



**VERBAL COMPREHENSION, PRODUCTION, AND USE OF GESTURES IN  
CHILDREN WITH LANGUAGE IMPAIRMENT USING ADAPTED  
KANNADA VERSION OF MAC ARTHUR COMMUNICATIVE  
DEVELOPMENT INVENTORY**

<sup>1</sup>Veena K D ,<sup>2</sup> Sunila John ,<sup>3</sup>Sattiavany Veerabudren ,<sup>4</sup>B. Rajashekhar

<sup>1,2,3,4</sup> Dept. of Speech & Hearing, SOAHS, MAHE, Manipal ,India

<sup>1</sup>r.veena@manipal.edu

**ABSTRACT**

*Background: Language Impairment is defined as a disorder in comprehension and/or use of spoken, written and or the symbol system (ASHA,1993). The MacArthur-Bates Communicative Development Inventory (MCDI) is a parent-reported measure designed to evaluate the communicative skills in children. Aim: The aim of this study was to compare the verbal comprehension, production, and use of gesture in children with language impairment using the adapted Kannada version of MCDI (K-MCDI). Method: The data were obtained from 15 children aged between 1-3 years and were diagnosed as having a Receptive and Expressive language delay. The Verbal comprehension, production, and use of gesture were assessed using Kannada version of the MCDI which was given to the parents in order to report the current level of verbal comprehension, expression, and gestural skills of their child. Results: The data collected was analysed and the verbal comprehension, production, and use of gestures was scored by determining the children's performance on each section. Conclusion: This study contributes to the accumulating evidence on using K-MCDI for valid inferences for diagnostic and intervention purposes in the Indian scenario. Key Words: Language Impairment, Verbal Comprehension, Verbal Productions, Gestures*



## INTRODUCTION

Gesture and the vocabulary development in the first year of life is very crucial, wherein gesture precedes the vocabulary development in typically developing children (Goodwyn & Acredolo, 1993) and paves the way for later language development (Ozcaliskan & Goldin-Meadow, 2005). Infants in the first year, produce a number of gestures than the words (Volterra et al., 2005). When young children gestures, parents usually provide verbal inputs to the child thereby translating these gestures into words (Golinkoff, 1986; Masur, 1982). By around 20 months, infants spoken communication dominates over the gestures (Capone & McGregor, 2004). It is further reported that, the development of gestures provides a significant basis for the appearance of language both atypical and typical development (Mundy et al., 1988; Wetherby et al., 1989).

Language Impairment is defined as a disorder in understanding and/ or use of both spoken, written and/or the symbol system (ASHA 1993). Language Impairment can be due to several factors such as hearing loss, intellectual impairment, Down syndrome, cerebral palsy, seizures, Autism spectrum disorder and Attention deficit hyperactive disorder. Studies on language abilities in children with communication or language impairment show a general delay in the language domain with specific dissociations among several linguistic domains like comprehension versus expression (Cardoso-Martins & Mervis, 1985; Caselli et al., 1994; Chapman, 1985; Fowler, 1990; Miller, 1992). These problems become more evident as the child develops.

Several literature reports state that children with Language impairment show significant deficits in different linguistic domains. Studies done among children with down syndrome have reported both gestural and language deficits (Caselli et al., 1998; Buckley, 2000; Zampini & D'Odorico, 2009; Zampini et al., 2015) with disturbances in nonverbal requesting skills (Mundy et al., 1995). However, despite demonstrating dissociations in comprehension and production, a synchronous development is reported in lexical comprehension and gestures (Caselli et al., 1998).

Buckley (2000) reported that the vocabulary growth is quite slow in Down Syndrome children. They found an average number of expressive vocabulary is 28,116, 248,272,330 at 2,3,4,5,6 years respectively. A normal child achieves a vocabulary of about 250 words by two years of age whereas Down syndrome children, attain this milestone by four years. Overall lexical growth is slow and delayed in Down syndrome children (Chapman, 1997). Nevertheless, Down syndrome children produce more percentage of gestures and showed a different pattern of vocabulary and gestural development as compared to normal children (Caselli et al., 1998).

Zampini and D'Odorico (2009) reported gesture production in 20 Italian children of aged 36 months with Down syndrome, seemed to be linked with both psychomotor development and word comprehension. It is not linked to word production. It was observed that vocabulary production was well correlated when the children with Down syndrome were reassessed at 42 months. Checa, et al., (2016) compared the productive vocabulary using MCDI in children with Down syndrome and normal



children between 8 and 29 months. The authors found that same vocabulary size in both the groups with a significant difference in larger production of nouns by children with DS. Price et al. (2007) reported Down syndrome children performed poorly on language comprehension than children with Fragile X syndrome. Children with fragile X without autism had higher receptive and expressive vocabulary than Down syndrome children ( Roberts et al. 2007).

The gestural and vocabulary development in Children with Specific Language Impairment (SLI) showed more usage of gestures during the narrative task, suggesting that they depend on more on gestures to communicate or express the message as they want to convey (Mainela-Arnold et al., 2014). Children with SLI had fewer words in their vocabularies as well as lesser knowledge of the words (Wray et al., 2016). Stolt et al., (2014) compared the development of gestures and predicted the development of language in children with Very Low Birth Weight (VLBW) and full-term babies. They reported that the gestures and receptive vocabulary development, together contribute to the emerging language skills of VLBW children. There also exist many variations within different patterns of gestural and vocabulary domains in children with language impairment (Chan & Iacono, 2001).

### **NEED FOR THE STUDY**

The literature evidence suggests that children with language impairment show significant delay and exhibits a different pattern of development in early vocabulary and gesture production. Most of the studies have focussed on gestural and vocabulary development in Down syndrome children.

However, scarcity of information on the gestural and vocabulary development in children with language impairment secondary to various other etiologies. In the Indian scenario, studies on the early development of words and gestures in children with language impairment are limited. Hence it is necessary to gain in-depth knowledge on the use of gestures and vocabulary size with respect to Indian children having language delays. It is also reported in the literature that gesture profiling is important along with the language profiling in the assessment and the management of children with language impairment (Crais, et al., 2009). One of the instruments available to assess both gesture and language is MacArthur-Bates Communicative Development Inventory (MCDI). It is a parent report measure of early vocabulary and gestures (Fenson et al., 1993). This instrument has been adapted to the Kannada language: Words & Gestures (Hazel, 2014). Also, currently adapted Kannada version of MCDI (K-MCDI) is not validated by administering on children with communication disorders. Therefore, the present study focuses on investigating the vocabulary development (comprehension and expression) and gestural development in children with language Impairment in order to understand the variability and the trend in vocabulary and gestural development.

### **AIM**

Main aim of this study was to compare the verbal comprehension, production, and use of gesture in children with language Impairment using the adapted Kannada version of MacArthur-Bates Communicative Development Inventory.

### **OBJECTIVES**



To determine the verbal comprehension, verbal production and use of gestures in children with language impairment of age between 1-3 years using Kannada Version of MacArthur-Bates Communicative Development Inventory.

## METHOD

15 children with language Impairment aged between 1-3 years (Mean age:2.8 years) participated in the study. All children visiting the Speech and Hearing department of a tertiary hospital with the complaint of language delay were recruited for the study. Receptive- Expressive-Emergent-Language Scale -2 test (REELS-2; Bzoch

& League, 1991) was administered to evaluate the presence of receptive and expressive language delay. Participants were selected based on the following criteria: Children chronological age between 1-3 years with the diagnosis of receptive-expressive language delay. Children whose mother tongue is Kannada and who had good social behaviour were included in the study. Children with Autism Spectrum Disorder and Attention Deficit Hyperactive Disorder were excluded from the study. Table 1 depicts the demographic details of the study participants.

Table 1: Demographic details of the children with Language Impairment

Sl.No	Age	Gender	Medical conditions
1.	2.1	F	Downs syndrome
2.	3	M	Downs syndrome
3.	3.1	M	-
4.	3	F	-
5.	2.4	F	Downs syndrome
6.	3	F	Downs syndrome
7.	3	F	Cerebral Palsy
8.	2.7	M	West syndrome
9.	3	F	-
10.	3	F	Downs syndrome
11.	1.9	M	-
12.	3	M	Cerebral palsy
13.	3	M	Cerebral palsy
14.	3	M	-
15.	2.9	M	Cerebral palsy

## INSTRUMENT USED

The verbal comprehension, production, and use of gestures were assessed by administering Kannada Version of the



MacArthur Communicative Development Inventory Part 1: Words and Gestures (Hazel, 2014). Section 1 is Early words which include: First signs of understanding, Phrases, starting to talk, and Vocabulary checklist and Section 2 actions and gestures includes 63 gestures that are organized into 6 sections which include: First communicative gestures, Games and routines, Actions with objects, pretending to be a parent, Imitating other adult actions, Pretend objects.

**PROCEDURE**

On the first or second visit, the adapted Kannada version of MCDI was self-administered by parents of children with receptive and expressive language delay as a part of the routine examination. Prior to the filling of the inventory, verbal parental consent was taken. As mother interacts more with the infant, she was given the inventory to fill. The mother was then advised to read the inventory before filling. However, if the mother required assistance, the inventory was interview assisted.

**DATA ANALYSIS**

The data obtained were analysed for verbal comprehension, production, and gestures. The descriptive statistics were used to analyse the data. Raw scores were obtained by combining the individual scores. Statistical analysis was done for the hand scores obtained from the inventory filled by the parents. Count, percentage, mean,

standard deviation, minimum and maximum was obtained.

**RESULTS**

The results are discussed under 2 sessions:

**PERFORMANCE ON EARLY WORDS**

Table 2: Performance of First Sign of Understanding in children with Language Impairment

% Percentage	Language Impairment (%)
Responding to name calling	100%
In response to "No"	80%
React to Father/Mother	93.3%

As indicated in Table 2, first signs of understanding were explored by counting the number of infants who responded 'yes' and percentage was calculated for each of the 3 questions. All the children with language impairment performed well in first signs of understanding. Table 3-5 indicated the performance of children with language impairment on phrases, vocabulary, and gestures.

**Table 3:** Performance on comprehension of phrase, Vocabulary comprehension & Vocabulary production in children with language impairment

	Mean	Std. Deviation	Maximum	Minimum	Std. Error Mean
--	------	----------------	---------	---------	-----------------



Phrases Understood	20.4	+/-6.93	25	2	1.70
Vocabulary Comprehension	169.07	+/-97.65	288	13	25.21
Vocabulary Production	91.73	+/-97.55	271	15	25.19

**Table 4:** Performance on starting to talk in children with language impairment

% Percentage	Language Impairment		
	Not achieved	Emerging	Frequently
Imitation	53.3%	33.3%	13.3%
Labelling	40%	40%	13%

### Performance on Action and Gestures

**Table 5:** Performance on Actions and Gestures in children with language impairment

	Mean	Std. Deviation	Minimum	Maximum	Std. Error Mean
Actions & Gestures	41.3	+/-17.37	2	68	4.48

## DISCUSSION

The main aim of the study was to find out the verbal comprehension, verbal production, and use of gestures in children with Language Impairment. It was found that children with language impairment showed delayed verbal comprehension, production and use of gestures when compared the data with previously obtained data for 16-17 months (Hazel, 2014). Similarly, Charman, et al., (2003) reported a delayed developmental trend in children with language impairment. They reported that the vocabulary development is delayed in both comprehension and expression with comprehension vocabulary being more than expression.

In terms of performance on early words, in the present study, only 80% of the children with language impairment responded to “No”. It has been reported in the literature that the typically developing infants by age 7-12 months will start to respond to “No” (Shipley & McAfee, 1998). Fenson et al., (1994), reported that infants use short phrases by 12 months and comprehension of words and phrases precedes production before 15 months. However, in the present study some of the language impaired children could not understand some phrases spoken.

In the present study, in terms of vocabulary comprehension, children with language impairment achieved less number of



receptive vocabulary. Vocabulary comprehension ranged from 13 to 288 (mean score-169.07). However, in the normative of 16-17 months typically developing children (Hazel, 2014) the vocabulary comprehension ranged from 66 to 335 (mean score-197.7). In terms of vocabulary production, children with language impairment achieved less number of expressive vocabulary. Vocabulary production ranged from 15 to 271 (Mean score -91.7333). However, in the normative of 16-17 months typically developing (Hazel 2014) children the vocabulary production ranged from 0 to 172 (mean score-67.56). Similar finding was reported in Down syndrome and Specific Language Impairment children. Authors reported that production vocabulary was limited when compared with typically developing cognitive matched children and vocabulary size of children with Down syndrome increased with the developmental ages, but with more individual variability (Zampini & D'odorico, 2013; Stella, et al.,1993; Miller, 1992). Authors (Trauner et al., 1995; Fletcher & Peters, 1984; Rice et al.,1994; Hick et al., 2002) also reported general delay in the overall vocabulary in children with SLI with particular difficulty in acquiring verbs; children started producing at a later age than typically developing children with considerable amount of variation. Caselli et al., (1998) reported that word comprehension is better than word production with marked individual differences between children. In the present study, it was observed that mean comprehension is also more than the production vocabulary.

In terms of starting to talk, only 13% of the children with language Impairment performed for imitation and labelling. Labelling and imitation are still emerging

in few of the children with language impairment and maximum percentage (53 % & 40%) of children with language impairment did not achieve labelling and imitation. However, 87% and 82.6% of the typically developing children in the normative data of 16-17 months performed the labelling and the imitation sections (Hazel, 2014).

In terms of Actions and gestures, the total number of gestures produced ranged from 2 to 68 (Mean -41.3). However, in the normative of 16-17 months typically developing children (Hazel, 2014) the total gestures ranged from 12 to 63 (mean-41.08). It was observed that there was substantial variability in participants recruited. It was also observed that those who performed poorly in gestures scores, also performed poorly in comprehension scores. But it was no so for verbal production. Children who had more difficulty in verbal production had continued communicating with gestures. It was reported that fewer numbers of gestures were produced by very low birth weight children than full-term children (Stolt et al., 2014). Caselli et al. (1995; 1998) reported that gestural production, verbal comprehension is achieved earlier than the verbal production in both typically and Down syndrome children. They also reported there is a good correlation between gesture production and comprehension, but not to verbal production.

In the present study, verbal comprehension, verbal production, and total gestures of the language impaired children fell within the 50th percentile of the scores obtained for the typically developing children of 16-17 months (Hazel, 2014), indicating language impaired children lag behind typically



developing children. Similar finding is also reported that 65% of Down syndrome children had a vocabulary size below the 10<sup>th</sup> percentile of normally developing children (Miller, 1995). Zampini & D'odorico, (2013) reported, in terms of word production Down syndrome children fall between the 10<sup>th</sup> and 25<sup>th</sup> percentiles of scores for normally developing children.

Extensive individual variability observed in the present study with respect to all the variables studied as language impairment is not a uniform condition. Language impairment in children varies with respect to associated medical problems. Similar findings were reported in the literature (Zampini & D'Odorico, 2009) where they reported substantial individual variability appeared in the use of gestures at 36 months in children with Down syndrome. Language impairment is a broad area of the language disorder in children and probably that would have resulted in considerable individual variability in the present study. In the present study, it was also observed that children with only receptive and/or expressive language delay performed better in gestures and comprehension followed by children with Cerebral palsy followed by Down syndrome and West syndrome. Majority of the studies had been reported in Down syndrome children, none had reported in cerebral palsy and Specific language impairment children. However, Literature supports that gestural capabilities are an essential base for language development in typically developing children as well as children with language Impairment (Zampini & D'Odorico, 2009; Mundy et al., 1995; Goodwyn et al., 2000).

In the literature, it has been well established that the CDI-Down is a valid

and reliable instrument which can be suitable for parents and the clinician dealing with Language Impaired children (Galeote et al., 2016). The current study is a preliminary investigation of the verbal comprehension, production, and use of gestures in Language Impaired children in the Indian scenario. However, extensive research has to be conducted in future in order to understand the lexicon and the gestural abilities in children of Language Impaired. This study would give information on the usefulness of the adapted Kannada version of the MCDI in a clinical population (in children with language impairment). Profiling of the vocabulary and the gestures using Kannada version of the MCDI would give an insight into the language Impaired children. This is a stepping stone for the clinician to plan better for the management of the language impaired children early and more effectively.

#### **LIMITATION OF THE STUDY**

Small sample size, no division among the childhood communication disorders made.

#### **CONCLUSION:**

Kannada version of MCDI is a useful tool in identifying the children who are at risk for communication disorders with in-depth analysis of linguistic domain. This study contributes to the accumulating evidence on using K-MCDI for valid inferences that may be used for diagnostic and intervention purposes in the Indian scenario. Further research should be continued to investigate the accuracy in larger samples with different types of language impairments in children

#### **BIBLIOGRAPHY**





- American Speech-Language-Hearing Association, (1993), Definition of communication disorders and variations.
- Bzoch, K.R. and League, R. (1991). Receptive –Expressive Emergent Language Test-second Edition, Austin,TX:PRO-ED.
- Capone, N.C. and McGregor, K.K. (2004). “Gesture development: A review for clinical and research practices”, *Journal of Speech, Language, and Hearing Research*, Vol. 47, No 1, pp.173-186.
- Caselli, M.C., Vicari, S., Longobardi, E., Lami, L., Pizzoli, C. and Stella, G. (1998). “Gestures and words in early development of children with Down syndrome”, *Journal of Speech, Language, and Hearing Research*, Vol. 41, No 5, pp.1125-1135.
- Chan, J. and Iacono, T. (2001), “Gesture and word production in children with Down syndrome”, *Augmentative and Alternative Communication*, Vol. 17, No 2, pp.73-87.
- Crais, E.R., Watson, L.R. and Baranek, G.T. (2009), “Use of gesture development in profiling children’s prelinguistic communication skills”, *American Journal of Speech-Language Pathology*, Vol. 18, No 1, pp. 95-108.
- Charman, T., Baron-Cohen, S., Swettenham, J., Baird, G., Drew, A. and Cox, A. (2003), “Predicting language outcome in infants with autism and pervasive developmental disorder”, *International Journal of Language & Communication Disorders*, Vol.38, No 3, pp.265-285.
- Cardoso-Martins C, M. C. (1985), “Early vocabulary acquisition by children with Down syndrome”, *American Journal of Mental Deficiency* ,Vol. 90,No 2, pp.177–184.
- Chapman, R. S. (1995), “Language development in children and adolescents with Down syndrome,”in P. F. MacWhinney(Ed), *The handbook of child language* , Oxford University Press, pp. 641–663.
- Fenson, L., Dale, P.S., Resnick, J.S., Thal, D., Bates, E., Hartung, J., Pethick, S. and Reilly, J. (1993). “The MacArthur communicative development inventory: Words and gestures”. San Diego: Centre for Research in Language.
- Galeote,M.,Checa,E., Sanchez-Palacios,C.,Sebastian,E and Soto,P.(2016), Adaptation of the MacArthur-Bates Communicative Development Inventories for Spanish Children with Down syndrome:Validity and Reliability data for vocabulary. *American Journal of Speech-Language Pathology*,Vol 25,No 3, 371-380.
- Fletcher, P. and Peters, J. (1984), “Characterizing language impairment in children: an exploratory study”, *Language Testing* 1, pp.33–49.
- Goodwyn, S.W. and Acredolo, L.P. (1993), “Symbolic gesture versus word: Is there a modality advantage for onset of symbol use?”, *Child*



- Development, Vol.64, No 3, pp.688-701.
- Golinkoff, R.M. (1986), “‘I beg your pardon?’: The preverbal negotiation of failed messages”, *Journal of Child Language*, Vol.13, No 3, pp.455-476.
- Hick, R.F., Joseph, K.L., Conti-Ramsden, G., Serratrice, L. and Faragher, B. (2002), “Vocabulary profiles of children with specific language impairment”, *Child Language Teaching and Therapy*, Vol.18, No 2, pp.165-180.
- Hazel, (2014), Adaptation and validation of McArthur Communicative Inventory (MCDI) Part I-ords and Gestures in Kannada. Unpublished dissertation, MAHE, Manipal.
- Miller, J.F. and Miller, J.F. (1991), “Quantifying productive language disorders”. *Research on Child Language Disorders: A decade of progress*, pp.211-220.
- Masur, E.F. (1982), “Mothers' responses to infants' object-related gestures: Influences on lexical development”, *Journal of Child Language*, Vol.9, No 1, pp.23-30.
- Mainela-Arnold, E., Alibali, M.W., Hostetter, A.B. and Evans, J.L. (2014), “Gesture–speech integration in children with specific language impairment”, *International Journal of Language & Communication Disorders*, Vol.49, No 6, pp.761-770.
- McGregor, K.K., Oleson, J., Bahnsen, A. and Duff, D. (2013), “Children with developmental language impairment have vocabulary deficits characterized by limited breadth and depth”, *International Journal of Language & Communication Disorders*, Vol 48, No 3, pp.307-319.
- Mundy, P., Kasari, C., Sigman, M. and Ruskin, E. (1995), “Nonverbal communication and early language acquisition in children with Down syndrome and in normally developing children”, *Journal of Speech, Language, and Hearing Research*, Vol.38, No 1, pp.157-167.
- Mundy P, Sigman M, Kasari C, Yirmiya N. (1988), “Nonverbal communication skills in Down syndrome children”, *Child Development*, Vol 59, pp235–249.
- Özçalışkan, Ş. and Goldin-Meadow, S. (2005), “Gesture is at the cutting edge of early language development”, *Cognition*, Vol 96, No 3, pp. B101-B113.
- Price, J., Robert, J., Vandergrift, N and Martin, G. (2007), “Language comprehension in boys with fragile X syndrome and boys with Down syndrome”, *Journal of Intellectual Disability Research*, Vol.51, pp.318-326.
- Rice, M. L., Oetting, J., Marquis, J., Bode, J. and Pae, S. (1994), “Frequency of input effects on word comprehension of children with specific language impairment”, *Journal of Speech and Hearing Research*, Vol.37, 106–22.
- Roberts, J., Price, J., Barnes, E., Nelson, L., Burchinal, M., Hennon, E.A., et al. (2007), “Receptive vocabulary, expressive vocabulary, and speech



- production of boys with fragile X syndrome in comparison to boys with Down syndrome”, American Journal on Mental Retardation, Vol.112, No 3, pp.177-193.
- Stolt, S., Mäkilä, A.M., Matomäki, J., Lehtonen, L., Lapinleimu, H. and Haataja, L. (2014), “The development and predictive value of gestures in very-low-birth-weight children: a longitudinal study”, International journal of speech-language pathology, Vol.16, No 2, pp.121-131.
- Trauner, D., Wulfeck, B., Tallal, P. and Hesselink, J. (1995), “Neurologic and MRI profiles of language impaired children. Technical Report CND9513” Center for Research in Language, University of California at San Diego.
- Volterra, V., Caselli, M.C., Capirci, O. and Pizzuto, E. (2005), “Gesture and the emergence and development of language.” Beyond nature-nurture: Essays in honor of Elizabeth Bates, pp.3-40.
- Wetherby, A. M., Prizant, B. M., & Hutchinson, T. (1998), “Communicative, social-affective, and symbolic profiles of young children with autism and pervasive developmental disorder.” American Journal of Speech Language Pathology, Vol.7, 79–91
- Wray, C., Norbury, C.F. and Alcock, K. (2016), “Gestural abilities of children with specific language impairment.” International Journal of Language & Communication Disorders, Vol.51, No 2, pp.174-182.
- Zampini, L., Salvi, A. and D’odorico, L. (2015), “Joint attention behaviours and vocabulary development in children with Down syndrome”, Journal of Intellectual Disability Research, Vol.59, No 10, pp.891-901.