

Brief communication

Vocabulary performance of children up to 36 months of age with Down syndrome

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ABSTRACT

Purpose: this study aimed to analyze the vocabulary performance of children with Down syndrome, up to 36 months of age, in different semantic categories.

Methods: eighteen children with Down syndrome, between 8 and 36 months of age. Section D of the MacArthur-Bates Communicative Development Inventory was applied with guardians: First Words and Gestures, in order to obtain expressive and receptive performance in 22 semantic categories. The data were analyzed in a descriptive and inferential manner, using the Kruskal-Wallis, Spearman's correlation and Tukey's range tests ($p < 0.05$).

Results: children had higher performance averages in understanding semantic categories than in understanding and expression. The "action words" were the most understood ones, while the "people" category was the most understood and expressed. The greater the chronological age, the greater the children's vocabulary. A statistical difference was found between the understanding of nouns and other categories, according to chronological age, with a greater performance after 24 months of age.

Conclusion: children with Down syndrome, up to 36 months of age, perform better in understanding vocabulary in all semantic categories.

Keywords: Down Syndrome; Child Language; Language Development; Vocabulary; Speech, Language and Hearing Sciences

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INTRODUCTION

Down Syndrome (DS) is a genetic alteration that is characterized by the trisomy of chromosome number 21, generated from an abnormal cell division, leading to numerous alterations in the organism that may impact on the neuropsychomotor development, cardiac system, stomatognathic system, hearing and vision¹. Thus, there is also a delay in global development, including language skills, in children with DS when compared to children with typical development (TD)²⁻⁵.

This global delay can be seen in tests for the evaluation and monitoring of child development, which report a performance below the expected for the child's chronological age (CI) in multiple skills, such as sensory, motor, cognitive and linguistic skills.

Concerning language development, this population shows a better performance in comprehension than in expression, with some aspects of receptive skills, such as vocabulary recognition, proportional to non-verbal cognitive ability levels²⁻⁶.

Children with DS say their first words at a much older age than children with TD and, once they start to produce words, language continues to progress more slowly^{3,6}. There is evidence that lexical performance of children with DS, both receptive and expressive, is lower than the performance of children with TD with the same mental age⁷.

The delay in vocabulary development seems to reflect more general deficits in cognitive development - such as short-term phonological memory failures - and may continue, or even worse, during adolescence and adulthood^{4,5}.

In this sense, further studies are required on this topic, as it is not widely studied⁸ and due to the relationship between vocabulary and the development of other language skills - such as syntactic and morphological skills⁴. In addition, differences in the development of expression and lexical comprehension according to word categories have not yet been fully investigated in this population⁹.

Such findings would contribute to an increase in the effectiveness of early speech-language pathology stimulation in DS, thus, favoring language development and the quality of life of children and their families¹⁰. In this sense, this study aimed to analyze the vocabulary performance of children with DS, up to 36 months of age, in different semantic categories.

METHODS

This is a descriptive and transversal study that was developed in an extension project of the Universidade Federal da Paraíba - UFPB, Brazil. In order to develop this study, the researchers followed all ethical aspects and all the participants involved signed the Free and Informed Consent Form. This study was assessed and approved by the Research Ethics Committee with Human Beings of the UFPB, under no. 1.302.829.

The research sample was constituted by convenience, in a non-probabilistic way and according to the following eligibility criteria: participants of both genders, aged between eight and 36 months, participating in the entire evaluation process of the study and not having any implications in the auditory and visual systems, which was confirmed by evaluations prior to data collection.

Thus, 18 children with DS were selected to participate in the study, being nine boys and nine girls, all aged between 8 and 36 months. The mean CI was 20.61 months (± 8.28) and the children were divided into three groups according to the age group:

- Group 1 - Including four children (22.2%) from eight to 12 months of age;
- Group 2 - Including nine children (50%) from 13 to 24 months of age;
- Group 3 - Including five children (27.8%) from 25 to 36 months of age.

Data collection was performed using the MacArthur-Bates Communicative Development Inventory: First Words and Gestures¹¹ with the guardian of the child in order to obtain vocabulary development data.

This instrument¹¹ was adapted and standardized to collect information on language comprehension, lexical production and use of the child's gestures from the family perspective. The inventory is divided into three parts: Part I, which consists of four sections and evaluates lexical understanding and production; Part II, which consists of six categories and evaluates the child's actions and gestures; and, Part III, which collects general family information, identification data and other information.

After applying the inventory, the data are converted into percentages. Despite the age range reported for the instrument, from eight to 12 months of age, section D has been used to collect information regarding semantic categories, in any age group, to verify the family's perception to the reception (understands) and expression (understands and speaks)¹². Therefore, this

instrument could be used in this study, which included participants aged between eight and 36 months.

Section D was designed to assess the observations regarding the communicative behavior of children and consists of 421 items organized in 22 semantic categories. These categories include nouns (toys, animals, vehicles, food and beverage, clothing, body parts, furniture and rooms, household utensils, objects, places and people), sound effects and animal sounds, verbs, qualities and attributes, games and routines, pronouns, quantifiers, time words, states (different meanings of “to be”), interrogatives, prepositions, locatives and articles. Then, the guardians must indicate which categories the children only understand and the categories that the children understand and speak^{11,12}.

Finally, CI data and category scores in section D of the MacArthur-Bates Communicative Development Inventory of each participant- both in understanding and in understanding and speaking - were classified and introduced in a digital spreadsheet. Then, the mean, standard deviation and absolute and relative frequency were used to assess the variables in an inferential and descriptive way.

The Kruskal-Wallis Test was used to compare the means in vocabulary sections according to chronological age groups, while the Tukey’s range test was used to the post-hoc analysis of groups.

Finally, Spearman’s correlation was used to investigate the correlation between scores in the vocabulary sections and chronological and performance ages. In

this study, correlation coefficient values from 0.1-0.3 were considered as a weak correlation; while values between 0.4-0.6 indicated a moderate correlation, and values ≥ 0.7 indicated a strong correlation between the variables.

The statistical software R v2.11.0 was used to perform the analyses with a 95% significance level ($p < 0.05$) for all tests.

RESULTS

Based on the application of the vocabulary list of the MacArthur-Bates Communicative Development Inventory, it was found that the means of “understanding” of the items of all semantic categories were higher than the means of “understanding and expression”. The “action words” section had the highest level of understanding by the participants, while the “people” section was the one that children with DS understood and spoke the most (Table 1).

In addition, statistical differences were found in the performance of “understanding” in sections D4, D5, D7, D8, D9, D10, D13, D15, D17, D21 (as shown in Table 1).

Correlations were also found between vocabulary performance and CI, being: moderate with sections D3, D4, D5, D6, D7, D9, D10, D11, D12, D13, D15 and D18; and strong with sections D8 and D21 (Table 1).

Finally, a post-hoc analysis was used and more statistical differences were verified between groups 1 and 3 (Table 2) to investigate the means of which groups differed.

Table 1. Comparison of means in vocabulary sections according to chronological age groups

SECTIONS	UNDERSTANDS							UNDERSTANDS AND SPEAKS						
	GROUP 1 UP TO 12 MONTHS		GROUP 2 13-24 MONTHS		GROUP 3 25-36 MONTHS		P-VALUE	GROUP 1 UP TO 12 MONTHS		GROUP 2 13-24 MONTHS		GROUP 3 25-36 MONTHS		P-VALUE
	Mean	SD	Mean	SD	Mean	SD		Mean	SD	Mean	SD	Mean	SD	
D1 – Sounds of things and animals	2	4	4.44	3.5	4.8	3.34	0.373	0	0	1.78	2.2	1	1	0.116
D2 – Animals	1.25	2.5	7.67	8.98	8.2	9.09	0.19	0	0	0.33	0.7	0	0	0.347
D3 – Vehicles +	1	0.81	3.22	2.44	3	1.22	0.117	0	0	0	0	0	0	1
D4 – Toys +	0.75	0.5	5	3	4.8	3.11	0.046*	0	0	0	0	0	0	1
D5 – Clothes +	0	0	5.22	5.33	7.6	6.8	0.025*	0	0	0	0	0	0	1
D6 – Food and beverage +	2	2.45	10.89	9.56	12	6.67	0.05	0	0	0.56	0.88	0.2	0.45	0.396
D7 – Body parts +	0.5	1	8.33	5.52	9	5.75	0.028*	0	0	0.33	0.71	0	0	0.347
D8 – Furniture and rooms°	0.5	0.58	7.22	6.36	12	6.48	0.022*	0	0	0	0	0.8	1.79	0.273
D9 – Household utensils +	0.5	1	12	9.96	16.6	7.16	0.015*	0	0	0	0	0	0	1
D10 – Objects and places outside the home +	0.25	0.5	6.22	7.82	10	6.44	0.016*	0	0	0	0	0.2	0.45	0.273
D11 – Games and social routines +	3.25	5.25	11.78	4.63	12.2	5.26	0.072	0	0	0.22	0.44	1.6	2.5	0.113
D12 – People +	3.25	2.22	5.11	2.15	4.6	4.5	0.424	0	0	1.78	1.78	2	2.12	0.082
D13 – Action words +	7.25	13.2	29.11	13.64	35	13.73	0.043*	0	0	0.44	1.01	1.4	3.13	0.617
D14 – States	0.5	1	0.22	0.67	1.2	1.1	0.162	0	0	0	0	0	0	1
D15 – Qualities and attributes +	0.25	0.5	12.22	10.3	14	9.87	0.046*	0	0	0	0	0	0	1
D16 – Time words	0.75	1.5	1.67	2.18	1.6	1.14	0.607	0	0	0.11	0.33	0	0	0.607
D17 – Questions	0.25	0.5	2.11	0.93	1.4	0.89	0.019*	0	0	0	0	0	0	1
D18 – Pronouns +	0	0	4.44	5.68	5.8	6.02	0.083	0	0	0.11	0.33	0	0	0.607
D19 – Adverbial Quantifiers, Adverbs and Locutions	0	0	2.78	2.33	2	3.46	0.055	0	0	0.11	0.33	0	0	0.607
D20 – Articles	0	0	1	2.29	1	1.14	0.375	0	0	0.33	0.71	0	0	0.347
D21 – Locatives°	0	0	2.56	3.09	4.8	3.27	0.024*	0	0	0.11	0.33	0	0	0.607
D22 – Prepositions	0	0	0.44	1.01	0.4	0.89	0.615	0	0	0.22	0.67	0	0	0.615

Kruskal-Wallis Test - Statistical Difference *p<0.05

Spearman's correlation. + Moderate correlation (test statistic between 0.4 and 0.6). °Strong correlation (test statistic between 0.7 and 0.9) – Statistical difference p<0.05.

Table 2. Post-hoc analysis of vocabulary comprehension performance among chronological age groups

UNDERSTANDING IN SECTIONS	GROUP 1 X GROUP 2	GROUP 1 X GROUP 3	GROUP 2 X GROUP 3
D4 – Toys	0.066	0.091	1
D5 – Clothes	0.086	0.026*	1
D7 – Body parts	0.041*	0.057	1
D8 – Furniture and rooms	0.168	0.018*	0.643
D9 – Household utensils	0.042*	0.019*	1
D10 – Objects and places outside the home	0.132	0.013*	0.623
D13 – Action words	0.101	0.055	1
D15 – Qualities and attributes	0.073	0.08	1
D17 – Questions	0.343	0.015*	0.787
D21 – Locatives	0.186	0.02*	0.623

Tukey's range test – Statistical difference *p<0.05

DISCUSSION

The performance in “understanding” of all semantic categories was better than in the expressive vocabulary in DS (Table 1). This greater development in receptive vocabulary in all categories can also be noticed in children with TD¹³. However, the means obtained in the TD up to 16 months of age - both in understanding and in expression¹³ - were higher than those observed in this study.

Phonological memory, which is a mnemonic skill related to the sequences of speech sounds, is a predictor for lexical development and processing and is impaired in DS^{9,14}. This ability can be improved or worsened throughout childhood and adolescence, so it is crucial to carry out a targeted intervention in aspects of phonological memory that can improve reading, writing and oral language - receptive and expressive¹⁴.

Regarding the word categories, children with DS had a higher mean of understanding in the “action words” category and of understanding and expression in the “people” category (Table 1). This performance was similar to that of children with TD up to 16 months of age, who had higher averages in these same categories¹³. This aspect is in line with the findings of studies²⁻⁶ on language development in DS, regarding children going through the same stages of the acquisition process, but in a delayed and slowed way.

Faced with a more restricted expressive vocabulary, children with DS favor the use of gestures in communication to participate in interactional contexts, which does not decrease with the increase in vocabulary and chronological age^{2,7}.

With respect to this increase in vocabulary, correlations were observed between the expansion of several categories and children’s chronological age (Table 1). This finding was also shown in the typical development and in other studies in DS^{6,7,15}. This increase has variability in children with DS, due to the syndrome phenotype¹, and is related to chronological age, maternal educational level and the development of auditory skills, non-verbal cognitive skills, working memory and phonological processing^{5,15}.

There was a statistical difference in the understanding of sections between groups 1 and 3, which means that there was a significant increase in vocabulary development in some semantic categories after 24 months of age (Table 2). This finding is associated with the vocabulary explosion phenomenon that occurs in child development, in which there is a rapid increase in the acquisition of new words by children⁶.

There is evidence that this phenomenon occurs in TD around 18 months of age, but it is not clear when it occurs in DS and even if it occurs in all children^{5,6}. The main changes in vocabulary size were reported at 36 months of age in DS in longitudinal observations⁶.

In view of this, early speech-language pathology stimulation in DS is understood as crucial to language development in this population¹⁰, due to the possible contributions to lexical acquisition, as well as other language skills.

Studies on vocabulary development, including performance in semantic categories, contribute to clinical practice to score classes of words more favorable to stimulation, such as “action words” and “people”, and classes that are more challenging, so that the speech-language pathologist can develop strategies sensitive to the child neurodevelopment process in DS. In this sense, further studies are recommended on this topic, including a larger sample and with a longitudinal approach, for example.

CONCLUSION

Children presented with Down syndrome, up to 36 months of age, perform better in understanding vocabulary in all semantic categories. The “action words” were the most understood, while the “people” category was the most understood and expressed. There is an expansion in the understanding of lexical elements, starting at 13 months of age and there is no expansion of expressive vocabulary until 36 months of age.

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