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ABSTRACT

Research with English-speaking populations has shown that there is a relationship between developmental language disorder (DLD) and emergent literacy skills in children. A small number of Arabic studies have indirectly investigated this relationship in typically developing (TD) children, and children with reading difficulties, and demonstrated the important role of morphosyntactic skills in Arabic reading acquisition. However, none of the previous work has examined the relationship between oral language and emergent literacy skills in children with and without DLD. The aims of this study are twofold: to investigate the language and emergent literacy skills of Saudi Arabic children with DLD aged between 4;0 – 6;11 years of age; to compare their performance to age and socioeconomic status matched TD children, and to investigate the relationship between language and emergent literacy skills in both groups. A comprehensive Arabic language and emergent literacy battery was administered. Findings demonstrated that the TD group significantly outperformed the DLD group on most emergent literacy tasks. The DLD group was significantly less accurate than TD group on syllable segmentation, and phoneme awareness skills. There were significant associations between oral language skills and emergent literacy skills in the DLD group. In TD group, vocabulary knowledge and syntactic skills were associated with some emergent literacy skills. Syntactic skills were found to have moderately significant relationship with all emergent literacy skills in both groups. This might suggest the important role of morphosyntactic skills to literacy development in Arabic. Overall, findings were consistent with existing literature, and demonstrated strong relationships between oral language and emergent literacy skills in the Arabic language.

Keywords: Developmental language disorder, phonological awareness, emergent literacy, language skills, Arabic

Introduction

The ability to read fluently and accurately is a crucial skill for academic success (Catts et al., 2002; Gough & Tunmer, 1986). Learning to read is a gradual process and starts to develop before formal reading exposure and prior to formal schooling. The concept of *emergent literacy* was initially proposed by Marie Clay (1966) and reflects children's knowledge and ability to understand reading and writing before they are considered readers and writers (Tael & Sulzby, 1986). Emergent literacy skills, which include phonological awareness, alphabet knowledge and print awareness, are acquired through an interactive and continuous process with oral language skills.

According to Whitehurst and Lonigan (1998), emergent literacy includes two distinct but interrelated domains: outside-in domain, which refers to oral language skills (e.g., print concept, vocabulary, grammar, narrative) and inside-out domain, which refers to decoding-related skills (e.g., phonological awareness, letter knowledge, name writing). According to the simple view of reading (SVR), children must use both word-level cues (i.e., decoding) and sentence level cues (i.e., during the comprehension process) to be successful readers (Gough & Tunmer, 1986). Scarborough (2001) supported the SVR model and proposed the reading rope model which defined the important subskills involved in the reading process domains (i.e., language comprehension & word recognition). Thus oral language plays an important role in emergent literacy development as oral language skills are the foundation of literacy acquisition (Nagy et al., 2014; Scarborough, 2009; Snow, 2020; Storch & Whitehurst, 2002). Children who are impaired with their language development may be at risk of having impaired emergent literacy and later literacy skills.

Developmental language disorder (DLD)[1] affects approximately 7.58% of children (Norbury et al., 2016) and is characterized by language difficulties with no known differentiating conditions (e.g., Autism spectrum disorder, cerebral palsy, brain injury, sensorineural hearing loss) (Bishop et al., 2016, 2017). Since reading is a linguistic based skill, children with DLD are at particular risk of having difficulties with emergent literacy and subsequently later literacy difficulties (Snowling et al., 2016, 2019; Tambyraja et al., 2015). The relationship between oral language deficits and emergent literacy and subsequent literacy acquisition has been well documented, however, there has been limited research in Arabic. This study aims to provide an initial investigation of emergent literacy skills in Saudi Arabic speaking children with and without DLD.

A large body of research, mainly focusing on English-speaking populations, has shown that oral language skills are linked to literacy skills in both typically developing (TD) children and in children with DLD. Storch and Whitehurst (2002), in a longitudinal study which followed 626 TD children from preschool up to 4th grade reported a strong positive correlation between decoding-related skills (i.e., print concept, phonological awareness, and emergent writing) and oral language skills (i.e., receptive and expressive vocabulary, narrative skills, basic concepts, and word structure) during the preschool period. They also found that the strength of this relationship changed over time. Oral language skills were significantly related to decoding-related/emergent literacy skills during the preschool period. Significant relationships between language (i.e., phonological skills, grammar, and vocabulary knowledge) and reading skills (both decoding and reading comprehension) were reported by Mutler et al., (2004). Phonological awareness skills (e.g., rhyme detection

[1] DLD- used throughout the paper, as a result of a consensus reached (see Bishop, D. V., Snowling, M. J., Thompson, P. A., Greenhalgh, T., & Catalise Consortium. (2016). CATALISE: A multinational and multidisciplinary Delphi consensus study. Identifying language impairments in children. *PLOS one*, *11*(7), e0158753.)

and production, initial and final phoneme deletion etc) which are part of emergent literacy skills, were strong predictors of word recognition skills, whereas vocabulary knowledge and grammatical skills were strong predictors of reading comprehension.

Language difficulties has been related to delayed emergent literacy skills in children with DLD. Boudreau and Hedberg (1999) reported that children with DLD aged 5;2 years old performed at a significantly lower level on emergent literacy skills such as rhyme, letter names and print concepts compared to age and socioeconomic matched TD children. Similarly, a longitudinal study by Catts el al. (2002) of 570 children with DLD (aged 5;10 – 6;0) found they were at high risk of developing reading difficulties in second and fourth grades in school. The children with more severe language impairments had lower reading outcomes. Recently, Snowling et al., (2016, 2019) found that children with DLD performed significantly lower than the TD group on all literacy measures. These findings have been replicated in other languages such as: Spanish (Pratt, 2017; Pratt et al., 2020), Italian (Brizzolara et al., 2011), Chinese (Wong et al., 2010), Czech (Moll et al., 2016), and Portuguese (Oliveira et al., 2021).

Studies in the Arabic language have mainly focused on investigating the importance of phonological awareness, and its relationship to literacy in school-aged children (Abu-Rabia, 2007; AI-Sulaihim, 2014; Asaad & Eviatar, 2014; Elbeheri & Everatt, 2007; Mannai & Everatt, 2005; Saiegh-Haddad & Haj, 2018; Schiff & Saiegh-Haddad, 2018; Taibah & Haynes, 2011). Few studies have included children with reading difficulties or language deficits (Abu-Rabia, 2007; Abu-Rabia et al., 2003; Elbeheri & Everatt, 2007). Abu-Rabia et al., (2003) compared school-aged children's performance on reading and cognitive processing skills (i.e., syntax, phonological awareness, morphology, working memory, and visual processing) and found that children with reading difficulties performed significantly lower, specifically in syntax and morphology,

than age and socioeconomic matched TD children.

Abu Ahmad et al. (2014) investigated the cognitive predictors of early reading acquisition. They assessed 194 Arabic speaking children twice - once at the end of kindergarten level (mean age = 5;9 years old, SD = 3.6 months), and again at the beginning of the 2nd grade level - and compared the effects of decoding-related skills (i.e., phoneme awareness, phonological processing, orthographic processing, print concept, and morphological awareness) and oral language skills (i.e., general nonverbal ability, receptive vocabulary, syntactic awareness, and working memory) on word reading. They concluded that decoding-related skills were stronger predictors of word recognition in Arabic than oral language skills. Decoding-related skills predicted 33% of the variance in word recognition while oral language skills predicted 11% of the variance in word recognition. They also found that morphological awareness skills, which explained 17% of the variance, are an important contributor to word recognition. This finding is in line with other Arabic studies (Abu-Rabia, 2007; Asadi et al., 2017), which point to the important role of morphology in reading development in Arabic.

Despite the available literature in Arabic, no studies have examined the relationship between emergent literacy and oral language skills in children with and without DLD. Most of the studies have focused on school-aged children so our knowledge about the emergent literacy skills in younger children is limited. Also, available studies have not considered a broad range of linguistic skills (e.g., semantic, morphosyntax, and comprehension) and emergent literacy skills (e.g., phonological awareness, letter knowledge, and decoding). As a result, the nature of the relationship between language and emergent literacy young Arabic-speaking children is still unclear.

It is possible that the relationship between oral language skills and emergent literacy may vary between languages, and given the phonological and orthographic

differences between English and Arabic, the relationship between language deficits and emergent literacy skills in Arabic may be different from English. Therefore, studies on the relationship between language and emergent literacy in Arabic are crucial to advance our knowledge on the foundational role that language plays in literacy development and to inform early intervention.

Present study

The aims of the present study are: (1) to investigate the emergent literacy skills of Saudi Arabic speaking children with and without DLD, aged between 4;0 and 6;11 years old (reflecting the age when many children are diagnosed with DLD and also when children transition to school), and (2) to explore the relationship between different language domains (i.e., semantics, morphology, syntax, and comprehension) and different emergent literacy skills which include phonological awareness skills (syllable segmentation, and phonemic awareness), letter knowledge and decoding. The research questions are:

(1) Do Saudi Arabic speaking children with DLD aged 4;0-6;11 differ from typically developing peers on emergent literacy skills?

(2) What is the relationship between language and emergent literacy skills in Saudi Arabic speaking children with and without DLD?

Based on the existing literature, we predict that, compared to TD children, children with DLD will demonstrate lower overall accuracy on emergent literacy tests. Since previous research has found a relationship between language and emergent literacy skills in TD and DLD children, we expect that oral language skills will be related to emergent literacy skills in both TD and DLD groups.

Method

Permission to conduct the testing was obtained from the Higher Ministry of Education in Riyadh, Saudi Arabia. Ethical approval was granted by the School of Psychology and Clinical Language Sciences Research Ethics Committee, University of Reading (approval no. 2019-050-VS).

Participants

Sixty-four Saudi children were recruited for the study. The participants included 40 TD children (20 boys, 20 girls; 4;0 – 6;11), and 24 children with DLD (16 boys, 8 girls; 4;0 – 6;11). All participants were monolingual Arabic speakers and matched for their age and socioeconomic status. In order to control for socioeconomic status, parents completed a demographic questionnaire including parental educational level, parental occupation, and family income. The groups did not differ significantly on gender $\chi 2$ (1, N = 64) = 1.69, p = .193, family income: $\chi 2$ (4, N = 61) = .58, p = .965, paternal educational level: $\chi 2$ (2, N = 64) = 4.46, p = .107 and maternal educational level $\chi 2$ (2, N = 64) = 2.44, p = .295.

The TD children (mean age= 65.45 months, *SD* = 9.37 months) were recruited from four public kindergartens and reported by their parents and teachers to be developing language typically. Inclusionary criteria for this group were: (1) age-appropriate language skills as reported by their parents, (2) no hearing impairment, (3) no history of speech, language or communication disorder, and (4) no other neurological, social, emotional, behavioural, emotional or sensory disorders.

The children with DLD (mean age = 62.96 months, *SD* = 11.18 months) were recruited from a speech and language clinic at King Abdulaziz University Hospital in Riyadh. Children were diagnosed with DLD by a qualified speech-language therapist (SLT) and had been receiving speech and language therapy. Since standardized Arabic language assessments are not available, it was crucial to ensure that children with DLD

met Bishop et al's (2016, 2017) criteria for DLD. Inclusionary criteria for this group were (1) a diagnosis of developmental language disorder, and (2) no known differentiating condition (e.g., brain injury, cerebral palsy, sensorineural hearing loss, autism, and other genetic conditions). This was confirmed by administering the Arabic language battery (see Table 3) which shows that the DLD group scored significantly lower than the TD group. All parents of potential participants were asked to sign consent forms and fill demographic and developmental history questionnaires.

See Table 1 for demographic information for both groups of participants.

Table 1. *Participants' demographic characteristics*

	Group	
	TD	*DLD*
	n = 40	*n* = 24
Family characteristics	**%(*n*)**	
Father's education		
High school & Diploma	20(8)	37.5 (9)
University degree/college diploma	40(16)	45.8(11)
Postgraduate degree	40(16)	16.7(4)
Mother's education		
High school & Diploma	10(4)	33.3(8)
University degree/college diploma	12.5(5)	58.3(14)
Postgraduate degree	55(22)	8.3(2)
Literacy home exposure	**%(*n*)**	
Book Exposure	75(30)	70.8(17)
Shared book activity		
Always	7.7(3)	12.5(3)
Sometimes	53.8(21)	45.8(11)
Rarely	33.3(13)	3.3(8)
Never	5(2)	8.3(2)

Note. **TD**: Typically Developing, **DLD:** Developmental Language Disorder.

* $p < .05$, ** $p < .01$

Materials

To assess the relationship between oral language skills and emergent literacy skills, a comprehensive Arabic language and emergent literacy test battery was administered. Table 2 provides a summary of these assessments. Due to the lack of standardized Arabic

assessments, all measures were developed and designed by the first author. Picture stimuli, words, and sentences were adapted from previous studies (Najmaldeen, 2020; Shaalan, 2010; Wallan, 2018). To evaluate the feasibility and the appropriateness of the adapted measures, all measures were piloted with 10 TD children aged between 48 and 72 months, with a mean age of 64 months (*SD* = 9.35). Results indicated that measures were age appropriate and age sensitive. Each assessment is described below.

Table 2. *Arabic Language Battery and Arabic Emergent Literacy Battery*

Arabic Language Battery		**Arabic Emergent Literacy Battery**	
Receptive Language Skills		*Phonological Awareness*	
(1) Vocabulary Knowledge	Receptive Expressive	(1) Syllable Segmentation	
(2) Oral Comprehension	Literal Inferential	*Phoneme Awareness*	
Expressive Language Skills		(2) Phoneme Isolation	Initial Final
(3) Sentence Repetition	Target Syntax	(3) Phoneme Deletion	Initial Final
(4) Language Sample	MPU	*Letter Knowledge*	
Phonological Processing skills		(4) Letter Name	
(5) Non-word Repetition		(5) Letter Sound	Isolation Initial Medial Final
(6) Digit Recall		*Decoding*	
		(1) Single word reading	

Note. **MPU:** Mean length per utterance

Arabic Language Battery

In 2010, the National Early Literacy Panel metanalysis' study noted that explicit oral language assessments (i.e., which address a broad range of linguistic skills) were more sensitive for defining the linguistic precursors for later literacy skills (Shanahan & Lonigan, 2010). Thus, a comprehensive language battery was administered to evaluate different receptive and expressive language skills. The following tests were included:

Arabic Picture Vocabulary Test (APVT) (Shaalan, 2010). The Arabic Picture Vocabulary Test (Shaalan, 2010) was standardized on Qatari children aged between 4;6 – 9;4 years old. The test includes 132 age- appropriate stimuli that increase in complexity and are divided into 10 different groups with 12 stimuli in each group. For the purposes of our study, the APVT test was modified to make it age and culturally appropriate for the participants. An adapted shorter version was used to evaluate children's receptive vocabulary knowledge. The test included 96 stimuli which ranged in difficulty and were divided into 8 different groups with 12 items per group. Stimuli were chosen from the following categories: verbs, nouns, adjectives, animals, and professions. Due to dialectal differences, some stimuli were substituted with common Saudi dialect words. For example, the Qatari dialect word /muχam:a/ which means 'broom' in English, was substituted by the Saudi dialect word: /muknisa/. The test was administered digitally using PowerPoint to improve child's engagement. Each slide consisted of 4 coloured pictures (obtained from Shutterstock.com). Children were required to point to the picture that they thought was correct. Every correct response was scored as 1, and every incorrect response was scored as 0.

Listening Comprehension Test. The Squirrel Story Narrative Comprehension Assessment (NCA) (Dawes, 2017) was used to assess children's listening comprehension skills by asking literal and inferential questions. Since the story was found to be culturally and age-appropriate, it was translated into Arabic. The story includes clear and simple story structure, emotions that can be inferred, and age appropriate vocabulary. The task includes 13 literal and inferential questions providing information about children's ability to orally comprehend narratives. The application version was used, and the NCA protocol and scoring scale was followed (Dawes, 2017). Children were required to watch and listen to the story on an iPad whilst the first author told the story. Children were then asked to answer comprehension questions while looking through the story pictures. The NCA scoring scale ranged from 0 – 2 points for each question.

Arabic Expressive Vocabulary Test-2 (AEVT-2). The Arabic Expressive Vocabulary test was developed to assess children's expressive vocabulary knowledge. Stimuli were selected based on item categories and difficulty. Stimuli were chosen to include verbs, adjectives, singular and plural nouns from different groups such as: animals, toys, objects, places and professions. A familiarity rating scale was collected from 10 adult Arabic speaking. Each word received a rating from 1 – 4 (1 = totally unfamiliar word and 4 = totally familiar word). Based on the familiarity rating scale and the author's clinical experience, the 85 stimuli were ranked from most familiar to least familiar. The test was administered digitally using PowerPoint. Each slide consisted of one coloured picture (obtained from Shutterstock.com). Children were asked to name the presented picture. Synonyms were counted as correct responses. Every correct response was scored as 1, and every incorrect response was scored as 0.

Arabic Sentence Imitation Task (ASIT). The Arabic Sentence Imitation Task (ASIT) was developed to assess children's ability to use morpho-syntactic structure and lexical skills during their communication. Following the LITMUS-S Rep's principles (Marinis & Armon-lotem, 2016), the ASIT task included different syntactically complex structures that have been found to be difficult for Arabic speaking children diagnosed with DLD (e.g., present tense, passive sentences, object questions, subject and object relatives sentences, and accusative pronouns). The task consisted of 37 sentences presented in a randomized order. Children were asked to listen carefully and repeat the heard sentence verbatim. Children's productions were scored using the target syntactic structure's scoring method (i.e., 1 = if the child used the target syntactic structure, 0 = if the child made an error or omitted using the target syntactic structure).

Spontaneous Language Sample. A language sample was used to provide a more naturalistic assessment of expressive language and as a tool for further language analysis (i.e., number of different words, mean length of utterance, and narrative skills). Spontaneous language samples were obtained using the wordless picture book "Frog, Where Are You?" (Mayer, 1969). This book was chosen because it has been used across different languages and cultures. Each child generated a story, "Frog, Where Are You?" while describing the presented pictures. Children's utterances were analyzed to calculate the mean morpheme per utterance (MPU). We followed Shaalan and Khater's (2006) guidelines of counting Arabic morphemes which were adapted from Dromi and Berman (1982).

Arabic Emergent Literacy Battery

Phonological Awareness Tests. Different phonological awareness tests were developed to evaluate children's meta-phonological skills. Analytic phonological awareness tests (i.e., deleting, counting, and manipulating) are the strongest predictors of decoding and reading comprehension (Shanahan & Lonigan, 2010). Thus, different analytic phonological awareness tests were administered and included different linguistic unit sizes (i.e., syllable level to phoneme level). The following tests were included:

Syllable Segmentation Test. A syllable segmentation test was developed to evaluate children's ability to detect the number of syllables in words. The test comprised three practice stimuli and 10 test stimuli ranging from one to five syllables in length (i.e., two stimuli for every syllable length). The order of the stimuli was randomized. Children were asked to listen to the word, and segment it into syllables. To simplify the task, five different tokens were presented, and children were asked to point to the tokens or clap while they orally segmented the words into syllables. Saying the words while segmenting its syllables considered a correct response, for example, segmenting the Arabic word /ʔisˁbaʕ/ (which means 'finger') into two syllables and saying /ʔisˁ-baʕ/. Correct oral responses were scored as 1, incorrect oral responses were scored as 0.

Phoneme Awareness Tests. Phoneme awareness skills were assessed using phoneme isolation (initial, final), and phoneme deletion (initial, final) tasks. The phoneme isolation sub-test aimed to assess children's ability to identify a sound in a word and isolate this sound. For the initial phoneme isolation sub-test, children were asked to listen to the words and then isolate the initial phoneme of the word. For example, "What is the first sound in the word /χaru:f/ (i.e., sheep in English)?" (answer: /χ/). For the final phoneme isolation subtest, children were asked to listen to word and isolate the final phoneme of the word. For example, "What is the last sound in the word /ħali:b/ (i.e., milk in English) ?" (answer /b/). The phoneme isolation sub-test consisted of three practice stimuli and 12 test stimuli ranging from one to three syllables in length. Correct responses were scored as 1, incorrect responses were scored as 0.

Phoneme deletion is considered to be more difficult than phoneme isolation as it requires a higher level of phonemic awareness. The phoneme deletion sub-test aimed to assess the child's ability to identify the target sound, delete the sound from the word, and then identify the new word. For the initial phoneme deletion sub-test, children were required to listen to the word, and then say the word without the initial phoneme, for example, say /na:r/ (i.e., fire in English) without /n/; the answer is: /a:r/. For the final phoneme deletion sub-test, children were required to listen to the word, and then say the word without the final phoneme. For example, say /bint/ (i.e., girl in English) without /t/; the answer is /bin/. This sub-test included 3 practice stimuli, and 12 test stimuli of one and two syllables in length. Correct responses were scored as 1, incorrect responses were scored as 0.

Letter Knowledge. Letter knowledge is the beginning of orthographic knowledge, and one of the higher levels of the emergent literacy skills. As children get more experienced with letters, they become more aware of the words' components: syllables and phonemes (Rhyner, 2009). Arabic orthography includes 28 letters. All of them are consonants except for the letter ا /a/ which acts as a carrier for the glottal phoneme /ʔ/ (i.e. أ, ء) (Saiegh-haddad & Henkin-Roitfarb, 2014). One factor that may influence the acquisition of Arabic reading is the variability of the Arabic graphemes' shapes in the written scripts (Asaad & Eviatar, 2013). Thus, three different tasks were used to evaluate children's letter knowledge: letter naming, grapheme-phoneme correspondence in isolation, and grapheme-phoneme correspondence in all positions to assess children's knowledge of all letter shapes. All letters were presented on white cards, and children were required to name them (in the letter naming task), and sound them out (in the grapheme-phoneme correspondence tasks). Correct responses were scored as 1, incorrect responses were scored as 0.

Decoding. Decoding words is one of the highest levels of emergent literacy skills. To read a single word, children must segment the word into phonemes, translate the phonemes into sounds, and blend the phonemes again. Thus, decoding requires sophisticated and explicit linguistic and cognitive processing skills. For the purpose of this study, a single word reading test was administered. The test included 20 simple single words presented on white cards. Every word contained three letters. For example: the word /ʃams/ (شمس) in Arabic which means 'sun' in English. Children were required to read the words. Correct responses were scored as 1, incorrect responses were scored as 0.

Additional tests

Nonverbal Reasoning Test. To assess the children's nonverbal reasoning abilities, the Raven's Coloured Progressive Matrices (CPM) (Raven, 1998) was administered.

Nonword Repetition Test. Shaalan's (2010) Nonword Repetition test was administered to assess: phonological short-term memory, phonological processing, auditory processing skills, and speech-motor processing skills. The test included 30 nonword stimuli which were presented in a randomized order. Children were required to carefully listen to the nonwords and repeat them verbatim. Correct responses were scored as 1, incorrect responses were scored as 0.

Digit Recall Test. A Digit Recall test was administered to evaluate children's verbal memory abilities. The Digit Recall subtest from the Clinical Evaluation of Language Fundamentals- Fourth Edition (CELF-4) (Semel et al., 2006) (Semel, Wiig, & Secord, 2006) was adapted for Arabic. The subtest consists of digits ranging from one to nine. Children were asked to repeat back a series of numbers in the same order they have heard them. Correct responses were scored as 1, incorrect responses were scored 0.

Procedure

Children were assessed individually in a quiet area of their nursery setting, school, or speech and language therapy clinic. The number of the sessions varied between two to three sessions depending on the participants' age, and motivation; younger children (i.e., 4;0 – 4;11 years old) required three sessions because of their lower attention span. Each session lasted approximately 1 hour and children were given as many breaks as needed. All participants were required to complete the general tests, the Arabic language battery, and the Arabic emergent literacy battery. Typically developing children were also required to complete the hearing screening in order to rule out any hearing deficits. Since DLD children already had their hearing screening prior to their diagnosis, they did not complete a hearing screening during testing. All tests were

administered by the first author, a qualified speech and language therapist, and audio-recorded using Sony ICD-UX560F digital voice recorder. In order to engage participants during testing, each child was provided with a token board to complete using print stamps as a reinforcement. Once the child completed the board (i.e., when all tests were administered), a big sticker was provided.

Reliability

Interrater reliability was established by having a second qualified Saudi Arabic-speaking speech and language therapist who independently scored the responses of 15 children (23% of the sample). For the language assessments, the agreement between the two raters were high, with 100% agreement for receptive vocabulary, and 86.7% agreement for expressive vocabulary, listening comprehension, sentence repetition, and MPU. For the emergent literacy assessment, the agreement between the raters were 100% agreement for syllable segmentation, phoneme awareness, letter knowledge, and decoding. Agreement between the raters was 86.7% for nonword repetition and 100% for digit recall.

Analysis

All statistical analyses were performed using IBM SPSS Statistics, version 27. Raw scores were converted to percentages, and composite scores of vocabulary knowledge (i.e., receptive and expressive vocabulary tests), listening comprehension (i.e., inferential and literal questions), phoneme awareness (i.e., phoneme isolation and deletion tests), and letter knowledge (i.e., letter naming and letter sound tests) were obtained. Shapiro-Wilk's test was used to test the normality of the distributions. Results revealed non-normal distribution of data ($p < .05$), and therefore, nonparametric tests were used. Mann Whitney U tests were used to investigate the differences in performance between groups on all emergent literacy tasks, and effect sizes were

calculated by dividing the Z score by the square-root of the total sample size. A p-value cut-off of 0.0125 was adopted and corrected for multiple comparisons using the Bonferroni approach as suggested by Field (2013). Further, Spearman rank order correlation coefficient controlling for age was carried out to examine the relationship between oral language skills and emergent literacy skills in TD and DLD groups. Significance levels were set at $p < .05$.

Results

Between group comparison

The first research question was to compare emergent literacy performance skills of the TD and DLD groups. Descriptive data for each group is presented in Table 3, and the differences in performance across groups in emergent literacy tests are presented in Figure 1.

Table 3. Language, emergent literacy, and additional baseline assessments for TD and DLD groups (raw and percentage correct % score)

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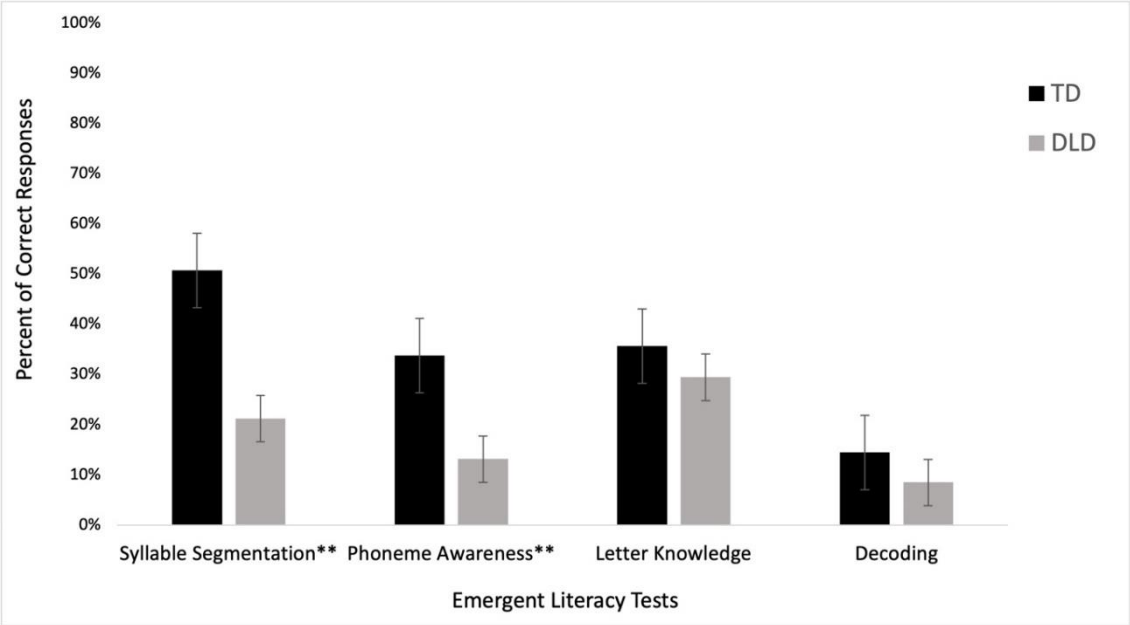
	TD *n* = 40				DLD *n* = 24			
	Raw Scores		*Percentage Correct %*		*Raw Scores*		*Percentage Correct%*	
Measures	*Mean (SD) Range*	*Median*	*Mean (SD) Range*	*Median*	*Mean (SD) Range*	*Median*	*Mean (SD) Range*	*Median*
Language Assessments								
Vocabulary Knowledge**	**135.88 (17.04)** 95 - 174	**137.50**	**75.10 (9.29)** 53 – 96	**76**	**113.33 (32.27)** 50 – 164	**114.50**	**62.71 (17.83)** 28 – 91	**63.50**
Syntactic Skills**	**29.70 (6.01)** 13 – 37	**31**	**80.33 (16.23)** 35 – 100	**84**	**12.83 (10.27)** 0 – 35	**11.50**	**34.67 (27.75)** 0 – 95	**31**
Listening Comprehension**	**16.25 (5.33)** 8 – 31	**16**	**47.60 (13.67)** 24 – 84	**48**	**7.54 (5.13)** 0 – 16	**8**	**22.92 (15.91)** 0 – 49	**24**
MPU**	**6.42 (1.89)** 4.10 – 13	**6**	**-** -	**-**	**4.78 (2.08)** 1.20 – 10.70	**4.80**	- -	-
Emergent Literacy Assessments								
Syllable Segmentation**	**5.08 (2.45)** 0 – 9	**5**	**50.85 (24.37)** 0 – 90	**50**	**2.13 (2.49)** 0 – 7	**1.50**	**21.25 (24.90)** 0 – 70	**15**
Phoneme Awareness**	**4.06 (3.37)** 0 – 11	**3.63**	**34.10 (28.06)** 0 – 90	**30**	**1.58 (3.12)** 0 – 11	**.00**	**13.38 (26.13)** 0 – 92	**.00**
Letter Knowledge	15.28 (15.30) 0 – 44	7.50	35.75 (33.56) 0 – 98	19.50	11.83 (16.45) 0 – 45	3	27.67 (35.93) 0 – 100	9
Decoding	2.90 (5.63) 0 – 19	.00	14.50 (28.17) 0 – 95	.00	1.71 (5.64) 0 – 20	.00	8.54 (28.19) 0 – 100	.00
Additional Assessments								
Nonverbal Reasoning	13.18 (4.47) 6 – 28	13	36.67 (12.37) 17 – 78	36	11.29 (5.59) 1 – 21	11	31.38 (15.52) 3 – 58	31
Nonword Repetition**	**26.18 (3.46)** 16 - 30	**27**	**87.25 (11.58)** 53 – 100	**90**	**10.75 (7.00)** 0 – 30	**9**	**35.83 (23.34)** 0 – 100	**30**
Digit Recall**	**5 (1.39)** 3 – 8	**5**	**31.33 (8.78)** 19 – 50	**31**	**3.08 (1.64)** 0 – 7	**3**	**19.29 (10.21)** 0 – 44	**16**

Note. TD: Typically developing, **DLD:** Developmental language disorder, **SD:** Standard deviation, **MPU:** Mean length of utterance.
*p<.05, **p<.001



436

437 **Figure 1.** *Mean scores in emergent literacy tests in Typically developing (TD) children*

438 *and children with Developmental Language Disorder (DLD)* **p<.001

439

440 To further investigate this hypothesis, the Mann Whitney U test was conducted to

441 compare the means of the two groups' performances on all emergent literacy measures.

442 Findings revealed significant differences between the groups on: Syllable Segmentation

443 (U = 198.5, z = -3.95, p < .001), and Phoneme Awareness (U = 249.5, z = -3.29, p <

444 .001). However, although the mean scores of letter knowledge and decoding in TD

445 group were higher than the DLD group, these scores were not significantly different

446 between the two groups (U = 202, z = -3.87, p = .069), (U = 414, z = -1.26, p = .206)

447 respectively. Overall, results indicated that typically developing children had

448 significantly higher scores on syllable segmentation, and phoneme awareness compared

449 to children with DLD.

450 ***Relationship between oral language skills and emergent literacy skills***

451 The second research question was to examine the relationship between oral language

452 and emergent literacy skills in the TD and DLD groups. We calculated Spearman rank

order correlation coefficients controlling for age within each group. These are shown in Table 4.

Table 4. Correlations between oral language and emergent literacy skills of TD and DLD groups (Spearman's rho)

	TD (*n* = 40)				DLD (*n* = 24)			
	SS	Phoneme A.	LK	Decoding	SS	Phoneme A.	LK	Decoding
Vocabulary Knowledge	.389*	.387*	.359*	.190	.587**	.675**	.732**	.386
Target Syntax	.355*	.390*	.534**	.357*	.661**	.653**	.683**	.529*
Listening Comprehension	-.018	.070	.051	-.168	.448*	.180	.476*	.045
MPU	.232	.258	.216	-.007	.682**	.643**	.580**	.461

Note. TD: Typically developing, DLD: Developmental language disorder, SS: Syllable segmentation, Phoneme A: Phoneme awareness, PA: Phonological awareness, LK: Letter knowledge , MPU: Mean length per utterances

*p<.05, **p<.001

As Table 4 shows, results were different for the two groups. In the TD group, significant positive correlations were observed between vocabulary knowledge and syllable segmentation, phoneme awareness, and letter knowledge. Further, there were significantly positive correlations between syntactic skills and all emergent literacy skills. In the DLD group, all language tasks were significantly positively correlated with syllable segmentation, phoneme awareness, and letter knowledge. Syntactic skills were also significantly correlated with decoding skills.

Discussion

This present study aimed to explore emergent literacy skills of Saudi Arabic speaking children with and without DLD aged 4;00 to 6:11 and investigate the relationship between language and emergent literacy skills. The overall findings of this study are: (1) children with DLD performed significantly lower than their TD peers in most emergent literacy tests; (2) oral language skills were related to emergent literacy skills in both groups; (3) significant correlations between oral language and emergent literacy skills were stronger in the DLD group than TD group; (4) syntactic skills were found to be significantly correlated to all emergent literacy skills in both groups. These findings will be discussed below.

Differences on measures of emergent literacy

Our first research question focused on differences between TD and DLD groups on emergent literacy tasks. Based on previous research (Boudreau & Hedberg, 1999a; Catts et al., 2002; Snowling et al., 2019), we predicted that children with DLD would perform lower than their TD peers in all emergent literacy tasks. As predicted, there were significant differences between the groups in syllable segmentation and phoneme awareness. However, no significant between group differences were observed in letter knowledge and decoding. Lack of differences between the groups on letter knowledge

was surprising; however, the children with DLD were receiving speech and language therapy sessions before the start of the data collection period. During their speech and language therapy sessions, children may have been exposed to different letters which may explain their familiarity with some letters. Another reason could be that 5-year old children in both groups are still acquiring letter knowledge. With regard to decoding skills, a lack of differences between the groups could be explained by the fact that many children in both groups have not started school. This skill usually starts to develop around age 6 when children are exposed to formal literacy instructions. As a result, not all children in the TD group were able to decode.

The finding that children with DLD scored significantly lower than the TD children on syllable segmentation and phoneme awareness is in line with the existing literature across different languages, such as English (Boudreau & Hedberg, 1999b; Catts et al., 2002), Spanish (Pratt, 2017), Italian (Brizzolara et al., 2011), and Chinese (Wong et al., 2010). Language plays a significant role in literacy development (Snow, 2020; Storch & Whitehurst, 2002). As a result, children must acquire strong linguistic and metalinguistic skills early during their development to competently decode and comprehend the written script (Gough & Tunmer, 1986; Scarborough, 2009). Thus, any deficits in any of the fundamental elements may interfere with the development of emergent literacy skills. Our findings provide additional support to the existing literature and demonstrate how language deficits may hinder the emergent literacy skills in Arabic speaking children.

Associations between oral language and emergent literacy skills

The second research question focused on whether the oral language skills were related to emergent literacy skills in the TD and DLD groups. Results of the correlational analyses demonstrated the variables are related in different ways in each group. In the

TD group only vocabulary knowledge and syntactic skills were significantly correlated with emergent literacy skills (but listening comprehension or MPU were not correlated with emergent literacy skills). TD children are acquiring emergent literacy skills in a typically developing pattern, with strong general language skills. Storch and Whitehurst (2002) argued for the importance of the relationship between emergent literacy and oral language skills in the preschool years (i.e., 4; 0 – 4;11 years old) and how this relationship weakened once children got older. As children get older and enter school, print knowledge and phonological awareness contribute to their reading ability.

In the DLD group, correlational analyses showed that all oral language skills assessed in the study were significantly positively correlated with emergent literacy skills. Children with DLD are known to have difficulties in linguistic processing skills, and lag behind their TD peers in all language domains (Leonard, 2014). This means that they may be using all their linguistic resources during emergent literacy tasks, resulting in stronger relationships between all assessed oral language skills and emergent literacy measures.

When comparing the groups, vocabulary knowledge and syntactic skills were found to be significantly correlated with emergent literacy skills in both groups. These findings are in line with the well-documented evidence that vocabulary and morphosyntax play an important role in literacy acquisition (Catts et al., 2002; Muter et al., 2004; Snow, 2020; Storch & Whitehurst, 2002). Vocabulary and morphosyntax are foundational skills for both decoding and reading comprehension (Duff et al., 2015; Muter et al., 2004). While decoding, children must have competent vocabulary knowledge and understand the rules and the structure of their language to comprehend written language. Since most of the alphabetic languages are morphologically based, understanding the morphological rules of the language is crucial for decoding the

written script as well. With regard to the Arabic language, previous studies (Abu-Rabia, 2007; Abu-Rabia et al., 2003) suggested that morphosyntax plays a significant role in Arabic literacy development which would suggest that it may also be related to emergent literacy. Our results support this, showing moderate positive correlations between MPU and most of the emergent literacy measures (e.g., syllable segmentation, phoneme awareness, and letter knowledge) in the DLD group.

Finally, moderate positive correlations were found between listening comprehension, syllable segmentation, and letter knowledge. One possible explanation for this could be similar underlying processing skills for both phonological awareness and listening comprehension skills. Both listening comprehension, and phonological awareness tap a broader range of linguistic skills (Catts & Kamhi, 2005). In listening comprehension, children must listen to the auditory input, analyse, and access their semantic and syntactic knowledge to comprehend the spoken output. Similarly, phonological awareness requires higher meta-linguistic skills.

To our knowledge, this is the first cross-sectional study that aimed to investigate the relationship between the oral language and emergent literacy skills in TD and DLD Saudi Arabic-speaking children aged between 4;0 and 6;11. Overall, our findings were in line with existing literature suggesting a strong relationship between oral language and emergent literacy skills in TD and DLD groups (Catts et al., 2002; Muter et al., 2004; Snow, 2020; Storch & Whitehurst, 2002). Specifically, children with DLD scored significantly lower on emergent literacy skills suggesting that their poorer oral language skills may impact negatively on the acquisition of emergent literacy skills. Further, our findings revealed that expressive syntactic skills have the most significant relationship with all emergent literacy in both groups. This highlights the potential importance of morphosyntactic structure for literacy development in the Arabic language.

Limitations

Findings of this study should be interpreted with caution due to the following limitations. First, small sample sizes in both groups might have constrained our results. Future studies should recruit larger sample sizes to replicate the existing findings so more definitive conclusions can be drawn. Second, the gender imbalance in the DLD group was not controlled due to the limited sample size resulting in more boys than girls. This may reflect the reported bias in boys with DLD being more likely to receive clinical services (Morgan et al., 2017) despite a similar prevalence in boys and girls (Norbury et al., 2016) as the participants in the study were recruited from SLT caseloads. Third, the study uses a cross-sectional design. To have more accurate understanding of the relationship between oral language and emergent literacy skills, future studies should include longitudinal designs and investigate this relationship across different time points. Also, it should be noted that multiple correlations were carried out, such that, by chance, 1 in 20 may be significant due to chance. Finally, most of the administered tasks were not standardized on Saudi Arabic-speaking children. Further validation of these tasks is required for research and clinical purposes.

Clinical Implication

Findings from this study provide SLTs with a preliminary description of emergent literacy skills in Arabic speaking children with DLD. For young children with DLD, SLTs are often the primary service providers (i.e., providing speech-language therapy sessions). Therefore, being sensitive to other speech and language related problems that these children might face later in the future, such as, literacy difficulties, is important. This knowledge should inform speech and language therapy management and intervention strategies, in terms of including emergent literacy tasks in assessment and intervention. Further, findings provide SLTs and teachers with preliminary evidence of

the role of oral language skills in emergent literacy (i.e., early reading). This evidence suggests that deficits in oral language skills might hinder the acquisition of emergent literacy skills. Teachers should be aware of this and, where oral language difficulties are identified, refer to SLTs to access appropriate support.

Conclusion

This study contributes to the field's knowledge regarding Arabic speaking children with DLD. It represents an important first step in understanding early literacy skills and their relationships to language in Arabic speaking children with and without DLD. Results demonstrated that language deficits may be related to the acquisition of emergent literacy skills. Furthermore, findings indicated the potential importance of the morphosyntactic structure for literacy acquisition in Arabic speaking children. This study paves the way for future research that investigates the relationship between oral language and early literacy skills in the Arabic language, which is very relevant for clinical and education provision the children receive.

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Declaration of interest

The authors report no declarations of interest.

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