studies, show lower linguistic abilities at all structural levels of language compared to children without this problem, stemming from the alterations in executive functions they present. The literature reports some studies comparing schoolchildren with and without ADHD, which indicate lower scores for the ADHD groups. There is evidence that the results in morphological, syntactic, and semantic linguistic abilities are inconsistent, unlike pragmatics, where the results of the present study showed a lower level of proficiency in all four skills and a lower score for pragmatics compared to the group without ADHD. There are also studies where syntax is highly affected in children with ADHD. The results of this study align with other publications and help us understand that attention

deficit disorder and ADHD indeed affect aspects such as schooling and language.

According to various studies, children with ADHD show lower linguistic abilities at all structural levels of language compared to children without this problem.¹²

The literature reports some studies comparing schoolchildren with and without ADHD, which indicate lower scores for the ADHD groups.¹³ Therefore, the results obtained in this study align with these publications. Generally, it is determined that the linguistic alterations at the morphological, syntactic, and semantic levels are inconsistent in children with this disorder. However, there is evidence that pragmatic alterations are consistently identified in the majority of studies.¹⁴

In another investigation, it was reported that among the four skills evaluated with the BLOC-S-R, children with ADHD had a low level overall, but pragmatics obtained a very low level compared to the group without ADHD. There are also publications indicating that these children present more specific difficulties in comprehension, as well as in subareas related to syntax, as they produce significantly less complex syntax than

Table 2: Analysis of the differences obtained in the BLOC-S-R test in the groups with ADHD and without ADHD.

Language abilities BLOC-S-R	Group with ADHD			Group without ADHD		
	Centil	Level	Interpretation	Centil	Level	Interpretation
Morphology	65	T	Shows low LA proficiency	81	S	Master the LA
Syntax	70	T	Shows low LA proficiency	85	S	Master the LA
Semantics	65	T	Shows low LA proficiency	80	S	Master the LA
Pragmatics	50	E	Shows very low LA proficiency	90	S	Master the LA
Global	62.5	T	Shows low LA proficiency	84	S	Master the LA

ADHD = attention deficit hyperactive disorder. LA = language abilities. T = transitional. E = emergence. S = superior.

Table 3: Differences in language abilities assessed with the BLOC-S-R test between the attention deficit hyperactivity disorder (ADHD) group by clinical subtype vs. non-ADHD group.

Language abilities BLOC-S-R	ADHD-C	ADHD-I	ADHD-H	non-ADHD	F	p
Morphology	66.1 ± 16.2	61.8 ± 18.1	70.1 ± 13.4	70.2 ± 28.4	26.3	0.05
Syntax	66 ± 10	65.3 ± 12.2	68.1 ± 9	82 ± 14.4	22	0.05
Semantics	70.1 ± 10.6	71.2 ± 13.3	69 ± 8.3	85 ± 7.6	26.2	0.05
Pragmatics	52.1 ± 19.2	50.5 ± 19.02	56.1 ± 18.1	84.5 ± 19.6	21.2	0.05

SD = standard deviation. ADHD-C = combined subtype. ADHD-I = inattentive subtype. ADHD-H = hyperactive-impulsive subtype. Values expressed as mean ± standard deviation.

their peers of the same age, showing poorer performance than typically developing children in structuring phrases and sentences.¹⁵

In another study, the percentile obtained for syntax was higher than for the other abilities; however, the level was interpreted as low compared to the group without ADHD. The results of this study align with other publications and help us understand that attention deficit disorder, and specifically a syndrome like ADHD, affects dimensions such as schooling and language.¹⁶

CONCLUSIONS

School children with ADHD present a greater alteration in the pragmatic language skill, followed by syntax. The scores on linguistic skills of schoolchildren with ADHD evaluated with the BLOC-S-R test are lower compared to the group without ADHD.

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