

Linguistic and metalinguistic characteristics of Persian-speaking children with autistic spectrum disorders: A systematic review

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Abstract

Studies of ASD children have mainly focused on pragmatics, but research showed they have problems in other language dimensions. The present systematic review aims to analyze the literature related to linguistic and metalinguistic studies to determine linguistic characteristics and their correlation with reading and writing. After reviewing 43 articles founded, the studies were divided into four main categories: descriptive, comparative, linguistic, and finally nonlinguistic interventional studies. 42% of studies are descriptive, 14% were comparative, and 5% were about the effect of linguistic and metalinguistic training on reading and writing. Studies on the effect of other training on linguistic and metalinguistic skills were about 39% of the studies. They have deficiencies in different linguistic and metalinguistic skills, especially grammar. There were no studies investigating the relationship between linguistic and metalinguistic abilities. The relationship between language and reading skills has been neglected and only one study has examined the correlation between phonological awareness and reading skills. Thus, there is a serious gap in metalinguistic studies. However, it is necessary to study these relationships due to the change in the reading education system from a phonological to a lexical path in schools. The effect of nonlinguistic interventions has been studied more than linguistic ones.

Keywords

Autism, language, metalinguistic skills, systematic review, reading, writing

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Introduction

Autism is one of the developmental disorders classified under autism spectrum disorder (ASD). Language acquisition deficit is one of its key diagnostic criteria.¹ In previous studies, the prevalence of ASD was estimated at 60 per 10,000 births; However, over time, a significant increase in their number has been observed.² While Social communication impairments are a main characteristic of ASD and Pragmatics is one component of language, structural language abilities, specifically semantics, and syntax, vary and result in marked individual differences.

Most linguistic studies on these children are conducted in English. For example, a detailed language assessment of individuals with ASD must take into account the true complexity of the language system.^{3,4} Studies on language development in ASD have also shown that the language profile of these children may change significantly with age.^{5,6} Preschool children are more likely to show

phonological and grammatical disorders. For example, Tuchman et al.⁷ showed phonological and grammatical problems. Similarly, Allen and Rapin⁸ demonstrated not only pragmatic impairments but also some difficulties in language comprehension. Some of these children also had phonological and syntactic disorders.

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Several studies indicate a discrepancy in expressive and receptive vocabulary scores, such that expressive vocabulary scores are higher than receptive vocabulary scores.⁹⁻¹¹ Other studies have reported no difference or higher receptive vocabulary scores than expressive vocabulary scores, and conflicting findings appear. It depends on the criteria and age of the participants.¹¹⁻¹³ In addition to deficits in standardized vocabulary scores, children with ASD exhibit unique deficits in specific subdomains of vocabulary, including the production and comprehension of personal pronouns, mental state terms, and prepositions.^{14,15}

In the syntax domain, children with ASD have variable deficits. Several studies have suggested that children with ASD show syntactic delay compared to peers with an intellectual disability or TD.¹⁶⁻¹⁹ These syntactic abnormalities can include challenges with verb phrases, regular and irregular past tense, present tense, and regular third-person singular verbs. Several studies have reported intact syntactic skills in individuals with ASD compared to TD peers.²⁰

Studies of Persian-speaking children with ASD have mainly focused on pragmatic language, still, there are some researches²¹⁻²³ that showed they have a problem with other linguistic skills such as syntax and relation with reading abilities.²⁴ Therefore, it is necessary to integrate linguistic and metalinguistic studies in these children and determine the results, and also compare the results with foreign studies as well as identify the research gaps in the studies. As we all know, reviewing their language research is essential because it can be very helpful in revealing their linguistic profile.²⁵

Language is a common system of spoken or written symbols that humans use to communicate with one another. McGuinness²⁶ believes that the ability to focus and think on language features is the same as metalinguistic awareness, including phonological awareness, morphological awareness, syntactic awareness, lexical awareness, and pragmatic awareness.²⁶ So, this paper aimed to analyze the research done on the linguistic and metalinguistic abilities of these children and the relationship between them and their reading abilities in Persian-speaking children and also to determine the areas the studies have occurred and their results and also the gaps.

Methods

For this study, the systematic review method was used and all articles and dissertations related to the subject were reviewed. Systematic reviews are literature review research that is a useful tool for gaining insight into particular research. Systematic reviews can help identify knowledge gaps as well as clarify the need for further research. The pleasant of this method is due to its neutral, logical, and normal technical process.

To do this study, first the keywords /autism/, /otism/, /utistik/, /otistik/, /autism/, /darkhodmandeh/, /darkhodmondegi/ in “ensani.ir,” “sid.ir,” “noormags.ir,” “magiran.com,” and “irandoc.ac.ir,” the number of articles in each field was determined and then, according to the relationship between linguistic and metalinguistic skills all related topics were separated and by reading abstracts and, if necessary, the whole article, related articles were collected. Article exclusion criteria is including: medical disorders and treatments in autism, studies on families of people with autism (parents and siblings), evaluation of autism characteristics in other populations and adults, evaluation of mental disorders associated with autism, etiology, prevalence, and other theoretical foundations of autism, standardization, and building tests for autism, translated or reviewed articles.

For assessing the quality of the primary research articles, we used the checklist developed by Kmet et al.²⁷ to include the relevant information for this systematic review. Specifically, the following criteria were rated: (a). Question/objective sufficiently described? (b). Is the study design evident and appropriate? (c). Method of subject/comparison group selection or source of information/input variables described and appropriate? (d). Subject (and comparison group, if applicable) characteristics sufficiently described? (e). If the interventional and random allocation was possible, was it described? (f). If interventional and blinding of investigators was possible, was it reported? (g). If interventional and blinding of subjects was possible, was it reported? (h). Outcome and (if applicable) exposure measure(s) well defined and robust to measurement/misclassification bias? Means of assessment reported? (i). Is the sample size appropriate? (j). Analytic methods described/justified and appropriate? (k). Some estimate of variance is reported for the main results. (l). Controlled for confounding? (m). Results reported in sufficient detail? (n). Conclusions supported by the results?

Then, all articles were independently coded by two reviewers. After assessing Interrater reliability and diagnosing differences, the reviewers discussed until an agreement was reached. Interrater reliability of the methodological quality assessment was acceptable for all items, with three items above 80%, fifth items above 70%, and six items above 90% agreement.

Results

After reviewing 43 articles found in the field of linguistic and metalinguistic skills of children with autism (Table 1), the studies were divided into four main categories:

Descriptive studies

Studies related to the describe their linguistic and metalinguistic skills. Table 2 shows that 10 of these studies are

Table 1. Articles confirmed at each stage of the review.

Expressions	Searching keywords	Reviewing titles	Reviewing abstracts and articles
/otism/	888	54	16
/utism/	1072	76	9
/statistic/	150	8	6
/utistic/	104	7	6
/dærkhodmande/	122	5	4
/dærkhodmandegi/	81	3	2

Table 2. Characteristics of subjects and studies.

Research	Tools	Area of analysis	Age	City	NEG	NCG
(9)	CCC	TLS	4–13	Mashhad	49	–
(10)	NDS		4–7	Tehran	5	–
(11)			–	Mashhad	30	–
(12)			2–8	–	30	30
(13)	NDA		–	–	20	20
(14)			4–7	Tehran	7	–
(15)	TOLD		–	–	15	–
(16)			6–12	–	20	–
(17)			5–8	Shiraz	26	26
(18)			5/6–7/8	Tehran	23	–
(19)	NDA	Semantic and pragmatic	2–8	Kerman	20	20
(20)	Three subtests of TOLD	Morphology	7–9	Kerman	15	15
(21)	NDA	Pragmatics	7, 9, 11	–	24	–
(4)	Syntax perception test	Syntax	6–9	Tehran	10	10
(22)	Syntax perception & grammar expression tests		6–9	Tehran	10	10
(23)	Grammar expression tests		6–9	Tehran	10	10
(6)	Syntax perception test		6–9	Tehran	10	10
(24)	Systemic functional grammar		6–10	–	10	10

NCG: number of subjects in the control group; NEG: number of subjects in the experimental group; TLS: total language score.

about total language ability. In seven studies, syntax and morphology were examined: one, pragmatics, and one, semantics and pragmatics.

Studies showed they had problems in spoken language, listening, organizing, speaking, semantics, and syntax, and their highest mean was in the picture vocabulary subtest and the lowest one was in grammar completion.²⁸ Autism have a delay in most skills.²⁹ The highest scores were in word articulation, sentence imitation, and picture vocabulary, and the lowest scores were in phonological analysis and syntactic understanding.³⁰ Two studies showed that autism is weak in pragmatics.^{31,32} Their level of perceptual, expressive, and cognitive language was lower than normal children's.³³ In the task related to the subject-verb agreement, the negative form of verbs, and the application of reference indexes, there is no significant difference between them and normal ones.^{34,35} Their mean length of utterance was much lower. Some delete the verb, the subject and verb agreement, and prepositions. Most of them have problems with passive construction.³⁶

In the field of syntax, there were perceptual problems in relative clauses, passive. They have problems with modality and mostly used present tense and to a lesser percentage simple tense and do not use the future, the use of subjunctive mood was so rare. Eighty-five percent of their sentences were indicative, 12% imperative, and 3% subjunctive moods, depicting that they would only talk about things and events which were present in their surroundings. They do not use unreal and mental events.³⁷ They have difficulty with grammatical expressions,^{22,23,38} such as Wh-questions, Yes/No questions, and singular/plural possessions. They have perceptual deficits in subject clauses, reversible sentences, and morphological-syntactic features, reversible active and passive sentences.

In the pragmatics field, there was a problem in using the principles of quantity, communication, and mood; And autism did not follow Grace's principles. there were difficulties in the representation of referents, and increasing age did not affect the representation of referrals.^{39,40}

Table 3. Characteristics of subjects and comparative field.

Research	Tools	Linguistic area of analysis	Age	NEG	City	NCG
(26)	TOLD & Theory of Mind test (TOM)	Total language score	4–6	110	–	–
(27)	Grammar expression test & TOM	Syntax	7–11	10	Tehran	10 age-matched, 10 Language-matched
(28)	NDA	Lexicon	3–6	–	–	Language-matched
(29)	CCC & BRIEF	Communication	6–11	82	–	–
(7)	Phonological awareness & reading test	Phonology	8	30	Tehran	30
(30)	Sidedness test & CCC	Communication	8–19	40	Tehran	–

NCG: number of subjects in the control group; NEG: number of subjects in the experimental group.

Table 4. Characteristics of subjects and treatment methods.

Research	Target area (test)	Training type	Age	NEG	City
(31)	NDA	Non-verbal motor imitation	3–9	22	–
(32)		Mirror neuron systems stimulation	5–8	6	–
(33)	NDS	Mirror neuron systems stimulation	5–8	6	–
(34)		Developmental, individual-difference, and relationship-based model	3–8	6	–
(35)		Picture exchange communication system and speech therapy	–	10	–
(36)		Superior hand manipulation exercises	6–8	30	Rafsanjan
(37)		Holistic multidimensional treatment	2–8	30	–
(38)		Melodic intonation therapy	7–10	13	Esfahan
(39)		Melodic intonation therapy	7–10	13	Esfahan
(40)		Music induction and intentional movement imitation	5–8	–	–
(41)	NDS & verbal imitation test	Reference education	3–6	56	–
(42)	Naming test	Non-verbal motor imitation	3–9	22	–
(43)	Asking question	Pivotal response treatment	1–6	3	–
(44)	TOLD	Storytelling	4–7	20	Mashhad
(45)		Pedagogical songs	8–10	30	–
(46)		Preverbal skills training	–	20	Tehran
(47)	Vocabulary development test (made by the researcher)	Applied Behavior Analysis & Pivotal Response Treatment (PRT)	4–6	30	–

NCG: number of subjects in the control group; NEG: number of subjects in the experimental group.

In the morphology field, there was a problem understanding the grammatical morphological categories of nouns, adjectives, verbs, and adverbs.⁴¹

Comparative studies

Studies related to comparing the relationship between their linguistic and metalinguistic skills with each other and their reading and writing. By reviewing the studies (Table 3), it was found that in two of them, the relationship between language and TOM has been investigated and there was a relationship between grammatical comprehension, picture vocabulary, and oral vocabulary and grammar expression with the ability of theory of mind.^{42,43} There was a positive correlation between language pragmatics and adaptive behavior, and the relationship between executive functions and language pragmatics.⁴⁴ The dominancy study showed a statistically significant difference between communication performance and educational state.⁴⁵

In phonological awareness and reading research,²⁴ there was a significant correlation between reading the word and some phonological awareness tasks; In addition, there was a significant difference between the autism and control groups in all subtests except syllable fragment subtests and phonological composition. Therefore, the level of skill and correlation in children with autism is different from normal children and should be given serious consideration in training them to read.

Nonlinguistic intervention studies

Studies investigating the effect of different training on their linguistic and metalinguistic skills. No research was found about the effect of training on metalinguistic skills, but in linguistic skills, about 82% of the study's total language skills, 6% of expressive syntax, and 12% of expressive lexical skills were considered (Table 4). In studies that have examined the effect of training on the total language,

in 64% of cases the NDS has been used, 22% TOLD, and in 14% of cases NDA.¹³ There were control groups in only two studies.^{46,47}

In most of the studies the statistics of the population and the city under study are not stated, and also most of the studies, although they are interventional, did not have a control group. This is because one of the criteria for the validity of intervention studies is having a control group.

Three studies have studied the effect of pre-verbal education in terms of social, physiological (imitation of movements), and speech-related issues on children's language development. The analysis of the effect of children's educational songs on the development of social, linguistic, and writing skills were effective.⁴⁸ Non-verbal motor imitation is effective on MLU and naming.^{46,47} Pre-verbal skills training improved communication skills in all subtests. They have problems creating and maintaining conversations with others.⁴⁹ The effectiveness of superiority manipulation exercises on expressive and perceptual language⁵⁰ was significant. Evaluating the effect of reference training on language skills increased their scores in expressional and perceptual language and verbal imitation. Studies related to melodic intonation therapy's effect on speech quality.^{51,52} A study related to the analysis of the effect of stimulation of mirror nervous systems on the development of different language skills of perception and expression) by comparing pre-test and post-test scores, showed a significant difference.⁵³⁻⁵⁵

In the study of response-based therapy, two studies were found. Response-oriented therapy on the questioning was effective⁵⁶; the effect of applied, response-oriented, and integrated behavior analysis methods on increasing the vocabulary was significant.⁵⁷ The mean vocabulary of the subjects in the combined group was significantly higher than the two others, so it was more effective. Therefore, integrated and general methods have better results. A study of the effect of holistic multidimensional treatment on receptive and expressive language skills was more effective.⁵⁸

The effect of storytelling on the spoken language was also significant.⁵⁹ The effect of communication-based picture exchange and speech therapy on communication systems showed that participants in the PECS group had significantly better development in communication skills.⁶⁰ A pilot study on the effectiveness of a developmental model, in improving language perception showed that this treatment significantly enhances language skills.⁶¹

Linguistic intervention studies

Studies investigating the effect of Linguistic training on their reading and writing. In only one study, the effect of improving the semantics of the language, that is, increasing the vocabulary, on the ability to comprehend in a 4-year-old child, showed that improving the semantics, increased the written comprehension of words.⁶²

In another study, the effectiveness of linguistic games on the language functions of high-functioning 10 children

with autism in Birjand has been investigated by TOLD.⁶³ The results showed that the intervention in the improvement of some language skills is not statistically significant but effective.^{64,65}

Discussion

An overview of about 43 studies on the linguistic and metalinguistic characteristics of children with autism reveals that the major part of the study (42%) is about the effect of different training on linguistic and metalinguistic skills, of which only one study on the effect of song teaching on writing skills has been discussed. About 14% are related to the comparison of linguistic and metalinguistic characteristics of these children with their other dimensions, among which the relationship between phonological awareness and reading has been investigated. About 5% were related to the study of the effect of linguistic and metalinguistic training on reading and writing. Therefore, apart from the three studies found on the reading and writing of children with autism, in other studies, the characteristics of the oral language of these children have been studied and no study has been done on the relation of their reading and writing with their linguistic abilities. About 39% were related to the study of the effect of other training on their linguistic and metalinguistic skills.

Descriptive studies

Analysis of data shows that in 42% of studies, the linguistic characteristics of these children have been described as covering various fields of morphology, syntax, pragmatics, and phonology. In research related to language ability, different tests have been used, so the results of different studies are not comparable, but the difficulties in syntax and grammar are a common result of all of them.

In the field of pragmatics, there is a problem with using the principles of quantity, communication, and mood.^{39,40} Their failure to follow the cooperative principles of Grace (quantity, quality, relation, and manner), makes their speech seem meaningless and irrelevant to the context of the language.

Given that all the syntactic studies^{22,23} were related to the ages of 8–10 year-old boys, it is necessary to examine these topics in other ages and especially girls with autism, such as assessing the development of syntax perception and expression of over 9 year-olds and under 6 years.

Considering the subjects' age and the development period of these indicators, it is necessary to conduct this study at other ages.²¹⁻²³ these studies have been done only in boys, then for generalizations, it is necessary to do it in girls as well. Both studies have been done on monolinguals, so doing the same research on less than 7 years old and over 11 years in bilinguals is also very useful.

For studying morphology subtests of TOLD were been used and these subtests are not designed for morphology assessment, it is better to design valid tests for this purpose and then assess the perception of the morphological feature in different ages and bilingual and monolingual children with autism.⁴¹

Comparative studies

The relationship between language and TOM has been shown that in children with autism, there is no significant correlation between grammatical expression and theory of mind, but there is a relationship between grammatical perception and theory of mind. According to the tests used in these two studies, it seems that more in-depth studies are needed in these fields, especially by constructing sentences similar to the ones used in the TOM (sentences with mental verbs).

Given that one of the theories about the causes of injury in children with autism is a defect in executive function and according to contradictory studies, it is also necessary to the relation between this function with the use of language (re) and other language skills of these children to be examined.⁴⁵

No studies investigated the relationship between linguistic and metalinguistic abilities in children with autism. Given that one study²⁴ has been found on reading and phonological awareness in these children, in future research, in addition to examining their different reading skills, the relationship between phonological awareness and reading and writing skills of these children should be examined, especially reading different types of words and nonwords. It is also necessary to examine the effect of different teaching methods of reading on their reading skills; and evaluate syntactic, morphological, and lexical awareness in children with autism to investigate the relationship between understanding different grammatical constructs and reading and other skills like the theory of mind.

Nonlinguistic intervention studies

The effect of different training studied and confirmed, but there are many research gaps in the Investigation of non-verbal motor imitation, applied behavior analysis, response-oriented, executive performance-related skills, and integrated behavior on different linguistic skills.⁴⁵ It is necessary to investigate the effect of training in understanding different grammatical constructs and mental verbs on their education. It is also necessary to evaluate increasing the ability of different types of memory, phonological awareness, and cognitive abilities on their reading and writing ability.

Linguistic intervention studies

The effect of improving the semantics of the language, that is, increasing the vocabulary of comprehension and expression, on the ability to comprehend⁶² and, the

effectiveness of teaching linguistic games on the language has been confirmed,⁶³ but they were not complete research and more studies are needed with more diverse categorized linguistic games (different linguistic skills) on different reading skills such as reading accuracy, speed, and comprehension.

In summary, there are difficulties in the linguistic and metalinguistic skills of children with autism, and most of these children have deficiencies in these skills. Although what is discussed in most studies is their pragmatic problems, these children have morphological, syntactic, and semantic problems. The review of descriptive studies also shows that most studies (56%) described their total language. However, in different linguistic studies, syntactic ones were more than other linguistic studies, which can be due to the lack of specific tests for other linguistic domains similar to semantics and pragmatics.

In comparative studies, no studies investigated the relationship between linguistic and metalinguistic abilities in these children. The relationship between language and cognition has been studied and the relationship between different language skills and reading skills has been neglected and only phonological awareness and its relationship with the reading skills of these children has been examined. Thus, there is a serious gap in the study of the metalinguistic skills of these children.

However, due to the change in the nonlinguistic reading education system from phonological to the lexical path, it is necessary to study the relationship between reading skills and morphological-semantic and semantic knowledge.

Despite nonlinguistic interventions, the effect of linguistic studies has been studied rarely, while linguistic and metalinguistic skills are essential for learning, especially learning to read and write.⁶³

Conclusion

Studies of ASD children have mainly focused on pragmatics, but research showed they have other language deficits. The present systematic review aimed to analyze the literature related to linguistic and metalinguistic studies to determine linguistic characteristics and their correlation with reading and writing. They have deficiencies in different linguistic and metalinguistic skills, especially in morpho-syntax or grammar. There were no studies to investigate the relationship between linguistic and metalinguistic abilities and the relationship between language and reading skills has been neglected. Further studies that evaluate the serious gap in metalinguistic studies are still needed.

Limitations

In this study, only the articles published in both English and Persian were reviewed, and studies in other languages were not included.

Recommendations

To this date, studies of linguistic and metalinguistic characteristics of Persian-speaking children with autistic spectrum disorders have been limited. Also, due to the diversity of abilities, and disabilities in patients, it is recommended to conduct more extensive studies to treat patients with autism in different languages. This way, speech therapists can use clinical trials with more confidence, and they can also design new effective treatments.

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