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# Executive functions in children with neurodevelopment disorders

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## BACKGROUND

**A**ttention deficit hyperactivity disorder (ADHD) possesses prevalence rates of 3% to 5% in school-age children and impairs personal, social and academic functioning (DSM 5). When ADHD occurs in comorbidity with difficulties of reading, the academic and social damages are increased. Both pathologies are associated with difficulties in executive functions (Horowitz-Kraus, 2016). Researches have been conducted to discover the profile of executive functions in children with ADHD; however, few provide information on the differences in executive functions between children with ADHD and comorbidity.

**Objective**: Analysing differences in the profile of executive functions in children with neurodevelopment disorders.

## METHODS

**Participants**
104 children aged 8 and 11 years old were divide into three groups:

- G1 → ADHD and Reading difficulties
- G2 → ADHD
- G3 → Without - ADHD and Reading difficulties

**Figure 1**. Description of the inclusion criteria in each group

**T**he parents or responsible persons of the children signed a Free and Informed Consent Form and completed a sociodemographic questionnaire; parents of children with ADHD also completed the SNAP-IV. The children signed the Minor Assent Term. The instruments used in order to reach the proposed objectives were Progressive Matrices of Raven; (for reading evaluation) competence test in reading words and nowords, Cloze Test; and (for executive functions) Digit Span, Corsi Block Test, Trail Making Test, Five Digit Test and Verbal Fluency Test. After having tested and not confirmed the homogeneity of the variance between groups ($p < 0.05$), it was decided to use Mann Whitney Test.

## RESULTS

**T**he G1 group presented a lower average accuracy in all tests of executive functions, compared to the contrasting groups. When considering the two-to-two comparison, we observed similarities in the performance of auditory and visuo-spatial memory tasks, inhibitory control and semantic fluency ($p < 0.05$) between groups G1 and G2. It should be noted that although no significant differences were found in the completion of these tasks, the G1 obtained a smaller average of hits than G2. These same groups differed in cognitive flexibility ($U = 23$, $p < 0.01$, $r = -0.61$) and phonological fluency ($U = 16$, $p < 0.01$, $r = -0,64$). No statistically significant differences were observed between the G2 and G3. The latter presented statistically significant differences in almost all tasks of executive functions compared to the G1 group ($p < 0.05$), with the exception of the task of semantic fluency.

Table 1. Mann-Whitney application in group comparison (post hoc)

| Skill | Group | Comparative Group | U | sig | *r* | Default Error |
|---|---|---|---|---|---|---|
| Auditory working memory | **CG** | ADHD | 241,5 | 0,10 | 0,24 | 36,4 |
| | | **ADHD/RD** | **89** | **0,001** | **-0,51** | **44,5** |
| | ADHD | ADHD/RD | 49,5 | 0,08 | -0,34 | 18,8 |
| Visuospatial memory | **CG** | ADHD | 164 | 0,919 | 0,01 | 33,6 |
| | | **ADHD/RD** | **126,5** | **0,05** | **-0,37** | **43,5** |
| | ADHD | ADHD/RD | 41,5 | 0,06 | -0,36 | 17,8 |
| Inhibitory Control (Sec.) | **CG** | ADHD | 123,5 | 0,23 | -0,18 | 34,7 |
| | | **ADHD/RD** | **403** | **0,001** | **0,50** | **44,9** |
| | ADHD | ADHD/RD | 109,5 | 0,055 | 0,37 | 18 |
| Cognitive Flexibility | **CG** | ADHD | 217,5 | 0,33 | 0,14 | 36,1 |
| | | **ADHD/RD** | **93** | **0,001** | **-0,49** | **44,7** |
| | **ADHD** | **ADHD/RD** | **23** | **0,001** | **-0,61** | **19,1** |
| Phonological Fluency | **CG** | ADHD | 155,5 | 0,78 | -0,04 | 34,7 |
| | | **ADHD/RD** | **94,5** | **0,001** | **-0,49** | **44,8** |
| | ADHD | **ADHD/RD** | **16** | **0,001** | **-0,64** | **17,9** |
| Semantic Fluency | **CG** | ADHD | 125,5 | 0,26 | -0,17 | 34,6 |
| | | ADHD/RD | 209,5 | 0,39 | -0,12 | 44,8 |
| | **ADHD** | ADHD/RD | 48 | 0,144 | -0,29 | 17,9 |

Note. Bold: prominent for statistically significant tests.

## RESULTS

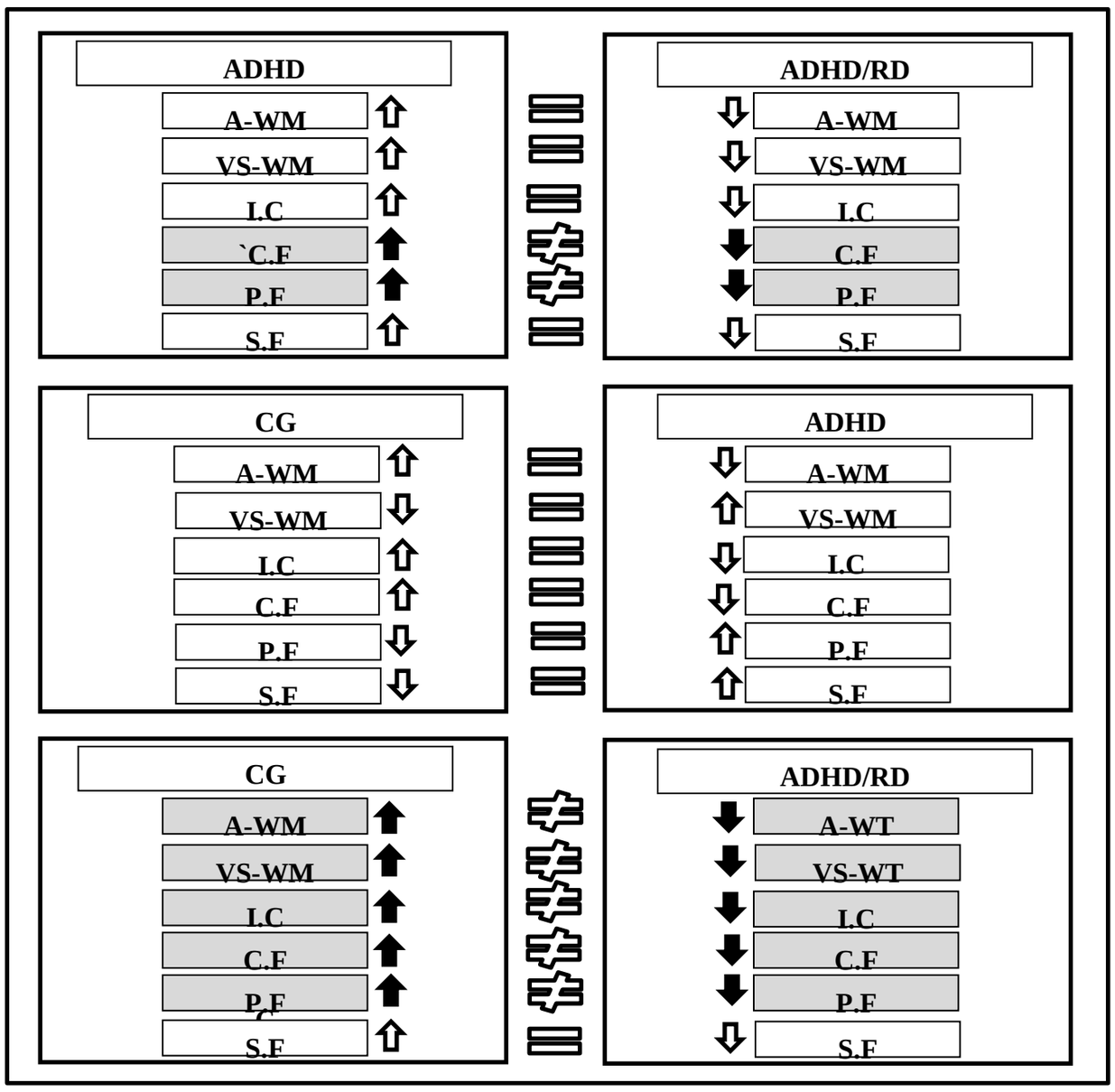


**Figure 2**. Profile of the differences between groups in executive function skills.
Note: Auditory Working Memory = A-WM; Visuospatial memory – VS-WM; Inhibitory Control = IC; Cognitive Flexibility = CF; Phonological Fluency = PF; Semantic Fluency = SF

## DISCUSSION

**A**nalyzing the results, it was observed that the ADHD + DR group presented a unique profile of executive functions. The literature shows that ADHD and DR are distinct disorders and the comorbid group has deficits of both pathologies (Voorde et al., 2010). Other studies demonstrate that ADHD + RD have deficits that are not in single-nature disorders and argue in favor of the hypothesis that comorbidity has a unique profile (Horowitz-Kraus, 2016). The results of this study corroborate with the hypothesis that ADHD + RD presents a unique and differentiated profile of the other disorders.

**T**he results showed that ADHD does not present a single profile of executive functions, which favors the adoption of the multiple deficit theory in ADHD. The literature states that an individual deficit may not be sufficient to understand the complex nature of this disorder. The multiple deficit view becomes more consistent for understanding ADHD was pointed out by Voorde et al. (2010). These authors concluded that children with ADHD did not present deficits in basic measures of EFs and that absence gave rise to the hypothesis that the main cause of ADHD is not the deficit in EFs, this would be only one of several possible causes.

## CONCLUSIONS

**T**he analysis indicated that the deficits in executive functions in ADHD only became accentuated when the reading difficulty was present. The G1 group differed from the G2 and G3 groups in the cognitive flexibility and phonological fluency skills, making it a disorder with its own characteristics. The absence of a single deficit in ADHD favors the adoption of the multiple deficit model to guide the evaluation and clinical intervention of this pathology. We conclude that the groups present different profiles of executive functions.

## REFERENCES

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**There is no potential conflict of interest**