Attention deficit hyperactivity disorder is neurobiological and usually identified in childhood. Children are diagnosed as predominantly inattentive (ADHD-I), hyperactive (ADHD-H) or combined (ADHD-C).

Prevalence rates in Spain range from 4-16% and a meta-analysis found a worldwide prevalence of 5.29% [1][2].

Some theorists believe that executive dysfunction is a core issue in ADHD [3]. Executive functions and ADHD have been associated with the prefrontal cortex (PFC).

The PFC can be functionally divided into four regions in each hemisphere: Dorsolateral (DLPFC); working memory, planning, decision making [4]; dorsomedial (DMPFC); error monitoring [5]; orbito-lateral (OLPFC); inhibitory control, stimulus–reward associations, emotional regulation [6][7]; ventromedial (VMPFC); emotional decision making [6].

Research has found smaller volumes in the prefrontal cortex of children with ADHD [9][10].

Using a similar method as the present study, Hatter (2009) found a smaller right DMPFC in the ADHD group.

The volume of the prefrontal cortex was captured using a semi-automated procedure.

A seed point was selected in the prefrontal cortex using the anterior and posterior limits of the corpus callosum. The lateral and medial regions were parcellated using the arcuate white matter and the transverse orbital sulcus [11].

In a region of interest module, each individual slice was edited in the sagittal view. Editing ensured only the prefrontal cortex was captured by removing skull bone, cerebral spinal fluid, and meninges.

After editing, the volume of each region was extracted and analyzed in SPSS.

\[ W = 7.93, z = -1.96, p = .051 \]

Non-parametric tests served to identify significance in the right DLPFC.

In the ADHD-C and control group, the left dorsolateral and right orbito-lateral approached significance.

Interestingly, and in contrast to previous studies, all significantly different volumes were larger in the ADHD groups. However, due to the significant IQ difference between groups (> IQ in controls), it is possible that the control group had a higher maturation rate (i.e., pruning and myelination) [12]. The negative correlations found support this idea as it was observed that higher volumes correlated with lower IQs.

Sowell et al. (2001) found a relationship between frontal lobe thinning in children and improved verbal memory.

Perhaps the gray matter volumes of the ADHD groups in this sample are significantly larger than controls. In this age range, bigger would not mean better as it indicates the PFC is not maturing normally.

Limitations

- The segmenter was blind to group membership, the sample was not well randomized; therefore, a training effect may have impacted our findings.
- For this initial study, it was not possible to control for total brain volume.
- Underpowered sample size may led to type II errors.

The hypotheses were only partially supported by the results. Significant differences in the left and right OLPFC were identified between the control and combined ADHD-C groups using parametric tests. Non-parametric tests served to identify significance in the right DLPFC.

In comparing the ADHD-C and the control group, the left dorsolateral and right orbito-lateral approached significance.

References