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RESEARCH ARTICLE

Comparison of Cognitive and Behavioral Profiles of Individuals with Attention Deficit Hyperactivity Disorder and Dyslexia

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ABSTRACT

Attention Deficit Hyperactivity Disorder and Developmental Dyslexia are disorders usually diagnosed in childhood and adolescence and affect different cognitive functions, however, with differences in central deficits. There is a consensus that children with Attention Deficit Hyperactivity Disorder manifest alterations in attention and executive functioning. Meanwhile, a growing number of researchers that investigated and described attentional and other executive function alterations in affected Dyslexia individuals. Therefore, our study aimed to compare the cognitive and behavioral profiles of 21 children with Attention Deficit Hyperactivity Disorder (n=7), Dyslexia (n=6), and a control group (n=8), ages 6 to 14 years old, evaluated from January 2022 to July 2023. We excluded children with other neurodevelopmental disorders or neurologic diseases. The results showed that in tasks of working memory and cognitive flexibility, the group with Attention Deficit Hyperactivity Disorder presented higher averages than the children with Dyslexia. Furthermore, participants with Attention Deficit Hyperactivity Disorder committed more mistakes in attentional tests, mainly in alternating attention, than the Dyslexia group ($z = -8.548$; $p=0.029$). Furthermore, participants with Attention Deficit Hyperactivity Disorder had higher means for externalizing problems (Average: 62.43; Standard Deviation: 8.36) when compared to the group with Dyslexia (Average: 57.50; Standard Deviation: 5.09), as well as dyslexics had higher means for behavior problems internalizing (Average: 66.00; Standard Deviation: 11.63) than the Attention Deficit Hyperactivity Disorder group (Average: 58.00; Standard Deviation: 8.16). The results found in this study showed that children with Attention Deficit Hyperactivity Disorder had higher averages than the group with Dyslexia in attention and executive functions and indicated the presence of a heterogeneous cognitive and behavioral profile among the participants, however, the clinical groups showed significant impairments in attention, executive functions and behavior, which can have an impact on the functionality and quality of life of these children.

Keywords: Attention Deficit Hyperactivity Disorder; Dyslexia; Child, Reading; Attention; Executive Functions; Cognitive Profile; Behavior Profile.

1. Introduction

Attention deficit hyperactivity disorder (ADHD) and Developmental Dyslexia (DD) are neurodevelopmental disorders usually diagnosed in childhood and adolescence[1] whose prevalence varies, approximately, from 5 to 10% of the population[2-5].

According to the Diagnostic and Statistical Manual of Mental Disorders – 5th edition (DSM-5)[1], ADHD is defined as the persistence of inattention and/or hyperactivity-impulsivity symptoms, manifesting in more than one environment.
On the other hand, DD is characterized as a Specific Learning Disorder, expressed as reading and orthographic difficulties, with below-average performance expected for the scholarship level. For both disorders, the person may have an average level of intelligence, absence of motor or sensory deficits, primary neurological diseases, or psychiatric conditions that could mimic the reading and writing delays (DD) and inattention and/or hyperactivity-impulsivity (ADHD)[1].

Regarding etiological factors, evidence shows that both conditions[7,8] are neurobiological states, where genetic, cognitive, and behavioral factors interact.

From the anatomic point of view, neuroimage studies in individuals with DD suggest functional and structural deficits in the supplementary motor area, anterior cingulate cortex, right inferior frontal cortex, and cerebellar frontostriatal circuit[9-11]. From a neuropsychological perspective, these deficits are associated with a reduction in attention and executive functioning[12]. For DD, neuroimaging studies show hyperactivation at the left inferior frontal region and hypoactivation of the temporoparietal and occipitotemporal regions of the left hemisphere. These alterations are associated with phonological processing deficits[13-16].

However, there is growing evidence that emphasizes alterations in visuospatial attention and different components of executive functions (EF) of DD individuals[17-21]. Authors hypothesize that attention deficits and executive functioning may go along with phonological processing alterations. However, many factors are not yet clarified in the relation between ADHD and DD.
While studying both disorders together, it is possible to categorize their individuals under three groups: DD-only, ADHD-only, and comorbid for both patients [22-24].

Neuropsychological-focused studies have been carried out to identify cognitive performance profiles that could permit the differentiation of these two conditions. A meta-analysis conducted by Lonergan et al[25], found 26 studies that examined: inhibition, alternate attention, and auditive operational memory performance in DD-only and comorbid DD-ADHD children. The results showed that the dyslexic group had difficulties concerning inhibition, alternate attention, and auditive working memory when compared to neurotypical controls. The comorbid DD-ADHD group exhibited the same impairment as the DD-only group in inhibition, attention, and operational memory. These data reinforce an EF deficit in DD individuals and added impairment when exists comorbid ADHD.

Fernández-Andrés[26] also compared ADHD-only, DD-only, and comorbid DD-ADHD groups of children regarding selective visual attention, orthographic recognition of words, and EF. The comorbid group presented with more severe impairment for all the evaluated functions. The ADHD-only group showed worse deficits in EF compared to the DD-only group; however, comorbid individuals exhibited worse deficits compared to the DD-only group, but not compared to the ADHD-only individuals, reinforcing the dissociation but also the existence of shared deficits between both conditions.

Still, research on the cognitive profile through neuropsychological performance tests may not be representative of children's functioning in daily activities, once they are applied outside their natural environment. Soriano-Ferrer et al[21] evaluated DD teenagers' performance with an ecological task questionnaire which allows the evaluation of everyday executive functions. Their results disclosed that the dyslexic presented executive impairments in daily life, especially for metacognitive processing (initiation, working memory, planning, task supervising, and planning-organization). Similarly, Oie, Storaas, and Egeland[27] evaluated an ADHD-only group with the Child Behavior Checklist (CBCL)[28] and the results pointed out that these individuals presented alterations in neuropsychological tests and also inattention symptoms in everyday life.

Due to the clinical particularities and the complexity of its symptoms, ADHD and DD diagnosis should be performed in an interdisciplinary form, once they could be confused with other disorders. Furthermore, children with DD, non-comorbid with ADHD, may show deficits in skills that are central to characterizing.

Despite these data, many aspects remain unclear in the DD-ADHD relation. Based on these

considerations, this study aimed to compare the cognitive and behavioral profiles of children and teenagers with ADHD and DD.

2. Methods

PARTICIPANTS

The study design is cross-sectional, exploratory, and descriptive study, with a non-probabilistic sample. We included 21 children and teenagers in three groups: ADHD, DD, and control (CG), ages 6 to 14 years old, evaluated at the Laboratório de Pesquisa em Dificuldade, Distúrbios de Aprendizagem e Transtorno da Atenção, (Disapre/Unicamp), located in the city of Campinas (Brazil), through January 2022 to July 2023. Those with intellectual developmental disorder (IDD), autism spectrum disorder (ASD), and/or other neurological conditions such as epilepsy or stroke were excluded. Diagnoses were confirmed through psychological, phono-audiological, pedagogical, and pediatric evaluations. In this study, we focused on presenting the neuropsychological evaluation results, regarding attention, executive functions, and behavioral performances.

This study was approved by the Ethics Committee of Campinas State University under # 63960720.0.0000.5404; besides, all ethical principles for medical research involving human subjects of the Declaration of Helsinki were followed.

INSTRUMENTS

a. Wechsler Intelligence Scale for Children – 4th edition (WISC – IV)[29]: considered the gold standard for evaluating the intelligence of children and teenagers from 6-16 years. It analyses and sums four indexes (verbal comprehension, perceptual organization, operational memory, and processing speed) obtaining the Intelligence Quotient (IQ). We will present all obtained IQ and working memory components scores (working memory index, digits [direct and inverse order], and numbers and letters sequence);
b. Psychological Evaluation for Attention Battery (PEAB)[30]: This instrument evaluates attention under three modalities: alternate, concentrated, and collective or individualized split memory. It is available for application from 6 years of age;
c. Five-digit test (FDT)[31]: The objective of this test is to evaluate abilities in executive functions such as flexibility and inhibition of children, teenagers, adults, and old-aged people;
d. The Child Behavior Checklist for 6-18 years (CBCL/6-18)[28]: a questionnaire that evaluates behavioral problems from children and teenagers. it is answered by the caregivers and is based on the behaviors presented in the last 6 months;
e. Escala de Avaliação de Comportamentos Infantojuvenis no Transtorno de Déficit de Atenção/Hiperatividade em Ambiente Familiar-Versão para Pais (EATDAH)[32]: a tool that is answered by parents or caregivers. It evaluates behaviors in the domestic environment and is used to investigate possible attention deficits, hyperactivity, impulsivity, and emotional and behavioral difficulties.

DATA ANALYSIS

Data was analyzed using the SPSS statistical program - version 25.0. Kruskal-Wallis non-parametric test was selected to compare the difference between the obtained means in the different groups, related to the performance of the executive functions, attention, behavioral problems, age, and IQ.

Comparisons were made in pairs, based on the differences found in Kruskal-Wallis tests; besides, the effect sizes of the statistically significant differences found were reported (0.30 weak, 0.50 average, 0.80 strong)[33].

Statistically significant results were considered with a p-value <0.05. Looking for a reduction of the type I error regarding multiple comparisons; the significance level was adjusted using Bonferroni Correction. Ultimately, descriptive analysis was used for the characterization of the sample.

3. Results

SAMPLE CHARACTERISTICS

Our sample had 61.9% (n=13) participants of the male sex, with 33.3% (n=7) with ADHD diagnosis and 28.6% (n=6) in the DD group. Our control group was formed with 8 children. At the moment of our evaluations, 42.9% (n=6) were attending 6th grade of elementary school, 9.5% were attending 2nd grade (n=2), 4.8% (=1) in the 3rd grade, 14.3% (n=3) in the 4th grade, 4.8% (n=1) in the 5th grade, 9.5% (n=2) in the 7th grade, 9.5% (n=2) in the 8th grade and 4.8 (n=1) in the 9th grade. No statistically significant differences in IQ or age were found between groups, as shown in Table 1.

Table 1 – Sample characterization

Variables	Groups (n)	M (SD)	%	Kruskal-Wallis test (p)
IQ	DD (6)	100.50 (12.09)	-	3.680 (0.159)
	ADHD (7)	95.57 (10.10)	-	
	CG (8)	105.63 (8.31)	-	
Age	DD (6)	10.83 (1.94)	-	1.820 (0.403)
	ADHD (7)	10.0 (3.05)	-	
	CG (8)	11.38 (0.51)	-	
Diagnosis	DD (6)	-	28.6%	
	ADHD (7)	-	33.3%	
	CG (8)	-	38.1%	

DD: Dyslexia; ADHD: attention deficit hyperactivity disorder; CG: control group; M: mean; SD: standard deviation; p: significance level ($p < 0.05$).

COGNITIVE PROFILES

Kruskal-Wallis test was performed to compare the executive functions among the three groups (ADHD, DD, CG) – shown in table 2 – in tests which evaluated working memory: operational memory index (OMI); digits (DG); inverse order digits (IODI); and direct order digits (DODI). Statistically significant results were found among the groups, however, posthoc analysis showed that the ADHD group obtained lower scores at OMI when compared to the CG ($z = -8,491$; $p=0.024$); in the DG subtest, when a paired comparison was made, the DD participants showed a lower score than the CG ($z = -8,208$; $p=0.041$), with a strong effect size. No other statistically significant differences were found.

For SNL, the ADHD group had lower scores compared to the CG ($z = -8,804$; $p=0.015$), and also at the DODI subtest ($z = -7,768$; $p=0.044$); at IODI and DOD, the DD group showed lower scores than the CG ($z = -8,938$; $p=0.021$ and $z = -10,625$; $p=0.004$, respectively). For all these statistically significant results, a strong effect size was found.

As shown in Table 2, no statistical difference was found for inhibition scores; but for flexibility, post-hoc analysis exhibited the ADHD group with lower scores than the CG ($z=-8.214$; $p=0.039$), with a strong effect size.

Table 2 – Comparison of cognitive profiles among groups

Measure	Group (n)	M (SD)	Kruskal-Wallis test (p)	Comparison pairwise	Effect size
OMI	DD (6)	89.50 (10.74)	8.686 (0.013)	ADHD<CG*	1.85
	ADHD (7)	87.43 (8.06)		ADHD<DD	
	CG (8)	104.00 (9.90)		DD<CG	
DG	DD (6)	8.00 (1.41)	7.449 (0.024)	DD<CG*	1.79
	ADHD (7)	8.29 (2.29)		DD=ADHD	
	CG (8)	11.25 (2.18)		ADHD<CG	
SNL	DD (6)	8.17 (2.13)	8.725 (0.013)	ADHD<CG*	1.92
	ADHD (7)	7.43 (1.27)		ADHD<DD	
	CG (8)	10.13 (1.46)		DD<CG	
IODI	DD (6)	6.83 (1.33)	7.292 (0.026)	DD<CG*	1.95
	ADHD (7)	9.14 (3.02)		DD<ADHD	
	CG (8)	10.38 (1.50)		ADHD<CG	
DODI	DD (6)	6.50 (1.64)	11.530 (0.003)	DD<CG*	-2.32
	ADHD (7)	7.71 (2.43)		ADHD<CG*	1.70
	CG (8)	11.75 (2.37)		ADHD<DD	

Inhibition	DD (6)	41.00 (26.79)	5.671 (0.129)	ADHD<DD	
	ADHD (7)	33.57 (21.55)		ADHD<CG	
	CG (8)	56.88 (24.34)		DD<CG	
Flexibility	DD (6)	45.00 (11.18)	10.170 (0.017)	ADHD<CG* ADHD>DD	-1.79
	ADHD (7)	40.00 (23.00)		DD<CG	
	CG (8)	71.25 (14.82)			

Legenda: DD: Dyslexia; ADHD: attention deficit hyperactviity disorder; CG: control group; M: mean; SD: standard deviation; OMI: operational memory index; DG: digits; SNL: sequence of numbers and letters; IODI: inverse order digits; DODI: SD: standard deviation; p: significance level (*p<0.05).

When comparing the attentional performance, statistically significant differences were found for the three modalities evaluated among groups (Table 3). The post-hoc analysis identified that children with ADHD presented lower percentiles in alternating attention (z = -10.286; *p*=0.006), divided attention (z =-10.375; *p*=0.006), and concentrated attention (z= -10.304; *p*=0.006) when compared to the CG, with strong effect size. No statistically significant differences were found among groups regarding attention performances.

Additionally, ADHD children presented more mistakes at alternating attention when compared to CG (z = -11,214; *p*=0.001) and DD (z = -8,548; *p*=0.029); the ADHD group also had more errors concerning divided (z = 11,955; *p*<0.001) and concentrated attention (z=13.357; *p*<0.001), with strong effect size.

Table 3 – Comparison of attention profiles among groups

Measure	**Group (n)**	**M (SD)**	**Kruskal-Wallis test (*p*)**	**Comparison pairwise**	**Effect size**
Attention_alt	DD (6)	50.00 (14.14)	13.262 (0.004)	ADHD<CG*	2.89
	ADHD (7)	23.00 (16.82)		ADHD<DD	
	CG (8)	60.00 (13.09)		DD<CG	
Attention_div	DD (6)	44.00 (19.45)	12.282 (0.005)	ADHD<CG*	2.82
	ADHD (7)	18.71 (11.90)		ADHD<DD	
	CG (8)	70.00 (25.07)		DD<CG	
Attention_con	DD (6)	46.00 (16.73)	12.484 (0.006)	ADHD<CG*	2.72
	ADHD (7)	24.43 (15.94)		ADHD<DD	
	CG (8)	62.50 (15.81)		DD<CG	
Alter_err	DD (6)	1.33 (1.97)	14.070 (0.001)	ADHD>CG*	2.45
	ADHD (7)	8.14 (4.41)		ADHD>DD*	-1.87
	CG (8)	0.25 (0.46)			
Div_err	DD (6)	5.50 (4.32)	13.923 (0.001)	ADHD>CG**	2.60
	ADHD (7)	10.00 (4.33)		ADHD>DD	
	CG (8)	1.25 (1.58)		DD>CG	
Con_err	DD (6)	1.33 (1,21)	15.244 (<0.001)	ADHD>CG**	2.91
	ADHD (7)	11.71 (12.01)		ADHD>DD	
	CG (8)	0.13 (0.35)		DD>CG	

Legenda: DD: Dyslexia; ADHD: attention deficit hyperactviity disorder; CG: control group; M: mean; SD: standard deviation; Attention_alt: alternating attention; Attention_div: divided attention; Attention_con: concentrated attention; Alter_err: mistakes at alternate attention; Div_err: mitakes at divided attention; Con_erro: concentrated attention mistakes; SD: standard deviation; p: significance level (***p <0.001; *p<0.05).

BEHAVIORAL PROFILES

Concerning behavioral problems evaluated through CBCL,28 results pointed to statistically significant differences among groups (Table 4). When paired comparison was obtained, the DD group had higher means for internalizing (z = -11.167; *p*=0.003) and externalizing behavioral problems (z = -8.500; *p*=0.031), when compared to the CG. ADHD children had higher for externalizing and higher points for attention problems when compared to the CG (z = 12,214; *p*<0.001 and (z = -13.357; *p*<0.001, respectively). For all results, a strong effect size was observed.

Table 4 – Comparison of behavioral profiles among groups

Measure	Group (n)	Average (SD)	Kruskal-Wallis test (p)	Comparison pairwise	Effect size
Internalizing	DD (6)	66.00 (11.63)	12.143 (0.002)	DD>CG*	-2.44
	ADHD (7)	58.00 (8.16)		DD>ADHD	
	CG (8)	41.88 (6.46)		DD>CG	
Externalizing	DD (6)	57.50 (5.09)	15.634 (<0.001)	DD>CG*	1.85
	ADHD (7)	62.43 (8.36)		ADHD>CG**	2.67
	CG (8)	33.50 (0.76)		ADHD>DD	
Att_probl	DD (6)	69.17 (12.69)	17.885 (<0.001)	ADHD>CG**	-2.91
	ADHD (7)	95.14 (4.18)		ADHD>DD	
	CG (8)	50.25 (0.46)		DD>CG	
ER	DD (6)	12.00 (10.37)	11.749 (0.008)	ADHD>CG*	2.14
	ADHD (7)	73.29 (28.67)		ADHD>DD*	-2.10
	CG (8)	16.88 (25.75)		DD>CG	
HY	DD (6)	11.00 (10.84)	14.320 (0.003)	ADHD>CG*	2.25
	ADHD (7)	79.71 (19.24)		ADHD>DD*	-1.97
	CG (8)	14.38 (26.52)		DD>CG	
Attention	DD (6)	82.00 (2.74)	15.013 (0.002)	ADHD>CG*	2.49
	ADHD (7)	93.43 (14.74)		ADHD>DD	
	CG (8)	15.63 (28.09)		DD>CG	

Legenda: DD: dyslexia; ADHD: attention deficit hyperactivity disorder; CG: control group; Att_probl: attention problems; ER: emotional regulation; HY: hyperactivity; SD: standard deviation; p: significance level (p <0.001**; p<0.05*).

Besides, ADHD children presented higher scores in emotional regulation when compared to the CG (z=9.804; *p*=0.011) and DD group (z=-9.629; *p*=0.042). For hyperactivity, the ADHD participants also had higher scores than CG (z=10.330; *p*=0.003) and DD children (z=-9.043; *p*=0.043). On attention, ADHD averages were higher when compared to CG (z=11.393; *p*=0.001). For all statistically significant results, a strong effect size was observed.

4. Discussion

Current studies have indicated changes in attention and components of executive functions, in addition to behavior problems in individuals with ADHD or DD. However, understanding possible differences in the cognitive and behavioral profile of these disorders is fundamental for the differential diagnosis and planning of interventions.

COGNITIVE PROFILES

This study aimed to compare the performance of children and teenagers with ADHD or DD with behavioral instruments and scales that evaluate attention and executive functions. It is noteworthy that comorbid ADHD plus DD patients were not included in our evaluations. Previous studies comparing both heterogeneous conditions highlighted alterations in different components of executive functioning, especially for ADHD children[4,17,20,35,36].

The differences found in our sample concerning some of the executive functions, such as working memory, demonstrate that both ADHD and DD groups present deficits in storing and manipulating verbal information. Generally speaking, these results corroborate previous findings that identified working memory deficits in these conditions[37-42]. In addition, these findings suggest that both disorders may present with auditive working memory deficits.

Numerous researches focused on working memory alterations in subjects with reading[43,44] and attention[45,42] difficulties. Hebert et al. (2018)[46] proposed that working memory may have a significant relationship with reading skills, as it may help in retaining or suppressing information related to text processing, such as segmentation and connection. In the meantime, working memory is key to maintaining controlled and sustained attention, even under inferences and distractions, capabilities with low performance in children with ADHD[47].

Inhibition performances did not show significant alterations between groups, but these children needed more time to complete their tasks. Similar results were described by Kofler et al[48], where ADHD children showed no difference compared to CG; Kibby et al[49] and Bexkens, Wildenberg, and Tijms[50] also did not identify inhibitory control deficits for subjects with DD.

These findings are different than those describing ADHD individuals with inhibitory control deficits. A meta-analysis joined 83 studies conducted by Willcutt, et al[51]. Executive function measurements were applied and the ADHD group showed deficits in inhibition, demonstrated by the number of

omission errors when compared to neurotypical children. Likewise, the same results were described by Tanir et al[34], Koltermann et al[40], and Ferreira et al[20], showing that deficits in cognitive inhibition may be shared with children in both conditions.

According to literature, when DD children present with deficits in inhibition, these may appear in cognitive tests but do not result from errors per action[52,53] or impulsiveness[54,55] in daily life as it is for ADHD subjects[51]. An alternative is to consider that inhibition deficits in DD may be apparent as a result of a slower processing speed, especially regarding verbal stimuli[56].

On the other hand, in FDT's[31] final tasks, which involves the capacity of alternating between one rule and another (flexibility), ADHD participants took longer to perform the tasks concerning processing speed and alternating attention, compared to the CG. These results were also found by Krieger and Amador-campo[57], Rubiales et al[58], and Marzocchi et al[59].

Attentional deficits in the ADHD group were identified by the greater number of errors committed in the execution of tasks that assessed this cognitive function and suggested impairments in focusing on a single source of information (concentrated visual attention), selecting one stimulus for another (alternating visual attention), as well as selecting two or more stimuli simultaneously (divided visual attention) among multiple distracting stimuli, with a pre-determined time. Similar findings were described by Fernández-Andrés[26] and Ferreira et al[20].

Despite our results did not indicate differences in attentional performance among groups, related to execution time for attention tests, in both conditions attention deficits were observed. Some studies also have shown that DD children may present with attention deficits, with a slower response pattern at visuospatial attention tasks[34,18,60-62].

Abreu et al[63] described that attention is a key factor for academic performance, and children with learning difficulties may also have attentional problems. The researchers emphasize the importance of evaluating attention during the diagnostic and treatment processes of learning disabilities and call attention to the relevance that early interventions may have in improving academic performance and the quality of life for these children.

Our results suggest that these ADHD and DD subjects, compared to the CG, presented deficits in different measurements regarding attention and executive functions, reinforcing the heterogenicity of both conditions. Data suggests that DD children may exhibit. In the face of the complexity found in both disabilities, we emphasize that the evaluation of attention and executive functions is important for differential diagnosis and intervention planning.

BEHAVIORAL PROFILES

In addition to the alterations in attention and executive functions shown in the neuropsychological tests, we also evaluated the impact of these deficits in the daily activities of these ADHD or DD children, measured by the ETDAH[32] and CBCL[28] scales. From the ecological point of view, parents and caregivers described attentional problems in both conditions.

For the ADHD group, it is expected that attentional deficits should affect the functionality of the subjects in various aspects of daily life, as it is one of the central criteria for diagnosing this condition[1]. For DD children it is unclear that, despite exhibiting attention issues at school, they will surpass the academic performance, as neuropsychological performance may not express how they function on a daily basis.

For this reason, some studies evaluated the behavioral performance for attention and executive functions in both conditions. Ferreira et al[17] used an ADHD scale to assess the behavioral profile of attention in children with DD. Altogether, results showed deficits in attention; nevertheless, in the qualitative analysis performed in their study, the attentional difficulties were observed only when the child was exposed to academic content. In other words, children with dyslexia may face specific challenges related to attention in activities involving reading and writing, making them more likely to get tired quickly and lose interest. This is different from individuals with ADHD who show difficulties in maintaining attention in different environments, especially if there are multiple distractions.

The presence of externalizing (impulsivity, aggressive behavior) and internalizing (anxiety, depression) behaviors in the report of ADHD and DD children's caregivers befits previous studies that describe both groups as able to present significant behavioral alterations, with great impacts in daily life activities, and familiar dynamics, worsening symptoms and reducing academic performance[64].

Internalizing and externalizing behavioral problems in ADHD children may result in negative outcomes, such as a growing risk for substance abuse and long-term conduct problems[64]. In contrast, internalizing behaviors in DD may evolve

to the development of low self-esteem, and depressive and anxious symptoms, that may have a negative impact on several life areas, as academic performance[65,66].

The available literature also describes emotional regulation traits in subjects with ADHD, and difficulties regarding this area have been associated with deficits in executive functioning[67]. In fact, as our study demonstrates, the ADHD group presented a lower-than-expected performance concerning tasks evaluating executive functions. Deficits in emotional regulation may increase the risk of the development of comorbidities, such as oppositional defiant disorder, and anxiety and depressive disorders[68]. Therefore, when evaluating ADHD or DD subjects, it is essential that an investigation concerning behavioral and emotional aspects is implemented, to guide the planning for adequate and assertive interventions.

5. Conclusions

The results found in this study indicate the presence of a heterogeneous cognitive and behavioral profile among the analyzed subjects; nonetheless, clinical groups showed significant deficits concerning attention, executive functions, and behavioral problems, which may impact functionality and in quality of life for these children. However, the results need a cautious interpretation, since our sample size is small and, thereby, the generalization of these outcomes is limited.

Some limitations of this study are the lack of control for parenting styles, parental stress levels, exposure to interventions prior to our evaluations, and investigation of behaviors in other environments attended by the children.

Future studies should focus on enlarging the sample size, verifying the association between parental stress and behavioral problems, and including multi-source reporting for the purpose of confirming manifestations and impacts of the behavioral and cognitive problems in, for example, academic environments.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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