

# Study of child language development and disorders in Iran: A systematic review of the literature

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Child language development and disorder in Iran has been the focus for research by different professions, the most prominent ones among them being psychologists and speech therapists. Epidemiological studies indicate that between 8% and 12% of children show noticeable signs of language impairment in the preschool years; however, research on child language in Iran is not extensive compared to studies in English speaking countries, which are currently the basis of clinical decision-making in Iran. Consequently, there is no information about the prevalence of child language disorders in Iranian population. This review summarizes Iranian studies on child language development and disorder in the preschool years and aims to systematically find the most studied topics in the field of normal development, the assessment and diagnosis of language impairments as well as exploring the current gaps within the body of literature. Three main Iranian academic websites of indexed articles along with four other nonIranian databases were scrutinized for all relevant articles according to the inclusion criteria: Iranian studies within the field of Persian language development and disorders in preschool children published up to December 2013. They are classified according to the hierarchy of evidence and weighed against the criteria of critical appraisal of study types. As this is a type of nonintervention systematic review, the preferred reporting items for systematic reviews and meta-analyses is modified to be more compatible to the designs of eligible studies, including descriptive studies, test-developing and/or diagnostic studies. Several limitations made the process of searching and retrieving problematic; e.g., lack of unified keywords and incompatibility of Persian typing structure embedded in Iranian search engines. Overall, eligible studies met the criteria up to the third level of the hierarchy of evidence that shows the necessity of conducting studies with higher levels of design and quality.

**Key words:** Iran, language development, language impairment, preschool children, preferred reporting items for systematic reviews and meta-analyses statement, systematic review

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## INTRODUCTION

The majority of children acquire language skills in line with other developmental milestones, which leads parents to expect their child to produce their first words by the time they are a year old and two-phrase utterances within their 2<sup>nd</sup> year. For some parents, normal language development can indicate a child's typical progress in some other aspects of development including cognitive and memory skills as well as sensory-motor development and other higher brain functions.<sup>[1,2]</sup> Language difficulties in preschool can be due to a range of co-occurring problems that include developmental, cognitive, sensory or sensory-motor problems, neurological disorders, emotional or pervasive developmental disorders.<sup>[3]</sup> There are also some occasions in which children do not show

language skills compatible with their chronological age without apparent concomitant problem as named above<sup>[1-3]</sup> This condition has been called specific language impairment (SLI) and has attracted researchers within last two decades in order to find the nature and entity of this problem in relation to typically developing language. A widespread well-known definition explains developmental language disorder or impairment as unexpected age-appropriate problems in any areas of language development that might be subsequent to any reason.<sup>[3]</sup>

An epidemiological study indicated that approximately 7% of preschool children show noticeable signs of language impairment measured by two of five language scores below the 10<sup>th</sup> percentile. These children are those whose scores traditionally locate toward the lower end

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of the normal range of language development.<sup>[4]</sup> Other sources report prevalence between 8% and 12% among this age range.<sup>[5]</sup>

Quantitatively, research on child language in Iran is not extensive compared to studies in English speaking countries which are now the basis of clinical decision-making in Iran. Currently, there is no information about the prevalence of child language disorders in the Iranian population. Focusing on preschool children what follows is a review of published Iranian studies of child language, in both areas of development and assessing disorders regardless of their cause, from an evidence-based practice point of view. Consequently, a comprehensive critical summary of the research inside Iran was pursued to reveal the un-studied side of language development and disorder as well as to motivate researchers to conduct higher level studies within this field.

## MATERIALS AND METHODS

The method employed appraised and categorized studies using the levels of evidence suggested by the Oxford Centre for Evidence-Based Medicine<sup>[6]</sup> and followed the preferred reporting items for systematic reviews and meta-analyses (PRISMA) checklist with some modifications, suggested by the developers of PRISMA statement.<sup>[7]</sup> The modified items of the PRISMA in this review included those items contained intervention type of studies.

The method of retrieving the articles was based on a comprehensive search through three principal Iranian database websites in which academic publications are recorded, (a) scientific information database (<http://www.sid.ir>), (b) Iranian Research Institute for Information Science and Technology (<http://www.irandoc.ac.ir>), and (c) IranMedex (<http://iranmedex.com>). Four external sources also included: MEDLINE and EMBASE as two external databases, Childes Forum and Google scholar search engine. Another source of information was personal communication through email and phone calls. All the academic documents including published articles and unpublished documents (thesis and conference presentations) related to child language studies with the following inclusionary criteria were gathered either published in Persian or English languages:

1. Studies of Iranian Persian-speaking children including preschoolers (up to 5 years of age),
2. Studies of Persian language development or disorder from the assessment and diagnostic point of view,
3. Include a component of the survey, normalizing, assessment or diagnosis of any part of spoken Persian language skills including grammar (syntax/morphology), lexicon or semantics.

The following keywords were used in retrieving the data in both Persian and English: "Speech and language development," "speech and language disorders," "language disorders/impairments," "speech therapy." The "speech" part of the search was used only to screen the documents with a component of test development.

Studies were matched against the criteria of study designs and hierarchy of evidence<sup>[7]</sup> [Figure 1]. The hierarchy was modified slightly to accommodate the appraisal questions which address descriptive or observational studies that form the major research body in Iranian speech therapy. Data extraction was performed by the corresponding author, and the studies were checked against the review protocol by two authors after partially translating the content of articles to English for the non-Persian-speaking author. Two reviewers agreed on the study designs as well as their quality according to the hierarchy of evidence that were ultimately confirmed and revealed in review tables. The main researcher was tried to prevent any bias regarding the subject of studies, professional field of authors, and selective reporting across studies. As suggested by the PRISMA statement, because of the "particular circumstances"<sup>[7]</sup> of studies on language development and disorders in Iran, the above-mentioned topics were modified items within the PRISMA checklist (see below).

A total of 32 out of 299 studies met the inclusion criteria specified in this review (as in December 2013) [Figure 2]; the vast majority of them, 28 studies, were descriptive, cross-sectional surveys, either for developing tests ( $n = 12$ ) or mere descriptive ( $n = 13$ ) representing the lowest level of evidence.<sup>[8,9]</sup> Seven remaining studies were of

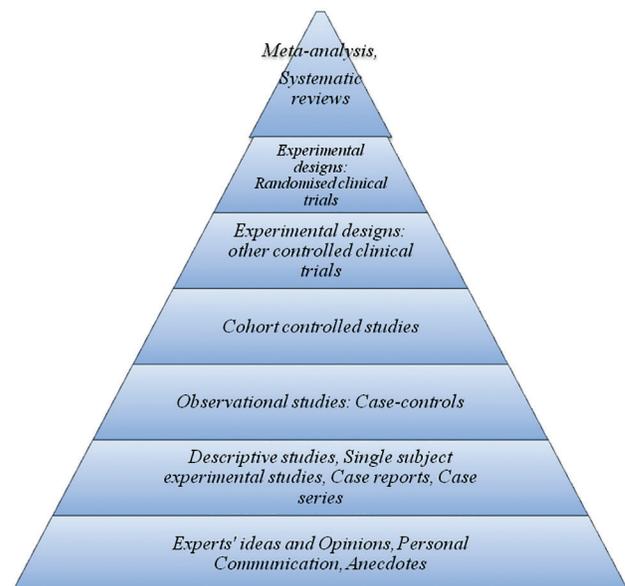
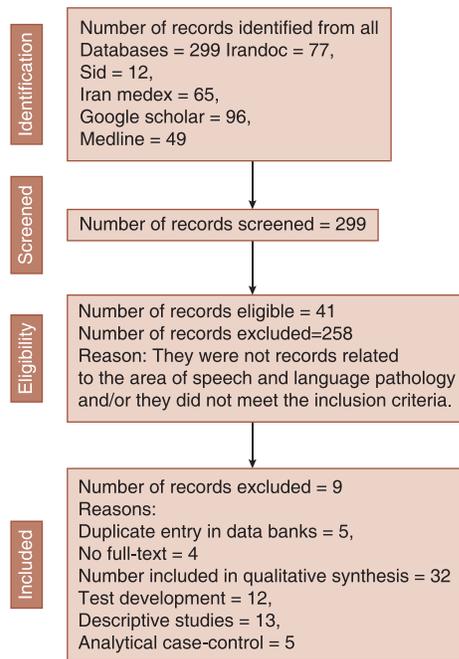


Figure 1: Hierarchy of evidence<sup>[8]</sup>



**Figure 2:** Adapted preferred reporting items for systematic reviews and meta-analyses (PRISMA) flowchart of the different phases of the current systematic review,<sup>[7]</sup> shaded boxes show the essential reported parts of the PRISMA statement, IRANDOC = short name of Iranian Research Institute for Information Science and Technology, SID = scientific information database

observational, cross-sectional analytic or case-control types, one level higher in the hierarchy of evidence. Studies were classified according to the study designs ascertained by the authors within the texts and in case of no type strictly specified; the study design was interpreted according to the methodology explained in the article or report.

## RESULTS

The results are organized based on the above-mentioned hierarchy. The main aim or outcome of each study is also stated within the tables.

### Descriptive studies

The studies with no comparison groups and no intention for test development were categorized as descriptive studies, which included 13 studies. They were either cross-sectional or longitudinal and described normal or impaired language development in Iranian children mostly with typically development. A review of them has been shown in Table 1 using criteria from "assessing scientific admissibility and merit of published articles, critical appraisal form, sections P-R."<sup>[10]</sup>

The importance of descriptive studies in current speech therapy in Iran is their capability for increasing awareness of the nature of Persian language development in children. The majority of descriptive studies were about

the specifications of Persian language development in Iranian children, with children as young as newborns recruited in sampling. There are cross-sectional studies among this group with large sample sizes (more than 100) that aimed to provide some comparisons across different Persian linguistic features, which would be beneficial in decision-making about what to look for at which age group in future studies.

### Psychometric studies of tests in Persian

Fifteen studies were described as test development studies that were designed to examine various psychometric features of either translated tests or tests developed for research purposes. Some of them have provided normal scores in large samples and the researchers claim that they can be used as a reference (norm-referenced) to find children with low-achievement behavior relating to the test items, although they are not published as tests, specifically without test manuals. Due to the highly limited number of assessment tools in Iran, it was tried to include as many studies as possible that focus on test making regardless of the linguistic area of the tool. The appraisals of these studies are shown in Tables 1 and 2 using the psychometric criteria introduced by McCauley and Swisher<sup>[24]</sup> in the field of speech and language therapy and most recently employed by:

1. Norming sample should be defined clearly so that the representativeness of the sample is documented by reasonable:
  - a. Geographical areas covered,
  - b. Socioeconomic status covered, and
  - c. "Normalcy of subjects in the sample" (p. 38) mentioning the procedure and number of excluded cases.

This condition assumes the study as a fully normative study; however, most of the studies reviewed were in the very first stages of developing a test so this condition was used cautiously for all types of studies containing test development. This ensured that sampling in nonnorming studies was checked as being representative against the study aims. This is true for all other criteria, too.
2. Sufficient sample size, minimum of 100 cases in each sample group for norming studies.<sup>[3]</sup>
3. Internal consistency of test structure should be reported in terms of item difficulty or validity, or both.
4. The measure of central tendency and variability should be reported for each sample group.
5. Concurrent validity report.
6. Predictive validity report.
7. Test-retest reliability of 0.90 or higher at 0.05 significance level or better.
8. Inter-examiner reliability of 0.90 or higher at 0.05 significance level or better.

**Table 1: Review and appraisal of descriptive studies on Iranian children with and without language impairment**

Study	CS versus longitudinal (L)	Population	Age	Inclusion/exclusion criteria clearly-stated	Random sampling	What studied	Data collection	Validity and reliability stated	Sources of bias stated	Statistical analysis explained	Results
Fahimi <sup>(11)(CB)</sup>	L	1	7-34 months	No	No	Speech and language development in early years of life	Parents reports and transcription, voice recording	No	No	NA	A comprehensive description of different developmental stages in early years of life including vocabulary, semantic relations and grammatical categories and morphology
Jalilevand et al., 2012 <sup>(12)(J)</sup>	L	2	12-36 months	Yes	No	What and when are the question words perceived in Persian?	Video-recorded free speech, 120 min/ months from 12 to 36 months old	Yes	No	Descriptive statistics	In Persian, questioning emerges by changing in intonation and follows the same pattern as development of question words in English
Bakhtiyari et al., 2012 <sup>(13)(J)</sup>	CS	42	18-36 months	Yes	No	Expressive lexicon size	P-MCDI vocabulary section	Cronbach's alpha reported along with professional consensus in a pilot study	No	Two-way ANOVA	Nouns were the largest categories among all three age groups The expressive lexicon increased by age
Mehdipour et al., <sup>(14)(CB)</sup>	L	21	18-24 months	Yes	No	Vocabulary count and type; sentence development	Parents and caregivers' reports	No	No	Descriptive statistics, age development by age comparisons using t-test	Vocabulary increases by age Nouns are the most frequent category No sex difference in terms of expressive vocabulary size High percentage of declarative sentences followed by imperatives and questions
Meshkato-dini, 2001 <sup>(15)(J)</sup>	L	2	NC	No	No	Grammar and vocabulary development	On-line transcription, universal grammar as an analytic framework applied	No	No	NA	An explanation for different grammatical features based on universal grammar account
Meshkato-dini, 2004 <sup>(16)(J)</sup>	L	2	23-42 months	No	No	Emerging sequence of inflectional affixes and morphemes	On-line transcription	No	No	No	Emerging morphology within these ages has been demonstrated through several tables
Modarres-zadeh, 2010 <sup>(17)(J)</sup>	CS	60	2.5 years	Yes	Yes	Expressive vocabulary	Persian picture naming test	Cronbach's alpha and split-half reliability reported	No	Descriptive statistics	Not contingent with the study question: the test is capable of showing the development of lexicon in this age range

Continued

Table 1: (Continued)

Study	CS versus longitudinal (L)	Population (L)	Age	Inclusion/exclusion criteria clearly-stated	Random sampling	What studied	Data collection	Validity and reliability stated	Sources of bias stated	Statistical analysis explained	Results
Naderi and Seifnazaragi, 1993 <sup>[18]CB</sup>	L	180	0-2 years	Not efficiently	No	Speech development in Farsi	Behavioural observation and note-taking, parents' interview	No	No	Descriptive statistics	A comprehensive quantitative report on all variables
Oryadi-Zanjani and Ghorbani, 2005 <sup>[19]J</sup>	CS	90	4-5 years	Yes	No	MLU-m, mean length of longest utterances, verb count, number of relative clauses, number of words, data on the length and the number of speech rate	Conversation and descriptive speech sampling with no	No	No	ANOVA, t-test	A comparative study on the indexes in different accents
Pouladi and Khoddam, 2002 <sup>[20]CB</sup>	CS	60	4-5 years	NC	Yes	MLU-w, MLU-m	50 utterances within two contexts: Conversation and picture description	NC	NC	NC	For 4-4; 6 years: MLU-w=3.5, MLU-m=7.09 For 4;6-5 years: MLU-w=4, MLU-m=7.5
Rahmany et al., 2010 <sup>[21]J</sup>	CS	51	2-7 years	Yes	No	Understanding relative clauses in Persian	Picture selection task	No	No	ANOVA-error analysis	More problems observed in processing of noncanonical word order sentences
Rezaei et al., 2011 <sup>[22]J</sup>	CS	110	2.5-4 years	Yes	Yes	Receptive and expressive vocabulary	Persian picture naming test	Cronbach's alpha and split-half reliability reported	No	ANOVA, independent t-test, correlation coefficient	Picture pointing and naming tasks can differentiate between ages 2.5 and 4 years old. No sex difference was seen. Expression and reception develop in parallel
Samadi and Perkins, 1998 <sup>[23]J</sup>	L	3	1; 8-3; 4 years	No	No	Developing Persian-LARSP	Persian-LARSP checklist	NR	NR	CHAT system and LARSP procedure	Reporting language grammar and vocabulary following stages of LARSP

J = Journal; D = Dissertation; LRR = Local research report; CB = Conference booklet; NC = Not clear; NR = Not reported; CS = Cross-sectional; LARSP = Language assessment remediation and screening procedure; CHAT = Codes for the human analysis of transcripts; MLU-m = Mean length of utterance in morphemes; MLU-w = Mean length of utterance in words

**Table 2: Appraisal of Iranian studies on test development for language assessment in Persian**

Study	Assessment	Abbreviation	Age range	Sample size	Diagnostic accuracy reported
Afshar <i>et al.</i> , 2013 <sup>[26]</sup>	Nonword repetition test		4-6 (years)	32	No
Pirmoradian <i>et al.</i> , 2012 <sup>[27]</sup>	Test of word finding – 2 <sup>nd</sup> edition	TWF-2	4-6 (years)	157	No
Sayyahi <i>et al.</i> , 2011 <sup>[28]</sup>	Nonword repetition test		4-4; 11 (years; months)	30	No
Heydari <i>et al.</i> , 2011 <sup>[29]</sup>	Speech intelligibility test		3-5 (years)	100	No
Hasanati <i>et al.</i> , 2011 <sup>[30]</sup>	Sentence repetition test		2; 6-4 (years; months)	72	No
Kazemi <i>et al.</i> , 2008 <sup>[31]</sup>	Persian MacArthur-Bates Communicative Development Inventory	P-MCDI	8-16 (months)	30	No
Kazemi and Derakhshandeh 2007 <sup>[32]</sup>	Oral/speech motor control protocol*		3-6 (years)	300	No
Soltaninejad <i>et al.</i> <sup>[33]</sup>	Picture verb test		36-54 (months)	106	No
Kazemi <i>et al.</i> , 2012 <sup>[34]</sup>	Mean length of utterance in morphemes	MLU-m	2; 6-5; 6 (years; months)	171	No
Oryadi-Zanjani <i>et al.</i> , 2006 <sup>[35]</sup>	Mean length of utterance* in words	MLU-w	2-5 (years)	580	No
Soleimani and Dastjerdi-Kazem 2005 <sup>[36]</sup>	Phonological awareness test*		4-7 (years)	203	No
Hasanzadeh and Minaei, 2000 <sup>[37]</sup> LRR	Test of language development-primary: 3*	TOLD-P: 3	4-8	1235	No

\*Specifically mentioned as a norming study; J = Journal; D = Dissertation; LRR = Local research report

**Table 3: Psychometric criteria met by each study**

Criterion	Number of studies reported this criterion	Studies reported this criteria as numbered in Table 1
Sample representative	12 out of 12	All studies
Sufficient sample size	3 out of 15	7, 10, 12
Internal consistency	10 out of 12	All studies except 9 and 10
Measures of central tendency and variability	9 out of 12	All studies except 3, 6, and 11
Concurrent validity	1 out of 12	11
Predictive validity	0	
Test-retest reliability	8 out of 12	All studies except 2, 7, 9, 10
Inter-examiner reliability	2 out of 12	4 and 9
Test performance instruction	10 out of 12	All studies except 10 and 11
Defining the eligibility for test administration	0	

9. A detailed and comprehensive test presentation and scoring system should be provided so that it can be replicated by others.
10. It should be clear who is eligible to do the test and whether there is a need for “specialized training for administrators or scorers.”

The resulting appraisal is summarized in Tables 2 and 3. None of the above-mentioned studies reported diagnostic measures for the tests or assessments used. Therefore, no judgment about how accurately any of them can identify children with language impairment

can be derived from applying these instruments in clinical settings.

Only one psychometric study on test of language development-primary reported some data about differentiating potential of this test. Children with some developmental problems, including learning disorders ( $n = 47$ ), speech and language disorders ( $n = 26$ ), mental retardation ( $n = 17$ ), and attention deficit and hyperactivity disorder ( $n = 8$ ) scored lower than children with normal development across almost all subscales of the test.<sup>[37]</sup> This study, however, did not implement any statistical test defined for phase I of a diagnostic accuracy to demonstrate this differentiation. So, the test judges about the difference merely based on the reported mean scores of these groups compared to normal peers.

The study of NWR of Afshar *et al.* showed some information with regard to the differentiation ability of this test in distinguishing between children with speech sound disorders and their normal peers ( $n$  in both groups = 32).<sup>[26]</sup>

Other studies did not include the framework of diagnostic accuracy within their research design nor reported comparative studies related to the measures or tests introduced, that is, no study investigate the differential competence of tests and measures at group level (phase I) or at individual level (phase II). This might reflect the second language teaching (SLT) researchers’ perspective that reporting the mere well-obtained psychometric

characteristics of the test would be sufficient also to consider it as a clinical tool.

### Case-control studies

Seven analytical observational cross-sectional case-control studies were found.<sup>[38-44]</sup> Critical appraisal forms from Stanford University were used to assess these studies<sup>[10]</sup> and the results are shown in Table 4.

Similar to non-Persian studies, a small sample size is a disadvantage of the above-mentioned studies. Besides that, in all but one, the number of children who were not enrolled in the study is not explained. Also, only two studies reported a random sampling and others had either no clear report of the sampling procedure (two studies) or did not recruit the population randomly.

Four studies had a clearly-stated hypothesis and the remaining three with an unclear hypothesis are those in which diagnosis overlapped with the outcome measures which would affect the validity of both. Six studies employed language sample measures either structured or informal; however, only two studies submitted a sufficient description of administration procedure. In some studies, e.g., Golpour *et al.*,<sup>[38]</sup> it was observed that the operational definition of the measures was not compatible with well-known definitions which caused a big problem in validity appraisal of these studies.

Apart from Foroodi-nejad's study,<sup>[42]</sup> no other study reported controlling statistics for the efficacy of the results such as confidence interval (CI) or effect size; however, they were calculated by the authors of this paper if sufficient data was available for computing. Table 5 shows the relevant 95% CI and effect size for those studies with a group of children with SLI. All the effect sizes of different measures are large (>0.8) which documents the large differences between children with and without language impairment in terms of language measures.

Case-control studies can also be analyzed in terms of evaluating the diagnostic competence of the tests they employed in comparing two groups of study. In an appraisal of this feature, none of studies were found to investigate the diagnostic accuracy of tests they employed which is known as phase II diagnostic accuracy studies;<sup>[46]</sup> however, all studies examined the capability of tests in identifying differences between two experimental groups which is considered as phase I diagnostic accuracy study. The majority of tests were able in diagnosing different pathological groups of children, that is, hearing impairment,<sup>[38,39,44]</sup> SLI,<sup>[40-42]</sup> and prematurely-born children.<sup>[43]</sup> This result needs to be further explored in terms of finding the diagnostic measures of tests

at individual level rather than group level including sensitivity, specificity, and likelihood ratios.

## DISCUSSION

Iranian studies of language development and disorder in Iranian preschoolers were reviewed using reliable critical appraisal forms which aimed to provide a detailed picture of the nature of studies relevant to this topic in the fields of speech therapy and child psychology.

This critical appraisal of studies showed that the highest level of evidence provided in this field does not exceed the third level in categorization of evidence defined by Greenhalgh.<sup>[8]</sup> Accordingly, future research should focus on conducting studies possessing higher levels of evidence in the hierarchy to improve the quality of research as well as increasing the professional confidence in applying the results both empirically and clinically. The previous effort so far, however, as indicated in this review, demonstrates that researchers were gradually becoming aware of the value and importance of well-designed research proposals that get benefit from stronger research methods and statistical procedures such as larger sample sizes that facilitates parametric analysis or applying reliability checks when appropriate.

Moreover, about test development within the discipline of speech therapy in Iran, domination of the psychological approach that prevents researchers to pay attention beyond a psychometric point of view was recognized. Paying attention to further steps of developing a new test or assessment tool within psychological approach, e.g., exploratory and confirmatory phases with regression analysis of statistical data as well as recruiting participants sufficiently various in type of language-health conditions, would strengthen the methodology of studies. Likewise, introducing more evidence-based approach to researchers would empower them to recruit more clinically practical research procedures within their methodologies and enhance the quality of evidence within the field of speech therapy in Iran. A limitation of this review located firstly in the insufficient search retrieval from the side of local search engines as well as a lack of unified keywords for professional terminology in Persian language. Several searches were made to overcome this problem that made the phase of retrieving data very long. Another limitation was incomplete access to the full text of sources such as theses or conference proceedings which made incomplete synthesis of data inevitable. These limitations show the necessity of improving data search engines to meet the need for more complete retrievals. It is also crucial for Iranian SLTs to have a unified terminology being developed in aid of empower Persian search within the local academic search engines.

**Table 4: Summary and appraisal of case-control studies on Iranian children with and without language impairment**

Study	Hypothesis clearly-stated	Population	Random selection of controls	Number of considered controls versus enrolled	Age	Inclusion/exclusion criteria stated for both groups	Clear and same diagnostic criteria for both groups	What studied	Data collection valid and reliable	Statistical analysis explained	Results
Golpour et al., 2007 <sup>(38)</sup>	Yes	10 cases (severe-profound hearing impaired) ~10 controls (age matched)	No	Only enrolled reported	4-5 years (SD not reported)	Yes	Same and clear	Total utterances, lexical and grammatical words, total words, TTR, MLU-w	Insufficiently described	t-test	Significant difference in all measures except TTR in both occasion of free speech and descriptive language
Lotfi et al., 2009 <sup>(39)</sup>	Stated not clearly	38 cases (hearing impaired) ~28 controls (age-matched)	No	Only enrolled reported	Cases' ages: 6 years (SD not reported), controls' ages not reported	No	Different not clearly-stated	Several language sample measures	Insufficiently described	Mann-Whitney U-test, t-test, not specifically-explained which one is used for which measure	Significant difference in all measures except unintelligible utterances, repetitive utterances and bad-formed sentences
Maleki-Shahmahmood et al., 2009 <sup>(40)</sup>	Stated not clearly	12 cases SLI ~12 controls (language-age matched)	Yes	Control: 40~12 Case: 15~12	Control: 4; 1 (±2) years, Case: 5; 7 (±6) years	Yes	Diagnosis overlaps outcome measures	TOLD-P (Farsi version) Percentage of some grammatical morphemes and words	Insufficiently described	Mann-Whitney U-test, t-test, not specifically-explained which one is used for which measure	Meaningful difference between two groups in some sub-tests of TOLD-P: Conjunction words, oral words, imitation, spoken quotient, organization quotient, semantic quotient No meaningful difference in percentage of some grammatical morphemes and words

*Continued*

Table 4: (Continued)

Study	Hypothesis clearly-stated	Population	Random selection of controls	Number of considered for enrollment versus enrolled	Age	Inclusion/exclusion criteria stated	Clear and same diagnostic criteria for both groups	What studied	Data collection valid and reliable	Statistical analysis explained	Results
Maleki-Shahm Mahmood et al., 2011 <sup>[41]</sup>	Stated not clearly	13 cases (SLI) ~13 controls (age matched)	Yes	Only enrolled reported	Control: 67 (±6.8) months Case: 67 (±6.9) months	Yes	Diagnosis overlaps outcome measures	TOLD-P (Farsi version), MLU-m, percentage of some grammatical morphemes and words	Yes for TOLD-P, insufficiently described for other measures	Mann-Whitney U-test, t-test, not specifically explained which one is used for which measure	Meaningful difference between two groups in some sub-tests of TOLD-P: Conjunction words, oral words, imitation, spoken quotient, organization quotient, semantic quotient Meaningful difference between two groups in MLU-m, lexical and grammatical words, lexical to grammatical words ratio
Foroodi-nejad, 2011 <sup>[42]</sup>	Yes	9 cases (SLI) ~16 controls (age matched)	Not explained	Only enrolled reported	Control: 69 (±9) months Cases: 67 (±13) months	Yes	Same but not clearly explained	ENNI's macro-structure and micro-structure, case marking in Persian, using clitics, agreement and tense use	Yes	t-test, Mann-Whitney U	Meaningful difference between two groups in ENNI measures Significant difference in the percentage of correct use of case marker <i>ra</i> Meaningful difference in percent of clitics usage No difference in percentage of correct agreement Meaningful difference in mean proportion of <i>mā</i> usage

Continued

**Table 4: Continued**

Study	Hypothesis clearly-stated	Population	Random selection of controls	Number of considered for enrollment versus enrolled	Age	Inclusion/exclusion criteria stated for both groups	Clear and same diagnostic criteria for both groups	What studied	Data collection valid and reliable	Statistical analysis explained	Results
Soraya <i>et al.</i> , 2012 <sup>[43]</sup>	Yes	42 cases (prematurely-born) ~42 controls (age matched)	No	Only enrolled reported	All: 18-36 months (SD not reported)	Yes	Same and clear	P-MCDI (toddler form) vocabulary section	Yes	Two-way ANOVA	Meaningful difference in vocabulary size between two groups
Zarifian <i>et al.</i> , 2012 <sup>[44]</sup>	Yes	9 cases (hearing-impaired) ~16 controls (age-matched)	No	Only enrolled reported	48-72 months (SD not reported)	Yes	Different but clearly explained	Types of grammatical errors and some language sample measures including MLU	Sufficiently described	t-test, Mann-Whitney U	No meaningful difference in types of errors between two groups Meaningful difference between two groups in MLU-w but not in the number of utterances and morphemes

J = Journal; D = Dissertation; SLI = Specific language impairment; TTR = Type-token ratio; MLU-m=Mean length of utterance in morphemes; MLU-w = Mean length of utterance in words; TOLD-P = Test of language development-primary; P-MCDI = Persian-MacArthur Bates Communicative Development Inventory; SD = Standard deviation; ENNI = Edmonton narrative norms instrument

**Table 5: The calculated 95% CIs and effect sizes for Iranian case-control studies with emphasize on SLI during preschool years**

Study	Effect size (Cohen's d)	95% CI
Maleki-Shahmahmood <i>et al.</i> , 2009 <sup>[40]</sup> Test: TOLD-P		
Semantic quotient	1.15	-2.01, -0.28
Organization quotient	1.52	-2.43, -0.61
Spoken language quotient	0.93	-1.77, -0.09
Sentence imitation	3.04	-4.22, -1.87
Oral vocabulary	2.93	-4.09, -1.78
Relational vocabulary	1.13	-1.99, -0.26
Maleki-Shahmahmood <i>et al.</i> , 2011 <sup>[41]</sup> Test: Free speech and language sampling		
MLU-m	1.65	-2.54, -0.76
Percentage of content words	1.5	0.63, 2.37
Percentage of grammatical words	1.5	-2.37, -0.63
Grammatical word to content word ratio	1.6	-2.48, -0.71
Foroodi-nejad, 2011 <sup>[42]</sup> Test: Structured elicitation task		
Percentage of correct use of case marking ( <i>ra</i> )	2.23	-3.25, -1.21
Percentage of clitics usage	1.19	-2.07, -0.31
Mean proportion of <i>mi</i> /usage (progressive marker in Persian)	4.23	-5.66, -2.81

Effect sizes of 2 or less is considered small, around 5 are medium, and those equal or >8 are large;<sup>[45]</sup> TOLD-P=Test of language development-primary; MLU-m=Mean length of utterance in morphemes; CI=Confidence interval; SLI=Specific language impairment

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## AUTHOR'S CONTRIBUTION

YK contributed in the conception and design of the work, definition of intellectual content, literature search, data acquisition, data analysis, manuscript preparation, manuscript editing, manuscript review, revising the draft, approval of the final version of the manuscript, and agreed for all aspects of the work. HS contributed in the conception and design of the work, definition of intellectual content, manuscript preparation, manuscript editing, Manuscript review, revising the draft. TK contributed in the conception and design of the work, definition of intellectual content, manuscript editing, manuscript review, revising the draft.

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