

# The respiratory sinus arrhythmia in young, low-functioning children with and without autism spectrum disorder



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## Background

- Heart rate variability, and more specifically, respiratory sinus arrhythmia (RSA) is considered as a peripheral biomarker of social competence and emotion regulation.
- Earlier research has often found lowered RSA in individuals with ASD and it has been associated to various difficulties in social cognition, such as emotion recognition, social responsiveness and spontaneous use of eye gaze. There have also been conflicting findings in the literature showing no ASD-specific differences in RSA.
- The aim of the study** was to investigate whether the possible lowered RSA is evident in low-functioning, young children with marked ASD. In order to study the effects of developmental level, we also had an IQ-matched comparison group of children with developmental delay without ASD. We also studied the connection between RSA and autistic behavior.

## Methods

### Participants.

- Twenty children with ASD, 20 typically developing children (TD) and 19 children with developmental delay without ASD (DD) participated in the study.
- Sufficient data for analysis were obtained from 14 ASD children, 17 TD children and 16 children with DD. ADI-R and ADOS-2 were used to confirm diagnoses in ASD children. Data of Social Communication Questionnaire (SCQ) was obtained from all the groups (Table 1).

**Table 1.** Participant info

Group	N (girls)	Age, years	IQ	SCQ	ADI-R social/comm./RRB	ADOS-2 Comparison
ASD	14 (2)	3.8 (2.6-5.3)	64 (45-88)	18 (5-30)	20 (6-28) 11 (7-15) 7 (3-12)	8 (6-10)
TD	17 (2)	4.2 (2.4-5.75)		3 (1-7)		
DD	16 (2)	4.8 (3.6-6.75)	59 (42-79)	7 (2-16)		

### Design.

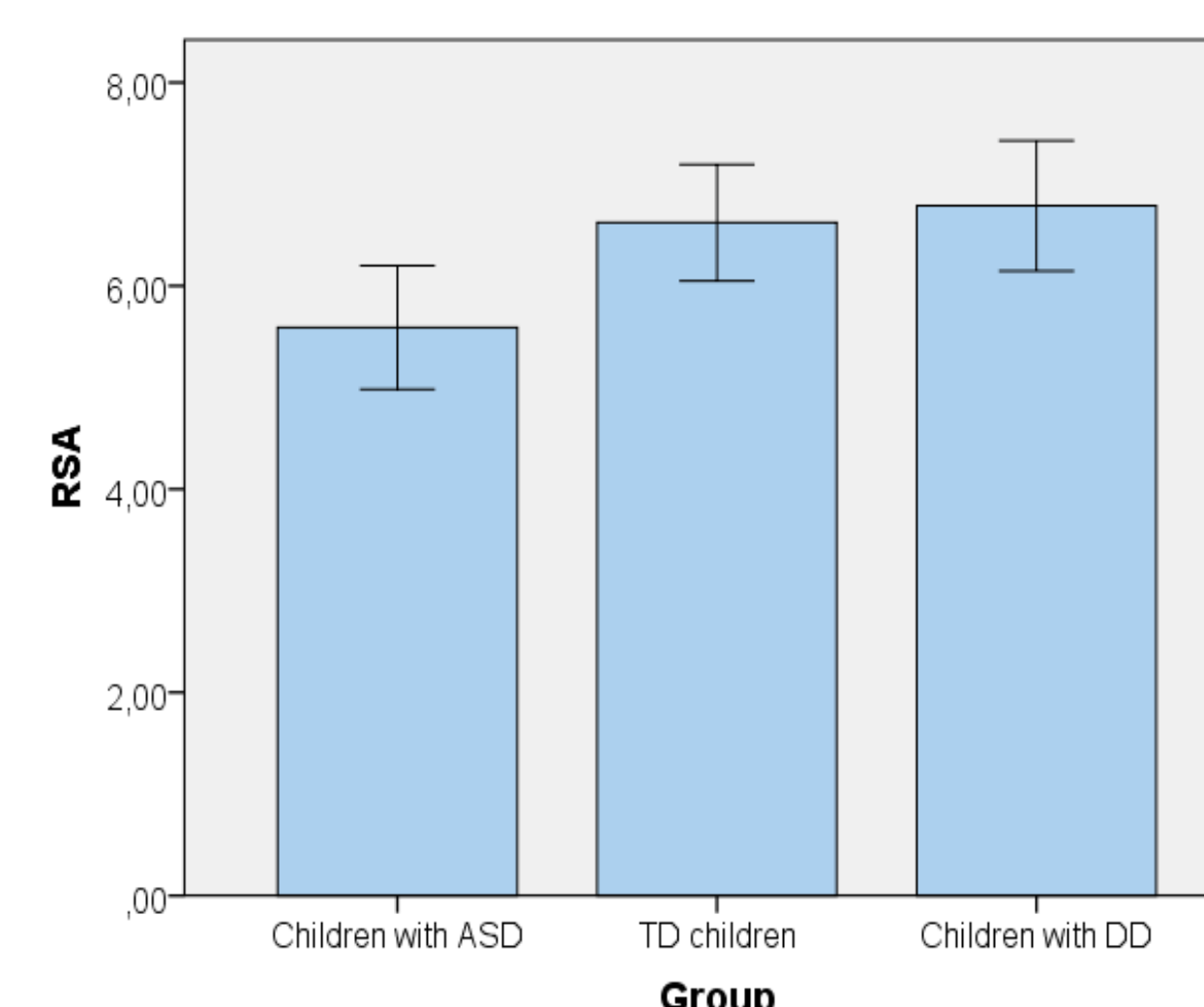
- Children looked at a neutral video about a person building with Lego bricks for 2 minutes and 49 seconds.
- Heart rate was recorded during the video viewing with Net Station 4.5.1 software using pregelled, self-adhesive electrodes placed to the left and right sides of the chest.

### Analyses.

- Data was carefully video analysed offline in order to reject artefacts.
- Participant's data were taken into further RSA analyses if the child stayed still and watched the video peacefully for at least 60 consecutive seconds. The length of time of the segment selected for further analyses varied from 53 to 170 seconds. There were no significant differences in watching times between the groups (Kruskal-Wallis,  $H = 3,679$ ,  $p > .05$ ).
- RSA was analysed in 0,24–1,04 Hz using a Matlab-based in-house program.
- Correlations between RSA and autistic behavior were investigated with ADOS-2, ADI-R and SCQ scores.

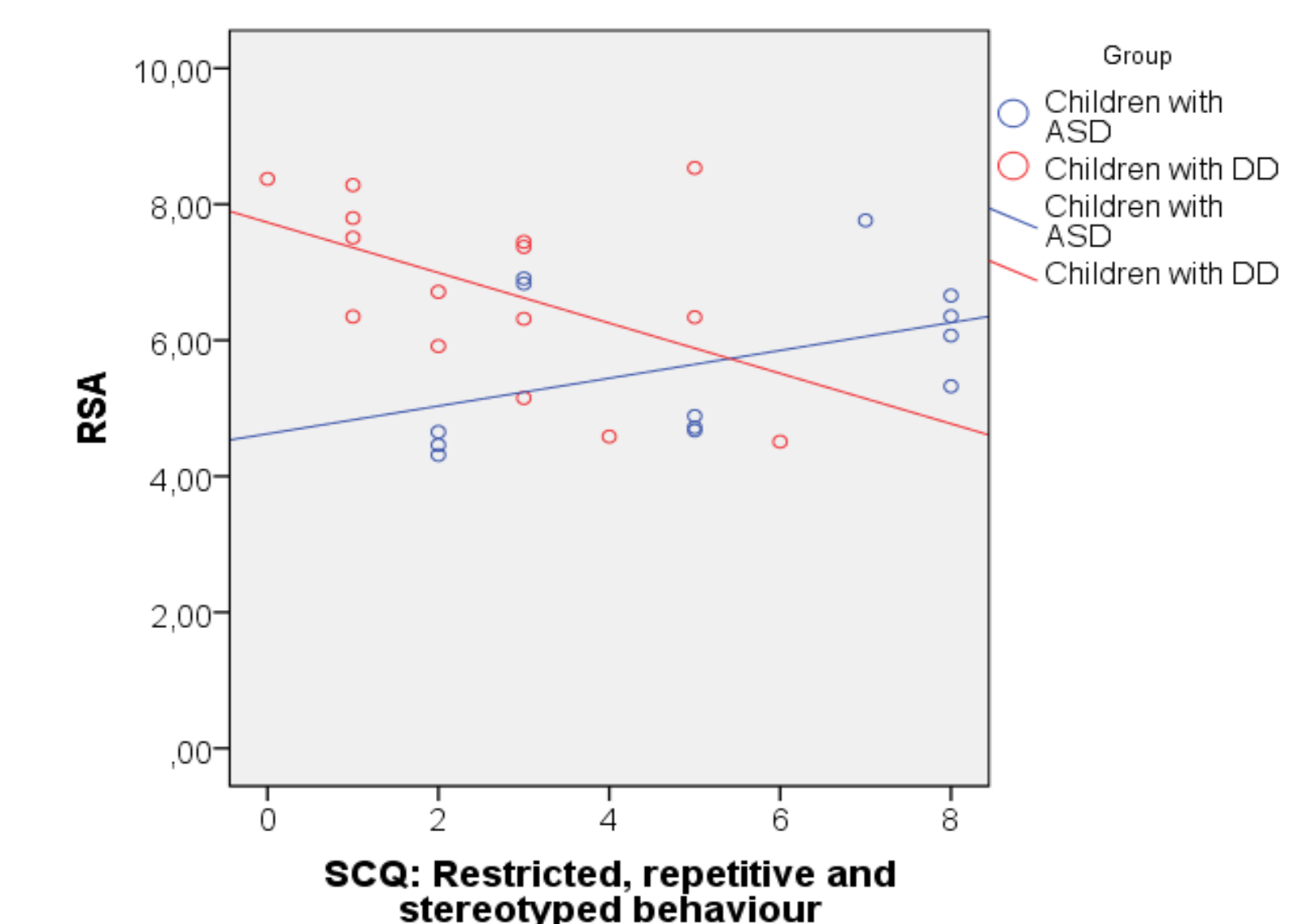
## Results

- The findings revealed significant difference in RSA between the groups** (Kruskal-Wallis  $H = 6,324$ ,  $p = .042$ ). Paired comparison showed that the children with ASD had lower RSA than TD children ( $p = .042$ ) and children with DD ( $p = .019$ ). There were no differences in RSA between TD and DD children (Figure 1).



**Figure 1.** Mean (and SEM) RSA in all groups.

- There were no significant associations between RSA and ADI-R or ADOS-2 in children with ASD.
- SCQ domains of reciprocal social interaction and communication were not associated to RSA in any of the groups. However, **a trend of interaction between RSA and restricted, repetitive, and stereotyped behaviour (RRB) was found both in the ASD** ( $r_s = 0.516$ ,  $p = .071$ ) **and DD groups** ( $r_s = -0.505$ ,  $p = .055$ ).
- The higher RSA was connected to more RRB in children with ASD whereas in children with DD higher RSA was connected with less RRB (Figure 2).



**Figure 2.** RSA and SCQ domain of RRB scores in children with ASD and children with DD.

## Discussion

- The findings of the study indicated that lowered RSA is detectable early in the autistic development and is not related to the developmental delay without ASD.
- Interestingly, the RSA connection to restricted, repetitive, and stereotyped behaviour seemed to be reversed between children with ASD and children with developmental delay without ASD.
- Restricted and repetitive behaviour as an aid for self-regulation in ASD deserves further clarification.