

9 Comparing Measures of Spontaneous Speech of Turkish-Speaking Children With and Without Language Impairment

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Children with language impairments (LIs) have deficits in one or more of the language areas, including phonology, syntax, morphology, semantics and pragmatics. In Turkey, identification of children with LI has recently been raised as an important issue. Speech-language therapy (SLT) is a young profession in Turkey, although it is growing rapidly (Topbaş, 2006). As part of the new professional law establishing SLT, regulations set forth by the Ministry of Health (2011) in cooperation with the Ministry of National Education (MoNE, 2014) included obligations to offer SLT services to individuals with speech-language impairments. Until a decade ago, the identification of children with LIs (including those who would now be diagnosed with specific language impairment [SLI]) was left to the intuition of doctors or other professionals' opinions. Language disorders were (a) included along with developmental disabilities occurring secondary to hearing impairment, mental retardation, learning disabilities, autism and other organic, neurological or psychiatric disorders; or (b) denied altogether, often by taking a wait-and-see approach for many years. No doubt, many children were inappropriately underdiagnosed or unattended.

According to the results of the first and only countrywide disability survey in Turkey by the State Institute of Statistics & State Planning Organization in 2006, speech impairment occurred in only 0.38% of the Turkish population. This rate did not include language disorders considered to be either primary LI or LI secondary to developmental disabilities, autism, hearing impairment, mental retardation or visual, physical or emotional disabilities. On the other hand, there has been an increase in the caseloads of SLTs, which consist mostly of preschool and school-age children who exhibit delayed language and/or LI with unknown etiologies,

i.e. SLI (Topbaş, 2006, 2010b). Families who are now more aware of the SLT profession are seeking help for their children. In light of this situation, the focus of this chapter will be on developing language measures that will identify children with LIs including delayed language development and children with SLIs. In this chapter, a very brief summary of the Turkish language and of typical development will be given, followed by a review of research on atypical language development (ALD). Efforts to develop standardized Turkish language tests are summarized and recent findings comparing the performance of children with and without LI on a variety of measures from language samples are presented.

Major Relevant Characteristics of the Turkish Language and Language Development

Turkish is a highly inflected, agglutinative language, belonging to the Turkic family of the Ural-Altai group. Inflection appears as suffixation where the derived and inflected suffixes are added to the root of nouns and verbs with rich combinations to create new meanings. Rarely, some prefixes and infixes are also used in foreign adapted words. The order of morphemes is fixed in that derivational morphemes precede the inflectional ones. A word can be a nominal (noun, pronoun, adjective), adverb, verb, postposition, conjunction, interjection or a discourse connective (Göksel & Kerslake, 2005).

The neutral word order is subject-object-verb (SOV), but word order is flexible for the pragmatic purposes of signaling topic-focus (Erguvanlı, 1984). In general, sentence-initial position is the topic position. According to Kornfilt (1997), topicalized constituents move to the sentence-initial position, backgrounded constituents move to the post-verbal position and new information or focused constituents occur immediately before the verb.

Basic grammatical relations depend on the use of inflectional marking on verbs and nouns. Noun phrases (NPs) are made transparent via case marking, permitting word-order variation. Object NPs are often overtly case marked but subject NPs are not. The subject pronouns *ben* (I) and *siz* (you) are typically omitted since inflectional morphemes on verbs (*-im*, *-sunuz*) indicate the person and number of the subject being marked as predicates. Object nouns may also be omitted depending on the context of utterance. Gender is not expressed in nouns or pronouns and it does not affect agreement; thus, gender is not expressed grammatically in Turkish (for a brief review, see Yavaş, 2010).

The course of language development is summarized based on the comprehensive review of Aksu-Koç (2010). With respect to *timing and order of acquisition in Turkish*, the rich and regular morphology is

acquired from 1;6 onward. By age 2;6, children command verb and noun inflections in simple sentences. There is a simultaneous emergence of verb and noun inflections, but nominal inflections are more subject to errors than verb inflections. Case marking follows a pattern of dative < accusative < locative < genitive < ablative < instrumental (Topbaş *et al.*, 2007). Among those, the dative and accusative markers appear much earlier and are more frequent than the other cases, but they are produced with more errors in some contexts. Because they are core cases in syntactic relations, they might be subject to more constraints that arise from the particular properties of the verbs with which they are used as arguments. Other factors that may cause difficulty are the complex interaction of the syntactic function of the accusative as a direct object marker with the pragmatic functions of word order, and the semantic features of objects such as specificity and referentiality. To sum up, in general, grammatical morphology in simple sentences is acquired at an early stage, although mastery necessarily waits upon further developments in complex syntax and semantics in the following years (Aksu-Koç, 2010; Ketrez & Aksu-Koç, 2009; Maviş & Ege, 2002; Özcan & Topbaş, 2000; Topbaş *et al.*, 1997, 2012).

Studies on Atypical Language Development in Turkey

Although there is substantial research on phonological disorders (an extensive summary can be found in Topbaş and Yavaş [2006] and Topbaş [2007]), there are few linguistic descriptions of childhood language disorders pertaining to either SLI or other developmental disorders in Turkish-speaking children (Özcan & Topbaş, 1994; Topbaş & Özcan, 1995). In this section, we summarize the current findings from the limited research available on the language characteristics of Turkish-speaking children with LI.

Acarlar (2008) compared the use of verb and noun morphology in Turkish children with ALD and children with typical language development (TLD) who were matched by mean length of utterance in words (MLU-W). The ALD group consisted of three children with pervasive developmental disorders, five children with general language delay, one child with autism and one with SLI. Language samples were transcribed and coded for inflectional morphology using the Turkish-Systematic Analysis of Language Transcripts (T-SALT; Acarlar *et al.*, 2006) conventions and were analyzed for MLU-W, MLU in morphemes (MLU-M) and frequency and percentage use of a representative set of noun and verb affixes in obligatory contexts. The typically developing (TD) children made no morphological errors whereas the children with ALD at the same MLU level had difficulty with noun affixes, but not verb affixes. Both groups were error free in their use of verb morphology. An analysis of error patterns on noun affixes indicated

a protracted course of development for children with ALD. Mastery of each affix seemed to occur at a later MLU than for the TLD group.

Güven *et al.* (2009) reported data on the morphosyntactic characteristics of children with SLI and TD children. The data of three children with SLI (mean age = 5;7) were compared with three age-matched and three language-matched TD children from the T-SALT database (mean MLU = 4.23). Spontaneous speech in conversational and narrative samples was analyzed using standard T-SALT measures, including MLU-W and MLU-M and accuracy of tense and non-tense morpheme use. The findings indicated that the productivity of Turkish children with SLI was delayed in that they used less complex sentences than the age- and language-matched children and they made more errors morphosyntactically. Turkish-speaking children with SLI used significantly fewer morphemes than both age-matched TD peers ($p = 0.05$) and language-matched children from the T-SALT database ($p = 0.05$). The authors also determined how often sentences of different lengths were used. Results indicated that children with SLI communicated mostly with short utterances (30% were one-word utterances and only 20% utterances were more than four words). In contrast, age-matched TD peers communicated mostly with sentences that consisted of more than three words (38.2%).

Next, the authors compared correct tense and non-tense morpheme use of the children to the age-matched and MLU-matched TD peers. Children with SLI produced more tense and non-tense morpheme errors (mean tense = 29.8%; mean non-tense = 26.2%) than the age-matched (mean tense = 0%; mean non-tense = 0%) and the MLU-matched (mean tense = 0%; mean non-tense = 1.3%) TD peers. The number and percentage of errors on tense and non-tense morpheme errors were very similar among the Turkish-speaking children with SLI. In addition, almost all the children in the group of typical language learners used many non-tense morphemes in complex sentences. Although some of the morphemes that the TD matches used in complex sentences were incorrect, the meaning was still clear in spite of the errors. In contrast, children with SLI used fewer morphemes than TD children.

In another study, Topbaş and Güven (2008) (cf. Topbaş, 2010a) focused on quantitative analyses of sentence repetition items on the TEDİL, the Turkish version of the Test of Early Language Development, Third Edition (TELD-3), to identify differences between TD ($n = 30$) and SLI children's ($n = 30$) capacity in repeating simple versus complex sentences and to identify any differences in error types. The number and type of errors in each sentence was analyzed in the following order: (a) the number of complete repetitions, incomplete repetitions and non-repetitions were compared to the target sentences; (b) specific error types in each incomplete sentence repetition (omission, addition of new elements, word-order inversion, errors

of bound morphology and lexical substitutions); and (c) errors in simple versus complex types.

The results of the study indicated that children with SLI performed worse than their age-matched peers, with the majority of the errors consisting of omission of elements and errors of bound morphology. TD children and children with SLI were able to repeat many of the case markings but particular difficulties were observed with noun morphology in contrast to children learning other languages who have more trouble with verb morphology. When sentences required more processing, either omissions or lexical and morphological substitutions occurred. In general, the majority of children changed the structure of complex sentences to simpler constructions, either by omitting the whole subordinate clause or by deleting the non-obligatory constituents such as adverbial phrases, whereas some children's repetitions were totally ungrammatical. The analysis of errors in simple versus complex sentences yielded differences between the TD and SLI groups. Bound morphological errors were evident in both the simple and complex sentence repetitions of children with SLI while TD children had errors in only 3% of the complex sentences.

Acarlar and Johnston (2011) elaborated their earlier study of grammatical morphology with developmental disorders. Language samples were collected from 30 preschoolers: 10 children with developmental disorders, 10 TD children matched by age and 10 TD children matched by length of utterance. T-SALT then generated MLU-M, the total number of noun errors, the total number of verb errors and the percentage use in obligatory contexts for noun suffixes. The potential effects of input frequency on the order of acquisition were analyzed as well. Turkish children in the MLU-W control group, aged 3;4, used noun and verb suffixes with virtually no errors. Children in the group with atypical language showed more persistent morphological errors than either age or language matches, especially on noun suffixes. Children with ALD and children in the MLU-W-matched group were acquiring noun case suffixes in an order that was strongly related to input frequencies. The findings of Acarlar and Johnston seem to reflect the influence of salience, regularity and frequency on language learning.

A general conclusion can be inferred from the scarce evidence that Turkish children with SLI showed difficulties with grammatical morphology like children with SLI in other languages. At the same time, language patterns seen in children with SLI may differ from one language type to the next; for example, greater difficulty occurs with noun morphology in Turkish-speaking children with SLI in contrast with greater difficulty with verb morphology in English-speaking children with SLI. Children acquiring Turkish may have greater difficulty with those features of grammar that have higher cognitive processing costs. However, many aspects of TLD

and ALD have yet to be investigated in depth in Turkish children before conclusions can be drawn. Other than those studies outlined above, there are ongoing studies on both monolingual and bilingual children with LIs mainly with SLI (COST Action Project IS0804; Maviş & Ölmez, n.d.; Topbaş, 2010a; Yarbay-Duman *et al.*, 2015; Yarbay-Duman & Topbaş, n.d.).

Language Assessment in Atypical Children

As mentioned above, the development of the SLT profession in Turkey and the inclusion of speech-language disorders within the legislation called for a need for valid and accurate diagnosis/assessment. This ultimately required comparison of a child's performance with a normative group (Merrell & Plante, 1997; Spaulding *et al.*, 2006). Consequently, a logical and timely first step was adapting tests from English to Turkish for normative assessment (cf. Topbaş, 2010b). Table 9.1 shows a list of some examples of language tests used in Turkey.

A challenge in the diagnosis of LI is that standardized language tests used to identify the condition may not work in translation, and they can only be interpreted if adequate norms exist for typical performance at different ages. In many countries, such data do not exist. Furthermore, even in English-speaking countries, there are difficulties in making international comparisons, because tests may be culturally specific (Parisse & Maillart, 2009). Standardized psychometric discrepancy criteria are more restrictive and perhaps less sensitive to LI than is clinical judgment based on a child's language performance in naturalistic contexts. While formal testing may ask children to engage in activities that are foreign to their experience, language sampling has the advantage of sampling a natural behavior of children. Due to the considerations discussed above, standardized tests are suggested to be only one aspect of a comprehensive assessment process (Šišková, 2012).

Measures of natural language samples

Measures derived from natural language samples require a significant investment of time; yet, they provide an index of the child's use of language in everyday informal settings and are especially useful for assessing a variety of pragmatic and discourse skills. Goffman and Leonard (2000) recommended using measures from natural language samples to assess language growth in children with SLI. Measures from natural language samples offer an assessment of a child's 'real-time language performance'. Such measures reveal a child's individual linguistic knowledge through verbal performance (Condouris *et al.*, 2003; Evans, 1996).

The use of objective measures from spontaneous language samples may provide a more clinically and ecologically valid approach to the

Table 9.1 Language tests used in Turkey

<i>Tool</i>	<i>Age range</i>	<i>Author(s)</i>	<i>Norms</i>
Test of Early Language Development-TELD-3: Turkish (Türkçe Erken Dil Gelişim Testi-TEDİL)	2;0– 6;11 years	Topbaş and Güven (2011)	+
Test of Language Development-TOLD-4: Turkish (Türkçe Okul Çağı Dil Gelişim Testi-TODİL)	4;0–9;11 years	Topbaş and Güven (in preparation)	+
CDI-MacArthur Communicative Inventory: Turkish (TİGE I and TİGE II-Türkçe İletişim Gelişim Envanteri)	08–18 months and 19–36 months	Aksu-Koç <i>et al.</i> (2012)	+
MLU as a Tool for Turkish Assessment	18–59 months	Ege (2010)	+
Preschool Language Scale (PLS-3): Turkish	2;0–6;0 years	Yalçınkaya and Belgin (2010)	Ongoing
T-SALT-Systematic Analysis of Language Transcripts-Turkish (Version 9) [computer software]	2;6–6;6	Acarlar <i>et al.</i> (2006)	+
TİFALDİ-Turkish Receptive & Expressive Language (Vocabulary) Test (Türkçe Alıcı ve İfade Edici Dil (Sözcük) Testi)	2;0–15 years	Güven and Berument (2010)	+
Sentence Repetition Test-Turkish (adaptation of SASIT by Marinis)	5;0–7;11 years	Topbaş <i>et al.</i> (in preparation within COST Action IS0804)	N/A
LDS-Turkish: Language Development Survey (DİLTAR-Dil Tarama Envanteri)	18–35 months	Topbaş <i>et al.</i> (in preparation)	+
LARSP for Turkish (TR-LARSP)	09 months–7;0 years	Topbaş <i>et al.</i> (2012)	N/A

identification of children with SLI than psychometric measures. A study by Dunn *et al.* (1996) compared the sensitivity of standardized test measures to measures derived from natural language samples for

diagnosing SLI in English-speaking children. They found that measures from natural language samples, specifically MLU and percentage of utterances containing structural errors, were better at defining SLI than were the psychometric tests that had been given to the children in their study. These findings have important implications for clinicians and researchers who depend on these types of language measures for diagnostic purposes, assessment and investigations of language impairments in LI. However, few studies in Turkey have compared the use of spontaneous language measures of language in TD children and children with language difficulties due to different etiologies (Acarlar, 2008; Acarlar & Johnston, 2010, 2011; Ege & Erdem, 2008; Tüfekçioğlu, 2010) and SLI (Güven *et al.*, 2009; Topbaş, 2010a).

Lexical measures

Measures of lexical diversity have been widely used in studies of language development and disorders. An intuitively straightforward measure of lexical diversity is the number of different words (NDW) used in a language sample. NDW has proved to be a potentially useful measure of child language development (Klee, 1992; Miller, 1991). However, NDW is dependent on the length of the language sample, and some form of standardization may be desired in comparing samples (e.g. using samples of fixed length, such as 50 or 100 utterances) (Lu, 2012).

Another traditional lexical diversity measure is the ratio of different words (types) to the total number of words (TNW; tokens), the so-called type-token ratio (TTR; e.g. Bates *et al.*, 1988; Lieven, 1978). However, this measure has been criticized for its sensitivity to sample size since the ratio tends to decrease as the size of the sample increases (Hess *et al.*, 1986; Richards, 1987 in Lu, 2012); that is, a longer text in general has a lower TTR value than a shorter text, which makes it especially complicated to use TTR in developmental comparisons between age groups, where the number of word tokens often increases with age.

Miller (1991) suggested that NDW might have better properties for investigating semantic development than TTR, which shows little developmental progression (Watkins *et al.*, 1995). Normative data on NDW controlling for sample length are available in Systematic Analysis of Language Transcripts (SALT) databases including the Bilingual SE Version 2010 for English- and Spanish-speaking children (Miller & Iglesias, 2010) and the T-SALT database. Differences in NDW have been reported between normally developing and SLI groups up through the age of five years. Therefore, NDW is believed to show promise as a means of measuring lexical development both in the preschool years and beyond (Malvern & Richards, 1997).

Grammatical complexity

Grammatical complexity is another measurable property of language, and different scales of measurement have been used to quantify grammatical complexity. The best known and most widely used is MLU, a measure of utterance length used as an index of children's grammatical complexity. MLU has been used as a diagnostic measure to differentiate between TD children and language-impaired populations in English-speaking children (e.g. Klee *et al.*, 1989; Scarborough *et al.*, 1986, 1991). In TD children, MLU correlates significantly with age up to approximately MLU 2.5–3.0 (Klee, 1992; Rondal *et al.*, 1987). With MLUs greater than 3.0, the association between age and MLU is less reliable; however, it continues to be a valid predictor of syntactic complexity and diversity up to approximately MLU 4.0 (Rollins *et al.*, 1996).

Specific morphosyntactic structures

After three years of age, children with SLI usually exhibit morphological and syntactic deficits, which are evidenced by the use of lower complexity syntactic structures in their native tongue. Areas of significant morphosyntactic impairment include tense marking and agreement, omitted by English-speaking children with SLI through at least the early elementary years.

In summary, a variety of lexical and morphosyntactic language sample measures have been used for language assessment with English-speaking children with and without LI. The limited research available on the performance of Turkish-speaking children indicates these measures have potential for diagnostic use in Turkish. However, specific noun and verb morphological forms must also be considered in order to address important features of Turkish in language assessment. Therefore, we recently conducted a study in which we examined the language samples of children with LI on a variety of quantitative measures and on the use of specific noun and verb inflections.

The Study

We compared the language samples of 18 children with LI to normative data from TD children in the T-SALT database on commonly used language sample analysis measures: MLU-M and MLU-W, number of total and different words (TNW and NDW) and TTR. We also compared the children's use of specific noun and verb inflections.

The 18 children in the study (one girl and seven boys from Bursa and three girls and seven boys from Eskişehir) were 3–5 years of age, as shown in Table 9.2 (mean age was 4 years, 3 months). The children had been identified as having LI (possibly SLI) by SLTs. All of the children

appeared to have normal motor and cognitive skills based upon the children's performance on the Ankara Development Test and the Denver Developmental Screening Test. Children with uncorrected hearing or vision impairment or multiple physical disabilities were excluded from the sample. They were all monolingual, speaking Turkish at home and at clinics. The children with LI had expressive language scores that were more than 1.5 SD below the mean for their age on the TEDİL (Topbaş & Güven, 2010). Most of the children had scores more than 1 SD below the mean on the TEDİL receptive scale as well, as shown in Table 9.2. As previously described, the TEDİL assesses expressive and receptive language in children from 2 to 7 years old.

Each child with LI was individually matched to the children of almost the same age group (± 6 months) from the Turkish SALT (T-SALT) database, which includes data on 140 TD children aged 2;6–6;6 (Acarlar *et al.*, 2006). We gathered 15-minute language samples, which included between 41 and 75 utterances, from the children with LI (Table 9.2).

Table 9.2 Children with LI and TD children selected from T-SALT database

	Age	Sex	No. of utterances (in 15 minutes)	TEDİL A raw score (SD)		Control group (T-SALT database)	
				Receptive	Expressive	Female	Male
1	3;1	M	65	9 (-1.80)	10 (-2.00)	15	18
2	3;4	F	59	10 (-1.60)	11 (-1.80)	17	19
3	3;7	M	41	8 (-2.00)	10 (-2.00)	22	18
4	3;7	M	63	9 (-1.80)	10 (-2.00)	22	18
5	3;9	M	42	8 (-2.00)	9 (-2.20)	20	18
6	3;9	F	44	12 (-1.20)	10 (-2.00)	20	18
7	3;10	M	47	11 (-1.40)	8 (-2.40)	18	20
8	3;11	M	71	14 (-0.80)	12 (-1.60)	20	20
9	4;1	M	60	12 (-2.40)	13 (-2.60)	19	19
10	4;1	M	45	13 (-2.20)	14 (-2.40)	19	19
11	4;2	F	53	11 (-2.60)	11 (-3.00)	19	17
12	4;5	M	59	11 (-2.60)	10 (-3.20)	18	16
13	4;7	F	75	9 (-3.00)	13 (-2.60)	18	15
14	4;9	M	46	14 (-2.00)	16 (-2.00)	17	18
15	5;2	M	71	18 (-1.83)	13 (-3.00)	17	16
16	5;3	M	56	13 (-2.66)	12 (-3.16)	17	17
17	5;8	M	54	20 (-1.50)	14 (-2.83)	20	18
18	5;9	M	46	19 (-1.66)	20 (-1.83)	25	22

Language sampling

A mother brought her child to the playroom. First, the child played with the toys alone, while the mother, the second author and an SLT with whom the child was not familiar, spoke quietly for 5 minutes. Then the mother left the room and the child played with the SLT for 15 minutes. The purpose of the play session was to elicit the highest level of play and language possible. The SLT was trained in language and play elicitation techniques, and had previous experience in interacting with preschoolers. Next, the child and his or her mother were given a standard set of toys provided that the child was able to participate for another 15–20 minutes interaction. Otherwise, this session was postponed to another day. The play set included toy cars, home furnishings, blocks, color markers and paper, a train set, puppets and picture-making booklets. The mothers were asked to play and interact with their children as they would at home.

We video and audio-recorded the sessions and an SLT student transcribed the speech samples. Ten transcripts were randomly selected for accuracy checks. If accuracy was judged inadequate, all the tapes done by that transcriber were rechecked by the graduate SLT. The percentage of agreement was rated word-for-word and morpheme-by-morpheme, and the interrater reliability for the transcriptions was 98.60%.

Language sample data

We derived the following measures from the language samples: grammatical complexity (MLU-M, MLU-W), lexical diversity (TNW, NDW and TTR) and morphosyntactic diversity (diversity of use of inflectional morphology and inflectional errors). The language samples of the children were 20–30 minutes long. Some of the samples of the language-impaired group included less than 50 utterances due to sparse production. Consequently, MLU-M, MLU-W, TNW, TTR and NDW were qualified as to time and utterance length. We selected these measures because of their sensitivity in indicating developmental changes in children's language abilities and their wide use in clinical practice and research on child language disorders.

We calculated the number of productive morphemes (excluding derivational morphemes) and words produced in intelligible utterances and determined the average number of morphemes/words per utterance (MLU-M and MLU-W).

NDW was calculated based on the NDW in language samples of a fixed length; in this work the sample lengths were (a) 50 utterances and, alternatively, (b) utterances produced in 15 minutes. Both methods of equalizing sample length have been shown to provide reliable measures of lexical diversity (Watkins *et al.*, 1995).

TTR takes the NDW (or types) and compares it to the TNW (or tokens) to yield a ratio that serves as a measure of lexical diversity (Richards, 1987). Although TTR is widely used in both first and second language acquisition studies, Miller (1981) claimed that TTR for the first 50 utterances of a sample yielded a ratio of approximately 0.45, regardless of age, in the age range of 3–8 years. Similar results were reported (Klee, 1992) in a study of children ranging from 2 to 4 years old. However, because TTR may yield different results in Turkish-speaking children, we compared the TTR of children with LI with matches in the T-SALT database.

The findings

Spontaneous language measures were calculated for all of the children using T-SALT analyses. Data from 18 children with LI were compared to the data of TD children (± 6 months of age) from language samples of equal length, based on utterances produced in 15 minutes. For NDW and TTR, comparisons were also made on an equal number of words (EW). Table 9.3 displays the overall performance of children with LI and TD children who were selected from the T-SALT database. We completed a series of group comparisons using *t*-test analyses to determine whether scores of the aforementioned language measures distinguished the two groups.

In our analyses, we compared the MLU-M, MLU-W, TNW, NDW and TTR ratios of typical children and children with LI in 15-minute samples. Children with LI performed significantly lower than control children on all grammatical and lexical measures based on *t*-test analyses, as shown in Table 9.3. Effect sizes were measured by calculating Cohen's *d* and EB *r* values, also shown in Table 9.3. Effect sizes for all measures except TTR were large and likely to be of clinical significance.

Table 9.3 Performance of LI and typically developing children in 15-minute language samples

Measure	15 minute samples								
	LI		TD SALT Database						
	Age mean 4;2		Age ± 6 months				<i>t</i>	<i>p</i>	Cohen's <i>d</i>
Mean	SD	Mean	SD						
MLU-M	1.76	0.33	4.59	0.45	-35.47	<0.001	-7.01	-0.96	
MLU-W	1.30	0.10	2.53	0.22	-47.44	<0.001	-6.82	-0.95	
TNW	72.5	16.8	140.3	30.2	-17.91	<0.001	-2.80	-0.81	
NDW-EU	38.1	8.15	76.02	14.2	-19.69	<0.001	-3.26	-0.85	
NDW-EW	38.3	8.13	47.9	8.61	-5.02	<0.001	-1.15	-0.49	
TTR-EW	0.56	0.08	0.69	0.33	-1.50	<0.001	-0.54	-0.26	

EU: equal number of utterances; EW: equal number of words.

Table 9.4 Performance of LI and typically developing children for noun and verb tense inflection types

Measure	LI		TD SALT database					
	50-utterance sample		Age ± 6 months					
	Age mean 4;2		Mean	SD	t	p	Cohen's d	EB r
<i>Noun inflections</i>								
Accusative	0.33	0.59	5.59	0.46	-37.56	<.001	-9.89	-0.98
Dative	0.22	0.54	6.28	0.86	-46.94	<.001	-7.27	-0.96
Locative	0.44	0.70	4.38	1.09	-23.74	<.001	-4.27	-0.90
Ablative	0.22	0.73	2.36	0.30	-12.42	<.001	-0.25	-0.12
<i>Verb inflections</i>								
Present progressive	4.72	4.84	17.76	3.90	-11.41	<.001	-2.96	-0.82
Past	4.38	3.08	8.44	1.00	-5.57	<.001	-1.76	-0.66
Perfect	0.38	0.60	3.26	0.47	-20.68	<.001	-5.28	-0.93
Present	0.50	0.70	1.95	1.91	-7.41	<.001	-1.41	-0.59
Future	1.11	1.49	1.95	0.19	-2.40	0.02	-0.79	-0.36

For analyses of noun and verb inflections we used group means, comparing the children with LI to the T-SALT data for children ages 3;8–4;10 (± 6 months from the LI group mean age of 4;2). The children with LI used an average of 11.3 nouns and an average of 10.2 verbs in 50-utterance samples and a *t*-test indicated that there was no significant difference in the number of nouns versus verbs used. We examined the four most frequently occurring noun inflection types (case markings) and the five most frequently occurring verb (tense) inflection types. Among TD children, the mean use of dative and accusative case markings was the highest followed by locative inflections, as shown in Table 9.4. Among children with LI, the use of case markings was low. We found the present progressive and past to be the most frequently used of verb tense markings among the TD children, followed by the perfect. Although children with LI did not use verb tense markers as frequently as children in the T-SALT database, they did use present progressive and past markers more frequently than the other verb inflections. Overall, it seems that there is a very significant developmental lag in the use of noun and verb inflections among preschool children with LI.

Conclusions

The acquisition of language is critical to cognitive, social and emotional development throughout the lifespan and difficulty with language acquisition may have a far-reaching impact on those developmental areas. Thus, research on the identification of children at an early age who are at risk is important so that appropriate interventions can be provided. However, the identification and classification of a clinical population with LI who do not have other significant medical, sensory, environmental or developmental diagnoses (i.e. SLI) is still challenging.

Clinicians typically depend on measures of language to diagnose children with LIs, to assess a range of language skills and to design and monitor treatment programs. Researchers use language measures to define their participant populations, to document their participants' language status, to match groups of participants or to investigate aspects of LI in different populations. Typically, two classes of measures are used for these purposes: (a) standardized psychometric tests and (b) measures of spontaneous speech derived from natural language samples, which can be collected in a variety of ways in different contexts (Marinis, 2011). Thus, both for clinical and research purposes there is a need for a diversity of valid language measures. Children learning Turkish (a non-Indo-European agglutinating language) offer challenging opportunities to expand current views of LI and assessment tools.

In our work, we seek to gather evidence to support the validity of measures, namely, MLU and inflectional use for morphosyntactic complexity, and TTR and NDW for lexical diversity, by comparing the performance of TD children from the T-SALT database and children with LI on the basis of language samples of equal length. Generally, we have found that in all the measures, MLU-M and MLU-W, TNW, NDW and TTR, children with LI lag behind their typical peers. However, it is worth noting that TTR has shown less of a difference than the other measures, particularly for 50-utterance samples. This result is similar to the findings of Watkins *et al.* (1995), who reported that TTR did not differentiate TD children from children with SLI.

In a study by Leonard *et al.* (1999), NDW calculated from 100-utterance samples was compared for TD children and children with SLI ranging in age from 2;2 to 6;11. A significantly lower NDW was found for the children with SLI than for the TD children of the same age, as was true for the Turkish-speaking children with LI in our study. In a study of the growth of lexical diversity in nine preschoolers with SLI, Goffman and Leonard (2000) found that the NDW used by these children in a 50-utterance sample was equivalent to or exceeded by the number used by younger TD children at the same MLU levels. This proved true for the children with SLI who began the study with a low MLU, as well as for those who began

with a higher MLU. However, Elin Thordardottir and Ellis Weismer (2001) reported no differences between children with SLI and a group of younger MLU-W-matched peers on measures of lexical diversity on both the number of different verbs and NDW in a 315-word sample.

From these studies, it can be inferred that children with SLI may have lexical deficits in addition to less complex morphosyntax compared to their peers when measures are taken from spontaneous speech. Morphosyntactic deficits are consistently found across studies. In the present study, MLU was lower than that of comparison children from the T-SALT database and the children with LI consistently used fewer noun and verb inflections than their peers. These results are compatible with the Acarlar and Johnston (2011) study.

Overall, the findings of our work support the evidence put forward by studies on Turkish children with LI (Acarlar, 2008; Acarlar & Johnston, 2010, 2011; Güven *et al.*, 2009; Topbaş & Güven, 2008). If more normative information were to become available, these measures might show promise in providing norm-referenced yet ecologically valid means of identifying LI. However, sensitivity and specificity data are needed to further explore the measures as possible identifiers of LI. Nonetheless, the summary of our current work provides initial support for language sample analysis and the use of the linguistic measures to identify Turkish-speaking children suspected of LI.

Summary

Valid language measures for identifying LI among Turkish-speaking children and information on TLD and ALD are essential to providing appropriate assessment and intervention services. This chapter provided a brief review of research on TLD and ALD in Turkish-speaking children, information on Turkish standardized language tests and data on the performance of Turkish-speaking children with and without LI on a variety of language sample measures. Similar to findings for young children who speak other languages, language sample analyses reveal significant differences between Turkish-speaking children with TLD and with LI on MLU and vocabulary diversity indices as well as on the use of specific noun and verb inflections. From a clinical perspective, general indices used for language sample analysis, such as MLU and vocabulary diversity measures, capture broad areas of difficulty and analyses of particular inflections provide a more detailed picture of children's development of the forms specific to the language they speak. The use of broad indices along with more specific analyses of language forms and the contexts of their use hold promise for identifying LI and specific areas of difficulty in Turkish-speaking children.

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