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Prematurity as a Differential Factor in The Executive functions in Children with ADHD

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Abstract

Several studies report the existence of a relationship between low birth weight and motor and cognitive development. It is observed that these children tend to present a low level of attention, behaviour, motor coordination and academic performance. The main objective of this study was to study the neuropsychological profile of a sample of patients with Attention Deficit Hyperactivity Disorder (ADHD) and to verify if there are significant differences between the participants (birth to term or premature). A neuropsychological assessment protocol was administered to a sample of 10 participants with ADHD. The scores obtained related to the cognitive/executive functioning of the sample are indicative of a medium cognitive profile, slight deficits to the levels of selective and alternating attention, and difficulties in the executive component of inhibition and change. There were differences in cognitive-executive performance between the ADHD group with term delivery and the ADHD group with preterm delivery, but there were no statistically significant differences.
Further studies will be needed in the future that will deepen these differences. Neuropsychological research has proved to be a tool capable of identifying changes in cognitive and executive processes.

Keywords: gestation period, premature birth, ADHD, executive functions

Introduction

ADHD is a neurodevelopmental disorder, highly based on genetic and hereditary factors, involving behavioural changes related to attention, impulsivity and motor hyperactivity (Fernandes, Piñón & Vázquez, 2017). Through bibliographical research, it was possible to verify that there is a connection of this pathology with the time of gestation (that is, premature birth <37 weeks and not premature within 37 weeks). Lamônica & Picolini (2009), they found that the fact of being born before 37 weeks of gestation (premature), causes it to have a factor of difficulties of longitudinal impact in the cognitive development, such as attention deficit, behavioural problems, visual and spatial deficits at the motor level, difficulties of perception and language.

Aasen et al (2016) studied the long-term sequences of preterm (<37 weeks gestation) in age adult compared to a non-preterm group and found no differences were made between groups, but the preterm group tended to develop care, attention, and adolescence.

Megan et al (2017), verified through an assessment of executive functions in children born before 28 weeks with 10 years of age. That they are at greater risk for neurodevelopmental problems, even if they contain a IQ within normal limits, have ADHD symptoms and are associated with deficits in executive functioning skills, including working memory, inhibition, and cognitive flexibility.

Studies on preterm birth with attention-deficit / hyperactivity (Rommel et al, 2017), consisting of two groups of adolescents one premature and one with ADHD found that considering the premature group (<37 weeks) has more difficulty in response preparation and response inhibition impediments compared to the ADHD group.

In this way, this study appeared to verify if there is any connection between gestation time and comorbidity of ADHD, for which a clinical analysis was performed with a sample of children diagnosed with ADHD born prematurely and at a normal gestational time (37 weeks). This analysis having as hypotheses: H0: Premature birth with ADHD will not interfere with executive function: processing speed and attention compared to a group of children with ADHD born normal delivery. H1: There are significant differences between premature birth with ADHD regarding executive function deficit: processing speed and attention compared to the group of children with ADHD born normal delivery. To verify the cognitive-executive performance a neuropsychological assessment was performed.

Methods

Research design

A cross-sectional design was used to evaluate the 10 children who participated in the study. Participants were recruited by an intentional consecutive sampling.

Participants

This study includes a cross-sectional study with data collection of children with Attention Deficit Hyperactivity Disorder (ADHD).

It consists of two groups: group 1 - not premature (born at 37 weeks or more) group 2 - premature (born before 37 weeks), and are classified as members of the children's mental health unit of the Clinicals Êbam (Spain). Inclusion criteria were 1) to be aged between 7 and 9 years; 2) received a diagnosis of

Hyperactivity Disorder and Attention Deficit Disorder performed by professionals (neuropediatric a clinical psychologist, psychiatrist) according to DSM-5 criteria (American Psychiatric Association, 2013); 3) that the parents, after reading the project information, sign the informed consent. The criteria for inclusion of the ADHD-Premature group were: 1) to have an age group between 7 and 9 years; 2) be born before 37 weeks; 3) have a diagnosis of Attention Deficit Hyperactivity Disorder and DSM-5; 3) that parents, after reading the project information, sign the informed and informed consent form.

All those who did not belong to the inclusion characteristics of the study were excluded.

The sociodemographic characteristics of the sample (ADHD and ADHD - Premature) are described in table 1.

Table 1

Sociodemographic Characterization of the Sample

Variables	**Group 1** ADHD Not Premature	**Group 2** ADHD Premature
Age (mean and standard deviation)	8.00 (1.00)	8.20 (1.09)
Gender	100% Boys	100% Boys
Subtype		
Clinical presence of inattention	40%	60%
Hyperactive / impulsive clinical presence	60%	20%
Inattentive clinical presence and hyperactive-impulsive combined	0%	0%
ADHD + PEA	0%	20%
Conduct disorders	40% Yes 60% No	20% Yes 80% N
Medication	60% Yes	40% Yes
Not Medication	40% Yes	60% Yes

Note. Parametric quantitative variables expressed through means and standard deviation; qualitative variables expressed as percentages.

Wechsler Intelligence Scale for Children-WISC-R (Wechsler, D. 2005)

It is a clinical tool for an individual application that assesses children's intellectual ability (6-16 years), global cognitive ability, and the four specific fields of intelligence that allows for more accurate analysis and deep cognitive processes. The WISC-R consists of 15 tests (10 main and 5 optional) using the obtained scalar score profile, a total IQ and 4 indexes: Verbal Comprehension, Preceptive Reasoning, Working Memory and Processing Speed. In this study, the subtests of Arithmetic (mental calculation and operative memory) and Digits (focused and sustained/sustained attention).

The STROOP test (Golden, 2006)

It's an instrument verbal is used in cases of neuropsychological problems, brain damage, and interference assessment. The application is preferably individual, with a chronological execution time of 5 minutes for ages 7 to 80 years. Selective attention evaluates the size of a complex stimulus presented at the same time as it evaluates the inhibition of a more automated response. The default version consists of three pages and each contains 100 elements distributed in five columns of 20 elements. Being useful for assessing the ability of cognitive inhibition and resistance to interference.

FDT: Five Digits Test (Sedo, 2007)

It is an instrument designed to measure very brief and simple cognitive processing speed, focus ability, reorient attention and ability to deal with interference, this test can be applied from 7 years without limit of application. It is based on the known effect of Stroop, but using numbers or digits, which will allow a wider range of evidence, which is used by people of lower cultural backgrounds, including people who do not know the language or illiterate people.

Proceeding

All participants were recruited by a consecutive sample. The sample was obtained from patients diagnosed with ADHD who were referred to the neuropsychology area of the Êbam Clinics for a neuropsychological evaluation. All participants and their parents or guardians were informed and accepted voluntary participation in the study, for which the parents signed the free and informed consent form. Sociodemographic variables were collected through the database of Êbam Clinics, all under the guidelines established by the Organic Law 15/1999, of December 13, on the Protection of Personal Data (From Spain, 1999).

The evaluations were performed between December 2012 and September 2013. All tests were applied in the neuropsychology area of Êbam clinics under similar conditions. A battery of neuropsychological tests (Table 2) was administered according to the applicable standards and correction criteria of each manual. A 60-minute evaluation session was held for each participant. At the time of data collection, the most up-to-date versions of these tests were used.

Table 2

Neuropsychological evaluation protocol

Neuropsychological tests	Evaluated functions
WISC-R	
Arithmetic	Mental calculus operative memory.
Digits	Focus, sustained attention and operational memory.
STROOP	
Words	Processing speed reader
Colors	Selective attention
Word – Colors	Cognitive inhibition
FDT	
Reading	Processing Speed
Content	Processing speed and sustained attention
Election	Selective attention
Switching	Alternate attention
Inhibition	Cognitive inhibition
Flexibility	Cognitive Flexibility

Data analysis

Statistical analysis was performed using the statistical software IBM SPSS Statistics 20. Descriptive analyses of the means and standard deviations of the scores of the participants in each of the applied tests were performed. To analyse the differences between group 1 (ADHD) and group 2 (ADHD-Premature), the T-test was used for normal distribution variables.

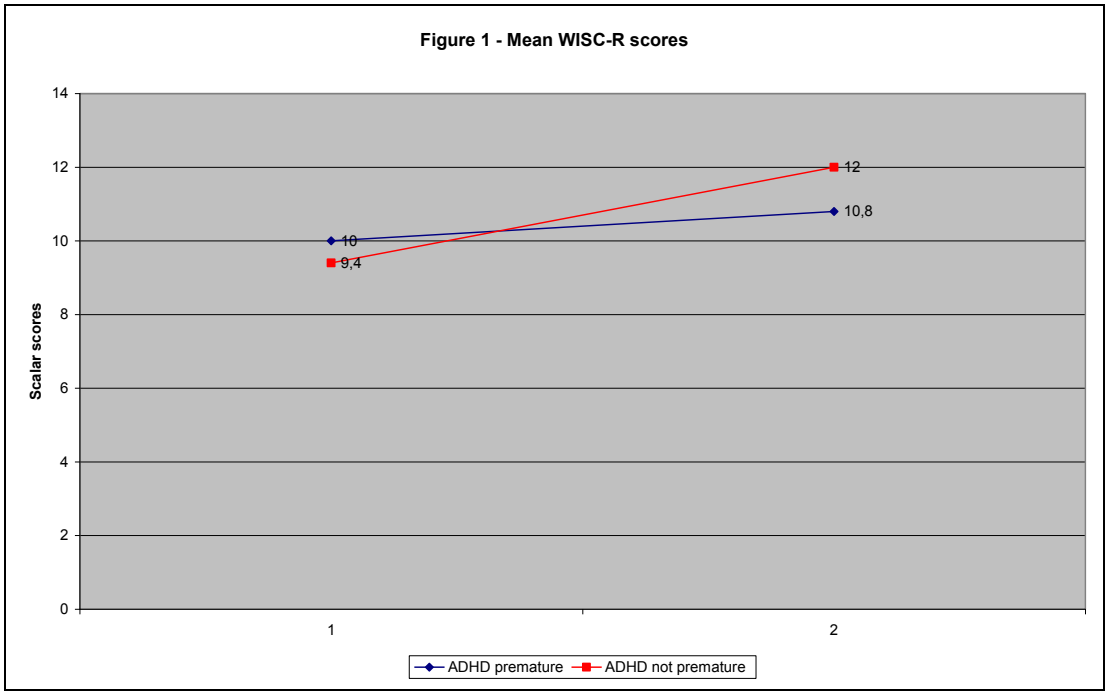
Results

The mean WISC-R scores of the ADHD group in the arithmetic subtests (M = 9.40, SD = 3.64) corresponded to average performance and in the subtests Digits (M = 12.00, SD = 3.74) corresponded to medium-high performance.

The mean WISC-R scores of the ADHD -Premature group in the subtests Digits (M = 10.80, SD = 3.96) and Arithmetic (M = 10.00, SD = 2.44) corresponded to an average performance. Figure 1 shows the means of sample execution (10 subjects) in the WISC-R subtests.

There were no statistically significant differences in the WISC-R subtest between the ADHD group and the ADHD - Premature group.

Figure 1. Mean performance of the ADHD-Not-Premature group (5 participants) and ADHD-Premature (5 participants) in the WISC-R subtests of digits (1) and arithmetic (2).



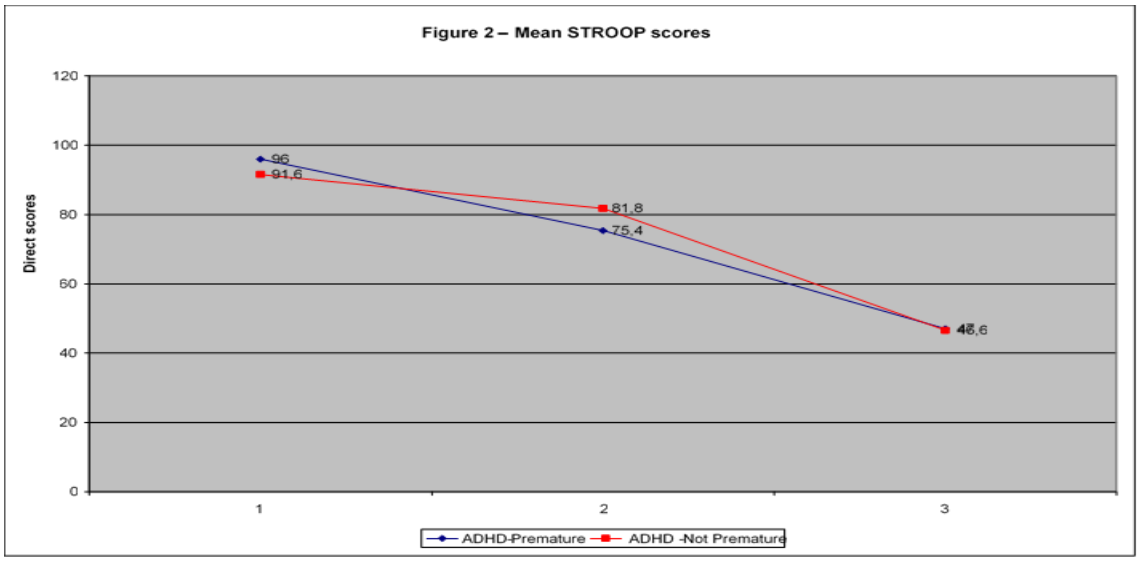
Mean scores obtained in the STROOP test by the ADHD group indicate a mean colour performance (M = 81.80, SD = 20.58), close to the mean in word colors (M = 46.60, SD = 8.05) and

below the average reading of the words (M = 91.60; SD = 11.39).

The mean scores obtained in the STROOP test by the ADHD-Premature group indicate a performance close to the mean colour (M = 75.40, SD = 3.36) and word colour (M = 47.00, SD = 6.85) and less than the mean reading of the words (M = 96.00, SD = 10.90), Figure 2 presents the means of sample execution (10 subjects) in the STROOP subtests.

No statistically significant difference was found between the ADHD group and the ADHD-Premature group.

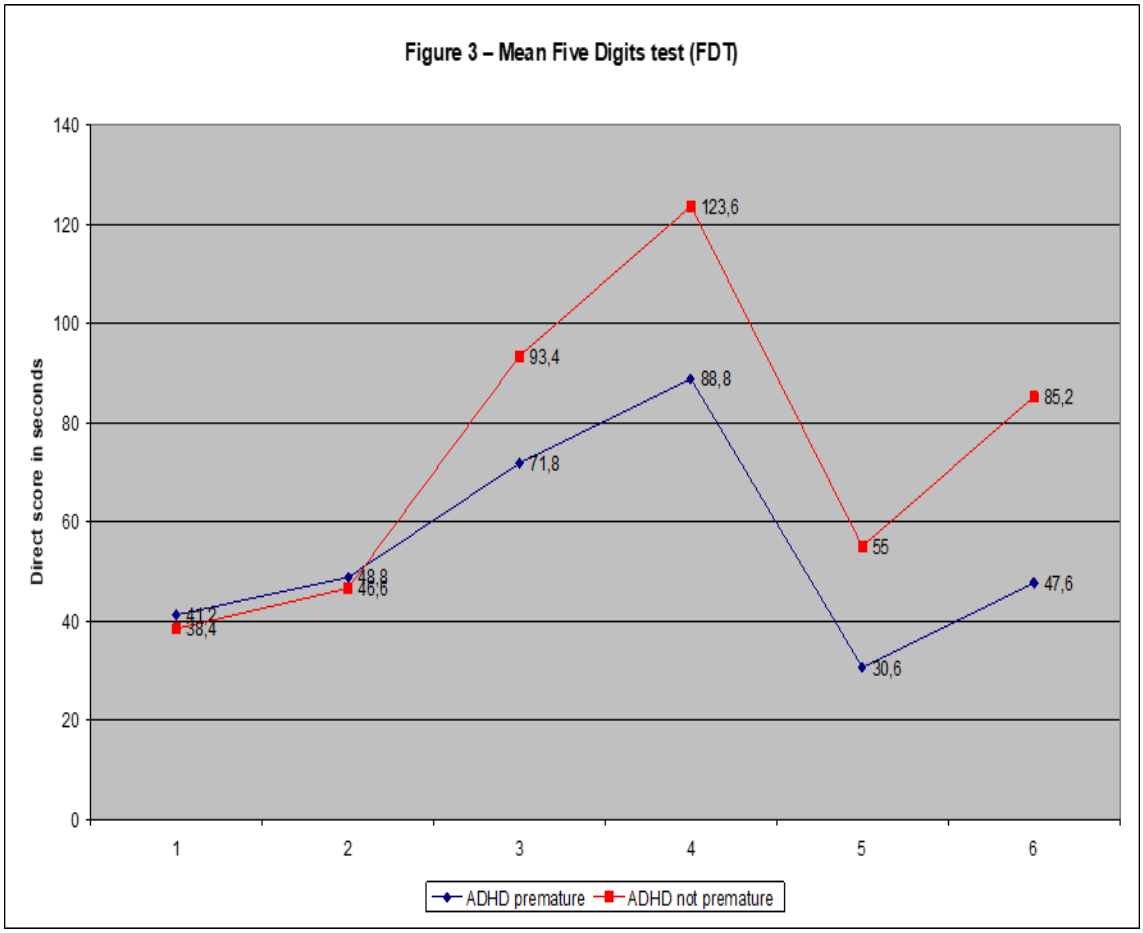
Figure 2. Mean performance of the ADHD-Not Premature group (5 participants) and ADHD-Premature (5 participants) in the STROOP word reading (1), colors (2) and word-colors (3) subtests.



The mean scores obtained in the FDT test by the ADHD group indicate a mean inhibitory performance (M = 30.60, SD = 16.54), medium-low in flexibility (M = 47.60, SD = 16.75) and lower (M = 71.80, SD = 21.63), counting (M = 48.80, SD = 10.40), alternation (M = 88.80, SD = 22.16) and reading M = 41.20, SD = 7.12).

The mean scores obtained in the FDT Test by the ADHD -Premature group indicated a lower performance than the mean score (M = 46.40, SD = 10.01), reading (M = 38.40, SD = 14.10), inhibition (M = 55.00, SD = 25.60), choice (M = 93.40, SD = 38.54), alternation (M = 123.60, SD = 71.80) and flexibility (M = 20, SD = 64.51). Figure 3 shows the sample execution averages (10 subjects) in the FDT subtests. There were no statistically significant differences in reaction time between the ADHD group and the ADHD -Premature group.

Figure 3. Mean of the performance of the ADHD-Not Premature group (5 participants) and ADHD-Premature (5 participants) in reading subtests (1),
Content (2), Election (3), Alternation (4), Inhibition) and Flexibility (6).



In summary mode, Table 3 presents the mean scores (and standard deviations) and independent tests performed, obtained in all the tests of the administered neuropsychological battery.

Table 3.

Mean scores (and standard deviations) of the independent tests performed

	Group 1 ADHD-Not Premature	**Group 2** ADHD – Premature	**Sig**
WISC-R[a]			
Arithmetic [1]	9.40 (3.64)	10.00 (2.44)	.768
Digits [1]	12.00 (3.74)	10.80 (3.96)	.636
STROOP[a]			
Words [2]	91.60 (11.39)	96.00 (10.90)	.550
Colors [2]	81.80 (20.58)	75.40 (3.36)	.512
Word-Color[2]	46.60 (8.05)	47.00 (6.85)	.935
FDT[a]			
Reading[2]	41.20 (7.12)	38.40 (14.10)	.702
Content[2]	48.80 (10.40)	46.60 (10.01)	.720
Election[2]	71.80 (21.63)	93.40 (38.54)	.306
Switching[2]	88.80 (22.16)	123.60 (71.80)	.331
Inhibition[2]	30.60 (16.54)	55.00 (25.60)	.111
Flexibility[2]	47.60 (16.75)	85.20 (64.51)	243

Values expressed as mean ± standard deviation [a]:

Scalar Score[1] Scalar Direct[2]

Levels of significance: *p ≤ 0.05 **p ≤ 0.01 ***p ≤ 0.001

Discussion

The objective of this study was to study the cognitive-executive performance of a clinical sample of children diagnosed with hyperactivity disorder and attention deficit and to analyze if there are differences between participants with preterm birth and term delivery.
Our working hypothesis was that the group of preterm infants diagnosed with ADHD presented worse general performance than the group of individuals with ADHD and full-term delivery.

The data obtained are in agreement with our initial hypothesis in which we propose that the participants with preterm birth with ADHD would present more alterations in the attentional subprocesses and / or executive functioning than the ADHD group with term delivery.

Although both groups present difficulties in processing speed in reading, small difficulties in selective attention and discrete deficits in executive components of inhibition and change, the ADHD-Premature group performed poorly on the choice subtest, alternation, flexibility and inhibition of FDT test and colour subtest of the STROOP Test than the ADHD group with a full-term pregnancy. These results are in line with what has been found in other studies (Chu et al., 2012).

Sample scores for executive / cognitive functioning are indicative of reduced processing speed readings, mild deficits at the level of selective and alternating attention, and difficulties in the executive components of inhibition and change.

Regarding the reading processing speed, both groups perform below average in relation to age. These data are different from those found in previous investigations, which indicated that individuals with ADHD do not present difficulties in processing speed tasks (Bustillo & Servera, 2015).
With respect to attention processes, both groups have adequate functioning in focused attention (Digits-WAIS.III) and slight deficits in selective attention (FDT-election) and alternate (FDT-alternation).
These results corroborate with other studies that indicate that their participants with ADHD have deficits in selective attention (Soprano, 2003; Arango Mejia, Silgado & Ochoa, 2008).
In our investigation, we evaluated the executive components of inhibition, change and updating since they are the most referenced in literature reviews on the population with ADHD (Ramos, Taracena, Sanchez & Matute, 2011).
With our study, there was a tendency ($p = 0.05$) for an increase in difficulties in verbal IQ: arithmetic and digital in permanent children with ADHD. Our hypothesis is that this finding may become statistically significant by including a larger number of participants. In addition, altered changes in other WISC components have been reported in the literature, namely working memory in children with ADHD (Zambrano, Martinez del Rio, Martinez & Poblano, 2010).In addition, deficits are detected with an executive component inhibition (FDT-inhibition) and no executive component of change (FDT-Flexibility), in line with previous investigations (Goncalves et al., 2013; Glozman & Shevchenko, 2014; Mesquita, 2011; Robinson & Tripp, 2013).
From these results, we can see that the performance of subjects with ADHD in

our sample is characterized by a reduced processing speed reading, slight deficits in selective and alternating attention, and difficulties in the executive components of inhibition and change.

On the other hand, when analyzing whether there are differences between patients with ADHD with preterm birth and term delivery, we did not find statistically significant differences, but we observed a worse overall performance of the ADHD group of preterm delivery.

Future studies should improve the representativeness of the sample and should be performed on larger samples, as well as increase the number of participants of the female gender and with a non-clinical randomized control group and matched groups.

Institution where the work was done: Child Mental Health Unit Êbam Clinics (Pontevedra, Spain).

THE AUTHORS DECLARE DO NOT HAVE CONFLICTS OF INTEREST

References

Aasen, I. E., Håberg, A. K., Olsen, A., Brubakk, A.-M., Evensen, K. A. I., Sølsnes, A. E., … Brunner, J. F. (2016). The relevance of the irrelevant: Attention and task-set adaptation in prematurely born adults. *Clinical Neurophysiology*, *127*(10), 3225–3233. doi :10.1016/j.clinph.2016.07.005

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders (DSM-5®)*. American Psychiatric Pub.

Bustillo, M., & Servera, M. (2015).Análisis del patrón de rendimiento de una muestra de niños con TDAH en el WISC-IV. *Revista de Psicología Clínica con Niños y Adolescentes*, *2*(2), 121-128. Retrieved from https://dialnet.unirioja.es/servlet/articulo?codigo=5150426

Fernandes, S.M, Vázquez-Justo, E., & Piñon-Blanco, A. (2017). Conception, evolution, and etiology of ADHD. In E. Vázquez-Justo & A. Blanco (Eds), *ADHD and Associated Disorders* (pp.3-5). Maribor, Slovenia: Lex Localis.

García, T., González-Castro, P., Pérez, C. R., Cueli, M., & Álvarez, D. Á. G. y L. (2014). Alteraciones del funcionamiento ejecutivo en el trastorno por déficit de atención con hiperactividad y sus subtipos. Psicología Educativa, 20(1), 23–32. doi:10.1016/j.pse.2014.05.003

Glozman, J. M., & Shevchenko, I. A.(2014). Executive function in children with ADHD. *Psychology & Neuroscience*, *7*(4), 453. doi:10.3922/j.psns.2014.4.04

García, T., González-Castro, P., Pérez, C. R., Cueli, M., & Álvarez, D. Á. G. y L. (2014). Alteraciones del funcionamiento ejecutivo en el trastorno por déficit de atención con hiperactividad y sus subtipos. Psicología Educativa, 20(1), 23–32. doi:10.1016/j.pse.2014.05.003

Golden, C. J. (1976). Identification of brain disorders by the Stroop Color and Word Test. *Journal of Clinical Psychology, 32*(3), 654–658. doi:10.1002/1097-

4679(197607)32:3<654::AID-JCLP2270320336>3.0.CO;2-Z

Golden, C.J. (2006). *Stroop: el test de colores y palabras*. Madrid: TEA Ediciones.

Gonçalves, H. A., Mohr, R. M., Moraes, A. L., Siqueira, L. de S., Prando, M. L., & Fonseca, R. P. (2013). Componentes atencionais e de funções executivas em meninos com TDAH: dados de uma bateria neuropsicológica flexível . *Jornal Brasileiro de Psiquiatria, 62*(1), 13-21. doi:10.1590/S0047-20852013000100003

Lamônica D. & Picolini M. (2009). Development abilities in preterm. Rev CEFAC,11, Supl (2), 145-153.

Ley Orgánica 15/1999, de 13 de diciembre, de Protección de Datos de Carácter Personal. *Boletín Oficial Del Estado*, *298* (2) de 14 de Diciembre de 1999.

Loyo J., Taracena A., Loyo L. (2011). Relationship between the Executive Function in Neuropsychological Tests and in the Social Context in Children with ADHD. *Journal Neuropsychology, Neuropsychiatry, and Neurosciences*, *11*(1) 1-16.

Mesquita, M. I. Q. M. de. (2011). *Avaliação das funções executivas em crianças: Estudos psicométrico, desenvolvimental e neuropsicológico* (Doctoral thesis, Porto: Universidade de Fernando Pessoa). Retrieved from https://bdigital.ufp.pt/bitstream/10284/3312/3/TD_mariaisabelmesquita.pdf

Scott, M. N., Hunter, S. J., Joseph, R. M., O'Shea, T. M., Hooper, S. R., Allred, E. N., Leviton, A., & Kuban, K. (2017). Neurocognitive Correlates of Attention-Deficit Hyperactivity Disorder Symptoms in Children Born at Extremely Low Gestational Age. *Journal of developmental and behavioral pediatrics : JDBP*, *38*(4), 249–259. doi:10.1097/DBP.0000000000000436

Portellano, J. (2007). *Neuropsychology Child*. Madrid: Editorial Sintesis.

Loyo, J. R., Taracena, A. M., Loyo, L. M. S., Matute, E., & Garrido, A. A. G. (2011). Relación entre el Funcionamiento Ejecutivo en Pruebas Neuropsicológicas y en el Contexto Social en Niños con TDAH. *Revista Neuropsicología, Neuropsiquiatría y Neurociencias*, *11*(1), 1-16. Retrieved from https://www.researchgate.net/publication/277274649_Relacion_entre_el_Funcionamiento_Ejecutivo_en_Pruebas_Neuropsicologicas_y_en_el_Contexto_Social_en_Ninos_con_TDAH

Réveillon, M., Borradori Tolsa, C., Monnier, M., Hüppi, P. S., & Barisnikov, K. (2016). Response inhibition difficulties in preterm children aged 9–12 years: Relations with emotion and behavior. *Child Neuropsychology*, *22*(4), 420–442. doi:10.1080/09297049.2014.994486

Robinson, T., & Tripp, G. (2013). Neuropsychological functioning in children with ADHD: Symptom persistence is linked to poorer

performance on measures of executive and nonexecutive function. *Japanese Psychological Research*, *55*(2), 154–167. doi:10.1111/jpr.12005

Rommel, A.-S., James, S.-N., McLoughlin, G., Brandeis, D., Banaschewski, T., Asherson, P., & Kuntsi, J. (2017). Association of Preterm Birth With Attention-Deficit/Hyperactivity Disorder–Like and Wider-Ranging Neurophysiological Impairments of Attention and Inhibition. *Journal of the American Academy of Child & Adolescent Psychiatry*, *56*(1), 40–50. doi:10.1016/j.jaac.2016.10.006

Scott, M. N., Hunter, S. J., Joseph, R. M., O'Shea, T. M., Hooper, S. R., Allred, E. N., Leviton, A., & Kuban, K. (2017). Neurocognitive Correlates of Attention-Deficit Hyperactivity Disorder Symptoms in Children Born at Extremely Low Gestational Age. *Journal of developmental and behavioral pediatrics : JDBP*, *38*(4), 249–259. doi:10.1097/DBP.0000000000000436

Sedó, M. A. (2007). *FDT: test de los cinco dígitos*. Madrid: Tea.

Soprano, A. M. (2003). Evaluación de las funciones ejecutivas en el niño. *Revista de neurología*, *37*(1), 44-50. Retrieved from https://d1wqtxts1xzle7.cloudfront.net/41262401/Evaluacion_FE.pdf?1452931786=&response-content-disposition=inline%3B+filename%3DEvaluacion_FE.pdf&Expires=1595437009&Signature=VQORU2uXz5~kT6l64AMXRxyhk~vol~~AgdEeydZeaARoa0f8faGasS3dsolrJ2SLqPXOn~epBxooEc0psreg2nF8hP4CeD9JaYmB5r0N83jNXjtnR-o3UuKz~mx5U76y9sAN3LsQXHhK2iGZnNdfG4ZKoqEM-~6xuFVbytY4c9I4YalSH954p8ppEdFP6CWIKDpkYBLpwBisKmZQcl58-YHeanHPsf4WDvEKsmWPMGmYhfrvG~q-tr8yNOSPBTx-htwbkR4hiQ3dEWoCtH8GXXbWivOXLs9lgGPl3E5k5pZpmLQwFGPtsn6oCJKSNBEZGFOXtpZKna0C07fM8lDR8w__&Key-Pair-Id=APKAJLOHF5GGSLRBV4ZA

Wechsler, D. (2005). *Escala de Inteligencia para Niños revisada*. Madrid: TEA.

Willcutt, E. G., Doyle, A. E., Nigg, J. T., Faraone, S. V, & Pennington, B. F. (2005). Validity of the Executive Function Theory of Attention-Deficit/Hyperactivity Disorder: A Meta-Analytic Review. *Biological Psychiatry*, *57*(11), 1336–1346. doi:10.1016/j.biopsych.2005.02.006

Zambrano-Sánchez, Elizabeth, Martínez-Cortés, José A, Rió-Carlos, Yolanda del, Martínez-Wbaldo, Maria del Consuelo, & Poblano, Adrián. (2010). Executive dysfunction screening and intelectual coefficient measurement in children with attention deficit hyperactivity disorder. *Arquivos de Neuro-Psiquiatria*, *68*(4), 545-549. doi:10.1590/S0004-282X2010000400013

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