

Behavioral characteristics of individuals with Rett syndrome in Korea

A cross-sectional study

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Abstract

Rett syndrome (RTT) is a severe neurodevelopmental disorder caused by mutations in the *MECP2* gene and characterized by developmental regression and stereotypic hand movements. We aimed to assess behavioral profiles in Korean individuals with RTT using caregiver-completed behavioral questionnaires. In this cross-sectional study, caregivers of 66 individuals with RTT completed the Korean version of the Rett Syndrome Behaviour Questionnaire (K-RSBQ, 45 items) and the Childhood Autism Rating Scale (CARS, 15 items). Descriptive statistics were used to summarize K-RSBQ total and subscale scores and CARS score distributions. Correlations between age and behavioral domains were also examined. This study represents a secondary analysis of anonymized survey data from a prior Korean RSBQ validation cohort. All 66 participants were female (mean age 12.89 ± 6.20 years; median 11.95, interquartile range 7.56–16.54). The median K-RSBQ total score was 41.5 (interquartile range 32.75–51.75). The hand behavior domain showed the highest score (8.71 ± 2.50 of 12), while nighttime behaviors and walking/standing showed lower scores. No K-RSBQ domain was significantly correlated with age. Several behavioral domains showed moderate inter-domain correlations, whereas hand behaviors appeared relatively independent. Among 58 participants who completed the CARS, 24 (41.4%) had scores in the severe autism range. Korean individuals with RTT demonstrated behavioral profiles characterized by prominent stereotypic hand movements and relatively stable behavioral patterns across age groups. These findings support the use of standardized caregiver-reported tools for characterizing behavioral phenotypes in RTT.

Abbreviations: CARS = Childhood Autism Rating Scale, K-RSBQ = Korean version of the Rett Syndrome Behaviour Questionnaire, RSBQ = Rett Syndrome Behaviour Questionnaire, RTT = Rett syndrome.

Keywords: behavioral phenotype, Childhood Autism Rating Scale, *MECP2* mutation, Rett syndrome, Rett Syndrome Behaviour Questionnaire

1. Introduction

Rett syndrome (RTT) is a rare neurodevelopmental disorder that primarily affects females and is most commonly caused by mutations in the methyl-CpG-binding protein 2 (*MECP2*) gene.^[1] The disorder is characterized by a period of apparently normal early development followed by developmental regression typically occurring between 6 and 18 months of age.^[2] During this regression phase, affected individuals experience loss of acquired language and motor skills, emergence of repetitive hand movements, and severe cognitive and developmental impairment.^[3–5] Recent advances in the understanding of RTT have highlighted its complex neurobiological mechanisms and evolving therapeutic landscape.^[6] Comprehensive characterization of neurological and behavioral features is therefore essential for improving clinical assessment and management of individuals with RTT.

RTT is associated with a distinctive behavioral phenotype. One of the most characteristic clinical features is the development of repetitive hand stereotypies such as hand wringing, clapping, or washing movements, accompanied by loss of purposeful hand use.^[6,7] In addition to stereotypic movements, individuals with RTT frequently exhibit a range of behavioral manifestations including teeth grinding,^[8] breathing abnormalities,^[7] sleep disturbances,^[9] anxiety,^[10,11] emotional dysregulation,^[12] and occasional self-injurious behaviors.^[2,12] These diverse behavioral characteristics contribute substantially to the clinical presentation and functional limitations observed in individuals with RTT.

Behavioral characterization of RTT has been facilitated by caregiver-reported assessment tools such as the Rett Syndrome Behaviour Questionnaire (RSBQ).^[13] The RSBQ is a 45-item instrument designed to quantify neurological and behavioral symptoms associated with RTT and has been widely used in

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observational studies and clinical trials evaluating therapeutic interventions. The questionnaire assesses 8 behavioral domains, including general mood, breathing problems, hand behaviors, repetitive facial movements, body rocking or expressionless face, nighttime behaviors, fear or anxiety, and walking or standing ability.^[13]

A Korean version of the K-RSBQ has recently been translated and validated for use in Korean individuals with RTT.^[14] The validation study demonstrated that the K-RSBQ is a reliable instrument for evaluating behavioral characteristics in this population. The present study used the same cohort from the previously published K-RSBQ validation study but focused on describing behavioral characteristics and relationships among behavioral domains rather than evaluating psychometric properties of the instrument. However, detailed descriptive analyses of behavioral profiles and inter-domain relationships in Korean individuals with RTT remain limited. Although the RSBQ has been widely applied in studies conducted in Europe,^[7] North America,^[8,13,15] and Australia,^[6,16] relatively limited data are available regarding behavioral characteristics of RTT in Asian populations. Cultural context, caregiver interpretation of behaviors, and differences in healthcare systems may influence how behavioral symptoms are reported and perceived. Population-specific analyses may therefore contribute to a more comprehensive understanding of the behavioral phenotype of RTT.

The present study aimed to characterize behavioral features of individuals with RTT in a Korean cohort using the K-RSBQ. Specifically, we analyzed the distribution of behavioral domain scores, examined correlations among behavioral characteristics, and evaluated associations between behavioral features and clinical variables such as age and caregiver education level. In addition, we investigated the distribution of Childhood Autism Rating Scale (CARS) scores to explore autism-related behavioral features in this population.

2. Materials and methods

2.1. Participants

This study was a cross-sectional secondary analysis of anonymized caregiver survey data collected through the Korean Rett Syndrome Parents Association between September and December 2023. Participants included individuals registered in the Korean National Rare Disease Registry with a diagnosis of RTT. Clinical diagnoses were established at tertiary care centers by specialists in pediatric neurology, developmental pediatrics, or clinical genetics. The registry requires either genetic confirmation of an *MECP2* mutation or fulfillment of defined clinical diagnostic criteria. These criteria are consistent with the internationally accepted revised diagnostic criteria for RTT,^[17] which define RTT as a clinical diagnosis based on a period of developmental regression, the presence of key clinical features, and the absence of exclusionary conditions. Individuals with known alternative neurological or metabolic disorders were not included, in accordance with registry exclusion criteria. All 66 individuals included in the study were female, consistent with the known sex distribution of RTT. Demographic information collected included age, mobility status, and caregiver characteristics.

2.2. Measures

Behavioral characteristics were assessed using caregiver-reported questionnaires. Primary caregivers of individuals with RTT completed an online survey that included the K-RSBQ^[14] and the CARS.^[18] The survey was distributed through the Korean Rett Syndrome Parents Association as part of a nationwide caregiver survey.

The RSBQ is a caregiver-completed scale assessing a wide range of neurological and behavioral symptoms in RTT.^[7,13] In the present study, parents or caregivers were asked to rate each item in Korean on a 3-point scale: 0 (not true), 1 (somewhat or sometimes true) or 2 (often true), according to how well it described their child's behavior over the last 6 months. The questionnaire contains 45 items, of which 38 contribute to 8 behavioral domains: general mood, breathing problems, hand behaviors, repetitive facial movements, body rocking or expressionless face, nighttime behaviors, fear or anxiety, and walking/standing ability.^[7,13] The CARS is a clinician-rated instrument widely used to assess autism-related behaviors in children. Each item is scored from 1 to 4 in 0.5-point increments, with higher scores indicating greater severity of autistic characteristics. The possible total score ranges from 15 at a minimum to 60 at maximum.^[18] Higher score represents the greater autism tendency, with children with scores between 30 and 36.5 have a clinically mild-moderate autism and children between 37 and 60 have severe autism.^[18] It has been validated in Korean and is widely used in clinical and research purposes.^[16] The Korean version of the K-RSBQ has been recently validated, demonstrating good internal consistency and reliability in caregiver-reported assessments.^[14]

The participants were asked to choose from 3 categories about ambulation status; walk without any problems, can walk independently but feel anxious or slow, can't walk independently.

2.3. Statistical analysis

Descriptive statistics were used to summarize demographic and clinical characteristics of the study population. Continuous variables were presented as means with standard deviations and medians with interquartile ranges, whereas categorical variables were summarized as frequencies and percentages.

The distribution of total and subscale scores of the K-RSBQ was analyzed using descriptive statistics. Pearson correlation coefficients were calculated to evaluate associations between age and each K-RSBQ behavioral domain, as well as inter-domain relationships among the 8 K-RSBQ subscales.

For the CARS, descriptive statistics were used to summarize score distributions. Participants were categorized into 3 groups according to established CARS thresholds: scores < 30, scores between 30 and 36.5, and scores ≥ 37.^[18] All statistical analyses were performed using SPSS version 28.0 (IBM Corp., Armonk), and a 2-tailed *P*-value < .05 was considered statistically significant.

2.4. Ethics statement

This study was approved by the Institutional Review Board (IRB) of Ewha Womans University Seoul Hospital (IRB No. 2026-03-023). Because the study analyzed previously collected anonymized data, the requirement for informed consent was waived by the IRB.

3. Results

3.1. Participant characteristics

The clinical and caregiver characteristics of the study population are summarized in Table 1. The mean age of individuals with RTT was 12.89 ± 6.20 years. Mobility status varied considerably across the cohort. Approximately 45.5% of individuals were unable to walk independently, while 43.9% retained independent walking ability with some degree of difficulty. Detailed clinical characteristics such as seizure history, head circumference (including microcephaly), and other neurological comorbidities were not available in the dataset and were therefore not included in the analysis.

3.2. Distribution of K-RSBQ scores in individuals with RTT

The distribution of total and subscale scores of the K-RSBQ is summarized in Table 2. The median K-RSBQ total score was 41.5 (interquartile range 32.75–51.75).

Among the 8 behavioral domains, the hand behavior domain demonstrated the highest mean score of 8.71 out of a maximum possible score of 12. This corresponds to approximately 73.3% of the maximum score, indicating that stereotypic hand movements were highly prevalent in this cohort. The fear or anxiety domain had a mean score of 3.68 out of 8, while the general mood domain had a mean score of 6.50 out of 16. Lower scores were observed in the nighttime behavior domain, with a mean score of 1.89 out of 6, and the walking or standing domain, with a mean score of 1.56 out of 4.

3.3. Correlation between age and each domain of the K-RSBQ

Correlation analysis between age and each domain of the K-RSBQ is presented in Table 3. No significant correlations were observed between age and any of the behavioral domains assessed by the K-RSBQ. The correlation coefficients ranged from -0.135 to 0.077 across domains. For example, the general mood domain showed a correlation coefficient of -0.077 ($P = .540$), while breathing problems and hand behaviors showed coefficients of -0.078 ($P = .534$) and 0.077 ($P = .537$), respectively. Similarly, repetitive face movement and body rocking/expressionless face demonstrated weak correlations with age ($r = -0.076$, $P = .543$; $r = -0.043$, $P = .729$). Nighttime behaviors, fear/anxiety, and walking/standing domains also showed no significant associations with age.

Table 1
Clinical and caregiver characteristics of individuals with Rett syndrome (n = 66).

Variable	Value
Age, mean $\pm$ SD (yr)	12.89 $\pm$ 6.20
Age, median (IQR)	11.95 (7.56–16.54)
Mobility status	
Walk independently	7 (10.6%)
Walk independently but slow/anxious	29 (43.9%)
Cannot walk independently	30 (45.5%)
Primary caregiver	
Mother	60 (90.9%)
Father	6 (9.1%)
Caregiver education level	
Graduate school	4 (6.1%)
University	47 (71.2%)

IQR = interquartile range, SD = standard deviation.

Table 2
Distribution of K-RSBQ total and subscale scores in individuals with Rett syndrome (n = 66).

Domain	Mean $\pm$ SD	Median (IQR)	Range
Total score (max 90)	42.85 $\pm$ 14.48	41.5 (32.75–51.75)	0–73
General mood (max 16)	6.50 $\pm$ 4.00	6.0 (3.0–8.75)	0–15
Breathing problems (max 10)	4.30 $\pm$ 2.81	4.0 (2.0–6.0)	0–10
Hand behaviors (max 12)	8.71 $\pm$ 2.50	9.0 (7.0–11.0)	0–12
Repetitive face movement (max 8)	3.03 $\pm$ 1.89	3.0 (2.0–4.0)	0–8
Body rocking/expressionless face (max 12)	5.47 $\pm$ 2.17	5.5 (4.0–7.0)	0–10
Nighttime behaviors (max 6)	1.89 $\pm$ 1.68	2.0 (0–3)	0–6
Fear/anxiety (max 8)	3.68 $\pm$ 1.73	4.0 (2.0–5.0)	0–8
Walking/standing (max 4)	1.56 $\pm$ 1.37	2.0 (0–2)	0–4

IQR = interquartile range, K-RSBQ = Korean version of the Rett Syndrome Behaviour Questionnaire, SD = standard deviation.

3.4. Inter-domain correlations

Correlations among the K-RSBQ behavioral domains are presented in Table 4. The general mood domain showed moderate to strong correlations with several domains, particularly nighttime behaviors ($r = 0.805$) and repetitive face movement ($r = 0.608$). Similarly, the body rocking/expressionless face domain demonstrated moderate correlations with general mood and nighttime behaviors. Breathing problems showed moderate correlations with several domains, generally ranging between $r = 0.30$ and $r = 0.45$. In contrast, the hand behavior domain showed relatively weak correlations with other domains, indicating that stereotypic hand movements may represent a distinct behavioral feature within the RTT phenotype. Repetitive face movement demonstrated moderate correlations with nighttime behaviors ($r = 0.537$) and body rocking/expressionless face ($r = 0.489$). The walking/standing domain also showed moderate correlations with repetitive face movement and general mood.

3.5. Caregiver education analysis

Caregiver characteristics are summarized in Table 1. To explore whether caregiver educational level influenced reported behavioral characteristics, participants were divided into 2 groups according to caregiver education level (university or higher vs high school or lower). Independent t tests were conducted to compare K-RSBQ scores between the 2 groups. No statistically significant differences were observed between the groups in the total K-RSBQ score or any behavioral domain.

3.6. Distribution of CARS scores in individuals with RTT

A total of 58 primary caregivers completed the CARS. Among these participants, 13 individuals (22.4%) had total CARS scores below 30, 21 individuals (36.2%) had scores between 30 and 36.5, and 24 individuals (41.4%) had scores of 37 or higher. Item-level analysis revealed that the highest mean scores were observed for the imitation and verbal communication domains, with mean scores of 3.77 and 3.76, respectively. The nonverbal communication domain also showed relatively high scores, with a mean value of 3.09. In contrast, lower scores were observed for the auditory response domain (mean = 1.42) and the domain assessing responses to taste, smell, and touch (mean = 1.56). Overall, most item scores ranged between 2 and 3, indicating moderate levels of behavioral impairment across many domains. The distribution of mean scores across CARS items is illustrated in Figure 1.

4. Discussion

This study aimed to characterize behavioral patterns observed in Korean individuals with RTT using caregiver-reported

Table 3**Correlation between age and K-RSBQ behavioral domains.**

Domain	Correlation coefficient (<i>r</i>)	<i>P</i> -value
General mood	−0.077	.540
Breathing problems	−0.078	.534
Hand behavior	0.077	.537
Repetitive face movement	−0.076	.543
Body rocking/expressionless face	−0.043	.729
Nighttime behaviors	−0.067	.595
Fear/anxiety	0.003	.979
Walking/standing	−0.135	.278

K-RSBQ = Korean version of the Rett Syndrome Behaviour Questionnaire.

Table 4**Inter-domain correlations among K-RSBQ behavioral subscales.**

	GM	BP	HB	RFM	BREF	NB	FA	WS
General mood (GM)	1.0							
Breathing problems (BP)	0.451**	1.0						
Hand behaviors (HB)	0.204	0.300*	1.0					
Repetitive face movement (RFM)	0.608**	0.446**	0.209	1.0				
Body rocking and expressionless face (BREF)	0.564**	0.309*	0.248*	0.489**	1.0			
Nighttime behaviors (NB)	0.805**	0.456**	0.148	0.537**	0.562**	1.0		
Fear/anxiety (FA)	0.446**	0.405**	0.217	0.298*	0.401**	0.364**	1.0	
Walking/standing (WS)	0.404**	0.196	0.307*	0.489**	0.459**	0.356**	0.272*	1.0

K-RSBQ = Korean version of the Rett Syndrome Behaviour Questionnaire.

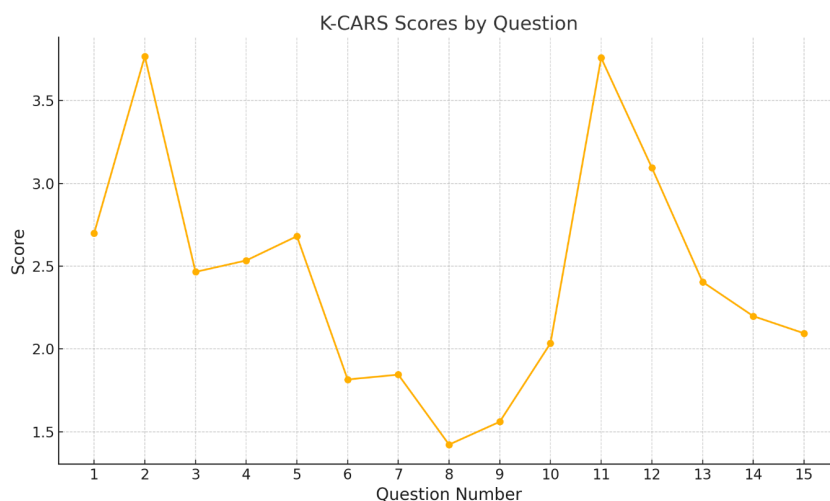
P* < .05.*P* < .01.

Figure 1. Distribution of mean K-CARS item scores in individuals with Rett syndrome (*n* = 58). Item numbers correspond to the following CARS domains: 1, relating to people; 2, imitation; 3, emotional response; 4, body use; 5, object use; 6, adaptation to change; 7, visual response; 8, listening response; 9, taste, smell, and touch response and use; 10, fear or nervousness; 11, verbal communication; 12, nonverbal communication; 13, activity level; 14, level and consistency of intellectual response; 15, general impressions. CARS = Childhood Autism Rating Scale, K-CARS = Korean version of the Childhood Autism Rating Scale.

questionnaires. By examining the distribution of scores across the domains of the K-RSBQ and the CARS, this study aimed to characterize behavioral patterns observed in individuals with RTT and to explore relationships among behavioral domains. The results provide several insights into the behavioral phenotype of RTT in this population.

4.1. Participant characteristics

In the present cohort, the mean age of individuals with RTT was approximately 13 years. RTT typically progresses through distinct

developmental stages, including early developmental stagnation, rapid regression, and a subsequent stabilization phase.^[7,19] Because most participants in this study were in late childhood or adolescence, many individuals may have already passed the period of rapid neurological regression.^[4,20] This may partly explain the relatively stable behavioral profiles observed across the cohort.

Motor impairment is also a well-recognized clinical feature of RTT.^[3,4,9,21] In the present cohort, nearly half of the participants were unable to walk independently, while a similar proportion retained partial ambulatory ability with slower or cautious gait. Gait abnormalities and progressive motor dysfunction have been

widely reported in individuals with RTT and contribute substantially to functional limitations in daily activities.^[9,12,21] The distribution of mobility status observed in this study therefore reflects the heterogeneous motor phenotype characteristic of RTT.

4.2. Distribution of K-RSBQ scores

Analysis of K-RSBQ scores revealed that the hand behavior domain showed the highest mean score among all behavioral domains. This finding reflects the well-established prominence of stereotypic hand movements in individuals with RTT. Repetitive hand stereotypes such as wringing, clapping, and washing movements represent one of the most recognizable and defining characteristics of the disorder.^[9,17,19,22,23] These stereotypic movements are thought to arise from dysfunction in neural circuits involved in motor control, particularly within basal ganglia and cortical motor pathways.^[19,23] The hand behavior domain showed the highest scores among behavioral domains, consistent with previous descriptions of RTT behavioral phenotypes.^[24] Similar findings have also been reported in studies using the RSBQ in other populations, including a pilot study in Japanese patients with RTT.^[25]

The general mood and fear/anxiety subscales showed relatively lower mean scores compared with other behavioral domains in this cohort. These findings suggest that emotional and affective symptoms may vary substantially across individuals with RTT.

In contrast, the nighttime behavior and walking/standing domains showed relatively lower scores compared with other behavioral domains. Sleep disturbances, including irregular sleep-wake cycles and nocturnal vocalizations, have been reported in many individuals with RTT.^[8] However, the severity and frequency of these symptoms vary considerably across patients. The relatively lower scores observed in the nighttime behavior domain in this cohort may therefore reflect this variability. Similarly, the walking/standing domain also demonstrated lower scores relative to other domains. Because this domain reflects motor ability rather than behavioral symptoms alone, the lower scores may indicate that some individuals in this cohort retained partial mobility or were able to ambulate with assistance.

Overall, the distribution of K-RSBQ scores observed in this study highlights the heterogeneous behavioral presentation of RTT. While stereotypic motor behaviors appear highly prevalent, other behavioral manifestations show substantial variability among individuals.

4.3. Age-related behavioral characteristics

RTT is known to show age-related changes in neurological and behavioral manifestations. Therefore, we examined the relationship between age and behavioral characteristics measured by the K-RSBQ. However, in the present study, none of the behavioral domains showed a significant correlation with age (Table 3). Although regression of speech and motor abilities is a well-recognized feature of RTT, no clear age-related association was observed in this cohort.

One possible explanation is that the mean age of the participants was relatively high (mean = 12.89 years; median = 11.95 years), suggesting that many individuals may have already passed the early regression phase and entered a more stable stage of the disorder. In addition, the substantial variability in symptom severity and progression among individuals with RTT may have contributed to the absence of detectable age-related trends in this cross-sectional analysis. Future longitudinal studies following individuals with RTT over extended periods may provide better insight into the developmental trajectory of behavioral symptoms.

4.4. Inter-domain correlations

Correlation analysis among behavioral domains revealed several notable patterns in the K-RSBQ profile. In particular, the

general mood domain showed strong associations with nighttime behaviors and repetitive face movement. Emotional dysregulation, irritability, and unexplained vocalizations are commonly reported behavioral features in individuals with RTT and may be associated with disturbances in autonomic and emotional regulatory systems.^[5,12] Previous studies have shown that stereotypic hand movements are a core clinical feature of RTT rather than a nonspecific behavioral manifestation.^[8]

Similarly, the body rocking/expressionsless face domain demonstrated moderate correlations with several behavioral domains, including general mood and nighttime behaviors. These findings suggest that certain behavioral manifestations may cluster together and represent related neurobehavioral features in individuals with RTT.

In contrast, the hand behavior domain showed relatively weak correlations with most other domains. This pattern suggests that stereotypic hand movements may represent a core motor manifestation of RTT that is relatively independent from emotional or behavioral symptoms captured by other domains of the questionnaire. Previous neurobiological studies have suggested that stereotypic motor behaviors in RTT may arise from dysfunction within specific motor circuits rather than from broader behavioral dysregulation.^[22] These findings indicate that behavioral features in RTT may consist of both interconnected behavioral clusters and relatively independent motor manifestations.

4.5. Caregiver education and behavioral reporting

The present study did not find significant differences in K-RSBQ scores according to caregiver educational level. This finding suggests that caregiver educational level was unlikely to introduce systematic bias in reporting behavioral characteristics in this cohort. Because caregiver-reported questionnaires rely on subjective interpretation of behaviors, potential reporting bias is an important consideration in questionnaire-based studies. The absence of significant differences between caregiver education groups therefore supports the reliability of caregiver-reported behavioral data in this context.

4.6. Distribution of CARS scores

Analysis of CARS scores revealed that a substantial proportion of individuals with RTT in this cohort exhibited elevated CARS scores, with approximately 41% of participants falling within the range typically associated with more severe autism-related behaviors. Several studies have noted that individuals with RTT may exhibit behavioral features that resemble autism spectrum disorder, particularly during early developmental stages.^[26] Previous studies have reported that many children with RTT initially present with behaviors resembling autism, including reduced social interaction, impaired communication, and repetitive behaviors.^[26] However, RTT represents a distinct neurodevelopmental disorder with a specific genetic etiology, most commonly involving pathogenic variants in the *MECP2* gene.

Item-level analysis further indicated that the highest mean scores were observed in the imitation and verbal communication domains. These findings are consistent with previous reports describing marked impairments in communication and social interaction in individuals with RTT, particularly during the regression stage of the disorder.^[17] Such impairments may contribute to the appearance of autism-like behavioral features during clinical evaluation.

In contrast, relatively lower scores were observed in domains related to sensory responses, including auditory response and responses to taste, smell, and touch. This pattern suggests that behavioral abnormalities related to social communication may be more prominent than sensory disturbances in this cohort. Previous studies have similarly reported that impairments in communication and social interaction represent key behavioral features of RTT.^[17]

4.7. Limitations

Several limitations should be considered when interpreting the findings of this study. First, the sample size was relatively modest, although it remains substantial for a rare genetic disorder such as RTT. Second, the study relied on caregiver-reported questionnaires, which may be influenced by subjective interpretation or recall bias. Third, as this was a secondary analysis of an anonymized survey dataset, detailed clinical information such as seizure history, head circumference (including microcephaly), and other neurological comorbidities were not systematically available, limiting the ability to fully characterize the clinical phenotype of the study population. Finally, the cross-sectional design limits the ability to evaluate longitudinal changes in behavioral characteristics over time. Future studies incorporating longitudinal follow-up and objective behavioral assessments may provide a more comprehensive understanding of the behavioral trajectory of individuals with RTT. Recent therapeutic developments, including the approval of trofinetide, further highlight the importance of reliable behavioral outcome measures in both clinical practice and research settings.^[27,28]

5. Conclusions

In summary, this study provides a descriptive analysis of behavioral characteristics in Korean individuals with RTT using caregiver-reported assessment tools. Stereotypic hand behaviors were the most prominent behavioral feature observed in this cohort, while other behavioral domains showed greater variability. Behavioral characteristics measured by the K-RSBQ were not significantly associated with age, suggesting relative stability of behavioral profiles in this population. Correlation analyses indicated that certain behavioral features, particularly those related to mood and nighttime behaviors, may be inter-related, whereas stereotypic hand movements appear relatively independent from other behavioral characteristics. Additionally, a substantial proportion of participants exhibited elevated CARS scores, reflecting overlapping autism-like behavioral features in individuals with RTT.

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