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**RESEARCH**

# Prevalence of psychiatric comorbidity and related variables in children with specific learning disabilities

## Özgül öğrenme bozukluğu olan çocuklarda psikiyatrik komorbidite yaygınlığı ve ilişkili değişkenler

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**Abstract**

**Purpose:** Psychiatric comorbidity is more common in specific learning disabilities (SLDs) than in the general population. It is extremely common. Psychiatric disorders associated with SLD cause more cognitive, social, and emotional difficulties, further impair functionality and worsen prognosis. This study aimed to examine the frequency of psychiatric comorbidity and the sociodemographic characteristics and clinical variables associated with comorbidity in children with SLD.

**Materials and Methods:** This study included 226 children and adolescents aged 7-17 years who were diagnosed with specific learning disabilities and who applied to our outpatient clinic between March 2021 and August 2021. A battery of tests was administered to all participants, including the Reading Test, Writing Test, Mathematics Test, Clock Drawing Test, Head Right-Left Discrimination Test, and Bender Gestalt Visual-Motor Perception Test. In addition, the Kent-EGY Test-Porteus Maze Test (PMT) or the Weschler Intelligence Scale for Children (WISC-R) were administered. A semi-structured diagnostic interview was conducted with the participants and their parents to investigate the presence of any psychopathology in the past and present (Turkish version of the Turkish version of the Schedule for the Interview for Affective Disorders and Schizophrenia for School-Age Children-Present and Lifetime Version (DSM-5-K-SADS-PL-DSM-5-T) was applied.

**Results:** There was at least one comorbid psychiatric disorder in 81.4% of the participants. The most common comorbid disorder was attention deficit hyperactivity disorder, with a frequency of 73.5%. Other common disorders were disruptive behavior disorders, elimination disorders, anxiety disorders, depressive disorders, and tobacco use disorders. Severe types of SLD were more

**Öz**

**Amaç:** Psikiyatrik bozukluk komorbiditesi, özgül öğrenme bozukluğunda (ÖÖB) genel popülasyona kıyasla daha fazladır ve son derece yaygındır. ÖÖB ile ilişkili psikiyatrik bozukluklar daha fazla bilişsel, sosyal ve duygusal zorluklara neden olmakta, işlevselliği daha da bozmakta ve prognozu kötüleştirmektedir. Bu çalışmanın amacı, ÖÖB olan çocuklarda psikiyatrik komorbidite sıklığını ve komorbidite ile ilişkili sosyodemografik özellikleri ve klinik değişkenleri incelemektir.

**Gereç ve Yöntem:** Bu çalışmaya Mart 2021 ile Ağustos 2021 tarihleri arasında polikliniğimize başvuran ve özgül öğrenme güçlüğü tanısı almış 7-17 yaş arasındaki 226 çocuk ve ergenler dahil edilmiştir. Tüm katılımcılara Okuma testi, Yazma testi, Matematik testi, Saat Çizme Testi, Baş Sağ-Sol Ayrım Testi, Bender Gestalt Görsel-Motor Algı Testi uygulanmıştır. Ayrıca Kent-EGY Testi-Porteus Labirent Testi (PMT) veya Weschler Çocuklar için Zeka Ölçeği (WISC-R) uygulanmıştır. Katılımcılar ve ebeveynleri ile yarı yapılandırılmış tanısal görüşme yapılarak geçmişte ve günümüzde herhangi bir psikopatoloji olup olmadığı araştırılmıştır (Okul Çağı Çocukları İçin Duygulanım Bozuklukları ve Şizofreni Görüşme Çizelgesi-Şimdi ve Yaşam Boyu Versiyonu'nun Türkçe versiyonu uygulanmıştır (DSM-5-K-SADS-PL-DSM-5-T).

**Bulgular:** Katılımcıların %81,4'ünde en az bir komorbid psikiyatrik bozukluk vardı. En sık görülen komorbid bozukluk %73,5 ile dikkat eksikliği hiperaktivite bozukluğudur. Diğer yaygın bozukluklar yıkıcı davranış bozuklukları, eliminasyon bozuklukları, anksiyete bozuklukları, depresif bozukluklar ve tütün kullanım bozukluklarıdır. Psikiyatrik komorbiditeleri olanlarda ağır ÖÖB türleri daha yaygındı ve ortalama yaş, olmayanlara kıyasla önemli ölçüde daha yüksekti.

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common in those with psychiatric comorbidities, and the mean age was significantly higher than in those without.
**Conclusion:** Being aware of the psychiatric comorbidity that children with SLD are called to face is essential for drawing up proper standards of assessment, hence ensuring these children have personalized psychiatric care and enhancing their quality of life.
**Keywords:**. Specific learning disorder; psychiatric comorbidity; attention deficit hyperactivity disorder; mood and anxiety disorders; elimination disorders; tobacco use disorders

**Sonuç:** ÖÖB olan çocukların karşı karşıya olduğu psikiyatrik komorbiditenin farkında olmak, uygun değerlendirme standartlarının oluşturulması, dolayısıyla bu çocuklara kişiselleştirilmiş psikiyatrik bakım sağlanması ve yaşam kalitelerinin artırılması için gereklidir.

**Anahtar kelimeler:** Özgül öğrenme bozukluğu; psikiyatrik komorbidite; dikkat eksikliği hiperaktivite bozukluğu, duygudurum ve anksiyete bozuklukları; eliminasyon bozuklukları; tütün kullanım bozuklukları

## INTRODUCTION

Specific learning disability (SLD) is a condition observed in children with normal or above-normal intelligence, in which the child performs poorly in listening, reading, written expression, or math skills compared to their peers and intelligence, despite having received a standard and adequate education. According to the Diagnostic and Statistical Manual of Mental Disorders (DSM-5), SLD is a neurodevelopmental disorder characterized by the presence of disorders including dysgraphia, dyslexia, and dyscalculia together or separately[1]. The prevalence of SLD amongst school-age children has been estimated to be 5-15%, and its severity can vary as mild, moderate, and severe[1].

In addition to the difficulties experienced in the academic field, daily living activities, and social and family functionality may also be impaired and this may provide a basis for the development of some psychiatric disorders in children with SLD. Although the rate of comorbid psychiatric disorders varies depending on the heterogeneity in study settings, methodologies, age groups, and case definitions of the studies, it has been reported that this rate is higher in children with SLD compared to their healthy peers[2-9]. In epidemiological studies, the rate of comorbid psychiatric disorders in SLD was reported to be approximately 30%, whereas this rate was reported as high as 92.5%, in studies with clinical samples[2-5]. These comorbid psychiatric conditions can be seen as internalizing and externalizing disorders in a spectrum including attention deficit hyperactivity disorder (ADHD), depression, anxiety, suicide, and alcohol and substance abuse. The common finding of many studies on this subject is that the most prevalent psychiatric comorbidity accompanying SLD is ADHD with a high frequency of 82%[2-7]. However, there is less data on comorbid internalizing disorders such as anxiety and depression in SLD. Still, the studies indicate that the rate of internalizing symptoms is also higher in SLD compared to the general population[5]. Moreover, it is known that psychiatric disorders accompanying SLD cause a vicious cycle, cause more cognitive, social, and emotional difficulties, and further impair functionality, thus worsening the prognosis. Thus, it is recommended that children diagnosed with SLD should be evaluated in terms of other psychiatric conditions and treated if any comorbid psychopathology is detected[2,4,5].

In the previous studies, it has been emphasized that there is a need for more studies on psychiatric comorbidity in SLD and revealing the sociodemographic characteristics and clinical variables associated with comorbid psychiatric conditions. Therefore, studies revealing more data on comorbid psychiatric conditions in SLD would raise awareness in terms of preventing the risk of developing comorbid conditions in clinical practice and would have a beneficial effect on the prognosis. However, the number of studies on this subject is limited. Thus, this study aimed to examine the prevalence of comorbid psychiatric conditions and associated sociodemographic characteristics and clinical variables, in children with SLD. The primary hypotheses of the study posit that psychopathology in children with specific learning disabilities (SLD) may be influenced by various demographic and clinical variables, including age, IQ value, type and severity of SLD, participation in special education, and previous psychopathologies.

## MATERIALS AND METHODS

### Sample

After power analysis, this study included all children

and adolescents between the ages of 7-17 years who were diagnosed with specific learning disabilities and applied to our outpatient clinic between March 2021 and August 2021. The Biostatistics Department determined that a minimum of 216 participants should be included in the study. A total of 226 patients applied during this period. The participants were selected from the patients who applied to the Sivas Cumhuriyet University Faculty of Medicine, Child and Adolescent Psychiatry Clinic and the Malatya İnönü University Faculty of Medicine, Child and Adolescent Psychiatry Clinic. SLD severity was determined according to the DSM-5 diagnostic criteria for SLD.

To minimize the effect of confounding factors, those with any chronic medical condition including epilepsy and cerebral palsy, sensory impairment (auditory and visual), those with a history of major head trauma, those with a defined syndrome diagnosis, and those with inadequate sociocultural opportunity (factors other than IQ and SLD, such as intense psychosocial deprivation, lack of family support during the acquisition of academic skills, and inadequate educational opportunities, may affect learning) were excluded from the study.

To evaluate the reading, writing, and maths skills in detail, the Reading test, Writing test, Maths test, Clock Drawing Test, Head Right-Left Discrimination Test, and Bender Gestalt Visual-Motor Perception Test were applied to each participant. In addition, the Kent-EGY Test-Porteus Maze Test (PMT) or Weschler Intelligence Scale for Children (WISC-R) to evaluate the verbal and performance intelligence quotient (IQ) were applied. Given that the instructions in the WISC-R are standardized and cannot be altered, the Kent Porteus test was administered to bilingual individuals, those lacking adequate social support, younger children, those with low socioeconomic status, those with stimulus deficits, and those with high anxiety levels during the test.

A semi-structured diagnostic interview was conducted with the participants and their parents to investigate whether there was any psychopathology in the past and present (Turkish version of the Schedule for Affective Disorders and Schizophrenia for School-Aged Children- Present and Lifetime Version was applied (DSM-5-K-SADS-PL-DSM-5-T).10,11 Informed consent was obtained after the participants and their parents were given clear and detailed information about the study.

Power Analysis: The study included children and adolescents aged 7-17 years who voluntarily applied to our outpatient clinic between March 2021 and August 2021 and were diagnosed with SLD. A minimum of 216 participants were included in the study, with a biostatistics $\alpha$ of 0.05 and d of $\pm$ 0.04, resulting in a 95% confidence interval (CI) of 6%-14%. The p-value was 0.10% and the q-value was 90%. The study was approved by the ethics committee and lasted for six months. The Biostatistics Department included all patients who presented during the six months, resulting in 226 referrals.

## Measures

### Turkish version of the Schedule for Affective Disorders and Schizophrenia for School-Aged Children–Present and Lifetime Version [K-SADS-PL-DSM-5-T]

The semi-structured interview form is utilized to identify current and lifelong psychopathologies in children and adolescents. The language used is clear, concise, and objective, with a formal register and precise word choice. The first part of the interview schedule includes questions about the child's sociodemographic characteristics, family background, complaints, developmental history, health status, and general functionality at school and home. The text follows conventional structure and formatting features, including consistent citation and footnote style. The content of the improved text closely mirrors the source text, with no additional aspects added. The second section includes screening questions that evaluate over 200 specific symptoms, both past and present. The third part presents evaluation and observation results to confirm DSM-5 diagnoses. Scoring is based on information obtained from the family and the child, as well as the clinician's observations[12]. The validity and reliability of the scale were studied by Gökler et al. in 2004[13].

### Kent EGY Test

The Kent Verbal Test is a brief assessment consisting of 10 items, designed for individuals aged 6-14 and adults who may have an intellectual disability. The test is not timed and does not measure speed, but rather evaluates knowledge and language abilities[14].

### The Porteus Mazes Test

The PMT is a test of non-verbal performance intelligence. It measures behavioral disinhibition,

non-verbal planning skills, visual-spatial perception, novelty adaptation, and executive functioning. Technical term abbreviations are explained when first used.

The language is clear, objective, and value-neutral, with a formal register and precise word choice. It consists of 12 mazes of increasing complexity arranged according to chronological age and was adapted into Turkish by Togrol. The test is based on the principle that the child can find the way out of the labyrinths. The text adheres to conventional structure and format, with consistent citation and footnote style. The structure is clear and logical, with causal connections between statements. The text is free from grammatical errors, spelling mistakes, and punctuation errors. No changes in content have been made[15,16].

### Specific learning disorder (SLD) test battery

The battery was developed to assess reading, writing, and basic arithmetic skills, as well as to identify impairments in visual perception, sequencing skills, right-left discrimination, lateralization, and fine motor skills, which are commonly associated with SLD. It comprises nine tests. The assessment includes reading and writing tests, questions related to the alphabet, addition and multiplication tables based on the grade level, inquiries about the month and day, and questions about priority-subsequence relationships. Additionally, the assessment includes tests such as Gessel figures, clock drawing, head right-left discrimination, and Harris lateralisation[17].

### Wechsler Intelligence Scale for Children-Revised (WISC-R)

The Wechsler Intelligence Scale for Children-Revised (WISC-R), which is an updated version of the WISC developed by Wechsler in 1949, underwent revision in 197418. Studies were conducted to standardize, validate, and establish the reliability of the Turkish version[19].

## Procedure

The study was conducted at the Cumhuriyet University Faculty of Medicine with the approval of the Clinical Research Ethics Committee (Approval date: 10 February 2021Approval number: 2021-02/19).

The study was conducted at Cumhuriyet University and İnönü University. This study centers is a university hospital and a center where research assistant doctors are trained and specialized. All applications (e.g. patient data and tests performed) are subject to strict security and confidentiality policies.

All files are stored in a secure database and can only be accessed by authorised personnel. All cases underwent a complete psychiatric and psychopathology examination based on DSM-5 criteria, conducted by a specialist child and adolescent psychiatrist. Ethical approval for the study was obtained from the local ethics committee and the study was conducted by Good Clinical Practice procedures and the current revision of the Declaration of Helsinki.

## Statistical analysis

The data were analyzed by using IBM SPSS 22.0 (SPSS Inc., Chicago, IL, USA). Normality was tested by a one-sample Kolmogorov-Smirnov test. All data were expressed as mean±standard deviation (SD), number (n), median (min-max), or percentage (%) as appropriate. Comparisons of the groups were performed by using the chi-square test and Fisher's exact test for categorical variables and the Mann–Whitney U test for continuous variables. A value of $p<0.05$ was considered statistically significant.

# RESULTS

The mean age of the sample was 9.24±2.18 years, 68.6% (n=155) of the participants were male and 31.4% (n=71) were female. It was found that 67.7% (n=153) of the patients lived in the urban area and 52.7% (n=119) were from low economic status. While 48.2% (n=109) of the mothers had primary education level or below, 42.0% (n=95) were high school graduates, and 9.8% were university graduates, 38.5% (n=87) of the fathers had primary education level or below, 39.4% (n=89) were high school graduates, and 22.1% (n=50) were university graduates. It was found that 77.4% (n=175) of the mothers and 20.8% (n=47) of the fathers were unemployed. The sociodemographic characteristics of the participants are given in Table 1.

**Table 1. Sociodemographic and clinical characteristics of participants**

| Variables | Number (%) or mean±SD |
|---|---|
| Age (mean-years±SD) | 9.24±2.18 |
| Gender (n,%) | |
| Male | 155 (68.6) |
| Female | 71 (31.4) |
| Place of residence (n,%) | |
| Urban | 153 (67.7) |
| Rural | 73 (32.3) |
| Family Income Level (n,%)† | |
| The minimum wage/less than minimum wage | 119 (52.7) |
| Above the minimum wage | 107 (47.3) |
| Maternal education level (n,%) | |
| Primary education and lower | 109 (48.2) |
| High school level | 95 (42.0) |
| University level | 22 (9.8) |
| Maternal occupation (n,%) | |
| Employed | 51 (22.6) |
| Unemployed | 175 (77.4) |
| Paternal education level (n,%) | |
| Primary education and lower | 87 (38.5) |
| High school level | 89 (39.4) |
| University level | 50 (22.1) |
| Paternal occupation (n,%) | |
| Employed | 179 (79.2) |
| Unemployed | 47 (20.8) |

The level of income was determined by the minimum wage value on the date of the study.

In our sample, 49.1% (n=111) of the children had mild SLD, 34.5% (n=78) had moderate, and 16.4% (n=37) had severe SLD. When the children were assessed according to the types of SLD, 39 (17.3%) had pure dyslexia, 9 (4.0%) had pure dyscalculia, 17 (7.5%) had pure dysgraphia, and the majority of the sample (71.2%, n=161) had combined type SLD. It was detected that 34.1% (n=77) of the participants had previously received or are currently receiving special education. Regarding the IQ scores of the children, the verbal IQ average score was 92.16±8.26, the executive IQ average score was 108.21±9.24 and the total IQ average score was 101.14±7.09. The clinical features of SLD are shown in Table 2.

**Table 2. Clinical features of participants**

| Variables | Number (%) or mean±SD |
|---|---|
| Severity of SLD (n,%) | |
| Mild | 111 (49.1) |
| Moderate | 78 (34.5) |
| Severe | 37 (16.4) |
| Types of SLD (n,%) | |
| Dyslexia | 39 (17.3) |
| Dyscalculia | 9 (4.0) |
| Dysgraphia | 17 (7.5) |
| Combined | 161 (71.2) |
| Verbal IQ (mean±SD) | 92.16±8.26 |
| Performance IQ (mean±SD) | 108.21±9.24 |
| Total IQ (mean±SD) | 101.14±7.09 |
| Previously and/or currently attending special education (n,%) | |
| Yes | 77 (34.1) |
| No | 149 (65.9) |

SLD, Specific Learning Disorder

In our sample, 92 children (40.7%) had previously been admitted to the psychiatry outpatient clinic for SLD or another reason, and 86 children (38.1%) had previously been diagnosed with SLD or another psychiatric disorder. The rate of a history of psychiatric treatment in the past (behavioral therapy only, or combined treatment i.e., behavioral therapy + pharmacotherapy) was 35.4% (n=80). Regarding the current psychiatric comorbidities of the cases, most of them (81.4%, n=184) had one or more accompanying psychiatric disorders. The most common comorbid condition was ADHD with a rate of 73.5% (n=166). Other accompanying psychiatric disorders include disruptive conduct disorders with a rate of 30.1% (n=68), elimination disorders with a rate of 15.5% (n=35), anxiety disorders with a rate of 14.6% (n=33), depressive disorders with a rate of 14.2% (n=32), obsessive-compulsive disorder (OCD) with a rate of 3.1% (n=7), trauma-related disorders with a rate of 2.7% (n=6), and tic disorders with a rate of 2.7% (n=6), respectively. It was found that 5.8% (n=13) of the children and adolescents in our sample were tobacco smokers, but alcohol and substance use were not observed among the participants. In addition, in the clinical evaluations performed according to DSM-5,[1] no eating disorders, somatoform disorders, psychosis, or bipolar disorder were observed in children. Comorbid psychiatric disorders accompanying SLD are shown in Table 3.

**Table 3: Psychiatric comorbidity in children with SLD**

| Variables | Number (%) |
|---|---|
| Previously referred to psychiatry outpatient clinic | |
| Yes | 92 (40.7) |
| No | 134 (59.3) |
| Presence of previous psychiatric diagnosis | |
| Yes | 86 (38.1) |
| No | 140 (61.9) |
| Previous psychiatric treatment | |
| Yes | 80 (35.4) |
| No | 146 (64.6) |
| Presence of current psychiatric comorbidity | |
| Yes | 184 (81.4) |
| No | 42 (18.6) |
| Kinds of psychiatric comorbidity | |
| Attention deficit hyperactivity disorder | 166 (73.5) |
| Disruptive conduct disorders | 68 (30.1) |
| Elimination disorders | 35 (15.5) |
| Anxiety disorders | 33 (14.6) |
| Depressive disorder | 32 (14.2) |
| Tobacco Use Disorder | 13 (5.8) |
| Obsessive-compulsive disorder | 7 (3.1) |
| Trauma and stressor-related disorders | 6 (2.7) |
| Tic disorders | 6 (2.7) |

SLD, Specific Learning Disorder

We found that no sociodemographic characteristics were significantly different between the groups with and without comorbid psychiatric disorder(s) accompanying SLD, except for age ($p > 0.05$, for all). However, the mean age of children with psychiatric comorbidity was significantly higher than those without ($9.87 \pm 2.32$ vs. $7.96 \pm 1.03$, $p < 0.001$). In addition, children with psychiatric comorbidities had significantly lower mean total IQ scores than those without ($p=0.026$), but mean verbal and performance IQ scores did not differ significantly between the two groups. There was no statistically significant difference between the two groups in terms of the severity of SLD. Additionally, it was observed that the presence of any type of SLD in pure or combined form did not affect the presence of comorbid psychopathology significantly ($p=0.071$). Children with psychiatric comorbidities had a significantly higher rate of past and/or present participation in special education compared to children without

psychiatric comorbidity (39.1% vs. 11.9%, p=0.001). Similarly, the rate of admission to a psychiatry clinic in the past, being diagnosed with a psychiatric disorder previously, and receiving treatment were significantly higher in children with psychiatric comorbidities compared to those without (p <0.001, for all). The clinical features of children with and without psychiatric comorbidity are presented in Table 4.

**Table 4. Clinical characteristics of children with and without psychiatric comorbidity**

| Variables | Psychiatric Comorbidity Yes (n=184) | Psychiatric Comorbidity No (n=42) | p-value* |
|---|---|---|---|
| Age (mean-years±SD) | 9.87±2.32 | 7.96±1.03 | **<0.001** |
| Verbal IQ (mean±SD) | 93.05±8.18 | 94.41±8.04 | 0.096 |
| Performance IQ (mean±SD) | 107.61±8.87 | 109.43±9.9 | 0.067 |
| Total IQ (mean±SD) | 100.36±6.81 | 102.71±7.40 | **0.026** |
| Severity of SLD (n,%) | | | 0.246 |
| Mild | 86 (46.7) | 25 (59.5) | |
| Moderate | 65 (35.4) | 13 (31.0) | |
| Severe | 33 (17.9) | 4 (9.5) | |
| Types of SLD (n,%) | | | 0.071 |
| Any SLD type alone | 48 (26.1) | 17 (40.5) | |
| Combined | 136 (73.9) | 25 (59.5) | |
| Previously and/or currently attending special education (n,%) | | | **0.001** |
| Yes | 72 (39.1) | 5 (11.9) | |
| No | 112 (60.9) | 37 (88.1) | |
| Previously referral to psychiatry outpatient clinic (n,%) | | | **<0.001** |
| Yes | 85 (46.2) | 7 (16.4) | |
| No | 99 (53.8) | 35 (83.3) | |
| Presence of previous psychiatric diagnosis (n,%) | | | **<0.001** |
| Yes | 80 (43.5) | 5 (11.9) | |
| No | 104 (56.5) | 37 (88.1) | |
| Previous psychiatric treatment (n,%) | | | **<0.001** |
| Yes | 76 (41.3) | 4 (9.5) | |
| No | 108 (58.7) | 38 (90.5) | |

The chi-square test for categorical variables and the Mann–Whitney U test for continuous variables were employed to test group differences. Bold font indicates statistical significance: p< 0.05.
Abbreviations: SLD, Specific Learning Disorder. IQ, Intelligence Quotient.

In subsequent analyses, existing psychopathologies were grouped into two predominantly externalizing disorders (conductive disorder, oppositional defiant disorder, ADHD/hyperkinesis, etc.) and predominantly internalizing disorders (depression, anxiety, obsessive-compulsive disorders, trauma-and-stressor-related disorders, and somatic symptom and related disorders, etc.). Since elimination disorders, tic disorders, and tobacco use disorders were not found alone without other psychopathologies, they were included in either the internalizing or externalizing group according to the other predominant diagnosis. Accordingly, 69.6% (n=128) of those with accompanying psychopathology had predominantly externalizing disorders, and 30.4% (n=56) had predominantly internalizing disorders. While externalizing disorders were significantly more common in boys and internalizing disorders were more common in girls (p<0.001). The mean age of those with externalizing disorders was significantly smaller compared to those with internalizing disorders (9.10±2.12 vs. 10.30±3.45, p=0.002). It was found that the income level, place of residence, education, and working status of parents did not differ significantly between the groups with predominantly externalizing disorders and predominantly internalizing disorders (p >0.05, for all). In addition, the type of comorbid psychopathology did not differ significantly according to the severity of SLD (p=0.236). The type of accompanying psychopathology (externalizing disorders or internalizing disorders) did not differ significantly according to the type of SLD, either it

was a combined type or any type of SLD alone (p=0.824). The comparison of clinical and sociodemographic characteristics according to the predominant type of comorbidity is given in Table 5.

**Table 5. Comparison of clinical and sociodemographic characteristics according to the predominant type of comorbidity**

| Variables | Predominantly externalizing disorders** (n=128) | Predominantly internalizing disorders*** (n=56) | p-value* |
|---|---|---|---|
| Gender (n, %) | | | <0.001 |
| Male | 110 (85.9) | 20 (35.7) | |
| Female | 18 (14.1) | 36 (64.3) | |
| Age (mean-years±SD) | 9.10±2.12 | 10.30±3.45 | 0.002 |
| Severity of SLD (n, %) | | | |
| Mild | 57 (44.5) | 29 (51.8) | 0.236 |
| Moderate | 44 (34.4) | 21 (37.5) | |
| Severe | 27 (21.1) | 6 (10.7) | |
| Types of SLD (n, %) | | | 0.824 |
| Any SLD type alone | 34 (26.6) | 14 (25.0) | |
| Combined | 94 (73.4) | 42 (75.0) | |

*The chi-square test for categorical variables and the Mann–Whitney U test for continuous variables were employed to test group differences. Bold font indicates statistical significance: p< 0.05.
**Conduct disorder, oppositional defiant disorder, attention deficit hyperactivity disorder/hyperkinesis, etc.
***Depression, anxiety, obsessive-compulsive, and trauma-and-stressor-related disorders, somatic symptom and related disorders, etc.
Abbreviations: SLD, Specific Learning Disorder

It was found that SLD was accompanied by at least one psychopathology in 83.9% (n=130) of boys and 76.1% (n=54) of girls, and there was no significant difference between genders in terms of the presence of comorbid psychopathology (p=0.161). Similarly, the presence of obsessive-compulsive disorder and tic disorders did not differ between genders (p >0.05 for both). However, the presence of ADHD, disruptive behavior disorders, elimination disorders, and tobacco use disorder was significantly higher in boys compared to girls (all p values <0.05), while anxiety disorders, depressive disorder, and trauma and stress-related disorders were significantly higher in girls compared to boys (p <0.05, for all). The distribution of psychiatric comorbidity by gender is given in Table 6.

**Table 6. Gender differences in psychiatric comorbidity**

| Variables | Males (n=155) | Females (n=71) | p-value* |
|---|---|---|---|
| Psychiatric comorbidity (n,%) | 130 (83.9) | 54 (76.1) | 0.161 |
| Attention deficit hyperactivity disorder (n,%) | 123 (79.4) | 43 (60.6) | **0.003** |
| Disruptive conduct disorders (n,%) | 65 (41.9) | 3 (4.2) | **<0.001** |
| Elimination disorders (n,%) | 31 (20.0) | 4 (5.6) | **0.006** |
| Anxiety disorders (n,%) | 14 (9.0) | 19 (26.8) | **<0.001** |
| Depressive disorder (n,%) | 9 (5.8) | 23 (32.4) | **<0.001** |
| Tobacco Use Disorder (n,%) | 21 (13.5) | 3 (4.2) | **0.035** |
| Obsessive compulsive disorder (n,%) | 3 (1.9) | 4 (5.6) | 0.210 |
| Trauma and stressor-related disorders (n,%) | 1 (0.6) | 5 (7.0) | **0.005** |
| Tic disorders (n,%) | 5 (3.2) | 1 (1.4) | 0.668 |

The chi-square test and Fisher's exact test (as appropriate) for were employed to test group differences. Bold font indicates statistical significance: $p< 0.05$.

## DISCUSSION

In this study, comorbid psychiatric conditions accompanying SLD and associated sociodemographic characteristics and clinical variables were investigated in a clinical sample diagnosed with SLD. The results of our study showed that 81.4% of children with SLD also had at least one

comorbid psychiatric condition, however, the type of the comorbid psychopathology was independent of the type and severity of SLD. On the other hand, the mean age of those with comorbid psychopathology was significantly higher, and the mean total IQ score was significantly lower. The rates of participation in special education, previous admission to a psychiatry clinic, and being diagnosed with a psychiatric condition and receiving treatment were found to be significantly higher in those with comorbid psychopathologies. This finding suggests that even if children receive special education, they continue to have difficulties in academic and daily life.

In previous studies, the rate of comorbid psychiatric disorders was found to be higher in children with SLD compared to healthy peers[2-9]. It has been reported that these comorbid conditions may be a direct result of the same deficit/problem in the central processing patterns that cause learning problems, as well as the difficulties that SLD causes in a child's life functional impairment[5]. It has been shown that the results regarding the frequency of psychiatric disorders accompanying SLD vary according to the methodology of the studies, and the frequency increases even more in the clinical sample. In recent studies, the prevalence of comorbid psychiatric conditions has been reported to be as high as 92.5%, in the clinical sample[2-5]. In our study, at least one comorbid psychiatric disorder was present in 84.1% of the participants and this finding is consistent with previous studies. When the types of comorbid psychopathologies were examined, it was found that the most common comorbid diagnosis was ADHD with a rate of 73.5% and it was followed by disruptive conduct disorders, elimination disorders, anxiety disorders, depressive disorder, tobacco use disorder, obsessive-compulsive disorder, trauma-related disorders, and tic disorders, respectively. Except for these, no other type of psychopathological condition was detected. This finding indicates that children with SLD have a higher incidence of psychiatric comorbidities than expected[2,4-6]. We also found that the presence of psychiatric comorbidity did not significantly differ according to the severity and type of SLD. This finding suggests that SLD can pave the way for other psychopathologies regardless of the type and severity. However, there are also studies reporting that the disease is more severe in patients with comorbid ADHD[2,5].

The study found that children with psychiatric comorbidities had a significantly higher mean age than those without. This finding can be explained by the fact that the difficulties and problems caused by SLD may become chronic with age and may predispose to other mental disorders[4]. As a matter of fact, studies have shown that the rate of psychopathologies increases with age in children with learning disabilities[4]. In addition, it was found that the total IQ levels were significantly lower in children with psychiatric comorbidities compared to those without. This result may be attributed to the fact that lower IQ levels in SLD may predispose to psychopathology, also it may be associated with lower performance in tests due to the neurocognitive effects of concomitant psychopathologies on cognitive functions, processing speed, attention, and concentration. In a study, it was found that SLD patients with low intelligence scores learned to read and write later and had more comorbid psychiatric disorders[2].

When the comorbid conditions accompanying SLD were grouped as internalizing disorders and externalizing disorders, the mean age of those with comorbid internalizing disorders was found to be significantly higher. This situation causes learning, academic, and functional problems caused by SLD to affect self-esteem negatively with age, leading to a negative self-evaluation, higher levels of trait anxiety, hopelessness, social skills problems, difficulties in social adaptation, and higher rates of depression[4,6]. It can also be explained by the fact that younger children are more likely to reveal their problems by behavioral responses (such as anger tantrums, aggression, and offensiveness) rather than verbal expression due to their limited ability to express their difficult experiences verbally[6]. On the other hand, in a study, it was found that mood disorders and externalizing pathologies/disorders are more common in the late stages of SLD[7]. Different results may be related to the methodology of the study, such as the source of cases, the criteria used to identify psychopathology, and the age-group, gender or sociodemographic status. The results of our study may be explained by the fact that adolescence is a sensitive period of life due to important physiological, psychological, and cognitive changes. This may cause difficulties in coping with stressful situations in the normal population, leading to the development of internalizing disorders that tend to increase with age[21]. Another finding of our study was that those with comorbid externalizing disorders had significantly lower total IQ scores. This finding

suggests that pathologies such as ADHD in the externalizing disorders cluster may be associated with neuropsychological test performance.

When the psychopathologies accompanying SLD were compared according to gender, it was seen that OCD and tic disorders did not differ between genders. However, while ADHD, disruptive conduct disorders, elimination disorders, and tobacco use disorders were significantly higher in boys, depressive disorders, anxiety disorders, and trauma and stressor-related disorders were significantly higher in females. In summary, internalizing disorders are significantly more prevalent in girls, while externalizing disorders are more common in boys. Our findings are consistent with the results of studies showing that more expressive symptoms are seen in boys and more inward symptoms in girls[8,9,22]. Studies have shown that boys with learning disabilities display a negative attitude in the classroom, express their emotions outwardly, and verbally explode, while girls show an even more introverted and depressive attitude by internalizing their academic disappointment[23,24]. When the frequency of psychopathologies accompanying SLD was examined one by one, it was found that ADHD was the most common comorbidity (73.5%); this finding is compatible with the literature[2-7]. In a recent systematic review study, it was found that the frequency of ADHD accompanying SLD varies between 12.3% and 82.3%[5]. In another study, the prevalence of ADHD in children with SLD was found to be between 18% and 60% (median prevalence: 38.2%), and this prevalence was approximately 7 times higher than the prevalence of ADHD in the general population[25,26]. Although there is no data on which condition starts first in the high association of ADHD and SLD, a common etiology including some neurological, psychiatric, and genetic explanations has been suggested. The most commonly accepted hypothesis is that both disorders have a common genetic basis and both disorders are associated with common hereditary factors and a strong genetic predisposition[12,27-29]. In one study, ADHD and SLD were found to belong to similar specific alleles, and the strong genetic link between ADHD symptoms and SLD was confirmed in twin studies[28,30,31]. Therefore, it is stated that ADHD and SLD share some common neuropsychological functioning deficits and these deficits may be associated with working memory and processing speed[27,29]. In addition, it is emphasized that overlapping appearances are quite common due to the similarity of symptoms in both disorders[4]. Considering the common etiology and similar symptoms, it has been emphasized that every case of SLD should be evaluated for ADHD, and vice versa. This approach can help minimize the impact of these conditions on the academic and psychosocial functionality of affected children[5,32].

Disruptive behavior disorders were the second most common psychiatric condition(s) associated with SLD in this study. In a study, disruptive conduct disorders were found five times more in children with SLD compared to the normal population[32]. In another study, it was reported that conduct disorder develops three times more in children with SLD compared to those without SLD[33]. In studies, disruptive behavior disorders were observed more frequently in SLD cases compared to non-SLD cases, and it has been reported that the presence of both SLD and ADHD poses a risk for other disruptive behavior disorders and there is a bidirectional relationship between the two conditions[33,34]. In support of this, it was determined that more conduct problems were reported by families and teachers in cases with both ADHD and SLD together and ADHD was thought to be a factor in the development of conduct disorders[35].

The third most common psychiatric condition in children with SLD was elimination disorders with a frequency of 15.5%. In a recent study investigating the psychiatric comorbidities in children with SLD, enuresis was found in 25% of the children encopresis was found in 6.3% of the children[2]. However, in the literature, no study specifically focuses on the association of elimination disorders in SLD. In a study conducted on enuretic children, however, the prevalence of SLD was shown to be higher than in controls and this was attributed to developmental delay[36]. As in disruptive behavior disorders, it has been observed that the association of elimination disorders in SLD increases with the coexistence of ADHD[2]. It has been emphasized that enuresis, associated with the coexistence of SLD and elimination disorders, disrupts the sleep cycle or affects attention functions by affecting the cyclic alternating pattern and may cause learning difficulties[36]. In addition, this association has been explained by the fact that enuresis is closely related to locus ceruleus dysfunction and the locus ceruleus has a significant effect on attention and learning[37]. Accordingly, it appears that dysfunction of the locus coeruleus is the underlying cause of the association

between SLD and enuresis[2]. However, a definite cause-effect relationship cannot be stated, since in this study, we were not able to test the possibility that the relationship between SLD and enuresis could be bidirectional. There is a need for detailed studies on this subject.

Anxiety disorders were the fourth most common psychiatric disorders after elimination disorders in children with SLD. Previous studies have also shown that the rate of anxiety disorders was higher in children with SLD compared to the normal population, and SLD can facilitate the development of anxiety and mood disorders[2,38-41]. In a systematic review study, the prevalence of comorbid anxiety disorders in SLD was found to be between 24.64% and 28.8%[5]. Moreover, it has been emphasized that children with SLD display more anxiety symptoms and have higher anxiety scores without a specific anxiety disorder[40]. Although anxiety disorders were not individually separated in our study, in studies conducted on this subject, specific phobias, separation anxiety disorder, generalized anxiety disorder, and social phobia were found to be higher in children with SLD, depending on age and developmental level[2,4]. Regarding anxiety symptoms and anxiety disorders observed in SLD, it is emphasized that anxiety develops secondary to learning disability, as situational anxiety becomes chronic due to academic failure experienced by children during learning problems. This explanation is supported by studies suggesting that anxiety and anxiety disorders in SLD are secondary to learning and academic problems[40,42]. This explanation is supported by studies suggesting that anxiety and anxiety disorders in SLD are secondary to learning and academic problems[40,3]. In our study, another frequently observed psychopathological condition was depressive disorder which was detected in 14.2% of the children, and this rate was found to be higher than the reported prevalence of depression (5%) in children and adolescents[1]. Our finding is consistent with the results of previous studies showing that the frequency of depression increased in SLD[29]. In a systematic review study, it was found that the prevalence of depression in children with SLD varied between 8.8% and 10.8%[5]. The relationship between depression and SLD may also be bidirectional, learning problems and negative academic life seen in children with SLD may cause a depressive mood, and a depressed mood may also impair attention, memory, and learning processes, causing problems in completing tasks that require a high motor and cognitive skills, and exacerbate learning problems. Also, the presence of a certain common brain dysfunction was thought to be a factor in the development of both depression and SLD[5,8]. Thus, it was emphasized that investigating the frequency of SLD in children with depression would help to explain the nature of the relationship between these two disorders.

In the current study, unlike other studies, tobacco use disorder, alcohol, and substance use in children with SLD were also investigated. It was found that 5.8% of the children with SLD were smokers, while alcohol and substance use were not detected. This result may be because the children included in the sample included adolescents in terms of age range. In addition, considering that tobacco use disorder is considered in the risk-taking behavior group and is more common in children and adolescents with ADHD, the high frequency of tobacco use disorder in our study can also be explained by the high rate of coexistent ADHD. In addition, poor academic performance and dysfunction in children with SLD are known predictors of the risk of beginning tobacco use disorder[45]. In a study comparing adolescents with and without learning disabilities, it was found that adolescents with learning disabilities and accompanying ADHD smoke tobacco and use cannabis more frequently[46]. In another study, it was stated that children with SLD are more likely to start smoking cigarettes at an earlier age than children without SLD[6]. Comprehensive studies are needed on this subject.

The strengths of this study are its larger sample size compared to previous studies, the fulfillment of robust exclusion criteria for all conditions that may confuse and affect mood, and the use of semi-structured interview techniques for psychopathology screening. However, some limitations of this study should be considered. First, the study included only children and adolescents presenting to tertiary child and adolescent psychiatry clinics, which may have resulted in a more complex clinical presentation and higher psychiatric diagnosis rates and symptom levels than children and adolescents with general SLD. Second, it is possible to mention relationships only, since this study is a cross-sectional method that does not allow us to make causal inferences and which limits our ability to claim the causality direction of the relationships. Third, although our sample size was quite large, the accompanying p sychiatric comorbidities could not be compared according to

the types of SLD, since the rates of pure existence of each SLD type were not large enough to allow statistical comparison. Fourth, regression analysis was not employed for advanced analysis methods. In light of these weaknesses, the results of this study need to be replicated and deepened by future studies addressing the psychiatric comorbidity in children with SLD. It seems that future studies that include larger sample sizes, the use of both clinical and non-clinical samples, and designing prospective longitudinal studies would help us to achieve more conclusive results.

In conclusion, SLD does not exist in isolation; it is not only related to education and academic problems but also closely associated with other psychiatric conditions and poor well-being. Therefore, it is very important to screen children with SLD for comorbid disorders routinely, as well as academic difficulties. Appropriate intervention depending on a comprehensive screening would be efficient on prognosis, mental health, and well-being. Given the very high rates of psychiatric comorbidity in children with SLD, our results also highlight the need for psychiatric cognitive and behavioral approaches and psychopharmacological treatments in addition to the special education intervention and rehabilitation programs offered to children with SLD. In this context, improving clinicians' awareness of the high rates of psychiatric comorbidity in children with SLD, attempts to screen for psychiatric comorbidities, and training expert trainers in SLD to serve in special education centers are important steps to be taken in this area.

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