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*Original Research*

# Parenting Attitudes, Family Functioning, and Temperament of Typically Developing Younger Siblings in Families of Children With Attention-Deficit/Hyperactivity Disorder: A Controlled Cross-Sectional Study With Age-Moderated Findings

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**Abstract**

**Background:** Attention-deficit/hyperactivity disorder (ADHD) is associated with substantial demands on families, but the care environment of typically developing younger siblings remains understudied. We examined maternal reports of sibling-directed parenting, family functioning, younger-sibling temperament, and maternal health-related quality of life, with particular attention to whether differences in family functioning varied by younger-sibling age. **Methods:** 80 mothers participated in a single-center controlled cross-sectional study, including 40 mothers of children with ADHD and 40 mothers from comparison families. ADHD was diagnosed clinically according to the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) criteria and confirmed using the K-SADS-PL-DSM-5-T by a trained child and adolescent psychiatrist; the Turgay scale was used for symptom screening. Measures included the Parenting Attitude Scale (PAS), Family Assessment Device (FAD), Children's Behavior Questionnaire–Short Form (CBQ-SF), and Short Form-36 (SF-36). Focal comparisons used Mann-Whitney U tests, Hedges' g, bootstrap confidence intervals (CIs), and Benjamini-Hochberg false discovery rate (FDR) correction; adjusted and targeted sensitivity analyses addressed education and other imbalances. **Results:** In the archived reproducible data, democratic parenting scores were lower among mothers from ADHD children (n = 36, mean [M] = 4.04, standard deviation [SD] = 0.83) than among comparison mothers (n = 40, M = 4.41, SD = 0.39, $p = 0.035$, Hedges' g = –0.57, 95% CI: [–0.95, –0.18]). However, this unadjusted contrast did not survive four-outcome FDR correction (q = 0.070). The association remained significant in adjusted models ($F(1, 71) = 5.71$, $p = 0.020$; heteroscedasticity-consistent standard error type 3 [HC3] $p = 0.010$). FAD general functioning was poorer in families affected by ADHD (n = 39 vs. 40, $p = 0.002$, q = 0.008, g = 0.68) and showed a group × younger-sibling-age interaction ($F(1, 73) = 6.39$, $p = 0.014$; HC3 $p = 0.022$). Age-specific contrasts were largest at ages 3 and 4 years. Effortful control and the originally archived SF-36 Mental Component Summary (MCS) summary did not differ significantly. **Conclusions:** The most reproducible evidence concerned poorer family general functioning in families affected by ADHD and cross-sectional variation in this difference by younger-sibling age. Maternal democratic-parenting scores also differed nominally and remained associated with group status after covariate adjustment, although the unadjusted contrast did not survive FDR correction. These maternal-report associations do not establish spillover, adaptation, or causal pathways and require replication in larger, socioeconomically comparable, multi-informant samples.

**Keywords:** attention-deficit/hyperactivity disorder; family functioning; parenting attitudes; sibling; temperament; cross-sectional studies

## 1. Introduction

Attention-deficit/hyperactivity disorder (ADHD) is a common neurodevelopmental condition characterized by developmentally inappropriate inattention and/or hyperactivity–impulsivity with functional impairment (American Psychiatric Association, 2013). Its implications extend beyond the diagnosed child. Recent quantitative syntheses linked ADHD symptom severity with parenting stress, negative parenting practices, parental psychopathology, and socioeconomic disadvantage (Jendreizik et al., 2023), and a broader systematic review and meta-analysis supported meaningful associations between parenting/family-environment factors and childhood ADHD (Claussen et al., 2024). Longitudinal population data further suggest that within-child increases in ADHD behaviors can precede small subsequent increases in family conflict and reductions in parental monitoring, underscoring the value of studying family processes over time (Saulsbury et al., 2025).

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Research on families navigating ADHD has nevertheless centered predominantly on the diagnosed child and parents, with comparatively little work focused on typically developing siblings. Qualitative cross-cultural work indicates that siblings can experience sustained family responsibilities and altered family dynamics in ADHD contexts (Oluoch et al., 2025). More generally, family-systems accounts of sibling influence distinguish between learned experience and resource dilution: experience with one child may alter parenting of another, whereas finite parental time, attention, and emotional resources may be distributed across children (Ruggiero et al., 2021). These concepts provide useful interpretive frameworks for sibling-specific parenting but were not directly measured in the present study.

Younger siblings aged 3–6 years are developmentally relevant because early childhood is characterized by rapid growth in self-regulation, while children remain strongly dependent on caregiver support and the emotional climate of the family (Feldman, 2007; Morris et al., 2007). Recent research in Turkish preschool samples also linked parenting practices with children's emotion regulation and psychological well-being (Kılıç et al., 2024). Thus, the same family context may be experienced differently by younger siblings depending on their developmental position, although cross-sectional age differences cannot be interpreted as within-family developmental change.

Two broad, non-exclusive interpretations can be considered. A spillover-deficit interpretation proposes that sustained demands associated with caring for a child with ADHD may coincide with fewer resources being available for sibling-directed parenting and broader family organization. A compensatory-adaptation interpretation proposes that prior caregiving experience may coincide with more effective routines or parenting responses toward another child. Resource dilution and learned experience offer related sibling-specific perspectives (Ruggiero et al., 2021). These accounts are theoretical interpretations only: the present cross-sectional study did not measure resource depletion, adaptation, parenting stress, or change over time and therefore cannot distinguish mechanisms.

The study compared mothers from families containing a child with ADHD and a typically developing younger sibling aged 3–6 years with mothers from comparison families containing at least two typically developing children. The two focal, hypothesis-linked outcomes were maternal democratic parenting attitudes toward the younger sibling and family general functioning. We explored whether less favorable maternal reports would be observed in families of children with ADHD. The Children's Behavior Questionnaire (CBQ) Effortful Control and maternal Short Form-36 Mental Component Summary (SF-36 MCS) were retained as contextual outcomes in the original four-outcome multiplicity-controlled comparison set without a directional a priori hypothesis. We also examined whether the cross-sectional group difference in family functioning varied with younger-sibling age. Exploratory cross-sectional conditional indirect-effect analyses were treated as hypothesis-generating and are reported in **Supplementary Table 4** and **Supplementary Fig. 1** rather than as mechanistic tests. The aim of this study was to compare maternal reports of parenting attitudes, family functioning, younger-sibling temperament, and maternal health-related quality of life between families with and without a child with ADHD, and to examine whether the between-group difference in family general functioning varied according to the younger sibling's age.

## 2. Materials and Methods

### *2.1 Participants and Procedure*

This single-center controlled cross-sectional study was conducted in Türkiye between July and October 2025. Families affected by ADHD were identified in a child and adolescent psychiatry clinical setting. Both groups were enrolled during the same study period under a common protocol and eligibility framework, and no individual pair-matching or propensity-based enrollment scheme was used. The archived study materials do not permit reconstruction of the exact referral/recruitment channel for each comparison family; accordingly, the comparison group is not characterized as community based. Among eligible families invited to participate, 17 declined, and 80 mothers were enrolled (40 ADHD-family and 40 comparison-family mothers). All procedures were covered by the approved protocol and written informed consent was obtained before participation.

ADHD-group inclusion criteria were: (a) an index child with a clinical Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) diagnosis of ADHD confirmed through structured diagnostic assessment; (b) a typically developing younger sibling aged 3–6 years; and (c) no current psychiatric diagnosis or treatment history for the mother. Comparison-group inclusion criteria were: (a) at least two typically developing children, one aged 3–6 years; and (b) no psychiatric diagnosis or treatment history for the mother or any child in the household. In the comparison group, the older typically developing child served as the index child to provide an age context comparable with the ADHD group, and the younger child aged 3–6 years was the target of sibling-directed parenting and temperament ratings.

Typically developing status of the younger sibling was established by child-psychiatric clinical evaluation incorporating developmental history, parent interview, and clinical assessment, with confirmation that no psychiatric or neurodevelopmental diagnosis was identified. A separate standardized developmental screening instrument was not administered. Exclusion criteria included maternal psychiatric history, younger-sibling age outside 3–6 years, and study data insufficient to derive the core study outcomes. Written informed consent was obtained from all participating mothers.

With 40 participants per group, a two-sided sensitivity calculation at $\alpha = 0.05$ and 80% power corresponds to an independent-group standardized mean difference of approximately $d = 0.63$. The study was therefore suited to detecting medium-to-large group differences but was not designed to provide stable estimates of small interactions or complex indirect effects; these latter analyses are treated as exploratory.

### *2.2 Measures and Clinical Characterization*

#### 2.2.1 ADHD Diagnostic and Clinical Assessment

ADHD diagnoses were established clinically according to DSM-5 criteria and confirmed using the Turkish adaptation of the Kiddie Schedule for Affective Disorders and Schizophrenia for School-Age Children–Present and Lifetime Version, DSM-5 (K-SADS-PL-DSM-5-T), administered by a child and adolescent psychiatrist trained in its use (Ünal et al., 2019). The Turgay DSM-IV-Based Child and Adolescent Behavior Disorders Screening and Rating Scale (Ercan et al., 2001) was used as a symptom-screening measure; final diagnoses were clinical. ADHD presentation and time since diagnosis were retained as aggregate clinical characteristics. Participant-level medication status, symptom-severity scores, and comorbidity variables were not retained in the archived analytic dataset and therefore could not be reconstructed for the present analyses.

#### 2.2.2 Parenting Attitude Scale (PAS)

The Parenting Attitude Scale (PAS; Ebeveyn Tutum Ölçeği [ETÖ]) is a 46-item Turkish parent-report measure with democratic, authoritarian, overprotective, and permissive dimensions (Karabulut Demir and Şendil, 2008). In the validated response direction, items are scored from 1 (never) to 5 (always), and higher subscale scores indicate greater endorsement of the named parenting attitude. Scores are reported in this validated direction. Available participant-level PAS results were re-derived from the archived data rather than inferred by reversing displayed summaries; the reported means, *p*-values, and effect estimates therefore come from the reproducible analysis. Democratic parenting was the focal PAS outcome.

#### 2.2.3 Family Assessment Device (FAD)

The McMaster FAD assesses family functioning across problem solving, communication, roles, affective responsiveness, affective involvement, behavior control, and general functioning domains (Bulut, 1990; Epstein et al., 1983). Items are scored so that higher scores indicate poorer family functioning. General functioning was the focal FAD outcome. Item-level rescoring was used for the affective involvement and behavior control subscales. Because affective involvement ($\alpha = 0.003$) and behavior control ($\alpha = 0.348$) showed unacceptable internal consistency in this sample, their results were retained descriptively in the **Supplementary Table 1** and not interpreted at the construct level.

#### 2.2.4 Children's Behavior Questionnaire–Short Form (CBQ-SF)

The CBQ-SF is a parent-report measure for children aged approximately 3–7 years and yields 15 temperament subscales aggregated into surgency, negative affectivity, and effortful control (Akın Sarı et al., 2012; Rothbart et al., 2001). Effortful control was calculated from attentional focusing, inhibitory control, low intensity pleasure, and perceptual sensitivity and was retained as a contextual outcome. In the present sample, its internal consistency was acceptable (Cronbach's $\alpha = 0.744$; McDonald's $\omega = 0.743$). CBQ subscales with very low reliability, including sadness ($\alpha = 0.356$), are not interpreted at the construct level and are reported only in the **Supplementary Table 1**.

#### 2.2.5 Short Form-36 (SF-36)

The SF-36 is a 36-item self-report measure of health-related quality of life yielding eight domains and physical and mental summary scores (Ware and Sherbourne, 1992). The Turkish version has established reliability and validity (Koçyiğit et al., 1999), and Turkish urban population norms have also been published (Demiral et al., 2006). The original study analysis used the standard United States norm-based weighted MCS algorithm (Ware et al., 1994) to preserve comparability with international SF-36 literature; this scoring was retained for the present analysis. A non-normed raw-composite sensitivity analysis yielded the same inferential conclusion. The SF-36 was included to characterize broad maternal health-related quality of life, not as a measure of parenting-specific stress, anxiety, depression, or family burden. The absence of those more proximal measures is addressed as a limitation.

### *2.3 Statistical Analysis*

Primary analyses were conducted using the SPSS Version 22.0 statistics package (IBM Corp., Armonk, NY, USA), with bootstrap confidence intervals and PROCESS analyses (Version 4.2; Hayes, 2022) in the same environment. All directly reproducible focal PAS, FAD, and CBQ results were re-derived from the archived raw/core data using available observations; no missing item values were added, and no statistical imputation was introduced. Analysis-specific sample sizes are therefore reported. The participant-level SF-36 MCS composite was not present in the available archived core; its archived scale-level summary is retained only as a contextual result and was not used in the new sensitivity analyses. Reliability estimates were interpreted considering available complete item data.

Four outcomes comprised the original multiplicity-controlled comparison set: PAS Democratic, FAD General Functioning, CBQ Effortful Control, and SF-36 MCS. For the three outcomes reproducible at participant level

from the archived core, group comparisons were recalculated using Mann-Whitney U tests, Hedges' g, and 5000-resample bootstrap 95% confidence intervals. The original archived MCS summary was retained as noted above. Benjamini-Hochberg false discovery rate (FDR) correction (Benjamini and Hochberg, 1995) was applied across the four outcome-level *p*-values. The democratic-parenting contrast is therefore described as nominally significant but not FDR-significant in the reproducible unadjusted analysis.

Covariate-adjusted analyses used regression/analysis of covariance (ANCOVA) models including maternal education, younger-sibling age, and younger-sibling sex. Maternal education was represented ordinally in the core adjusted specification and categorically with dummy variables in a sensitivity analysis. For FAD General Functioning, the group × younger-sibling-age term was examined after the common-slope assumption was evaluated; the interaction is treated as cross-sectional effect modification rather than a longitudinal developmental trajectory. HC3 heteroscedasticity-consistent standard errors were used as robustness checks.

Targeted sensitivity analyses addressed observed socioeconomic and demographic imbalance. A logistic propensity model using maternal-education categories as the specified predictor generated three tied fitted scores; consequently, 1:1 nearest-neighbor matching without replacement was equivalent to exact matching within education strata and produced 24 pairs. Matched-outcome comparisons retained the pair structure and used Wilcoxon signed-rank tests on complete pairs; Hedges' g is reported descriptively for magnitude. Because raw-data verification also identified a large index-child sex imbalance, categorical-education models were repeated with index-child sex added as an additional sensitivity covariate. Matching and covariate adjustment are treated as sensitivity analyses and cannot eliminate residual socioeconomic confounding. The results of these sensitivity analyses are provided in **Supplementary Table 2**.

A descriptive same-source diagnostic was added across six construct-level scores (the four corrected PAS dimensions, FAD General Functioning, and CBQ Effortful Control) because all substantive measures were maternal reports. Among 76 complete cases, the first unrotated component accounted for 36.5% of total variance. This diagnostic is not considered evidence that common-method bias is absent; same-reporter variance and social-desirability effects remain design limitations (Podsakoff et al., 2024). The results of this descriptive diagnostic are provided in **Supplementary Table 3**.

The broad exploratory correlation and cross-sectional conditional indirect-effect analyses (Hayes, 2015) are shown in the **Supplementary Table 4** and **Supplementary Fig. 1** and clearly identified as hypothesis-generating. Cross-sectional mediation estimates can differ materially from longitudinal mediation effects (Maxwell and Cole, 2007), and recent methodologic work emphasizes that sensitivity analyses cannot substitute for temporal data (Georgeson et al., 2025). No causal or mechanistic interpretation is assigned to these analyses.

## 3. Results

### *3.1 Participant Characteristics*

The study included 80 mothers (40 ADHD-family and 40 comparison-family mothers); 17 eligible families declined participation before enrollment. Raw-data verification identified two descriptive transcription discrepancies: the comparison-group index-child male count was corrected from 31/40 to 16/40, and younger-sibling age was corrected to M = 4.50 (SD = 1.13) in both groups, with exactly 10 younger siblings at each whole-year age from 3 through 6 years in each group. The corrected index-child sex imbalance was substantial (38/40 [95.0%] male in the ADHD group vs. 16/40 [40.0%] in the comparison group; Cramér's V = 0.59). Maternal and paternal education also differed materially between groups. These imbalances are treated as confounding/generalizability concerns rather than evidence of close matching (Table 1).

Within the ADHD group, 22 children (55.0%) had combined presentation, 14 (35.0%) predominantly inattentive presentation, and four (10.0%) predominantly hyperactive-impulsive presentation; mean time since diagnosis was 38.95 months (SD = 24.74) (Table 2). Given the hyperactive-impulsive subgroup (n = 4) and the absence of participant-level symptom-severity, comorbidity, and treatment variables in the archived analytic dataset, presentation-specific inferential analyses were not performed because such estimates would be unstable.

### *3.2 Primary Group Comparisons*

Using archived available PAS scores in the validated direction (1 = never, 5 = always; higher = greater endorsement), ADHD-family mothers had lower Democratic parenting scores than comparison mothers, n = 36, mean = 4.04 (SD = 0.83) vs. n = 40, mean = 4.41 (SD = 0.39), U = 517, $p = 0.035$. The effect estimate was moderate, Hedges' g = –0.57, bootstrap 95% CI: [–0.95, –0.18]. After Benjamini-Hochberg correction across the original four-outcome comparison set, q = 0.070; thus, the reproducible unadjusted democratic-parenting contrast did not meet the FDR threshold and was not described as a multiplicity-adjusted positive finding.

FAD General Functioning was poorer in families affected by ADHD in the unadjusted analysis, n = 39, mean = 1.71 (SD = 0.54) vs. n = 40, mean = 1.38 (SD = 0.42), U = 1096, $p = 0.002$, FDR q = 0.008, Hedges' g = 0.68, bootstrap 95% CI: [0.25, 1.16]. CBQ Effortful Control did not differ, mean = 5.17 (SD = 0.92) vs. 5.34 (SD = 0.64), U = 713, $p = 0.405$, FDR q = 0.405, g = –0.22, 95% CI: [–0.65, 0.21]. The originally archived SF-36 MCS summary was

**Table 1. Participant characteristics.**

| Variable | ADHD (n = 40) | Control (n = 40) | Effect size |
|---|---|---|---|
| Index child age, M (SD), years | 9.35 (2.53) | 9.18 (2.32) | SMD = 0.07 |
| Index child sex, male, n (%) | 38 (95.0) | 16 (40.0) | V = 0.59[1] |
| Index child birth order, M (SD) | 1.35 (0.53) | 1.10 (0.30) | SMD = 0.58 |
| Number of children, M (SD) | 2.60 (0.63) | 2.48 (0.55) | SMD = 0.21 |
| Family structure: nuclear, n (%) | 33 (82.5) | 31 (77.5) | V = 0.23 |
| Maternal age, M (SD), years | 36.93 (3.99) | 37.80 (6.62) | SMD = −0.16 |
| Maternal education | | | V = 0.40[1] |
| Less than high school, n (%) | 11 (27.5) | 6 (15.0) | |
| High school, n (%) | 19 (47.5) | 8 (20.0) | |
| University, n (%) | 10 (25.0) | 26 (65.0) | |
| Paternal age, M (SD), years | 40.48 (5.75) | 41.48 (6.39) | SMD = −0.16 |
| Paternal education | | | V = 0.45[1] |
| Less than high school, n (%) | 10 (25.0) | 7 (17.5) | |
| High school, n (%) | 20 (50.0) | 6 (15.0) | |
| University, n (%) | 10 (25.0) | 27 (67.5) | |
| Younger sibling age, M (SD), years | 4.50 (1.13) | 4.50 (1.13) | SMD = 0.00 |
| Younger sibling sex, male, n (%) | 17 (42.5) | 18 (45.0) | V = 0.03 |
| Younger sibling preschool, yes, n (%) | 11 (27.5) | 9 (22.5) | V = 0.06 |

Note: ADHD, attention-deficit/hyperactivity disorder; SMD, standardized mean difference; M, mean; SD, standard deviation; V, Cramér's V. [1]$p < 0.01$. Family-structure V is based on the full three-category family-structure variable although the nuclear-family count is displayed. The groups were not individually pair-matched. Raw-data verification identified and corrected the comparison index-child male count and younger-sibling age summaries shown here; education and index-child-sex imbalances are addressed in sensitivity analyses and limitations.

**Table 2. Clinical characteristics of the ADHD group.**

| Characteristic | ADHD group (n = 40) |
|---|---|
| ADHD presentation | |
| Combined, n (%) | 22 (55.0) |
| Predominantly inattentive, n (%) | 14 (35.0) |
| Predominantly hyperactive-impulsive, n (%) | 4 (10.0) |
| Time since diagnosis, months | Mean = 38.95 (SD = 24.74); Median = 36.5 (IQR 17.5–56.5) |

Note: Presentation and time since diagnosis are descriptive. Individual symptom-severity and treatment-status variables were not retained in the archived analytic dataset. IQR, interquartile range.

also nonsignificant, mean = 39.96 (SD = 7.09) vs. 40.91 (SD = 10.01), $p = 0.266$, FDR q = 0.355, g = –0.11, 95% CI: [–0.65, 0.30] (Table 3; Fig. 1).

### *3.3 Covariate-Adjusted Democratic Parenting*

In the core adjusted model controlling for maternal education, younger-sibling age, and younger-sibling sex, the democratic-parenting association remained present among the 76 participants with available PAS democratic scores: adjusted mean = 4.04 in the ADHD group and 4.42 in the comparison group, $F(1, 71) = 5.71$, $p = 0.020$, partial eta-squared = 0.074; heteroscedasticity-consistent standard error type 3 (HC3)-robust $p = 0.010$. When maternal education was instead dummy coded categorically, the group coefficient remained similar (b = –0.391, $p = 0.022$; HC3 $p = 0.015$). These adjusted results support a conditional association but do not override the fact that the unadjusted four-outcome FDR-corrected PAS result was q = 0.070 (Table 4).

### *3.4 Cross-sectional Age Modification of Family General Functioning*

For FAD General Functioning, the reproducible adjusted continuous-age model (n = 79) showed a group × younger-sibling-age interaction, $F(1, 73) = 6.39$, $p = 0.014$, partial eta-squared = 0.080; HC3-robust $p = 0.022$. This is a cross-sectional interaction: it indicates that the between-family ADHD-comparison difference in maternal-rated family functioning varied with the younger sibling's age, not that individual families improved or adapted over time.

**Table 3. Primary group comparisons: unadjusted estimates and effect sizes.**

| Outcome | ADHD mean (SD) | Control mean (SD) | *p* | FDR q | g [95% CI] |
|---|---|---|---|---|---|
| PAS Democratic | 4.04 (0.83) | 4.41 (0.39) | 0.035 | 0.070 | −0.57 [−0.95, −0.18] |
| FAD General Functioning | 1.71 (0.54) | 1.38 (0.42) | 0.002 | 0.008 | 0.68 [0.25, 1.16] |
| CBQ Effortful Control | 5.17 (0.92) | 5.34 (0.64) | 0.405 | 0.405 | −0.22 [−0.65, 0.21] |
| SF-36 MCS | 39.96 (7.09) | 40.91 (10.01) | 0.266 | 0.355 | −0.11 [−0.65, 0.30] |

Note: PAS, Parenting Attitude Scale; FAD, Family Assessment Device; CBQ, Children's Behavior Questionnaire; SF-36 MCS, Short Form-36 Mental Component Summary; FDR, false discovery rate. PAS, FAD, and CBQ estimates were re-derived from archived participant-level data using available observations; analysis-specific n is given in the text. Hedges' g is coded ADHD minus comparison. PAS follows the validated direction (1 = never, 5 = always; higher = greater endorsement), whereas higher FAD scores indicate poorer functioning. The SF-36 MCS row reproduces the archived scale-level summary because the participant-level MCS composite was not present in the available archived core and was not used in the sensitivity analyses.

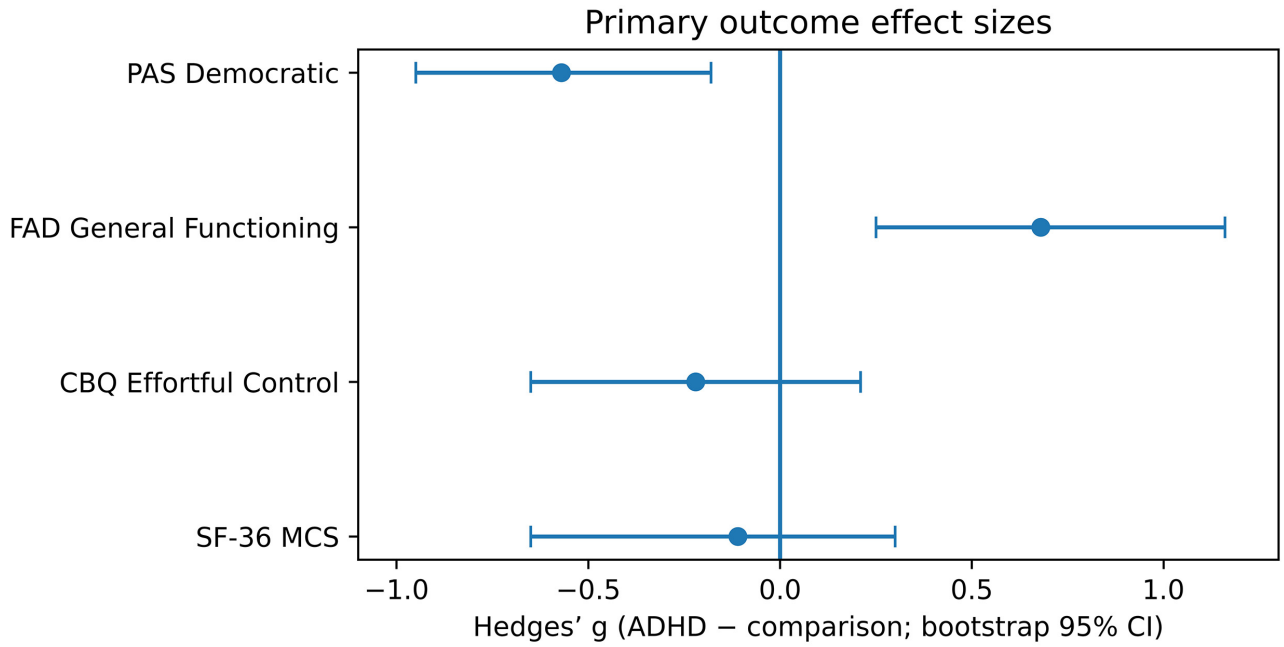



**Fig. 1. Primary outcome effect sizes**. Hedges' g values and bootstrap 95% confidence intervals for the original four-outcome comparison set. Negative PAS Democratic values indicate lower democratic-parenting endorsement in ADHD-family mothers. Reproducible unadjusted BH-FDR q values were 0.070 for PAS Democratic, 0.008 for FAD General Functioning, 0.405 for CBQ Effortful Control, and 0.355 for the archived SF-36 MCS summary. BH-FDR, Benjamini–Hochberg false discovery Rate; CI, confidence interval.

**Table 4. Covariate-adjusted analyses for the original three-outcome set.**

| Outcome | Adj. ADHD M [95% CI] | Adj. Control M [95% CI] | F | *p* | $\eta^2 p$ |
|---|---|---|---|---|---|
| PAS Democratic | 4.04 [3.81, 4.26] | 4.42 [4.20, 4.63] | 5.71 | 0.020 | 0.074 |
| FAD General Functioning | — | — | — | See interaction | — |
| CBQ Effortful Control | 5.09 [4.84, 5.35] | 5.40 [5.14, 5.65] | 2.57 | 0.113 | 0.034 |

Note: Core covariates were maternal education, younger-sibling age, and younger-sibling sex. PAS Democratic is presented in the validated direction; the reproducible adjusted model included n = 76. For FAD General Functioning, a group × younger-sibling-age interaction was present and the overall common-slope group main effect was not interpreted. CBQ is retained as contextual outcomes from the analysis framework. Adj., adjusted.

Age-specific adjusted contrasts were used only to localize the interaction. The estimated ADHD-comparison difference was 0.63 at age 3 years, 95% CI: [0.27, 0.98], Holm $p = 0.003$, and 0.39 at age 4 years, 95% CI: [0.14, 0.63], Holm $p = 0.007$. Contrasts at ages 5 and 6 years were not statistically supported after multiplicity correction. The

**Table 5. Age-specific adjusted contrasts for FAD General Functioning.**

| Sibling age (years) | ADHD adj. M | Control adj. M | Δ [95% CI] | Holm *p* |
|---|---|---|---|---|
| 3 | 1.85 | 1.23 | 0.63 [0.27, 0.98] | 0.003 |
| 4 | 1.73 | 1.35 | 0.39 [0.14, 0.63] | 0.007 |
| 5 | 1.61 | 1.47 | 0.15 [−0.10, 0.39] | 0.499 |
| 6 | 1.49 | 1.59 | −0.10 [−0.47, 0.28] | 0.610 |

Note: Higher FAD General Functioning scores indicate poorer functioning. Covariates were maternal education and younger-sibling sex. The continuous group × age interaction was the inferential effect-modification test; age-specific estimates are localization aids. Exact recruitment strata were 10 participants at each whole-year age in each group; the model used n = 79 owing to one unavailable FAD General Functioning score.

sampling design contained exactly 10 participants per age × group stratum, although the FAD model used n = 79 because one participant lacked an available General Functioning score. These age-specific results remain imprecise localization aids; the continuous interaction is the inferential anchor (Table 5; Fig. 2).

### *3.5 Targeted Robustness Analyses*

Targeted robustness analyses preserved the direction of the two focal adjusted patterns. With maternal education dummy-coded categorically, the democratic-parenting group coefficient was b = –0.391, $p$ = 0.022 (HC3 $p$ = 0.015), and the FAD group × age coefficient was b = –0.295, $p$ = 0.003 (HC3 $p$ = 0.003). Because raw-data verification identified a major index-child sex imbalance, additional models included index-child sex; the democratic-parenting coefficient remained b = –0.494, $p$ = 0.013 (HC3 $p$ = 0.003), and the FAD interaction remained b = –0.294, $p$ = 0.003 (HC3 $p$ = 0.003).

The maternal-education propensity model produced three tied fitted scores and 24 matched pairs, yielding exact balance on the three education strata (ordinal education SMD –0.71 before matching to 0.00 after matching). Pair structure was retained in outcome analyses. For democratic parenting, 20 complete pairs yielded a mean of 4.17 vs. 4.42, descriptive g = –0.56, and paired Wilcoxon $p$ = 0.050. For FAD General Functioning, 23 complete pairs yielded a mean of 1.76 vs. 1.46, descriptive g = 0.60, and paired Wilcoxon $p$ = 0.055. Thus, matching preserved the direction and approximate magnitude of the focal contrasts but substantially reduced precision; it is not presented as confirmation of statistical significance or as elimination of residual socioeconomic confounding.

For completeness, the descriptive same-source diagnostic was conducted using six construct-level maternal-report scores among 76 complete cases; the first unrotated component accounted for 36.5% of the total variance. This diagnostic cannot exclude common-method variance, which remains an inherent limitation of the maternal single-informant design (Table 6).

### *3.6 Secondary and Exploratory Analyses*

To reduce analytical overbreadth relative to the sample size, secondary subscale results and cross-sectional conditional indirect-effect analyses were removed from the main evidentiary narrative and are provided in **Supplementary Table 1**, **Supplementary Table 4**, and **Supplementary Fig. 1** for transparency. Findings from subscales with unacceptable internal consistency are descriptive only. The conditional indirect-effect analyses are explicitly hypothesis-generating and are not interpreted as evidence of a causal spillover pathway.

## 4. Discussion

This study examined maternal-reported parenting attitudes and family functioning in families containing a child with ADHD and a typically developing younger sibling, with particular attention to whether family-functioning differences varied by younger-sibling age. FAD General Functioning showed the clearest reproducible unadjusted group difference and a cross-sectional group × younger-sibling-age interaction. Democratic-parenting scores were also lower in mothers of families affected by ADHD and remained associated with group status after covariate adjustment, but the reproducible unadjusted contrast did not survive FDR correction. Effortful control and the archived maternal MCS summary were not significantly different. Overall, the findings support a cautious, association-focused interpretation centered on family general functioning; no causal or mechanistic conclusions can be drawn.

### *4.1 Democratic Parenting in a Sibling-Family Context*

The democratic-parenting result should be interpreted as a maternal-perception finding rather than evidence of objectively observed parenting behavior. In the reproducible data, the unadjusted contrast was nominally significant ($p$ = 0.035; g = –0.57) but attenuated to q = 0.070 after four-outcome FDR correction. The association persisted after adjustment for education, younger-sibling age, and sex and in categorical-education and index-child-sex sensitivity models. This pattern is compatible with, but does not demonstrate, a family spillover interpretation because par-

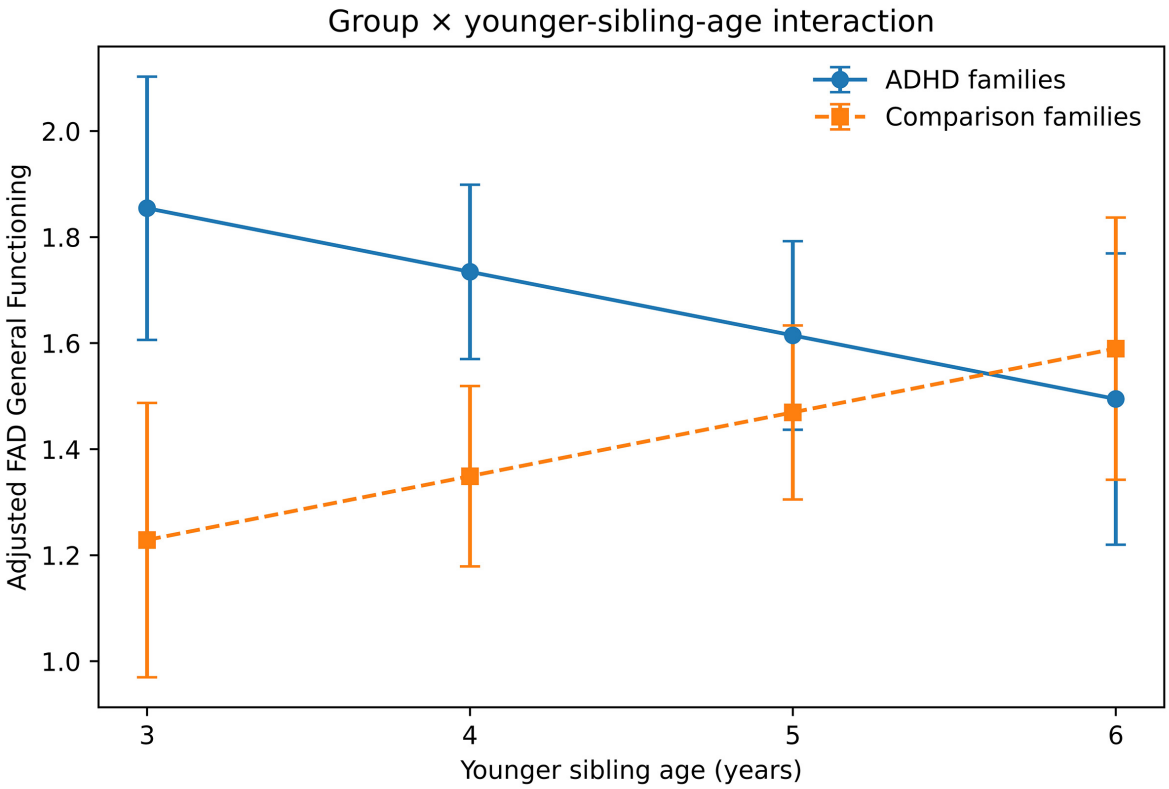



**Fig. 2. Adjusted FAD General Functioning by younger-sibling age**. Higher FAD scores indicate poorer family functioning. The reproducible continuous group × younger-sibling-age interaction was $F(1, 73) = 6.39$, $p = 0.014$, partial eta-squared = 0.080; HC3-robust $p = 0.022$. Age-specific values illustrate cross-sectional interaction and should not be interpreted as within-family change. Error bars indicate 95% confidence intervals.

**Table 6. Targeted sensitivity analyses**.

| Analysis | n | Estimate/balance | *p* | Robust *p*/interpretation |
|---|---|---|---|---|
| PAS Democratic; maternal education categorical | 76 | Group b = −0.391 | 0.022 | HC3 $p = 0.015$ |
| FAD General Functioning; education categorical | 79 | Group × age b = −0.295 | 0.003 | HC3 $p = 0.003$ |
| PAS + corrected index-child sex sensitivity | 76 | Group b = −0.494 | 0.013 | HC3 $p = 0.003$ |
| FAD interaction + corrected index-child sex sensitivity | 79 | Group × age b = −0.294 | 0.003 | HC3 $p = 0.003$ |
| 1:1 maternal-education propensity matching | 48 | 24 pairs; education SMD −0.71 → 0.00 | — | Exact balance on education strata |
| Matched PAS Democratic | 20 complete pairs | Mean 4.17 vs. 4.42; g = −0.56 | 0.050 | Paired Wilcoxon; reduced precision |
| Matched FAD General Functioning | 23 complete pairs | Mean 1.76 vs. 1.46; g = 0.60 | 0.055 | Paired Wilcoxon; reduced precision |
| Single-component diagnostic | 76 | First component = 36.5% variance | — | Descriptive; does not exclude common-method bias |

HC3, heteroscedasticity-consistent standard error type 3.

enting stress, resource depletion, observed parent-child behavior, and temporal change were not measured.

Several family-systems interpretations are plausible but were not tested. ADHD-related caregiving demands could coincide with fewer available emotional or organizational resources, consistent with a resource-dilution/spillover interpretation; alternatively, experience with an older child can alter expectations and strategies to-

ward a younger sibling through learned experience (Ruggiero et al., 2021). Contemporary meta-analytic evidence links ADHD symptom severity with parenting stress, negative parenting practices, and socioeconomic factors (Jendreizik et al., 2023), and longitudinal evidence demonstrates that ADHD behaviors and family-environment processes can be temporally related (Saulsbury et al., 2025). These external findings make family-resource interpretations plausible, but the present study did not measure resource depletion, parenting stress, or temporal change and therefore cannot adjudicate among them.

### *4.2 Younger-Sibling Age and Family General Functioning*

The FAD General Functioning interaction indicates cross-sectional heterogeneity in the ADHD-comparison difference across younger-sibling ages. The continuous interaction was statistically supported, and localization contrasts were largest at ages 3 and 4 years, whereas ages 5 and 6 were not supported after Holm correction. These findings cannot establish adaptation, recovery, or developmental changes within families because participants at different ages represent different families. They instead identify an age-related pattern that warrants longitudinal replication.

### *4.3 Maternal Health-Related Quality of Life and Temperament*

The null effortful control and MCS findings should not be interpreted as evidence that sibling self-regulation or maternal well-being is unaffected by ADHD-family context. The estimates were imprecise in this modest sample, and the SF-36 was designed to assess broad health-related quality of life rather than parenting-specific distress. Parenting stress, depression, and anxiety were not measured with dedicated instruments. Systematic-review evidence indicates that parenting stress is related to parental, child, and situational factors, including maternal depression, child behavioral problems, social support, and education (Fang et al., 2024). Future studies should therefore include parenting-specific stress and mental-health measures rather than treating a generic MCS score as a mechanistic proxy.

### *4.4 Socioeconomic Confounding and Cultural Context*

Socioeconomic and demographic confounding remains central. Maternal and paternal education differed substantially between the groups, and corrected raw data also revealed a large index-child sex imbalance. Dummy-coded education models and models additionally including index-child sex preserved the focal adjusted coefficients, and education matching preserved their direction and approximate magnitude but reduced precision (paired $p = 0.050$ for democratic parenting and $p = 0.055$ for FAD General Functioning). These analyses improve transparency but do not make the groups exchangeable and cannot remove unmeasured socioeconomic, referral, or family-context differences.

Cultural interpretation also warrants restraint. Parenting processes are shaped by both individual family characteristics and broader social contexts. Studies comparing Türkiye with other countries show both shared and culture-contingent determinants of parenting (Acet and Oliver, 2024), and recent cross-cultural qualitative work suggests that some family experiences of ADHD may be shared across markedly different healthcare and cultural contexts while others may depend on local healthcare systems and sociocultural norms (Oluoch et al., 2025). We therefore avoid treating Türkiye as culturally homogeneous or assuming a single "collectivist" explanation. Replication across regions and cultural settings is needed.

### *4.5 Limitations*

Several limitations constrain interpretation. First, the cross-sectional design precludes causal or directional inference and cannot establish spillover, resource dilution, compensation, or within-family adaptation. Accordingly, the present findings should be interpreted as exploratory and hypothesis-generating rather than as confirmatory evidence. Second, all substantive constructs were maternal reports, creating common-method and social-desirability concerns that a descriptive single-component diagnostic cannot resolve. Third, the sample was small and single-center; analysis-specific missingness reduced the reproducible PAS and FAD samples to 76 and 79, respectively. Fourth, the exact recruitment/referral channel for each comparison family could not be reconstructed from the archived study materials, so selection mechanisms remain uncertain. Fifth, maternal and paternal education and index-child sex were markedly imbalanced; adjustment, matching, and sensitivity analyses do not eliminate residual confounding. Sixth, parenting stress, paternal psychopathology/report, household economic stress, participant-level ADHD symptom severity, medication status, and comorbidity variables were not retained for analysis. Seventh, the younger siblings' typically developing status was based on clinical child-psychiatric assessments, developmental history, and parent interviews rather than separate standardized developmental screening. Eighth, the participant-level SF-36 MCS composite was not present in the available archived core; consequently, the original scale-level MCS summary was retained only as contextual information and not re-used in new sensitivity analyses. Finally, age-specific FAD contrasts are based on small strata and should be regarded as localization of the continuous interaction rather than stable subgroup estimates.

## 5. Conclusions

In this selected single-center sample, maternal-rated family general functioning was poorer in families affected by ADHD and the magnitude of the ADHD-comparison difference varied cross-sectionally with younger-sibling age. Democratic-parenting scores were also lower in mothers of

families navigating ADHD, but the reproducible unadjusted contrast did not survive four-outcome FDR correction despite persisting in covariate-adjusted models. These findings are associations based on maternal reports and do not demonstrate a spillover mechanism, compensatory adaptation, or intervention effect. Larger longitudinal studies with better socioeconomic comparability, multi-informant or observational parenting measures, and fuller clinical characterization are needed.

## Abbreviations

ADHD, attention-deficit/hyperactivity disorder; CBQ-SF, Children's Behavior Questionnaire–Short Form; CI, confidence interval; PAS, Parenting Attitude Scale; FAD, Family Assessment Device; FDR, false discovery rate; HC3, heteroscedasticity-consistent standard error type 3; K-SADS-PL-DSM-5-T, Kiddie Schedule for Affective Disorders and Schizophrenia for School-Age Children–Present and Lifetime Version; MCS, Mental Component Summary; SF-36, Short Form-36; SMD, standardized mean difference.

## Availability of Data and Materials

The de-identified data and analysis syntax supporting the findings are available from the corresponding author upon reasonable request, subject to ethical and institutional requirements.

## Author Contributions

MS and AET designed the research study. MS, GKÇ, BAA, PÖ, GGÖ, Yİ, YÖ, and AET performed the research and contributed to data collection. MS, YÖ, and AET analyzed the data. MS and AET wrote the original draft. MS, GKÇ, BAA, PÖ, GGÖ, Yİ, YÖ, and AET critically reviewed and edited the manuscript. All authors contributed to the revision, read and approved the final manuscript, and agreed to be accountable for all aspects of the work.

## Ethics Approval and Consent to Participate

All procedures conformed to the Declaration of Helsinki and were approved by the Bolu Abant İzzet Baysal University Non-Interventional Clinical Research Ethics Committee (Decision No. 2025/277, July 1, 2025). The approved protocol included the study groups and the PAS, FAD, CBQ-SF, and SF-36 assessments used in this report. All participating mothers provided written informed consent before study participation. The manuscript contains no individual-level identifiable data, images, videos, or recordings; consent for publication is therefore not applicable.

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## Conflicts of Interest

The authors declare no conflicts of interest.

## Supplementary Material

Supplementary material associated with this article can be found, in the online version, at https://doi.org/10.31083/BP55954.

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