**Title**: Food approach and avoidance in autistic and non-autistic children: The role of repetitive behaviors, ADHD traits and executive functioning

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**Introduction**: Autistic individuals, and those with higher autistic traits, are more likely to demonstrate food avoidance or show limited food approach (Harris et al., 2022). The factors that underlie different food approach and avoidance profiles however are not well understood. Autistic children with greater attention-deficit/hyperactivity disorder (ADHD) traits have been linked with greater food approach behaviors in children, particularly food responsiveness and emotional overeating (Leventakou et al., 2016) and overall poorer diet quality (Mian et al., 2019). Further, behaviors common in both autism and ADHD, including executive functioning and restricted and repetitive behaviors, are thought to impact eating behaviors (Bitsika & Sharpley, 2018; Foinant et al., 2022; Kelly et al., 2020; Saure et al., 2024). However, the interplay between autistic and ADHD-related traits on eating behaviors is not well understood (Harris et al., 2022). The following study examines the role of ADHD traits and behaviors commonly observed in both ADHD and autism (i.e., executive functioning challenges and restricted and repetitive behaviors) with food approach and avoidance behaviors in a sample of autistic and non-autistic children. We hypothesize that certain executive functioning challenges, such as inhibitory control, will be associated with more food approach behaviors while restricted and repetitive behaviors, such as ritual seeking, will predict greater food avoidance.

**Method**: Participants included 133 children (n=53 autistic; 49.6% assigned-female-at-birth) aged 4-8 years (*M*=6.03, *SD*=1.431) and their parents enrolled in an ongoing longitudinal study. Parents completed several measures including the Child Eating Behaviour Questionnaire (CEBQ; Wardle et al., 2001), ADHD Rating Scale-5 (ADHD-5; DuPaul et al., 2016), Repetitive Behaviour Scale-Revised (RBS-R; Bodfish et al., 1999; Bodfish et al., 2000), and Behaviour Rating Inventory of Executive Functioning (BRIEF-2; Gioia et al., 2015). Results were analysed using correlations between measures and two stepwise linear regressions, one model predicting CEBQ food approach scores and one model predicting CEBQ food avoidance scores. Block 1 includes demographic factors (i.e., age, assigned-sex, diagnosis), block 2 includes ADHD-5 scores (i.e. inattentive, hyperactive, combined), and block 3 adds executive functioning challenges (i.e. BRIEF subscales) and repetitive behaviours (i.e. RBS-R subscales).

**Results**: No associations were found between ADHD-5, BRIEF, or RBS-R scores and food approach behaviours. Inattention scores, *r*=.256, *p*<.001, and combined scores, *r*=.254, *p*<.001, from the ADHD-5 were significantly associated with food avoidance behaviours. Several RBS-R scales were also positively correlated with food avoidance including the compulsiveness scale, *r*=.202, *p*=.040, ritual scale, *r*=.222, *p*=.023, and sameness scale, *r*=.205, *p*=.037. Food avoidance was associated with overall BRIEF scores, *r*=.309, *p*=.002, and more specifically shift t-scores, *r*=.242, *p*=.018, emotional control t-scores, *r*=.360, *p*<.001, working memory t-scores, *r*=.308, *p*=.002, and plan/organization t-scores, *r*=.347, *p*<.001. Children who were rated higher (i.e., greater difficulty) across these areas were more likely to demonstrate food avoidance behaviours. Despite insignificant correlations, RBS-R ritual scores, *B*=-.253, *p*=.040, predicted food approach in the second and final model, F(4, 92)=1.274, *p*=.286, of a stepwise linear regression. Food avoidance was predicted by assigned-sex, *B*=-.219, p=.031, ADHD-5 inattention scores, *B*=.306, *p*=.004, RBS-R compulsiveness scores, *B*=.598, *p*<.001, and RBS-R restricted scores, *B*=-.403, *p*=.014, in the fourth and final model. This suggests that children who score higher in inattention and compulsiveness are more likely to demonstrate food avoidance, while children who are assigned-male-at-birth and scored lower on restricted behaviours predicted less food avoidance. Model 4, F(6, 92)=5.699, *p*<.001, factoring all predictors (see table), demonstrated significant F-change from the previous model, FΔ(1,86)=6.360, *p*=.014 and accounted for nearly 24% of the variance in ODD symptoms, *Adj. R2* = 0.235.

**Discussion:** Autistic and non-autistic children are more likely to exhibit food avoidance behaviours if they also have elevated levels of inattention. While greater compulsive behaviour among children predicted more food avoidance, children reported as having more restricted behaviours seem to have less food avoidance. This relationship was also predicted by the child’s assigned-sex, indicating that children assigned-female-at-birth have a greater chance of developing food avoidance behaviours compared to children assigned-male-at-birth. Future research could investigate moderating factors for these relationships and explore feeding interventions tailored to females with food avoidance behaviours.

**References**

Bitsika, V., Sharpley, C. F. (2018). Specific aspects of repetitive and restricted behaviours are of greater significance than sensory processing difficulties in eating disturbances in high-functioning young girls with ASD. Journal of Developmental and Physical Disabilities, 30(2):259–267. <https://doi.org/10.1007/s10882-017-9583-8>

Bodfish, J. W., Symons, F. J., & Lewis, M. H. (1999). The Repetitive Behavior Scale. *Western Carlina Center Research Reports*

Bodfish, J. W., Symons, F. J., Parker, D. E., & Lewis, M. H. (2000). Varieties of repetitive behavior in autism. *Journal of Autism and Developmental Disabilities, 30,* 237-243.

DuPaul, G. J., Power, T. J., Anastopoulos, A. D., & Reid, R. (2016). *ADHD Rating Scale-5 for Children and Adolescents: Checklists, Norms, and Clinical Interpretation*. Guilford Press.

Foinant, D., Lafraire, J., & Thibaut, J. P. (2022). Relationships between executive functions and food rejection dispositions in young children. *Appetite, 176*, 106102. <https://doi.org/10.1016/j.appet.2022.106102>

Gioia, G. A., Isquith, P. K., Guy, S. C., & Kenworthy, L. (2015). *Behavior Rating Inventory of Executive Function, Second Edition (BRIEF-2)*. Psychological Assessment Resources.

Harris, H. A., Bowling, A., Santos, S., Greaves-Lord, K., & Jansen, P. W. (2022). Child ADHD and autistic traits, eating behaviours and weight: A population-based study. *Pediatric obesity, 17*(11), e12951. <https://doi.org/10.1111/ijpo.12951>

Kelly, N. R., Jaramillo, M., Ramirez, S., Altman, D. R., Rubin, S. G., Yang, S. B., Courville, A. B., Shank, L. M., Byrne, M. E., Lemay-Russell, S., Brady, S. M., Broadney, M. M., Tanofsky-Kraff, M., & Yanovski, J. A. (2020). Executive functioning and disinhibited eating in children and adolescents. *Pediatric obesity, 15*(6), e12614. <https://doi.org/10.1111/ijpo.12614>

Leventakou, V., Micali, N., Georgiou, V., Sarri, K., Koutra, K., Koinaki, S., Vassilaki, M., Kogevinas, M., & Chatzi, L. (2016). Is there an association between eating behaviour and attention-deficit/hyperactivity disorder symptoms in preschool children?. *Journal of child psychology and psychiatry, and allied disciplines, 57*(6), 676–684. <https://doi.org/10.1111/jcpp.12504>

Mian, A., Jansen, P. W., Nguyen, A. N., Bowling, A., Renders, C. M., & Voortman, T. (2019). Children's attention-deficit/hyperactivity disorder symptoms predict lower diet quality but not vice versa: Results from bidirectional analyses in a population-based cohort. *The Journal of Nutrition, 149*(4), 642–648. <https://doi.org/10.1093/jn/nxy273>

Saure, E., Laasonen, M., Kylliäinen, A., Hämäläinen, S., Lepistö-Paisley, T., & Raevuori, A. (2024). Social communication and restricted, repetitive behavior as assessed with a diagnostic tool for autism (ADOS-2) in women with anorexia nervosa. *Journal of clinical psychology, 80*(8), 1901–1916. <https://doi.org/10.1002/jclp.23700>

Wardle, J., Guthrie, C. A., Sanderson, S., & Rapoport, L. (2001) Development of the Children’s Eating Behaviour Questionnaire. *Journal of Child Psychology and Psychiatry, 42*, 963-970.

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*Table 1. Stepwise linear regression models organized by variables entered or removed with each step*

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Model** |

|  |
| --- |
| **Step** |

 | **Variable** | **Entered or Removed** | **Standardized Beta** | **p-value** | **Adjusted R²**  | **F** | **Sig.** |
| **1** | 1 | Age | Entered | .031 | .764 | .058 | 2.877\* | .041 |
| 2 | Assigned sex | Entered | -.278\*\* | .007 |
| 3 | Diagnostic status | Entered | .099 | .329 |
| **2** | 1 | Age | Entered | -.001 | .989 | .121 | 4.162\*\* | .004 |
| 2 | Assigned sex | Entered | -.258\*\* | .010 |
| 3 | Diagnostic status | Entered | -.023 | .833 |
| 4 | ADHD-5 inattention score | Entered | .295\*\* | .008 |
| 5 | ADHD-5 combined score | Removed | - | - |
| **3** | 1 | Age | Entered | .031 | .749 | .187 | 5.244\*\* | <.001 |
| 2 | Assigned sex | Entered | -.307\*\* | .002 |
| 3 | Diagnostic status | Entered | -.158 | .167 |
| 4 | ADHD-5 inattention score | Entered | .268\* | .012 |
| 5 | ADHD-5 combined score | Removed | - | - |
| 6 | RBS-R compulsive scale | Entered | .312\*\* | .005 |
| 7 | RBS-R ritual scale | Removed | - | - |
| 8 | RBS-R sameness scale | Removed | - | - |
| 9 | RBS-R restricted scale | Removed | - | - |
| 10 | BRIEF shift subscale | Removed | - | - |
| 11 | BRIEF emotional control subscale | Removed | - | - |
| 12 | BRIEF working memory subscale | Removed | - | - |
| 13 | BRIEF plan/organize subscale | Removed | - | - |
| 14 | BRIEF GEC score | Removed | - | - |
| **4** | 1 | Age | Entered | .069 | .465 | .235 | 5.699\*\* | <.001 |
| 2 | Assigned sex | Entered | -.219\* | .031 |
| 3 | Diagnostic status | Entered | -.137 | .219 |
| 4 | ADHD-5 inattention score | Entered | .306\*\* | .004 |
| 5 | ADHD-5 combined score | Removed | - | - |
| 6 | RBS-R compulsive scale | Entered | .598\*\* | <.001 |
| 7 | RBS-R ritual scale | Removed | - | - |
| 8 | RBS-R sameness scale | Removed | - | - |
| 9 | RBS-R restricted scale | Entered | -.403\* | .014 |
| 10 | BRIEF shift subscale | Removed | - | - |
| 11 | BRIEF emotional control subscale | Removed | - | - |
| 12 | BRIEF working memory subscale | Removed | - | - |
| 13 | BRIEF plan/organize subscale | Removed | - | - |
| 14 | BRIEF GEC score | Removed | - | - |

\*\*. Correlation is significant at the 0.01 level

\*. Correlation is significant at the 0.05 level