Executive Functioning of Children with ASD: An Analysis of the BRIEF
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Introduction

Background

Executive Functioning (EF) is an umbrella term that encompasses various cognitive processes which are necessary for starting, stopping and changing behavior, in order to show adequate and goal-directed behavior. Children with Autism Spectrum Disorders (ASD) often have EF-problems (Hill, 2004; Kenworthy et al., 2008). The possible differences in EF between ASD subgroups have amply been studied (Verté et al., 2006).

To evaluate EF, both laboratory neuropsychological tests and behavior rating measures can be applied. The latter assess how a child performs in complex unstructured everyday problem-solving situations. They are considered to have greater ecological validity than laboratory neuropsychological test. Next to that, they are often administered in considerable less time.

The BRIEF (Behavior Rating Inventory of Executive Functions; Gioia et al., 2000) is such a rating measure. It is an in-depth, comprehensive inventory that measures EF problems in 5- to 18-year-olds. The BRIEF focuses on potential problems in the areas of inhibition, shifting, emotional control, initiation, working memory, planning and organizing, organization of materials, and monitoring.

Objectives

The main question is whether there is a specific BRIEF score profile found in children with ASD. The consequential question is whether different ASD subtypes (Autistic disorder, Asperger's disorder and PDD-NOS) show different profiles. The final question regards on how IQ and BRIEF scores relate to one another in ASD.

Methods

The sample consisted of 127 Dutch children between 5 and 18 years old (98 boys, 29 girls) (see Table 1). All had a specific ASD diagnosis (n = 35 AD, n = 27 AS, & n = 65 PDD-NOS). Parents filled in a BRIEF (Dutch version), which consists of 75 behavior descriptions. The eight clinical scales (T-scores) and the validity scales (negativity and inconsistency) were analyzed. Their intelligence was assessed using the WISC-III; PIQ and VIQ scores were analyzed.

There was no control group for this study; the normative sample from the original Dutch BRIEF manual was used as a reference group. It concerns Dutch children in the age of five to eighteen, from primary and secondary school, without a psychiatric or learning disorder/problem (n = 847).

Table 1 Descriptives of the Participants

ASD subgroups		n	M (SD)	
			VIQ	PIQ
Diagnosis	AD	35	83.14 (15.92)	83.60 (16.77)
	AS	27	113.19 (17.38)	105.56 (12.63)
	PDD-NOS	65	89.28 (16.35)	91.98 (19.26)
Total		127	92.67 (19.69)	92.56 (18.87)

Note. Results of one-way ANOVA show that the three ASD subgroups differ on VIQ (F(2, 124) = 28.23; p < .001) as well as on PIQ (F(2, 124) = 12.24; p < .001). Bonferroni post-hoc analyses show that children with AS have, as can be expected, a higher VIQ and PIQ than the other two groups.

Results

The Negativity scale deviated in 65% of the participants. As stated by the BRIEF manual, this does not necessarily implicate that these data are invalid, since a high score on this scale can also indicate serious EF problems or rigidity problems. After checking the content of the items, it turned out that six out of nine items of this scale focus on rigid behavior (see Table 2). This scale correlates highly with the Shift scale (r = .75, p < .001).

The total ASD group (N = 127) has significantly higher scores - indicative of more EF problems - than the BRIEF normative sample on all clinical scales (mean T-score ≥ 50, p < .001, d = .64 - 1.49), except for Organization of Materials (See Table 3: column ASD). The shift scale even shows a significant elevation above the clinical cut-off (mean T-score ≥ 65, p = .007, d = 0.24).

Each ASD subgroup has the same score profile as mentioned above (mean T-score ≥ 50, p = .05-.001, d = .52 - 1.66; see Table 3: columns AD/AS/PDD-NOS). ANCOVA demonstrates that they do not differ significantly. Next to that, decision tree analysis and hierarchical cluster analysis show that none of the BRIEF variables serve as a predictor for any of the ASD subgroups.

PIQ has significant negative correlations with the BRIEF scales Inhibit, Shift, Working Memory, Plan/Organize and Monitor. However, this is only true if there are no EF-problems (T-score < 65), except in the case of Inhibit (T-score ≥ 65). Also, the greater the distance between PIQ and VIQ (favoring PIQ), the less EF problems occur on the scales Initiate, Working Memory, Plan/Organize, Organization of Materials, and Monitor. VIQ does not correlate significantly with any of the BRIEF scales.

Table 2 Overview of the Negativity Scale Items of the BRIEF (Gioia et al., 2000)

Item	Behavior description	BRIEF Scale	Rigidity
8	Tries same approach to a problem over and over even when it does not work	Shift	✓
13	Is disturbed by change of teacher or class	Shift	✓
23	Resists change of routine, food, places, etc.	Shift	✓
30	Has trouble getting used to new situations (classes, groups, friends)	Shift	✓
62	Angry or tearful outbursts are intense, but end suddenly	Emotional Control	
71	Lies around the house a lot	Initiate	
73	Has trouble moving from one activity to another	n/a: additional item	✓
74	Cannot stay on the same topic when talking	n/a: additional item	
75	Says the same thing over and over	n/a: additional item	✓

Table 3 Mean T-scores for BRIEF Scales for the ASD Groups Compared to the Mean of the BRIEF Normative Group (T = 50)

Scale	n	Total ASD group M (SD)	d	n AD / AS / PDD-NOS	AD M (SD)	d	AS M (SD)	d	PDD-NOS M (SD)	d
Inhibit	127	63.60 (12.81)***	1.06	35 / 27 / 65	65.43 (13.27)***	1.16	62.22 (11.77)***	1.04	63.18 (13.05)***	1.00
Shift	126	67.94 (12.04)***	1.49	35 / 27 / 64	67.63 (11.68)***	1.51	68.19 (10.99)***	1.66	68.02 (12.81)***	1.41
Emotional Control	127	63.26 (13.30)***	1.00	35 / 27 / 65	62.11 (13.11)***	0.92	64.04 (12.87)***	1.09	63.55 (13.73)***	0.99
Initiate	126	62.31 (10.61)***	1.16	34 / 27 / 65	63.00 (9.47)***	1.37	63.07 (12.21)***	1.07	61.63 (10.59)***	1.10
Working Memory	126	59.76 (11.39)***	0.86	35 / 27 / 64	60.86 (9.94)***	1.09	57.59 (11.66)**	0.65	60.08 (12.06)***	0.84
Plan/Organize	116	57.44 (11.66)***	0.64	31 / 26 / 59	58.84 (10.54)***	0.84	56.08 (11.80)*	0.52	57.31 (12.27)***	0.60
Organization of Materials	127	50.16 (12.09)	0.01	35 / 27 / 65	50.26 (11.30)	0.02	52.41 (11.61)	0.21	49.17 (12.73)	0.07
Monitor	124	59.49 (9.18)***	1.03	33 / 27 / 64	60.30 (8.51)***	1.21	59.15 (9.24)***	0.99	59.22 (9.59)***	0.96

*p < .05. **p < .01. ***p < .001.

Note. All means of the BRIEF scale Shift are above clinical cut-off score (T ≥ 65), however for the ASD subgroups they are not statistically significant (95% CI for AD: 63.76 – 71.50; AS: 64.04 – 72.34; PDD-NOS: 64.88 – 71.61).

Discussion

Consistent with other studies, children with ASD have elevated scores on all BRIEF clinical scales, except for Organization of Materials. The scores are however not clinically elevated; they should be considered as more general trends considering potential EF deficits. The BRIEF scale Shift (a.k.a. cognitive flexibility) is elevated above clinical cut-off. This indicates a clinically significant EF weakness in ASD.

No differentiation could be made between the three ASD subgroups, which is in agreement with the DSM-5 proposed revisions: dictating a single diagnostic category (ASD) with the inclusion of individual clinical specifiers (e.g., severity and verbal abilities) and associated features (e.g., intellectual disability). EF problems could be seen as such an associated feature, for which the severity should be specified individually.

The relation between IQ and EF is complex in children with ASD. There are some significant correlations, but this depends on the type of intelligence considered (only PIQ is associated), the possible discrepancy between VIQ and PIQ, and the specific EF ability measured. More research is needed.

In children with ASD, the Negativity scale should not be considered a validity index - indicative of a negative answer tendency of parents - but much more as a significant characteristic of their BRIEF profile, namely as an indicator for rigidity problems.

For interpretation of the BRIEF in children with ASD, it is recommended to omit the Negativity scale as an indication of a negative answer tendency of parents. One can consider a high score on this index as a unique characteristic of their BRIEF profile, namely as an indication of their rigidity problems..

References

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