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Research Paper – Araştırma Makalesi

## COULD EARLY LITERACY SCORES AFFECT THE DIAGNOSIS OF SPECIFIC LEARNING DISORDER IN CHILDREN AT RISK

### ERKEN OKURYAZARLIK PUANLARI RİSK ALTINDAKİ ÇOCUKLARDA ÖZEL ÖĞRENME BOZUKLUĞU TANISINI ETKİLER Mİ?

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#### Özet

Bu çalışmanın amacı, Özel Öğrenme Bozukluğu (ÖÖB) riski altındaki okul öncesi çocukların erken okuryazarlık becerilerini değerlendirmektir. Bu amaçla ÖÖB'li çocukların kardeşleri, konuşma bozukluğu olan çocuklar ve sağlıklı kontrollerin Erken Okuryazarlık Testi (EROT) puanlarını karşılaştırdık. 60-72 aylık çocuklar çalışmaya alındı. Toplam katılımcı sayısı 81'dir. Sosyodemografik Veri Formu, Renkli Progresif Matrisler Testi (RPM) ve EROT tüm katılımcılara uygulanmıştır. Üç grup arasında EROT'un tüm alt testlerinde anlamlı farklar bulunmuştur. Konuşma bozukluğu olan çocuklar, kelime dağarcığı dışındaki tüm alt testlerde en kötü puanı almışlardır; bunu ÖÖB'li çocukların kardeşleri takip ederken, kontrol grubu ise en yüksek puanları almıştır. Mevcut çalışma, ÖÖB riski olan Türkçe gibi şeffaf bir dili kullanan okul öncesi çocukların EROT puanlarını araştıran ilk çalışmadır. Konuşma bozukluğu olan riskli grup, incelenen hemen hemen tüm alt testlerde en kötü performansı sergilemiştir. Bu grubun gelecekte en yüksek risk altında olacağını varsayarak müdahalelere erken başlamak kritik öneme sahiptir.

**Anahtar Kelimeler:** Disleksi, erken okuryazarlık, okul öncesi çocuklar, konuşma bozukluğu.

#### Abstract

The aim of this study was to evaluate the early literacy skills of pre-school children at risk of Specific Learning Disorder (SLD) by comparing Test of Early Literacy (TEL) scores between three groups including the siblings of children with SLD, children with speech disorder and healthy controls. Children between the age of 60-72 months were recruited. The total number of participants was 81. A sociodemographic Data Form, the Colored Progressive Matrices Test (CPM) and TEL were applied to all participants. A significant difference was determined between the performance of the three groups in all sub-tests of TEL. The children with speech disorder displayed the worst score in all sub-tests except vocabulary; this was followed by the siblings of children with SLD while the control group displayed the highest scores. The current study is the first investigating the TEL scores of pre-school children using a transparent language like Turkish at risk of SLD. The risky group with a language disorder showed the worst performance in almost all subtests examined. It is critical to start interventions early, assuming that this group will be at highest risk in the future.

**Keywords:** Dyslexia, early literacy, pre-school children, speech disorder.

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## 1. INTRODUCTION

Special Learning Disorder (SLD) is a very common neurodevelopmental disorder of childhood that causes impairment in the child's functionality in one or more areas (Silver et al., 2008, pp. 217-219). The prevalence of SLD in school-age children in DSM-5 was reported as 5-15%, and its prevalence in adults was reported as 4%. SLD is diagnosed more frequently in boys than in girls (American Psychiatric Association (APA), 2013, pp. 45-47). SLD is a neurodevelopmental disorder in which genetic, epigenetic and environmental factors are all implicated (American Psychiatric Association (APA), 2013, pp. 45-47). Risk factors thought to be involved in the etiology of SLD include family history, language structure impairment, specific language disorder, articulation disorder, phonological awareness problems, deficit in audio-visual processing and home literacy environment.

A meta-analysis study conducted by Snowling et al. in 2016 reported that an average of 45% of children who had a first-degree relative with a reading disorder were diagnosed with dyslexia (Snowling et al., 2016 pp. 498-545). Moreover, language development was reported to be necessary for reading and comprehension skills (Snowling, 2005, pp. 55-75). In addition, many studies have shown that delay in language development is associated with dyslexia (Bird et al., 1995 pp. 446-462; Pennington Bishop, 2009, pp. 60). While some studies have suggested that expressive language skills predict phonological awareness skills, others have reported the lack of any relationship between reading skills and expressive language skills (Bishop and Snowling, 2004, pp. 858; Carroll et al., 2017, pp. 9; Pennington and Bishop, 2009, pp. 60). Most studies indicate that specific language disorder can negatively affect reading skills.

Early literacy encompasses the knowledge, skills and attitudes of children before they start their formal literacy learning in the early period. This is the concept of "early literacy", which states that the child begins to experience reading and writing by interacting with their environment, this includes acquisition of some knowledge, skills and attitudes as a predictor of subsequent reading and writing skills (Whitehurst and Lonigan, 1998, pp. 848-872). Early literacy skills consist of phonological awareness, lettering awareness, letter and alphabet knowledge, vocabulary, listening comprehension, and writing (Aarnoutse et al., 2005, pp. 253-275; Dickinson and McCabe, 2001, pp. 186-202; Elliott and Olliff, 2008, pp. 551-556; Spira et al., 2005, p. 225).

Early literacy skills are thought to be directly related to vocabulary and language skills (van Viersen, et al., 2017, pp. 937-949). According to the word reconstruction theory, vocabulary knowledge is effective in the development of phonological awareness through phonological symbols. According to this theory, as new words are added to a child's mental dictionary and its density increases, segmental restructuring of lexical items begins to form more elaborate phonological symbols (Metsala and Walley, 1998, pp. 89-120). Many studies have shown that there is a significant, linear relationship between vocabulary and reading comprehension skills (Armbruster, 2010, pp. 125-138; Beck et al., 2002; Greene et al., 2002, pp. 465).

Alphabet knowledge is the ability of children to realize that words are made of letters, that letter sounds are used to transfer words to the verbal language, and that different words are formed by combining different letters (Bennett-Armistead et al., 2005, pp. 235-280). Letter-phonetics is the understanding that each letter has a sound. Letter naming is a skill that describes

the phonemic representation of a visual symbol. Knowing the sound of the letter is more difficult, it needs to know the phonetic representation of each letter individually. In other words, it is more necessary to know the sounds of letters in the development of phonological awareness skills (McBride-Chang, 1999, pp. 285-308). Phonological awareness is the ability to distinguish the similarities and differences in sounds that make up words (Bennett-Armistead et al., 2005, pp. 235-280). From a developmental point of view, phonological awareness skills include skills such as word, syllable, first and last phonetic awareness, rhyme and phoneme awareness (Phillips et al., 2008 pp. 3-7). Many studies suggest that phonological awareness, even in different languages, is a predictor of dyslexia and a risk factor for SLD (Goswami et al., 2000, pp. 11-30). In addition, children who have familial risk but without SLD can have impairments in phonological awareness skills not severely. It's believed that the impairment in phonological awareness skills might have an genetic basis, its indicated as an endophenotype (Gellert Elbro, 2017, pp. 227-237; Moll et al., 2013, pp. 385-397; Pennington Lefly, 2001, pp. 816-833; Snowling et al., 2003, pp. 358-373). Vocabulary is the sum of words understood when read, heard (receptive vocabulary), or written and spoken (expressive vocabulary). Listening or reading comprehension, on the other hand, is making a meaning out of the text read by someone or by the child themselves. This requires the knowledge of grammar, vocabulary, comprehension strategies and the text being read (Bennett-Armistead et al., 2005, pp. 89-105). Comprehension is a highly complex process, while vocabulary and understanding begin to develop mutually. Children who read aloud learn more new words and the child who learns more new words starts to understand more complex stories. This suggests that listening comprehension is a necessary skill for reading comprehension (McGee Morrow, 2005, pp. 58-91).

Learning disability, which is a developmental disorder and whose effects can last a lifetime, is difficult to diagnose in the preschool period. For this reason, it is recommended to use the term 'at risk' for suspected learning disabilities in the preschool period (Snowling and Melby-Lervag, 2016, pp. 498-545). Identification of children at risk can be very valuable in terms of early diagnosis, follow-up and intervention. In addition, the prevention of possible failures at school of these children could also be protective in terms of mental health. In the current study, we aimed to evaluate early literacy skills at the preschool period in children at risk for learning disabilities. We planned to test the hypothesis that the literacy skills of children in the risk group would be lower than those of children in the control group. The Test of Early Literacy (TEL) scores of children with speech disorders, who are known to be in the risk group for SLD, was compared with preschool children with a family history of SLD and a control group using a transparent language such as Turkish.

## 2. METHODS

### 2.1. Participant selection

A pilot study was conducted between March 2017 and June 2017 in order to calculate the sample size. Calculation of the difference between the averages of the groups with the F test, taking the common  $sd=3$  at 85% power, 0.05 significance level, suggested that 27 individuals were required for each group. The total number of participants to be recruited was therefore calculated as 81. Before applying the early literacy test to all children included in the study, the colored progressive matrices test was applied and children with normal mental



development were included in the study. Additionally, illiterate children were included in the study.

## **2.2. Procedure**

Children who were admitted to the Ankara University Faculty of Medicine, Department of Child and Adolescent Psychiatry Outpatient Clinic, children who had a sibling between 60-72 months of age with a diagnosis of speech disorder and SLD, and healthy controls were included in the study. All the children and parents were informed about the study and volunteers were involved. Informed consent was obtained from all individuals included in the study. Ethical committee approval was obtained from the Clinical Research Ethics Committee, Ankara University Faculty of Medicine, with the decision number 11- 624-17. The Parents of the children involved in the study filled out a Sociodemographic Information Form. The Colored Progressive Matrices Test (CPM) and TEL were applied to all children recruited to the study. Children who scored an average of less than 25% according to their age in the CPM test were not included in the study.

## **2.3. Data Collection Tools**

*The Sociodemographic Information Form* consisted of questions containing the sociodemographic characteristics (age, gender, history, family history of the children and their parents) was prepared by the authors of the current study.

*The Colored Progressive Matrices (CPM)* is a test developed to evaluate mental development and intellectual maturity. The reliability, validity and norm studies for this test has been conducted for the Turkish population Revised and arranged in a parallel form, the CPM consists of 36 pieces, with 3 sets of 12 each. Individuals who score an average of less than 25% in this test are classified as intellectually low (Bildiren A. 2017, pp. 13-20).

*The Test for Early Literacy (TEL)* was developed by Kargin et al. in 2015, and its validity and reliability study was conducted on children between 60-72 months of age attending kindergarten. TEL consists of 7 sub-tests: receptive language, expressive language, general naming, functional knowledge, letter knowledge, phonological awareness, and listening comprehension.

## **2.4. Statistics**

Statistical analyses were carried out using the SPSS 23.0 statistical package program. Research data were summarized by using descriptive statistics such as number and percentage distributions and minimum, maximum, mean and median values. Pearson Chi-Square Test and/or Fisher's Exact Test were used to test the distribution of categorical variables in terms of group factor. The Kruskal-Wallis Test was applied because parametric test conditions could not be met in examining the difference between continuous variables between the three groups. A p value of <0.05 was considered to be statistically significant.

### 3. RESULTS

The study consisted of a total of 81 children with 27 participants in each group. Sociodemographic results were shown in the Table 1. There was no statistically significant difference in the mean age in months between the three groups. The speech disorder group consisted of 21 girls (77%) and 6 boys (23%), the SLD sibling group consisted of 10 girls (37%) and 17 boys (63%), while the healthy control group consisted of 17 girls (63%) and 10 boys (37%). There was no significant difference in gender distribution between the speech disorder and control groups, while a statistically significant difference between the SLD sibling group and the speech disorder and control groups were identified. There was no statistically significant difference in the educational status of the parents between the three groups both for the mother and father. A statistically significant difference in the mother's age was identified only in the speech disorder group. A statistically significant difference was also identified in the socioeconomic levels between the three groups, the speech disorder group and the SLD sibling group showed a similar level of socioeconomic status, while the same in the control group was higher. A statistically significant difference in the age of onset of speech was identified between the three groups. The age of onset of speech was earliest in the control group, followed by the SLD sibling group, and finally the speech disorder group.

**Table 1: Sociodemographic Characteristics of the Groups**

Groups	Speech Disorder		SLD Sibling		Control		
	Count	Percent	Count	Percent	Count	Percent	
Gender							p=0.009 <sup>1</sup>
Female	21	77.7	10	37.0	17	63	
Male	6	23.3	17	63.0	10	37	
	<b>Median</b>	<b>Min-Max</b>	<b>Median</b>	<b>Min-Max</b>	<b>Median</b>	<b>Min-Max</b>	
Maternal age (years)	32	25-40	35	29-44	35	24-46	$\chi^2=7.81^2$ p=0.012 <sup>2</sup>
Age of onset of speech (months)	24	12-42	18	12-36	15	9-18	$\chi^2=32.18^2$ p=0.000 <sup>2</sup>
Mother's educational status	<b>Count</b>	<b>Percent</b>	<b>Count</b>	<b>Percent</b>	<b>Count</b>	<b>Percent</b>	p=0.184 <sup>1</sup>
Primary education	13	48.1	7	25.9	5	18.6	
High school	9	33.3	13	48.1	13	48.1	
University	5	18.6	7	25.9	9	33.3	
Father's educational status							p=0.054 <sup>1</sup>
Primary education	11	40.8	12	44.4	3	11.1	
High school	7	26.0	5	18.6	12	44.4	
University	9	33.3	10	37	12	44.4	
Socioeconomic Status (SES)							p=0.015 <sup>1</sup>
Lower SES	10	37.0	7	25.9	1	3.8	
Medium SES	10	37.0	11	40.8	9	33.3	
Upper SES	7	26.0	9	33.3	17	62.9	

SLD: Special Learning Disorder; Min: Minimum; Max: Maximum; 1 Pearson chi-square 2 Kruskal-Wallis test p<0.05





The children included in the study were compared according to the vocabulary sub-test of the TEL. TEL results were shown in the Table 2. The median value of the vocabulary total score was 30 in the speech disorder group (min-max: 20-44), 33 in the SLD sibling group (min-max; 22-45), and 39 in the control group (min-max; 29-47). These differences between the groups were statistically significant. A statistically significant difference was also identified in the subtests of the vocabulary test (receptive language, expressive language, general naming, and word knowledge) between the groups. Significant differences were identified only in the receptive language subtest scores between the speech disorder and SLD sibling groups, in the vocabulary total score and all subtests between the speech disorder and control groups, and expressive language, general naming subtests and vocabulary total score between the SLD sibling group and control group.

Pairwise comparisons were conducted between the groups to understand which groups had the difference in vocabulary scores. Except for the receptive language subtest, no difference was found between the speech disorder and SLD sibling groups in terms of other subtests and vocabulary total scores. A statistically significant difference was found between the total vocabulary score and subtest scores of the speech disorder and control groups. There was no difference between all subtests and vocabulary total scores between the SLD siblings group and the control group, except for receptive language and word knowledge.

The median total score of the phonological awareness subtest of the TEL was 10 in the speech disorder group (min-max: 2-19), 16 in the SLD sibling group (min-max:12-21), and 17 in the control group (min-max:15-27). The difference in all subtests and phonological awareness total scores was found to be statistically significant between the three groups except for the sound matching subgroup. The difference between the subtests rhyme awareness, word separation, syllable separation and syllable concatenation as well as total scores was statistically significant between the speech disorder group and the SLD sibling group. In addition, the difference in all subtests and total scores was statistically significant between the speech disorder and the control groups. The difference in word separation, syllable separation, syllable concatenation subtests and phonological awareness total scores between the SLD sibling group and the control group was statistically significant.

Pairwise comparisons were conducted between the groups to understand which groups had the difference between the phonological awareness average scores in the groups. A statistically significant difference was found between the speech disorder group and the SLD sibling groups in rhyme awareness, word separation, syllable separation, syllable concatenation subtests and phonological awareness total scores. A statistically significant difference was found between the speech disorder and the control group in all phonological awareness subtests and phonological awareness total scores. A statistically significant difference was found between the total scores of word separation, syllable separation, syllable concatenation subtests and phonological awareness between the SLD sibling group and the control group.

A comparison of the TEL listening comprehension subtest score between the three groups indicated that the median value was 2 in the speech disorder group (min-max: 0-5), 3 in the SLD sibling group (min-max: 1-5), and 4 in the control group (min-max: 1-16); these differences were statistically significant. A statistically significant difference was also found in the pairwise comparison of listening comprehension scores between the three groups.

Pairwise comparisons were conducted between the groups to understand which groups had the difference in listening comprehension scores. A statistically significant difference was found between the listening comprehension scores at all groups.

**Table 2: Comparison of the TEL Scores of the Groups**

Groups	Speech Disorder			SLD Sibling			Control			
	Median	Min	Max	Median	Min	Max	Median	Min	Max	
Recipient language	12	6	14	12	10	15	13	10	15	$\chi^2=15,52$ $p=0.001^*$
Expressive language	7	4	14	8	3	13	10	6	15	$\chi^2=18,71$ $p=0.000^*$
General nomenclature	5	2	9	6	3	10	7	3	10	$\chi^2=18.01$ $p=0.000^*$
Function information	6	3	10	7	3	10	8	4	10	$\chi^2=11.83$ $p=0.005^*$
Vocabulary total	30	20	44	33	22	45	39	29	47	$\chi^2=22.51$ $p=0.000^*$
Recipient language lettering	1	0	4	2	1	7	3	2	7	$\chi^2=28.42$ $p=0.000^*$
Expressive lettering	0	0	2	1	0	2	1	0	6	$\chi^2=21.10$ $p=0.000^*$
Letter information total	1	0	6	3	1	9	4	2	13	$\chi^2=31.72$ $p=0.000^*$
Rhyme awareness	2	0	3	3	1	4	2	1	4	$\chi^2=10.71$ $p=0.008^*$
Initial sound pairing	1	0	3	2	0	4	2	0	4	$\chi^2=9.96$ $p=0.015^*$
Final audio matching	2	0	3	2	0	4	2	1	4	$\chi^2=4.29$ $p=0.137^*$
Word separation	1	0	3	4	0	3	3	1	4	$\chi^2=45.39$ $p=0.000^*$
Syllable separation	3	0	4	4	3	4	4	3	4	$\chi^2=33.70$ $p=0.000^*$

Syllable concatenation	3	0	4	3	2	4	4	3	4	$\chi^2=32.31$ $p=0.000^*$
First sound off	-	-	-	-	-	-	-	0	3	$\chi^2=8.76$ $p=0.016^*$
Final sound off	-	0	1	-	0	1	-	0	2	$\chi^2=14.69$ $p=0.001^*$
Phonological awareness	10	2	19	16	12	21	17	15	27	$\chi^2=50.81$ $p=0.000^*$
Listening comprehension	2	0	5	3	1	5	4	1	6	$\chi^2=32.99$ $p=0.000^*$

SLD: Special Learning Disorder; Min: Minimum; Max: Maximum; \*Kruskal-Wallis test  $p<0.05$

## 4. DISCUSSION

The current study compared preschool children with speech disorder or siblings of children with SLD with healthy controls and with each other for their sociodemographic parameters and EROT scores. A statistically significant difference was identified in the gender distribution between the groups in the current study. This difference was particularly evident between the speech disorder and SLD sibling groups with the number of boys in the former being significantly lower than the number of boys in the latter. It is culturally accepted in Turkey that males speak later than females and that speech disorder will improve over time. Because of this point of view, it is likely that girls with speech disorders are more likely to apply to the clinic earlier than boys. However, the effect of this difference on the data collected appears to be limited, as gender did not affect the test score when the validity and reliability of TEL was evaluated (Kargın et al., 2015, pp. 237-268). No significant difference in age distribution was identified between the groups. The validity and reliability study of TEL showed that there was no significant difference in the TEL scores of children aged 60-72 months; thus, any potential effect of age was already considered in the study.

A significant difference in the maternal age was identified between the speech disorder group and the other two groups with the maternal age being lower in the speech disorder group. Studies have shown that younger mothers may create an insufficient literacy environment for the child, which may be a risk factor for dyslexia (Fergusson Woodward, 1999, pp. 479-489; Mascheretti et al., 2015, pp. 120-129). No significant difference in the level of education of the mother or father was identified between the 3 groups in the current study. Many studies have shown the role of parental education in the development of dyslexia (Sun et al., 2013, pp. 258-293). In particular, a higher level of education of the mother ensures that the mother has good communication skills with her child and contributes to the child's language development. It also helps the mother to create a better home literacy environment for her child (Lewis et al., 2013, pp. 258-293).





The socioeconomic status (SES) of the children in the control group was found to be higher than the other two groups in the current study. When the effects of SES on the children's early literacy skills are examined, the diversity of written materials provided by families to their children and the time spent by the child and parents on literacy activities (reading books together, word games, etc.) are directly proportional to the SES (Gonzalez et al., 2011, pp:475-483). This is corroborated by the fact that the children in the risk group in the current study also had a lower SES.

A significant difference in the age of onset of speech was identified between the three groups. Thus, children in the speech disorder group were found to have the onset of speech relatively late while the control group had a relatively early onset of speech. Delayed language development is common in children with dyslexia (Bishop Snowling, 2004, pp. 858; McArthur et al., 2000, pp. 869-874; Melby-Lervåg et al., 2012, pp. 322). A rich vocabulary is considered to facilitate phonological awareness and can positively affect phonological processing performance (Goswami, 2000, pp. 133-151; Walley, 1993, pp. 286-350). The current study also showed that the phonological awareness and phonological speed was affected in the speech disorder group, supporting the findings in the literature.

In accordance with the hypothesis of the current study, significant differences in the total score of vocabulary knowledge was found between the groups. While the children in the two risk groups scored lower than the controls, this difference was especially evident between the speech disorder and the control groups. Thus, the vocabulary of the children is an important prerequisite for semantically correct meaning of the words that are read. Although children with limited vocabulary use correct pronunciation when they start reading, it is difficult for them to reach concrete meanings from these words if they cannot find an answer in their vocabulary. Thus, reading comprehension skill, which is necessary for reading, will not be realized (Kargin et al., 2017, pp.237-268).

We observed that poor receptive language skills were notable only in the speech disorder group and not in the SLD group. Previous studies suggest that receptive language delay can be seen in children with SLD; however, it has been suggested that being in the risk group does not necessarily cause receptive language delay (Clay, 2005, pp. 358-396). Considering the findings of the current study in the light of the literature, children with speech disorders and accompanying receptive language delay should be followed-up closely for dyslexia.

Expressive language skills could differentiate the risk group from the control group in the current study. Other studies have shown that expressive language is an important predictor of dyslexia (Scarborough, 1990, pp.1728-1743; Torppa et al., 2010, pp. 308-321). Expressive language skills require fast and accurate associations between the symbols of words; such skills may be defective in children with SLD (Menghini et al., 2011, pp. 199-213). In the subtest measuring expressive language skills in TEL, children are required to name the object they see within ten seconds of looking at the pictures. Considering the difficulties that children with SLD experience in both working memory (Menghini et al., 2011, pp. 199-213) and processing speed (Shanahan et al., 2006, pp. 584), it is obvious that they may have difficulties in naming the objects in the pictures within the given limited time.

Letter knowledge is an important skill for the children's future reading speed and decoding performance (Treiman Rodriguez, 1999, pp. 334). Children who start primary school with letter knowledge from the pre-school period can acquire word decoding much earlier than those who do not. Studies have emphasized that letter knowledge is an important indicator in predicting children's reading success in the short and long term (Evans et al., 2006, pp. 959-

989; Leppänen et al., 2006, pp. 3-30). In the current study, the total letter knowledge scores of all groups were significantly different from each other, supporting the findings in the literature.

The level of phonological awareness in the preschool period is considered to be a variable that predicts literacy skills after starting school (Goswami et al., 2011, pp. 325-337). In addition, it has been shown that the phonological awareness skills of children with speech disorders in the preschool period was lower than those of children with risk of familial dyslexia (Carroll et al., 2017, pp. 9; Catts et al., 2005, pp. 1378-1396). The phonological awareness scores in the current study were the highest in the control group, followed by the SLD sibling, and the speech disorder groups, which is consistent with the hypothesis of the current study and supports previous findings reported in the literature. In the rhyme awareness test, which is a subtest of the phonological awareness test, no difference was found between the SLD sibling group and the control group. This lack of a significant difference may be related to the structural feature of Turkish as a language, since it is expected that the awareness of rhyme structures in a transparent language such as Turkish is simpler and is expected to be acquired more quickly than in other languages (Anthony Francis, 2005, pp.255-259).

Listening comprehension skill is considered to be an important prerequisite for the children's future reading skills and reading comprehension skills. The highest listening comprehension performance was found in the control group, followed by the SLD sibling group and the speech disorder group, supporting the study hypothesis. Listening comprehension skills in the early ages are an important predictor of reading comprehension skills in the future (Lonigan, Shanahan, National Institute for, 2009, pp. 157-168). In addition, problems with attention (Marzocchi et al., 2009, pp. 567-581), execution functions (Reiter et al., 2005, pp. 116-131), working memory (Menghini et al., 2011, pp. 199-213), and short-term memory are found in children diagnosed with SLD. Thus, these children at risk find it challenging to keep facts in mind; the listening comprehension subtest and phonological awareness subtest can be important indicators in differentiating risk groups from controls and from each other.

The current study has several strengths. It is the first study to evaluate the preschool TEL score of children at risk of dyslexia who speak a transparent language sample such as Turkish. An additional strength of the current study includes a comparison between children with speech impairment and siblings of children with SLD with healthy controls. However, the fact that there was no significant difference in the level of parental education and mental states between the groups enabled these important variables to be controlled, making the results of the study stronger.

The limitations of the current study are as follows: A significant difference in gender was identified between the groups. Speech disorder is usually more common in males. Based on the culturally accepted assumption in Turkey that boys will speak late and their speech disorder (if any) will improve over time suggest that parents may seek professional help for girls more often and earlier, which may have led to the skewed gender balance in the current study. We may eliminate this difference in the future by continuing the study prospectively and expanding the sample group. An additional limitation is the difference in both maternal age and SES between the groups. However, since clinical psychopathologies are mostly seen in families with low SES and in young mothers, it is perhaps not surprising that these variables were different between the clinical and control groups. Since there is no standardized measurement tool for the diagnosis of SLD, diagnostic consistencies may differ both in Turkey and worldwide. We attempted to minimize any diagnostic inconsistency in the current study by ensuring that a detailed evaluation of the patients and controls was carried out by a research



assistant specializing in child psychiatry, as well as a clinical child psychologist (both authors of the current study) for the clinical diagnosis of SLD.

In conclusion, the observations of the current study suggest that children in the risk group scored lower overall than the controls; the speech disorder group scored even lower than the SLD sibling group. The risky group with a language disorder showed the worst performance in almost all subtests examined. Thus, it is important to start interventions early, assuming that this group will be at highest risk in the future. Test performance of the SLD sibling group was worse than the control group; however, the scores were better than the speech disorder group. The fact that siblings of children with SLD have a certain level of neurobiological deficits relevant to SLD supports the view that this group may be an endophenotype. Such children may need early-onset preventive interventions since they constitute a risk group in the early period.

## 5. CONCLUSIONS

In our study, the risky group with a language disorder showed the worst performance in almost all subtests examined. It is critical to start interventions early in childhood preschool period, assuming that this group will be at highest risk in the future.

Further studies are clearly needed to evaluate possible risk factors such as maternal age, SES, home literacy environment to evaluate the risk of dyslexia in preschool children. The study participants should be followed-up prospectively; additionally, these children should be re-evaluated for SLD after they start formal education, in order to check whether the scores are consistent with the pre-school outcomes.

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### **Ethical considerations**

Ethical committee approval was obtained from the Clinical Research Ethics Committee, Ankara University Faculty of Medicine, with the decision number 11- 624-17.

### **Conflicts of Interest and Source of Funding**

There is no financial support. The manuscript has been read and approved by all the authors. There is no conflict of interest.

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