TESIS DOCTORAL

UCAM
UNIVERSIDAD CATÓLICA DE MURCIA

ESCUELA INTERNACIONAL DE DOCTORADO

Programa de Doctorado en Ciencias de la Salud

Factores psicolingüísticos asociados a la dislexia infantil: Un estudio sobre el lenguaje, la cognición, el funcionamiento ejecutivo y su impacto en el bienestar y la dinámica familiar

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AUTORIZACIÓN DEL DIRECTOR DE LA TESIS
PARA SU PRESENTACIÓN

La Dra. Dña. Isabel López-Chicheri García y el Dr. D. Miguel López Zamora como Directores de la Tesis Doctoral titulada "*Factores psicolingüísticos asociados a la dislexia infantil: Un estudio sobre el lenguaje, la cognición, el funcionamiento ejecutivo y su impacto en el bienestar y la dinámica familiar*" realizada por Dña. Nadia Porcar Gozalbo en el Programa de Doctorado de Ciencias de la Salud, **autorizan su presentación a trámite** dado que reúne las condiciones necesarias para su defensa.

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Dr. D. Miguel López Zamora

RESUMEN

La dislexia es un trastorno específico del aprendizaje de origen neurobiológico que dificulta la adquisición y consolidación de las habilidades lectoras, afectando a la precisión, la velocidad y la comprensión, sin explicarse por déficits intelectuales, sensoriales ni por falta de escolarización. Con una prevalencia estimada entre el 5% y el 15% de la población infantil, tiene un impacto relevante en el rendimiento académico, la salud emocional y la participación social. El objetivo principal de la presente tesis fue analizar de forma integral el perfil clínico, lingüístico, cognitivo y emocional de niños y niñas de 7 a 9 años con dislexia, en comparación con menores con desarrollo normotípico, y explorar el papel de la prematuridad y la familia. La muestra estuvo formada por 120 participantes distribuidos en cuatro grupos: prematuros con dislexia, prematuros sin dislexia, nacidos a término con dislexia y nacidos a término sin dislexia. Se administró un amplio protocolo de evaluación que incluyó medidas estandarizadas de lectura (PROLEC-R), lenguaje (CELF-5), funciones ejecutivas (ENFEN), inteligencia (WISC-V), conducta y emociones (BASC-3, SENA), estrés parental (PSI-SF) y calidad de vida (Kiddo-Kindl). Los análisis estadísticos (MANOVA y regresión lineal múltiple) mostraron que la prematuridad por sí sola no explica una proporción significativa de la varianza del rendimiento lector, pero su combinación con la dislexia ejerce un efecto acumulativo que agrava de manera notable las dificultades en decodificación, comprensión y fluidez. Los niños y niñas prematuros con dislexia constituyeron el grupo con peor rendimiento global, tanto en lectura como en lenguaje expresivo y receptivo. Asimismo, los menores con dislexia, independientemente de la edad gestacional, presentaron déficits significativos en procesamiento fonológico, memoria de trabajo verbal, velocidad de denominación y funciones ejecutivas (flexibilidad y resistencia a la interferencia), confirmando el carácter neuropsicológico amplio del trastorno. En el ámbito emocional y familiar, los resultados evidenciaron en la dislexia un perfil caracterizado por mayores niveles de ansiedad, problemas de atención y dificultades de adaptación, asociado a un incremento del estrés parental y a una menor calidad de vida familiar, lo que señala una relación bidireccional entre las dificultades lectoras y la dinámica psicosocial. En conjunto, los hallazgos subrayan la necesidad de un enfoque biopsicosocial y de protocolos de detección temprana

que integren la evaluación de funciones lingüísticas y cognitivas con indicadores emocionales y familiares, así como programas de intervención interdisciplinares que combinen apoyo psicopedagógico, estimulación lingüística y cognitiva y orientación a las familias.

PALABRAS CLAVE

Dislexia; infancia; prematuridad; cognición; lenguaje; emoción; conducta; estrés parental; familia.

ABSTRACT

Dyslexia is a specific learning disorder of neurobiological origin that hinders the acquisition and consolidation of reading skills, affecting accuracy, speed, and comprehension, and cannot be explained by intellectual or sensory deficits or by lack of educational opportunities. With an estimated prevalence of 5–15% in the child population, it has a substantial impact on academic achievement, emotional health, and social participation. The main aim of this dissertation was to conduct a comprehensive analysis of the clinical, linguistic, cognitive, and emotional profile of 7- to 9-year-old children with dyslexia, compared with typically developing peers, and to explore the role of prematurity and family. The sample comprised 120 participants distributed across four groups: preterm children with dyslexia, preterm children without dyslexia, full-term children with dyslexia, and full-term children without dyslexia. A broad assessment protocol was administered, including standardised measures of reading (PROLEC-R), language (CELF-5), executive functions (ENFEN), intelligence (WISC-V), behaviour and emotions (BASC-3, SENA), parental stress (PSI-SF), and quality of life (Kiddo-Kindl). Statistical analyses (MANOVA and multiple linear regression) showed that prematurity alone does not account for a significant proportion of the variance in reading performance; however, its combination with dyslexia exerts a cumulative effect that markedly exacerbates difficulties in decoding, comprehension, and fluency. Preterm children with dyslexia constituted the group with the lowest overall performance, both in reading and in expressive and receptive language. Likewise, children with dyslexia, regardless of gestational age, showed significant deficits in phonological processing, verbal working memory, rapid naming speed, and executive functions (cognitive flexibility and resistance to interference), confirming the broader neuropsychological nature of the disorder. In the emotional and family domains, the results revealed in dyslexia a profile characterised by higher levels of anxiety, attention problems, and adaptation difficulties, associated with increased parental stress and lower family quality of life, pointing to a bidirectional relationship between reading difficulties and the psychosocial

dynamics of the immediate environment. Taken together, the findings highlight the need for a biopsychosocial approach and early detection protocols that integrate the assessment of linguistic and cognitive functions with emotional and family indicators, as well as interdisciplinary intervention programmes combining psychoeducational support, cognitive and linguistic stimulation, and guidance for families.

KEYWORDS

Dyslexia; childhood; prematurity; cognition; language; emotion; behavior; parental stress; family.

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A mis padres, Norma Gozalbo García y Manuel Porcar Escrig, gracias por vuestra dedicación, cariño y apoyo constante. De vosotros he aprendido que lo más importante en la vida es ser buena persona, pero también el valor del esfuerzo, la humildad, el respeto y la gratitud. Me habéis enseñado con vuestro ejemplo que ayudar a los demás es una forma de vivir y de relacionarse con el mundo. A mi hermana Lucía Porcar Gozalbo, que es noble, generosa, espontánea, divertida y reflexiva, gracias por estar siempre a mi lado, por escucharme con paciencia y complementarme tan bien. Sin duda, una de las mejores cosas de la vida es poder compartirla contigo. *Família, gràcies per ser arrel i ales*.

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A ti que estás leyendo esto, espero que leer sobre la dislexia te ayude a entenderla y atenderla mejor. Ojalá llegue un día en el que no sea necesario seguir reivindicando que todos los niños y niñas, independientemente de su origen y su estatus socioeconómico, puedan acceder a todos aquellos servicios educativos y sanitarios necesarios para poder desarrollarse de forma plena. Leer nos enseña a pensar y a ser más libres, así que muchas gracias por leer.

"Viu com si anares a morir demà; aprèn com si anares a viure sempre". Mahatma Gandhi (1869-1984).

ÍNDICE GENERAL

SIGLAS Y ABREVIATURAS

AyL, Audición y Lenguaje

ANOVA, Análisis Univariados de la Varianza

APA, Asociación Americana de Psiquiatría

CI, Cociente Intelectual

DSM-5, Manual Diagnóstico y Estadístico de los Trastornos Mentales, 5ª edición

DSM-5-TR, Manual Diagnóstico y Estadístico de los Trastornos Mentales, 5ª edición, Texto Revisado

DT, Desviación Típica

ECoG, Electrocorticografía

EEG, Electroencefalografía

fRMI, Resonancia Magnética Funcional

IVH, Hemorragia intraventricular

M, Media

MANOVA, Análisis Multivariados de la Varianza

MEG, Magnetoencefalografía

PT, Pedagogía Terapéutica

PVL, Leucomalacia periventricular

R2 ajustado, Coeficiente de Determinación Ajustado

TDAH, Trastorno por Déficit de Atención / Hiperactividad

TEA, Trastorno del Espectro Autista

TOC, Trastorno Obsesivo Compuslivo

UCI, Unidad de Cuidados Intensivos

UCIN, Unidad de Cuidados Intensivos Neonatales

VWFA, Área de la forma visual de las palabras

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I – INTRODUCCIÓN

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1.1. LA LECTURA

La lectura es un proceso cognitivo superior de adquisición reciente en la historia de la humanidad que, en contraposición con otros procesos cognitivos innatos como el lenguaje, requiere de una instrucción explícita y sistemática para desarrollarse (Cuetos, 2015). El aprendizaje de la lectura involucra múltiples factores biológicos, cognitivos, lingüísticos, emocionales, ambientales, socioeconómicos y pedagógicos (O'Brien y Yeatman, 2021).

Desde sus inicios, la lectoescritura ha sido considerada una herramienta de educación y de acceso a la información y, por ende, de conocimiento (Dezcallar *et al.*, 2014), propulsora del desarrollo de las habilidades lingüísticas y cognitivas, así como de las relaciones interpersonales (Delgado *et al.*, 2020). El aprendizaje de la lectoescritura en niños y niñas con dificultades en el lenguaje y en la comunicación implica la adquisición de herramientas para comunicar contenidos verbales (como complemento o como sustitución a la comunicación oral) y para representar tanto visual como fonológicamente la estructura de las palabras, siendo un apoyo para la construcción morfosintáctica y para la corrección del habla, respectivamente (Monfort y Juárez, 2004).

No obstante, aun siendo la alfabetización una prioridad mundial desde la segunda mitad del siglo XIX, el informe mundial sobre la Atención y Educación de la Primera Infancia (UNESCO y UNICEF; 2025) estima que el 37% de la población infantil del mundo (más de 300 millones de personas) no alcanzarán las habilidades básicas de lectura y escritura de aquí a 2030.

1.1.1. Procesos implicados en la lectura

La lectura está compuesta por una serie de subprocesos que parten del código fonológico. En el código alfabético, las unidades mínimas de representación son los grafemas, los cuales representan los sonidos del habla o fonemas (Paguay *et al.*, 2024). En el español, la relación entre fonema y grafema es unívoca y sistemática, es decir, la misma combinación de letras se pronuncia igual independientemente de la palabra en la que se encuentre, es por eso por lo que el español se considera una lengua transparente, y esta característica es determinante tanto en el proceso de aprendizaje de la lectura como en el procesamiento de esta (Jiménez y Hernández-Cabrera, 2019), siendo la sílaba la unidad mínima de procesamiento (Luque *et al.*, 2013).

Durante la lectura, la información del texto se extrae a través de las fijaciones visuales (Hindmarsh *et al.*, 2021). Se estima que el tiempo aproximado de fijación en cada palabra es de 250 milisegundos en lectores expertos. No obstante, dicho tiempo varía en función de la legibilidad del texto, la dificultad lingüística, las propiedades de la propia persona que lee y los objetivos de la lectura (Rayner *et al.*, 2016). El procesamiento de la información visual influye en la planificación de los movimientos sacádicos del ojo, es decir, en los movimientos oculares breves y bruscos que permiten desplazar la fóvea (centro de mayor agudeza visual) hacia las siguientes palabras (Hindmarsh *et al.*, 2021). Así pues, los movimientos sacádicos generalmente mueven los ojos de una palabra a la siguiente, a excepción de frente a palabras que son altamente frecuentes, cortas o predecibles, que en estas palabras no se produce la fijación y se reconocen por visión parafoveal y/o por las expectativas sobre la palabra (Angele y Rayner, 2013). Sin embargo, no todos los movimientos oculares se desplazan hacia la siguiente palabra, los movimientos de refijación en la misma palabra, sobre todo en aquellas palabras de mayor longitud, y las regresiones, los movimientos que permiten volver a una palabra anterior, son movimientos comunes en el proceso lector (Rayner *et al.*, 2016).

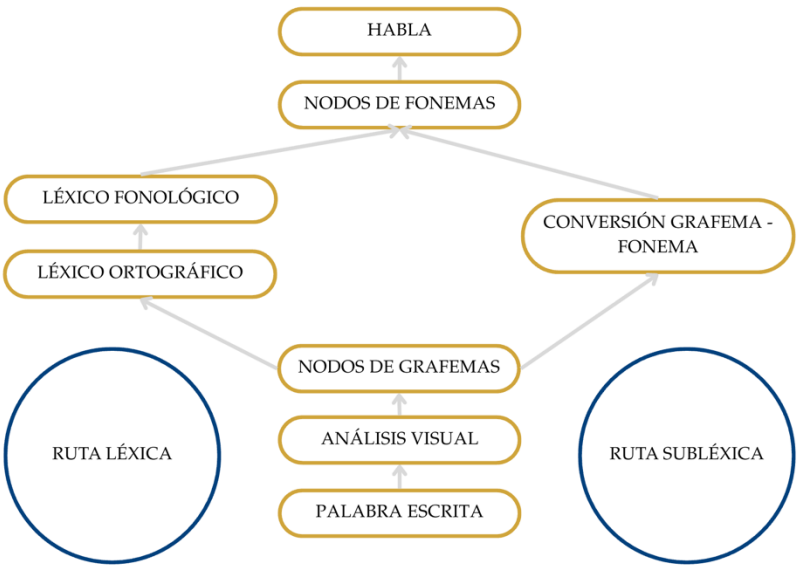
Desde la perspectiva del modelo de Procesamiento Distribuido en Paralelo (PDP; McClelland y Rumelhart, 1981), en la identificación de las palabras intervienen tres niveles: nivel de rasgos, nivel de letras y nivel de palabras. Cuando se presenta una palabra, los tres niveles de identificación se retroalimentan para

conseguir la identificación final de la palabra, estableciendo conexiones inhibitorias con las letras y las palabras que no se adecuan a las características que se están procesando.

La identificación de las palabras es un paso previo al reconocimiento de las mismas y, por ende, al acceso automático a su significado y a su articulación, independientemente de si la lectura es en voz alta o silenciosa (Cuetos, 2010). El reconocimiento de las palabras está influido por características como la lexicalidad, la frecuencia, la edad de adquisición, la regularidad, la imaginabilidad, la vecindad ortográfica y la longitud (Eisenhauer *et al.*, 2022; Gregg *et al.*, 2023).

El modelo cognitivo más popular sobre el reconocimiento de las palabras es el Modelo Dual o Modelo de Doble Ruta (Coltheart, 1981; *Figura 1*), un modelo de procesamiento lineal en cascada en el cual la información fluye principalmente de forma unidireccional entre los diferentes módulos, pero no es necesario que un módulo haya terminado con el procesamiento para que se active el siguiente. El modelo presenta dos vías: la vía léxica (también conocida como vía ventral o visual) y la vía subléxica (también conocida como vía dorsal o fonológica).

Figura 1. *Modelo Dual o Modelo de Doble Ruta de Coltheart (1981)*



La vía léxica permite leer todas las palabras conocidas, tanto regulares como irregulares, siempre y cuando la persona cuente con las representaciones ortográficas de las palabras. Dicha vía opera identificando de forma paralela las letras que conforman la palabra y reconociéndola en contraste con las representaciones existentes en el léxico ortográfico de input (o léxico visual). Así, accede al significado correspondiente en el sistema semántico y, si es necesario, activa la representación fonológica para recuperar los fonemas que componen la palabra y ejecuta los programas motores encargados de su articulación (Pritchard *et al.*, 2018).

La vía subléxica, por su parte, permite leer todas las palabras y pseudopalabras regulares, sean o no conocidas. Dicha vía actúa transformando cada uno de los grafemas que componen la palabra en sus correspondientes fonemas - mediante el análisis grafémico, la asignación de fonemas y el ensamblaje de fonemas - y permite el acceso al significado a partir de los mecanismos utilizados en la comprensión del lenguaje oral (Gori *et al.*, 2014).

El uso de una u otra vía de lectura está determinado por las características de las palabras (sistema ortográfico al que pertenecen, frecuencia, regularidad…), por las características de la tarea de lectura (decodificación, comprensión…) y por las características del lector (aprendiz o experto). No obstante, ambas interactúan durante la lectura de palabras, aportando información fonológica y semántica de forma conjunta (Cuetos, 2015).

Otro de los modelos de reconocimiento de palabras más relevante es el modelo del Triángulo, desarrollado por Plaut *et al.* (1996). Este modelo distingue tres niveles de procesamiento de las palabras - ortográfico, fonológico y semántico - conectados entre sí, las conexiones de los cuales dependen de la práctica, es decir, cuantas más veces se activen, mayor será la fuerza de conexión y, por ende, más fácilmente procesarán la palabra en futuras ocasiones. Dicho modelo asume la existencia de dos vías diferentes para la lectura en voz alta: una vía que conecta la ortografía con la fonología de forma directa, y otra que conecta la ortografía con la fonología pasando por la semántica.

Sin embargo, aun teniendo los modelos conexionistas inspirados en el funcionamiento cerebral como el Modelo del Triángulo una gran aceptación en la comunidad científica (Chang *et al.*, 2024; Li *et al.*, 2023), el Modelo de Doble Ruta es de los más respaldados en la literatura científica por ser el modelo más consolidado y el que mejor explica las dificultades de la dislexia en español (Ardila y Cuetos, 2016).

Reconocer las palabras es un proceso fundamental para comprender un texto, pero comprender un texto va más allá de reconocer las palabras que lo componen; de hecho, el reconocimiento de palabras es un proceso que, con la experiencia, se automatiza, pero la comprensión lectora no (Li y Doyle, 2021).

El Modelo Simple de la Lectura de Hoover *et al.* (1990; *Figura 2*) plantea que en la comprensión lectora interactúan dos habilidades clave: la decodificación y la comprensión del lenguaje oral. La decodificación permite reconocer las palabras, y la comprensión del lenguaje permite construir interpretaciones globales a partir del análisis sintáctico y el análisis semántico. El Modelo de la Cuerda de Scarborough (2001; *Figura 3*) matiza estas dos habilidades indicando que la comprensión del lenguaje oral está determinada por los conocimientos previos, el vocabulario, las estructuras lingüísticas, el razonamiento verbal y la alfabetización y, el reconocimiento de palabras, por las habilidades fonológicas, la decodificación y el reconocimiento visual.

Figura 2. *Modelo Simple de la Lectura de Hoover et al. (1990)*

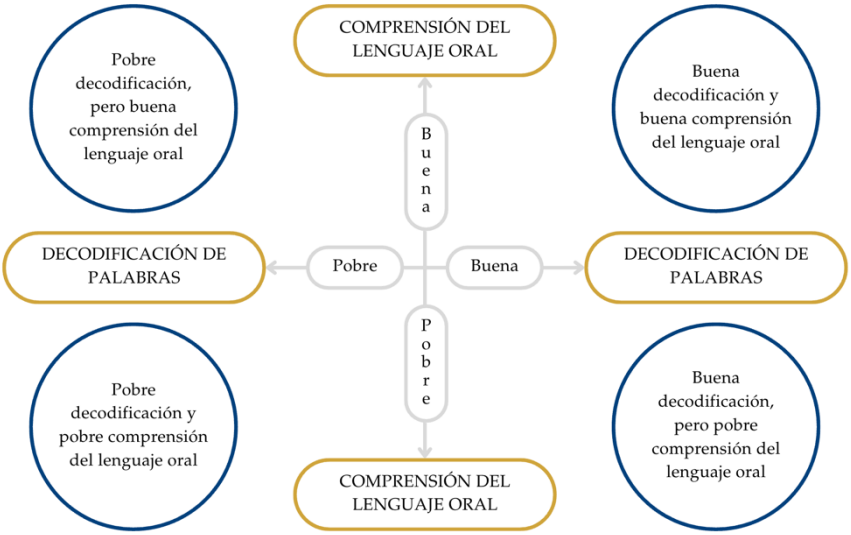
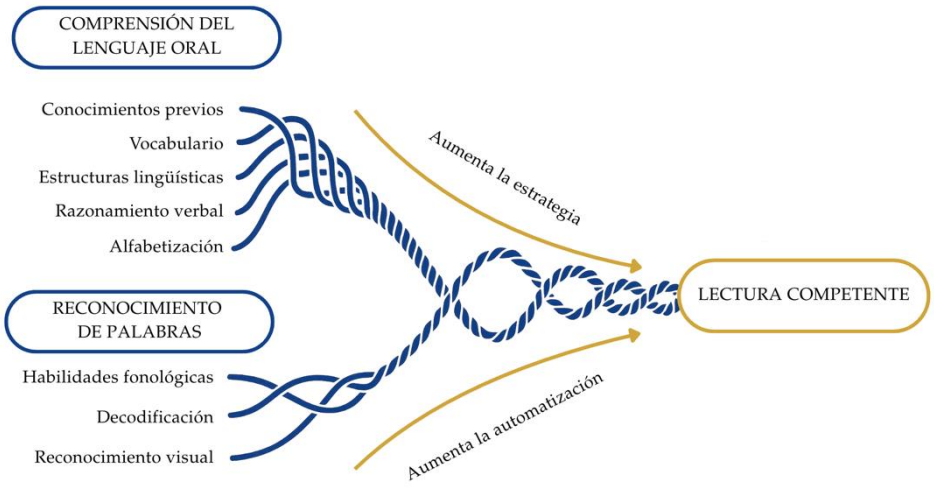


Figura 3. *Modelo de la Cuerda de Scarborough (2001)*



Autores como Tierney *et al.* (1987) y Frazier y Rayner (1982) proponen que el análisis sintáctico consta de dos estadios independientes. En el primer estadio, se agrupan las palabras que componen una oración en su etiqueta correspondiente (por ejemplo, sintagma nominal) y se establecen interrelaciones entre dichas agrupaciones para construir una estructura sintáctica provisional, basada en el orden de las palabras, la categoría gramatical de las palabras y los signos de puntuación. En el segundo estadio, partiendo de la información semántica y pragmática, se valora la viabilidad de la estructura precreada.

El siguiente proceso que interviene en la comprensión lectora es el procesamiento semántico. Van Dijk y Kintsch (1983) establecieron tres niveles de representación del texto. En el primer nivel, se construye una representación superficial del texto, extrayendo las palabras que componen las oraciones y manteniéndolas en la memoria de trabajo. En el segundo nivel, se extrae una serie de proposiciones del texto, formando una microestructura – entendida como proposiciones básicas extraídas del texto que se conectan entre sí – y una macroestructura – entendida como la formación de ideas más generales y abstractas del texto que se consigue mediante la supresión de información poco relevante, la unión de ideas básicas y la construcción de nuevas proposiciones. En el tercer nivel, se construye el modelo de situación, en el cual se integra la información procedente del texto y la información que quien lee activa de sus

propios conocimientos; este hecho deriva en que un mismo escrito pueda ser interpretado de forma distinta dependiendo de la persona que lo lee. Sin embargo, puede que quien lee no disponga de los conocimientos lingüísticos, específicos sobre el tema, generales del mundo (conocidos como esquemas), organizacionales del texto, estratégicos y metacognitivos necesarios para poder comprender el texto (García-Madruga, 2006).

1.1.2. Bases neurobiológicas de la lectura

El cerebro alfabetizado contiene mecanismos corticales especializados comunes en todos los seres humanos. No obstante, el origen de la escritura se remonta a hace cinco mil cuatrocientos años y, el del alfabeto, a tres mil ochocientos, un intervalo de tiempo reducido como para que la evolución haya generado dichos mecanismos corticales en los seres humanos. Ante esta disyuntiva, Dehaene *et al*. (2005) plantearon la hipótesis del reciclaje neuronal, la cual plantea que la arquitectura cerebral está sujeta a restricciones anatómicas y funcionales heredadas de la evolución, aunque es parcialmente modificable debido a la plasticidad neuronal dependiente de la experiencia. Así pues, la lectura, entendida evolutivamente como un invento cultural, solo puede adquirirse ajustándose a las propiedades de la arquitectura cerebral existente.

El inicio del circuito cerebral de la lectura es similar al de otras funciones visuales. La luz reflejada o emitida por una página o una pantalla con texto se codifica como impulsos nerviosos en la retina, los cuales son transportados al núcleo geniculado lateral del tálamo por el nervio y el tracto óptico, y luego a la corteza visual primaria por medio de las radiaciones ópticas (Yeatman y White, 2021). La retinotopía de la corteza visual primaria, es decir, el principio que indica que las neuronas individuales están organizadas en un mapa del espacio visual, de modo que los puntos adyacentes en la superficie cortical responden a estímulos en puntos adyacentes del campo visual, permite que múltiples letras sean procesadas en paralelo por diferentes poblaciones neuronales (Jacobs *et al*., 2014).

Técnicas de neuroimagen como la electroencefalografía (EEG), la magnetoencefalografía (MEG) y la electrocorticografía (ECoG) demuestran que el procesamiento visual inicia con el procesamiento de las características visuales básicas que conforman las letras, proceso que dura entre los 80 y 100 milisegundos

después de la aparición del estímulo (Marinkovic *et al.*, 2003). Posteriormente, se procesan las letras entre los 120 y 160 milisegundos (Thesen *et al.*, 2012), hasta llegar al procesamiento de las palabras a partir de los 200 milisegundos en adelante (Hirshorn *et al.*, 2016).

La resonancia magnética funcional (fRMI) evidencia que tres regiones cerebrales distribuidas en cuatro lóbulos están implicadas en la lectura: el giro frontal inferior izquierdo, la región temporoparietal izquierda y la región occipitotemporal izquierda (Kearns *et al.*, 2018).

El giro frontal inferior izquierdo (el cual se superpone con el área de Broca) se asocia al almacenamiento de la información sobre los sonidos que contienen las palabras y a la vinculación de esta información con otras representaciones de la palabra en el cerebro, así como con regiones motoras, permitiendo a quien lee ordenar correctamente los sonidos cuando pronuncia una palabra en voz alta, activándose tanto si la persona decodifica la palabra como si la reconoce visualmente (Richlan *et al.*, 2011).

La región temporoparietal izquierda incluye el giro temporal superior (el cual se superpone con el área de Wernicke), el giro supramarginal y el giro angular. El giro temporal superior se asocia al procesamiento del habla, ayudando a la persona a extraer fonemas del continuo del habla que escucha. El giro supramarginal, a su vez, permite establecer la correspondencia entre los fonemas y los grafemas y, el giro angular, se vincula al procesamiento del significado de las palabras (Seghier *et al.*, 2010); estableciéndose así la región temporoparietal izquierda como el centro de decodificación de la lectura.

La región occipitotemporal izquierda, que incluye el giro fusiforme y el giro temporal inferior, se asocia al reconocimiento rápido y automático de las palabras (Gaillard *et al.*, 2006). Una parte del giro fusiforme es conocida como área de la forma visual de las palabras (VWFA, por sus siglas en inglés; Lerma-Usabiaga *et al.*, 2018), la cual está compuesta por dos áreas diferenciadas (White *et al.*, 2019): VWFA1 y VWFA2. El área VWFA1 se ubica en la parte posterior del surco occipitotemporal, en las terminaciones ventrales del fascículo longitudinal inferior y del fascículo occipital vertical (Kay y Yeatman, 2017), y se asocia a la codificación de las propiedades visuales del texto (Lerma-Usabiaga *et al.*, 2018), siendo modulada por la atención espacial. El área VWFA2 se ubica en la parte anterior del

surco occipitotemporal, en las terminaciones ventrales del fascículo arqueado, aunque también recibe proyecciones del fascículo longitudinal inferior (Grotheer *et al.*, 2020), y se asocia al procesamiento de las propiedades lingüísticas del texto (Lerma-Usabiaga *et al.*, 2018).

La vía dorsal conecta el giro temporal superior (encargado del procesamiento del habla), el giro angular (encargado del procesamiento del significado), el giro supramarginal (encargado de la correspondencia entre fonemas y grafemas), el giro paracentral (encargado de controlar la articulación) y el giro frontal inferior (encargado de almacenar y secuenciar el habla). Se ha observado una activación mayor durante los comienzos del aprendizaje de la lectura y durante la lectura de palabras desconocidas en lectores expertos (Gori *et al.*, 2014).

La vía ventral conecta el giro temporal medio (encargado de procesar palabras de forma visual y su significado), la región occipitotemporal (encargada de reconocer las letras y las palabras) y el giro frontal inferior (encargado de almacenar y secuenciar el habla). Se ha observado una mayor activación en lectores expertos durante la lectura de palabras familiares (Gu *et al.*, 2023).

En esta misma línea, estructuras subcorticales como el estriado (una región que incluye el núcleo caudado, el putamen y los ganglios basales) y el tálamo, también se asocian a la lectura. No obstante, no existe un consenso sobre la función que desempeñan (Kearns *et al.*, 2018).

El cerebro alfabetizado consigue realizar todos los procesos presentados anteriormente, que pueden resumirse en transformar una palabra escrita en sonido y significado, en un par de cientos de milisegundos (Sereno y Rayner, 2003), adaptando toda su estructura cortical a la función lectora (Dehaene *et al.*, 2005).

1.1.3. Marco normativo sobre el aprendizaje lector en la etapa escolar

El aprendizaje de la lectura se inicia desde el nacimiento y está moldeado por las condiciones del ambiente familiar y sociocultural (Bravo, 2016). Existen algunos procesos cognitivos que se desarrollan previo a iniciar el aprendizaje formal de la lectura y que son determinantes para su éxito inicial, manteniendo su influencia en los años posteriores (Suárez-Coalla *et al.*, 2013): el procesamiento fonológico (el cual incluye la conciencia fonológica, la memoria fonológica y la codificación fonológica en el acceso al léxico) y la denominación rápida y automatizada. La conciencia fonológica es la capacidad para manipular las unidades del habla, siendo para ello necesaria la conciencia de que las palabras están compuestas por segmentos subléxicos que se combinan; la memoria fonológica es la capacidad para conservar y manipular información en la memoria verbal de trabajo (a corto plazo); y la codificación fonológica en el acceso al léxico es la capacidad para recuperar la información fonológica almacenada en la memoria a largo plazo.

Gutiérrez-Fresneda (2020) apunta a que a los cuatro años los niños y niñas están preparados para iniciarse en el proceso de adquisición de la lectura. No obstante, es a los cinco años cuando se produce una mayor vinculación entre las habilidades de procesamiento fonológico y el desempeño lector, por lo que es aconsejable iniciar el desarrollo de las habilidades prelectoras en las primeras etapas de la Educación Infantil, y comenzar con el aprendizaje explícito de la lectura en la última etapa de la Educación Infantil o la primera etapa de la Educación Primaria (Heintzman y Deacon, 2024).

El Real Decreto 95/2022, de 1 de febrero, por el que se establece la ordenación y las enseñanzas mínimas de la Educación Infantil (Gobierno de España, 2022a), indica que dicha etapa es un entorno idóneo para realizar un acercamiento progresivo a la lectura como forma de comunicación, conocimiento y placer. En esta se debe contribuir a desarrollar en los niños y niñas las capacidades que les permitan iniciarse en las habilidades de la lectura y la escritura, sin que el desarrollo de dichas habilidades sea exigible para iniciar la Educación Primaria. Se recomienda que la aproximación al lenguaje escrito se lleve a cabo a través de formas escritas y símbolos presentes en el entorno, aproximándoles a los usos

sociales del lenguaje escrito, y estableciendo la lectura compartida junto con adultos, siempre respetando el ritmo de desarrollo de cada niño y niña.

El Real Decreto 157/2022, de 1 de marzo, por el que se establecen la ordenación y las enseñanzas mínimas de la Educación Primaria (Gobierno de España, 2022b), indica que la finalidad de esta etapa es facilitar al alumnado el aprendizaje de la lectura (entre otras habilidades clave), desarrollando y fomentando el hábito lector tanto en la lengua castellana como en la lengua cooficial de la comunidad autónoma (en caso de haberla). En el primer ciclo de la Educación Primaria (primero y segundo curso), se fomenta la motivación hacia la lectura, así como su aprendizaje a través de estrategias como localizar, entender e integrar la información relevante y explícita, realizando con ayuda inferencias directas y atendiendo a aspectos formales como la distribución del texto. En el segundo ciclo de la Educación Primaria (tercero y cuarto curso), los alumnos y alumnas deben adquirir estrategias que les permitan realizar inferencias directas de forma guiada y, posteriormente autónoma. En el tercer ciclo de Educación Primaria (quinto y sexto curso), los alumnos y alumnas deben ser capaces de comprender la información de varios tipos de escritos, realizando inferencias directas y captando el doble sentido del texto. En términos generales, el fin de esta etapa es sentar las bases que permitan a los niños y niñas ser lectores competentes, autónomos y críticos, capaces de utilizar la lectura en todos los ámbitos de su vida diaria e integrándola como fuente de placer y de conexión social.

1.2. LA DISLEXIA

1.2.1. Concepto y prevalencia de la dislexia

El *Manual Diagnóstico y Estadístico de los Trastornos Mentales* (DSM-5-TR; APA, 2022) incluye a la dislexia en los trastornos del neurodesarrollo, los cuales son condiciones que se caracterizan por presentar alteraciones en la maduración del sistema nervioso central que derivan en déficits en el funcionamiento de la persona (Thapar *et al.*, 2017). Esta clasificación engloba un amplio espectro de condiciones neurológicas, las cuales tienen en común el origen multifactorial, el inicio en la infancia, la relevancia clínica, la interferencia en todos o en alguno de los ámbitos de la vida diaria (cognición, comunicación, motricidad, emocionalidad…), la comorbilidad y las variaciones sintomatológicas en las distintas etapas del ciclo vital (López y Förster, 2022). Esta última característica es de gran relevancia puesto que los trastornos del neurodesarrollo son condiciones denominadas "no estáticas" debido a que las manifestaciones clínicas cambian (no de forma lineal ni continua) debido a factores genéticos y ambientales.

La dislexia es un trastorno específico del aprendizaje que se caracteriza por presentar dificultades persistentes en la lectura, manifestándose en una lectura de palabras lenta, imprecisa o con dificultades para su comprensión. Estas habilidades son significativamente inferiores a lo esperado para la edad cronológica y están presentes desde la etapa escolar, pero pueden no manifestarse hasta que las demandas académicas superan las habilidades lectoescritoras de la persona. Las dificultades en la lectura interfieren en el rendimiento académico y en las actividades de la vida diaria, y no pueden atribuirse a otros trastornos sensoriales, psíquicos o neurológicos, ni a una carencia de instrucción educativa adecuada (APA, 2022; Carroll *et al.*, 2025).

Se estima que, en España, un 10% de los niños y niñas en educación primaria presenta dislexia (Francés *et al.*, 2023), situándose este valor cerca de la prevalencia del trastorno estimada a nivel mundial, el 7,10% (Yang *et al.*, 2022). Asimismo, se observa una diferencia significativa por sexo, con una proporción entre niños y niñas de aproximadamente 2:1 (Yang *et al.*, 2022).

La dislexia suele coexistir con otros trastornos del neurodesarrollo. Diversos estudios señalan que entre un 25% y un 40% de los niños y niñas con dislexia cumple también criterios para establecer el diagnóstico de TDAH; siendo esta asociación bidireccional, es decir, una proporción similar de menores con TDAH presentan dificultades lectoras propias de la dislexia (Boada *et al.*, 2012; McGrath *et al.*, 2020). Varios metaanálisis apuntan a que el TDAH es la comorbilidad más frecuente en los trastornos específicos del aprendizaje y esta asociación deriva en un perfil cognitivo y conductual más complejo (DuPaul *et al.*, 2013; Visser *et al.*, 2020). En cuanto al TEA, aunque la evidencia es más limitada, se ha descrito que aproximadamente un 10–15% de los niños y niñas con dislexia presentan sintomatología asociada al TEA, así como que las dificultades lectoras son más frecuentes en la población con TEA que en la población general (Brimo *et al.*, 2021). Además de su elevada coexistencia con otros trastornos del neurodesarrollo, la dislexia también se asocia con un incremento del riesgo de presentar trastornos psicopatológicos como ansiedad, depresión y TOC, especialmente en contextos de dificultades escolares persistentes y experiencias reiteradas de fracaso académico (Bonti *et al.*, 2024).

La literatura científica ha puesto de manifiesto la comorbilidad entre la dislexia y las alteraciones perceptivas y auditivo-musicales. Con respecto a las alteraciones perceptivas, estudios evidencian que una parte de las personas con dislexia presenta alteraciones en el reconocimiento de caras y de objetos visualmente complejos, hecho que sugiere solapamientos parciales con trastornos como la prosopagnosia o, al menos, con déficits en etapas superiores del procesamiento visual (Åsberg Johnels *et al.*, 2022; Sigurdardottir *et al.*, 2018). Con respecto a las alteraciones auditivo-musicales, se ha descrito una comorbilidad relevante entre dislexia y amusia congénita, con estudios que indican que alrededor del 30% de los adultos con dislexia cumplen criterios de amusia, y que aproximadamente una cuarta parte de las personas con amusia presenta dificultades lectoras significativas compatibles con dislexia (Couvignou *et al.*, 2023).

1.2.2. Bases genéticas de la dislexia

Debido a ser una invención cultural relativamente reciente, es complejo establecer la existencia de genes específicos para la lectura (Dehaene, 2010). Sin embargo, sí que existen influencias genéticas sobre rasgos cognitivos y conductuales evolucionados que son necesarios para desarrollar la competencia lectora (Pennington y Olson, 2005).

Desde las primeras definiciones de la dislexia, fueron varios los estudios que indicaron la alta incidencia entre hermanos, hermanas, padres, madres y otros familiares de primer grado (Fisher, 1905; Hinshelwood, 1911). Partiendo de esta premisa, Hallgren (1950) llevó a cabo un estudio epidemiológico genético de una gran muestra de familias e infirió que la dislexia se ajustaba a un patrón de transmisión autosómico dominante. No obstante, las limitaciones metodológicas del estudio dificultaron el establecimiento de dicha transmisión como único mecanismo genético implicado.

La asociación entre familia y dislexia es coherente con la participación de factores genéticos, pero también puede explicarse por influencias ambientales que son comunes a los sujetos dentro de una familia (Fisher y DeFries, 2002). Con el objetivo de paliar dicha disyuntiva, se realizaron estudios con gemelos monocigóticos y dicigóticos, los cuales permitieron aportar evidencia de la influencia genética controlando los efectos del entorno familiar. Ejemplo de dichos estudios es el de Bakwin (1973), el cual evidenció que la concordancia de dislexia es significativamente mayor en gemelos monocigóticos, los cuales tienen una composición genética prácticamente idéntica, que en gemelos dicigóticos, los cuales comparten alrededor de la mitad de sus alelos segregantes, igual que los hermanos comunes.

Un metaanálisis reciente desarrollado por Andreola *et al.* (2021) analizó 49 artículos, cuyo tamaño muestral fue de 38.670 individuos (15.990 individuos monocigóticos y 22.680 individuos dicigóticos) de edades comprendidas entre los 4,1 y los 18,5 años, y determinó la heredabilidad de la lectura general (66%) y de las habilidades asociadas con el rendimiento lector: el conocimiento de las letras y las palabras (62%), la decodificación (68%), la comprensión lectora (68%), la conciencia fonológica (52%), el RAN (denominación automatizada rápida; 46%), la ortografía (80%) y el lenguaje (34%); siendo el efecto del ambiente (tanto el compartido como

el no compartido) determinante en menor proporción (a excepción de en el lenguaje).

La heredabilidad sustancial de la dislexia reportada derivó en la realización de estudios de genética molecular con el objetivo de identificar genes específicos asociados con la dislexia (Erbeli *et al.,* 2021). Doust *et al.* (2022) realizaron un estudio de asociación del genoma de 51.800 personas adultas con diagnóstico de dislexia (21.513 hombres y 30.287 mujeres) y 1.087.070 controles e identificaron 42 loci significativos independientes de todo el genoma: 15 en genes vinculados a la capacidad cognitiva / nivel educativo y 27 nuevos y potencialmente más específicos de la dislexia (*Tabla 1*).

Tabla 1. *Locis significativos en la población adulta con dislexia*

Banda citogenética	Función asociada
chr20q13.13, chr17q12, chr4q31.3, chr12q24.12, chr5q34, chr7q22.3, chr2p22.1, chr1p13.3, chr3p21.31, chr2q33.1, chr14q32.2, chr5q35.1, chr12q24.31, chr1q41	Capacidad cognitiva general y nivel educativo
chr1q21.3, chr2q22.3, chr2q33.1, chr3p12.1, chr3q22.3, chr6p22.3, chr7p14.1, chr7q11.22, chr7q11.22, chr9q34.11, chr11q23.1, chr17q23.3, chrXq27.3, chr2q12.1, chr3p24.3, chr10q24.33, chr13q12.13, chr1p32.1, chr2p23.2, chr3q26.33, chr3p13, chr5q33.3, chr9p22.3, chr10q24.2, chr11p14.1, chr19q13.2, chr20q11.21	Dificultades en las habilidades lectoras

1.2.3. Bases neurobiológicas de la dislexia

Los estudios de neuroimagen evidencian que las dificultades en las habilidades lectoras que presentan las personas con dislexia están asociadas a diferencias estructurales y funcionales en las redes neuronales que se utilizan durante la lectura, incluyendo el giro frontal inferior izquierdo, la región temporoparietal izquierda y la región occipitotemporal izquierda (Paulesu *et al.*, 2014).

Las personas con dislexia presentan una baja activación en la región occipitotemporal izquierda, concretamente en el área visual de las palabras, asociándose dicha hipoactivación con las dificultades en la denominación rápida y en la identificación de las palabras (Norton y Wolf, 2012). La región temporoparietal izquierda también presenta una menor actividad durante las tareas de procesamiento fonológico (Temple *et al.*, 2001). En contraposición, los estudios de neuroimagen evidencian una mayor activación en el giro frontal inferior izquierdo (Hoeft *et al.*, 2007), la cual se asocia a procesos compensatorios o a un aumento del esfuerzo cognitivo (Price, 2012). Se ha evidenciado una diferencia significativa en la activación de dichas áreas cerebrales incluso cuando las personas con dislexia son comparadas con lectores más jóvenes emparejados por su nivel de habilidad lectora (Hoeft *et al.*, 2007), sugiriendo de este modo que la etiología de la dislexia no se debe únicamente a una maduración tardía de las redes neuronales.

Las pruebas de neuroimagen estructural han hallado una disminución de la sustancia gris en las regiones occipitotemporales y temporoparietales (Richlan *et al.*, 2013), así como una disminución de la de conectividad en los tractos de sustancia blanca del hemisferio izquierdo como el fascículo arqueado, el fascículo longitudinal superior y el fascículo longitudinal inferior, los cuales se asocian con las dificultades lectoras (Langer *et al.*, 2017) y predicen su desarrollo futuro (Wang *et al.*, 2017). En contraposición, se ha hallado una mayor conectividad en los tractos de sustancia blanca lateralizados hacia la derecha como el fascículo longitudinal superior derecho (Hoeft *et al.*, 2011), y en el cuerpo calloso (Dougherty *et al.*, 2007), la cual se asocia a la compensación de las habilidades lectoras en menores con dislexia (Wang *et al.*, 2017).

En esta misma línea, también se ha observado una disminución del volumen de la materia gris y una disminución de la activación en el cerebelo de las personas con dislexia (Martin *et al.,* 2016). Estos hallazgos no son consistentes, sin embargo, es probable que el deterioro de la función cerebelosa sea una alteración en el neurodesarrollo que provoque diferencias en las redes de la lectura (Stoodley y Stein, 2013).

Es importante destacar que las diferencias en la estructura y el funcionamiento cerebral características de la dislexia se han observado en niños y niñas prelectoras en riesgo de presentar dislexia incluso antes del inicio formal de la instrucción en lectura, lo que indica que la dislexia no es el resultado de una dificultad para aprender a leer, sino que representa una predisposición biológica presente desde el nacimiento (Sanfilippo *et al.*, 2020).

1.2.4. El proceso de evaluación y los criterios diagnósticos de la dislexia

En la actualidad, la evaluación de la dislexia sigue el modelo biopsicosocial, el cual integra el dominio biológico, psicológico y social para poder entender y atender mejor a la persona (Osorio, 2024). Fernández Ballesteros (2013) establece cuatro fases en el proceso de evaluación correspondientes al enfoque descriptivo-predictivo: (I) Primera recogida de información; (II) Formulación de hipótesis y deducción de enunciados verificables; (III) Contrastación inicial de hipótesis; (IV) Comunicación de resultados. Dichas fases permiten establecer un diagnóstico diferencial y realizar un plan de intervención individualizado (Balado *et al.*, 2017).

La recogida inicial de información se lleva a cabo a través de una entrevista al menor con sospecha de dificultades en la lectura, y a su familia. Existen diferentes tipos de entrevista en función de las variables que la configuran, siendo en el contexto de la dislexia la entrevista semiestructurada la más utilizada por su guion de áreas concretas de contenido para evaluar con una mayor libertad en la forma de formular las preguntas (Guillén y Moreno, 2019). En la entrevista inicial se debe recoger información sobre los datos personales, familiares y evolutivos, los antecedentes clínicos, el desarrollo motor, del lenguaje, de la lectura, de la escritura, del cálculo y de otros aprendizajes complejos, y la sociabilidad (Balado *et al.*, 2017). Asimismo, es conveniente complementar dicha información con una entrevista a

los docentes del menor para que, de forma cualitativa, puedan ofrecer información sobre su rendimiento académico y sobre los factores del ambiente escolar que puedan estar determinando dicho rendimiento, tales como sensibilidad y preparación docente para la detección temprana de posibles dificultades, cantidad de alumnado por aula, disponibilidad de materiales de lectura apropiados y metodología de enseñanza (Mather y Wendling, 2024).

La formulación de hipótesis y deducción de enunciados verificables parte de la información recabada en la entrevista inicial, la cual permite formular hipótesis y establecer con qué instrumentos estandarizados se van a valorar cada una de las variables determinantes en el proceso de la lectura (Fernández-Ballesteros, 2013). El proceso de evaluación estandarizado inicia con la identificación de posibles dificultades en los procesos cognitivos, lingüísticos y sensoriales que puedan influir en el proceso lector, con el objetivo de detallar un perfil de fortalezas y debilidades (Preilowski y Matute, 2011), así como la evaluación de la lectura propiamente dicha.

La contrastación inicial de hipótesis se lleva a cabo planificando y aplicando las pruebas estandarizadas específicas que valoren cada uno de los procesos planteados anteriormente, y analizando, una vez obtenidos los resultados, si se cumplen las hipótesis diagnósticas preestablecidas. El Col·legi Oficial de Logopedes de Catalunya (Casas *et al*., 2015) establece un listado de pruebas estandarizadas que son susceptibles de ser utilizadas en un niño o niña con sospechas de dislexia, entre las que se destacan las pruebas de uso más común (*Tabla 2*).

Tabla 2. *Pruebas estandarizadas susceptibles de ser aplicadas durante la evaluación de la dislexia*

Prueba estandarizada	**Objetivo**
BASC-3. Sistema de Evaluación de la Conducta de Niños y Adolescentes-3 (Reynolds y Kamphaus, 2015)	Evaluación conductual y emocional.

ENFEN. Evaluación Neuropsicológica de las Funciones Ejecutivas en Niños (Portellano *et al.*, 2011)	Evaluación de las funciones ejecutivas.
BRIEF-2. Evaluación Conductual de la Función Ejecutiva-2 (Gioia *et al.*, 2015)	Evaluación de las funciones ejecutivas.
WISC-V. Escala de Inteligencia de Wechsler para Niños-5 (Wechsler, 2014)	Evaluación de la aptitud intelectual.
PROLEC-R. Batería de Evaluación de los Procesos Lectores – Revisada (Cuetos *et al.*, 2014)	Evaluación de los procesos implicados en la lectura.

Nota. Adaptado de Casas *et al.* (2015).

El análisis de los resultados obtenidos en las pruebas seleccionadas para la evaluación de los procesos relacionados con la lectura permite establecer un perfil del menor con sospechas de dificultades en la lectura que, junto con los criterios diagnósticos establecidos en el DSM-5-TR (APA, 2022) correspondientes al Trastorno Específico del Aprendizaje (*Tabla 3*), permiten establecer, o no, el diagnóstico diferencial de dislexia con la codificación (*Tabla 4*) y el grado de severidad (*Tabla 5*) correspondiente.

Tabla 3. *Criterios diagnósticos del Trastorno Específico del Aprendizaje (DSM-5-TR)*

Criterios diagnósticos del Trastorno Específico del Aprendizaje
A. Dificultades en el aprendizaje y uso de habilidades académicas, evidenciadas por la presencia de al menos uno de los siguientes síntomas que han persistido durante al menos seis meses, a pesar de haber recibido intervenciones dirigidas a esas dificultades:
1. Lectura de palabras inexacta o lenta y con esfuerzo (por ejemplo, lee palabras sueltas en voz alta de forma incorrecta o lenta y vacilante, adivina palabras con frecuencia, tiene dificultad para pronunciar las palabras).

2. Dificultad para comprender el significado de lo que se lee (por ejemplo, puede leer el texto con precisión, pero no entender la secuencia, las relaciones, las inferencias o los significados profundos de lo leído).

3. Dificultades con la ortografía (por ejemplo, puede añadir, omitir o sustituir vocales o consonantes).

4. Dificultades con la expresión escrita (por ejemplo, comete múltiples errores gramaticales o de puntuación dentro de las oraciones; presenta una mala organización de los párrafos; la expresión escrita de ideas carece de claridad).

5. Dificultades para dominar el sentido numérico, los hechos numéricos o el cálculo (por ejemplo, tiene una comprensión deficiente de los números, su magnitud y relaciones; cuenta con los dedos para sumar números de un solo dígito en lugar de recordar el dato matemático como lo hacen sus compañeros; se pierde en medio de una operación aritmética y puede cambiar de procedimiento).

6. Dificultades con el razonamiento matemático (por ejemplo, tiene serias dificultades para aplicar conceptos, hechos o procedimientos matemáticos para resolver problemas cuantitativos).

B. Las habilidades académicas afectadas se encuentran sustancial y cuantificablemente por debajo de lo esperado para la edad cronológica del individuo, y causan una interferencia significativa en el rendimiento académico o laboral, o en las actividades de la vida diaria. Esto debe confirmarse mediante pruebas estandarizadas de rendimiento académico aplicadas individualmente y una evaluación clínica integral. En individuos de 17 años o más, se puede sustituir la evaluación estandarizada por una historia documentada de dificultades de aprendizaje con impacto funcional.

C. Las dificultades de aprendizaje comienzan durante los años escolares, pero pueden no manifestarse plenamente hasta que las demandas académicas superan las capacidades limitadas del individuo (por ejemplo, en exámenes cronometrados, al leer o redactar informes complejos bajo presión de tiempo, o ante cargas académicas excesivas).

D. Las dificultades de aprendizaje no se explican mejor por otras causas, como discapacidad intelectual, problemas no corregidos de visión o audición, otros trastornos mentales o neurológicos, adversidad psicosocial, falta de dominio del idioma de instrucción académica o instrucción educativa inadecuada.

Nota. Adaptado de APA (2022).

Tabla 4. *Codificación correspondiente a las dificultades en la lectura (DSM-5-TR)*

Codificación de las dificultades de la lectura
Se deben especificar todos los dominios académicos y subhabilidades que estén alterados. Cuando hay más de un dominio afectado, cada uno debe codificarse individualmente de acuerdo con los siguientes especificadores. Especificar si:
F81.0 – Con alteración en la lectura:
Precisión en la lectura de palabras
Velocidad o fluidez lectora
Comprensión lectora

Nota. Adaptado de APA (2022).

Tabla 5. *Gravedad sintomatológica de la dislexia (DSM-5-TR)*

Gravedad de los síntomas de la dislexia	
Leve	Algunas dificultades para aprender habilidades en uno o dos dominios académicos, pero de una gravedad suficientemente leve como para que el individuo pueda compensar o funcionar adecuadamente cuando recibe adaptaciones o servicios de apoyo apropiados, especialmente durante los años escolares.
Moderada	Dificultades marcadas para aprender habilidades en uno o más dominios académicos, de manera que es poco probable que el individuo adquiera un nivel de competencia adecuado sin intervalos de enseñanza intensiva y especializada durante los años escolares. Puede necesitar adaptaciones o servicios de apoyo al menos parte del día en la escuela, en el trabajo o en el hogar para completar las actividades con precisión y eficacia.

Grave	Dificultades severas para aprender habilidades, que afectan a varios dominios académicos, de modo que es poco probable que el individuo adquiera esas habilidades sin enseñanza intensiva, individualizada y especializada de forma continua durante la mayor parte de los años escolares. Incluso con una amplia gama de adaptaciones o servicios adecuados en el hogar, la escuela o el lugar de trabajo, es posible que el individuo no pueda completar todas las actividades de manera eficaz.

Nota. Adaptado de APA (2022).

El diagnóstico de dislexia no es un proceso sencillo por varios motivos, entre los que se destaca la variabilidad individual en el desarrollo de los procesos implicados en la lectura, la gran cantidad de factores que influyen en el rendimiento lector óptimo y la carencia de indicadores universales que sustenten el diagnóstico (Balado *et al.*, 2017). Es por esto por lo que suele detectarse varios años después de haber empezado con la enseñanza explícita de la lectura, teniendo esta demora temporal un impacto negativo en el desarrollo de las habilidades académicas y socioemocionales de los menores, así como en sus familias (Sanfilippo *et al.*, 2020).

Las dificultades en la conciencia fonológica, en el vocabulario expresivo y comprensivo, en el conocimiento de las letras y en la denominación rápida predicen el rendimiento lector previo a la enseñanza formal tanto en menores con antecedentes familiares de dislexia como sin ellos (van Viersen *et al.*, 2017). El procesamiento fonológico resulta ser el mejor predictor en la precisión lectora y, la denominación rápida y automatizada (RAN), en la velocidad lectora, permitiendo la detección temprana de menores con riesgo de desarrollar dificultades en la lectura desde las primeras etapas de Educación Infantil (Suárez-Coalla *et al.*, 2013), a partir de los cuatro años de edad (Cuetos *et al.*, 2015).

1.2.5. Perfil neonatal y prematuridad

La Organización Mundial de la Salud define la prematuridad como el nacimiento que ocurre antes de las 37 semanas completas de gestación, o antes de los 259 días desde la fecha del primer día del último periodo menstrual de la mujer. Para el recién nacido, el nacimiento prematuro es un factor de riesgo que impacta en la salud y la calidad de vida durante todo el ciclo vital (Vogel *et al.*, 2018).

La prematuridad se asocia con un mayor riesgo de presentar afección respiratoria, hemorragia intraventricular, leucomalacia periventricular, enterocolitis necrosante, sepsis, hipoxia – isquemia, afecciones alimentarias, visuales y auditivas (Mwaniki *et al.*, 2012; Saigal y Doyle, 2008), así como dificultades cognitivas, lingüísticas, motrices, conductuales, socioemocionales y de aprendizaje durante la infancia (Johnson *et al.*, 2015; Moreira *et al.*, 2014; Orchinik *et al.*, 2011), las cuales conllevan costes significativos para los sistemas de salud (Petrou *et al.*, 2009). Asimismo, se estima que las complicaciones relacionadas con el nacimiento prematuro fueron la principal causa de muerte en la población infantil menor de cinco años a nivel mundial, representando aproximadamente el 37% de las muertes entre los recién nacidos (United Nations Inter-agency Group for Child Mortality Estimation, 2025).

El desarrollo cerebral en la población infantil prematura está condicionado por los factores intrauterinos adversos y las consecuencias de la inmadurez fisiológica que comprometen procesos biológicos como la mielinización de la sustancia blanca, la neurogénesis y la sinaptogénesis (Volpe, 2009). El tipo más común de lesión cerebral en bebés prematuros es la lesión difusa de la sustancia blanca, caracterizada por lesiones microscópicas difusas, disminución del volumen de la sustancia blanca y adelgazamiento de los tractos de la misma (Ophelders *et al.*, 2020), asociada con alteraciones en la maduración de los oligodendrocitos, las células predominantes responsables de la mielinización (Segovia *et al.*, 2008). Debido al papel clave que los oligodendrocitos desempeñan en el desarrollo y la función axonal, estudios relacionan la lesión difusa de la sustancia blanca con la reducción de la integridad funcional de los axones neuronales en la corteza cerebral, el cerebelo, el tálamo, el hipocampo y los ganglios basales (Keunen *et al.*,

2012), hecho que perjudica el crecimiento, el desarrollo y la función neuronal tras un parto prematuro (Galinsky *et al.*, 2018).

Estudios realizados con resonancia magnética por difusión en menores prematuros han evidenciado reducciones en la anisotropía fraccional en los tractos de sustancia blanca como el fascículo arqueado, involucrado en la integración de información fonológica, ortográfica y semántica, y el fascículo longitudinal superior, relacionado con las habilidades lingüísticas orales y escritas (Meisler y Gabrieli, 2022), así como en el giro frontal inferior izquierdo y en el giro temporal superior (Rimrodt *et al.*, 2010), afectando negativamente a la velocidad y eficiencia de la transmisión neuronal en los nodos que constituyen la red cerebral de la lectura.

1.2.6. Perfil lingüístico en población infantil con dislexia

La lectura es una habilidad psicolingüística compleja que requiere la interacción de los sistemas fonológico, morfosintáctico, semántico y pragmático (Calet *et al.*, 2019). Se ha evidenciado la relevancia de las habilidades fonológicas en el proceso de aprendizaje de la lectura (Melby-Lervåg *et al.*, 2012), estableciéndose como variables predictoras tempranas del desarrollo de la lectura en los sistemas ortográficos alfabéticos como el español (Caravolas *et al.*, 2012). Asimismo, las habilidades morfosintácticas predicen el rendimiento lector en etapas posteriores de la adquisición de la lectura, siendo clave en la fluidez lectora (Giazitzidou y Padeliadu, 2022; Marcolini *et al.*, 2011). El priming semántico predice la eficiencia en la lectura de palabras y pseudopalabras en menores con dislexia (van der Kleij *et al.*, 2019), y las habilidades pragmáticas son especialmente relevantes para la comprensión del lenguaje escrito no literal (Bambini *et al.*, 2011).

Durante las últimas décadas, la hipótesis del déficit fonológico (Vellutino *et al.*, 2004) ha predominado en la comprensión de las dificultades lectoras y, actualmente, sigue siendo objeto de debate. Se ha planteado que los menores con dislexia presentan dificultades para percibir y almacenar información relacionada con los sonidos del habla, hecho que interfiere en la formación de representaciones fonológicas y léxicas. En contraposición, autores sugieren que las representaciones léxicas están intactas, pero el acceso a ellas está deteriorado (Boets *et al.*, 2013). Otros

autores postulan que las dificultades lectoras en la dislexia están vinculadas a dificultades en el aprendizaje de las habilidades fonológicas y su correspondiente automatización (Lum *et al.*, 2013).

Uno de los indicadores más sólidos del déficit fonológico es la conciencia fonológica (Farquharson *et al.*, 2014), en la cual las personas con dislexia muestran bajo rendimiento incluso después de haber aprendido a leer (Wilson y Lesaux, 2001). En esta misma línea, el déficit fonológico también se manifiesta en una escasa memoria fonológica y memoria a corto plazo (Artuso *et al.*, 2021), una pobre percepción de las propiedades psicoacústicas del habla (Ramus *et al.*, 2013), dificultades en la decodificación (Łockiewicz *et al.*, 2020) y representaciones fonológicas débiles (Farquharson *et al.*, 2014).

Si bien la dislexia se caracteriza por el déficit fonológico, las dificultades también afectan a otros dominios del lenguaje. Así pues, los menores con dislexia suelen presentar un rendimiento inferior en las habilidades morfosintácticas que se manifiestan en dificultades en la derivación y en la inflexión, tanto en la producción como en la recuperación de bases, en diferentes categorías léxicas (Melloni y Vender, 2022). Este perfil coincide con hallazgos previos que afirman que los menores con dislexia presentan dificultades en la aplicación de reglas de concordancia de tiempo pasado y pluralización de palabras sin sentido (Joanisse *et al.*, 2000), en la concordancia de género y número (Guzmán *et al.*, 2004), en la formación de sufijos, en la declinación de pronombres personales, y en el cambio de género de los adjetivos y de los números cardinales con respecto al género de un sustantivo (Duranovic *et al.*, 2014).

Dichas dificultades en el dominio morfosintáctico tienden a coexistir con dificultades en el dominio semántico. En este sentido, diversos estudios han señalado que un repertorio léxico reducido puede ser un predictor significativo, aunque no concluyente, de la dislexia desde los primeros dos años de vida (Maassen *et al.*, 2022). Así, Van Vreckem *et al.* (2023) hallaron que los menores con dislexia en edad escolar presentan un rendimiento inferior que sus iguales normo lectores en el vocabulario expresivo, así como la población adulta con dislexia una menor destreza en la producción oral de oraciones complejas (Wiseheart y Altmann, 2018).

No obstante, estudios apuntan que la información morfológica y semántica durante la lectura puede compensar las dificultades fonológicas (de Pontes y Salles, 2016). La evidencia científica sugiere que los menores con dislexia dependen más de la información semántica durante la lectura de palabras que sus iguales normotípicos, probablemente como una forma de compensar sus dificultades (van der Kleij *et al.*, 2019). Asimismo, Cavalli *et al.* (2016) proponen que las personas con dislexia son capaces de usar pistas semánticas contenidas en los morfemas para facilitar el acceso al significado de las palabras durante la lectura.

La comprensión lectora parte del acceso al significado de las palabras (Smith-Spark, 2018) y de la realización de inferencias psicológicas, aquellas que se basan en el conocimiento relacionado con los estados mentales, e inferencias no psicológicas, aquellas que se basan en el conocimiento general (Golly-Ledoux *et al.*, 2023). Algunos estudios se han focalizado en que los menores con dislexia presentan dificultades en la pragmática caracterizadas por dificultades en la comprensión de metáforas y en la comprensión del significado implícito, revelando dificultades en la supresión de la interpretación literal de la expresión idiomática y en la realización de inferencias basadas en la información lingüística del contexto, respectivamente (Cersosimo *et al.,* 2024; Kasirer y Mashal, 2017). Asimismo, Cardillo *et al.* (2017) hallaron que los menores con dislexia presentan dificultades en la Teoría de la mente, evidenciando dificultades para comprender creencias, intenciones, pensamientos e ideas ajenas, así como para comprender el lenguaje figurado. Griffiths (2007) halló que en la adultez las dificultades pragmáticas se manifiestan en las dificultades para la extracción de la información inferencial de una historia y en la comprensión del humor, y determinó que estas dificultades están asociadas a las dificultades para automatizar el procesamiento del lenguaje características en la dislexia que provocan una sobrecarga en la memoria de trabajo. El estudio de Cappelli *et al.* (2018) corroboró estos hallazgos, evidenciando dificultades en la comprensión del lenguaje figurado, incluyendo metáforas, modismos, proverbios y chistes, y amplió el alcance de las dificultades pragmáticas a la producción, que resultan en intercambios conversacionales deteriorados.

1.2.7. Perfil cognitivo y de funcionamiento ejecutivo en población infantil con dislexia

La lectura es una habilidad compleja que requiere el adecuado funcionamiento de muchos procesos cognitivos diferentes para ser efectiva (Ekstrand *et al.*, 2019). Se ha evidenciado que los menores con dislexia, en comparación con sus pares normotípicos, presentan un espectro más amplio de dificultades cognitivas que afectan a la memoria, la atención, la capacidad visoespacial, la velocidad de procesamiento y las funciones ejecutivas (Smith-Spark y Gordon, 2022). Las funciones ejecutivas son procesos que controlan y regulan el pensamiento y la acción, permitiendo a las personas alcanzar metas, adaptarse a situaciones cotidianas novedosas y gestionar las interacciones sociales (Cristofori *et al.*, 2019). Habilidades como la memoria de trabajo, el control inhibitorio, la flexibilidad cognitiva, la planificación y la monitorización forman parte de las funciones ejecutivas y contribuyen significativamente a la comprensión lectora (Sesma *et al.*, 2009).

Durante el proceso de lectura, el rendimiento adecuado de la memoria de trabajo está relacionado con la decodificación (Ober *et al.*, 2020) y con la retención de información anterior del texto, la relación con contenido posterior para mantener la coherencia local y la recuperación de conocimientos previos almacenados en la memoria a largo plazo, integrándolos con la información del texto para generar inferencias (Follmer, 2018). Las dificultades en la memoria de trabajo están bien documentadas en la dislexia, tanto en la población infantil (Jeffries y Everatt, 2004; Wang *et al.*, 2022) como en la población adulta (Fostick y Revah, 2018; Smith-Spark y Fisk, 2007), siendo confirmadas por estudios realizados mediante resonancia magnética funcional (Beneventi *et al.*, 2010; Vasic *et al.*, 2008). En términos generales, dichas dificultades se asocian al déficit fonológico característico en la dislexia que se manifiesta en dificultades para la retención de información mientras se decodifican las palabras o se construye el significado de las oraciones complejas, en las cuales el bucle articulatorio, un subsistema de la memoria de trabajo especializado en el almacenamiento temporal de información verbal, está comprometido (Jeffries y Everatt, 2004). Sin embargo, algunos autores afirman la existencia simultánea de dificultades en el bucle articulatorio y en la

memoria de trabajo visoespacial, un subsistema de la memoria de trabajo especializado en el almacenamiento temporal de información visual, cuando la carga cognitiva del procesamiento y de la memoria es más exigente (Smith-Spark y Fisk, 2007; Wang *et al.*, 2022).

El control inhibitorio contribuye en la decodificación precisa (Qiu *et al.*, 2023) y en la focalización de la atención en la información relevante, garantizando que solo la información necesaria para la tarea acceda a la memoria de trabajo, descartando así los estímulos irrelevantes para mitigar la interferencia durante la comprensión lectora (Borella *et al.*, 2010). Estudios indican que los menores con dislexia presentan dificultades en el control inhibitorio, las cuales se manifiestan en dificultades para ignorar distracciones irrelevantes y, en consecuencia, en errores de comprensión y menor eficiencia lectora (Booth *et al.*, 2010; Wang y Yang, 2015). Dichas dificultades persisten en la edad adulta (Proulx y Elmasry, 2015) y, junto con las dificultades en la memoria de trabajo, se establecen como predictoras de la dislexia (Booth *et al.*, 2014; Doyle *et al.*, 2018).

La flexibilidad cognitiva también está involucrada en la decodificación (Vadasy *et al.*, 2023) y en la comprensión lectora, ya que permite gestionar el procesamiento de las características fonológicas, morfosintácticas y semánticas del texto de forma simultánea, habilidad conocida como flexibilidad grafofonológico-semántica (Butterfuss y Kendeou, 2018), así como cambiar la estrategia de lectura, hacer predicciones y formular preguntas (Gnaedinger *et al.*, 2016), incorporando información nueva e inesperada durante la lectura (Cadime *et al.*, 2024). Los menores con dislexia presentan una menor capacidad para alternar activamente la atención entre la información grafema-fonema asociada a las palabras y el significado de las mismas, es decir una menor flexibilidad grafofonológica-semántica en comparación con sus iguales normolectores (Cartwright *et al.*, 2017; Varghese y Shanbal, 2024). Alrubaian (2025) establece la inflexibilidad cognitiva, junto con las dificultades en la atención y en la denominación rápida, el retraso en la adquisición del lenguaje y las dificultades en la conciencia fonológica, como los cinco principales predictores de la dislexia.

Los procesos más complejos de la comprensión lectora están vinculados al uso efectivo de las habilidades de planificación y monitorización, que incluyen el

establecimiento de planes para la lectura de un texto, el control del proceso de lectura, las estrategias para lograr los objetivos de lectura y la revisión de estas (Rollins *et al.*, 2022). Estudios vinculan las dificultades en la planificación y en la monitorización que presentan los niños y niñas con dislexia con las dificultades en la comprensión lectora (Cutting *et al.*, 2009; Locascio *et al.*, 2010).

Cualquier alteración en los mecanismos atencionales pueden provocar dificultades para desarrollar las habilidades lectoras. La atención sostenida, necesaria para poder leer durante un período prolongado de tiempo, está alterada en los menores con dislexia, manifiesta en la comisión de errores durante tareas prolongadas de lectura (Seshadri *et al.*, 2023). Asimismo, la atención visoespacial selectiva es necesaria para el reconocimiento secuencial de las letras en las palabras (Kermani *et al.*, 2018), las cuales deben seleccionarse con precisión mediante una rápida orientación del foco atencional para poder realizar una adecuada integración grafema – fonema (Hari y Renvall, 2001). Ferretti *et al.* (2008) hallaron que las personas con dislexia presentan un desplazamiento atencional lento y no siguen la estrategia de lectura de izquierda a derecha típica de los normolectores. En esta misma línea, Franceschini *et al.* (2012) evidenciaron la existencia de déficits tanto en la búsqueda visual en serie como en la facilitación mediante señalización espacial en personas con dislexia. Las pruebas de neuroimagen respaldan la relación existente entre la atención visual y la lectura. Finn *et al.* (2014) evidenciaron que las personas con dislexia presentan una conectividad diferente entre las áreas de asociación visual y las áreas de atención prefrontal, así como un mayor reclutamiento de circuitos neuronales vinculados con la decodificación, sugiriendo que las personas con dislexia tienen dificultades para modular su atención a fin de integrar la información textual. Ekstrand *et al.* (2019), a través de la resonancia magnética funcional, determinaron que el procesamiento subléxico depende de procesos de atención espacial focalizada y voluntaria y que, el procesamiento léxico, depende de la orientación atencional automática.

La memoria a largo plazo desempeña un papel esencial en la consolidación de la información fonológica y ortográfica, derivando en el establecimiento de unas representaciones léxicas fonológicas y ortográficas estables y un reconocimiento rápido de palabras. Autores afirman que los menores con dislexia presentan

dificultades para almacenar y manejar las representaciones fonológicas en la memoria a largo plazo (Artuso *et al.*, 2021; Melby-Lervåg *et al.*, 2012), así como en los dominios no verbales (Menghini *et al.*, 2010). Sin embargo, otros autores indican que, si los menores con dislexia se comparan con sus iguales normotípicos, presentan diferencias significativas en los dominios verbales de la memoria a largo plazo, pero comparados con menores con la misma edad de lectura, no las presentan (Lazzaro *et al.*, 2021).

El sueño parece desempeñar un papel importante en la consolidación de la memoria, un proceso dinámico que implica la transformación y estabilización continua de la información recién adquirida, así como nuevas instancias de activación de la información existente (Ackermann y Rasch, 2014). Solbi y Earle (2025) determinaron que el sueño parece ser menos efectivo para la consolidación de la memoria en menores con dislexia, hecho que puede estar relacionado con las dificultades en los procesos de lectura.

La velocidad de procesamiento es la capacidad de procesar información de un estímulo externo y generar una respuesta apropiada dentro de límites de tiempo restringidos (Weiler *et al.*, 2002). Los menores con dislexia presenten una velocidad de procesamiento reducida en comparación con sus iguales normolectores, manifiesta en una menor fluidez lectora, pero esta es similar cuando se compara con menores con el mismo nivel de lectura, sugiriendo que la velocidad de procesamiento lenta está asociada con la inmadurez lectora (Stefanac *et al.*, 2019). En los adultos con dislexia se observa un peor rendimiento en el procesamiento de tareas fonológicas frente a tareas ortográficas (Breznitz, 2003), hecho que permite inferir que el procesamiento fonológico lento puede causar una asincronía entre el procesamiento de los diversos subprocesos en la lectura y derivar en una lectura de palabras no automatizada y, en consecuencia, en una lectura no fluida (Breznitz y Misra, 2003). Estudios como el de Bogon *et al.* (2014) y Stenneken *et al.* (2011) evidencian la existencia de una reducción de la velocidad de procesamiento perceptivo.

1.2.8. Perfil conductual y emocional en población infantil con dislexia

La complejidad del proceso lector impacta en el desarrollo madurativo, conductual, social, emocional y afectivo de los menores con dislexia, así como en su salud mental (Huang *et al.*, 2020; Livingston *et al.*, 2018), viéndose comprometida su calidad de vida (Karande y Venkataraman, 2012).

Achenbach (1966) propuso un modelo que permite clasificar los síntomas conductuales y emocionales de la población infantil de forma dicotómica en sintomatología internalizante y sintomatología externalizante. La sintomatología internalizante incluye la expresión interna del componente emocional del individuo, caracterizada por alteraciones en el estado de ánimo como la ansiedad, la depresión, el retiramiento social y las quejas somáticas (Hughes y Gullone, 2008). En contraposición, la sintomatología externalizante incluye la expresión externa del componente emocional del individuo, caracterizada por alteraciones en la regulación del comportamiento como la agresividad, la impulsividad, la hiperactividad, la falta de atención, la desobediencia y la conducta delictiva (Alarcón y Bárrig, 2015).

Los problemas internalizantes y externalizantes pueden presentarse de forma comórbida y, aunque en términos generales, los síntomas externalizantes suelen opacar la detección de los síntomas internalizantes (López *et al.*, 2010), en la población infantil con dislexia se detectan con mayor facilidad los síntomas internalizantes (Livingston *et al.*, 2018). Se ha evidenciado que los menores con dislexia presentan una mayor prevalencia de ansiedad generalizada y social (Mammarella *et al.*, 2016; Nelson y Harwood, 2011), depresión (Maughan *et al.*, 2003; Wilmot *et al.*, 2024), sintomatología somática como cefalea, dolor de estómago, insomnio y fatiga (Arnold *et al.*, 2005; de Lima *et al.*, 2020), ira y conductas disruptivas (Michopoulou *et al.*, 2003). Dicha sintomatología internalizante y externalizante se acentúa en el entorno escolar (Novita, 2016) y se asocia a las interacciones con el profesorado y con el alumnado, así como a la preocupación por las pruebas de rendimiento (Alexander-Passe, 2008).

Las dificultades sociales, emocionales y conductuales que presentan los menores con dislexia se asocian con una baja autoestima académica, producto de sus problemas lectoescritores (Terras *et al.*, 2009). Durante la infancia y la

preadolescencia, la autoestima está vinculada con el rendimiento académico, la motivación, la personalidad y las relaciones sociales (Zuppardo *et al.*, 2020). Los menores con dificultades en la lectura tienen un mayor riesgo de desarrollar autopercepciones negativas de sí mismos como estudiantes (Gibby-Leversuch *et al.*, 2021), las cuales se ven reforzadas por el rendimiento académico por debajo de lo esperado y el continuo reproche al que se ven expuestos, derivando en una merma del autoconcepto y la autoeficacia (Castillo *et al.*, 2019). En esta misma línea, la dislexia se ha asociado con la indefensión aprendida, es decir, los fracasos académicos constantes llevan a los menores a considerar que no tienen control sobre su propio rendimiento y, por ende, carecen de motivación para involucrarse en las tareas académicas (Burden, 2008).

El impacto de las consecuencias de la dislexia sobre la propia persona con dislexia es heterogéneo y está condicionado por factores personales como la capacidad de alfabetización y la capacidad verbal general (Elbro, 2010), factores socioemocionales como la alteración de alfabetización autopercibida y el afrontamiento centrado en el problema (Alexander-Passe, 2006) y factores ambientales como las demandas de lectura y el apoyo escolar y familiar (Bazen *et al.*, 2023). Estudios afirman que el apoyo manifestado a través de la reafirmación de la autoestima del estudiante, la explicación de la dislexia y sus implicaciones, la muestra de confianza en sus capacidades, el fomento del diálogo interno adaptativo, la personalización e individualización de la intervención, así como la prevención de burlas y de acoso escolar, favorece el rendimiento de la población infantil con dislexia (Huang *et al.*, 2021; Singer, 2008).

1.3. IMPACTO PSICOSOCIAL DE LA DISLEXIA

Históricamente la investigación sobre la dislexia se ha centrado en las manifestaciones académicas del trastorno (Peterson y Pennington, 2012) y, si bien estas perspectivas han proporcionado aportes importantes, también han eclipsado otros aspectos críticos que impactan en el desarrollo y la calidad de vida de os menores con dislexia, como el contexto familiar.

A medida que la población infantil progresa en el entorno académico, la lectura se vuelve una variable vehicular para el aprendizaje y, aquellos menores que presentan dificultades, a menudo son etiquetados como perezosos e incompetentes (Sanfilippo *et al.*, 2020). La posibilidad de que el menor presente una dislexia suele pasar desapercibida hasta que el niño o niña ha fracasado repetidamente en su aprendizaje y ha impactado en su calidad de vida y en la de su familia (Mugnaini *et al.*, 2009).

El tiempo anterior a la obtención del diagnóstico de dislexia se ha descrito como un período de frustración e incertidumbre caracterizado por la desregulación emocional. Dicha desregulación emocional se vincula a variables internas como la comprensión de la existencia de una dificultad, las razones para solicitar un diagnóstico, el impacto emocional y los mecanismos de afrontamiento activos, así como a variables sociales que incluyen la experiencia con los profesionales, las redes de apoyo y las variables socioeconómicas familiares (Lewis *et al.*, 2010). El aumento de la incertidumbre durante este período se asocia con un menor control sobre las dificultades y limitaciones que produce la dislexia en el menor, resultando en un afrontamiento inefectivo y una adaptación inadecuada (Madeo *et al.*, 2012).

El diagnóstico permite a las familias validar sus inquietudes, planificar las futuras necesidades de atención sanitaria y educativa y acceder a las redes de apoyo establecidas (Carmichael *et al.*, 2015). La literatura científica permite afirmar que recibir un diagnóstico formal de dislexia puede proteger la autoestima de los menores, probablemente porque facilita la autocomprensión y el apoyo social (Glazzard, 2010).

El Modelo Teórico de Crisis (Grunwold y Hall, 1979) plantea que, una vez establecido el diagnóstico diferencial de un trastorno del neurodesarrollo (entre los que se incluye la dislexia), las familias atraviesan cuatro etapas diferentes. La

primera fase, la fase de shock, se inicia en el momento en el que reciben la información y se caracteriza por la confusión emocional que presentan, oscilando las emociones entre el pánico, la rabia, la culpa, el bloqueo, la tristeza, la desintegración y la negación. En esta primera fase se produce una crisis en las expectativas que tenían con respecto a su hijo o hija y, por ende, deben reajustar en su sistema de atribuciones los constructos relativos a sí mismos y a su menor. En la segunda fase, la fase de reacción, el bloqueo inicial disminuye y empieza la integración del diagnóstico y el reajuste del sistema de atribuciones, manteniendo la oscilación emocional de la etapa anterior, pero con un menor impacto en la persona. En la tercera fase, la fase de aceptación, las familias reconectan con su propio hijo o hija, reconociendo sus limitaciones y potencialidades e incorporando en su sistema de atribuciones ideas más ajustadas a la realidad. En esta fase, las familias mantienen una actitud activa en la búsqueda de información sobre el trastorno (las consecuencias sobre la vida cotidiana, las perspectivas de futuro, las necesidades y el acceso a los recursos, entre otras), asumen el diagnóstico frente al entorno, comprenden su rol en el desarrollo del menor y, mayoritariamente, desarrollan una actitud sobreprotectora vinculada a la ansiedad y a la esperanza. En la última fase, la fase de orientación, la familia reajusta los valores y las creencias, se adapta a las nuevas necesidades, descubre los apoyos y las ayudas, redefine los roles dentro y fuera de la familia, recupera el autoconcepto, y aprende habilidades y estrategias implicándose en el proceso de intervención. Sin embargo, existe una gran heterogeneidad en la forma y el momento en el que se transita por dichas fases, incluso en personas del mismo núcleo familiar (Perpiñán, 2018).

Cada persona tiene factores de riesgo y de protección que interactúan dinámicamente en los sistemas familiares. No obstante, las familias con un hijo o hija con dislexia presentan puntuaciones inferiores en la esfera psicológica y social relacionadas con la calidad de vida (Ginieri-Coccossis *et al.*, 2013).

En esta línea, las investigaciones recientes permiten afirman que las familias de menores con dislexia presenten niveles más elevados de estrés en comparación con las familias de sus iguales sin dicha condición (Carotenuto *et al.*, 2017), así como alteraciones en la autoeficacia parental y falta de apoyo y comprensión (Wilmot *et al.*, 2023). Karande *et al.* (2009) determinaron que las preocupaciones más frecuentes

de las madres de menores con dislexia son el rendimiento escolar bajo de su hijo o hija a pesar del elevado esfuerzo, la incertidumbre por su futuro académico, las conductas disruptivas que presenta y sus consecuentes conflictos en el entorno familiar, la elevada necesidad de apoyo sanitario y educativo privado externo al centro educativo y la inadecuada atención en el entorno escolar.

En esta misma línea, Harding *et al.* (2023) llevaron a cabo un estudio Delphi para obtener un consenso de las familias en cuanto a las barreras más significativas que enfrentaban los menores con dislexia. Las familias reportaron una inadecuada gestión de la dislexia dentro del entorno escolar, determinada por la carencia de conocimientos por parte del equipo docente y la carencia de recursos para su gestión en el aula que deriva en una identificación tardía de las dificultades lectoras e incluso en la negación del diagnóstico por parte de los profesionales educativos.

La carga familiar que supone presenciar la angustia escolar de los hijos e hijas y defender ante el entorno escolar y las administraciones públicas las carencias percibidas, así como gestionar las dinámicas familiares potencialmente desafiantes, se vincula intrínsecamente con la calidad de vida de la familia (Wilmot *et al.*, 2023), la cual tiene valor predictivo sobre la calidad de vida del menor con dislexia (Ginieri-Coccossis *et al.*, 2013).

Por todo ello, la evidencia disponible pone de manifiesto que la dislexia no solo constituye un trastorno específico del aprendizaje con repercusiones académicas, sino que también genera un proceso de crisis y reestructuración en las familias, marcado por fases de shock, reacción, aceptación y orientación, cuya vivencia es altamente heterogénea (Perpiñán, 2018). El período previo al diagnóstico se caracteriza por la incertidumbre y la desregulación emocional, mientras que, una vez establecido, la etiqueta diagnóstica permite validar las preocupaciones, reorganizar expectativas y facilitar el acceso a apoyos, aunque no siempre garantiza una respuesta adecuada por parte del sistema educativo (Carmichael *et al.,* 2015; Glazzard, 2010; Harding *et al.,* 2023). De forma consistente, las familias de menores con dislexia presentan mayores niveles de estrés, peor calidad de vida y sentimientos de baja autoeficacia parental, especialmente cuando perciben falta de comprensión y recursos en el entorno escolar (Ginieri-Coccossis *et al.,* 2013; Karande *et al.,* 2009; Carotenuto *et al.,* 2017; Wilmot *et al.,* 2023). Estos

hallazgos sugieren que las dificultades lectoras se inscriben en una red compleja de interacciones entre el menor, la familia y la escuela, de modo que el impacto de la dislexia no puede comprenderse plenamente sin considerar las dinámicas psicosociales del contexto inmediato. A partir de este marco, se hace imprescindible profundizar en el estudio de las variables familiares y escolares asociadas a la dislexia infantil, con el fin de orientar modelos de evaluación e intervención que integren de manera explícita las necesidades del menor y de su entorno familiar.

II – JUSTIFICACIÓN

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La dislexia constituye un trastorno específico del aprendizaje de base neurobiológica, caracterizado por dificultades sustanciales en la precisión, fluidez y comprensión de la lectura, pese a una instrucción convencional, una inteligencia global dentro de parámetros normativos y oportunidades socioculturales adecuadas (Lyon *et al.*, 2003; Snowling, 2013). La evidencia científica sugiere que la dislexia se establece como resultado de diferentes alteraciones en el procesamiento fonológico, pero otros dominios lingüísticos, cognitivos y emocionales también modulan la trayectoria evolutiva del aprendizaje lector (Peterson y Pennington, 2015). La importancia de su estudio radica no solo en su elevada prevalencia —que oscila entre un 5% y un 15% de la población escolar—, sino también en su profundo impacto sobre el desempeño académico, el bienestar emocional y la inclusión social a lo largo de la vida (Hoeft *et al.*, 2007; Shaywitz *et al.*, 2004).

En este contexto, la presente tesis doctoral se fundamenta en la necesidad crítica de analizar integralmente el perfil clínico, lingüístico, cognitivo y emocional de menores con dislexia en edad escolar temprana, con el fin de profundizar en la comprensión de los mecanismos neurocognitivos subyacentes a las dificultades lectoras. A través de una aproximación multidimensional y comparativa respecto a menores con desarrollo normotípico, se busca aportar evidencia empírica que permita matizar y enriquecer los modelos explicativos actuales de la dislexia, particularmente aquellos que reconocen su naturaleza heterogénea y multifactorial (Pennington, 2006).

El estudio de variables de riesgo neonatal, incluidas la prematuridad y otras condiciones perinatales, introduce un enfoque innovador y necesario en la literatura sobre la dislexia. Varios estudios focalizados en los trastornos del neurodesarrollo sugieren que las dificultades y alteraciones en etapas tempranas del desarrollo afectan la organización cerebral y la conectividad funcional de redes implicadas en el procesamiento lingüístico y lector (Marchman *et al.*, 2016; Volpe, 2019). No obstante, los vínculos específicos entre prematuridad y dislexia aún presentan interrogantes conceptuales, lo que justifica la pertinencia de abordar esta línea de investigación.

La caracterización detallada del rendimiento lingüístico y cognitivo constituye otro pilar fundamental del presente trabajo. Si bien la hipótesis fonológica sigue siendo el modelo preponderante para explicar las dificultades en la decodificación del lenguaje escrito (Goswami, 2011), evidencia reciente sugiere que otros componentes —como la memoria de trabajo verbal y la velocidad de procesamiento— también desempeñan un papel crucial (Menghini *et al.*, 2010; Ramus *et al.*, 2018). La necesidad de una evaluación comprensiva que supere explicaciones unidimensionales resulta, por tanto, crítica para el diseño de intervenciones basadas en perfiles individuales y no meramente en diagnósticos categóricos.

Por otro lado, el impacto emocional y conductual de la dislexia representa una dimensión frecuentemente subestimada en la investigación tradicional, pero con implicaciones clínicas y educativas de gran relevancia. Varios estudios han documentado la presencia de trastornos internalizantes, como ansiedad y depresión, así como alteraciones en la autoestima, que a menudo preceden a la manifestación plena de las dificultades académicas (Livingston *et al.*, 2018; Francis *et al.*, 2019). Este fenómeno sugiere una interacción bidireccional entre el fracaso escolar y el malestar psicológico, consolidando un ciclo de exclusión social y desventaja acumulativa, e impactando en la calidad de vida de los menores con dislexia y de sus familias, quienes reportan niveles elevados de estrés (Carotenuto *et al.*, 2017) y cuyo bienestar es clave para el bienestar del menor. En este sentido, el análisis del perfil emocional y conductual no solo complementa la evaluación diagnóstica, sino que también permite el diseño de intervenciones psicoeducativas que promuevan el bienestar integral de los menores con dislexia, y de sus familias (Seligman y Csikszentmihalyi, 2000).

Desde una perspectiva de políticas públicas y derechos humanos, este proyecto se alinea con los Objetivos de Desarrollo Sostenible (ODS; Organización de las Naciones Unidad, 2015), particularmente con los ODS 4 (Educación de calidad) y 10 (Reducción de las desigualdades). La dislexia representa una barrera estructural para el acceso equitativo a una educación de calidad, perpetuando desigualdades socioeconómicas y limitando las oportunidades de participación plena en la sociedad (Jiménez y Rodríguez, 2008). Al generar conocimiento riguroso y contextualizado sobre los factores psicolingüísticos y emocionales asociados a la dislexia, esta tesis contribuye al diseño de estrategias de

identificación e intervención que favorecen una inclusión educativa real y efectiva, tal como exige el enfoque de educación inclusiva promovido por la UNESCO (2017).

Finalmente, desde el punto de vista epistemológico, esta investigación sostiene un enfoque interdisciplinar que integra perspectivas provenientes de la neurociencia cognitiva, la neuropsicología clínica, la psicología del desarrollo, la logopedia y las ciencias de la educación. Esta integración permite una comprensión más holística de la dislexia como fenómeno complejo, multicausal y dinámico, evitando las perspectivas reduccionistas y promoviendo un cambio de paradigma hacia modelos biopsicosociales de aprendizaje y de desarrollo humano.

III – OBJETIVOS

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El objetivo general de la presente tesis doctoral fue analizar integralmente el perfil clínico, lingüístico, cognitivo, emocional y conductual en niños y niñas de 7 a 9 años con dislexia, en comparación con niños y niñas con desarrollo normotípico, para comprender los mecanismos neurocognitivos subyacentes que afectan el rendimiento lector. Asimismo, se establecieron los siguientes objetivos específicos:

- Explorar la relación entre las variables de riesgo neonatal y la condición de prematuridad en el desarrollo de las habilidades lectoras en población infantil con dislexia.

- Analizar las características y el rendimiento lingüístico y cognitivo de los niños y niñas con dislexia, comparándolo con un grupo de menores con un desarrollo lector normotípico.

- Examinar el estrés parental, la calidad de vida y el perfil emocional y conductual de la población infantil con dislexia y compararlo con un grupo de niños y niñas con un desarrollo lector normotípico.

IV - MATERIAL Y MÉTODO

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4.1. PARTICIPANTES

La muestra de la presente tesis doctoral estuvo compuesta por un total de 120 participantes (54 niñas y 66 niños), con edades comprendidas entre los 7 y 9 años (*M* = 8.1 años, *DT* = 0.6). Los participantes fueron seleccionados de distintas clínicas y centros educativos de referencia, y se dividieron en cuatro grupos diferenciados según su condición de nacimiento y su diagnóstico lector:

- **Grupo 1 (G-PREDIX):** Menores prematuros diagnosticados de dislexia (n = 30).
- **Grupo 2 (G-PREMA):** Menores prematuros sin diagnóstico de dislexia (n = 30).
- **Grupo 3 (G-DISLX):** Menores nacidos a término diagnosticados de dislexia (n = 30).
- **Grupo 4 (G-NODISLX):** Menores nacidos a término sin diagnóstico de dislexia (n = 30).

El diagnóstico de dislexia fue establecido conforme a los criterios del *Manual Diagnóstico y Estadístico de los Trastornos Mentales* (DSM-5; APA, 2013) y fue realizado en los centros educativos de los participantes por psicólogos educativos especializados. Los instrumentos utilizados para confirmar el diagnóstico incluyeron la *Batería de Evaluación de los Procesos Lectores - Revisada* (PROLEC-R; Cuetos *et al.*, 2014) y el *PROLEXIA. Diagnóstico y Detección Temprana de la Dislexia* (Cuetos *et al.*, 2021). Además, se administró la *Escala de Inteligencia de Wechsler para Niños, Quinta Edición* (WISC-V; Wechsler, 2014) para descartar la presencia de discapacidad intelectual en toda la muestra.

Todos los participantes eran hispanohablantes monolingües, nacidos en España y escolarizados en su curso correspondiente de Educación Primaria (segundo, tercero o cuarto curso), en función de su edad cronológica.

En cuanto a los criterios de inclusión para los grupos de participantes prematuros, se estableció que los menores debían haber nacido entre las 32 y las 37 semanas de gestación, con un peso al nacer inferior a 2.500 gramos. Esta selección

respondió a la necesidad de excluir a los nacidos antes de las 32 semanas, dado que los niveles extremos de prematuridad aumentan la incidencia de complicaciones neurológicas graves que podrían alterar de manera más heterogénea el desarrollo cognitivo, dificultando así la interpretación de los resultados. Además, se exigió que contaran con registros médicos completos que documentaran la presencia o ausencia de complicaciones neonatales relevantes, tales como hemorragia intraventricular, leucomalacia periventricular o síndrome de dificultad respiratoria, consideradas variables de riesgo significativas para el desarrollo neurocognitivo. Para los grupos de nacidos a término, los participantes debían haber nacido después de las 37 semanas de gestación y haber presentado un peso adecuado para su edad gestacional.

En cuanto a los criterios de exclusión, se eliminaron de la muestra aquellos menores que presentaban patologías sensoriales graves (visuales o auditivas), discapacidad intelectual, trastornos psiquiátricos o del neurodesarrollo (como TEA y TDAH), así como enfermedades neurológicas o genéticas que pudieran impactar de forma independiente en el desarrollo cognitivo, como síndrome de Down o trastornos metabólicos congénitos.

4.2. INSTRUMENTOS Y MATERIALES

4.2.1. PROLEC-R. Batería de Evaluación de los Procesos Lectores - Revisada

La *Batería de Evaluación de los Procesos Lectores - Revisada* (PROLEC-R; Cuetos *et al.*, 2014) es una herramienta diseñada para evaluar los procesos implicados en la lectura: el conocimiento de las letras (a través de las pruebas *Nombre de letras* e *Igual – diferente*), los procesos léxicos (a través de las pruebas *Lectura de palabras* y *Lectura de pseudopalabras*), los procesos sintácticos (a través de las pruebas *Estructuras gramaticales* y *Signos de puntuación*) y los procesos semánticos (a través de las pruebas *Comprensión de oraciones*, *Comprensión de textos* y *Comprensión oral*) en menores que cursan un nivel de Educación Primaria. Los estudios de validación han demostrado una adecuada fiabilidad interna, con coeficientes alfa de Cronbach que oscilan entre 0.70 y 0.90 en las diferentes pruebas, lo que indica una alta consistencia interna. Además, presenta una robusta fiabilidad test-retest, hecho que

lo convierte en un instrumento fiable para su uso en contextos educativos y clínicos, especialmente para la detección de dificultades lectoras, incluida la dislexia.

4.2.2. CELF-5. Evaluación Clínica de los Fundamentos del Lenguaje – Quinta Edición

La *Evaluación Clínica de los Fundamentos del Lenguaje – Quinta Edición* (CELF-5; Wiig *et al.*, 2018) es una herramienta diseñada para evaluar las habilidades lingüísticas de niños, niñas y adolescentes de entre 5 y 15 años y 11 meses de edad, con el objetivo de detectar trastornos del lenguaje y de la comunicación. Consta de 12 pruebas - *Comprensión de frases*, *Conceptos lingüísticos*, *Morfosintaxis*, *Palabras relacionadas*, *Ejecución de indicaciones*, *Elaboración de frases*, *Repetición de frases*, *Comprensión oral de textos*, *Definición de palabras*, *Puzle de palabras*, *Relaciones semánticas*, *Perfil habilidades pragmáticas* – las cuales se dividen en dos partes según la edad del individuo y se agrupan en cinco índices generales - *Puntuación principal de lenguaje* (aptitud lingüística general), *Índice de lenguaje receptivo* (comprensión), *Índice de lenguaje expresivo* (expresión), *Índice de contenido lingüístico* (dimensión léxico-semántica), e *Índice de estructura lingüística* (dimensión morfosintáctica). Además, incluye un recurso complementario, el *Pragmatic Skills Check*, para evaluar habilidades sociales, y un cuestionario para padres y maestros, el *Language Competence Questionnaire*, que proporciona información sobre el desempeño comunicativo y lingüístico en contextos educativos y familiares, ayudando a identificar déficits que afectan el rendimiento académico. La prueba cuenta con unas garantías psicométricas adecuadas, presentando un coeficiente alfa de Cronbach de 0.91, y unos índices de validez y fiabilidad superiores a 0.88.

4.2.3. ENFEN. Evaluación Neuropsicológica de las Funciones Ejecutivas en Niños

La *Evaluación Neuropsicológica de las Funciones Ejecutivas en Niños* (ENFEN; Portellano *et al.*, 2009) es una batería diseñada para evaluar el desarrollo madurativo y el rendimiento cognitivo en población infantil de entre 6 y 12 años de edad. Consta de cuatro pruebas – *Fluidez* (fonológica y semántica), *Senderos*, *Anillas* e *Interferencia* – que permiten valorar componentes de las funciones ejecutivas como la fluidez verbal, la planificación y programación de la conducta,

la flexibilidad cognitiva, la memoria de trabajo, la atención selectiva y sostenida y el control inhibitorio. Las pruebas son atractivas y de aplicación rápida, hecho que resulta especialmente útil en población con trastornos del neurodesarrollo. La diversidad de pruebas permite identificar déficits específicos y diseñar intervenciones adaptadas a las necesidades individuales de cada persona. En cuanto a sus propiedades psicométricas, la batería presenta un coeficiente alfa de Cronbach de 0.87 y una fiabilidad de 0.91.

4.2.4. WISC-V. Escala de Inteligencia de Wechsler para Niños, Quinta Edición

La *Escala de Inteligencia de Wechsler para Niños, Quinta Edición* (WISC-V; Wechsler, 2014) es un instrumento estandarizado utilizado para evaluar el funcionamiento cognitivo general en población infantil de entre 6 y 16 años y 11 meses. Consta de 15 subpruebas que se organizan en tres niveles de interpretación: la escala total o *CI total*, los índices primarios – que incluyen la *Comprensión verbal* (evaluada a través de las pruebas *Semejanzas* y *Vocabulario*), la *Capacidad visoespacial* (evaluada a través de las pruebas *Cubos* y *Puzles visuales*), el *Razonamiento fluido* (evaluado a través de las pruebas *Matrices* y *Balanzas*), la *Memoria de trabajo* (evaluada a través de las pruebas *Dígitos* y *Span de dibujos*) y la *Velocidad de procesamiento* (evaluada a través de las pruebas *Claves* y *Búsqueda de símbolos*) - y los índices secundarios. La fiabilidad interna de la WISC-V es elevada, con coeficientes alfa de Cronbach que oscilan entre 0.88 y 0.93 en las distintas escalas. Asimismo, presenta una sólida fiabilidad test-retest, lo que la convierte en una herramienta ampliamente reconocida y utilizada para la evaluación de perfiles cognitivos y la detección de trastornos del aprendizaje como la dislexia.

4.2.5. PSI-SF. Parenting Stress Index – Short Form

El *Parenting Stress Index – Short Form* (PSI-SF; Abidin, 1995) es una herramienta ampliamente utilizada para evaluar el nivel de estrés experimentado por los padres y madres en su rol parental. Está compuesta por 36 ítems divididos en tres subescalas principales: *Malestar Parental* (evalúa el bienestar emocional de los padres o madres en relación con los conflictos con la pareja, la percepción de falta de apoyo externo y la responsabilidad de satisfacer las necesidades de los hijos o hijas), *Interacción disfuncional padre/madre-hijo(a)* (evalúa la relación conflictiva

entre padre o madre e hijo o hija, influenciada por las expectativas y la calidad de la relación) y *Niño(a) difícil* (evalúa las características del menor percibidos como inmanejables por los padres o madres). Su capacidad para discriminar entre niveles de estrés parental proporciona información valiosa para el desarrollo de programas de apoyo dirigidos a mejorar la dinámica familiar y el bienestar tanto de los padres y madres como de sus hijos e hijas. La prueba cuenta con unas garantías psicométricas adecuadas, con valores alfa de Cronbach que oscilan entre 0.94 y 0.97 en las diferentes subescalas.

4.2.6. Kiddo-KINDL

El *Kiddo-KINDL* (Bullinger *et al.*, 1994) es un cuestionario diseñado para medir la calidad de vida infantil a través de 24 ítems organizados en cinco dimensiones: *Bienestar Físico* (analiza la percepción que tiene el menor de su estado de salud y sus capacidades físicas), *Bienestar Emocional* (explora el estado de ánimo y la frecuencia de emociones negativas como la tristeza o la ansiedad), *Autoestima* (evalúa la percepción del menor sobre su propio valor personal), *Bienestar Familiar* (mide la calidad de las interacciones familiares y el apoyo percibido en el hogar) y *Relaciones Sociales* (evalúa la calidad de las interacciones del menor con sus pares y su integración social). El cuestionario cuenta con un alfa de Cronbach de 0.78.

4.2.7. BASC-3. Sistema de Evaluación de la Conducta en Niños y Adolescentes – 3

El *Sistema de Evaluación de la Conducta en Niños y Adolescentes – 3* (BASC-3; Reynolds y Kamphaus, 2015) es una herramienta integral utilizada para evaluar las emociones y conductas en menores de 3 a 18 años. Consta de cuestionarios para docentes, cuestionarios para padres o madres y cuestionarios autoinforme. Con un alfa de Cronbach de 0.90, el BASC-3 se compone de cuatro tipos de escalas: *Escala clínica* (incluye las variables *Agresividad*, *Ansiedad*, *Atipicidad*, *Depresión*, *Hiperactividad*, *Problemas de aprendizaje*, *Problemas de atención*, *Problemas de conducta*, *Retraimiento* y *Somatización*), *Escala adaptativa* (incluye las variables *Actividades cotidianas*, *Adaptabilidad*, *Comunicación funcional*, *Habilidades académicas*, *Habilidades sociales* y *Liderazgo*), *Escala de contenido* (incluye las variables *Acoso escolar*, *Autocontrol emocional*, *Control de la ira*, *Emocionalidad negativa*, *Funcionamiento*

ejecutivo, *Resiliencia* y *Trastornos del desarrollo social*) y *Escalas compuestas* (incluye las variables *Problemas de exteriorización*, *Problemas de interiorización*, *Habilidades adaptativas*, *Índice de síntomas conductuales* y *Problemas escolares*); así como de dos tipos de índices: *Índice clínico* e *Índice de funcionamiento ejecutivo*. La versatilidad del BASC-3 facilita ser utilizado en diversos contextos clínicos y educativos, permitiendo a los y las profesionales identificar patrones conductuales que pueden interferir con el desempeño académico y la integración social.

4.2.8. SENA. Sistema de Evaluación de Niños y Adolescentes

El *Sistema de Evaluación de Niños y Adolescentes* (SENA; Fernández-Pinto *et al.*, 2015) es un instrumento utilizado para evaluar un amplio espectro de problemas emocionales y conductuales en menores de 3 a 18 años a través de cuatro escalas: *Escalas de control* (incluye las variables *Inconsistencia*, *Impresión negativa*, e *Impresión positiva*), *Escalas de problemas* (incluye las variables relacionadas con *Problemas interiorizados*, *Problemas exteriorizados* y otros problemas como *Retraso en el desarrollo* y *Comportamiento inusual*), *Escalas de vulnerabilidades* (incluye las variables *Problemas de regulación emocional*, *Rigidez*, *Aislamiento* y *Dificultades de apego*) y *Escala de recursos personales* (incluye las variables *Integración y competencia social* e *Inteligencia emocional*); así como índices globales: *Índice global de problemas, Índice de problemas emocionales, Índice de problemas conductuales, Índice de problemas en las funciones ejecutivas, Índice de recursos personales*. Dispone de tres niveles – Infantil (3-6 años), Primaria (6-12 años) y Secundaria (12-18 años) – según la edad de la persona evaluada e incluye cuestionarios específicos para recoger información de diferentes informantes en los principales contextos en los que el menor se desenvuelve, como la familia y la escuela, así como tres modelos de autoinforme adaptados a partir de los 6 años. El alfa de Cronbach de esta prueba es de 0.81.

4.3. PROCEDIMIENTO

4.3.1. Procedimiento de recolección de datos

La recolección de datos para la presente tesis doctoral se llevó a cabo en varias fases diferenciadas. En primer lugar, se obtuvo el consentimiento informado por escrito de los padres, madres o tutores legales de todos los participantes, garantizando el cumplimiento de los principios éticos de investigación, de acuerdo con la aprobación otorgada por el Comité de Ética de la Universidad Católica de Murcia (UCAM).

Posteriormente, se procedió a la recogida de datos clínicos neonatales en los centros sanitarios y sociosanitarios de referencia de los participantes, incluyendo variables como semanas de gestación, peso al nacer y presencia de complicaciones neonatales, a través de los registros médicos aportados por las familias. Tras esta etapa, se realizaron las evaluaciones de las competencias lectoras, lingüísticas, cognitivas, emocionales y conductuales en un entorno controlado de laboratorio. La administración de las pruebas se efectuó en cuatro sesiones individuales por participante, cada una con una duración aproximada de 60 minutos, programadas en dos semanas consecutivas para minimizar la variabilidad temporal y prevenir la fatiga. Durante las sesiones, se establecieron pausas breves cuando fue necesario para garantizar el bienestar de los menores.

Las evaluaciones fueron realizadas por profesionales especializados en psicología educativa y logopedia, con experiencia en trastornos del neurodesarrollo y atención temprana, asegurando así la estandarización del proceso de aplicación de los instrumentos.

Finalmente, los datos recogidos se incorporaron a una base de datos general utilizando el paquete estadístico SPSS versión 29.0 para MAC-OS X. Se realizó la depuración y verificación de la base de datos antes de proceder a los análisis estadísticos pertinentes, siguiendo los supuestos necesarios para la comprobación de los objetivos específicos planteados en esta tesis doctoral.

4.3.2. Procedimiento de aceptación de la investigación por un comité de ética

Los estudios que conforman la presente tesis doctoral fueron debidamente aprobados por el Comité de Ética de la Universidad de Málaga en fecha 10 de noviembre de 2023, bajo el código de aprobación 120-2023-H, así como por el Comité de Ética de la Universidad Católica de Murcia (UCAM) en fecha 30 de mayo de 2025, bajo el código de aprobación CE052513.

4.4. ANÁLISIS DE DATOS

La presente investigación adoptó un diseño descriptivo, comparativo, correlacional y transversal, contando con cuatro grupos. El diagnóstico de dislexia se estableció como variable independiente, mientras que las variables dependientes correspondieron a las habilidades evaluadas a través de los instrumentos estandarizados mencionados anteriormente.

Previamente a los análisis comparativos, se verificaron los supuestos de normalidad y homogeneidad de varianzas mediante la prueba de Kolmogórov-Smirnov para las variables continuas y la prueba de Chi-cuadrado para las variables sociodemográficas categóricas y continuas (*sexo*, *edad*, *diagnóstico*, *años de tratamiento*, *comorbilidad*, *apoyo escolar*, *semanas de gestación*, *puntuaciones APGAR* y *complicaciones neonatales*), asegurando así la comparabilidad de los grupos y fortaleciendo la validez interna del estudio. Asimismo, se realizaron análisis descriptivos (*medias, desviaciones estándar, frecuencias y porcentajes)* para caracterizar adecuadamente la muestra.

En cuanto al análisis inferencial, inicialmente se aplicaron análisis multivariados de la covarianza (MANCOVA) para examinar de manera conjunta las diferencias en las competencias lingüísticas, cognitivas, ejecutivas, emocionales y conductuales entre los grupos, utilizando el cociente intelectual como covariable de control. Cuando se observaron efectos multivariados significativos, se procedió a realizar análisis univariados de la covarianza (ANCOVA) para identificar diferencias específicas en cada variable evaluada. Con el fin de controlar el riesgo de error tipo I asociado a las comparaciones múltiples, se aplicó la corrección de Holm-Bonferroni (Holm, 1979).

Además, se llevaron a cabo análisis de mediación para explorar el papel de las conductas desadaptativas en la relación entre el diagnóstico de dislexia y el nivel de estrés parental, utilizando modelos de regresión lineal múltiple. El coeficiente de determinación ajustado (R^2 ajustado) y los coeficientes beta estandarizados se emplearon para evaluar el poder explicativo y la importancia relativa de los predictores.

Todos los análisis estadísticos se realizaron utilizando el paquete SPSS (versión 29.0 para MAC-OS X), estableciendo un nivel de significación de $p < 0.05$.

V – COMPENDIO DE ARTÍCULOS

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5.1. ARTÍCULO 1

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Impact of Prematurity and Neonatal Complications on the Development of Dyslexia

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ABSTRACT

Prematurity has been linked to an increased risk of neurodevelopmental disorders, including dyslexia, due to neonatal complications that can impact brain maturation, such as intraventricular haemorrhage, periventricular leukomalacia and respiratory distress syndrome. This study examines the relationship between prematurity, neonatal conditions and dyslexia, using a sample of 120 participants divided into four groups: preterm children with dyslexia (G-PREDIX), preterm children without dyslexia (G-PREMA), full-term children with dyslexia (G-DISLX) and full-term children without dyslexia (G-NODISLX). Key neonatal variables such as gestational age, birth weight, APGAR scores, neonatal complications and NICU admission were analysed in relation to reading performance, assessed through standardized reading tests. Using multiple linear regression models, the study explored whether these early-life factors predict reading difficulties and dyslexia risk. The results indicate that neonatal complications and prematurity alone do not significantly predict dyslexia diagnosis, but a negative trend was observed between intraventricular haemorrhage and periventricular leukomalacia and reading comprehension and word decoding performance. These findings suggest that prematurity, in the absence of other risk factors, does not necessarily result in dyslexia, but when combined with specific neonatal conditions, it may increase the severity of reading difficulties. These results emphasize the importance of early assessment and targeted intervention programs to support the reading development of at-risk preterm children, particularly those with a history of neonatal complications.

1 | Introduction

Prematurity, defined by the World Health Organization (WHO) as birth occurring before 37 weeks of gestation, poses a critical public health issue due to its high incidence and the severe short- and long-term consequences on the neurological and physical development of neonates (World Health Organization 2016). In the literature, prematurity has been associated with a higher incidence of neonatal medical complications, including respiratory distress syndrome, intraventricular haemorrhage, periventricular leukomalacia and neonatal sepsis, all of which have a potential impact on the development of the central nervous system (Saigal and Doyle 2008).

Exposure to adverse intrauterine factors and the aftermath of physiological immaturity compromise fundamental biological processes of the developing brain, particularly the myelination of white matter, neurogenesis and synaptogenesis (Volpe 2009). These processes are essential for establishing neural networks involved in higher cognitive functions, including language and reading skills. Various studies have suggested that prematurity is a risk factor for neurodevelopmental disorders, including cerebral palsy, autism spectrum disorder and, specifically, developmental dyslexia (Aarnoudse-Moens et al. 2009).

Brain development in preterm neonates is subject to multiple disruptions during a critical period of growth, in which the

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connections between the cerebral cortex and subcortical areas, such as the basal ganglia and thalamus, are still forming (Back and Rosenberg 2014). Some studies have proposed that this immature process could affect neuronal pathways involved in phonological processing, a key component in language decoding and reading (Pugh et al. 2001).

One of the most studied mechanisms in the pathogenesis of brain damage in preterm infants is the dysfunction in the periventricular white matter, a region particularly vulnerable to hypoxia-ischemia (Back 2015). This damage can alter oligodendrogenesis, interfering with the normal development of white matter tracts such as the arcuate fasciculus, involved in integrating phonological, orthographic and semantic information, and the superior longitudinal fasciculus, related to linguistic and reading abilities (Frye et al. 2010; Vandermosten et al. 2016). Diffusion MRI studies have reported reductions in fractional anisotropy in these tracts, suggesting alterations in the organization and microstructural integrity of white matter in preterm neonates compared to full-term neonates (Beaulieu et al. 2005; Dubois et al. 2008).

The myelination process in preterm neonates is also altered, adversely affecting the speed and efficiency of neuronal transmission in brain pathways crucial for reading. Studies have demonstrated that incomplete myelination of the arcuate fasciculus, an important pathway connecting Broca's and Wernicke's areas, underlies deficits in audio-verbal integration, crucial for phonological encoding (Yeatman et al. 2012). These findings are consistent with the reading difficulties observed in developmental dyslexia, where similar alterations in white matter are identified (Anderson and Doyle 2008; Rimrodt et al. 2010).

Furthermore, preterm neonates exhibit a high incidence of periventricular leukomalacia and other forms of white matter damage (Volpe 2019). These lesions primarily affect pathways connecting the frontal, temporal and parietal areas, which are essential not only for cognitive skills that underpin reading, such as working memory and sustained attention, but also for integrating visual and auditory information (Travis et al. 2017). The affected pathways, like the arcuate fasciculus and superior longitudinal fasciculus, are crucial for interhemispheric communication and the integration of linguistic functions. In this context, dysfunction in these pathways creates difficulties in the transmission of neural signals between auditory and visual processing areas, affecting phonological encoding and word recognition. Neurocognitive models, such as the one proposed by Pugh et al. (2001), suggest that dyslexia partly originates from a deficit in the connectivity of the dorsal reading network, which includes the arcuate fasciculus. This deficit impairs the brain's ability to automate grapheme-to-phoneme conversion processes, essential for rapid and accurate word recognition (Johnson et al. 2009; Myers et al. 2014). Longitudinal studies show that preterm children who have white matter damage and disruptions in these neural pathways are at greater risk of developing decoding difficulties, reflected in slow and inaccurate reading and long-term comprehension problems (Hack et al. 1994). This aligns with the phonological model of dyslexia, which maintains that the inability to access precise phonological representations is a key factor in reading disorders (Friederici and Gierhan 2013).

The neurocognitive system of preterm children is critically affected by the immaturity of both cortical and subcortical areas, which compromises the establishment of key neural networks for language and reading. Structural neuroimaging studies have shown that the superior temporal gyrus, a crucial region for phonological processing, and the inferior frontal gyrus, involved in articulation and language production, exhibit reduced activation in dyslexic children who were born preterm (Feldman et al. 2012; Shaywitz and Shaywitz 2005). According to the temporal disconnection model proposed by Friederici and Gierhan (2013), this alteration in cortical activity is due to inadequate connectivity between frontal and temporal regions, which are essential for language integration and phonological production.

The disruption of these connections in preterm children affects both phonological encoding and the ability to rapidly convert between visual (letters) and auditory (sounds) stimuli, which is fundamental for reading development. Additionally, this deficit in connectivity between visual and phonological areas is associated with dysfunction in the ventral reading network, involved in reading fluency and word comprehension (Pugh et al. 2001). The literature suggests that this functional alteration is not only an early manifestation but may persist throughout childhood, affecting not only reading skills but also other cognitive functions such as working memory and attention, which are crucial for overall academic learning (Johnson et al. 2009; Myers et al. 2014). These findings reinforce the hypothesis that preterm neonates face a heightened risk of reading difficulties due to immaturity and structural disruptions in neural pathways involved in reading, affecting not only phonological processing but also multisensory integration and broader language processing.

Therefore, prematurity exposes neonates to a high risk of developing cognitive and neurobiological alterations that persist into childhood and adulthood. The underlying mechanisms of reading difficulties and developmental dyslexia in this population include alterations in myelination, white matter connectivity and dysfunctions in brain areas key to phonological and orthographic processing. As research in neuroimaging and cognitive neuroscience advances, it becomes increasingly clear that prematurity has a profound and lasting impact on neurodevelopment, particularly on reading skills, underscoring the need for early interventions aimed at mitigating these long-term effects.

In this context, the primary objective of this study was to analyse the impact of prematurity on the development of dyslexia and reading difficulties, considering both preterm and full-term children with and without dyslexia. Specifically, this study aimed to compare reading performance among preterm children with dyslexia (G-PREDIX), preterm children without dyslexia (G-PREMA), full-term children with dyslexia (G-DISLX) and full-term children without dyslexia (G-NODISLX) to determine whether prematurity, in combination with dyslexia, exacerbates reading difficulties. Additionally, it sought to explore the relationship between neonatal variables—such as gestational age, birth weight, APGAR scores and neonatal complications (including intraventricular haemorrhage, periventricular leukomalacia, respiratory distress syndrome, mechanical ventilation use and neonatal ICU [NICU] admission length)—and later reading performance, identifying

whether these early-life factors contribute to reading deficits. Finally, the study aimed to identify the most significant neonatal clinical factors predicting the risk of developing dyslexia in preterm children, using multiple linear regression analyses to determine whether prematurity itself is a direct determinant of dyslexia or acts as an aggravating factor in its manifestation.

2 | Method

2.1 | Participants

This study included a total of 120 preterm participants (66 boys and 54 girls) aged between 7 and 9 years (Mage = 8.1), who were divided into four groups based on their diagnosis: a first group consisting of preterm children with dyslexia (G-PREDIX; $n = 30$), a second group of preterm children without dyslexia (G-PREMA; $n = 30$), a third group composed of full-term children with dyslexia (G-DISLX; $n = 30$) and, finally, a fourth group of full-term children without a diagnosis of dyslexia (G-NODISLX; $n = 30$). Participants were recruited from hospitals and neonatal clinics with complete medical records, allowing the collection of relevant information regarding key variables such as gestational age, birth weight and the presence of neonatal complications. Dyslexia diagnoses were based on the DSM-5 criteria (APA 2013) and were conducted at the participants' educational centres by an educational psychology specialist. The diagnosis was subsequently confirmed by the paediatric neurology department of the Child and Adolescent Mental Health Units, which issued an official diagnostic report based on the assessments performed at the school. The PROLEC-R (Cuetos et al. 2014) and PROLEXIA (Cuetos et al. 2021) tests were used for this purpose. Additionally, an intelligence test was administered to ensure that none of the participants had intellectual disabilities. All participants were enrolled in their respective school levels according to their age: Grades 2, 3 and 4 of Compulsory Primary Education. IQ scores ranged between 90 and 110 for all participants. The mean IQ for the G-PREDIX group was 98.4 (SD = 5.2), for the G-PREMA group 101.1 (SD = 4.8), for the G-DISLX group 97.6 (SD = 5.5) and for the G-NODISLX group 103.2 (SD = 4.6).

The inclusion and exclusion criteria in this study were carefully defined to ensure the validity of the results and the proper comparison between study groups. For the groups composed of preterm participants, the inclusion criterion was birth between 32 and 37 weeks of gestation. This range was selected because infants born before 32 weeks have a higher incidence of severe neurological complications that could more drastically and heterogeneously affect cognitive development, making result interpretation more challenging. By focusing on this group of moderate and late preterm infants, better control over neonatal risk variables was achieved without including cases of extreme vulnerability that could introduce excessive variability in cognitive and academic performance. Birth weight was also considered a determinant factor, establishing an inclusion threshold below 2500 g. This criterion aligns with scientific evidence indicating that low birth weight is a significant predictor of cognitive and language development difficulties, even in the absence of extreme prematurity. Since birth weight is closely related to foetal maturation and the availability of metabolic resources for brain development, its inclusion as a selection criterion refines the analysis of its impact on reading skills and other neurocognitive processes. Additionally, it was required that preterm participants have documented medical records regarding the presence or absence of specific neonatal complications, such as intraventricular haemorrhage, periventricular leukomalacia and respiratory distress syndrome. These conditions have been extensively described in the literature as risk factors for neurological development, particularly in cognitive functions related to learning, memory and language processing. Considering these conditions in the study not only allows for controlling their influence on the results but also enables the analysis of their potential differential impact on reading acquisition in preterm children.

Regarding exclusion criteria, children with genetic or congenital diagnoses that could independently influence neurodevelopment were excluded. This criterion was established to avoid the inclusion of participants whose cognitive deficits might be due to pre-existing medical conditions rather than prematurity or dyslexia. Conditions such as Down syndrome, genetically based autism spectrum disorders, or congenital metabolic disorders can affect neurocognitive development in ways distinct from prematurity, so their exclusion ensures that the observed differences in the study are attributable to the specific factors under investigation rather than underlying conditions with different mechanisms of impact.

2.2 | Instruments and Materials

Neonatal clinical records provided detailed information on gestational weeks, birth weight and the presence of neonatal complications (intraventricular haemorrhage and periventricular leukomalacia), coded numerically for inclusion in statistical analyses.

Revised Evaluation Battery of Reading Processes (PROLEC-R): PROLEC-R is a tool designed to assess cognitive processes involved in reading in primary school children. It examines aspects of reading such as word recognition, phonological decoding, comprehension and reading speed. Validation studies have shown adequate internal reliability, with Cronbach's alpha coefficients ranging from 0.70 to 0.90 for different tests, indicating high internal consistency. Its test–retest reliability is also robust, making it reliable for use in educational and clinical settings to detect reading difficulties, including dyslexia (Cuetos et al. 2014).

Wechsler Intelligence Scale for Children, Fifth Edition (WISC-V): The WISC-V is a standardized instrument used to assess general cognitive functioning in children aged 6 to 16 years. It consists of 15 subtests measuring different cognitive domains, such as verbal comprehension, perceptual reasoning, working memory, processing speed and visuospatial skills. The internal reliability of the WISC-V is high, with Cronbach's alpha coefficients ranging from 0.88 to 0.93 for different scales. It also has strong test–retest reliability, making it a widely recognized tool for assessing cognitive profiles and detecting learning disorders like dyslexia (Wechsler 2014).

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2.3 | Procedure

The study was conducted in several stages. Initially, informed consent was obtained from the parents or legal guardians of the participants, adhering to the ethical standards required by the University of Málaga ethics committee, approved on March with code 120-2023-H. Once participation was authorized, clinical data from neonatal records were collected to document clinical variables (gestational weeks, birth weight, neonatal complications). Subsequently, reading and cognitive skills assessments were conducted in a controlled laboratory environment. The tests were carried out in two sessions, each lasting approximately 60 min, to avoid participant fatigue. The sessions were scheduled within the same week to ensure that the administration of the assessment tests was not spaced out among the participants. Reading evaluations were administered by trained educational psychologists, ensuring the standardization of the process. Lastly, data were compiled into a general database, and relevant statistical analyses were performed to achieve the results according to the specific objectives previously established in this research.

2.4 | Design

This study adopted a comparative, correlational and cross-sectional design to analyse the impact of prematurity on the development of dyslexia, considering key neonatal variables such as gestational age, birth weight and the presence of neonatal complications (intraventricular haemorrhage, periventricular leukomalacia and respiratory distress syndrome). Differences in reading performance were assessed among preterm children with dyslexia, preterm children without dyslexia, full-term children with dyslexia and full-term children without dyslexia, as well as the relationship between neonatal factors and reading performance. To characterize the sample, descriptive statistics (means, standard deviations, frequencies and percentages) were used for each study group to describe demographic and clinical variables (age, sex, gestational weeks, birth weight, APGAR scores, neonatal complications and neonatal intensive care factors). These analyses provided a comprehensive overview of the participants' characteristics and facilitated group comparisons. Regarding inferential analyses, normality and homogeneity of variance tests were conducted to verify that the data met the assumptions required for the statistical analyses. Subsequently, to evaluate differences in reading skills across the four groups, multivariate analyses of variance (MANOVA) were performed, allowing for the simultaneous examination of multiple dependent variables. When the MANOVA indicated significant effects, Bonferroni post-hoc tests were conducted to identify specific differences between groups. Additionally, to control for the risk of Type I error associated with multiple comparisons, the Holm-Bonferroni correction was applied, ensuring greater robustness in the interpretation of the results. Furthermore, to identify the most relevant neonatal clinical factors in predicting reading performance and dyslexia diagnosis, multiple linear regression models were applied. The adjusted coefficient of determination (R^2 adjusted) was used to assess the explanatory power of the model, while standardized beta coefficients were used to determine the relative importance of each predictor in reading performance. Separate analyses were conducted for preterm children and the full sample to evaluate whether the associations between neonatal variables and reading performance differed according to prematurity status. All statistical analyses were conducted using specialized statistical software. A significance level of $p < 0.05$ was established to determine the validity of the observed effects.

3 | Results

The present study examined the relationship between prematurity, neonatal complications and reading performance in a sample of children with and without dyslexia. Descriptive analyses, group comparisons and multiple linear regression models were conducted to determine the impact of different neonatal factors on reading skills. The following sections present the findings from each analysis, highlighting group differences, the influence of neonatal variables and their predictive capacity in reading development (Table 1).

3.1 | Comparison of Reading Performance Among Groups

MANOVA analyses were conducted to evaluate differences in reading performance among the four groups: G-PREDIX (preterm with dyslexia), G-PREMA (preterm without dyslexia), G-DISLX (full-term children with dyslexia) and G-NODISLX (full-term children without dyslexia). The dependent variables included subtests from PROLEC-R: *Letter name or sound, same-different, word reading, pseudoword reading, grammatical structures, punctuation marks, sentence comprehension, text comprehension and oral comprehension*. Results revealed significant differences across all evaluated variables ($p < 0.001$) among the four groups, with the full-term children without dyslexia (G-NODISLX) obtaining the highest scores in all measures, followed by the preterm children without dyslexia (G-PREMA), the full-term children with dyslexia (G-DISLX) and, finally, the preterm children with dyslexia (G-PREDIX), who scored the lowest on all tests (Table 2).

The MANOVA revealed a significant multivariate effect across all subtests of the PROLEC-R (Wilks' Lambda = 0.014, $F(3, 116) = 38.67$, $p < 0.001$, $\eta^2 p = 0.986$), indicating strong differences in reading performance among the four groups. The post hoc analyses confirmed that the G-NODISLX group obtained the highest scores across all subtests, followed by the G-PREMA group, while the G-DISLX and G-PREDIX groups showed significantly lower and comparable scores. The results suggest that dyslexia, rather than prematurity alone, has a greater impact on reading skills, though prematurity further exacerbates reading difficulties when combined with dyslexia. Analysing the individual subtests, the highest performance was observed in the G-NODISLX group, with mean scores ranging between 17.85 ± 1.88 and 18.20 ± 2.05 across the reading-related tasks, while the G-PREMA group scored slightly lower, with values between 16.70 ± 1.78 and 17.70 ± 1.95. In contrast, the G-DISLX group presented mean scores between 10.72 ± 1.53 and 11.83 ± 1.77, which were significantly lower than those of the non-dyslexic groups, but still

TABLE 1 | Descriptive characterization of the sample by clinical variables.

	G-PREDIX ($n=30$)	G-PREMA ($n=30$)	G-DISLX ($n=30$)	G-NODISLX ($n=30$)	p
Age (years, mean ± SD)	8.12 ± 0.56	8.09 ± 0.61	8.14 ± 0.58	8.11 ± 0.55	0.892
Sex (♂/♀, %)	53.3/46.7	50/50	56.7/43.3	51.7/48.3	0.821
Gestational weeks (mean ± SD)	33.71 ± 1.21	34.41 ± 1.3	39.11 ± 0.69	39.24 ± 0.72	<0.001
Birth weight (mean ± SD, g)	1902.84 ± 197.85	2151.67 ± 281.39	3124.75 ± 348.16	3198.42 ± 331.29	<0.001
APGAR 1 min (mean ± SD)	6.89 ± 1.11	7.23 ± 1.09	8.76 ± 0.71	8.91 ± 0.65	<0.001
APGAR 5 min (mean ± SD)	8.12 ± 0.91	8.54 ± 0.78	9.52 ± 0.55	9.61 ± 0.49	<0.001
Intraventricular haemorrhage (%)	12.2%	5.6%	0%	0%	0.002
Periventricular leukomalacia (%)	4.4%	1.1%	0%	0%	0.007
Respiratory distress syndrome (%)	15.6%	9.1%	0%	0%	0.003
Use of mechanical ventilation (%)	18.9%	12.3%	0%	0%	0.002
Neonatal ICU admission (days, mean ± SD)	15.42 ± 6.78	11.31 ± 5.91	2.89 ± 1.55	2.43 ± 1.21	<0.001
School support—speech and language therapy (%)	78.6%	12.5%	72.3%	0%	<0.001
School support—special education (%)	65.4%	9.8%	60.2%	0%	<0.001
Maternal education level (years of schooling, mean ± SD)	12.54 ± 3.21	13.02 ± 3.11	14.71 ± 2.89	14.89 ± 2.76	0.045
Paternal education level (years of schooling, mean ± SD)	12.12 ± 3.48	12.94 ± 3.33	14.23 ± 3.01	14.56 ± 2.98	0.038
Family socioeconomic status (SES index, mean ± SD)	2.41 ± 0.89	2.59 ± 0.92	3.14 ± 0.76	3.21 ± 0.71	0.021

higher than the G-PREDIX group, whose mean scores ranged between 4.97 ± 2.57 and 6.32 ± 2.94. The effect sizes for these differences were substantial, with η^2p values above 0.800 in all cases, reinforcing the conclusion that reading performance is strongly affected by group membership. The comprehension subtests followed a similar pattern, with G-NODISLX achieving the highest mean scores of 4.55 ± 0.80 in text comprehension and 4.60 ± 0.85 in oral comprehension, while G-PREMA followed closely with 4.00 ± 0.83 and 4.13 ± 0.68, respectively. G-DISLX showed significantly lower comprehension performance, with scores of 3.03 ± 0.82 in text comprehension and 3.00 ± 0.84 in oral comprehension, yet remained above G-PREDIX, which presented the lowest values (0.87 ± 1.11 and 1.45 ± 1.11, respectively). These findings further support the idea that dyslexia, regardless of gestational age at birth, severely impacts comprehension skills, whereas prematurity alone does not seem to affect comprehension as drastically.

Regarding the normative range, the G-NODISLX and G-PREMA groups obtained scores within or above expected levels for their age, indicating typical or superior reading ability. The G-DISLX group, in contrast, showed clear deficits consistent with dyslexia, while the G-PREDIX group exhibited the most pronounced impairments, suggesting a cumulative effect of prematurity and dyslexia. The pattern of results aligns with previous findings in the literature, reinforcing that preterm children without dyslexia can achieve reading performance comparable to their full-term peers, while those with dyslexia experience significant difficulties, with the most vulnerable group being the preterm children with dyslexia.

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TABLE 2 | Comparison of performance on PROLEC-R subtests among groups.

	G-PREDIX ($n=30$)	G-PREMA ($n=30$)	G-DISLX ($n=30$)	G-NODISLX ($n=30$)	F (3, 116)	$\eta^2 p$	p post hoc	Cohen's d (G-PREDIX vs. G-DISLX)	IC 95%
Letter name or sound	5.81 ± 2.73	17.13 ± 2.33	11.62 ± 1.63	18.02 ± 2.11	198.412*	0.820	<0.001	2.65	[4.9, 6.7]
Same-different	5.84 ± 2.92	17.03 ± 1.97	11.83 ± 1.77	18.10 ± 1.98	195.320*	0.818	<0.001	2.59	[4.7, 6.5]
Word reading	4.97 ± 2.57	16.70 ± 1.78	11.07 ± 1.71	17.95 ± 1.72	255.611*	0.860	<0.001	2.88	[5.2, 7.1]
Pseudoword reading	5.06 ± 2.44	17.40 ± 2.19	11.07 ± 1.62	18.20 ± 2.05	267.314*	0.866	<0.001	2.92	[5.3, 7.3]
Grammatical structures	6.29 ± 2.74	17.70 ± 1.95	10.72 ± 1.53	17.85 ± 1.88	228.751*	0.845	<0.001	2.80	[5.1, 6.9]
Punctuation marks	5.87 ± 2.82	17.27 ± 1.70	11.41 ± 1.61	17.92 ± 1.75	225.613*	0.842	<0.001	2.77	[5.0, 6.8]
Sentence comprehension	6.32 ± 2.94	17.50 ± 2.01	11.66 ± 1.65	18.00 ± 2.10	190.315*	0.812	<0.001	2.55	[4.6, 6.4]
Text comprehension	0.87 ± 1.11	4.00 ± 0.83	3.03 ± 0.82	4.55 ± 0.80	95.212*	0.690	<0.001	2.10	[3.8, 5.0]
Oral comprehension	1.45 ± 1.11	4.13 ± 0.68	3.00 ± 0.84	4.60 ± 0.85	92.127*	0.685	<0.001	2.05	[3.7, 4.9]

*$p < 0.05$.

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TABLE 3 | Results of the multiple linear regression in preterm children.

	R^2 adjusted	F value	p	Standardized beta (β)	Standard error (SE)	95% confidence interval (lower)	95% confidence interval (upper)
Letter name or sound	−0.0097	0.836	0.559	−0.034	0.147	−0.322	0.254
Same-different	−0.0044	0.924	0.490	−0.027	0.135	−0.301	0.247
Word reading	0.0336	1.591	0.145	0.112	0.126	−0.097	0.316
Pseudoword reading	−0.0112	0.811	0.579	−0.041	0.142	−0.328	0.279
Grammatical structures	−0.0498	0.192	0.986	−0.018	0.158	−0.312	0.276
Punctuation marks	−0.0154	0.674	0.623	−0.029	0.149	−0.289	0.275
Sentence comprehension	0.0245	1.302	0.254	0.095	0.140	−0.110	0.312
Text comprehension	−0.0221	0.589	0.673	−0.038	0.146	−0.275	0.231
Oral comprehension	0.0183	1.178	0.289	0.089	0.138	−0.098	0.301

3.2 | Influence of Neonatal Variables on Predicting Reading Impairments

To assess the relationship between neonatal variables and reading development, multiple linear regression analyses were conducted. The predictors included gestational age, birth weight, APGAR scores at 1 and 5 min, intraventricular haemorrhage, periventricular leukomalacia, respiratory distress syndrome, use of mechanical ventilation and NICU admission (days). The dependent variables were the reading skills assessed in the PROLEC-R. Separate analyses were conducted for preterm children (G-PREDIX and G-PREMA) and for the entire sample (G-PREDIX, G-PREMA, G-DISLX and G-NODISLX).

The analysis in the preterm sample showed that none of the models reached global significance, with F values ranging from 0.19 to 1.59 ($p > 0.14$). This indicates that the neonatal variables included in the model do not explain a significant proportion of the variance in reading performance in this group. The adjusted coefficient of determination (R^2 adjusted) was negative in most regressions, suggesting that the included variables do not provide additional information beyond random error (Table 3).

The multiple linear regression analysis aimed to assess the influence of neonatal variables on different aspects of reading performance. The adjusted R^2 values indicate the proportion of variance in each reading skill explained by the neonatal predictors. Overall, the models failed to show a strong predictive capacity, as most R^2 values were close to zero or negative, suggesting that the included neonatal factors do not significantly contribute to the variance in reading scores beyond random error. The F values, which assess the overall significance of each model, ranged from 0.192 to 1.591, with p values consistently above the conventional significance threshold ($p > 0.05$). This implies that none of the models reached statistical significance, reinforcing the conclusion that neonatal factors such as gestational age, birth weight, APGAR scores and neonatal complications do not have a substantial impact on later reading skills within this sample. Despite the lack of statistical significance, some trends can be observed in the standardized beta coefficients (β). Word reading ($\beta = 0.112$, $p = 0.145$) and sentence comprehension ($\beta = 0.095$, $p = 0.254$) showed the highest positive beta values, suggesting that there may be a weak, non-significant relationship between better neonatal health indicators and stronger reading performance. Conversely, pseudoword reading ($\beta = -0.041$, $p = 0.579$) and text comprehension ($\beta = -0.038$, $p = 0.673$) exhibited slight negative beta values, indicating a possible trend where certain neonatal complications might be weakly associated with poorer reading outcomes, although the effect sizes remain small and non-significant. The standard errors (SEs) and confidence intervals (CIs) further confirm the instability of the models. Wide 95% CIs across all variables suggest that the estimated beta coefficients fluctuate considerably, making it difficult to establish consistent or reliable associations. For instance, word reading had a CI spanning from −0.097 to 0.316, indicating that the true effect could range from a negative to a positive influence, thus reinforcing the statistical uncertainty of the results.

From a statistical perspective, these findings suggest that neonatal factors do not significantly contribute to reading development outcomes, at least within this sample and using these specific predictors. The results contrast with some previous research that has identified gestational age and neonatal complications as potential risk factors for learning difficulties. However, it is possible that the effects of prematurity on reading skills may be mediated by other postnatal factors, such as educational

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TABLE 4 | Results of the multiple linear regression in all groups.

	R^2 adjusted	F value	p	Standardized beta (β)	Standard error (SE)	95% confidence interval (lower)	95% confidence interval (upper)
Letter name or sound	−0.0078	1.102	0.366	−0.029	0.143	−0.317	0.259
Same-different	0.0034	1.435	0.225	0.018	0.132	−0.275	0.249
Word reading	0.0292	1.789	0.114	0.109	0.128	−0.091	0.311
Pseudoword reading	−0.0033	0.987	0.418	−0.025	0.140	−0.315	0.285
Grammatical structures	−0.0451	0.238	0.954	−0.012	0.155	−0.309	0.285
Punctuation marks	−0.0185	0.721	0.599	−0.035	0.146	−0.278	0.281
Sentence comprehension	0.0271	1.405	0.241	0.098	0.139	−0.107	0.318
Text comprehension	−0.0254	0.635	0.689	−0.042	0.144	−0.268	0.225
Oral comprehension	0.0229	1.223	0.276	0.093	0.137	−0.094	0.305

environment, cognitive stimulation and language exposure, which were not included in this analysis. Additionally, the lack of statistical significance does not entirely rule out the potential role of neonatal factors. Future studies could explore non-linear relationships, interaction effects or latent neurocognitive variables that may better explain how early-life complications affect later reading development. Moreover, a larger sample size and longitudinal design may provide stronger statistical power to detect subtle effects that this study was unable to confirm.

The multiple linear regression analysis in the full sample, including all four study groups, did not show significant effects of neonatal variables on reading performance. None of the models exhibited a relevant predictive capacity, with F values ranging from 0.20 to 1.79 and $p > 0.10$ in all cases, indicating that the included variables do not explain a significant proportion of the variability in the scores obtained in the reading tests. In terms of the adjusted coefficient of determination (R^2 adjusted), the values were low or negative, suggesting that the model does not provide additional information beyond random error (Table 4).

The multiple linear regression analysis aimed to examine the extent to which neonatal variables influence reading performance across various reading skills. The results indicate that none of the models achieved statistical significance, with F values ranging from 0.238 to 1.789 and p values consistently above the conventional significance threshold ($p > 0.05$). These findings suggest that neonatal factors, including gestational age, birth weight, APGAR scores and neonatal complications, do not play a significant role in predicting reading outcomes in this sample. The adjusted R^2 values, which indicate the proportion of variance in reading performance explained by neonatal predictors, were low or negative across all models. This suggests that the included variables do not contribute meaningfully to explaining differences in reading skills, with most models failing to account for variance beyond what would be expected by random chance. A closer examination of the individual variables highlights weak trends in some reading skills. Word reading exhibited the highest adjusted R^2 value ($R^2 = 0.0292$), suggesting a minimal but positive relationship between neonatal factors and word reading ability, whereas grammatical structures had the lowest adjusted R^2 value ($R^2 = -0.0451$), indicating that the predictors contributed negligibly to grammatical processing. Sentence comprehension ($R^2 = 0.0271$) also showed a small positive association, though this remained statistically insignificant. In contrast, text comprehension ($R^2 = -0.0254$) and pseudoword reading ($R^2 = -0.0033$) exhibited negative adjusted R^2 values, suggesting that neonatal factors did not explain meaningful variance in these skills.

The standardized beta coefficients further support the weak predictive value of neonatal factors on reading performance. The highest positive beta coefficients were found for word reading ($\beta = 0.109$) and sentence comprehension ($\beta = 0.098$), indicating that there may be a weak relationship between neonatal health indicators and these specific reading abilities. However, these associations remain statistically non-significant. In contrast, pseudoword reading ($\beta = -0.025$) and text comprehension ($\beta = -0.042$) displayed slight negative beta coefficients, suggesting a weak trend where certain neonatal complications might be associated with poorer performance in these areas. However, these effects were small, inconsistent and failed to reach significance. The weakest relationship was observed for grammatical structures ($\beta = -0.012$, $p = 0.954$), reinforcing the idea that neonatal factors do not play a meaningful role in grammatical processing. The SEs and CIs further reinforce the instability of

the observed relationships. The wide 95% CIs suggest a high degree of uncertainty in the estimated effects, with most intervals encompassing zero, indicating no clear direction of association. For example, the CI for word reading ranged from −0.091 to 0.311, meaning that the true effect could be slightly negative, zero, or moderately positive. Similarly, the interval for text comprehension spanned from −0.268 to 0.225, demonstrating that neonatal factors are not reliable predictors of performance in this domain.

When evaluating the broader implications of these findings, it becomes evident that neonatal variables alone do not account for significant differences in reading ability. This contradicts some previous research that has linked prematurity and neonatal complications to later learning difficulties, suggesting that other factors—such as postnatal cognitive stimulation, educational quality and family environment—may be stronger determinants of reading development. It is possible that the effects of prematurity on reading are indirect and mediated by postnatal experiences, language exposure and early educational interventions. Moreover, the fact that none of the neonatal predictors reached significance implies that their influence may be more complex, requiring a non-linear approach or interaction models to uncover subtle effects.

4 | Discussion

This study aimed to analyse the impact of prematurity on the development of dyslexia, focusing on three key aspects. First, reading performance was compared among preterm children with dyslexia, preterm children without dyslexia and full-term children with dyslexia to determine whether prematurity exacerbates the reading difficulties associated with this disorder. Second, the relationship between neonatal variables, such as gestational age and birth weight and the presence of dyslexia was explored to assess whether these variables predict the onset of the disorder. Finally, the most relevant neonatal clinical factors for predicting the risk of developing dyslexia in preterm children were identified. The findings provide new insights into the influence of prematurity on learning disorders and highlight the importance of neonatal factors in the neurocognitive and linguistic development of school-aged children.

4.1 | Comparison of Reading Performance Among Groups

The analysis of reading performance among the different groups revealed that G-PREDIX obtained the lowest scores on all reading tests compared to the other groups. These findings support the hypothesis that the combination of prematurity and dyslexia creates a cumulative impact on reading difficulties. Full-term G-DISLX also performed worse than children without dyslexia, but their performance was significantly better than that of preterm children with dyslexia, suggesting that prematurity exacerbates the deficits characteristic of the disorder.

These findings align with previous research documenting a higher prevalence of reading difficulties in preterm children due to the disruption of brain development during critical neurodevelopmental stages (Anderson and Doyle 2008; Dubois et al. 2008). The immaturity of white matter and disrupted connectivity between cortical areas responsible for phonological and visual integration have been identified as key factors in the development of reading difficulties in preterm children (Back and Rosenberg 2014). Specifically, it has been demonstrated that reading development depends on the integrity of the connections between the parietotemporal cortex and the arcuate fasciculus, structures found to be altered in preterm children in neuroimaging studies (Feldman et al. 2012).

Disruptions in these circuits impair phonological decoding and reading fluency, the skills in which preterm children with dyslexia exhibited the greatest deficits in this study. Previous research has indicated that preterm children show lower activation in frontotemporal areas during phonological processing tasks, leading to greater difficulty in automatizing grapheme-phoneme conversion processes (Myers et al. 2014; Pugh et al. 2001; Travis et al. 2017; Wandell and Yeatman 2013).

On the other hand, G-PREMA obtained scores comparable to those of full-term G-NODISLX in most reading tasks, suggesting that prematurity, in the absence of dyslexia, is not a determinant factor of reading difficulties. These results reinforce the idea that dyslexia is the main explanatory factor for differences in reading performance, while prematurity acts more as an aggravating factor rather than a direct cause of reading deficits. This aligns with studies showing that not all preterm children develop reading problems, but the risk increases in those with neonatal brain injuries or an unfavourable postnatal environment (Yeatman et al. 2012).

4.2 | Relationship Between Neonatal Variables and the Presence of Dyslexia

Contrary to previous studies suggesting that children born before 37 weeks are at higher risk of developing reading difficulties (Yeatman et al. 2012; Myers et al. 2014), this study did not find a significant relationship between gestational age and dyslexia diagnosis. This finding challenges the widely accepted assumption that prematurity alone is a direct cause of dyslexia, suggesting instead that its influence may be more complex and dependent on interactions with other clinical and environmental factors. While it is well-established that premature birth is associated with a higher prevalence of neurodevelopmental difficulties, including cognitive and language impairments, the absence of a significant association in this study highlights the importance of considering additional mediating variables, such as neonatal health complications, perinatal care and postnatal environmental stimulation.

The literature has consistently emphasized that the third trimester of pregnancy is a crucial period for the maturation of the brain structures involved in reading. During this time, there is significant consolidation of white matter tracts and the formation of functional circuits between the parietotemporal cortex and frontal areas, which are fundamental for phonological processing, working memory and visual-orthographic integration (Pugh et al. 2001; Travis et al. 2017; Wandell and Yeatman 2013). These structures play a central role in the

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development of fluent and accurate reading, as the ability to decode and comprehend text depends on efficient connectivity between language-processing areas and executive control mechanisms. Despite the widely accepted neurodevelopmental vulnerability associated with preterm birth, this study found that gestational age did not significantly predict dyslexia, suggesting that prematurity alone does not determine reading deficits. This supports the hypothesis that the presence of additional risk factors, such as neonatal brain injuries, perinatal complications and the quality of early linguistic exposure, may be more influential in shaping reading outcomes than gestational age itself. It is possible that children born prematurely who do not experience additional complications, particularly those with adequate postnatal care and cognitive stimulation, can develop compensatory mechanisms that support reading development, thereby minimizing the impact of early birth on later academic skills.

Birth weight showed a slight positive trend in its relationship with word reading and pseudoword reading performance, although it did not reach statistical significance. This observation is in line with previous findings that suggest higher birth weight is often associated with better foetal development and, consequently, more advanced neural maturation at birth (Feldman et al. 2012). A larger birth weight is commonly linked to greater brain volume, better metabolic reserves and enhanced myelination processes, which are all factors that contribute to cognitive and linguistic skills. However, the absence of a significant effect in this study aligns with other research suggesting that brain maturation is more closely related to gestational age than to birth weight alone (Yeatman et al. 2012). This distinction is particularly important because while low birth weight is often associated with developmental risks, it is not necessarily an independent determinant of dyslexia. Rather, its impact may be modulated by additional neonatal factors, such as nutritional status, intrauterine growth restriction and medical interventions during the neonatal period. It is also possible that, within this sample, variability in birth weight was not extreme enough to produce clear associations, as the study did not include extremely low birth weight infants, who are at the highest risk for neurodevelopmental impairments.

Additionally, APGAR scores at 1 and 5 min were not significant predictors of reading performance in the analysed sample. Although APGAR scores are widely used as a clinical measure of neonatal adaptation to extrauterine life, their role as a predictor of long-term cognitive and academic performance remains debated. The APGAR test primarily assesses heart rate, respiratory effort, muscle tone, reflex irritability and skin coloration, providing an immediate evaluation of the newborn's physiological stability. However, its ability to predict neurodevelopmental outcomes is often limited, particularly in the absence of severe perinatal events such as neonatal hypoxia or hypoxic–ischemic encephalopathy (Shaywitz and Shaywitz 2005). This aligns with previous findings indicating that while low APGAR scores can be associated with a higher risk of cognitive difficulties and developmental delays, children with moderate or normal scores do not necessarily exhibit long-term academic impairments (Pugh et al. 2001; Travis et al. 2017). In this study, most participants had APGAR scores within the normal range, which may explain the lack of an observable impact on reading abilities. Moreover, the presence of neuroplasticity mechanisms in early childhood may allow children with initial physiological instability to recover and develop compensatory pathways that support normal cognitive and language development.

Taken together, these findings suggest that gestational age, birth weight and APGAR scores alone are insufficient to explain reading difficulties. Rather than acting as direct causal factors, these neonatal characteristics may serve as risk indicators that interact with a range of other variables, including medical complications, family environment, early language exposure and educational interventions. The absence of significant relationships in this study highlights the need for a more nuanced understanding of how multiple biological and environmental factors interact over time to influence literacy acquisition. Future research should focus on longitudinal designs that track children from infancy to school age, incorporating neuroimaging techniques and detailed assessments of home literacy environments to better understand the complex mechanisms underlying reading development in preterm populations. Additionally, studies should explore whether early intervention programs targeting phonological awareness, working memory and executive functions could mitigate the potential risks associated with prematurity, particularly for children who present additional vulnerabilities such as neonatal brain injuries or socioeconomic disadvantages.

4.3 | Neonatal Factors Associated With Dyslexia Development

Regression analyses conducted on the full sample did not identify any neonatal complications as significant predictors of reading performance, which contrasts with previous studies that have linked conditions such as intraventricular haemorrhage and periventricular leukomalacia with neurocognitive deficits and an increased risk of learning disorders (Pugh et al. 2001; Travis et al. 2017; Volpe 2019). These findings challenge the widely held assumption that early brain injuries inherently lead to later academic difficulties and suggest that other compensatory mechanisms, neuroplasticity, or postnatal interventions may mitigate their impact on reading acquisition. However, a negative trend was observed in the relationship between these neonatal complications and performance on reading comprehension and grammatical structures tasks, suggesting that while their effect may not be immediately apparent in broad statistical models, subtle influences on higher-order language processing cannot be entirely ruled out. Intraventricular haemorrhage (IVH) has been extensively studied in relation to cognitive and linguistic development in children, as it directly affects periventricular white matter, which plays a critical role in connectivity between language-related brain areas and the integration of phonological and semantic information (Rimrodt et al. 2010). White matter pathways, particularly those involving the arcuate fasciculus and superior longitudinal fasciculus, are essential for phonological decoding, word retrieval and syntactic processing, which are foundational skills for reading and grammar comprehension. Disruptions in white matter integrity have been shown to impair the automatization of reading, executive function and working memory, contributing to deficits in reading fluency and phonological processing (Volpe 2019). The negative trend observed

in reading comprehension and grammatical structures performance in children with a history of IVH may reflect underlying difficulties in integrating phonological, morphological and syntactic cues, which are particularly important for advanced literacy skills. Given that IVH often leads to mild-to-moderate white matter injury rather than widespread cortical damage, it is possible that its effects manifest more prominently in tasks requiring higher cognitive load and linguistic integration, rather than in basic word reading measures.

Similarly, periventricular leukomalacia (PVL) is another common form of white matter injury in preterm infants, often associated with disruptions in myelination and neural transmission speed. Previous studies have demonstrated that PVL is linked to language processing difficulties and deficits in working memory, which are crucial for both reading comprehension and grammatical reasoning (Travis et al. 2017). However, in the current study, no statistically significant relationship was found between PVL and reading outcomes, though a negative association with reading comprehension was observed. This may indicate that the impact of subtle white matter alterations is not easily detected through broad reading assessments but could become more apparent in longitudinal studies tracking language development over time. Another possibility is that children with PVL who do not present co-occurring neurological impairments may develop adaptive strategies that help compensate for early disruptions in connectivity, particularly if they receive early educational support and phonological training.

Additionally, NICU admission and the use of mechanical ventilation did not show significant effects on reading development. While previous studies have linked prolonged NICU stays to a higher prevalence of neurodevelopmental disorders (Anderson and Doyle 2008), the findings of this study suggest that neonatal hospitalization duration is not a direct determining factor in reading performance. This does not necessarily imply that NICU admission is benign but rather that its long-term effects may depend more on the underlying medical condition that led to hospitalization rather than the hospitalization itself. For instance, some preterm infants who require mechanical ventilation may experience chronic hypoxia, inflammation or neurotoxic effects from prolonged oxygen therapy, which could theoretically contribute to altered brain development and learning difficulties. However, in the absence of severe complications, NICU exposure alone does not appear to have a measurable impact on reading acquisition.

One possible explanation for these findings is that modern neonatal care has improved significantly, with advances in respiratory support, nutritional interventions and early neurodevelopmental monitoring helping to mitigate some of the adverse effects previously associated with NICU stays and mechanical ventilation. Moreover, the variability in post-discharge medical follow-ups, early intervention programs and home literacy environments could play a more crucial role in determining later reading success than the neonatal complications themselves. Another consideration is that not all children who experience early-life adversities develop reading difficulties, as individual differences in cognitive resilience, family support and access to high-quality education may buffer the potential negative effects of early brain injuries.

Taken together, these findings emphasize the need for a more nuanced understanding of how neonatal complications interact with other developmental and environmental factors to influence reading acquisition. While this study did not find statistically significant effects of IVH, PVL, NICU admission or mechanical ventilation on reading skills, the observed negative trends suggest that further investigation is warranted. Future research should focus on longitudinal studies with larger sample sizes, incorporating neuroimaging data to assess white matter integrity and exploring potential interaction effects between neonatal complications and postnatal interventions. Additionally, it would be valuable to examine whether specific cognitive functions, such as executive function, phonological awareness and processing speed, mediate the relationship between neonatal health factors and later reading performance. Such research could help identify at-risk children earlier and inform the development of targeted interventions to support literacy development in preterm populations.

4.4 | Implications, Limitations and Future Prospects

This study provides an in-depth perspective on the relationship between prematurity, neonatal complications and dyslexia, highlighting that dyslexia appears to be the main explanatory factor for reading performance, while prematurity functions more as an aggravating factor rather than a direct determinant of reading difficulties. These findings have significant implications for the early assessment and intervention of preterm children, as they suggest that preterm children should be monitored closely for potential reading deficits before they become evident.

One of the main limitations of this study is the relatively small sample size, which may have limited the ability to detect subtle associations between neonatal variables and dyslexia. Additionally, the cross-sectional design prevented an evaluation of how reading skills evolve over time. Future research should adopt a longitudinal approach and incorporate neuroimaging techniques to clarify the relationship between prematurity and the brain's reading network organization. Overall, these findings underscore the complex relationship between prematurity and dyslexia, emphasizing the need for a multidimensional approach that considers clinical, educational and environmental factors in assessing and treating reading difficulties in preterm children.

5 | Conclusions

The results of this study suggest that prematurity, while not a sole determinant of dyslexia, acts as an aggravating factor in the development of reading difficulties when combined with this disorder. Unlike previous studies that have identified gestational age and neonatal complications as direct predictors of dyslexia, this analysis did not find a significant relationship between these variables and the diagnosis of the disorder. However, the comparison of reading performance among the different groups revealed that preterm children with dyslexia performed significantly worse in all reading tasks compared to full-term children with dyslexia and preterm children without dyslexia. These findings reinforce

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the idea that prematurity, in combination with dyslexia, increases the severity of reading difficulties, suggesting a cumulative effect of neurocognitive vulnerability. Additionally, it was identified that preterm children with a history of neonatal complications tend to face a higher risk of difficulties in fundamental reading skills, including phonological decoding, word recognition and reading comprehension. Although intraventricular haemorrhage and periventricular leukomalacia were not significant predictors in the regression models, a negative trend was observed between these conditions and reading performance. This aligns with previous studies that have suggested that alterations in periventricular white matter may affect connectivity between key brain areas for reading acquisition. These findings highlight the need for early assessment and continuous monitoring in preterm children, particularly those with a history of medical complications, to implement interventions aimed at optimizing their cognitive and academic development. From both clinical and educational perspectives, the findings of this study reinforce the importance of implementing personalized intervention strategies for preterm children at risk of reading difficulties. Early stimulation programs and targeted interventions in phonological processing, reading fluency and text comprehension could help mitigate the impact of prematurity on reading development, promoting better school adaptation. For future research, it is essential to expand sample sizes and incorporate a longitudinal design that allows for an analysis of reading skills development from early childhood to adolescence. Additionally, integrating functional and structural neuroimaging techniques could provide a more precise understanding of the relationship between prematurity and the organization of the brain circuits involved in reading. Furthermore, exploring specific therapeutic interventions could help compensate for deficits associated with prematurity and dyslexia, ensuring optimal cognitive development in this vulnerable population.

Author Contributions

Miguel López-Zamora: project administration, funding acquisition, supervision an writing – review and editing. **Nadia Porcar-Gozalbo**: writing – original draft, data curation, resources, investigation and methodology. **Isabel López-Chicheri**: writing – review and editing, data curation, investigation and methodology and visualization. **Alejandro Cano-Villagrasa**: conceptualization, investigation, methodology, writing – original draft and writing – review and editing.

Consent

Informed consent was obtained from all subjects involved in the study.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The original data presented in this study are openly available in FigShareat 10.6084/m9.figshare.28643675.v1.

Institutional Review Board Statement

The study was conducted according to the guidelines of the Declaration of Helsinki and approved by the Ethics Committee of University of Málaga ethics committee, approved on March with code 120-2023-H.

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5.2. ARTÍCULO 2

López-Zamora, M., Porcar-Gozalbo, N., López-Chicheri García, I., & Cano-Villagrasa, A. (2025). Linguistic and Cognitive Abilities in Children with Dyslexia: A Comparative Analysis. *European Journal of Investigation in Health, Psychology and Education*, *15*(3), 37. https://doi.org/10.3390/ejihpe15030037

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Article

Linguistic and Cognitive Abilities in Children with Dyslexia: A Comparative Analysis

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Abstract: Introduction: Dyslexia is a prevalent learning disorder that significantly affects the child population. It is often accompanied by deficits in language processes, cognition, and executive functioning, all of which are crucial for reading development. Children with dyslexia frequently exhibit difficulties in phonological processing, semantics, morphosyntax, and also in cognitive areas such as working memory, inhibition, planning, and attention. Objective: The primary objective of this study was to compare the linguistic, cognitive, and executive functioning abilities between children diagnosed with dyslexia and those with typical reading development. Methodology: A total of 120 children were selected and divided into two groups: the G-DYSLEXIA group (n = 60), consisting of children diagnosed with dyslexia, and the G-CONTROL group (n = 60), with typical reading development. Language, cognition, and executive functions were assessed using standardized tests: CELF-5, WISC-V, and ENFEN. Statistical analyses included descriptive statistics, independent sample t-tests, and Chi-square tests to compare the performance between these two groups. Results: The study revealed significant differences between the two groups in all dimensions assessed. Specifically, children with dyslexia showed markedly lower performance in linguistic, cognitive, and executive functioning measures compared with their peers with typical development. Conclusion: Children with dyslexia present a distinct clinical profile characterized by significant difficulties in language processing, cognition, and executive functions. These challenges interfere with their reading acquisition and academic performance, limiting their integration into educational environments and impacting their overall quality of life.

Keywords: dyslexia; childhood; language; cognition; executive functions

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1. Introduction

The process of learning to read involves multiple biological, cognitive, linguistic, emotional, environmental, socioeconomic, and pedagogical factors (O'Brien & Yeatman, 2021). These factors not only individually affect the acquisition of literacy skills but also interact with each other, making the study of typical reading development highly complex. While most children learn to read without difficulty, a percentage of the population faces significant challenges in this process (Park & Lombardino, 2013). It is estimated that between 30% and 40% of children in early school years experience reading-related difficulties (Sparks et al., 2006).

Literacy problems have a substantial impact on academic performance. Recent studies have shown that more than 15% of children aged 10 to 12 exhibit some form of delay in reading acquisition (Olusanya et al., 2023; Yang et al., 2022). Many of these children remain undiagnosed or do not receive appropriate intervention, contributing to a school dropout rate of approximately 8% among children and adolescents aged 4 to 17 (de Bree et al., 2022; Price et al., 2022). While the origins of reading difficulties are diverse, current research emphasizes the role of specific learning disorders in literacy challenges (Chan et al., 2023). Among these, dyslexia has become a primary focus of interest in both educational and clinical settings.

Dyslexia is a severe, persistent, and specific difficulty in acquiring and developing reading skills. It is considered unexpected because it occurs independently of general cognitive abilities and academic instruction (American Psychiatric Association, 2013). Its origin is not attributed to sensory impairments but rather to a strong genetic and hereditary component (Adlof & Hogan, 2018). It is estimated that approximately 3% to 7% of the population has dyslexia (Jiménez & Rodríguez, 2008; Wagner et al., 2020; Wolff & Lundberg, 2002). Reading difficulties stem from neuroanatomical changes that affect access, processing, and retrieval of phonological information related to speech sounds (Habib & Giraud, 2013; Luque et al., 2011). Likewise, various studies indicate that neuroimaging techniques conducted between the ages of 3 and 5 have proven to be sensitive and predictive in correlating reading impairments in children (Guttorm et al., 2011; Hämäläinen et al., 2013; Leppänen et al., 2012). Similarly, studies such as that of Torppa et al. (2010) suggest that at early stages of development, certain skills predict reading process impairments, such as working memory, verbal memory, processing speed, vocabulary, or rapid naming, all of which can be measured using standardized and validated assessment protocols in Spanish, such as the PROLEXIA instrument, among others.

Models of reading processing have identified two fundamental pathways for word reading (Coltheart et al., 2001): the sublexical or indirect pathway, which involves breaking down words into letters and converting each letter into a sound before merging them into a verbal form, and the lexical or direct pathway, where familiar words are recognized through a mental dictionary. The lexical pathway allows direct access to a word's meaning, whereas the sublexical pathway requires phonological decoding.

Within these models, reading automation is a key process that promotes fast and fluent reading (Ardila & Cuetos, 2016). In transparent languages such as Spanish, where grapheme–phoneme conversion rules are more predictable, reading speed has proven to be a particularly useful measure for assessing reading performance. Although children with dyslexia may make relatively few errors, they typically exhibit significant deficits in reading speed, making it a crucial diagnostic metric (Defior & Serrano, 2014). On the other hand, accuracy, which combines speed with the number of correct responses, has been the most commonly used measure to assess reading performance in dyslexia (Cappelli et al., 2018). This same finding could apply to other transparent languages, such as Italian. In the study by Carioti et al. (2022), a cohort of monolingual Italian children was evaluated on rapid naming tasks, indicating that this ability is a universal marker for early detection of dyslexia. Similarly, research by Casani et al. (2022) also emphasizes linguistic processes and dimensions such as morphology and syntax as early indicators for diagnosing dyslexia in children in transparent languages such as Italian. In their study, the authors highlighted that morphosyntactic skills influence writing decoding.

However, reading goes beyond these mechanical processes. It also involves broader cognitive functions, such as interpreting word meanings (Smith-Spark, 2018), storing information (Dorofeeva et al., 2022), and retrieving written content (Snowling & Hulme, 2011), all of which contribute to comprehensive reading comprehension (Bishop & Snowling, 2004).

Numerous studies have shown that children with dyslexia experience difficulties not only in expressive and receptive language but also in various cognitive processes such as planning, inhibition, attention, and verbal memory, among others (Bazen et al., 2020). Therefore, executive functions play a fundamental role in the proper acquisition of reading processes, as these higher cognitive skills allow for the efficient regulation, supervision, and coordination of the multiple processes involved in reading.

Executive functions such as working memory (Beneventi et al., 2010), cognitive flexibility, and inhibitory control are crucial for retaining and manipulating information while reading, adapting to new tasks or comprehension challenges, and suppressing inappropriate automatic responses to focus on the relevant content of the text (Reiter et al., 2005). These skills are fundamental not only in educational settings but also in everyday life, enabling individuals to function effectively and efficiently across various situations.

Recent studies have highlighted that children with dyslexia exhibit significant deficits in these executive functions, negatively impacting their reading performance. For instance, limited working memory can hinder information retention while decoding words or constructing the meaning of complex sentences (Smith-Spark & Fisk, 2007). This shortfall in working memory means that essential information might be lost in the process, making it difficult to build a coherent and fluent understanding of the text. Moreover, difficulties in inhibitory control may cause children with dyslexia to struggle with avoiding frequent errors or adjusting reading strategies when encountering unfamiliar words (Booth et al., 2010). This difficulty manifests as a reduced ability to ignore irrelevant distractions, which can lead to comprehension errors and less efficient reading. Inhibitory control is crucial for maintaining focus on reading tasks in the face of distracting stimuli or previously automated inappropriate reading habits. Additionally, planning and organization—key components of executive functions—allow readers to anticipate content, set reading goals, and adjust their pace according to the text's demands. The absence or weakness of these skills in children with dyslexia not only slows down the reading process but also affects overall reading comprehension. This occurs because cognitive resources are excessively concentrated on word decoding, leaving little capacity for interpreting, analyzing, or integrating the information read (Varvara et al., 2014). The consequences of these difficulties are that the reading process becomes slower and more laborious, requiring greater cognitive effort than for children without dyslexia. This can lead to rapid fatigue during reading tasks and decreased motivation to engage in activities involving extensive or complex reading. Over time, these challenges can impact general academic performance and the child's self-esteem.

The literature suggests that children with impairments in linguistic competencies are at higher risk of developing dyslexia. Specifically, Bishop and Snowling (2004) argue that when comparing children diagnosed with dyslexia and those with language disorders, both share a phonological deficit, but they differ in the extent to which broader language skills, such as vocabulary and comprehension, are affected. These findings have led most dyslexia studies to focus on the role of phonological skills as causal factors in decoding development (Capin et al., 2022; Lyytinen et al., 2005; Ramus & Szenkovits, 2008). However, evidence suggests that broader language skills may also play a crucial role in decoding processes, particularly in children with more advanced literacy experience (Marshall et al., 2011). Morphological awareness has been identified as a unique predictor of variability in word-reading ability in children over the age of 8 (Casani et al., 2022). For example, Giazitzidou and Padeliadu (2022) found that morphological awareness predicted word-reading variations, even after controlling for age, phonological awareness, and naming speed.

Despite the extensive literature on dyslexia, most research has been conducted on English-speaking populations or has examined phonological processing in isolation. There

is a lack of comprehensive studies comparing the linguistic and cognitive performance of Spanish-speaking children with dyslexia to that of typically developing readers. Since Spanish is a transparent orthographic language with more predictable grapheme–phoneme conversion rules, it is crucial to investigate how reading difficulties manifest in this linguistic context and whether the reading speed and accuracy deficits observed in other languages also apply to Spanish. Moreover, few studies have explored the impact of executive functions and other cognitive processes, such as working memory and fluid reasoning, in Spanish-speaking children with dyslexia. Understanding these relationships will not only enable more precise identification of areas of deficit but will also enhance diagnostic and intervention strategies, adapting them to the educational and linguistic needs of Spanish-speaking children with dyslexia.

In addition to linguistic difficulties, individuals with dyslexia also exhibit cognitive deficits, particularly in planning and monitoring, which are higher-order cognitive skills associated with executive functions (Smith-Spark & Gordon, 2022). Although there are various perspectives on executive functioning (Miyake et al., 2000), all theories agree on its role in regulating, organizing, and integrating cognitive processes (Denckla, 1996). According to Baddeley's model (Baddeley, 2007), the central executive is the control system of working memory. However, the relationship between dyslexia and executive functions remains an open question. Studies such as those by Barbosa et al. (2019) suggest that inefficient phonological processing could negatively impact executive functioning, which may explain the cognitive difficulties observed in children with dyslexia.

This study seeks to address existing gaps in the literature by providing empirical evidence on how dyslexia affects both linguistic and cognitive domains in a language with transparent orthography such as Spanish. Additionally, it aims to contribute to the ongoing discussion regarding the role of executive functions in dyslexia and their relationship with reading performance in Spanish-speaking children.

2. Materials and Methods

2.1. Participants

A total of 120 participants (58 girls and 62 boys) aged between 6 and 8 years (M = 7.2; SD = 0.8) were selected. The sample was evenly divided into two groups: an experimental group of 60 children diagnosed with dyslexia (G-DYSLEXIA) and a control group of 60 children with typical reading development (G-CONTROL).

The process of diagnosing dyslexia in the participants involved a thorough assessment adhering to the established diagnostic criteria of the *Diagnostic and Statistical Manual of Mental Disorders*, Fifth Edition (DSM-5) (American Psychiatric Association, 2013). This manual is widely recognized and used by clinicians globally to ensure consistency and accuracy in the diagnosis of various psychological disorders, including dyslexia. By following these standards, evaluators can reliably identify specific learning disorders related to reading.

Confirmation of the dyslexia diagnosis was achieved using the PROLEC-R assessment battery (Cuetos et al., 2014). The PROLEC-R battery is specifically designed to evaluate the reading abilities of children and is commonly used in both clinical and educational settings to identify specific learning disorders in reading. This battery not only helps in confirming a diagnosis but also in understanding the specific reading challenges faced by each child, which is crucial for planning effective interventions.

The focus on children aged six and seven is particularly important because dyslexia is usually diagnosed after a child has had at least two years of literacy instruction. This timeframe allows for clearer observation of the child's learning patterns and difficulties in acquiring basic reading skills, which are less evident without formal education. By this

age, children have typically been exposed to systematic reading instruction, providing a substantial basis for evaluating their reading abilities and identifying deviations from typical development.

The strict diagnostic criteria included several key components. Firstly, a documented history of potential difficulties in the reading process helps identify children at risk early on. Secondly, the lack of response to early literacy interventions is a critical indicator that standard educational approaches may not be sufficient for the child's learning needs, suggesting underlying learning disorders. Lastly, a comprehensive clinical evaluation rules out other potential causes of reading impairments, such as sensory impairments or cognitive deficits, ensuring that the diagnosis of dyslexia is specific and accurate.

Once diagnosed, all participants received psychopedagogical support interventions tailored to each child's needs and delivered by educational psychologists and language and hearing specialists. These interventions are crucial, as they are designed to address the unique learning challenges faced by children with dyslexia. By providing specialized support in the final stages of Early Childhood Education, these interventions aim to equip children with the necessary skills to succeed in later schooling.

In the Spanish educational system, where formal reading instruction begins in the third year of Early Childhood Education (ages 3–4), early identification and intervention are possible and beneficial. Starting pre-reading skill stimulation at this early stage enables educators to address reading difficulties before they become deeply ingrained, thereby enhancing the overall effectiveness of the interventions and improving the academic trajectory for children with dyslexia. This early start is essential to laying a solid foundation for literacy development and ensuring that all children, including those with learning disorders, have the best possible support from the beginning of their educational journey.

To control for potential confounding variables, age matching was performed between the groups, and statistical tests confirmed no significant differences in age distribution. Additionally, since a notable proportion of participants were born before 35 weeks of gestation, care was taken to ensure a balanced distribution of preterm births between groups, minimizing the potential influence of prematurity on cognitive and linguistic outcomes.

All participants were monolingual Spanish speakers born in Spain. The inclusion criteria for the G-DYSLEXIA group required a formal dyslexia diagnosis, an age between six and eight years, and evidence of expressive language development. Exclusion criteria for both groups included severe sensory impairments (auditory or visual), a diagnosis of intellectual disability, or any severe psychiatric disorder that might interfere with cognitive and linguistic evaluations. While comorbidity with other neurodevelopmental disorders was controlled for, it was not considered an exclusionary criterion in the G-DYSLEXIA group, ensuring a sample representative of dyslexic populations at the population level.

2.2. Instruments and Materials

The following instruments were used to assess the linguistic and cognitive abilities in the participants:

CELF-5. Clinical Evaluation of Language Fundamentals—5th Edition (Wiig et al., 2018): This battery assesses the language skills of children and adolescents between the ages of 5 and 15. Its main objective is to detect language and communication disorders through 12 tests, with each subtest containing between 10 and 15 items, including sentence comprehension, linguistic concepts, and morphosyntax. The tests are divided into two parts based on the individual's age and are grouped into five general indices that describe various aspects of language: comprehension, expression, and linguistic structure. It also includes a questionnaire for parents and teachers that evaluates communicative performance in school and family environments. The psychometric scores, calculated based on our sample, show

a Cronbach's alpha of 0.91, indicating high internal consistency. For this study, variables such as semantics, morphosyntax, pragmatics, and auditory comprehension were used. This battery comprehensively assesses language skills, including sentence comprehension, linguistic concepts, and morphosyntax. Therefore, all its subtests require significant verbal abilities to evaluate various aspects of language such as comprehension, expression, and linguistic structure.

WISC-V. Wechsler Intelligence Scale for Children—5th Edition (Wechsler, 2010): This clinical instrument is used to assess cognitive ability in children aged 6 to 16 years. The WISC-V provides composite scores for cognitive domains such as verbal comprehension, fluid reasoning, and working memory, as well as a full-scale score representing general intellectual ability. The battery consists of 10 primary subtests (ranging from 15 to 20 items each) and 5 supplementary subtests. The reliability analysis, based on our sample, yielded a Cronbach's alpha of 0.89, confirming high internal consistency. This instrument offers a diverse assessment that includes areas requiring verbal skills and others that do not. The verbal comprehension subtests, which involve understanding and manipulating spoken language, directly depend on linguistic skills. However, other subtests like those assessing fluid reasoning and working memory may not require direct verbal abilities, as they evaluate the capacity to reason and manipulate information in formats that are not exclusively verbal.

ENFEN. Neuropsychological Assessment of Executive Functions in Children (Portellano et al., 2009): This battery is designed to assess executive functions in children aged 6 to 12 years. The ENFEN consists of four subtests: verbal fluency (15 items), trail making (20 items), ring construction (15 items), and resistance to interference (15 items). The internal consistency of the instrument, calculated from our study's sample, showed a Cronbach's alpha of 0.87, ensuring high reliability. The ENFEN is widely used in the assessment of children with cognitive difficulties. This battery combines tests that assess both verbal and non-verbal skills. Specifically, the verbal fluency subtest requires children to generate words under certain constraints, making intensive use of linguistic skills. The other subtests, such as trail making, ring construction, and resistance to interference, focus more on assessing cognitive and psychomotor skills, where the linguistic component is minimal or non-essential. These examine how children organize their thoughts and movements efficiently and how they handle distractions.

2.3. Procedure

The study was approved by the Ethics Committee of the University of Málaga (UMA) under approval code 120-2023-H. All families of the participants provided informed consent to participate in the study, ensuring compliance with data protection regulations and confidentiality.

Data collection was carried out in two main phases. In the first phase, an initial interview was conducted with the parents or guardians of the participants to collect sociodemographic information, medical and academic history, and other relevant details for the evaluation (such as family history of learning difficulties or comorbidities). During this interview, further details about the study, its objectives, and the evaluation procedure were explained, addressing any questions the families might have had. Following this, the assessment sessions took place. The linguistic and cognitive assessments were administered individually to each participant in a quiet, controlled environment, such as a dedicated room within their school or a designated area in the reference hospital. The evaluation was spread across three sessions to avoid participant fatigue, with each session lasting approximately 90 min. These sessions were scheduled over the course of a week to ensure that the participants could perform optimally in each session. In the first session, linguistic

assessments were conducted using the CELF-5. The second session focused on cognitive assessments, where the WISC-V was administered to evaluate general cognitive ability. The third session involved the ENFEN battery to assess executive functions, allowing for a comprehensive analysis of the participants' cognitive development.

Each session was conducted by trained evaluators (psychologists and speech therapists with experience in administering these tests) to ensure the accurate application of the instruments and the validity of the results. Special care was taken to include breaks during the sessions if the children showed signs of fatigue to maintain the validity of their responses. The study included a total of 120 participants, 62 male (51.6%) and 58 female (48.4%). Of these, 60 participants were diagnosed with dyslexia (32 male and 28 female), while 60 participants did not have a dyslexia diagnosis (30 male and 30 female). In the second phase, the collected data were reviewed and organized into a database for analysis. Quality control procedures were implemented to ensure the accuracy of data entry and to avoid any coding errors. The data were then prepared for comprehensive statistical analysis using the tools selected for this study. In addition, follow-up communication was maintained with the participants through their schools and families, ensuring that no additional factors interfered with their performance during the evaluations. The entire data collection process was carried out over a period of three months.

2.4. Design

This is a descriptive, cross-sectional study with an experimental group (G-DYSLEXIA) and a control group (G-CONTROL). The dependent variables were the linguistic and cognitive functions assessed through the standardized instruments mentioned earlier. The independent variable was the diagnosis of dyslexia.

A descriptive statistical analysis of the same variables was then conducted. To compare the two groups, an independent samples *t*-test was performed with a Bonferroni correction applied to control for the risk of Type I errors. The statistical analyses were conducted using SPSS version 26.

3. Results

First, various descriptive analyses were conducted, and the homogeneity of the participant sample was verified for each sociodemographic variable. The results of these analyses are reflected in Table 1 below:

Table 1. Characteristics of the study participants.

	Dyslexia (N, %)	No Dyslexia (N, %)
Gender		
Male	35 (58.3%)	27 (45.0%)
Female	25 (41.7%)	33 (55.0%)
Age		
6 years	20 (33.3%)	22 (36.7%)
7 years	18 (30.0%)	19 (31.7%)
8 years	22 (36.7%)	19 (31.7%)
Years of Treatment		
1 year	33 (55.0%)	0
2 years	15 (25.0%)	0
3 years	12 (20.0%)	0

Table 1. *Cont.*

	Dyslexia (N, %)	No Dyslexia (N, %)
Comorbidity		
Dysgraphia	18 (30.0%)	0
Dyscalculia	20 (33.3%)	0
Dysgraphia and dyscalculia	22 (36.7%)	0
School Support		
Yes	30 (50.0%)	0
No	30 (50.0%)	0
Weeks of Gestation		
30–35	18 (30.0%)	20 (33.3%)
35–40	20 (33.3%)	20 (33.3%)
More than 40	22 (36.7%)	20 (33.3%)
Apgar		
At risk	16 (26.7%)	18 (30.0%)
Intermediate	22 (36.7%)	21 (35.0%)
Normal	22 (36.7%)	21 (35.0%)

3.1. Comparison of Linguistic Performance

The difference in scores was calculated using the independent samples *t*-test for variables related to linguistic competencies. The results showed significant differences in all variables related to language. The results of Levene's test and the *t*-test analysis for language performance are described in Table 2.

Table 2. Results of differences in measures of linguistic competence between G-DYSLEXIA and G-CONTROL.

Language Skills	Groups		*t*-Test for Equality of Means				
	G-DYSLEXIA	G-CONTROL	t	df	Sig. (Bilateral)	Mean Difference	ð (SE)
Sentence Comprehension	M = 6.58 SD = 1.64	M = 10.28 SD = 2.12	7.594	118	<0.001	3.700	1.95 (0.22)
Linguistic Concepts	M = 5.68 SD = 1.89	M = 11.26 SD = 1.96	8.648	118	<0.001	5.580	2.89 (0.26)
Morphosyntax	M = 7.84 SD = 1.29	M = 14.17 SD = 2.67	6.484	118	<0.001	6.330	3.01 (0.26)
Pragmatic Skills Profile	M = 3.87 SD = 1.35	M = 9.46 SD = 1.35	4.654	118	<0.001	5.590	4.14 (0.32)
Oral Text Comprehension	M = 5.12 SD = 3.84	M = 10.53 SD = 1.99	7.498	118	<0.001	5.410	1.76 (0.21)

The statistical results presented in the table reveal highly significant differences between the G-DYSLEXIA and G-CONTROL groups across all the linguistic skills assessed using an independent samples *t*-test. Firstly, the Levene's test for equality of variances yielded significance values greater than 0.05 for all variables, confirming that there were no significant differences in the variances between the two groups, thus allowing the assumption of homogeneity of variances in the analysis. In terms of sentence comprehension, the G-DYSLEXIA group had a mean of 6.58 (SD = 1.64) compared with a mean of 10.28

(SD = 2.12) in the G-CONTROL group. The *t*-test analysis showed t(118) = 7.594, with a bilateral significance of $p < 0.001$, confirming a highly significant difference between the groups. The effect size calculated using η^2 was 0.845, indicating a very large effect. The mean difference between the groups was 3.700 points, with a Cohen's d value of 1.95, further emphasizing the magnitude of this disparity in sentence comprehension. Regarding linguistic concepts, children with dyslexia scored a mean of 5.68 (SD = 1.89) compared with a mean of 11.26 (SD = 1.96) in the control group. The *t*-test resulted in t(118) = 8.648, $p < 0.001$, again indicating a highly significant difference. The effect size was considerably large ($\eta^2 = 0.685$), and the mean difference between the groups was 5.580 points, with a d value of 2.89, reflecting a substantial difference in the ability to handle linguistic concepts. Morphosyntax also showed significant differences, with a mean of 7.84 (SD = 1.29) in G-DYSLEXIA compared with 14.17 (SD = 2.67) in G-CONTROL. The *t*-test yielded t(118) = 6.484, $p < 0.001$, with an effect size of $\eta^2 = 0.954$, indicating that the variance explained by the group is very high. The mean difference was 6.330 points, and the d value was 3.01, suggesting that morphosyntactic ability is significantly lower in children with dyslexia. For the pragmatic skills profile, the G-DYSLEXIA group had a mean of 3.87 (SD = 1.35), significantly lower than the control group's mean of 9.46 (SD = 1.35), with t(118) = 4.654, $p < 0.001$. The effect size was notable ($\eta^2 = 0.659$), with a mean difference of 5.590 points and a d value of 4.14, reflecting significant pragmatic difficulties in children with dyslexia. Finally, oral text comprehension also showed significant differences, with a mean of 5.12 (SD = 3.84) in G-DYSLEXIA compared with 10.53 (SD = 1.99) in G-CONTROL. The *t*-test showed t(118) = 7.498, $p < 0.001$, with an effect size of $\eta^2 = 0.953$ and a mean difference of 5.410 points (d = 1.76), indicating a considerable deficit in oral text comprehension in the dyslexic group.

3.2. Comparison of Cognitive Performance and Executive Functioning

The difference in scores was calculated using the independent samples *t*-test for variables related to cognitive competencies. The results showed significant differences in all variables related to cognition. The results of the Levene's test and the *t*-test analysis for cognitive performance are described in Tables 3 and 4.

Table 3. Results of differences in measures of cognitive competence between G-DYSLEXIA and G-CONTROL (WISC-V).

Cognitive	Groups		*t*-Test for Equality of Means				
	G-DYSLEXIA	G-CONTROL	t	df	Sig. (Bilateral)	Mean Difference	ð (SE)
Verbal Comprehension	M = 7.11 SD = 1.58	M = 12.96 SD = 2.68	10.374	118	<0.001 *	5.850	2.65 (0.25)
Visuospatial	M = 6.48 SD = 1.52	M = 13.91 SD = 2.01	9.515	118	<0.001 *	7.430	4.16 (0.32)
Fluid Reasoning	M = 6.15 SD = 1.85	M = 11.69 SD = 2.93	7.549	118	<0.001 *	5.540	2.26 (0.23)
Working Memory	M = 5.99 SD = 2.02	M = 10.36 SD = 1.64	6.419	118	<0.001 *	4.370	2.37 (0.24)
Processing Speed	M = 6.09 SD = 1.61	M = 11.71 SD = 1.72	7.549	118	<0.001 *	5.620	3.37 (0.28)

* $p < 0.05$.

Table 4. Results of differences in measures of executive functioning between G-DYSLEXIA and G-CONTROL (ENFEN).

Executive Functions	Groups		*t*-Test for Equality of Means				
	G-DYSLEXIA	G-CONTROL	t	df	Sig. (Bilateral)	Mean Difference	ð (SE)
Interference Resistance	M = 5.37 SD = 2.51	M = 12.37 SD = 3.28	8.459	118	<0.001 *	7.000	−2.39 (0.23)
Trail Making	M = 6.50 SD = 2.76	M = 12.07 SD = 2.90	8.148	118	<0.001 *	5.567	−1.97 (0.22)
Verbal Fluency	M = 7.00 SD = 2.80	M = 12.67 SD = 2.29	7.198	118	<0.001 *	5.667	−2.21 (0.23)
Ring Construction	M = 5.97 SD = 2.95	M = 10.97 SD = 2.35	6.148	118	<0.001 *	5.000	−1.87 (0.21)

* $p < 0.05$.

The results from the comparative analysis of cognitive processes between the two groups, G-DYSLEXIA and G-CONTROL, using the WISC-V subscales, provide a robust insight into the cognitive disparities between children diagnosed with dyslexia and their typically developing peers. The statistical tests conducted across various cognitive domains—verbal comprehension, visuospatial skills, fluid reasoning, working memory, and processing speed—reveal highly significant differences, underscoring the impact of dyslexia on cognitive function. In the realm of verbal comprehension, G-CONTROL (control group) displayed significantly superior abilities compared with G-DYSLEXIA (dyslexia group). The mean difference in scores was 5.850 points, with a t-value of 10.374, which is highly significant ($p < 0.001$). The effect size, as indicated by η^2, was 0.801, suggesting a large effect. The Cohen's delta of 2.65 further confirmed a substantial difference between the groups. This implies that children without dyslexia have a much stronger grasp of language-based tasks such as understanding and processing verbal information, which are crucial for effective communication and academic performance. Similarly, in visuospatial skills, which involve the ability to understand and remember the visual and spatial relations among objects, G-CONTROL exhibited significantly better performance, with a mean difference of 7.430 points. The statistical significance of this disparity was marked by a t-value of 9.515 ($p < 0.001$) and an even larger effect size ($\eta^2 = 0.841$), with a Cohen's delta of 4.16. These results highlight that children in the control group are better at visualizing and manipulating objects, skills important for subjects like mathematics and sciences. In fluid reasoning, which is the capacity to think logically and solve problems in novel situations, independent of acquired knowledge, G-CONTROL also significantly outperformed G-DYSLEXIA. The mean difference here was 5.540 points, with a t-value of 7.549 ($p < 0.001$), an effect size of 0.675, and a Cohen's delta of 2.26. Fluid reasoning is critical for the general understanding and handling of abstract concepts, indicating that the control group possesses stronger abilities in adapting to new cognitive challenges. For working memory, which reflects the ability to hold and manipulate information over short periods, G-CONTROL again stood out, with a mean difference of 4.370 points, a t-value of 6.419, and a highly significant *p*-value (<0.001). The effect size was 0.765, and Cohen's delta was 2.37. This suggests that children without dyslexia can better manage multiple pieces of information simultaneously, a skill fundamental to many educational and everyday tasks. Lastly, in processing speed, the ability to perform simple cognitive tasks quickly and fluently, G-CONTROL showed superior performance, with a mean difference of 5.620 points, mirrored by the same t-value as fluid reasoning (7.549), a significant *p*-value, an effect size of 0.680, and a Cohen's delta of

3.37. Faster processing speed in the control group suggests a more efficient cognitive system that can execute tasks more swiftly, beneficial in both academic settings and daily life.

In the analysis of executive functions between the groups G-DYSLEXIA and G-CONTROL evaluated through the ENFEN subscales, statistical tests were conducted to examine differences in interference resistance, trail making, verbal fluency, and ring construction. The results highlighted highly significant disparities between the groups in all evaluated areas, indicating notable differences in executive functions. In interference resistance, G-CONTROL exhibited significantly superior performance compared with G-DYSLEXIA ($t(118) = 8.459$, $p < 0.001$, $\eta^2 = 0.856$, $\delta = -2.39$), with a mean difference of 7.000 points. Similarly, in trail making, G-CONTROL showed significantly better performance ($t(118) = 8.148$, $p < 0.001$, $\eta^2 = 0.652$, $\delta = -1.97$), with a mean difference of 5.567 points. In verbal fluency, G-CONTROL significantly outperformed G-DYSLEXIA ($t(118) = 7.198$, $p < 0.001$, $\eta^2 = 0.796$, $\delta = -2.21$), with a mean difference of 5.667 points. In ring construction, G-CONTROL stood out significantly ($t(118) = 6.148$, $p < 0.001$, $\eta^2 = 0.751$, $\delta = -1.87$), with a mean difference of 5.000 points. These results underscore the presence of substantial disparities in executive functions between the two groups, highlighting the superior performance of G-CONTROL in all evaluated dimensions of the ENFEN.

4. Discussion

The primary objective of this study was to compare the linguistic and cognitive performance of two groups of children: one diagnosed with dyslexia (G-DYSLEXIA) and another with typical reading development (G-CONTROL). The results confirm the initial hypotheses, showing significant deficiencies in all evaluated linguistic and cognitive competencies in children with dyslexia compared with the control group. Below, we discuss these findings in greater depth, exploring the possible underlying causes and their implications in academic and clinical contexts.

The analysis of linguistic competencies reveals that children with dyslexia present significantly lower performance in all evaluated areas: sentence comprehension, linguistic concepts, morphosyntax, pragmatics, and oral text comprehension. It is essential to clarify that, in this study, dyslexia is defined according to the DSM-5 TR criteria, specifically, as a specific learning disorder characterized by difficulties in accurate or fluent word recognition, spelling, and decoding, without including reading comprehension disorder as part of the diagnosis. The differences observed between the groups are not only statistically significant but also clinically relevant, as they affect key areas of language development essential for academic success and daily communication.

One of the main explanations for these deficiencies lies in the altered phonological processing that characterizes reading and writing difficulties (Hulme & Snowling, 2016). Children with dyslexia struggle to segment, identify, and manipulate speech sounds, which directly impacts their ability to process oral and written language. This limitation is crucial in tasks such as sentence comprehension and linguistic concepts, where the quick and precise identification of phonemes and words is essential for proper understanding. Additionally, difficulties in morphosyntax reinforce the idea that dyslexia affects not only word recognition but also the construction and comprehension of complex grammatical structures. Errors in verb conjugation and the construction of complex sentences observed in the G-DYSLEXIA group align with previous studies suggesting that children with dyslexia have difficulties acquiring and automating grammatical rules (Marshall et al., 2011). A possible explanation is that children with dyslexia must allocate more cognitive resources to word decoding, leaving fewer resources available for processing morphosyntactic rules, which compromises their grammatical production and comprehension.

The results in pragmatic skills also revealed significant differences, suggesting that children with dyslexia face difficulties not only at the phonological and grammatical levels but also in the effective use of language in social contexts. Pragmatics, which involves the appropriate use of language in everyday situations, appears to be impaired in these children, limiting their ability to participate autonomously in social activities. This may be partly due to anxiety or frustration stemming from their linguistic difficulties, inhibiting social interaction and affecting their ability to navigate complex communicative situations (Coltheart et al., 2001).

Regarding oral text comprehension, the significant difference observed between the groups highlights how dyslexia affects children's ability to process and retain orally presented information. Children with dyslexia, facing difficulties in working memory and phonological processing, struggle to follow and understand the flow of an oral text, impairing the construction of a coherent understanding of the message (Snowling et al., 2020). It is important to note that these difficulties do not stem from a primary comprehension deficit but from the phonological challenges inherent in dyslexia, reinforcing the importance of differentiating between dyslexia and reading comprehension disorders in this study.

The results of cognitive and executive function tests also revealed notable differences between the groups across all evaluated areas. Children with dyslexia scored significantly lower in verbal comprehension, fluid reasoning, working memory, and processing speed, highlighting the complexity of dyslexia, which affects not only language but also fundamental cognitive skills essential for learning. These findings align with studies conducted in other transparent languages, such as Italian, where children with dyslexia also exhibit deficits in executive functions, including working memory and cognitive flexibility (Mascheretti et al., 2017). This suggests that orthographic transparency does not eliminate executive function deficits in dyslexia but may influence how these deficits manifest.

Verbal comprehension was one of the most affected areas in children with dyslexia. In examining the cognitive deficits associated with dyslexia, it is crucial to differentiate the root causes of these difficulties. This study specifically attributes the observed deficits in reading and related cognitive processes to the phonological processing challenges inherent in dyslexia as opposed to issues primarily arising from verbal comprehension disorders. This distinction is vital for understanding the specific nature of dyslexia and for tailoring appropriate educational interventions.

Phonological processing—the ability to discern and manipulate sounds in speech—has long been recognized as a core difficulty for those with dyslexia. Individuals with this disorder often struggle with tasks such as rhyming, segmenting sounds from words, and rapidly naming series of random letters or numbers, all of which are critical for effective reading and spelling. This contrasts with a primary verbal comprehension disorder, which would imply broader difficulties in understanding spoken language, extending beyond the decoding issues associated with dyslexia.

The conceptual framework adopted from Hulme and Snowling (2016) supports this interpretation by emphasizing the phonological deficits as central to dyslexia. According to their research, difficulties in phonological processing can impede the development of efficient reading skills, which in turn affects reading fluency and comprehension. By referencing this framework, the study aligns with established theoretical perspectives that advocate for a phonological processing deficit model in dyslexia, reinforcing the specificity of the challenges faced by individuals with this condition.

Integrating this clarification into the discussion section of the study is not just about academic rigor; it also serves a practical purpose. It ensures that the findings are interpreted correctly and that the implications for intervention are appropriate. Misattributing these deficits to a primary verbal comprehension disorder could lead to less targeted, and thus,

less effective interventions, potentially focusing on broader language skills rather than the specific phonological skills that individuals with dyslexia need to develop.

Moreover, this focus helps in communicating the findings to educators and clinicians who are involved in designing and implementing educational strategies. Understanding that the core issue lies in phonological processing rather than general verbal comprehension allows for more focused educational approaches. These might include phonics-based reading programs, which have been shown to significantly improve the reading abilities of children with dyslexia by strengthening their phonological processing capabilities.

Therefore, by emphasizing that the deficits observed are linked specifically to the phonological processing challenges associated with dyslexia, the study not only aligns with a well-established body of research but also guides future educational practices and interventions toward more effective and specific methodologies that address the root of the problem. This clarification ensures that both the academic community and practitioners are on the same page regarding the nature of dyslexia and the most effective ways to support those affected by it.

Previous studies have shown that problems in verbal comprehension are related to difficulties in accessing and using mental lexicons as well as applying grammatical rules effectively (Hulme & Snowling, 2016). In this context, children with dyslexia must exert additional cognitive effort to understand and process verbal information, leading to cognitive fatigue and reducing the accuracy and speed of their responses.

Fluid reasoning also showed significant differences, as it involves the ability to solve novel problems, requiring cognitive flexibility and the integration of different types of information. Children with dyslexia seem to struggle in this area due to the additional cognitive load they face when processing written language. This overload limits their ability to allocate sufficient cognitive resources to tasks requiring logic and abstract reasoning (Giazitzidou & Padeliadu, 2022). Working memory, crucial for temporarily holding and manipulating information, was also significantly lower in the children with dyslexia, affecting both their reading ability and overall performance in complex cognitive tasks.

Regarding executive functions, the results revealed substantial differences between the groups in tests of interference resistance, verbal fluency, ring construction, and trail making (Marshall et al., 2011). Executive functions, such as inhibition, attentional control, and planning, are essential for problem solving and managing cognitive demands effectively. Difficulties observed in interference resistance and verbal fluency suggest that children with dyslexia struggle to suppress automatic responses and flexibly switch between tasks, consistent with the literature documenting deficits in inhibition and cognitive flexibility in this population (Barbosa et al., 2019). The consideration of prematurity in studies involving cognitive development is crucial due to its potential impact on neurological development and subsequent cognitive functions. Prematurity has been consistently linked with a variety of developmental challenges, including delays in cognitive and language skills that could confound results when studying conditions such as dyslexia. Recognizing this, the study took meticulous steps to control for the variable of prematurity, ensuring that any conclusions drawn about the cognitive abilities of participants, particularly their executive functions and reading skills, were not unduly influenced by this factor.

In the execution of the study, the researchers ensured an equitable distribution of preterm births between the dyslexic and non-dyslexic groups. This strategy involved a careful selection process where the history of each participant was reviewed and categorized. By matching the number of participants born prematurely in each group, the study aimed to neutralize the impact of prematurity as a confounding variable. This was essential to isolate the effects of dyslexia on cognitive outcomes from those potentially attributable to early birth.

The use of a normal distribution of preterm births across both groups is a statistical approach that further strengthens the study's design. By ensuring that the sample resembles a normal curve with respect to the timing of birth, researchers mitigate the risk of skewed results that could favor one group over the other. This normal distribution implies that the sample contains a range of preterm to full-term births in proportions that are statistically expected, which helps in generalizing the findings to a broader population.

However, it is important to note that even with such controls in place, prematurity may still exert subtle influences on the developmental trajectories of children. While it was not considered the primary explanatory factor for the observed deficits in this study, prematurity could interact with dyslexia in ways that are not fully understood, potentially affecting the severity or manifestation of dyslexic symptoms. Longitudinal studies and further research could explore these interactions in depth, examining how early birth influences learning and cognitive development over time in the presence of dyslexia.

Thus, by meticulously controlling for prematurity during participant selection, the study provides a clearer, more accurate assessment of the cognitive and executive function deficits attributable to dyslexia, minimizing the potential interference of prematurity as a confounding factor. This approach not only enhances the validity of the study's conclusions but also contributes to a more nuanced understanding of how different factors influence cognitive development in children with learning disorders.

It is important to note that these executive function deficits are not exclusive to dyslexia but may be related to the additional cognitive effort these children must exert to process language (Snowling et al., 2020). The cognitive overload resulting from language decoding difficulties reduces the resources available for tasks requiring inhibitory control and sustained attention. This reinforces the idea that reading difficulties and executive functions are interrelated, affecting multiple aspects of academic performance and overall development.

From a neurobiological perspective, several studies have identified structural and functional abnormalities in brain areas related to language processing in individuals with dyslexia, such as the angular gyrus and inferior frontal gyrus, which are involved in phonological decoding and information integration (Mascheretti et al., 2017). These neuroanatomical alterations may explain why children with dyslexia struggle with tasks requiring manipulation and recognition of speech sounds, affecting their reading and writing abilities.

Finally, the epigenetic approach highlights how genetic and environmental factors interact to influence the expression of dyslexia, emphasizing that while there is a genetic predisposition, factors such as the quality of the educational environment and family support can modulate the severity and manifestation of symptoms. This is key to understanding why some children with dyslexia respond better to educational and therapeutic interventions, while others face persistent difficulties (López-Resa & Moraleda-Sepúlveda, 2023). Therefore, adopting a holistic approach to dyslexia treatment, integrating educational interventions with emotional and family support, is essential.

5. Conclusions

In conclusion, the results of this study confirm that individuals with dyslexia exhibit substantial alterations in language and cognition processes, supporting previously formulated research hypotheses. Significant difficulties were identified in various linguistic skills, consistent with the current scientific literature. These include alterations in phonological coding, naming speed, lexical richness, morphosyntax, pragmatics, and oral comprehension, contributing to an altered linguistic profile in the population with dyslexia. Limitations in phoneme identification and categorical perception and reduced vocabulary suggest difficulties accessing the functional lexicon and executing routes during

automatic reading. Additionally, cognitive and executive functioning difficulties were found in the children with dyslexia compared with the children with typical reading performance. The results align with the scientific literature, demonstrating alterations in executive skills such as planning, inhibition, emotional control, working memory, organization, and monitoring. These difficulties, from a neuropsychological perspective, are rooted in structural and functional anomalies in brain areas associated with language processing, affecting phonological decoding and integration. The additional cognitive load when processing written information can explain the alterations in executive functioning such as organization and monitoring.

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5.3. ARTÍCULO 3

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Parental stress, quality of life, and behavioral alterations in children with dyslexia

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ABSTRACT

Introduction: Dyslexia is a learning disorder that, in addition to affecting reading skills, has a significant impact on emotional, social, and family well-being. Despite advances in understanding the disorder, its influence on parental stress and children's quality of life remains an underexplored area.
Objective: The aim of this study was to analyze differences in parental stress, quality of life, and behavioral profiles between children with dyslexia and those with typical development, as well as to assess possible relationships between these factors.
Method: A total of 100 children (50 diagnosed with dyslexia and 50 with typical development), aged between 8 and 10 years, participated in the study along with their caregivers. Variables were measured using the PSI-SF (parental stress), Kiddo-KINDL (quality of life), and BASC-3 (behavior) instruments, complemented by descriptive statistical analyses, t-tests, and a mediation model.
Results: Caregivers of children with dyslexia exhibited significantly higher levels of stress ($p < .001$) across all evaluated dimensions, with pronounced effects in the subscales of emotional distress and perceived difficulties in the child. Children with dyslexia showed reduced quality of life, particularly in areas such as self-esteem and social relationships, with statistically significant differences ($p < .001$). Additionally, they exhibited more behavioral problems, especially in aggression and anxiety. However, mediation analyses did not identify problematic behaviors as direct mediators between dyslexia diagnosis and parental stress.
Conclusions: The findings highlight how dyslexia affects both children and their families, exerting a multidimensional impact. This study underscores the importance of continued research into the interactions between emotional, social, and family factors to optimize support for this population.

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1. Introduction

Dyslexia is a specific learning disorder characterized by persistent difficulties in acquiring reading skills, including decoding, fluency, and reading comprehension, despite adequate intelligence and appropriate educational instruction (APA, 2022). It is a neurodevelopmental disorder that not only significantly interferes with academic performance but also affects emotional and social functioning throughout an individual's lifespan. Approximately 5–10 % of the global child population has dyslexia, making it one of the most prevalent conditions affecting academic achievement (Snowling, 2013). Given its high prevalence, dyslexia is widely studied in terms of cognitive deficits and reading intervention strategies. However, its far-reaching consequences beyond academic struggles have received comparatively less attention (Gabrieli, 2009; Peterson & Pennington, 2012).

Historically, research on dyslexia has focused primarily on the cognitive manifestations of the disorder, particularly in relation to phonological deficits, and on developing pedagogical strategies aimed at improving reading skills (Gabrieli, 2009; Peterson & Pennington, 2012). While these perspectives have provided crucial insights into dyslexia's cognitive underpinnings, they have also overshadowed other critical aspects of the disorder, such as its impact on emotional, social, and familial domains. Recent research has increasingly emphasized that dyslexia extends beyond the academic sphere and significantly influences the psychological well-being, self-esteem, and interpersonal relationships of affected individuals (Peterson & Pennington, 2015). This broader understanding of dyslexia calls for an integrated approach that not only addresses reading difficulties but also considers the disorder's social-emotional repercussions.

Dyslexia has also been examined from a developmental perspective, with researchers emphasizing the importance of early diagnosis and intervention. The earlier dyslexia is identified, the better the outcomes for academic success and self-esteem (Vellutino et al., 2004). Longitudinal studies indicate that children diagnosed and supported in their early years show fewer academic and emotional difficulties later in life (Shaywitz & Shaywitz, 2008). In contrast, individuals whose dyslexia goes undiagnosed until adolescence or adulthood often experience greater struggles in both educational and professional settings, highlighting the necessity of systematic screening and early intervention programs.

From a neuropsychological perspective, dyslexia is associated with structural and functional brain differences, particularly in areas involved in phonological processing, sensory integration, and reading fluency. Neuroimaging studies have consistently shown reduced activation in the left temporoparietal and occipitotemporal regions of the brain, which are critical for grapheme-phoneme conversion and the development of efficient word recognition pathways (Bruni et al., 2009; Saccani et al., 2022). These findings suggest that dyslexia results from inefficient neural connectivity in reading-related areas, leading to slow and effortful reading processes.

Moreover, the dual-route model of reading suggests that dyslexia arises from impairments in both the phonological route (grapheme-to-phoneme conversion) and the lexical route (whole-word recognition), leading to difficulties in word retrieval and fluency (Coltheart et al., 2001). This model supports the hypothesis that dyslexia is not a single deficit disorder but rather a spectrum of impairments involving multiple cognitive and neurological processes.

Additional research has identified a genetic basis for dyslexia, with studies showing that the disorder often runs in families (Fisher & DeFries, 2002). Specific genetic markers, such as those found on chromosomes 6 and 15, have been associated with increased risk for dyslexia (Scerri & Schulte-Körne, 2010). These genetic findings further reinforce the idea that dyslexia is a biologically rooted condition rather than simply a result of poor instruction or lack of motivation.

Furthermore, dyslexia is not limited to phonological impairments but also involves broader cognitive deficits, particularly in attention, memory, and executive functioning. Studies indicate that individuals with dyslexia exhibit difficulties in sustained and selective attention, making it challenging to concentrate for extended periods, particularly during reading tasks (Cheng et al., 2021). Deficits in working memory, especially verbal memory, further contribute to reading difficulties, as individuals with dyslexia struggle to retain and manipulate linguistic information while processing text (Gathercole & Alloway, 2008). Additionally, impairments in executive functions, including planning, organization, and inhibitory control, create further academic challenges, making it difficult for students with dyslexia to develop effective study strategies and adapt to structured learning environments (Reiter et al., 2005).

Beyond its cognitive impairments, dyslexia has a profound impact on emotional well-being and social interactions. Children with dyslexia frequently experience frustration and distress due to their persistent reading struggles, which can lead to low self-esteem and emotional dysregulation (Karande et al., 2009a). As a result, they are at a higher risk of developing anxiety, depression, and social withdrawal, further exacerbating their academic and personal challenges (Marchand-Krynski et al., 2018).

Dyslexia has been linked to learned helplessness, a condition in which repeated academic failure leads children to believe they have no control over their success (Burden, 2008). This can result in a lack of motivation to engage in reading or academic tasks, even when accommodations are provided. The social consequences of dyslexia can be severe, as peer relationships are often affected when children struggle with reading-related classroom activities, group projects, and oral presentations (Mugnaini et al., 2009).

Despite extensive research on the academic and psychological effects of dyslexia on children, its impact on family dynamics and parental stress has been significantly understudied. Because dyslexia is a chronic condition requiring continuous attention and intervention, it places a high emotional and psychological burden on both the affected children and their families (Hagan et al., 2016; Zhang et al., 2011). Parents of children with dyslexia often experience elevated stress levels due to the ongoing need to provide academic support, navigate school accommodations, and advocate for their child's educational rights (Hernández Pérez & Rabadán Rubio, 2023; Karande et al., 2009b).

Parental stress is often exacerbated by feelings of guilt and frustration, as parents may struggle to understand why their child faces difficulties despite their efforts to provide support (Shaywitz & Shaywitz, 2020). This stress can be compounded by negative interactions with teachers and school administrators, who may lack proper training in recognizing and addressing dyslexia, leading to misunderstandings and inadequate support structures.

Children with dyslexia frequently exhibit difficulties in emotional regulation and behavioral control, particularly in response to academic stressors. Frustration stemming from reading and writing tasks often translates into externalizing behaviors, such as aggression, impulsivity, and oppositional tendencies (Ramus, 2003; Willcutt & Pennington, 2000). Conversely, internalizing symptoms such as anticipatory anxiety related to reading performance can further exacerbate academic avoidance and social withdrawal (Goswami et al., 2011; Terras et al., 2009). These behavioral patterns not only hinder academic success but also contribute to heightened parental stress, creating a negative feedback loop that impacts the entire family system (Hernández Pérez & Rabadán Rubio, 2023).

Despite the growing attention to these multidimensional aspects of dyslexia, significant gaps remain in the current literature. Most studies have addressed the individual manifestations of the disorder without considering the interaction between parental stress, quality of life, and the behavioral profile of children with dyslexia. Therefore, the present study aimed to compare parental stress, quality of life, and behavioral profile between a group of children diagnosed with dyslexia and a group with typical development. Additionally, we examined the mediating role of behavioral problems in the relationship between parental stress and the diagnosis of dyslexia. Based on previous literature, we hypothesized that parents of children with dyslexia would report significantly higher levels of stress compared to parents of typically developing children. Furthermore, we expected that children with dyslexia would exhibit lower quality of life and more behavioral difficulties than their typically developing peers. Lastly, we hypothesized that behavioral problems would mediate the relationship between parental stress and the diagnosis of dyslexia, such that increased parental stress would be associated with greater behavioral issues, which in turn would be linked to dyslexia.

2. Method

2.1. Participants

The study included a total of 100 children, of whom 48 were girls and 52 were boys, aged between 8 and 10 years ($M = 9.2$, $SD = .6$), divided into two groups of 50 participants each. The selected age range was based on developmental milestones in reading acquisition, as children in this stage are expected to have consolidated basic reading skills, allowing for a clearer distinction between typical readers and those with reading difficulties. Participants in the dyslexia-diagnosed group (G-DYSLEXIA) were identified through formal clinical diagnoses of developmental dyslexia conducted by multidisciplinary teams at hospital and educational referral centers. These diagnoses followed standardized criteria, incorporating neuropsychological assessments, academic history reviews, and structured evaluations of phonological processing, reading fluency, and comprehension. Only children who had been diagnosed at least one year before the study were included, ensuring that their difficulties were persistent rather than transient delays in literacy acquisition.

Children with typical development (G-CONTROL) were selected to match the G-DYSLEXIA group in terms of age, gender distribution, and socioeconomic background, which was determined based on parental education and household income. These participants were recruited from the same schools as the experimental group to minimize potential confounding variables related to educational environment and instruction quality. None of the children in the control group had a history of learning difficulties, language impairments, or neurodevelopmental disorders, and their teachers confirmed that they demonstrated typical reading skills for their age. To further validate their inclusion, they underwent screening assessments, including measures of phonological awareness, rapid automatized naming, and word reading efficiency, to ensure they were within the expected range for their age and grade level.

Participants were recruited from public and private elementary schools that collaborated with hospital centers specializing in neurodevelopmental disorders. The schools provided additional information regarding the type of academic support children with dyslexia received, including specialized reading intervention programs, individualized education plans, and accommodations such as extra time for reading tasks. Parents of all participants provided informed consent, and children assented to participation after a detailed explanation of the study's objectives and procedures. Exclusion criteria were strictly applied, ruling out children with severe sensory pathologies, intellectual disabilities, psychiatric or neurodevelopmental disorders other than dyslexia, and any preexisting neurological or medical conditions that could influence cognitive or emotional abilities. By ensuring a rigorous selection process and a well-matched control group, the study aimed to isolate the specific effects of dyslexia on academic, emotional, and social variables.

2.2. Design

The present study adopted a descriptive and cross-sectional design, with the aim of analyzing the differences and relationships between behavioral, emotional, and executive variables in children with and without dyslexia. The descriptive design allowed for characterizing and comparing the levels of parental stress, children's quality of life, and maladaptive behaviors in the two participant groups, while the cross-sectional nature focused on a single-point-in-time measurement, providing a snapshot of the variables of interest in the studied population (Hernández-Sampieri et al., 2014). This approach is particularly suitable when seeking to examine the impact of an independent variable—in this case, the diagnosis of dyslexia—on a series of dependent variables, without the need for experimental manipulation.

2.3. Instruments

2.3.1. Parental Stress Index – Short Form (PSI-SF)

The Parental Stress Index – Short Form (PSI-SF; Abidin, 1995) is a widely used tool for assessing the level of stress experienced by parents in their parental role. It is composed of 36 items organized on a five-point Likert scale. This instrument is divided into three

main subscales: Parental Distress, Dysfunctional Parent-Child Interaction and Difficult Child. The Parental Distress subscale focuses on the perceived quality of the bond between parent and child, while the Dysfunctional Parent-Child Interaction subscale evaluates parents' perceptions of the responsibilities and burdens associated with raising the child. Finally, the Difficult Child subscale measures the emotional well-being of the parents in relation to their parental role and external factors that may influence their experience of stress. The PSI-SF allows for a comprehensive evaluation of parental stress, facilitating the identification of specific areas requiring intervention. Studies have demonstrated its efficacy across different cultural and socioeconomic contexts, making it a versatile tool for research and clinical practice (Abidin, 1995). Its ability to discriminate between levels of parental stress provides valuable information for developing support programs aimed at improving family dynamics and the well-being of both parents and their children. The Cronbach's alpha obtained in the present study was.85. Given the absence of validated norms for the Spanish population, raw scores were used to compare relative differences between groups, following the approach adopted in previous international studies examining parental stress in diverse cultural contexts.

2.3.2. Kiddo-KINDL

The Kiddo-KINDL (Bullinger et al., 1994) is a questionnaire designed to measure children's quality of life across five fundamental dimensions, composed of 24 items evaluated on a five-point scale. The five dimensions it assesses are: Physical Well-being, Emotional Well-being, Self-esteem, Family Well-being, and Social Relationships. The Physical Well-being dimension focuses on the child's perception of their health status and physical abilities, while Emotional Well-being explores mood and the frequency of negative emotions such as sadness or anxiety. The Self-esteem dimension evaluates the child's perception of their personal worth—a crucial aspect in dyslexia studies, as children with this disorder often experience difficulties in this area. Additionally, the Family Well-being dimension measures the quality of family interactions and the perceived support at home, and the Social Relationships dimension assesses the quality of the child's interactions with peers and their social integration. The Cronbach's alpha obtained in the present study was.89. Since no newly adapted version for the Spanish population is currently available, the results were interpreted in relation to international benchmarks, ensuring comparability while acknowledging the need for future validation studies within the Spanish-speaking population.

2.3.3. Behavior Assessment System for Children and Adolescents – 3 (BASC-3)

The Behavior Assessment System for Children and Adolescents – 3 (BASC-3; Reynolds & Kamphaus, 2015) is a comprehensive tool used to evaluate children's emotions and behaviors through multiple informants, including parents, teachers, and self-reports. With a Cronbach's alpha coefficient of.90, the BASC-3 covers a wide range of behavioral and emotional variables, such as Aggressiveness, Anxiety, Depression, Somatization, Atypicality, Withdrawal, Attention Problems, Adaptability Problems, Social Skills Problems, Limitations in Daily Activities, and Lack of Functional Communication. Each variable is designed to provide a detailed and specific evaluation of different aspects of the child's behavior and emotional well-being. The versatility of the BASC-3 makes it suitable for a variety of clinical and educational contexts, enabling professionals to identify behavioral patterns that may interfere with academic performance and the social integration of children with dyslexia. Its multi-informant structure facilitates a comprehensive and balanced view of the child's behavior, which is essential for designing effective interventions that address both academic challenges and the emotional and social difficulties associated with dyslexia. The Cronbach's alpha obtained in the present study was.91.

2.4. Procedure

Data collection was carried out in two stages. In the first stage, initial interviews were conducted with parents or guardians by qualified researchers to gather demographic information, family history, and parental stress, complemented by the administration of the PSI-SF. These interviews were conducted in a quiet environment to ensure parents felt comfortable providing detailed responses. In addition to parental stress measures, the interviews included questions about the child's developmental history, educational background, and any previous interventions received for learning difficulties. Parents were also asked about their perceptions of their child's emotional well-being and social adaptation.

In the second stage, direct assessments of the children were conducted individually in a quiet, distraction-free setting within their school or at the research center, depending on parental preference and logistical feasibility. Each child participated in two 45-minute sessions administered by trained neuropsychologists and educational psychologists. The first session focused on behavioral and emotional assessment using the BASC-3, in which structured observations and self-report scales were completed to evaluate emotional functioning, adaptive behavior, and potential behavioral challenges. The second session included the administration of the Kiddo-KINDL, assessing the child's quality of life across multiple domains, including emotional well-being, self-esteem, social relationships, and school-related stress. Additional observations were recorded to note children's engagement, attentional capacity, and any signs of test anxiety.

To ensure standardized administration, examiners followed a structured protocol and received specialized training on the selected instruments. Any child who showed signs of excessive anxiety or fatigue was allowed breaks, and assessments were scheduled at optimal times to prevent cognitive overload. After the evaluations, parents received debriefing sessions where general insights about their child's performance were shared, without disclosing specific scores, to ensure ethical and non-harmful communication of results.

This research was approved by the Ethics Committee under approval code *120–2023-H*. Informed consent was obtained from the families and participating children, ensuring that they understood the objectives, procedures, risks, benefits, and data confidentiality, in compliance with LOPD-GDD 3/2018 and the GDPR (EU Regulation 2016/679).

2.5. Data analysis

Before proceeding with the comparative analyses, a normality analysis (Chi-square test, $p < .05$) and descriptive analyses (means, standard deviations, and frequencies) were conducted to ensure sociodemographic comparability between the groups and to characterize the variables of interest, thereby strengthening the internal validity of the study and preparing the data for subsequent analyses. Next, Welch's t-tests for independent samples were applied to compare the means of the dependent variables (parental stress, children's quality of life, and maladaptive behaviors) between children with dyslexia and those with typical development, as Welch's test is more robust to violations of homogeneity of variance. Within-group comparisons across different dimensions were conducted using paired-sample T-tests. Finally, mediation analyses were performed to explore whether behavioral problems mediate the relationship between the diagnosis of dyslexia and total parental stress. All statistical analyses were conducted using SPSS v.29 (IBM Corp, 2023).

3. Results

The chi-square analysis of all demographic variables (*sex, age, dyslexia diagnosis, years of treatment, comorbidity, school support, weeks of gestation, and Apgar score*) was not significant ($p > .50$), thereby confirming that no sample differences would arise as a function of these variables (Table 1).

To address the study's objectives, Welch's t-tests were conducted to compare the scores of both groups on variables related to parental stress, quality of life, and behavioral patterns (Table 2, Table 3, and Table 4). Levene's test confirmed the assumption of homogeneity of variances ($p > .05$), indicating that the variances of the groups in the evaluated variables are homogeneous.

The analysis of parental stress, measured through the subscales *Parental Distress, Parental-Child Dysfunctional Interaction*, and *Difficult Child*, revealed statistically significant differences ($p < .001$) between caregivers of G-DYSLEXIA and G-CONTROL. In *Parental Distress*, G-DYSLEXIA obtained a mean of 39.78 ($SD = 5.068$) compared to 19.60 ($SD = 4.463$) in G-CONTROL, reflecting greater emotional distress in the dyslexia group (a difference of −20.18 points; $t(96) = -21.130$, $p < .001$). In the *Parental-Child Dysfunctional Interaction* subscale, the dyslexia group averaged 39.00 ($SD = 5.402$) compared to 19.30 ($SD = 4.626$) in the control group (a difference of −19.70 points; $t(96) = -19.586$, $p < .001$), indicating greater difficulty in the parent-child interaction. Finally, in *Difficult Child*, G-DYSLEXIA reached 39.84 ($SD = 5.850$) compared to 18.84 ($SD = 4.533$) in G-CONTROL, with a difference of −21.00 points ($t(98) = -20.066$, $p < .001$, $\eta^2 = .681$), underscoring an increase in the perception of behavioral difficulties among children with dyslexia.

The analysis of the dimensions of quality of life (*Self-esteem, Emotional Well-being, Peer-Related Development/Activity, Family Well-being*, and *Physical Well-being*) shows statistically significant differences ($p < .001$) between the G-DYSLEXIA and G-CONTROL, with consistently lower means for G-DYSLEXIA on all scales. In *Self-esteem*, G-DYSLEXIA obtained 2.04 ($SD = .856$) compared to 8.12 ($SD = 2.545$) in the control group (a difference of −6.08 points; $t(98) = -16.013$, $p < .001$, $\eta^2 = .703$). In *Emotional Well-being*, the dyslexia group averaged 3.16 ($SD = 1.405$) versus 13.78 ($SD = 2.985$) in the control group (a difference of −10.62 points; $t(98) = -22.763$, $p < .001$, $\eta^2 = .841$). In *Peer-Related Development/Activity*, the values were 3.02 ($SD = 1.464$) for G-DYSLEXIA and 14.14 ($SD = 3.307$) for G-CONTROL (a difference of −11.12 points; $t(98) = -21.740$, $p < .001$, $\eta^2 = .623$). For *Family Well-being*, G-DYSLEXIA reached 2.00

Table 1
Participant Characteristics.

Variable	G-DYSLEXIA	G-CONTROL	Chi-square Test Results
Sex	52 % males (N = 26) 48 % females (N = 24)	52 % males (N = 26) 48 % females (N = 24)	Chi-square = 3.901 $p = .330$
Age	34.0 % 8 years old (N = 17) 32.0 % 9 years old (N = 16) 34.0 % 10 years old (N = 17)	34.0 % 8 years old (N = 17), 32.0 % 9 years old (N = 16), 34.0 % 10 years old (N = 17)	Chi-square = 7.230 $p = .622$
Dyslexia Diagnosis	50 % diagnosed (N = 50)	100.0 % not dyslexia diagnosis (N = 50)	Chi-square = 19.170 $p = .999$
Years of Treatment	28.0 % 1 year (N = 14) 32.0 % 2 years (N = 16) 40.0 % 3 years (N = 20)	100.0 % not treatment (N = 50)	Chi-square = 5.872 $p = .493$
Comorbidity	30.0 % dysgraphia (N = 15) 33.0 % dyscalculia (N = 17) 37.0 % both conditions (N = 18)	100.0 % not comorbidity (N = 50)	Chi-square = 6.988 $p = .582$
School Support	50.0 % receiving support (N = 25), 50.0 % not receiving support (N = 25)	100.0 % not receiving support (N = 50)	Chi-square = 20.170 $p = .999$
Gestational Weeks	32.0 % 30–35 weeks (N = 16), 34.0 % 35–40 weeks (N = 17), 34.0 % > 40 weeks (N = 17)	32.0 % 30–35 weeks (N = 16), 34.0 % 35–40 weeks (N = 17), 34.0 % > 40 weeks (N = 17)	Chi-square = 6.322 $p = .534$
Apgar Score	28.0 % at risk (N = 14) 36.0 % intermediate (N = 18) 36.0 % normal (N = 18)	28.0 % at risk (N = 14) 36.0 % intermediate (N = 18) 36.0 % normal (N = 18)	Chi-square = 6.079 $p = .516$

Table 2
Results of the differences in the measures related to parental stress between the G-DYSLEXIA and G-CONTROL groups, as evaluated through the PSI-SF instrument.

Parental Stress	Groups		Levene's Test			Welch's t-tests for Comparison of Means				
	G-DYSLEXIA	G-CONTROL	*F*	Sig.	η^2	*t*	df	Sig. (bilateral)	Mean Difference	δ
Parental Distress	*M* = 39.78 *SD* = 5.068	*M* = 19.60 *SD* = 4.463	1.267	.263	-	−21.130	96	< .001*	−20.180	4.764
Dysfunctional Parent-Child Interaction	*M* = 39.00 *SD* = 5.402	*M* = 19.30 *SD* = 4.626	2.039	.156	-	−19.586	96	< .001*	−19.700	4.929
Difficult Child	*M* = 39.84 *SD* = 5.850	*M* = 18.84 *SD* = 4.533	7.648	.007	.681	−20.0.66	98	< .001*	−21.000	5.228

* $p < .05$

Table 3
Results of the differences in the measures related to quality of life between G-DYSLEXIA and G-CONTROL, evaluated through the Kiddo-KINDL instrument.

Quality of life	Groups		Levene's Test			Welch's t-tests for Comparison of Means				
	G-DYSLEXIA	G-CONTROL	*F*	Sig.	η^2	*t*	df	Sig. (bilateral)	Mean Difference	δ
Self-esteem	M = 2.04 *SD* = .856	*M* = 8.12 *SD* = 2.545	47.291	< .001*	.703	−16.013	98	< .001*	−6.080	1.952
Emotional Well-being	*M* = 3.16 *SD* = 1.405	*M* = 13.78 *SD* = 2.985	32.162	< .001*	.841	−22.763	98	< .001*	−10.620	2.348
Peer-Related Development/ Activity	*M* = 3.02 *SD* = 1.464	*M* = 14.14 *SD* = 3.307	43.933	< .001*	.623	−21.740	98	< .001*	−11.120	2.531
Family Well-being	*M* = 2.00 *SD* = .902	*M* = 7.86 *SD* = 2.587	37.938	< .001*	.831	−15.120	98	< .001*	−5.860	1.942
Physical Well-being	*M* = 2.10 *SD* = .735	*M* = 7.48 *SD* = 2.742	89.637	< .001*	.902	−13.399	98	< .001*	−5.380	1.982

* $p < .05$

(*SD* =.902) versus 7.86 (*SD* = 2.587) in G-CONTROL (a difference of −5.86 points; *t*(98) = -15.120, $p < .001$, $\eta^2 = .831$). Lastly, in *Physical Well-being*, the dyslexia group reported 2.10 (*SD* =.735) compared to 7.48 (*SD* = 2.742) in the control group (a difference of −5.38 points; *t*(98) = -13.399, $p < .001$, $\eta^2 = .902$). These results indicate a large effect on the perception of quality of life in children with dyslexia, particularly in the emotional, social, and physical dimensions.

The statistical analysis of the behavioral profile scores showed significant differences ($p < .001$) between G-DYSLEXIA and G-CONTROL on all evaluated scales, with consistently higher averages in G-DYSLEXIA. For example, in Aggressiveness, G-DYSLEXIA obtained a mean of 53.18 (*SD* = 8.34) compared to 17.40 (*SD* = 6.07) in G-CONTROL (a difference of 35.78; *t*(98) = 24.514, $\eta^2 = .586$). Similarly, in Anxiety, Depression, and Somatization, the mean differences ranged between 33.22 and 37.58 points ($p < .001$). The scales related to social and adaptive skills also showed remarkable discrepancies; in Social Skills Problems, G-DYSLEXIA obtained 55.64 (*SD* = 8.30) compared to 19.86 (*SD* = 5.31) in G-CONTROL (a difference of 35.78; *t*(98) = 25.671, $p < .001$, $\eta^2 = .611$). Moreover, in Social Development Disorders, the gap reached 37.30 points (*t*(98) = 26.539, $p < .001$, $\eta^2 = .834$). In general, the effect sizes ranged between.509 and.971, indicating a moderate to high impact on the behavioral and emotional dimensions associated with dyslexia.

Finally, the mediation analysis conducted using the PROCESS procedure for SPSS explored whether behavioral problems mediate the relationship between the diagnosis of dyslexia and total parental stress. The results revealed that the diagnosis of dyslexia has a significant impact on both aversive behavioral aspects and parental stress levels, although no evidence was found of a mediating effect of behavioral alterations in this relationship.

In the first model, the effect of the diagnosis of dyslexia on behavioral problems was evaluated. The results showed that the diagnosis of dyslexia explains 43.1 % of the variability in behavioral problems (R^2 =.4314). The effect of the diagnosis on behavioral alterations was significant ($\beta = -1.3071$, $p < .001$), with an estimated coefficient of −1.4400 and a 95 % confidence interval between −1.7714 and −1.1086. This indicates a significant inverse relationship between the diagnosis of dyslexia and the behavioral aspect. The specific results of this model are presented in Table 5.

The inclusion of "problematic behavior patterns" as a mediating variable was based on existing evidence suggesting that children with dyslexia are at a higher risk of developing emotional and behavioral difficulties due to the cumulative impact of academic struggles, frustration, and social challenges (Goswami et al., 2011; Willcutt & Pennington, 2000). These behavioral problems can manifest as externalizing behaviors (e.g., aggression, hyperactivity, oppositionality) or internalizing symptoms (e.g., anxiety, depression, withdrawal), both of which can influence family dynamics and parental stress (Terras et al., 2009). The justification for this mediation model lies in the theoretical framework that posits that learning difficulties, such as dyslexia, do not operate in isolation but rather interact with psychological and environmental factors, shaping broader developmental outcomes (Snowling & Melby-Lervåg,

Table 4
Results of the differences in the measures related to the behavioral profile between G-DYSLEXIA and G-CONTROL, evaluated through the BASC-3.

Behavioral profile	Groups		Levene's Test			Welch's t-tests for Comparison of Means				
	G-DYSLEXIA	G-CONTROL	*F*	Sig.	η^2	*t*	*df*	Sig. (bilateral)	Mean Difference	δ
Scores of the Composite, Clinical, and Adaptive Scales										
Aggressiveness	*M* = 53.18 *SD* = 8.344	*M* = 17.40 *SD* = 6.074	11.232	.001*	.586	24.514	98	< .001*	35.780	7.246
Anxiety	*M* = 56.16 *SD* = 7.552	*M* = 18.58 *SD* = 6.341	1.337	.250	-	26.947	98	< .001*	37.580	6.990
Depression	*M* = 53.50 *SD* = 7.643	*M* = 19.63 *SD* = 6.56	.850	.359	-	23.431	98	< .001*	33.680	6.964
Somatization	*M* = 52.28 *SD* = 7.70	*M* = 19.82 *SD* = 6.700	2.649	.107	-	23.467	98	< .001*	33.220	7.049
Atypicality	*M* = 55.78 *SD* = 7.937	*M* = 18.68 *SD* = 5.727	11.368	.001*	.971	26.805	98	< .001*	37.100	7.156
Withdrawal	*M* = 53.56 *SD* = 8.011	*M* = 19.88 *SD* = 6.100	5.973	.016*	.685	23.653	98	< .001*	33.680	7.050
Attention Problems	*M* = 52.30 *SD* = 8.011	*M* = 19.52 *SD* = 5.444	4.383	.039*	.753	25.664	98	< .001*	32.780	6.603
Adaptability Problems	*M* = 54.64 *SD* = 7.690	*M* = 19.32 *SD* = 5.995	4.151	.044*	.698	25.614	98	< .001*	35.320	7.248
Social Skills Problems	*M* = 55.64 *SD* = 8.305	*M* = 19.86 *SD* = 5.307	15.809	< .001*	.611	25.671	98	< .001*	35.780	7.159
Limitations in Daily Activities	*M* = 52.92 *SD* = 7.134	*M* = 19.58 *SD* = 5.621	1.330	.252	-	25.957	98	< .001*	33.340	6.560
Lack of Functional Communication	*M* = 54.86 *SD* = 7.871	*M* = 18.80 *SD* = 6.471	1.933	.168	-	25.023	98	< .001*	36.060	7.414
Scores of the Content Scales										
Anger Control Problems	*M* = 54.48 *SD* = 8.671	*M* = 18.14 *SD* = 6.230	5.979	.016*	.814	24.066	98	< .001*	36.340	7.350
School Bullying	*M* = 53.52 *SD* = 7.166	*M* = 19.20 *SD* = 6.455	.201	.655	-	25.161	98	< .001*	34.320	6.643
Social Development Disorders	*M* = 56.26 *SD* = 7.868	*M* = 18.96 *SD* = 6.071	6.024	.016*	.834	26.539	98	< .001*	37.300	6.851
Lack of Emotional Self-Control	*M* = 55.10 *SD* = 7.739	*M* = 19.10 *SD* = 5.963	5.936	.017*	.812	26.056	98	< .001*	36.000	6.908
Executive Functioning Problems	*M* = 53.78 *SD* = 7.760	*M* = 17.52 *SD* = 6.469	2.296	.133	-	25.379	98	< .001*	36.260	7.122
Negative Emotionality	*M* = 55.62 *SD* = 7.309	*M* = 18.58 *SD* = 5.786	2.520	.116	-	28.097	98	< .001*	37.040	6.554
Resilience Problems	*M* = 52.10 *SD* = 8.438	*M* = 18.64 *SD* = 5.813	5.744	.018*	.509	23.092	98	< .001*	33.460	7.282

* $p < .05$

Table 5
Relationship between the diagnosis of dyslexia and the behavioral profile.

Variable	Coefficient	Standard Error	*t*	*p*	95 % CI Lower	95 % CI Upper
Constant	2.8800	.2640	10.9077	< .001*	2.3560	3.4040
Diagnosis	−1.4400	.1670	−8.6233	< .001*	−1.7714	−1.1086
R^2	.4314					

* $p < .05$

2016). By analyzing behavioral problems as a mediating variable, this study aimed to explore whether these emotional and behavioral responses act as an explanatory mechanism linking dyslexia to increased parental stress. Previous research has indicated that children with dyslexia who exhibit higher levels of behavioral difficulties tend to elicit greater stress responses from their caregivers, reinforcing a negative cycle that impacts both the child's adaptation and family well-being (Hendren et al., 2018). Furthermore, the conceptualization of behavioral difficulties in this study was grounded in standardized measures such as the BASC-3, which evaluates a broad spectrum of maladaptive behaviors. These include difficulties with emotional regulation, social interactions, and impulse control—factors that have been identified as common comorbidities in children with dyslexia (Gabay et al., 2016). Therefore, the decision to include behavioral problems as a mediating variable was intended to provide a more comprehensive understanding of the pathways through which dyslexia influences parental stress and overall family dynamics.

Subsequently, in the second model, both the diagnosis of dyslexia and behavioral problems were included to predict levels of parental stress. This model showed an excellent fit, explaining 91.78 % of the variability in parental stress (R^2 =.9178). The diagnosis of dyslexia had a strong and significant direct effect on parental stress ($\beta = -1.8769$, $p < .001$), with an estimated coefficient of

−59.9450 and a 95 % confidence interval between −64.8148 and −55.0753. This indicates that the diagnosis of dyslexia is strongly associated with higher levels of parental stress. However, the pattern of problematic behavior did not show a significant effect on parental stress ($\beta = .0224$, $p = .5632$), suggesting that this variable does not contribute significantly to explaining the levels of parental stress. The complete results of this model are presented in Table 6.

Finally, the direct and indirect effects of the diagnosis of dyslexia on parental stress were evaluated. The direct effect of the diagnosis was strong and significant (-59.9450, $p < .001$), while the indirect effect through behavioral problems was not significant (-.9350, 95 % CI: [-4.4122, 2.6409]). This confirms that behavioral problems do not significantly mediate the relationship between the diagnosis of dyslexia and parental stress levels. These results highlight that the diagnosis of dyslexia has a significant direct impact on parental stress, whereas behavioral problems do not act as a mediator in this relationship. The overall model explains a high percentage of the variability in parental stress, emphasizing the relevance of the dyslexia diagnosis as the main predictor of this phenomenon.

4. Discussion

The present study aimed to compare the levels of parental stress, quality of life, and behavioral profile between G-DYSLEXIA and G-CONTROL. The results indicate that dyslexia significantly impacts not only academic performance but also the emotional and behavioral well-being of the children, as well as the family environment. These findings reinforce the view that dyslexia, beyond being a reading disorder, is a condition that affects multiple areas of development (Snowling, 2013; Peterson & Pennington, 2015).

4.1. Parental stress

The findings highlight that parents of children with dyslexia experience higher levels of stress, as evidenced by increased scores in *Parental Distress*, *Dysfunctional Parent-Child Interaction*, and the *Perception of a Difficult Child*. These data are consistent with research portraying dyslexia as a chronic stressor for families, given the additional demands imposed by the need for constant academic support, the complexity of compensatory strategies, and the uncertainty regarding the child's future development (Karande et al., 2009b). Added to this are subjective factors, such as the degree of understanding and acceptance that parents have regarding the child's condition or their ability to manage both their own expectations and those of their environment (Hernández Pérez & Rabadán Rubio, 2023).

The literature indicates that the overload experienced by caregivers of children with learning difficulties can be explained by the simultaneous occurrence of multiple demands. On one hand, they must address academic challenges through coordination with teachers, remedial sessions, tutoring, and continuous reviews of reading progress. On the other hand, they face social pressure derived from comparisons with other children and the fear that dyslexia might negatively affect their child's future opportunities (Remache Bunci et al., 2024). This combination of factors can reinforce the feeling of distress and strain the parent-child relationship when coping strategies prove ineffective or when it is assumed that the child could "try harder" to overcome their reading difficulties (Cuéllar Calvo & Gallego Echeverri, 2024).

The fact that no clear mediating effects of problematic behaviors were found in the relationship between the diagnosis and stress suggests that the dyslexia label, by itself, may carry enough weight to trigger emotional overload in parents (Carotenuto et al., 2017). This finding does not diminish the relevance of disruptive behaviors, but it does indicate that the very experience of dyslexia—coupled with the process of finding adequate support and living with constant uncertainty—can trigger levels of tension that manifest even in families with children who do not exhibit extremely difficult behaviors (Vite Sierra & Vázquez Ramírez, 2014). This circumstance underscores the multifactorial nature of the parental experience and the need to study in greater detail other elements (for example, family resilience or the availability of support networks) that could also moderate how dyslexia affects the emotional state of caregivers (Hernández Pérez & Rabadán Rubio, 2023).

4.2. Quality of life

Regarding the quality of life of the children, the differences found between the dyslexia group and the control group were markedly evident in dimensions such as Self-esteem, Emotional Well-being, and Peer-Related Development. This pattern is consistent with abundant evidence linking dyslexia with recurring feelings of failure, a low perception of competence, and the experience of a school environment perceived as hostile or unsupportive (Humphrey, 2003; Mugnaini et al., 2009). The fact that these reading difficulties emerge at an early age and persist over time increases the likelihood that the child internalizes the label "I'm not capable," which

Table 6
Relationship between diagnosis, comorbidities, and parental stress.

Variable	Coefficient	Standard Error	*t*	*p*	95 % CI Lower	95 % CI Upper
Constant	177.6300	4.3527	40.8088	< .001*	168.9910	186.2690
Diagnosis	−59.9450	2.4536	−24.4314	< .001*	−64.8148	−55.0753
Conduct Problems	.6493	1.1192	.5802	.5632	−1.5719	2.8705
R^2	.9178					

* $p < .05$

affects not only their self-confidence but also their willingness to take academic and social risks (Zou et al., 2022).

Evidence suggests that children with dyslexia tend to find themselves in a vulnerable position when placed in a school context that prioritizes speed and reading accuracy, especially if the feedback they receive focuses predominantly on their errors (Zuppardo et al., 2020). This situation can consolidate a sense of isolation and limit opportunities for integration with peers, as reflected in the lower scores on peer-related development. Studies such as Grills-Taquechel et al. (2012) also argue that an unsupportive school environment fosters stigma and triggers rejection behaviors, which exacerbates feelings of loneliness and a low quality of life.

Emotional well-being is further compromised by the coexistence of other variables that tend to accompany dyslexia, such as anxiety about public reading or the fear of being judged for decoding difficulties (Goswami et al., 2011). As Terras et al. (2009) point out, this anxiety can operate both as a cause and a consequence of dyslexia: on one hand, it anticipates failure, and on the other, it is reinforced with every negative classroom experience. Consequently, the impact of these experiences on the children's quality of life is profound, affecting their academic, social, and intrapersonal spheres (McNulty, 2003).

4.3. Behavioral profile

The results revealed that children with dyslexia exhibit higher levels of aggressiveness, anxiety, and attention problems compared to the control group. These observations are in line with both classic and current studies documenting how learning disorders can be associated with maladaptive behavioral and emotional responses, fueled by the repeated feeling of difficulty and the potential for bullying or misunderstanding by the environment. The accumulated stress from reading or writing tasks—often intensified by school demands that are not appropriately adapted—could explain the irritability and defensive outbursts of aggressiveness.

Anxiety emerges as a central variable in this profile. Consistent with Terras et al. (2009), there is evidence that many children with dyslexia develop an "anticipatory fear" related to reading or linguistic processing, which not only affects their academic performance but also extends to their interactions with peers and their self-worth. The finding of attention problems, as also reported in the literature (Smith-Spark & Fisk, 2007), suggests that reading difficulties could converge with deficits in self-regulation and executive function (Varvara et al., 2014), complicating the child's ability to concentrate in class, manage impulsivity, and handle frustration (Thomson & Crewther, 2022).

Nonetheless, one of the significant contributions of this work was the analysis of whether these disruptive or anxious behaviors mediate the relationship between dyslexia and parental stress. The data did not show a clear mediating effect, which supports the idea that the mere presence of the diagnostic label may be sufficient to elevate family tension (Hernández Pérez & Rabadán Rubio, 2023). This result diverges from proposals that expect maladaptive behaviors to inevitably amplify parental burden (Bonifacci et al., 2019). On the contrary, while problematic behaviors might reinforce the emotional overload, they do not determine it in caregivers who are already immersed in a context of high demand stemming from dyslexia (Leitão et al., 2017).

4.4. Limitations and future perspectives

Although the results are consistent with the existing literature, it is important to consider some limitations of the study. The cross-sectional design employed prevents establishing causal relationships between parental stress and the children's behavioral problems. Additionally, the reliance on self-reports from parents for data collection may introduce subjective biases. Future research could include evaluations from multiple informants, such as teachers and educational psychologists, to obtain a more comprehensive view of the behavioral and emotional difficulties. Incorporating longitudinal designs in future studies could also help clarify the directionality of the relationships identified, providing stronger evidence of causality.

Furthermore, the study treated dyslexia as a homogeneous condition, without exploring possible subtypes or variations in severity. Investigating these differences could provide a more detailed understanding of how dyslexia affects family dynamics and the well-being of children. Given that dyslexia manifests in diverse ways, future research should consider subgroups based on phonological deficits, rapid naming difficulties, or visual processing challenges, as these distinctions may have different implications for both academic performance and behavioral outcomes.

Despite these limitations, the findings highlight the complexity of dyslexia and underscore the importance of interdisciplinary approaches to address its multiple dimensions, promoting interventions that enhance both the well-being of the children and that of their families. The practical implications of these results are significant, as they emphasize the need for early detection and targeted interventions that extend beyond academic support. Schools should implement programs that incorporate psychological and behavioral support for children with dyslexia, fostering emotional resilience and reducing stress within the family unit. Additionally, parental training programs could be developed to equip caregivers with strategies to manage stress and effectively support their children's learning process.

One of the key strengths of this study is its contribution to the understanding of the bidirectional relationship between dyslexia and parental stress. By demonstrating how behavioral difficulties mediate this association, the study provides valuable insights into the broader impact of dyslexia on family life. Furthermore, the use of standardized behavioral and quality-of-life assessments strengthens the reliability of the findings, making them relevant for both clinical and educational settings. Future research should build upon these findings by designing intervention models that integrate academic, emotional, and family-based support, ensuring a more holistic approach to addressing the challenges associated with dyslexia.

5. Conclusions

In conclusion, this study has identified significant differences between children with dyslexia and those with typical development in terms of parental stress, quality of life, and behavioral profile. The results underscore that dyslexia not only affects academic performance but also impacts emotional well-being and family dynamics, increasing parental stress and deteriorating the quality of life of the children—particularly in areas such as self-esteem and interpersonal relationships. Additionally, a higher prevalence of behavioral problems was observed among children with dyslexia, reinforcing the need for comprehensive interventions that address both academic difficulties and associated emotional and behavioral issues to improve the quality of life for these children and their families. These difficulties not only affect academic performance but also have a considerable impact on social adaptation and overall well-being. These findings highlight the importance of approaching dyslexia from an interdisciplinary perspective that considers both academic challenges and emotional and behavioral implications, thereby promoting interventions that improve the quality of life of these children and their families.

Ethics committee

The study was approved by the ethics committee of the University of Málaga (UMA) under code 120–2023-H. Informed consent was obtained from all subjects involved in the study.

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CRediT authorship contribution statement

Cano-Villagrasa Alejandro: Writing – review & editing, Writing – original draft, Methodology, Investigation, Conceptualization. **López-Chicheri Isabel:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Conceptualization. **Porcar-Gozalbo Nadia:** Writing – original draft, Resources, Methodology, Investigation, Data curation. **López-Zamora Miguel:** Writing – review & editing, Supervision, Project administration, Funding acquisition.

Declaration of Competing Interest

There are no conflicts of interest.

Data Availability

Data will be made available on request.

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5.4. ARTÍCULO 4

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Original Article

Executive, behavioural and emotional functioning in Spanish children with dyslexia

Funcionamiento ejecutivo, conductual y emocional en niños españoles con dislexia

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Keywords

Dyslexia
Executive Functions
Anxiety
Depression
Behavioral Disorder

ABSTRACT

Purpose: Dyslexia is a specific learning disorder that affects reading and is associated with emotional and behavioral problems. Previous research indicates that children with dyslexia are at greater risk of developing anxiety, depression, and difficulties in executive functions, which affect their academic performance and well being. **Methods:** This study explored and compared behavioral, emotional, and executive functioning profiles in children with dyslexia and in neurotypical children in a sample of 120 children aged 8 to 10, divided into a dyslexia group and a control group. The BASC-3, SENA, and ENFEN were used for assessments, and data were analyzed using t-tests, Levene's test, and mediation analyses. **Results:** Children with dyslexia showed significantly higher levels of aggressiveness, anxiety, depression, and attention problems. In addition, they exhibited difficulties in executive functions such as resistance to interference and verbal fluency, highlighting the impact of dyslexia in these areas. **Conclusion:** Mediation analyses suggest that dyslexia is a potential indicator of difficulties in executive functioning and behavior, as well as influencing internalized and externalized emotional problems. These findings underscore the need to implement comprehensive educational and therapeutic strategies to address the needs of this vulnerable population.

Descriptores

Dislexia
Funciones Ejecutivas
Ansiedad
Depresión
Trastornos del Comportamiento

RESUMEN

Objetivo: La dislexia es un trastorno específico del aprendizaje que afecta la lectura y se asocia con problemas emocionales y conductuales. Investigaciones previas indican que los niños con dislexia tienen mayor riesgo de desarrollar ansiedad, depresión y dificultades en las funciones ejecutivas, lo que afecta su rendimiento académico y bienestar. **Método:** Este estudio exploró y comparó los perfiles conductuales, emocionales y de funcionamiento ejecutivo en niños con dislexia y en niños normotípicos en una muestra de 120 niños de 8 a 10 años, divididos en un grupo con dislexia y un grupo control. Se usaron el BASC-3, SENA y ENFEN para las evaluaciones, y los datos se analizaron mediante pruebas t, el test de Levene y análisis de mediación. **Resultados:** Los niños con dislexia mostraron significativamente mayores niveles de agresividad, ansiedad, depresión y problemas de atención. Además, presentaron dificultades en funciones ejecutivas como resistencia a la interferencia y fluidez verbal, evidenciando el impacto de la dislexia en estas áreas. **Conclusión:** Los análisis de mediación sugieren que la dislexia es un indicador potencial de dificultades en las funciones ejecutivas y la conducta, además de influir en problemas emocionales interiorizados y exteriorizados. Estos hallazgos destacan la necesidad de implementar estrategias educativas y terapéuticas integrales para atender las necesidades de esta población vulnerable.

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INTRODUCTION

The development of specific learning processes for reading represents a significant challenge for children's maturational and academic trajectory, constituting a determining factor in educational success during the early school years[1,2]. Unlike language, reading is a relatively recent neurocognitive process that does not have a predetermined anatomical basis in the brain, which explains the need for explicit instruction for its acquisition[3-5]. This learning requires the precise organization of the cortical system to effectively integrate the various reading processes. However, several factors can lead to ineffective cortical connections, resulting in difficulties in the acquisition and development of reading skills[6-8].

Dyslexia is one of the most prevalent disorders affecting reading acquisition. It is a specific learning disorder that affects between 4.66% and 9.22% of school-age children in Europe[9,10]. Globally, a systematic review conducted by Yang et al.[11], which included 58 studies published from the 1950s to 2021, revealed a combined prevalence of 7.1%. This review, covering schoolchildren aged 6-13 years in 16 countries, including six low-income countries, showed similar prevalence estimates in high-income countries, ranging from 6.8% to 8.3%. These data highlight the importance of studying and understanding the neurocognitive bases of reading acquisition, as well as the factors influencing its development to adequately address the effects of dyslexia.

However, despite progress in characterizing the neurocognitive profiles associated with dyslexia, a significant gap in the literature regarding an integrated understanding of the emotional, behavioral, and executive factors involved remains[7,8]. Most studies address these dimensions in isolation without sufficiently exploring the possible mediating relationships between them[10,11]. In particular, the role of executive functions as potential explanatory mechanisms linking reading difficulties with emotional and behavioral symptoms remains underexplored, limiting both the interpretation of findings and the development of more specific and effective interventions[11].

Despite having normative intelligence and no neurological or sensory deficits hindering this skill, children with dyslexia present difficulties in word recognition, spelling, and decoding[12,13]. Therefore, learning to read represents a significant, constant, and frustrating limitation for children with dyslexia, negatively impacting their lives[14].

Recent research has reported that nearly 60% of children with a primary diagnosis of dyslexia meet the criteria for at least one mood, anxiety, or depressive disorder[15-20]. Moreover, a high proportion of anxiety and depressive disorders among children with dyslexia. Burke et al.[21] showed that individuals with reading process difficulties exhibit significantly higher rates of internalizing and externalizing disorders than individuals without reading impairments. Similarly, Wang[22] showed that children with dyslexia who have higher levels of anxiety and depression perform worse in academic learning skill.

A lower academic performance predicts an increase in anxiety and depressive symptoms in children with dyslexia[23]. Studies have identified that school-related stress and anxiety are more prevalent in primary school students with dyslexia[24] compared to students at higher academic levels, such as university students[25]. Because children with dyslexia perceive themselves as worse at academic tasks, they often develop disruptive behaviors and social isolation in classrooms[26], which reduces their self-esteem and distorts their self-concept[27]. According to authors such as Alexander-Passe[28], these disruptive behaviors are triggered by anxiety, which in turn is produced by anxious feelings, leading children with dyslexia to frequently interrupt class, ignore the teacherâ€™s explanations, or get into fights with classmates.

Similarly, low self-esteem may cause depression in children with dyslexia[20,29]. However, the literature results are inconsistent. Internalizing symptoms refer to emotional difficulties that manifest internally, such as anxiety, depression, social isolation, or low self-esteem. These problems are usually less visible to others but deeply affect a personâ€™s emotional well being. On the other hand, externalizing symptoms involve behaviors that manifest outwardly, such as aggression, impulsivity, or disruptive conduct, and are more noticeable due to their impact on the environment. In this context, studies by Katsantonis et al.[30] and Miller et al.[31] have not found a significant relationship between dyslexia and elevated levels of internalizing symptoms, such as anxiety or depression, suggesting that the emotional difficulties experienced by these children may not be as evident in terms of internalized symptoms. Therefore, no global consensus has clearly described the relationship between bullying, victimization, and the onset of anxiety and mood disorders.

Apart from evidence on the emotional alterations of individuals with specific reading learning difficulties, the specific executive functioning profile in this population may be closely related to anxiety, depression, and behavioral disorders[32]. Children diagnosed with dyslexia present deficits in executive functioning[33-35], regardless of additional difficulties that may arise or develop as comorbid conditions[36,37]. Consistent empirical evidence indicates that children with dyslexia exhibit poor performance in executive function tasks involving motivational and emotional processes[38].

There is also deterioration in functions such as behavioral inhibition, which is associated with aggressive behavior and conduct disorder in primary school children (6-12 years) and preschoolers (4 years)[39], compared to other functions such as planning and working memory. However, the scientific literature does not reveal a common pattern in executive function impairments among children with dyslexia. This is largely due to participant heterogeneity and individual differences, creating a complex situation for comparing results across published studies.

In this regard, a better understanding of executive functioning and its role in dyslexia has not only theoretical implications but also high applied value. Identifying specific executive impairment profiles could enable the design of more personalized intervention strategies that address not only reading difficulties but also the associated emotional and behavioral symptoms. This is especially relevant for health and education professionals as it could facilitate the implementation of preventive and therapeutic programs in school contexts, promoting an interdisciplinary and needs-centered approach for students with dyslexia.

Therefore, the main objective of this study was to explore differences in behavioral processes, the pattern of internalizing and externalizing emotional behaviors, as well as executive functioning in a cohort of children with dyslexia, comparing the measurement results in each of the areas with another group of children with typical development. Likewise, the relationship between all these variables and their mediating effects was explored.

METHOD

Participants

A total of 120 participants (58 girls and 62 boys) aged between 8 and 10 years (M = 9.2) were selected. Participants diagnosed with dyslexia had been evaluated by their reference hospital and educational center, following the diagnostic criteria established in the DSM-5 TR[9]. The assessment tool used by healthcare and educational professionals (psychologists and speech-language therapists) for diagnosing dyslexia was the PROLEC-R test[40]. The sample was divided into two groups: an experimental group composed of 60 individuals diagnosed with dyslexia (G-DYSLEXIA) and a comparison group consisting of 60 individuals with typical reading development (G-CONTROL). All study participants were monolingual Spanish speakers born in Spain.

A series of inclusion and exclusion criteria were applied to form the sample groups. The inclusion criteria for the G-DYSLEXIA group were as follows: diagnosis of dyslexia, age between 8 and 10 years, and possessing expressive language. The exclusion criteria for participants in both groups (G-DYSLEXIA and G-CONTROL) included having a severe sensory pathology, a diagnosis of intellectual disability, suspected severe psychiatric disorder, or other pre-existing conditions that could hinder the assessment.

Instruments and materials

BASC-3, Behavior Assessment System for Children Third Edition

The BASC-3, Behavior Assessment System for Children – Third Edition (BASC-3)[41], is a clinical tool used to assess the emotions and behaviors of children and adolescents, detecting maladaptive disorders in contexts such as family and school. The BASC-3 includes a self-report for the child and two questionnaires aimed at parents (P) and teachers or tutors (T). For the purposes of this research, only the questionnaires for parents and teachers were considered. The Cronbach's α for this test is 0.90.

SENA, System for the Evaluation of Children and Adolescents

The SENA, System for the Evaluation of Children and Adolescents (SENA)[42], consists of a set of nine questionnaires designed for three specific age groups: Preschool (3–6 years), Primary (6–12 years), and Secondary (12–18 years). This system includes questionnaires for gathering information from different informants in the main contexts in which the child interacts, such as family and school. It also incorporates three self-report models adapted to the child's age, applicable from age 6 onwards. In each questionnaire, informants rate the frequency with which the described behavior occurs using a five-point scale (from Never or Almost Never to Always or Almost Always), except for the self-report for children aged 6–8 years, which uses a three-option scale: Yes, No, and Sometimes. The Cronbach's α for this test is 0.81.

ENFEN, Neuropsychological Evaluation of Executive Functions in Children

The ENFEN, Neuropsychological Evaluation of Executive Functions in Children (ENFEN)[43] is a tool designed to individually assess the level of maturity and cognitive performance in tasks related to executive functions in children aged −12 years. The battery consists of four tests (Verbal Fluency, Trail Construction, Ring Construction, and Resistance to Interference) that measure different aspects of executive functions. The results obtained allow for a deeper diagnosis and guide neuropsychological intervention, both in typically developing children and in those with developmental delays or cognitive or emotional alterations resulting from dysfunctions or brain damage. The Cronbach's α for this test is 0.84.

Procedure

The study was approved by the ethics committee of Universidad de Málaga (UMA). All families of the participants agreed to participate in the study by signing an informed consent form, ensuring anonymity and data protection. Data collection was conducted in two stages. An initial interview was conducted in the first stage, followed by the administration of behavioral, emotional, and executive functioning assessment tests. Two individual sessions were conducted, each lasting approximately 45 min, spaced 3 to 5 business days apart, depending on the availability of the school and of the child's needs. This interval helped prevent fatigue and ensured a more accurate and comfortable assessment for the participants.

The assessments were administered by a team of trained professionals consisting of educational psychologists and neuropsychologists with experience in child assessment. All evaluators received specific training for the standardized administration of each instrument to ensure the data reliability. In the second stage, an analysis of the data collected from the study participants were analyzed using the selected statistical methods and a database was generated with the results of the evaluated individuals.

Design

This is a descriptive, cross-sectional study with an experimental group (G-DYSLEXIA) and a control group (G-CONTROL). The choice of a cross-sectional design, rather than a longitudinal one, responds to the need to evaluate significant differences at a specific point in early school development, a stage in which reading difficulties and their

possible emotional and behavioral repercussions are most evident. This design allows for an efficient comparison of two well defined groups within a homogeneous age range, facilitating a more direct interpretation of results regarding the diagnosis of dyslexia.

The dependent variables were the functions and skills assessed using the aforementioned standardized instruments. The independent variable of the study was dyslexia diagnosis in this population.

To analyze the study variables, a normality test was first performed using the Chi-square test for the sociodemographic variables of the participants, such as Sex, Age, Diagnosis, Years of Treatment, Comorbidity, School Support, Gestational Weeks, and Apgar. To examine the relationships and trends among the variables related to behavioral, emotional, and executive functioning components, a descriptive statistical analysis was conducted along with a paired-samples t-test to observe differences between the two groups. Likewise, to observe the relationships and influence among the variables in the present study, a mediation analysis was performed between the variables related to emotional problems and dyslexia. All analyses were performed using the SPSS software, version 29.

RESULTS

Descriptive analysis was conducted on the sociodemographic variables of sex, age, dyslexia diagnosis, years of treatment, comorbidity, school support, gestational weeks, and Apgar score, along with the Chi-square test results for each variable. No significant differences were found in any of the variables ($P > 0.05$).

To address the objectives of this study, the results from the independent samples t-test analyses comparing the scores of the two groups on measures related to behavior, internalizing and externalizing emotional behavior, as well as executive functioning are presented below. Differences in scores were calculated using independent samples t-tests for the cognitive competence variables. The results revealed significant differences in all variables related to executive functioning. Levene's test for equality of variances was then conducted for each variable, confirming the assumption of homogeneity of variances, as the significance value exceeded 0.05 ($P > 0.05$), indicating that the variances of the groups on the assessed variables were homogeneous (Tables 1, 2, and 3).

The results showed statistically significant differences between the G-DYSLEXIA and G-CONTROL groups across several key dimensions. In the behavioral profile, children with dyslexia scored significantly higher on scales such as Aggressiveness (M = 53.38, SD = 8.36) compared to the control group (M = 17.63, SD = 5.91), with t(118) = 27.022, $P < 0.001$, a large effect size (d = 7.246), and a substantial explained variance ($P = 0.586$). Similarly, significant differences were found in Anxiety (t(118) = 28.417, $P < 0.001$, d = 6.990, $\eta^2 = 0.689$) and Depression (t(118) = 27.134, $P < 0.001$, d = 6.964, $\eta^2 = 0.521$), where children with dyslexia showed higher levels compared to their peers without dyslexia.

Regarding emotional problems, children with dyslexia presented a higher prevalence of Depression (M = 74.52, SD = 14.68) and Social Anxiety (M = 73.63, SD = 13.48), with significant differences compared to the control group ($P < 0.001$ for both), reflected in t(118) = 18.636 (d = 12.898, $\eta^2 = 0.847$) and t(118) = 21.575 (d = 11.632, $\eta^2 = 0.884$), respectively. This suggests greater emotional vulnerability in the dyslexic group.

Finally, in executive functioning measures, children with dyslexia exhibited marked difficulties in Resistance to Interference (M = 24.22, SD = 6.77) compared to the control group (M = 67.62, SD = 9.66), with t(118) = −28.494, $P < 0.001$, d = 8.342, $\eta^2 = 0.856$, and in Verbal Fluency (t(118) = −28.100, $P < 0.001$, d = 1.767, $\eta^2 = 0.796$). These results highlight the considerable impact of dyslexia not only on academic skills but also on essential cognitive functions for learning and social adaptation.

Moreover, mediation analysis revealed that variables related to dyslexia diagnosis (internalizing emotional problems, executive functioning problems, and dyslexia diagnosis) had a significant effect on internalizing emotional problems [$\beta = -41.41$, $P = 0.001$], indicating a negative relationship between dyslexia diagnosis and the increase in internalizing emotional problems. Furthermore, executive functioning significantly affected emotional problems [$\beta = -2.47$, $P = 0.01$], suggesting that lower executive functioning is associated with increased internalization of emotional problems.

In turn, executive functioning showed a significant relationship with the diagnosis of dyslexia. When executive functioning was included as a mediating variable, the direct effect of dyslexia diagnosis on internalizing emotional problems decreased [$\beta = -4.13$, $P = 0.001$] but remained significant, indicating an indirect impact through executive functioning. This confirms that executive functioning partially mediates the relationship between dyslexia and internalizing symptoms (Figure 1).

A multiple linear regression model was performed to determine the dyslexia-related factors that best predicted the risk of developing internalizing emotional problems. In this analysis, the independent variables included dyslexia diagnosis and executive functioning. The results (Table 4) revealed that executive functioning is one of the strongest predictors of the development of internalizing emotional problems.

The findings show that both dyslexia diagnosis and executive functioning are significant factors in predicting the development of internalizing emotional problems. The model indicates that 75.5% of the variability in depressive symptoms is explained by the variables analyzed.

Similarly, mediation analysis revealed that variables related to dyslexia diagnosis (executive functioning problems and dyslexia diagnosis) had a significant effect on externalizing emotional problems [$\beta = -39.87$, $P = 0.001$], indicating a negative relationship between dyslexia diagnosis and the increase in externalizing symptoms. Moreover, executive functioning also significantly affected externalizing emotional problems [$\beta = -3.05$, $P = 0.01$], suggesting that lower executive functioning is associated with an increase in externalizing symptoms.

Table 1. Results of differences in measures related to the behavioral profile between the G-DYSLEXIA and G-CONTROL groups, assessed using the BASC-3

Behavioral and Emotional Problems	Groups		Levene's test for equality of variances			T test for equality of means				
	G-DYSLEXIA	*G-CONTROL*	*F*	*Sig.*	η^2	*t*	*df*	*Sig. (bilateral)*	*Mean difference*	ð
Composite, Clinical, and Adaptive Scales										
Aggressiveness	M = 53.38 SD = 8.36	M = 17.63 SD = 5.91	14.878	<.001	0.586	27.022	118	<.001	35.750	7.246
Anxiety	M = 55.63 SD = 7.44	M = 19.37 SD = 6.49	1.254	0.265	0.689	28.417	118	<.001	36.267	6.990
Depression	M = 54.13 SD = 7.34	M = 19.63 SD = 6.56	0.698	0.405	0.521	27.134	118	<.001	34.500	6.964
Somatization	M = 52.28 SD = 7.70	M = 18.77 SD = 6.22	2.227	0.138	0.855	26.210	118	<.001	33.517	7.049
Atypicality	M = 54.95 SD = 8.10	M = 18.85 SD = 6.05	11.679	<.001	0.971	27.631	118	<.001	36.100	7.156
Withdrawal	M = 53.48 SD = 8.06	M = 19.93 SD = 5.85	10.826	0.001	0.685	26.066	118	<.001	33.550	7.050
Attention Problems	M = 53.28 SD = 7.61	M = 20.13 SD = 5.40	10.830	0.001	0.753	27.497	118	<.001	33.150	6.603
Adaptability	M = 55.08 SD = 8.12	M = 19.38 SD = 6.24	5.360	0.022	0.698	26.978	118	<.001	35.700	7.248
Social Skills	M = 55.33 SD = 8.54	M = 19.83 SD = 5.43	20.250	<.001	0.611	27.160	118	<.001	35.500	7.159
Daily Activities	M = 53.53 SD = 7.39	M = 19.57 SD = 5.59	3.038	0.084	0.684	28.361	118	<.001	33.967	6.560
Functional Communication	M = 54.45 SD = 8.23	M = 18.20 SD = 5.99	5.155	0.025	0.752	26.227	118	<.001	35.500	7.414
Content Scales										
Anger Control	M = 54.48 SD = 8.49	M = 18.20 SD = 5.99	8.091	0.005	0.814	27.039	118	<.001	36.283	7.350
Bullying	M = 53.55 SD = 7.05	M = 19.30 SD = 6.20	0.472	0.493	0.862	28.239	118	<.001	34.250	6.643
Social Developmental Disorders	M = 56.15 SD = 7.66	M = 19.42 SD = 5.92	5.693	0.019	0.834	29.368	118	<.001	36.733	6.851
Emotional Self-Control	M = 55.00 SD = 7.72	M = 19.32 SD = 5.98	7.390	0.008	0.812	28.293	118	<.001	35.683	6.908
Executive Functioning	M = 53.57 SD = 7.72	M = 17.73 SD = 6.46	3.045	0.084	0.877	27.560	118	<.001	35.833	7.122
Negative Emotionality	M = 55.88 SD = 7.45	M = 18.43 SD = 5.51	6.806	0.010	0.683	27.560	118	<.001	37.450	6.554
Resilience	M = 52.18 SD = 8.44	M = 19.23 SD = 5.89	6.490	0.012	0.509	31.297	118	<.001	32.950	7.282

Caption: Abbreviations: G-DYSLEXIA = Dyslexia group; G-CONTROL = Control group; M = mean; SD = standard deviation; F = *F* statistic (Levene's test/ANOVA); Sig. = *p* value; η^2 = eta squared (effect size); t = *t* statistic; df = degrees of freedom; Sig. (bilateral) = two-tailed *p*; Mean difference = difference in group means (G-DYSLEXIA – G-CONTROL); d = Cohen's *d*.

Table 2. Results of differences in measures related to internalizing and externalizing emotional behavior between the G-DYSLEXIA and G-CONTROL groups, assessed using the SENA test

Behavioral and Emotional Problems	Groups		Levene's test for equality of variances			T test for equality of means				
	G-DYSLEXIA	*G-CONTROL*	*F*	*Sig.*	η^2	*t*	*df*	*Sig. (bilateral)*	*Mean difference*	ð
Internalizing Problems										
Depression	M = 74.52 SD = 14.68	M = 30.63 SD = 10.81	8.935	0.003	0.847	18.636	118	<.001	43.883	12.898
Anxiety	M = 73.88 SD = 16.16	M = 28.35 SD = 9.29	32.239	<.001	0.748	18.875	118	<.001	45.533	13.213
Social Anxiety	M = 73.63 SD = 13.48	M = 27.82 SD = 9.42	9.780	0.002	0.884	21.575	118	<.001	45.817	11.632
Somatic Complaints	M = 71.12 SD = 14.13	M = 28.85 SD = 11.05	4.074	0.046	0.689	21.271	118	<.001	49.267	12.686
Externalizing Problems										
Attention Problems	M = 73.90 SD = 14.18	M = 28.68 SD = 9.69	9.680	0.002	0.588	20.388	118	<.001	45.217	12.148
Hyperactivity-Impulsivity	M = 74.72 SD = 14.01	M = 29.88 SD = 9.97	7.889	0.006	0.698	20.203	118	<.001	44.833	12.155
Anger Control Problems	M = 75.05 SD = 14.40	M = 30.87 SD = 10.88	7.520	0.007	0.612	18.961	118	<.001	44.183	12.763
Aggression	M = 71.28 SD = 14.51	M = 30.97 SD = 11.26	5.371	0.022	0.693	17.003	118	<.001	40.317	12.988
Defiant Behavior	M = 73.45 SD = 15.36	M = 29.18 SD = 10.38	18.934	<.001	0.788	18.486	118	<.001	44.267	13.116

Caption: Abbreviations: G-DYSLEXIA = Dyslexia group; G-CONTROL = Control group; M = mean; SD = standard deviation; F = *F* statistic (Levene's test/ANOVA); Sig. = *p* value; η^2 = eta squared (effect size); t = *t* statistic; df = degrees of freedom; Sig. (bilateral) = two-tailed *p*; Mean difference = difference in group means (G-DYSLEXIA – G-CONTROL); d = Cohen's *d*.

In turn, executive functioning showed a significant relationship with the diagnosis of dyslexia. When executive functioning was included as a mediating variable, the direct effect of dyslexia diagnosis on externalizing emotional problems decreased [$\beta = -5.14$, $P = 0.001$] but remained significant, indicating an indirect impact through executive functioning. This confirms that executive functioning partially mediates the relationship between dyslexia and externalizing emotional problems (Figure 2).

A multiple linear regression model was performed to determine the dyslexia-related factors that best predict the risk of developing externalizing emotional problems. In this analysis, the independent variables included dyslexia diagnosis and executive functioning. The results (Table 5) revealed that executive functioning is one of the strongest predictors of the development of externalizing emotional problems.

The findings show that both dyslexia diagnosis and executive functioning are significant factors in predicting the development of externalizing emotional problems. The model indicated that 64.1% of the variability in externalizing emotional problems is explained by the variables included in the model.

Table 3. Results of Differences in Measures of Executive Functioning between G-DYSLEXIA and G-CONTROL, assessed using the ENFEN test

Executive Functions	Groups		Levene's test for equality of variances			T test for equality of means				
	G-DYSLEXIA	*G-CONTROL*	*F*	*Sig.*	η^2	*t*	*df*	*Sig. (bilateral)*	*Mean Difference*	ð
Resistance to Interference	M = 24.22 SD = 6.77	M = 67.62 SD = 9.66	8.885	0.003	0.856	–28.494	118	<.001	–43.400	8.342
Trails	M = 13.68 SD = 5.75	M = 43.30 SD = 10.70	39.928	<.001	0.652	–18.879	118	<.001	–29.617	8.592
Verbal Fluency	M = 2.80 SD = 1.48	M = 11.87 SD = 2.01	4.190	0.043	0.796	–28.100	118	<.001	–9.067	1.767
Rings	M = 363.13 SD = 35.83	M = 147.80 SD = 23.89	19.471	<.001	0.751	38.727	118	<.001	215.333	30.455

Caption: Abbreviations: G-DYSLEXIA = dyslexia group; G-CONTROL = control group; M = mean; SD = standard deviation; F = *F* statistic (Levene's test); Sig. = *p* value; η^2 = eta squared (effect size); t = *t* statistic; df = degrees of freedom; Sig. (bilateral) = two-tailed *p*; Mean Difference = G-DYSLEXIA – G-CONTROL; d = Cohen's *d*.

Table 4. Results of the multiple linear regression model predicting the risk of internalizing emotional problems

Variable	B	Standard Error	t	p-valuer	IC 95%
Dyslexia Diagnosis	–41.41	0.001	3.56	<.001	[-55.30, –30.22]
Executive Functioning	–2.47	0.01	4.89	<.001	[-3.52, –1.42]
Adjusted R^2	0.755				

Caption: Abbreviations: B = unstandardized coefficient; Standard Error (SE) = standard error of B; t = *t* statistic; p-value (p) = significance level; 95% CI = 95% confidence interval for B; Adjusted R^2 = coefficient of determination adjusted for the number of predictors.

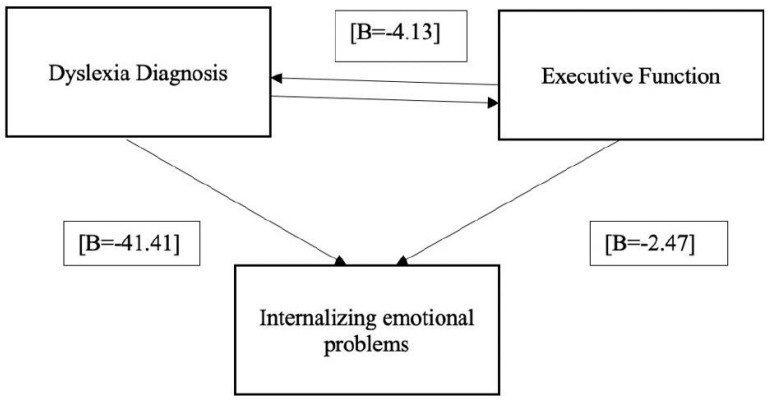

Figure 1. Mediation diagram between dyslexia, executive functioning, and internalizing symptoms

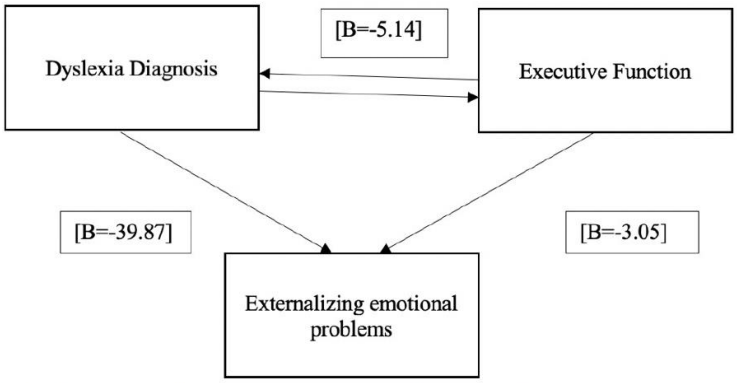

Figure 2. Mediation diagram between dyslexia, executive functioning, and externalizing emotional problems

Table 5. Results of the multiple linear regression model predicting the risk of externalizing emotional problems

Variable	B	Standard Error	t	p-value	IC 95%
Dyslexia Diagnosis	–39.87	0.001	3.56	<.001	[-52.80, –28.94]
Executive Functioning	–3.05	0.01	4.89	<.001	[-4.32, –1.78]
Adjusted R^2	0.641				

Caption: Abbreviations: B = unstandardized coefficient; Standard Error (SE) = standard error of B; t = *t* statistic; p-value (p) = significance level; 95% CI = 95% confidence interval for B; Adjusted R^2 = coefficient of determination adjusted for the number of predictors.

DISCUSSION

The present study aimed to explore and compare the behavioral, emotional, and executive functioning profiles between children with dyslexia and those with typical reading development. Dyslexia, a specific learning disorder primarily affecting reading, has traditionally been associated with academic difficulties; however, recent studies have shown that its impact is much broader, affecting the emotional well being, behavior, and executive functions of children with dyslexia[44,45].

One of the most relevant findings of our study was the identification of a higher prevalence of emotional problems, specifically anxiety and depression, in children with dyslexia than in those without this disorder[46,47]. This result aligns with previous research indicating that children with dyslexia are at greater risk of developing emotional disorders, such as anxiety and depression[48], due to repeated experiences of academic failure and social stigmatization[49]. For example, a systematic review by Wilson et al.[50] highlighted that children with dyslexia are significantly more likely to experience depressive symptoms, which are associated with their inability to meet academic and social expectations. This situation can lead to low self-esteem and hopelessness, further reinforcing feelings of anxiety and depression. Moreover, these emotional problems can create a cycle in which anxiety and depression intensify learning difficulties, adding another layer of limitation to academic progress[49].

It is also important to consider that dyslexia not only affects academic skills but also has a profound impact on children's mental health[46]. Academic pressure and constant comparison with peers without learning difficulties can increase stress levels, negatively affecting the emotional well being of these children[47,48]. Therefore, early intervention and psychological support have emerged as fundamental strategies to mitigate these effects and improve the quality of life of children with dyslexia. Providing an inclusive learning environment that is sensitive to emotional needs can significantly reduce levels of anxiety and depression, thereby fostering a more balanced development in this clinical population[50].

Our study's results also indicated that children with dyslexia exhibit a greater degree of behavioral problems, such as hyperactivity, impulsivity, and defiant behaviors, compared to their peers without dyslexia. This finding is consistent with literature suggesting that learning difficulties, such as dyslexia, may be associated with increased disruptive behaviors, possibly as a response to frustration and stress linked to low academic performance[51,52]. It is important to consider that the behavioral problems observed in children with dyslexia may reflect their internal struggle to adapt to academic demands they cannot meet due to their reading difficulties. These behaviors may be interpreted as attempts to cope with or express accumulated frustration, resulting in defiant or disruptive behaviors in the classroom[53].

Additionally, the lack of understanding from teachers and peers can exacerbate these behaviors, creating a hostile environment for the child, which may lead to social isolation and increased problematic behaviors[54]. An interesting point to consider is that while behavioral problems may be more visible and therefore easier to identify, their underlying origin in dyslexia may be more complex. Difficulties in emotional self-regulation and impulse control—characteristics observed in children with dyslexia—appear to be linked to deficits in executive functions, impairing their ability to adequately manage emotions[55].

Executive functioning encompasses a set of cognitive processes that are crucial for adapting to academic and social demands, including working memory, cognitive flexibility, planning, and inhibition [24â€“26]. Our study revealed that children with dyslexia present significant alterations in these functions compared to their peers without dyslexia, which is consistent with previous research highlighting executive function difficulties as a key component of dyslexia[56,57]. The difficulties in executive functions observed in the dyslexia group may partly explain why these children struggle to organize and plan school tasks, maintain attention over long periods, and adapt to task changes[51].

These skills are essential not only for academic performance but also for daily life, as they enable individuals to manage multiple tasks, make informed decisions, and regulate emotions[58]. Moreover, neuropsychological studies have suggested that executive function difficulties in children with dyslexia may be linked to alterations in the brain networks supporting these functions[18-22], particularly in areas such as the prefrontal cortex[59]. Such alterations could be one of the reasons why children with dyslexia perform worse in tasks requiring higher cognitive control, such as planning and inhibition[60].

These findings have significant implications for educational interventions. Programs that include executive function training, such as improving working memory or planning skills, could help children with dyslexia overcome cognitive barriers. Furthermore, incorporating teaching strategies tailored to these children's cognitive strengths and weaknesses could improve not only their academic performance but also their self-esteem and overall well being[59-61].

It is important to note that many of the emotional symptoms observed in children with dyslexia may be interpreted as indirect consequences of persistent reading difficulties. The frustration associated with lower academic performance, feelings of incompetence compared to peers, and pressure to meet academic goals not adapted to their needs contribute to the development of anxiety, sadness, demotivation, and low self-esteem. In this sense, dyslexia not only represents a cognitive challenge but also a condition that can trigger a process of progressive emotional vulnerability if its secondary effects in educational and social environments are not properly addressed.

In line with these observations, the Risk and Resilience model proposed by Hoeft et al.[62] provides a valuable conceptual framework for understanding the complexity of dyslexia beyond the academic domain. This model suggests that while reading difficulties pose a significant risk of emotional development, individual and contextual protective factors can modulate their negative effects. Self-esteem, family support, coping strategies, and brain plasticity are among these factors. Neuroimaging studies, such as those conducted by Hoeft et al.[62], have shown that some children with dyslexia achieve functional adaptation through neural compensation networks, highlighting the importance of fostering positive and resilient learning environments. Incorporating this approach not only helps explain why some children with dyslexia show fewer emotional symptoms than others but also informs interventions that strengthen these protective capacities.

Finally, another key finding of this study was the identification of executive functioning as a predictor of both internalizing and externalizing emotional problems in children with dyslexia. From an educational perspective, these findings reinforce the need to design intervention programs that integrate executive function training into the school curriculum. Strategies such as using graphic organizers, visual routines, emotional self-regulation techniques, and structured games can facilitate planning, inhibition, and cognitive flexibility in children with dyslexia.

Moreover, implementing methodological adaptations, such as breaking down complex tasks into smaller steps, providing extra time for assignments, or using visual aids, can contribute to a more accessible learning environment. Training teachers to recognize the specific difficulties of these children and to use neuroeducation-based pedagogical tools can reduce students' frustration and foster active participation, improving both academic performance and emotional well being in the classroom.

The results showed that dyslexia diagnosis has a significant negative effect on internalizing emotional problems. These findings are consistent with those of previous studies demonstrating that children with dyslexia are at greater risk of developing emotional symptoms due to frustration and persistent academic difficulties[48,63]. Research by Snowling and Hulme[64] highlighted that dyslexia not only affects reading skills but also has a significant impact on children's emotional well being, intensified by constant experiences of academic failure.

The mediating role of executive functioning in this relationship is particularly relevant. This study showed that executive functioning has a direct effect on emotional problems, both internalizing and externalizing, suggesting that deficits in these cognitive functions exacerbate emotional symptoms in children with dyslexia. These findings align with previous research showing that executive functioning is fundamental for emotional regulation and impulse control, which in turn may influence the emergence of internalizing symptoms such as anxiety and depression[65].

Indeed, Diamond[66] argued that children with executive function difficulties, such as those with dyslexia, are more prone to developing emotional disorders due to their inability to manage academic stress and social demands. The reduction of the direct effect of dyslexia on emotional problems after including executive functioning as a mediating variable reinforces the importance of this factor in the relationship between dyslexia and mental health.

This finding underscores the need for interventions that focus not only on the academic skills of children with dyslexia but also on strengthening their executive functioning skills as a way to mitigate the emotional impact associated with this disorder[67]. Furthermore, the association between dyslexia and externalizing emotional problems, such as aggression and defiant behavior, has been widely documented in the literature. This study confirms this relationship, showing a significant effect of dyslexia diagnosis on externalizing symptoms, consistent with research indicating that children with learning difficulties are more likely to display disruptive behaviors as a way of coping with frustration and anxiety[68,69].

Despite the important findings of this study, some limitations should be noted. One major limitation is the reliance on self-reports and parent-reported assessments, which may introduce bias in evaluating emotional and behavioral problems. Future studies could benefit from incorporating more objective assessments, such as direct classroom observations or neuropsychological tests administered by professionals, to provide a more comprehensive and accurate evaluation.

Similarly, although this study focused on comparisons between children with and without dyslexia, future research could explore how additional factors, such as family environment, quality of school support, and previous interventions, influence behavioral, emotional, and executive functioning profiles in children with dyslexia. It would also be important to investigate the effectiveness of different intervention programs in improving these profiles and reducing gaps between children with and without dyslexia.

Finally, continued research on the neurobiological underpinnings of dyslexia and how they affect the development of executive and emotional functions is necessary. A better understanding of these relationships could lead to more personalized and effective interventions that not only address dyslexia symptoms but also improve the overall well being and quality of life of children with this diagnosis.

This study makes an original contribution by demonstrating the mediating role of executive functioning in the relationship between dyslexia and emotional symptoms, an area that has been scarcely explored in Spanish-speaking child populations. By integrating behavioral, emotional, and cognitive measures, this work provides a comprehensive view of the multidimensional impact of dyslexia. Identifying specific patterns among these variables not only enriches the theoretical understanding of the disorder but also opens new research and intervention pathways to address the needs of children with dyslexia in both school and clinical settings.

CONCLUSIONS

In conclusion, this study highlights that children with dyslexia exhibit significant differences in emotional, behavioral, and executive functioning profiles compared to their peers without dyslexia. The results indicate that children with dyslexia are more likely to experience disorders such as anxiety, depression, or behavioral problems, including hyperactivity and impulsivity, which are associated with deficits in executive functioning such as inhibition, planning, and working memory. These difficulties not only affect their academic performance but also have a considerable impact on their social adaptation and overall well being. These findings underscore the importance of addressing dyslexia not only from an academic perspective but also by considering its emotional and behavioral implications, emphasizing the need for an interdisciplinary approach to the study and understanding of this learning disorder.

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MLZ: project administration, funding acquisition, supervision and writing – review and editing; NPG: writing – original draft, data curation, resources, investigation and methodology; ACV: conceptualization, investigation, methodology, writing – original draft and writing – review and editing; ILC: writing – review and editing, data curation, investigation and methodology and visualization.

VI – RESULTADOS Y DISCUSIÓN

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Las dificultades en las competencias lingüísticas, cognitivas, emocionales y conductuales observadas en menores con dislexia repercuten de forma significativa en su desarrollo global, especialmente durante las primeras etapas de su escolarización. Los menores que presentan dislexia se enfrentan diariamente a retos complejos que inciden en su trayectoria educativa y en su calidad de vida, así como en la de su familia. Esta realidad pone de manifiesto la importancia de llevar a cabo un enfoque de intervención interdisciplinar, que contemple no solo los aspectos académicos, sino también las dimensiones psicolingüísticas, emocionales y conductuales de la dislexia.

El propósito general de la presente tesis doctoral fue analizar de forma exhaustiva el perfil clínico, lingüístico, cognitivo, emocional y conductual de niños y niñas con el diagnóstico de dislexia, en comparación con un grupo control con desarrollo normotípico, desde una perspectiva biopsicosocial. Para ello, se evaluaron de forma sistemática las habilidades relacionadas con el aprendizaje lector, las habilidades lingüísticas, cognitivas, emocionales y conductuales, así como variables clínicas neonatales asociadas al riesgo de presentar dificultades lectoras. Asimismo, se exploraron modelos explicativos que consideran el papel mediador de factores emocionales y conductuales presentes en la dislexia en la calidad de vida y la dinámica familiar.

En los apartados siguientes, se exponen los resultados obtenidos para cada uno de los objetivos específicos propuestos en la presente investigación, junto con su discusión en el marco teórico correspondiente.

6.1. CARACTERIZACIÓN DE LOS PARTICIPANTES

En primer lugar, se llevó a cabo una serie de estadísticos descriptivos de las variables sociodemográficas de cada uno de los grupos de participantes, con el objetivo de observar los supuestos de homogeneidad de la muestra. Estos resultados se pueden observar en la siguiente tabla (*Tabla 6*):

Tabla 6. *Características de la muestra de participantes del estudio*

Variables sociodemográficas	G-PREDIX (n=30)	G-PREMA (n=30)	G-DISLX (n=30)	G-NODISLX (n=30)	*p*
Edad (años, media ± DT)	8.12 ± 0.56	8.09 ± 0.61	8.14 ± 0.58	8.11 ± 0.55	0.892
Sexo (%)	53.3 / 46.7	50 / 50	56.7 / 43.3	51.7 / 48.3	0.821
Semanas de gestación (media ± DT)	33.71 ± 1.21	34.41 ± 1.3	39.11 ± 0.69	39.24 ± 0.72	<0.001*
Peso al nacer (media ± DT, g)	1902.84 ± 197.85	2151.67 ± 281.39	3124.75 ± 348.16	3198.42 ± 331.29	<0.001*
APGAR 1 min (media ± DT)	6.89 ± 1.11	7.23 ± 1.09	8.76 ± 0.71	8.91 ± 0.65	<0.001*
APGAR 5 min (media ± DT)	8.12 ± 0.91	8.54 ± 0.78	9.52 ± 0.55	9.61 ± 0.49	<0.001*
Hemorragia intraventricular (%)	12.2%	5.6%	0%	0%	0.002*
Leucomalacia periventricular (%)	4.4%	1.1%	0%	0%	0.007*
Síndrome de dificultad respiratoria (%)	15.6%	9.1%	0%	0%	0.003*
Uso de ventilación mecánica (%)	18.9%	12.3%	0%	0%	0.002*
Ingreso en UCI neonatal (días, media ± DT)	15.42 ± 6.78	11.31 ± 5.91	2.89 ± 1.55	2.43 ± 1.21	<0.001*
Apoyo escolar – AyL (%)	78.6%	12.5%	72.3%	0%	<0.001*
Apoyo escolar – PT (%)	65.4%	9.8%	60.2%	0%	<0.001*
Nivel educativo materno (años de escolaridad, media ± DT)	12.54 ± 3.21	13.02 ± 3.11	14.71 ± 2.89	14.89 ± 2.76	0.045*
Nivel educativo paterno (años de escolaridad, media ± DT)	12.12 ± 3.48	12.94 ± 3.33	14.23 ± 3.01	14.56 ± 2.98	0.038*
Nivel socioeconómico familiar (Índice SES, media ± DT)	2.41 ± 0.89	2.59 ± 0.92	3.14 ± 0.76	3.21 ± 0.71	0.021*

Nota. * $p < 0.05$

6.2. RELACIÓN ENTRE VARIABLES NEONATALES, PREMATURIDAD Y HABILIDAD LECTORA

El primer objetivo específico de la presente tesis doctoral fue investigar la relación entre las variables de riesgo neonatal y la condición de prematuridad en el desarrollo de las habilidades lectoras en población infantil con dislexia.

6.2.1. Resultados correspondientes al primer objetivo

Se llevaron a cabo análisis MANOVA para evaluar las diferencias en el rendimiento lector entre los grupos. Los resultados revelaron diferencias significativas en todas las variables evaluadas ($p < 0.001$) entre los cuatro grupos, siendo los menores nacidos a término sin dislexia (G-NODISLX) quienes obtuvieron las puntuaciones más altas en todas las medidas, seguidos por los menores prematuros sin dislexia (G-PREMA), los menores nacidos a término con dislexia (G-DISLX) y, finalmente, los menores prematuros con dislexia (G-PREDIX), quienes registraron las puntuaciones más bajas en todas las pruebas (*Tabla 7*).

Tabla 7. *Resultados de la comparación del rendimiento de los cuatro grupos en las subpruebas del PROLEC-R*

	G-PREDIX (n=30)	G-PREMA (n=30)	G-DISLX (n=30)	G-NODISLX (n=30)	F (3, 116)	η^2p	*P* post-hoc	*d* de Cohen (G-PREDIX vs. G-DISLX)	IC 95%
Nombre de letras	5.81 ± 2.73	17.13 ± 2.33	11.62 ± 1.63	18.02 ± 2.11	198.412*	0.820	<0.001	2.65	[4.9, 6.7]
Igual-diferente	5.84 ± 2.92	17.03 ± 1.97	11.83 ± 1.77	18.10 ± 1.98	195.320*	0.818	<0.001	2.59	[4.7, 6.5]
Lectura de palabras	4.97 ± 2.57	16.70 ± 1.78	11.07 ± 1.71	17.95 ± 1.72	255.611*	0.860	<0.001	2.88	[5.2, 7.1]
Lectura de pseudopalabras	5.06 ± 2.44	17.40 ± 2.19	11.07 ± 1.62	18.20 ± 2.05	267.314*	0.866	<0.001	2.92	[5.3, 7.3]

Estructuras gramaticales	6.29 ± 2.74	17.70 ± 1.95	10.72 ± 1.53	17.85 ± 1.88	228.751*	0.845	<0.001	2.80	[5.1, 6.9]
Signos de puntuación	5.87 ± 2.82	17.27 ± 1.70	11.41 ± 1.61	17.92 ± 1.75	225.613*	0.842	<0.001	2.77	[5.0, 6.8]
Comprensión de oraciones	6.32 ± 2.94	17.50 ± 2.01	11.66 ± 1.65	18.00 ± 2.10	190.315*	0.812	<0.001	2.55	[4.6, 6.4]
Comprensión de textos	0.87 ± 1.11	4.00 ± 0.83	3.03 ± 0.82	4.55 ± 0.80	95.212*	0.690	<0.001	2.10	[3.8, 5.0]
Comprensión oral de textos	1.45 ± 1.11	4.13 ± 0.68	3.00 ± 0.84	4.60 ± 0.85	92.127*	0.685	<0.001	2.05	[3.7, 4.9]

Para analizar la relación entre las variables neonatales y el desarrollo lector, se realizaron análisis de regresión lineal múltiple. Como predictores se incluyeron variables como la edad gestacional, el peso al nacer, las puntuaciones de APGAR al minuto y a los cinco minutos, la presencia de hemorragia intraventricular, leucomalacia periventricular, síndrome de dificultad respiratoria, el uso de ventilación mecánica y la duración de la estancia en la UCIN. Las variables dependientes correspondieron a las habilidades lectoras evaluadas mediante el PROLEC-R. Se realizaron análisis por separado para la muestra menores prematuros (G-PREDIX y G-PREMA) y para la muestra total (G-PREDIX, G-PREMA, G-DISLX y G-NODISLX) (*Tabla 8 y 9*).

Tabla 8. *Resultados de la relación entre las variables neonatales y el desarrollo lector en la muesta de menores prematuros (G-PREDIX y G-PREMA)*

	R^2 *ajustado*	*F*	*p*	**Beta estandarizada (β)**	**Error estándar (SE)**	**95% Intervalo de confianza (inferior)**	**95% Intervalo de confianza (superior)**
Nombre de letras	-0.0097	0.836	0.559	-0.034	0.147	-0.322	0.254
Igual-diferente	-0.0044	0.924	0.490	-0.027	0.135	-0.301	0.247
Lectura de palabras	0.0336	1.591	0.145	0.112	0.126	-0.097	0.316

Lectura de pseudopalabras	-0.0112	0.811	0.579	-0.041	0.142	-0.328	0.279
Estructuras gramaticales	-0.0498	0.192	0.986	-0.018	0.158	-0.312	0.276
Signos de puntuación	-0.0154	0.674	0.623	-0.029	0.149	-0.289	0.275
Comprensión de oraciones	0.0245	1.302	0.254	0.095	0.140	-0.110	0.312
Comprensión de textos	-0.0221	0.589	0.673	-0.038	0.146	-0.275	0.231
Comprensión oral de textos	0.0183	1.178	0.289	0.089	0.138	-0.098	0.301

Tabla 9. *Resultados de la relación entre las variables neonatales y el desarrollo lector en los cuatro grupos*

	R^2 *ajustado*	*F*	*p*	β	DT	95% Intervalo de confianza (inferior)	95% Intervalo de confianza (superior)
Nombre de letras	-0.0078	1.102	0.366	-0.029	0.143	-0.317	0.259
Igual-Diferente	0.0034	1.435	0.225	0.018	0.132	-0.275	0.249
Lectura de Palabras	0.0292	1.789	0.114	0.109	0.128	-0.091	0.311
Lectura de Pseudopalabras	-0.0033	0.987	0.418	-0.025	0.140	-0.315	0.285
Estructuras Gramaticales	-0.0451	0.238	0.954	-0.012	0.155	-0.309	0.285
Signos de Puntuación	-0.0185	0.721	0.599	-0.035	0.146	-0.278	0.281
Comprensión de oraciones	0.0271	1.405	0.241	0.098	0.139	-0.107	0.318
Comprensión de textos	-0.0254	0.635	0.689	-0.042	0.144	-0.268	0.225
Comprensión oral de textos	0.0229	1.223	0.276	0.093	0.137	-0.094	0.305

6.2.2. Discusión correspondiente al primer objetivo

Los resultados sugieren que las variables neonatales, por sí solas, no explican diferencias significativas en la habilidad lectora. Esto contrasta con algunas investigaciones previas que han asociado la prematuridad y las complicaciones neonatales con dificultades posteriores de aprendizaje, indicando que otros factores —como la estimulación cognitiva posnatal, la calidad educativa y el entorno familiar— podrían ser factores más relevantes en el desarrollo lector. Es posible que los efectos de la prematuridad sobre las habilidades lectoras sean indirectos y estén mediados por experiencias postnatales, exposición al lenguaje temprano e intervenciones educativas. La ausencia de significación en los predictores neonatales sugiere que su influencia podría ser más compleja, requiriendo modelos no lineales o de interacción para detectar efectos más sutiles.

El análisis del rendimiento lector entre los diferentes grupos reveló que los menores prematuros con dislexia obtuvieron puntuaciones más bajas en todas las pruebas de lectura en comparación con los demás grupos. Estos resultados respaldan la hipótesis de que la combinación de prematuridad y dislexia genera un impacto acumulativo sobre las dificultades lectoras. Los menores nacidos a término con dislexia también mostraron un rendimiento inferior al de los menores sin dislexia, aunque su desempeño fue significativamente mejor que el de los prematuros con dislexia, lo que sugiere que la prematuridad agrava las dificultades características del trastorno.

Estos hallazgos son consistentes con investigaciones anteriores que documentan una mayor prevalencia de dificultades lectoras en menores prematuros, atribuidas a alteraciones en el desarrollo cerebral durante etapas del neurodesarrollo críticas (Anderson y Doyle, 2008; Dubois *et al.*, 2008). La inmadurez de la sustancia blanca y las alteraciones en la conectividad entre las áreas corticales responsables de la integración fonológica y visual se han identificado como factores clave en el origen de las dificultades lectoras en menores prematuros (Back y Rosenberg, 2014). En concreto, se ha demostrado que el desarrollo de la lectura depende en gran medida de la integridad de las conexiones entre la corteza parietotemporal y el fascículo arqueado, estructuras que, según estudios de neuroimagen, presentan alteraciones menores prematuros (Feldman *et al.*, 2012).

Las disrupciones en estos circuitos afectan negativamente al proceso de decodificación fonológica y a la fluidez lectora, habilidades en las que los menores prematuros con dislexia mostraron mayores déficits en el presente estudio. Investigaciones previas han demostrado que los menores prematuros presentan una activación reducida de las áreas frontotemporales durante tareas de procesamiento fonológico, lo que genera mayores dificultades para automatizar la conversión grafema-fonema (Myers *et al.*, 2014; Pugh *et al.*, 2000; Travis *et al.*, 2017; Wandell y Yeatman, 2013).

Por otro lado, los menores prematuros sin dislexia obtuvieron puntuaciones comparables a las de los menores nacidos a término sin dislexia en la mayoría de las tareas de lectura, lo que sugiere que la prematuridad, en ausencia de dislexia, no constituye un factor determinante para la aparición de dificultades lectoras. Estos resultados refuerzan la idea de que la dislexia es el principal factor explicativo de las diferencias en el rendimiento lector, mientras que la prematuridad actúa más como un factor agravante que como una causa directa de los déficits lectores. Esta conclusión se alinea con estudios que indican que no todos los menores prematuros desarrollan dificultades de lectura, pero sí que existe un mayor riesgo en aquellos con lesiones cerebrales neonatales o en aquellos expuestos a entornos posnatales desfavorables (Yeatman *et al.*, 2012).

Contrariamente a estudios anteriores que sugieren que los menores nacidos antes de las 37 semanas de gestación presentan un mayor riesgo de desarrollar dificultades lectoras (Myers *et al.*, 2014; Yeatman *et al.*, 2012), este estudio no encontró una relación significativa entre la edad gestacional y el diagnóstico de dislexia. Este hallazgo contradice a la suposición ampliamente aceptada de que la prematuridad, por sí sola, constituye una causa directa de la dislexia, sugiriendo en cambio que su influencia puede depender de interacciones más complejas con otros factores clínicos y ambientales. Aunque se reconoce que el nacimiento prematuro está asociado a un mayor riesgo de trastornos en el neurodesarrollo, incluyendo alteraciones cognitivas y lingüísticas, la ausencia de una asociación significativa en este estudio resalta la importancia de considerar variables mediadoras adicionales, tales como las complicaciones neonatales, la calidad del cuidado perinatal y la estimulación lingüística temprana.

Durante el tercer trimestre del embarazo se produce un período sumamente importante para la maduración de las estructuras cerebrales implicadas en la lectura. En esta etapa ocurre una consolidación importante de los tractos de sustancia blanca y de la formación de circuitos funcionales entre la corteza parietotemporal y las áreas frontales, esenciales para el procesamiento fonológico, la memoria de trabajo y la integración viso-ortográfica (Pugh *et al.*, 2000; Travis *et al.*, 2017; Wandell y Yeatman, 2013). Estas estructuras desempeñan un rol central en el desarrollo de la lectura fluida y precisa, ya que la decodificación y la comprensión del texto dependen de la conectividad eficiente entre las áreas de procesamiento lingüístico y los mecanismos de control ejecutivo. A pesar de la conocida vulnerabilidad en el neurodesarrollo asociada al nacimiento prematuro, los resultados de este estudio indican que la edad gestacional no predice de manera significativa el diagnóstico de dislexia, lo que sugiere que la prematuridad por sí sola no determina los déficits lectores. Esta evidencia apoya la hipótesis de que la presencia de factores de riesgo adicionales — como lesiones cerebrales neonatales, complicaciones perinatales o carencias en la estimulación lingüística temprana — puede ser más determinante que la edad gestacional en sí misma. Es posible que los menores prematuros que no experimentan complicaciones adicionales y que reciben un cuidado posnatal adecuado junto con estimulación cognitiva y lingüística de calidad, logren desarrollar mecanismos compensatorios que minimicen el impacto del nacimiento prematuro en sus habilidades académicas.

En cuanto al peso al nacer, se observó una ligera tendencia positiva en su relación con el rendimiento en la lectura de palabras y pseudopalabras, aunque esta no alcanzó significancia estadística. Este hallazgo es consistente con investigaciones previas que señalan que un mayor peso al nacer suele asociarse a un mejor desarrollo fetal y, por ende, a una mayor maduración neurológica al momento del nacimiento (Feldman *et al.*, 2012). Un mayor peso al nacer se vincula habitualmente con un mayor volumen cerebral, mejores reservas metabólicas y procesos de mielinización más robustos, todos ellos factores que favorecen el desarrollo cognitivo y lingüístico. Sin embargo, la ausencia de un efecto significativo en este estudio coincide con otros trabajos que apuntan que la maduración cerebral está más estrechamente relacionada con la edad gestacional que con el peso al nacer por sí solo (Yeatman *et al.*, 2012). Esta distinción es importante, ya que, aunque el bajo peso al nacer representa un factor de riesgo, no

necesariamente constituye un determinante independiente de dislexia; su impacto puede depender de otros factores neonatales como el estado nutricional intrauterino o las intervenciones médicas posteriores. Además, es posible que dentro de esta muestra no existiera una variabilidad suficiente en el peso al nacer como para observar asociaciones claras, dado que no se incluyeron recién nacidos con peso extremadamente bajo.

Respecto a las puntuaciones APGAR a los 1 y 5 minutos, estas no se mostraron como predictores significativos del rendimiento lector en la muestra analizada. Aunque la prueba de APGAR es ampliamente utilizada como medida clínica de la adaptación neonatal a la vida extrauterina, su capacidad para predecir resultados cognitivos o académicos a largo plazo es limitada, especialmente en ausencia de eventos perinatales graves como hipoxia o encefalopatía hipóxico-isquémica (Shaywitz y Shaywitz, 2005). Esto coincide con estudios anteriores que han indicado que, mientras puntuaciones bajas pueden asociarse a un mayor riesgo de dificultades cognitivas, los menores con puntuaciones normales o intermedias no necesariamente presentan problemas académicos posteriores (Pugh *et al.*, 2001; Travis *et al.*, 2017). En el presente estudio, la mayoría de los participantes presentaron puntuaciones APGAR dentro del rango normal, lo que podría explicar la falta de impacto observable en las habilidades lectoras. Además, la neuroplasticidad cerebral en la infancia temprana puede facilitar la recuperación funcional en aquellos menores que han presentado adaptaciones iniciales desfavorables, contribuyendo así a un desarrollo cognitivo y lingüístico adecuado. En conjunto, estos hallazgos sugieren que la edad gestacional, el peso al nacer y las puntuaciones APGAR no son suficientes, por sí solos, para explicar las dificultades lectoras. Más que actuar como factores causales directos, parecen ser indicadores de riesgo que interactúan con una serie de variables clínicas y ambientales, como las complicaciones médicas, el entorno familiar, la exposición temprana al lenguaje y la calidad de las intervenciones educativas.

En cuanto a las complicaciones neonatales específicas, los análisis de regresión en la muestra del presente estudio no las identificaron como predictoras significativas del rendimiento lector, hecho que contrasta con estudios anteriores que han vinculado la hemorragia intraventricular (IVH) y la leucomalacia periventricular (PVL) con déficits neurocognitivos y un mayor riesgo de trastornos del aprendizaje (Pugh *et al.*, 2001; Travis *et al.*, 2017; Volpe, 2019). Estos resultados

cuestionan la noción ampliamente aceptada de que las lesiones cerebrales tempranas conducen inevitablemente a dificultades académicas, sugiriendo, en cambio, que factores de compensación neuroplástica o intervenciones posnatales podrían amortiguar su impacto en el desarrollo lector. Sin embargo, se observaron tendencias negativas en la relación entre la presencia de IVH o PVL y el rendimiento en las tareas de comprensión lectora y estructuras gramaticales, indicando que, aunque su efecto no fue significativo en términos estadísticos, no puede descartarse del todo su influencia sutil en el procesamiento lingüístico de orden superior. La IVH ha sido ampliamente estudiada debido a su impacto en el desarrollo cognitivo y lingüístico, ya que afecta directamente a la sustancia blanca periventricular, crítica para la conectividad entre áreas cerebrales implicadas en la integración fonológica y semántica (Rimrodt *et al.*, 2010). Las vías de sustancia blanca, como el fascículo arqueado y el fascículo longitudinal superior, son fundamentales para la decodificación fonológica, la recuperación de palabras y el procesamiento sintáctico, habilidades esenciales para la lectura y la comprensión gramatical. Las disrupciones en estas vías pueden dificultar la automatización de la lectura, la función ejecutiva y la memoria de trabajo, hecho que repercute negativamente en la fluidez lectora y en el procesamiento fonológico (Volpe, 2019).

Del mismo modo, la PVL, otra forma frecuente de lesión de la sustancia blanca en recién nacidos prematuros, se ha asociado a alteraciones en la mielinización y en la velocidad de transmisión neural. Investigaciones previas han vinculado la PVL con dificultades en el procesamiento del lenguaje y deficiencias en la memoria de trabajo, aspectos cruciales tanto para la comprensión lectora como para el razonamiento gramatical (Travis *et al.*, 2017). No obstante, en el presente estudio, aunque no se halló una relación significativa entre PVL y las habilidades lectoras, se observó una tendencia negativa respecto a la comprensión de textos, lo que podría reflejar un impacto sutil en tareas que requieren una integración lingüística más compleja.

En cuanto a la admisión en las UCIN y el uso de ventilación mecánica, tampoco se encontraron efectos significativos sobre el desarrollo lector. Si bien estudios anteriores han vinculado estancias prolongadas en las UCIN con un mayor riesgo de trastornos del neurodesarrollo (Anderson y Doyle, 2008), los resultados aquí obtenidos sugieren que la duración de la hospitalización neonatal no constituye un factor determinante directo del rendimiento lector. Esto no

implica necesariamente que la admisión en la UCIN sea benigna, sino más bien que sus efectos a largo plazo pueden depender más de la condición médica subyacente que llevó a la hospitalización que de la hospitalización en sí misma.

Una posible explicación de estos hallazgos es que la atención neonatal moderna ha mejorado significativamente, con avances en el soporte respiratorio, las intervenciones nutricionales y el seguimiento temprano del neurodesarrollo que ayudan a mitigar algunos de los efectos adversos previamente asociados con las estancias en la UCIN y el uso de ventilación mecánica. Además, la variabilidad en los seguimientos médicos tras el alta, los programas de intervención temprana y los entornos de alfabetización en el hogar podrían desempeñar un papel más crucial en la determinación del éxito lector posterior que las propias complicaciones neonatales. Otra consideración es que no todos los menores que experimentan adversidades tempranas desarrollan dificultades lectoras, ya que las diferencias individuales en resiliencia cognitiva, apoyo familiar y acceso a una educación de alta calidad pueden amortiguar los posibles efectos negativos de las lesiones cerebrales tempranas.

En definitiva, estos hallazgos subrayan la necesidad de una comprensión más pormenorizada de cómo las complicaciones neonatales interactúan con factores ambientales y del desarrollo para influir en la adquisición de la lectura. Aunque no se encontraron efectos estadísticamente significativos de la IVH, PVL, la admisión en UCIN o la ventilación mecánica sobre las habilidades lectoras, las tendencias negativas observadas sugieren que merece la pena seguir investigando estas relaciones. Los futuros estudios deberían utilizar muestras más amplias, diseños longitudinales, y técnicas de neuroimagen que permitan evaluar la integridad de la sustancia blanca, así como explorar la mediación de funciones cognitivas específicas como la memoria de trabajo, la conciencia fonológica y las funciones ejecutivas en la relación entre la salud neonatal y el rendimiento lector.

6.3. DIFERENCIAS EN EL RENDIMIENTO LINGÜÍSTICO-COGNITIVO EN POBLACIÓN INFANTIL CON DISLEXIA

El segundo objetivo específico que se estableció en la presente tesis doctoral fue explorar el rendimiento lingüístico y cognitivo de la población infantil con dislexia y observar las diferencias existentes en comparación con un grupo de menores con un desarrollo lector normotípico.

6.3.1. Resultados correspondientes al segundo objetivo

Se llevaron a cabo análisis de prueba t para muestras independientes para comparar las puntuaciones de menores con dislexia (G-DISLX) y menores sin dislexia (G-NODISLX) en las variables relacionadas con la competencia lingüística (*Tabla 10*). Los resultados evidenciaron diferencias significativas en todas las variables relacionadas con el lenguaje.

Tabla 10. *Resultados de las diferencias en las medidas relativas a la competencia lingüística entre el G-DISLX y el G-NODISLX, evaluadas mediante el CELF-5*

Lenguaje	**Grupos**		**Prueba *t* para la igualdad de medias**				
	G-DISLX	***G-NODISLX***	***t***	**df**	***Sig. (bilateral)***	***Diferencia de medias***	**ð (SE)**
Comprensión de oraciones	M = 6.58 DT = 1.64	M = 10.28 DT = 2.12	7.594	118	<0.001	3.700	1.95 (0.22)
Conceptos lingüísticos	M = 5.68 DT = 1.89	M = 11.26 DT = 1.96	8.648	118	<0.001	5.580	2.89 (0.26)
Morfosintaxis	M = 7.84 DT = 1.29	M = 14.17 DT = 2.67	6.484	118	<0.001	6.330	3.01 (0.26)
Perfil de habilidades pragmáticas	M = 3.87 DT = 1.35	M = 9.46 DT = 1.35	4.654	118	<0.001	5.590	4.14 (0.32)

Comprensión de textos orales	M = 5.12 DT = 3.84	M = 10.53 DT = 1.99	7.498	118	<0.001	5.410	1.76 (0.21)

Se llevaron a cabo análisis de prueba t para muestras independientes para comparar las puntuaciones de menores con dislexia (G-DISLX) y menores sin dislexia (G-NODISLX) en las variables relacionadas con la competencia cognitiva (*Tabla 11*) y de funcionamiento ejecutivo (*Tabla 12*). Los resultados mostraron diferencias significativas en todas las variables relacionadas con la cognición y el funcionamiento ejecutivo.

Tabla 11. *Resultados de las diferencias en las medidas relativas a la competencia cognitiva entre el G-DISLX y el G-NODISLX, evaluadas mediante la WISC-V*

Cognición	**Grupos**		**T test for equality of means**				
	G-DISLX	***G-NODISLX***	***t***	***gl***	***Sig. (bilateral)***	***Diferencia de medias***	**ð (SE)**
Comprensión verbal	M = 7.11 DT = 1.58	M = 12.96 DT = 2.68	10.374	118	<0.001	5.850	2.65 (0.25)
Visuoespacial	M = 6.48 DT = 1.52	M = 13.91 DT = 2.01	9.515	118	<0.001	7.430	4.16 (0.32)
Razonamiento fluido	M = 6.15 DT = 1.85	M = 11.69 DT = 2.93	7.549	118	<0.001	5.540	2.26 (0.23)
Memoria de trabajo	M = 5.99 DT = 2.02	M = 10.36 DT = 1.64	6.419	118	<0.001	4.370	2.37 (0.24)
Velocidad de procesamiento	M = 6.09 DT = 1.61	M = 11.71 DT = 1.72	7.549	118	<0.001	5.620	3.37 (0.28)

Tabla 12. *Resultados de las diferencias en las medidas relativas a la competencia del funcionamiento ejecutivo entre el G-DISLX y el G-NODISLX, evaluadas mediante el ENFEN*

Funciones ejecutivas	Grupos		Prueba t para la igualdad de medias				
	G-DISLX	*G-NODISLX*	*t*	*df*	*Sig. (bilateral)*	*Diferencias de medias*	ð (SE)
Resistencia a la interferencia	M = 5.37 DT = 2.51	M = 12.37 DT = 3.28	8.459	118	<0.001	7.000	-2.39 (0.23)
Construcción de senderos	M = 6.50 DT = 2.76	M = 12.07 DT = 2.90	8.148	118	<0.001	5.567	-1.97 (0.22)
Fluidez verbal	M = 7.00 DT = 2.80	M = 12.67 DT = 2.29	7.198	118	<0.001	5.667	-2.21 (0.23)
Construcción con anillas	M = 5.97 DT = 2.95	M = 10.97 DT = 2.35	6.148	118	<0.001	5.000	-1.87 (0.21)

6.3.2. Discusión correspondiente al segundo objetivo

El análisis de la competencia lingüística revela que los menores con dislexia presentan un rendimiento significativamente inferior en todas las áreas evaluadas: comprensión de oraciones, conceptos lingüísticos, morfosintaxis, pragmática y comprensión de textos orales. Las diferencias observadas entre los grupos no solo son estadísticamente significativas, sino también clínicamente relevantes, ya que afectan a áreas clave del desarrollo del lenguaje esenciales para el éxito académico y la comunicación cotidiana.

Una de las principales explicaciones de estas dificultades radica en el procesamiento fonológico alterado que caracteriza las dificultades de lectura y escritura (Hulme y Snowling, 2016). Los menores con dislexia tienen dificultades para segmentar, identificar y manipular los sonidos del habla, lo cual impacta directamente en su capacidad para procesar el lenguaje oral y escrito. Esta

limitación resulta crucial en tareas como la comprensión de oraciones y los conceptos lingüísticos, donde la identificación rápida y precisa de fonemas y palabras es esencial para una adecuada comprensión.

Asimismo, las dificultades en morfosintaxis refuerzan la idea de que la dislexia afecta no solo al reconocimiento de palabras, sino también a la construcción y comprensión de estructuras gramaticales complejas. Los errores en la conjugación verbal y en la construcción de oraciones complejas observados en el grupo con dislexia coinciden con estudios previos que sugieren que los menores con dislexia presentan dificultades para adquirir y automatizar las reglas gramaticales (Marshall *et al.,* 2011). Una posible explicación es que los menores con dislexia deben destinar más recursos cognitivos a la decodificación de palabras, dejando menos recursos disponibles para el procesamiento de las reglas morfosintácticas, lo que compromete su producción y comprensión gramatical.

Los resultados en las habilidades pragmáticas también revelaron diferencias significativas, lo que sugiere que los menores con dislexia enfrentan dificultades no solo a nivel fonológico y gramatical, sino también en el uso efectivo del lenguaje en contextos sociales. La pragmática, que implica el uso apropiado del lenguaje en situaciones cotidianas, parece estar afectada en estos menores, limitando su capacidad para participar de manera autónoma en actividades sociales. Esto puede deberse en parte a la ansiedad o frustración derivada de sus dificultades lingüísticas, hecho que inhibe la interacción social y afecta su habilidad para desenvolverse en situaciones comunicativas complejas (Coltheart *et al.,* 2001).

En cuanto a la comprensión de textos orales, la diferencia significativa observada entre los grupos destaca cómo la dislexia afecta a la capacidad de los menores para procesar y retener información presentada oralmente. Los menores con dislexia, al enfrentar dificultades en la memoria de trabajo y el procesamiento fonológico, tienen problemas para seguir y comprender la información de un texto oral, lo que deteriora la construcción de una comprensión coherente del mensaje (Snowling *et al.,* 2020). Es importante señalar que estas dificultades no se deben a un déficit primario de comprensión, sino a los desafíos fonológicos inherentes a la dislexia, lo que refuerza la importancia de diferenciar entre dislexia y trastornos de la comprensión oral en este estudio.

Los resultados de las pruebas de funciones cognitivas y ejecutivas también revelaron diferencias notables entre los grupos en todas las áreas evaluadas. Los

niños y niñas con dislexia obtuvieron puntuaciones significativamente más bajas en comprensión verbal, razonamiento fluido, memoria de trabajo y velocidad de procesamiento, hecho que resalta la complejidad de la dislexia, que afecta no solo al lenguaje, sino también a habilidades cognitivas fundamentales para el aprendizaje. Estos hallazgos coinciden con estudios realizados en otros idiomas transparentes, como el italiano, en los cuales los menores con dislexia también presentan déficits en funciones ejecutivas, incluidas la memoria de trabajo y la flexibilidad cognitiva (Mascheretti *et al.*, 2017). Esto sugiere que la transparencia ortográfica no elimina los déficits en funciones ejecutivas en la dislexia, aunque puede influir en la manera en que estos déficits se manifiestan.

La comprensión verbal fue una de las áreas más afectadas en los menores con dislexia. Al examinar los déficits cognitivos asociados con la dislexia, es crucial diferenciar las causas de estas dificultades. Este estudio atribuye específicamente los déficits observados a los problemas de procesamiento fonológico inherentes a la dislexia, en lugar de a dificultades derivadas principalmente de trastornos de comprensión verbal. Esta distinción es vital para comprender la naturaleza específica de la dislexia y para diseñar intervenciones educativas adecuadas.

El procesamiento fonológico ha sido reconocido desde hace tiempo como una dificultad central en quienes presentan dislexia. Las personas con este trastorno suelen tener dificultades en tareas como identificar rimas, segmentar sonidos de las palabras o nombrar rápidamente series de letras o números aleatorios, todas ellas habilidades críticas para una lectura y escritura efectivas. Esto contrasta con un trastorno primario de la comprensión verbal, que implicaría dificultades en la comprensión más allá de los problemas de decodificación asociados con la dislexia. El marco conceptual adoptado de Hulme y Snowling (2016) respalda esta interpretación al enfatizar los déficits fonológicos como el núcleo de la dislexia. Según su investigación, las dificultades en el procesamiento fonológico pueden obstaculizar el desarrollo de habilidades lectoras eficientes, lo que a su vez afecta a la fluidez y la comprensión lectora. Al referirse a este marco, el estudio se alinea con perspectivas teóricas consolidadas que defienden un modelo de déficit en el procesamiento fonológico en la dislexia, reforzando la especificidad de los desafíos que enfrentan las personas con esta condición.

Integrar esta aclaración no solo responde a un criterio de rigor académico, sino que también cumple un propósito práctico: asegura que los hallazgos se

interpreten correctamente y que las implicaciones para la intervención sean adecuadas. Atribuir erróneamente estos déficits a un trastorno primario de la comprensión verbal podría conducir a intervenciones menos específicas y, por tanto, menos eficaces, al centrarse potencialmente en habilidades lingüísticas generales en lugar de en las habilidades fonológicas específicas que los individuos con dislexia necesitan desarrollar.

Además, este enfoque contribuye a comunicar los hallazgos a docentes y profesionales clínicos que participan en el diseño e implementación de estrategias educativas. Comprender que el problema central radica en el procesamiento fonológico, y no en la comprensión verbal general, permite plantear enfoques educativos y terapéuticos más focalizados, incluyendo programas de lectura basados en la fonología, los cuales han demostrado mejorar significativamente las habilidades lectoras de los menores con dislexia al fortalecer sus capacidades de procesamiento fonológico.

Estudios previos han demostrado que los problemas en la comprensión verbal están relacionados con dificultades para acceder y utilizar el léxico mental, así como para aplicar eficazmente las reglas gramaticales (Hulme y Snowling, 2016). En este contexto, los menores con dislexia deben realizar un esfuerzo cognitivo adicional para comprender y procesar la información verbal, hecho que provoca fatiga cognitiva y reduce la precisión y la velocidad de sus respuestas.

El razonamiento fluido también mostró diferencias significativas, el cual implica la capacidad de resolver problemas novedosos, requiriendo flexibilidad cognitiva e integración de distintos tipos de información. Los mrnotrd con dislexia parecen tener dificultades en esta área debido a la sobrecarga cognitiva adicional que enfrentan al procesar el lenguaje escrito. Esta sobrecarga limita su capacidad para destinar suficientes recursos cognitivos a tareas que requieren lógica y razonamiento abstracto (Giazitzidou y Padeliadu, 2022).

La memoria de trabajo, crucial para retener y manipular información temporalmente, también fue significativamente más baja en los menores con dislexia, afectando tanto a su habilidad lectora como a su rendimiento general en tareas cognitivas complejas.

En cuanto a las funciones ejecutivas, los resultados revelaron diferencias sustanciales entre los grupos en pruebas de resistencia a la interferencia, fluidez verbal, construcción con anillas y construcción de caminos (Marshall *et al.,* 2011).

Las funciones ejecutivas, como la inhibición, el control atencional y la planificación, son esenciales para la resolución de problemas y la gestión eficaz de las demandas cognitivas. Las dificultades observadas en resistencia a la interferencia y fluidez verbal sugieren que los menores con dislexia tienen dificultades para suprimir respuestas automáticas y cambiar de manera flexible entre tareas, en línea con la literatura que documenta déficits en inhibición y flexibilidad cognitiva en esta población (Barbosa *et al.,* 2019).

Es importante destacar que estos déficits en funciones ejecutivas no son exclusivos de la dislexia, sino que pueden estar relacionados con el esfuerzo cognitivo adicional que estos menores deben realizar para procesar el lenguaje (Snowling *et al.,* 2020). La sobrecarga cognitiva derivada de las dificultades en la decodificación lectora reduce los recursos disponibles para tareas que requieren control inhibitorio y atención sostenida. Esto refuerza la idea de que las dificultades lectoras y las funciones ejecutivas están interrelacionadas, afectando a múltiples aspectos del rendimiento académico y del desarrollo global.

Desde una perspectiva neurobiológica, varios estudios han identificado alteraciones estructurales y funcionales en áreas cerebrales relacionadas con el procesamiento del lenguaje en personas con dislexia, como el giro angular y el giro frontal inferior, que participan en la decodificación fonológica y en la integración de la información (Mascheretti *et al.,* 2017). Estas alteraciones neuroanatómicas podrían explicar por qué los menores con dislexia tienen dificultades en tareas que requieren manipulación y reconocimiento de los sonidos del habla, afectando sus habilidades de lectura y escritura.

Finalmente, el enfoque epigenético destaca cómo los factores genéticos y ambientales interactúan para influir en la expresión de la dislexia, enfatizando que, si bien existe una predisposición genética, factores como la calidad del entorno educativo y el apoyo familiar pueden modular la gravedad y la manifestación de los síntomas. Esto es clave para comprender por qué algunos menores con dislexia responden mejor a las intervenciones educativas y terapéuticas, mientras que otros enfrentan dificultades persistentes (López-Resa y Moraleda-Sepúlveda, 2023).

6.4. ESTRÉS PARENTAL, CALIDAD DE VIDA Y DIFERENCIAS EN EL PERFIL EMOCIONAL Y CONDUCTUAL DE LA POBLACIÓN INFANTIL CON DISLEXIA

Por último, el tercer objetivo específico de la presente tesis doctoral fue examinar el estrés parental, la calidad de vida y el perfil emocional y conductual de la población infantil con dislexia y compararlo con un grupo de niños y niñas con un desarrollo lector normotípico.

6.4.1. Resultados correspondientes al tercer objetivo

Se llevaron a cabo análisis de prueba *t* para muestras independientes para comparar las puntuaciones de menores con dislexia (G-DISLX) y menores sin dislexia (G-NODISLX) en las variables relacionadas con el estrés parental, la calidad de vida y el patrón conductual (*Tabla 13*, *Tabla 14*, *Tabla 15* y *Tabla 16*).

Tabla 13. *Resultados de las diferencias en las medidas relativas al estrés parental entre el G-DISLX y G-NODISLX, evaluadas mediante el PSI-SF*

Estrés parental	Grupos		Prueba de Levene para la igualdad de varianzas			Prueba t para la igualdad de medias				
	G-DISLX	*G-NODISLX*	*F*	*Sig.*	η^2	*t*	*df*	*Sig. (bilateral)*	*Diferencia de medias*	ð
Malestar parental	M = 39.78 DT = 5.068	M = 19.60 DT = 4.463	1.267	0.263	-	-21.130	96	<.001	-20.180	4.764
Interacción disfuncional padre/madre-hijo(a)	M = 39.00 DT = 5.402	M = 19.30 DT = 4.626	2.039	0.156	-	-19.586	96	<.001	-19.700	4.929
Niño(a) difícil	M = 39.84 DT = 5.850	M = 18.84 DT = 4.533	7.648	0.007	0.681	-20.0.66	98	<.001	-21.000	5.228

Tabla 14. *Resultados de las diferencias en las medidas relativas la calidad de vida entre el G-DISLX y G-NODISLX, evaluadas mediante el Kiddo-Kindl*

Calidad de vida	Grupos		Prueba de Levene para la igualdad de varianzas			Prueba t para la igualdad de medias				
	G-DISLX	*G-NODISLX*	*F*	*Sig.*	η^2	*t*	*df*	*Sig. (bilateral)*	*Diferencia de medias*	ð
Autoestima	M = 2.04 DT = 0.856	M = 8.12 DT = 2.545	47.291	<0.001	0.703	-16.013	98	<0.001	-6.080	1.952
Bienestar emocional	M = 3.16 DT = 1.405	M = 13.78 DT = 2.985	32.162	<0.001	0.841	-22.763	98	<0.001	-10.620	2.348
Actividad relacionada con los pares	M = 3.02 DT = 1.464	M = 14.14 DT = 3.307	43.933	<0.001	0.623	-21.740	98	<0.001	-11.120	2.531
Bienestar familiar	M = 2.00 DT = 0.902	M = 7.86 DT = 2.587	37.938	<0.001	0.831	-15.120	98	<0.001	-5.860	1.942
Bienestar físico	M = 2.10 DT = 0.735	M = 7.48 DT = 2.742	89.637	<0.001	0.902	-13.399	98	<0.001	-5.380	1.982

Tabla 15. *Resultados de las diferencias en las medidas relativas al perfil conductual entre el G-DISLX y G-NODISLX, evaluadas mediante el BASC-3*

Perfil Conductual	Grupos		Prueba de Levene para la igualdad de varianzas			Prueba t para la igualdad de medias				
	G-DISLX	*G-NODISLX*	*F*	*Sig.*	η^2	*t*	*df*	*Sig. (bilateral)*	*Diferencia de medias*	ð
Puntuaciones de las escalas compuestas, clínicas y adaptativas										
Agresividad	M = 53.18 DT = 8.344	M = 17.40 DT = 6.074	11.232	.001	.586	24.514	98	<0.001	35.780	7.246
Ansiedad	M = 56.16 DT = 7.552	M = 18.58 DT = 6.341	1.337	.250	-	26.947	98	<0.001	37.580	6.990
Depresión	M = 53.50 DT = 7.643	M = 19.63 DT = 6.56	0.850	.359	-	23.431	98	<0.001	33.680	6.964
Somatización	M = 52.28 DT = 7.70	M = 19.82 DT = 6.700	2.649	.107	-	23.467	98	<0.001	33.220	7.049

Atipicidad	M = 55.78 DT = 7.937	M = 18.68 DT = 5.727	11.368	.001	.971	26.805	98	<0.001	37.100	7.156
Retraimiento	M = 53.56 DT = 8.011	M = 19.88 DT = 6.100	5.973	.016	.685	23.653	98	<.001	33.680	7.050
Problemas de atención	M = 52.30 DT = 8.011	M = 19.52 DT = 5.444	4.383	.039	.753	25.664	98	<0.001	32.780	6.603
Problemas de adaptabilidad	M = 54.64 DT =7.690	M = 19.32 DT = 5.995	4.151	.044	.698	25.614	98	<0.001	35.320	7.248
Problemas en habilidades sociales	M = 55.64 DT = 8.305	M = 19.86 DT = 5.307	15.809	<.001	.611	25.671	98	<0.001	35.780	7.159
Limitaciones en actividades cotidianas	M = 52.92 DT = 7.134	M = 19.58 DT = 5.621	1.330	.252	-	25.957	98	<0.001	33.340	6.560
Falta de comunicación funcional	M = 54.86 DT = 7.871	M = 18.80 DT = 6.471	1.933	.168	-	25.023	98	<0.001	36.060	7.414
Puntuaciones de las escalas de contenido										
Problemas de control de la ira	M = 54.48 DT = 8.671	M = 18.14 DT = 6.230	5.979	.016	.814	24.066	98	<0.001	36.340	7.350
Acoso escolar	M = 53.52 DT = 7.166	M = 19.20 DT = 6.455	0.201	.655	-	25.161	98	<0.001	34.320	6.643
Trastornos del desarrollo social	M = 56.26 DT = 7.868	M = 18.96 DT = 6.071	6.024	.016	.834	26.539	98	<0.001	37.300	6.851
Falta de autocontrol emocional	M = 55.10 DT = 7.739	M = 19.10 DT = 5.963	5.936	.017	.812	26.056	98	<0.001	36.000	6.908
Problemas de funcionamiento ejecutivo	M = 53.78 DT = 7.760	M = 17.52 DT = 6.469	2.296	.133	-	25.379	98	<0.001	36.260	7.122
Emocionalidad negativa	M = 55.62 DT = 7.309	M = 18.58 DT = 5.786	2.520	.116	-	28.097	98	<0.001	37.040	6.554
Problemas de resiliencia	M = 52.10 DT = 8.438	M = 18.64 DT = 5.813	5.744	.018	.509	23.092	98	<0.001	33.460	7.282

Tabla 16. *Resultados de las diferencias en las medidas relativas al perfil conductual y emocional entre el G-DISLX y G-NODISLX, evaluadas mediante el SENA*

Perfil Conductual	Grupos		Prueba de Levene para la igualdad de varianzas			Prueba t para la igualdad de medias				
	G-DISLX	*G-NODISLX*	*F*	*Sig.*	η^2	*t*	*df*	*Sig. (bilateral)*	*Diferencia de medias*	ð
Problemas interiorizados										
Depresión	M = 74.52 SD = 14.68	M = 30.63 SD = 10.81	8.935	.003	.847	18.636	118	<.001	43.883	12.898
Ansiedad	M = 73.88 SD = 16.16	M = 28.35 SD = 9.29	32.239	<.001	.748	18.875	118	<.001	45.533	13.213
Ansiedad social	M = 73.63 SD = 13.48	M = 27.82 SD = 9.42	9.780	.002	.884	21.575	118	<.001	45.817	11.632
Quejas somáticas	M = 71.12 SD = 14.13	M = 28.85 SD = 11.05	4.074	.046	.689	21.271	118	<.001	49.267	12.686
Problemas exteriorizados										
Problemas de atención	M = 73.90 SD = 14.18	M = 28.68 SD = 9.69	9.680	.002	.588	20.388	118	<.001	45.217	12.148
Hiperactividad - impulsividad	M = 74.72 SD = 14.01	M = 29.88 SD = 9.97	7.889	.006	.698	20.203	118	<.001	44.833	12.155
Problemas de control de ira	M = 75.05 SD = 14.40	M = 30.87 SD = 10.88	7.520	.007	.612	18.961	118	<.001	44.183	12.763
Agresión	M = 71.28 SD = 14.51	M = 30.97 SD = 11.26	5.371	.022	.693	17.003	118	<.001	40.317	12.988
Conducta desafiante	M = 73.45 SD = 15.36	M = 29.18 SD = 10.38	18.934	<.001	.788	18.486	118	<.001	44.267	13.116

El análisis de mediación realizado mediante el procedimiento PROCESS para SPSS se utilizó para determinar si los problemas conductuales median la relación entre el diagnóstico de dislexia y el estrés parental total. Los resultados revelaron que el diagnóstico de dislexia tiene un impacto significativo tanto en el aspecto de conducta aversivo como en los niveles de estrés parental, aunque no se

encontró evidencia de un efecto mediador de las alteraciones conductuales en esta relación (*Tabla 17, Tabla 18 y Tabla 19)*.

Tabla 17. *Relación entre el diagnóstico de dislexia y el patrón conductual*

Variable	Coeficiente	Error Estándar	t	*p*	IC 95% Inferior	IC 95% Superior
Constante	2.8800	0.2640	10.9077	< 0.001	2.3560	3.4040
Diagnóstico	-1.4400	0.1670	-8.6233	< 0.001	-1.7714	-1.1086
R^2	**0.4314**					

Tabla 18. *Relación entre el diagnóstico de dislexia, problemas de conducta y estrés parental*

Variable	Coeficiente	Error Estándar	t	p	IC 95% Inferior	IC 95% Superior
Constante	177.6300	4.3527	40.8088	< 0.001	168.9910	186.2690
Diagnóstico	-59.9450	2.4536	-24.4314	< 0.001	-64.8148	-55.0753
Problemas de conducta	0.6493	1.1192	0.5802	0.5632	-1.5719	2.8705
R^2	**0.9178**					

Tabla 19. *Efectos directos e indirectos del diagnóstico de dislexia sobre el estrés parental*

Tipo de Efecto	Efecto	Error Bootstrapping	IC 95% Inferior	IC 95% Superior
Efecto directo	-59.9450	2.4536	-64.8148	-55.0753
Efecto indirecto	-0.9350	1.7629	-4.4122	2.6409

6.4.2. Discusión correspondiente al tercer objetivo

Los hallazgos evidencian que las familias de menores con dislexia experimentan niveles más elevados de estrés, observables en el aumento de las puntuaciones en *Malestar parental*, *Interacción disfuncional Padre/Madre-Hijo(a)* y *Niño(a) Difícil*. Estos datos coinciden con investigaciones que retratan la dislexia como un estresor crónico para las familias, dadas las exigencias adicionales que supone la necesidad de apoyo académico constante, la complejidad de las estrategias compensatorias y la incertidumbre acerca de la evolución futura del menor (Karande *et al.*, 2009; Marchand-Krynski *et al.*, 2018). A esta realidad se suman factores subjetivos, como el grado de comprensión y aceptación que tienen las familias de la condición del menor o su habilidad para gestionar las expectativas propias y las del entorno (Hernández y Rabadán, 2023).

La literatura científica señala que la sobrecarga que experimentan las personas cuidadoras de menores con dificultades de aprendizaje puede explicarse por la simultaneidad de múltiples demandas. Por un lado, deben responder a los retos académicos a través de la coordinación con docentes, las sesiones de refuerzo, las tutorías y las revisiones continuas del progreso lector. Por otro, se enfrentan a la presión social derivada de la comparación con otros menores y al temor de que la dislexia repercuta negativamente en las oportunidades futuras de su hijo o hija (Hagan *et al.*, 2016). Esta combinación de factores puede retroalimentar la sensación de malestar y tensar la relación entre la familia y el menor cuando las estrategias de afrontamiento no resultan efectivas o cuando se asume que el menor podría "esforzarse más" para superar sus dificultades lectoras (Marchand-Krynski *et al.*, 2018).

El hecho de que no se encontraran efectos de mediación claros por parte de las conductas problemáticas en la relación entre el diagnóstico de dislexia y el estrés sugiere que la etiqueta de dislexia puede, por sí misma, suponer un impacto suficiente como para desencadenar una sobrecarga emocional en las familias. Este hallazgo no reduce la relevancia de los comportamientos disruptivos, pero sí indica que la propia experiencia de la dislexia —unida al proceso de encontrar apoyos adecuados y convivir con la incertidumbre constante— puede disparar niveles de tensión que se manifiesten incluso en familias con menores que no presentan comportamientos extremadamente difíciles (Willcutt y Pennington, 2000). Este

resultado se aleja de planteamientos que esperan que las conductas desadaptativas amplifiquen inevitablemente la carga de las familias. Por el contrario, los problemas de comportamiento podrían reforzar, pero no determinar, la sobrecarga emocional en aquellas personas cuidadoras ya inmersas en un contexto de alta demanda derivado de la dislexia.

Tal circunstancia pone de relieve el carácter multifactorial de la vivencia parental y la necesidad de estudiar con más detalle otros elementos (por ejemplo, la resiliencia familiar o la disponibilidad de redes de ayuda) que también podrían moderar la forma en que la dislexia repercute en el estado emocional de las personas que cuidan (Hernández y Rabadán, 2023).

En relación con la calidad de vida de los menores, las diferencias encontradas entre el grupo con dislexia y el grupo control se manifestaron de manera marcada en dimensiones como la *Autoestima*, el *Bienestar emocional* y el *Desarrollo relacionado con los pares*. Este patrón coincide con la abundante evidencia que asocia la dislexia con sentimientos reiterados de fracaso, la baja percepción de competencia y la percepción del entorno escolar como hostil o poco comprensivo (Humphrey, 2003; Mugnaini *et al.*, 2009). El hecho de que estas dificultades lectoras aparezcan a edades tempranas y persistan en el tiempo aumenta la probabilidad de que el menor interiorice la etiqueta de "no soy capaz", lo que repercute no solo en su autoconfianza, sino también en la asunción de riesgos académicos y sociales (Nieves-Gutiérrez, 2019).

La evidencia sugiere que la población infantil con dislexia tiende a situarse en una posición de vulnerabilidad cuando se inserta en un contexto escolar que prioriza la rapidez y la precisión lectora, especialmente si la retroalimentación que recibe se centra predominantemente en sus errores (Huang *et al.*, 2020). Esta situación puede consolidar la sensación de aislamiento y limitar las oportunidades de integración en grupos de pares, reflejándose en las puntuaciones más bajas del *Desarrollo relacionado con los pares*. Trabajos como el de Sanfilippo *et al.* (2020) sostienen, además, que un entorno escolar poco sensibilizado favorece el estigma y desencadena conductas de rechazo, lo que agrava la percepción de soledad y la baja calidad de vida.

El bienestar emocional también se ve mermado por la coexistencia de otras variables que tienden a acompañar a la dislexia, como la ansiedad ante la lectura en público o el temor a ser juzgado por las dificultades de decodificación (Goswami

et al., 2011). Tal como señalan Terras *et al.* (2009), esta ansiedad puede operar como causa y como consecuencia de la dislexia: por un lado, anticipa el fracaso y, por otro, se refuerza con cada experiencia negativa en el aula. La repercusión de estas vivencias en la calidad de vida infantil es, en consecuencia, muy profunda, abarcando la esfera académica, social e intrapersonal de los menores.

Los resultados del estudio revelaron que los menores con dislexia presentan más agresividad, niveles más altos de ansiedad y mayores problemas de atención respecto al grupo control. Estas observaciones concuerdan con estudios clásicos y actuales que documentan cómo los trastornos de aprendizaje pueden asociarse con respuestas conductuales y emocionales desajustadas, influidas por el sentimiento reiterado de dificultad y el posible acoso o incomprensión por parte del entorno (Ramus, 2003; Willcutt y Pennington, 2000). El estrés acumulado ante tareas de lectura o escritura, que muchas veces se intensifica con exigencias escolares poco adaptadas, podría explicar la irritabilidad y los estallidos de agresividad defensiva.

La ansiedad se establece como una variable central en este perfil. Coincidiendo con Goswami *et al.* (2011), existe evidencia de que muchos menores con dislexia desarrollan un miedo anticipatorio vinculado a la lectura o al procesamiento lingüístico, que no solo afecta a su desempeño académico, sino que además se extiende a la interacción con los pares y a la percepción de su propia valía (Terras *et al.*, 2009). El hallazgo de problemas de atención, tal como se ha encontrado también en la literatura, sugiere que las dificultades de lectura podrían confluir con dificultades en la autorregulación y la función ejecutiva, complicando la capacidad del menor de concentrarse en el aula, gestionar la impulsividad y manejar la frustración (Peterson y Pennington, 2012).

6.5. IMPLICACIONES PRÁCTICAS

Los resultados obtenidos en la presente tesis doctoral plantean una serie de implicaciones clínicas y prácticas de gran relevancia para el abordaje integral de la dislexia, especialmente en aquellos casos en los que coexisten antecedentes de prematuridad o complicaciones neonatales.

En primer lugar, se evidencia la necesidad de establecer protocolos de evaluación temprana que permitan detectar señales de alarma previas al inicio formal de la etapa escolar. Estos protocolos deben contemplar no solo las

habilidades lectoras iniciales, sino también indicadores relacionados con el desarrollo lingüístico, cognitivo y emocional, así como antecedentes clínicos neonatales. La detección temprana permite una intervención temprana, un aspecto necesario para minimizar el impacto funcional de las dificultades observadas.

Asimismo, se refuerza la importancia de adoptar un enfoque interdisciplinar en la intervención, integrando a profesionales del ámbito de la logopedia, la psicología general sanitaria, la neuropsicología, la psicología educativa y la pedagogía terapéutica.

En el ámbito educativo, los resultados respaldan la urgencia de desarrollar prácticas pedagógicas inclusivas que contemplen las particularidades del alumnado con dislexia. Estas prácticas deben implicar adaptaciones metodológicas y curriculares, así como el acceso a recursos de apoyo especializados dentro del entorno escolar. La escuela no solo debe garantizar el aprendizaje de los contenidos curriculares, sino también ofrecer un contexto emocionalmente seguro y motivador, que promueva la autoestima del alumnado, su sentido de pertenencia y su participación plena en la vida escolar. Del mismo modo, se destaca la necesidad de formar a los docentes en el reconocimiento temprano de las dificultades lectoras y en el uso de estrategias didácticas eficaces para el alumnado con dislexia. Una formación específica en lenguaje, cognición, funcionamiento ejecutivo, emocionalidad, conducta y trastornos del aprendizaje puede mejorar significativamente la capacidad del profesorado para responder de forma empática, informada y eficaz a las necesidades del alumnado. Esta formación también contribuiría a disminuir el estigma asociado a la dislexia y a fomentar una cultura escolar más comprensiva y equitativa.

En el ámbito sanitario, los equipos de neonatología y de atención temprana deben continuar evaluando de forma sistemática el desarrollo cognitivo y lingüístico de los menores prematuros, especialmente cuando han presentado complicaciones médicas durante el período neonatal. Aunque las variables neonatales analizadas no se mostraron como predictores significativos del rendimiento lector, su estudio sigue siendo de interés clínico, especialmente en contextos de riesgo perinatal. La detección de señales de alerta en estos primeros años de vida puede permitir la implementación de intervenciones preventivas que favorezcan un desarrollo óptimo.

Finalmente, las dificultades observadas en el rendimiento lector, las funciones ejecutivas y las competencias lingüísticas en la población con dislexia requieren su inclusión explícita, junto con el trabajo específico en las rutas de lectura, en los programas de intervención terapéutica personalizados, que respondan no solo a las necesidades académicas, sino también a los desafíos cognitivos y emocionales que enfrentan estos menores. La intervención, por tanto, debe estar diseñada desde una perspectiva biopsicosocial, considerando tanto los factores individuales como los contextuales que intervienen en el desarrollo infantil.

Una de las contribuciones relevantes de este estudio es la identificación de un mayor nivel de estrés en las personas que cuidan a menores con dislexia, independientemente de la presencia de problemas conductuales significativos. Este hallazgo pone de manifiesto la necesidad de incluir a las familias como agentes activos en los procesos de intervención, no solo para potenciar los avances del menor, sino también para preservar su propio bienestar. El acompañamiento psicoemocional a las familias, la psicoeducación sobre la dislexia y la promoción de redes de apoyo son estrategias que pueden aliviar la carga emocional derivada de la crianza de un hijo o hija con necesidades educativas especiales.

En conjunto, los hallazgos de esta investigación subrayan la necesidad de adoptar una mirada holística sobre la dislexia, en la que se articulen los esfuerzos clínicos, escolares y familiares para favorecer el bienestar y la inclusión plena de la población infantil que convive con esta condición.

VII – CONCLUSIONES

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Atendiendo a los objetivos establecidos en la presente tesis doctoral, se puede concluir, en base a los resultados obtenidos, que la población infantil con dislexia muestra un perfil clínico amplio y heterogéneo en lo relativo a las alteraciones lingüísticas, cognitivas, de funcionamiento ejecutivo, conductuales y emocionales, lo cual influye en su calidad de vida y en la de su familia.

Tras los resultados obtenidos en la presente investigación, se pueden destacar las siguientes conclusiones:

- La prematuridad, así como otras variables neonatales como la hemorragia intraventricular y la leucomalacia periventricular, no explica la varianza en el rendimiento lector. Sin embargo, cuando se combina con el diagnóstico de dislexia, se observa un efecto acumulativo que intensifica de manera notable las dificultades en todos los subprocesos de la lectura.
- Los menores con dislexia presentan un peor rendimiento lingüístico-cognitivo en comparación con sus iguales, mostrando dificultades en áreas lingüísticas como la fonética-fonología, la semántica, la morfosintaxis y la pragmática, así como en áreas cognitivas como la memoria, la atención o el funcionamiento ejecutivo.
- Las familias compuestas por un miembro con diagnóstico de dislexia presentan niveles más elevados de estrés y una calidad de vida inferior en comparación con aquellas en las que no existe esta condición. Asimismo, el perfil emocional y conductual de los menores con dislexia muestra alteraciones en comparación con quienes presentan un desarrollo lector normotípico.

VIII - LIMITACIONES Y FUTURAS LÍNEAS DE INVESTIGACIÓN

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Como toda investigación científica, la presente tesis doctoral presenta una serie de limitaciones que deben ser consideradas a la hora de interpretar los resultados.

En primer lugar, el diseño de la investigación, así como el diseño de la mayoría de los estudios utilizados para la revisión y comparación, es transversal. Este tipo de diseño, si bien permite obtener una fotografía puntual del estado de las variables analizadas, limita la posibilidad de establecer relaciones causales y de observar la evolución de los participantes a lo largo del tiempo. Un enfoque longitudinal habría permitido seguir el desarrollo de los participantes, proporcionando una visión más completa y dinámica del impacto de los factores neonatales, de las variables psicolingüísticas y del entorno familiar en el desarrollo lector.

En segundo lugar, deben señalarse las características de la muestra. Los participantes con diagnóstico de dislexia presentan una amplia heterogeneidad en cuanto a sintomatología, antecedentes médicos, comorbilidades y características individuales y contextuales. Esta variabilidad, aunque refleja la complejidad real de la dislexia, puede influir en los resultados y dificultar la generalización de las conclusiones. Así pues, debe ser tenido en cuenta al interpretar los resultados obtenidos.

En tercer lugar, se observa una limitación relacionada con el estado actual de la literatura científica. El número de artículos publicados en la literatura científica actual que vinculen varias de las variables comprendidas en este estudio es reducido. Por ejemplo, son escasas las investigaciones que relacionan la prematuridad y las complicaciones neonatales con la dislexia. En la actualidad, esta vinculación resulta clave para determinar el correcto desarrollo madurativo de las diferentes áreas como el lenguaje, la cognición y los aspectos sociales y emocionales. La escasez de trabajos previos dificultó la comparación de los resultados obtenidos en la presente tesis doctoral con otros estudios.

A partir de las limitaciones señaladas, se proyectan diversas líneas de investigación futuras.

En primer lugar, se considera fundamental promover estudios longitudinales que permitan seguir a los menores desde etapas tempranas del desarrollo (incluso desde el período neonatal) hasta la edad escolar. Este enfoque metodológico facilitaría la identificación de trayectorias evolutivas que puedan anticipar la aparición de dificultades lectoras, así como la detección temprana de factores de riesgo y la implementación temprana de intervenciones específicas.

En segundo lugar, resulta necesario llevar a cabo investigaciones con muestras más amplias y, en la medida de lo posible, más homogéneas o diseñadas de forma estratificada, con el fin de controlar la variabilidad clínica que caracteriza a la población infantil con dislexia. Estudiar subgrupos más definidos (por ejemplo, según las alteraciones específicas en la lectura, el perfil cognitivo o la presencia de antecedentes perinatales) permitiría obtener conclusiones más precisas y aplicables en contextos clínicos y educativos.

De forma más específica, una línea prometedora se centraría en el estudio de los mecanismos neurobiológicos y neurocognitivos que podrían mediar entre los eventos perinatales adversos (como la prematuridad, la hipoxia o las complicaciones respiratorias) y las alteraciones observadas en los procesos de lectura, cognición y lenguaje. La incorporación de técnicas de neuroimagen o biomarcadores genéticos podría arrojar luz sobre estos procesos y contribuir a una comprensión más profunda de la relación entre estos factores.

Asimismo, sería de gran interés profundizar en el impacto del entorno familiar y educativo en el desarrollo de los menores con antecedentes neonatales complejos. El estudio del papel de los factores protectores, como el nivel educativo de los progenitores, el apoyo escolar o la intervención temprana, podría ser clave para comprender cómo se mitigan los efectos negativos de las complicaciones perinatales sobre el desarrollo lingüístico, cognitivo, emocional y lector.

Finalmente, las futuras investigaciones podrían enfocarse en el diseño y evaluación de programas de intervención orientados a la prevención y atención personalizada de la población infantil en situación de riesgo de presentar dislexia desde edades tempranas. Estos programas deberían tener como objetivo favorecer un desarrollo adecuado de las habilidades lectoras y paliar, en la medida de lo posible, las dificultades propias de la dislexia. Asimismo, sería relevante incorporar intervenciones psicológicas dirigidas al entrenamiento en habilidades de regulación emocional y afrontamiento, tanto en los menores con dislexia como en

sus familias, con el fin de reducir los niveles de estrés, mejorar el bienestar emocional y, en definitiva, mejorar su calidad de vida.

IX - REFERENCIAS BIBLIOGRÁFICAS

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X – ANEXOS

X - ANEXOS

ANEXO 1. Aceptación del Comité de Ética de la Universidad de Málaga

UNIVERSIDAD DE MÁLAGA

ANDALUCÍA TECH
Campus de Excelencia Internacional

Vicerrectorado de Investigación y Transferencia
Comité Ético de Experimentación de la Universidad de Málaga
(CEUMA)

Nº: 56	Nº de Registro CEUMA: 120-2023-H

INFORME DEL COMITÉ ÉTICO DE EXPERIMENTACIÓN DE LA UNIVERSIDAD DE MÁLAGA

CEUMA

Reunido el Comité Ético de Experimentación en Málaga, el 30 de octubre de 2023, ha evaluado la solicitud del proyecto denominado "**Procesos perceptivos aplicados a la detección temprana de trastornos del desarrollo**" cuyo investigador principal es **D. Miguel López Zamora.**

Una vez examinada la documentación presentada y verificados aquellos aspectos relacionados con la ética y la legislación en materia de investigación que se indican:

-Se cumplen los requisitos necesarios de idoneidad del protocolo en relación con los objetivos del estudio.

- La idoneidad del procedimiento experimental, especialmente la posibilidad de alcanzar conclusiones válidas de acuerdo con los objetivos establecidos.

- La capacidad del investigador principal y sus colaboradores, los medios y las instalaciones previstas y laboratorios de la Universidad de Málaga reúnen las condiciones necesarias para llevar a cabo el proyecto indicado.

- El alcance de las compensaciones y motivaciones previstas no interfiere con el respeto a los postulados éticos.

Acuerda por consenso emitir Informe Ético **FAVORABLE** para dicho proyecto.

Una vez instruido el procedimiento, y en base a lo dispuesto en el artículo 82 de la Ley 39/2015, de 1 de octubre, del Procedimiento Administrativo Común de las Administraciones Públicas, se le da audiencia para qué en un plazo de 10 días, contados a partir de la recepción/publicación del presente informe, pueda formular alegaciones y presentar los documentos y justificaciones que estime pertinentes. Este informe tiene una validez de 4 años.

Para que así conste Dª María Zaida Díaz Cabiale, Vicerrectora de Investigación y Transferencia y Presidenta del Comité Ético de Investigación de la Universidad de Málaga lo firma en Málaga a 10 de noviembre de 2023.

Fdo: María Zaida Díaz Cabiale

DIAZ CABIALE MARIA ZAIDA - 25709512C

Firmado digitalmente por DIAZ CABIALE MARIA ZAIDA - 25709512C
Fecha: 2023.11.10 11:41:04 +01'00'

EFQM AENOR

Pabellón de Gobierno, planta 3ª. Campus El Ejido. 29071. Tel.: 952 13 42 04
E-mail- ceuma@uma.es

ANEXO 2. Aceptación del Comité de Ética de la UCAM

UCAM
UNIVERSIDAD CATÓLICA SAN ANTONIO

COMITÉ DE ÉTICA DE LA UCAM

Universidad Católica San Antonio. Vicerrectorado de Investigación. Salida nº 8921 02/06/2025

DATOS DEL PROYECTO

Título:	"Factores psicolingüísticos asociados a la dislexia infantil: Un estudio sobre el lenguaje, la cognición, el funcionamiento ejecutivo y su impacto en el bienestar y la dinámica familiar"	
Investigador Principal	**Nombre**	**Correo-e**
Dra.	Isabel López-Chicheri García	ilchicheri@ucam.edu

INFORME DEL COMITÉ

Fecha	**30/05/2025**	**Código**	**CE052513**

Tipo de Experimentación

Investigación experimental clínica con seres humanos	
Investigación experimental no clínica con seres humanos	
Utilización de tejidos humanos procedentes de pacientes, personas sanas, tejidos embrionarios o fetales	
Utilización de tejidos humanos, tejidos embrionarios o fetales procedentes de bancos de muestras o tejidos	
Investigación observacional, psicológica o comportamental en humanos	X
Uso de datos personales, información genética, etc.	X
Experimentación animal	
Utilización de agentes biológicos de riesgo para la salud humana, animal o las plantas	
Uso de organismos modificados genéticamente (OMGs)	

Comentarios Respecto al Tipo de Experimentación
Nada Obsta

Comentarios Respecto a la Metodología de Experimentación
Nada Obsta

UNIVERSIDAD CATÓLICA SAN ANTONIO · UCAM · COMITÉ DE ÉTICA · MURCIA ·

UCAM
UNIVERSIDAD CATÓLICA SAN ANTONIO

COMITÉ DE ÉTICA DE LA UCAM

Sugerencias al Investigador

A la vista de la solicitud de informe adjunto por el Investigador y de las recomendaciones anteriormente expuestas el dictamen del Comité es:

Emitir Informe Favorable	X
Emitir Informe Desfavorable	
Emitir Informe Favorable condicionado a Subsanación	

MOTIVACIÓN
Incrementará conocimientos en su área

Vº Bº El Presidente,

Fdo.: José Alberto Cánovas Sánchez

El Secretario,

Fdo.: José Alarcón Teruel

ANEXO 3. Consentimiento informado

UCAM
UNIVERSIDAD CATÓLICA SAN ANTONIO

ANEXO II

CONSENTIMIENTO INFORMADO

Yo, ..., con DNI:.....

Padres o Tutores legales de .....,

DECLARO:

Haber sido informado/a de los procedimientos del estudio e investigación del Proyecto titulado: Factores psicolingüísticos asociados a la dislexia infantil: Un estudio sobre el lenguaje, la cognición, el funcionamiento ejecutivo y su impacto en el bienestar y la dinámica familiar.

Los investigadores que tendrán acceso a nuestros datos personales y a los resultados de las pruebas son: Nadia Porcar Gozalbo, Miguel López Zamora e Isabel López-Chicheri García.

Asimismo, he podido realizar preguntas sobre el estudio, entendiendo que mi hijo/a o menor a mi cargo participa en él de forma voluntaria y que puede abandonarlo en cualquier momento sin que ello le suponga perjuicio alguno.

CONSIENTO:

1.-) Someterse a las siguientes pruebas: Evaluación Clínica de los Fundamentos del Lenguaje – Quinta Edición (CELF-5), Inventario de Evaluación del Comportamiento de las Funciones Ejecutivas – Segunda Edición (BRIEF-2), Evaluación Neuropsicológica de las Funciones Ejecutivas en Niños (ENFEN), Escala de Inteligencia de Wechsler para Niños - Quinta Edición (WISC-V), PROLEC-R. Batería de Evaluación de los Procesos Lectores – Revisada, PROLEXIA. Diagnóstico y Detección Temprana de la Dislexia, Sistema de Evaluación del Comportamiento Infantil (BASC-3) y Sistema de Evaluación de Niños y Adolescentes (SENA).

2.-) El uso de los datos obtenidos según se indica en el siguiente párrafo:
En cumplimiento del Reglamento (UE) 2016/679 del Parlamento Europeo y del Consejo, de 27 de abril de 2016, y de la Ley Orgánica 3/2018, de 5 de diciembre, de Protección de Datos Personales y garantía de los derechos digitales, le informamos que los datos que usted ha proporcionado y los que se obtengan como resultado de las pruebas a las que se va a someter, pasarán a formar parte del fichero automatizado de INVESALUD, cuyo titular es la Fundación Universitaria San Antonio, con la finalidad de investigación y docencia en las áreas de conocimiento de las ciencias experimentales y las ciencias de la salud.
Usted tiene derecho a acceder a esta información, así como a cancelarla o rectificarla, dirigiéndose a la dirección de la entidad, en Avda. de los Jerónimos de Guadalupe 30107 (Murcia). Esta entidad garantiza la adopción de las medidas adecuadas para asegurar el tratamiento confidencial de dichos datos.

En Valencia a ……. de ……..de 202…

Padre/Madre/Tutor legal, El/la investigador/a

Firma:..... Firma:……

ANEXO 4. Declaración jurada de originalidad del trabajo

DECLARACIÓN JURADA DE ORIGINALIDAD DEL TRABAJO

Yo, Nadia Porcar Gozalbo, con DNI/Pasaporte 20613178A, alumna inscrita en la Escuela Internacional de Doctorado, perteneciente a la Universidad Católica San Antonio de Murcia,

DECLARO

Ser el único autor del texto entregado para obtener el título académico de Doctor, y que tal texto no ha sido entregado ni total ni parcialmente para obtención de un título académico en ninguna otra universidad o instituto, ni ha sido publicado anteriormente para cualquier otro fin.

Así mismo, declaro no haber trasgredido ninguna norma universitaria con respecto al plagio ni a las leyes establecidas que protegen la propiedad intelectual.

Declaro, además, que el archivo PDF corresponde exactamente al texto impreso que presento junto al mismo.

Por último, declaro que soy conocedor de las sanciones penales en caso de infringir las leyes del plagio y de falsa declaración, y que firmo la presente con pleno uso de mis facultades y asumiendo todas las responsabilidades de ella derivada.

Firma

Firmado por NADIA PORCAR GOZALBO - NIF:***1317** el día 17/12/2025 con un certificado emitido por ACCV RSA1 CLIENTE

En Murcia, a 17 de diciembre de 2025