Journal of
Modern Rehabilitation
October 2020, Volume 14, Number 4

Research Paper: A Study of Word Reading in Persian-speaking Children With Dyslexia and Normal Ones

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Citation: Ahadi H, Nadarkhani R, Ghayoomi M. A Study of Word Reading in Persian-speaking Children With Dyslexia and Normal Ones. Journal of Modern Rehabilitation. 2020; 14(4):207-216. http://dx.doi.org/10.18502/jmr.v14i4.7718

http://dx.doi.org/10.18502/jmr.v14i4.7718

Article info:
Received: 21 Apr 2020
Accepted: 20 Jul 2020
Available Online: 01 Oct 2020

Keywords:
Dyslexia, Persian-speaking children, Reading skills, Reading patterns

ABSTRACT

Introduction: Reading is undoubtedly one of the most valuable skills of human beings. This complex behavior is composed of several distinct skills. Different theories about reading methods have been proposed and many researchers believe that reading methods varies in languages because of the different transparency in their orthography, so the purpose of this study is to investigate the Persian word reading pattern in children with dyslexia and normal children and compare their abilities.

Materials and Methods: For conducting this cross-sectional study, after issuing required permits, the elementary school children with dyslexia were identified by referring to learning disorders schools in Tehran City, Iran. After evaluating and diagnosing by the psychologist and speech therapist, 16 students with dyslexia were found. Then 32 normal age-matched students of Tehran's public schools were randomly selected from the available population as the control group. The reading and phonological awareness tests were then performed in different sessions. The results of the tests were recorded and the data were analyzed by the Mann-Whitney and Spearman tests in SPSS version 20.

Results: There was a significant difference between children with dyslexia and their age-matched normal group in reading skills and phonological awareness ($P<0.05$). In both groups, the mean percentage in reading irregular words was higher than the mean percentage of non-word reading. There is a significant correlation between reading speed and reading irregular words in both groups, and also between reading accuracy and reading non-words ($P<0.05$). There was a significant correlation between the reading speed and reading non-words in the group with dyslexia ($P<0.05$). But in normal children, there is no significant correlation between these tasks. This difference shows the problem of children with dyslexia pertains to reading non-words.

Conclusion: Based on the results of the present study, in children with dyslexia, there is a problem with reading non-words, and the dual-route of word reading has changed to only the whole word reading route. So it is important to consider phonological awareness skills training in children with dyslexia.

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1. Introduction

Children with different cognitive abilities use different reading patterns. Therefore, probably reading patterns of individuals with different abilities such as children with dyslexia is not the same. The International Dyslexia Association (2002) has defined dyslexia as a specific learning disability that is neurological in origin. It is characterized by difficulties with accurate and or fluent word recognition and by poor spelling and decoding abilities [1]. Prevalence of dyslexia ranges from 5% to 10%, depending on the primary language spoken in a population and the criteria used to identify the disorder [2]. In a simple view of reading (Guff & Tonmer: 1986), reading ability is defined as a skill of decoding and reading comprehension [3]. Word recognition in reading is related to the process of converting printed words into speech and expressive language and involves visual recognition of words which is called decoding. Word decoding is necessary for reading comprehension. [4].

In the early stages of learning reading, children focus on learning the correct word recognition and employ phonetic decoding strategies to express unfamiliar words [5]. Reading scientists believe that in early elementary school, from kindergarten to the third grade, word recognition and automatization develop, including automatic visual word recognition and strong phonetic decoding ability that increases the accuracy, fluency, and speed of reading [6]. The importance of word recognition ability in whole word reading cannot be ignored.

Among the types of reading patterns, the "dual-route of reading" pattern has received the most research [7]. In a study on children with superficial and phonological developmental dyslexia, it was found that the dual-route of reading patterns could provide a correct schema of children's reading behavior at all stages of reading development. Also, different types of reading problems can be interpreted and therapeutic strategies could be purposed [8]. One of the reasons for designing dual-route patterns in reading is the contrast between regular and irregular words. On the one hand, it is not possible to pronounce irregular words through graphemes-phonemes correspondence, and on the other hand, the fact that the reader can read new and unfamiliar regular chains of syllables indicates the presence of these rules [9].

Based on the dual-route of reading theory, the ability to recognize printed words is accomplished by two distinct and interactive processes, called lexical and non-lexical routes. By identifying the printed word, either lexically or non-lexically, the meaning associated with that word is activated in the mental lexicon. This lexicon contains individual concepts or stored vocabularies, along with information about the vocal structures of the words and the visual pattern. A written word that is repeatedly read is easily recognized and its pronunciation, spelling, and meaning are easily recognized, too [5]. Creating robust, automated visual vocabulary for children's reading is essential to facilitate the retrieval of pronunciation and the corresponding meaning of each word [7]. Given this pattern, the skilled reader has an internal lexicon in which the writing form of the familiar written word is stored [10]. In the non-lexical method, individual letters are first identified, and then the reader converts each character to a phonetic code and uses the combination of phonemes to pronounce words. Through the lexical route, it is possible to read familiar regular and irregular words, but non-words cannot be read from this route because they are pronounced by the use of grapheme-phonemic rules [7]. Attempts to read or spell non-words by the lexical pathway leads to generalized errors [11]. Based on the dual-route of written word processing, growth patterns assume that the reader acquires dual-route of reading. Thus, beginner readers first rely on the non-lexical route and then move towards using the lexical route [12].

The study of reading methods and providing patterns that can be used to explain the reading status of normal or reading-impaired individuals or even to design interventions for them is of great importance in any language community. In recent years, different research studies have emerged in the field of reading skill of children with dyslexia, but most of the studies targeted English students.

Oney and Goldman (1984) examined 20 students of the first and third grades learning to read Turkish and English on a pseudo-word reading task and a paragraph comprehension task. They found that Turkish students are faster and more accurate on the comprehension task than Americans. So they suggested that languages with more regular letter-sound correspondences lead to faster acquisition of decoding skills [13].

Wimmer and Goswami (1994) gave a nonsense word reading task and a number word reading task to a group of 7-9 years old children who were learning to read English and German. They could read nonsense words by analogy to the number words. The German children were better at reading nonsense words. This result is the evidence of using different strategies for word recognition in the two orthographies. German children relied on grapheme-phoneme conversion, but English children relied more on whole word reading [14].

Goswami et al. (2003) used a cross-language blocking experiment by using small-unit non-words and large-unit non-words [15]. These small-unit and large-unit non-words were either presented mixed in the same lists or separately. They found that English children have better performance in separate unit lists than the mixed lists because they have to switch back and forth between small-unit and large-unit processing and as a result, doing these tasks takes much more time. These findings can be interpreted as a different development in the grain size of the phonological recoding mechanisms in English and German children [15].

McDougall et al. (2005) presented a method that serves to estimate readers' reliance on sight vocabulary and phonetic decoding during real word recognition by applying process dissociation procedure to the reading of regular and exception words. Their new method allows us to explore normal reading acquisition and also the delay and deviance accounts of developmental dyslexia[1]. They presented evidence that developmental surface dyslexia was not simply a delayed reading deficit [16].

Ziatabar Ahmadi et al. (2010) compared the ability to identify the initial phoneme as phonetic awareness sub-skills in meaningful and meaningless words and phonemes in 5-6 years old Persian children. This study compared 100 normal children (50 girls and 50 boys) in Tehran´s kindergartens. The research tool was 24 words and 24 non-words. The results showed that in both groups identifying the initial phonemes of meaningful words was easier than that in non-words. Girls' scores on the designed tasks were slightly higher than boys [17].

Baharloo et al. (2010) examined the relationship between reading skills and non-word visual memory in first-grade girls by using the diagnostic reading test of Shirazi and Nilipour (2004). They examined 100 female students and found a significant relationship between reading accuracy and non-word visual memory and no correlation between reading speed and non-word visual memory. As a result, skills such as decoding and visual memory play an important role in reading, especially in reading correctly [18].

Ziegler et al. (2010) investigated the role of phonological awareness, memory, vocabulary, rapid naming in reading performance in five languages with different transparency, namely Finnish, Hungarian, Dutch, Portuguese, and French. This research was conducted on 1265 second-grade students. Their results showed that phonological awareness is a key factor in reading performance. Although their precise value varied, its impact was dependent on the transparency of the orthography, and the impact was stronger in less transparent orthographies [19].

Alipour et al. (2011) investigated the effect of phonological training on reading ability in second-grade boys with dyslexia. They examined 30 students of Shahr-e-Rey City, Iran by using phonological awareness tests, Wechsler verbal intelligence tests, and word reading and non-word tests. The results showed that phonological training enhances phonological awareness skills, reading speed, and accuracy of male students with dyslexia in word and non-word reading [20].

Oliveria et al. (2014) investigated reading component skills in dyslexia. They evaluated the components of the reading comprehension model and predictive skills on children and adolescents with dyslexia. A total of 40 children (8-13 years old) were divided into two groups: 18 children with dyslexia and 22 normal children. They found no group differences in the accuracy in oral language comprehension and reading comprehension, phonological awareness, naming, and vocabulary scores. The performance of children with dyslexia in word recognition was worse than that in the control group and this group was slower in naming. However, children with dyslexia could achieve a normal score on the reading comprehension test. Their result supported the importance of research in different reading strategies embedded in the word recognition component [21].

Chung and Lam (2019) investigated cognitive-linguistic skills underlying word reading and spelling difficulties in Chinese adolescents with dyslexia. They examined the co-occurrence of word reading and spelling difficulties for Chinese first language (L1) and English second language (L2) and the role of morphological awareness in word reading and spelling ability across two languages. A total of 110 Hong Kong Chinese-speaking students in grade 7, including 55 adolescents with dyslexia and 55 typically-developing adolescents participated in the experiment. They assessed the cognitive-linguistic measures of morphological awareness, phonological awareness, vocabulary knowledge, rapid naming, word reading, and word spelling and found that

1. Research studies show that there are two types of dyslexia: pure cases of developmental phonological dyslexia with dysfunctional phonetic decoding processing but with normal sight vocabulary processing; and pure cases of developmental surface dyslexia with dysfunctional sight vocabulary processing but with normal phonetic decoding processing.

adolescents with dyslexia had poorer performance in all L1 and L2 measures except the phonological awareness in Chinese than normal students. They further showed that in both groups of students, morphological awareness contributed uniquely to word reading and spelling in L1 and L2. Moreover, rapid letter naming contributed uniquely to English word spelling. The findings highlight that morphological awareness may play an important role in predicting word reading and spelling across languages for Chinese adolescents with dyslexia and those without difficulty [22].

Van Reybroeck and De Rom (2019) investigated reading inhibition deficit in children with dyslexia to demonstrate whether it is specific or general. Eighteen children with dyslexia from the fourth grade were compared with typically-developing children that were on both chronological age and reading level. They used a cognitive inhibition task and a reading inhibition task, consisting of reading sentences in which an expected word was replaced by an orthographic neighbor. Their results showed that the performance of the two groups in the cognitive inhibition task was the same, while the reading accuracy in children with dyslexia was less than the two control groups in the reading inhibition task, and they also were slower than children of the same age. Therefore, children with dyslexia had an inhibition deficit specific to the reading task. Their study showed the importance of more research on reading difficulties of children with dyslexia to find a better treatment approach [23].

Regarding the difference between the grapheme and writing system in different languages, the reading patterns can also be different. Writing transparency means the ease of predicting the pronunciation of the writing. Transparent languages are the ones that their writing representation and pronunciation are predictable such as Turkish, Italian, and Spanish, but opaque languages are the ones which their writing representation and pronunciation are not predictable such as English, French, and Arabic [1]. The transparency of the language determines the pattern of reading in different languages (with different transparency). So the reading pattern for each language should be investigated. This current research aimed at Persian to explore the pattern of reading in normal and Persian-speaking children with dyslexia. In this study, we not only try to compare the reading ability of students with dyslexia and normal ones but also study the reading patterns and the usage of the patterns in each group. Knowing the pattern of reading in normal children and children with dyslexia

2. Materials and Methods

Study participants

In this descriptive, analytic, and cross-sectional research, the study population consisted of all children with dyslexia in Tehran in their second grade. A total of 16 monolingual Persian-speaking children with dyslexia in Tehran who were referred to the Learning Disorders Center from November to December 2018 were selected as the experimental group (convenience sampling method). A total of 32 second-grade students of Tehran's public schools were randomly selected from the available population as the control group. Because of the small number of second-grade elementary school children attending dyslexia centers and some drop-outs during the assessment, 16 students with dyslexia and 32 normal students were selected for comparison. The inclusion criteria were being 7-8 years old, studying in the second grade of elementary school, having valid consent from their parents, gaining IQ > 80 assessed by the Wechsler scale for Iranian children, lacking psychiatric co-morbidities like attention deficit hyperactivity disorder or impairment in hearing or vision. The exclusion criteria included an incomplete assessment or non-cooperation of the child. Reading and phonological awareness tests were used for doing this study. The mean chronological age of the children with dyslexia was 95.31 months and their overall intelligence was 84.93 which is normal according to the psychologist.

Study materials

Reading test

Shirazi and Nilipour (2004) diagnostic reading test was used to assess reading skills. This is a solo test consisting of reading texts and supplementary tests. In this study, in addition to reading comprehension, the number of text words compared to reading time (reading speed) and the ratio of the number of correctly read words to the total number of text words is also measured (reading accuracy) [24].

A. Subtest for reading irregular words: The purpose of this subscale is to examine the subject's whole reading. The vocabulary of this section is selected in a way that cannot be read in phonetic reading (one-to-one grapheme-phoneme matching) and the reader must use other reading skills such as whole word reading or reading sight words.

B. Subtest for reading non-words: The purpose of this subscale is to examine the individual's ability to read

words that have never been seen before. As a result, their reading can only be done through the phonetic route by recognizing the individual letters and their corresponding sound and then combining these sounds. The syllable structure of these non-words varies and is based on the syllable structure of the Persian language.

C. Subtest for reading comprehension: This subtest consists of three texts. The purpose of this test is to determine to what extent the child can understand the texts and answer the questions. The student reads passages aloud, and then orally responds to comprehension questions after each passage. Fluency (reading speed) is calculated from the reading comprehension subtest by measuring the average number of words read correctly per minute. The texts were also used to calculate the reading accuracy by measuring the percentage of words that the student read them correctly.

D. Subtest for grapheme-phoneme correspondence: This subtest relates to the individual letters which represent individual sounds in the language and the student should read them aloud. Reliability for the subtests of the test is from 0.87 to 0.94 and the validity of the test ranges from 0.83 to 0.94.

Phonological awareness test

This test has ten subtests: syllable segmentation, homogeneity, rhyme recognition, phoneme blending, first phoneme recognition, final phoneme recognition, phoneme segmentation, deleting final phoneme and deleting middle phoneme. In the rhyme recognition subtest, the participants should recognize the monosyllabic words which have the same ending. Homogeneity includes recognizing the word with the same first phoneme. Reliability for the subtests of the test ranges from 0.85 to 0.96 and the validity of the test ranges from 0.76 to 0.97 [25].

Study procedures

The participants' parents are asked to give their written informed consent to take part in the study. The average duration of testing was about one hour that took place over two sessions. The participants' performance was recorded and for each correct answer, one mark was added to the total score. Then, the total score and the score of each subtest in two tests were determined and analyzed in SPSS V. 20. First, the Kolmogorov-Smirnov test was used to decide if the data were distributed normally. The test data were analyzed statistically. The comparison of the total scores between normal and children with dyslexia was done by the Mann-Whitney U-test. The relationship between variables was calculated by the Spearman correlation test.

3. Results

The purpose of this study was to investigate reading patterns in children with dyslexia and normal children. Descriptive statistics were used to describe central indices such as minimum, maximum, mean, and Standard Deviation (SD). Then, the reading speed and accuracy of reading in each group of irregular words and non-words were studied.

The next tables report the comparison of different reading subtests between the normal children and the dyslexic group. The Mann-Whitney test results were used to compare the mean scores of the two groups and the Spearman test results were used to examine the correlation of word reading skill with phonological awareness subtests and other reading skills (rate, accuracy, and perception of reading) scores in each group.

Table 1. Descriptive statistics of reading subtests in the normal group and dyslexic group

Groups	Subtests	Min.	Max.	Mean±SD
Normal	Reading speed (words per minute)	31.37	141.72	98.91±26.33
	Reading accuracy	93.33	100.00	99.46±1.57
	Irregular words reading	93.33	100.00	99.09±2.34
	Non-words reading	90.00	100.00	96.36±3.83
	Grapheme - phoneme correspondence	93.33	100.00	99.32±1.51
Dyslexia	Reading speed (words per minute)	13.59	120.88	57.25±24.10
	Reading accuracy	70.00	100.00	93.22±8.03
	Irregular words reading	26.67	100.00	90.00±19.77
	Non-words reading	70.00	100.00	88.75±8.06
	Grapheme-phoneme correspondence	88.33	100.00	96.97±3.28

Table 2. Descriptive statistics of phonological awareness subtests in the normal group and dyslexic group

Subtests	Dyslexia			Normal		
	Min.	Max.	Mean±SD	Min.	Max.	Mean±SD
Syllable segmentation	0.00	100.00	87.10±34.70	50.00	100.00	91.40±10.80
Homogeneity	0.00	100.00	71.90±26.10	60.00	90.00	79.00±8.70
Rhyme recognition	0.00	90.00	55.60±24.20	70.00	100.00	86.40±7.90
Phoneme blending	0.00	100.00	63.10±40.40	100.00	100.00	100.00±0.00
First phoneme recognition	0.00	90.00	51.90±34.10	70.00	100.00	89.50±9.00
Final phoneme recognition	0.00	90.00	50.60±33.40	60.00	100.00	83.10±9.90
Phoneme segmentation	0.00	100.00	58.70±30.90	70.00	100.00	84.10±8.00
Deleting final phoneme	0.00	100.00	74.40±37.40	60.00	100.00	93.60±9.00
Deleting middle phoneme	0.00	100.00	55.60±36.30	60.00	100.00	81.40±10.40
Deleting first phoneme	0.00	70.00	47.50±21.40	70.00	100.00	85.00±7.40
Total score	0.00	85.00	62.19±21.88	81.00	94.00	87.45±30.90

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Table 3. Comparison of different reading subtests between the normal group and dyslexia group

Subtests	Mann-Whitney test	Z	P
Reading speed (words per minute)	39.00	-4.05	0.000
Reading accuracy	41.00	-4.38	0.000
Irregular words reading	117.00	-2.25	0.024
Non-words reading	71.00	3.22	0.001
Grapheme-phoneme correspondence	78.00	-3.17	0.002

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Table 4. Comparison of phonological awareness subtests between normal group and dyslexic group

Subtests	Mann-Whitney test	z	P
Syllable Segmentation	176.00	0.00	1.00
Homogeneity	165.50	-0.23	0.75
Rhyme recognition	37.00	-4.23	0.00
Phoneme blending	33.00	-5.02	0.00
First phoneme recognition	32.50	-4.32	0.00
Final phoneme recognition	54.50	-3.68	0.00
Phoneme segmentation	94.50	-2.48	0.01
Deleting final Phoneme	110.00	-2.12	0.03
Deleting middle Phoneme	100.50	-2.28	0.02
First phoneme Deleting	1.50	-5.26	0.00
Total score	5.00	-5.07	0.00

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Table 5. Correlation between reading skills in the normal group and dyslexic group

Groups	Subtests	Irregular Words Reading	Non-words Reading
Normal	Reading speed	0.429*	0.384
	Reading accuracy	0.262	0.485*
	Grapheme-phoneme correspondence	0.403	0.092
Dyslexia	Reading speed	0.606*	0.614*
	Reading accuracy	0.357	0.645*
	Grapheme-phoneme correspondence	0.348	0.024

*P<0.05

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Table 6. Correlation between word reading and phonological awareness in normal group and dyslexia group

Subtests	Dyslexia		Normal	
	Irregular Words Reading	Non-words Reading	Irregular Words Reading	Non-words Reading
Syllable Segmentation	-0.418	-0.249	0.211	-0.066
Homogeneity	0.116	-0.266	0.345	0.218
Rhyme recognition	0.285	-0.527*	0.169	-0.130
Phoneme blending	-0.030	-0.157	-	-
First phoneme recognition	0.103	-0.215	-0.330	-0.261
Final phoneme recognition	-0.023	-0.452	0.143	-0.317
Phoneme segmentation	0.108	0.096	0.387	0.158
Deleting final phoneme	0.387	-0.195	0.389	-0.062
Deleting middle phoneme	0.301	-0.046	0.034	-0.134
First phoneme deleting	0.547*	0.207	0.310	-0.187
Total score	0.103	-0.202	0.159	-0.065

*P<0.05

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4. Discussion

As explained earlier, this study aimed to examine reading patterns in children with dyslexia and normal children who are Persian speakers. In this study, we want to compare the reading ability of students with dyslexia with normal children, and also to study the reading patterns on each group.

Based on the results of the study, the mean reading speed in normal children in the three reading texts was 98.91 words per minute, but in the children with dyslexia, the average reading speed in all three reading texts was 57.25 words per minute (Table 1). Besides, reading accuracy is also higher in the normal group. In the normal group, 99.46% of the words were correctly read, but in the group with dyslexia, 75.51% of the words were correctly read. In spite that the highest mean of phonological awareness, in normal group was related to Syllable Segmentation, but in children with dyslexia was related to Phoneme blending (Table 2) and also there is significant difference between two groups (in all subtest of phonological awareness), in both groups, the mean of irregular word reading was higher than the mean of non-word reading. According to the study results, there is a significant difference between children with dyslexia group and age-matched normal children in the reading speed, accuracy, and grapheme-phoneme correspondence (Table 3) (P<0.05).

The mean percentage of reading different words was also significantly different (P<0.05). Reading through the lexical route involves recognizing the familiar regular and irregular printed words as a general unit among the familiar words stored in the subjective lexicon. Thus the readers can attain the pronunciation or the meaning of words as they see the familiar word stored in their minds, and unfamiliar words do not appear in the lexicon. As a result, non-words could not be read through the lexical route, and more errors in reading non-words denote more reliance of both groups to the lexical route. Researchers also argue that a reader, who uses the lexical route to reach lexicon, relies on the vision only and can read the regular and irregular words easily, but they usually cannot read the non-words [7].

As we mentioned before, reading through the non-lexical route involves converting letters and chains of printed letters to their corresponding sounds, according to phoneme-grapheme correspondence rules. By using this route, we can read regular words, unfamiliar words, and pronounceable non-words [9]. Based on the data obtained, normal students initially used the lexical method and therefore had less error in reading irregular words, and after understanding the ineffectiveness of the lexical route in reading non-words, refer to the non-lexical route and read the non-word through it. The group with dyslexia is less inclined to switch from the lexical method to the non-lexical one, and they attempt to read the non-words in the same way of irregular words that result in more errors.

These findings are consistent with the findings of Ehrie [6] and Martin [7] that in the early stages of reading learning, children focus on learning the correct word recognition and then develop phonetic decoding strategies for

spelling unfamiliar words. The high percentage of errors in reading non-words is in line with McDougall's findings [16] which attempted to read or spell irregular words by the non-lexical route that leads to generalized errors.

A comparison of phonological awareness between the two groups (Table 4) shows a significant difference between the mean of some subtests of phonological awareness between the normal group and group with dyslexia (P<0.05). This finding shows that attention to phonological awareness in the treatment of dyslexia is necessary. This finding is consistent with Alipour et al. [19] who investigated the effect of phonological awareness on reading ability in children with dyslexia and showed that phonological training enhances phonological awareness skills, reading speed, and accuracy of word and non-word reading.

According to Table 5, there was a significant correlation between reading speed and reading irregular words in both groups, and also between reading accuracy and reading non-words (P<0.05). As shown in Table 5, there was a significant correlation between the reading speed and reading non-words in the group with dyslexia (P<0.05). However, in normal children, there is no significant correlation between these tasks. This difference shows the problem of children with dyslexia in reading non-words. This finding is consistent with the results of Baharloo et al. [17] who examined the relationship between reading skills and non-word visual memory in first-grade girls. They found a significant relationship between reading accuracy and non-word visual memory and no correlation between reading speed and non-word visual memory. This finding is also consistent with the findings of Oliveria et al. (2014) who investigated reading component skills in dyslexia and found that performance in word recognition in the group with dyslexia was worse than the control group and was slower in naming [21]. Findings are also consistent with Van Reybroeck and De Rom [23] who showed that the performance of the two groups in the cognitive inhibition task was the same, while the reading accuracy in children with dyslexia was less than the two control groups in the reading inhibition task, and they also were slower than children of the same age.

As can be seen in Table 6, in the group with dyslexia, there is a significant correlation between the mean percentages of "irregular words reading" and "first phoneme deleting," and also there is a significant negative correlation between "rhyme recognition" and "non-words reading." In the normal group, there is no significant correlation between the mean percentages of "words reading" and "phonological awareness" subtests. This finding can be interpreted by the fact that by increasing the skills of children with dyslexia in performing rhyme recognition tasks, the mean percentage in "reading non-words" decreases [10]. As we know, rhyme recognition is necessary for reading the word by analogy. A decrease in the skill of deleting the first phoneme can cause a decrease in reliance on whole word reading that is necessary for accurate reading of irregular words. Our finding is consistent with the finding of McDougall et al. [16] who applied the process of dissociation to the reading of regular and exception words.

5. Conclusion

The dual-route of reading patterns in children with dyslexia has changed to one-route of reading (the whole word reading; so they are pure cases of developmental phonological dyslexia and have dysfunction in phonetic decoding processing but their sight vocabulary processing is normal). This problem can be due to poor phonological awareness and grapheme-phoneme correspondence, so it is important to consider phonological awareness skills training in children with dyslexia and to study their reading patterns in future research after phonological awareness skills training. Because of time constraints, this study was conducted only among the second-grade students, so it is recommended that in future studies, researchers examine the pattern of children's reading in other grades and compare the results with normal children.

Ethical Considerations

Compliance with ethical guidelines

All ethical principles are considered in this article. The participants were informed about the purpose of the research and its implementation stages; they were also assured about the confidentiality of their information; moreover, they were free to leave the study whenever they wished, and if desired, the research results would be available to them.

Funding

This project was funded by the Institute for Humanities and Cultural Science (Research Project Code: 444).

Authors' contributions

All authors were equally contributed in preparing this article.

Conflict of interest

The authors declared no conflict of interest.

Acknowledgements

We express our special gratitude to the directors of Tehran Learning Disorders Centers and all people that assisted us in this research.

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