Original articles

Mental age in the evaluation of the expressive vocabulary of children with Down Syndrome

Consideração da idade mental na avaliação do vocabulário expressivo de crianças com Síndrome de Down

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ABSTRACT

Purpose: to verify the expressive vocabulary of children with Down syndrome, compare it to the performance of children of both genders with typical development, in two distinct pairings: chronological and mental age, separately, and determine the influence of the age considered in this population evaluation.

Methods: ethical aspects were met. The sample consisted of 42 children of both genders, 14 with Down syndrome, and chronological age between 38 and 63 months, 14 with typical development paired by gender and mental age, and 14 with typical development paired by gender and chronological age. An interview and the Child Language ABFW Vocabulary Test Part B were conducted. Statistical analysis was performed by applying the parametric ANOVA, the Kruskal-Wallis test and the Tukey`s test, whenever necessary.

Results: children with Down syndrome showed a lower performance compared to those in the group paired by chronological age for correct naming and no naming of the figures. There was no significant difference between the group with Down syndrome and the group with typical development paired by mental age for any of the three skills evaluated.

Conclusion: children with Down syndrome showed expressive vocabulary below the expected for their chronological age, but close to the expected for their mental age, allowing the inference that the age considered in the evaluation of the language of this population interferes in the analysis of the results found.

Keywords: Vocabulary; Child; Down Syndrome; Child Language; Child Development

RESUMO

Objetivo: verificar vocabulário expressivo de crianças com Síndrome de Down, comparar ao desempenho de crianças com desenvolvimento típico de mesmo gênero em dois pareamentos distintos: considerando idade cronológica e mental, separadamente, e determinar a influência da idade considerada na avaliação desta população.

Métodos: cumpriram-se aspectos éticos. Participaram 14 com Síndrome de Down, idade cronológica entre 38 a 63 meses, 14 com desenvolvimento típico pareado por gênero e idade mental e 14 com desenvolvimento típico pareado por gênero e idade cronológica. Após entrevista, aplicou-se Teste de Linguagem Infantil ABFW–Vocabulário Parte B. Para pareamento da idade mental utilizou-se o teste Stanford Binet. Aplicação do teste paramétrico ANOVA, teste Kruskal-Walis e Teste Tukey, quando necessário.

Resultados: verificou-se desempenho inferior das crianças com Síndrome de Down comparadas ao grupo pareado por idade cronológica para nomeação correta e não nomeação das figuras. Não houve diferença significante entre o grupo com Síndrome de Down e com desenvolvimento típico pareado por idade mental.

Conclusão: as crianças com Síndrome de Down apresentaram vocabulário expressivo aquém do esperado para a idade cronológica, porém próximo ao esperado para a idade mental, permitindo inferir que a idade considerada na avaliação da linguagem desta população interfere na análise dos resultados encontrados.

Descritores: Vocabulário; Criança; Síndrome de Down; Linguagem Infantil; Desenvolvimento Infantil

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INTRODUCTION

The language development of children with Down syndrome (DS) is continuous, there is slowness in the beginning of acquisition and a differentiated rhythm of development, though[1-3].

Language and cognition have an important relation based on the neuroscience perspective[4]. The verbal and non-verbal mental age influence the cognitive flexibility of children with DS; there is a direct correlation between the verbal performance and the cognitive flexibility, and between the intellectual quotient and the functional, and participation development[5-9].

It is necessary to consider the innumerable intrinsic and extrinsic variables that influence the cognitive and language development, which culminate in the heterogeneity of the personal functioning found in children with DS[10-16]. However, some authors have pointed out the neuropsychological profile of the child with DS is characterized by the lack of homogeneity in development between the cognitive and language skills with a bigger language impairment[17].

In the DS, alterations are predicted in the attention, memory, symbolic functioning, grammar rules recognition, and the auditory and visual processing skills. There is also a possibility of maladaptive behaviors, which directly influence lexical development and communication skills[5,6,11,18].

Regarding the expressive language, this is associated with not only the oral production of words, but also with the production of gestures, facial expressions, and body movements. The concept that gestures positively influence the oral language development is settled and their presence interferes directly in communication, development of joint attention, and lexical development as a whole[10,18-23].

There are quantitative differences in the global gestures used as a communication media by children with DS, which are not always accompanied by oral production[24].

The study aimed to verify the expressive vocabulary of children with Down syndrome and compare it to the performance of children with typical development, of the same gender and socioeconomic status, in two distinct pairings: the participants´ chronological and mental age, separately, and determine the influence of the age considered in this population evaluation.

METHODS

Before its execution, this study was submitted to the appraisal and approval of the Research Ethics Committee of the Institution where it was carried out (Process n. 040/2009).

The study constituted of 42 children, 14 with Down Syndrome (Experimental Group - EG), of both genders and chronological age between 36 and 62 months; 14 children with typical development, paired by gender and mental age with the experimental group (Comparative Group 1 - CG1), with chronological age between 13 and 50 months; and 14 with typical development, paired by gender and chronological age with the experimental group (Comparative Group 2 - CG2).

The inclusion criteria for the three groups were:

- Experimental Group (EG): to have a diagnosis of DS (Trisomy 21); have been born at term; have not been born with very low weight; have results indicative of normality in the neonatal auditory, visual and metabolism screenings (mainly for congenital hypothyroidism); do not have characteristics of the Autism Spectrum Disorder; have visual skills to perform the activities proposed; have attended rehabilitation procedures since the first trimester of life; be attending regular school (public) and be in the age group between 36 the 62 months of chronological age.

- Comparative group 1 (GC1) and Comparative Group 2 (GC2): to have typical neuropsychomotor development; have been born at term; have not been born with low weight; have results indicative of normality in the neonatal auditory, visual and metabolism screenings; do not have characteristics of the Autism Spectrum Disorder; have visual abilities to perform the activities proposed; be paired according to gender, mental age (CG1), chronological age (CG2), school, and socioeconomic status with the EG.

After the application of the inclusion criteria in the EG, 11 children with DS were excluded, reaching the 14 children that were evaluated: two presented congenital hypothyroidism; two were born with very low weight; two were born preterm; one presented signals of the Autism Spectrum Disorder; two were not initiated the rehabilitation procedures early and two were not attending school.

After signing the Consent Form, the children´s legal responsible answered an anamnesis protocol with information on the participant´s previous life.

The participants` mental age was established after a psychological evaluation with the New Version of the Stanford-Binet Method, adapted by Terman and Merril (1979)[25], used for children from two to five years old. The test provides values in the form of mental age, converted into IQ, from the performance in tests involving: compliance to simple sequential orders, identification and fitting of forms, discrimination and visual memory of details, identification of body parts, and illustrated vocabulary with object identification both by name and by its use.

The evaluation constituted of the application of the Child Language Test ABFW - Vocabulary Part B[26], which evaluates expressive vocabulary. The nine conceptual fields were evaluated in the same sequential order and the answers of the participants were filmed and annotated in a specific protocol for further analysis. The rules followed were recommended in the Instructions Manual for the analysis of the designations of usual words (DUW - correct naming), no designations (ND - no naming) and processes of substitution (PS - production of another word, functionality, or representative gesture). For the statistical analysis, we considered the average of DUW, ND, and PS of each participant by the sum of the percentages gotten in each of these items and division by the total of the conceptual fields evaluated.

The statistical analysis was conducted by the application of the parametric test ANOVA - Analysis of variance. The group needed to present a normal distribution of its sample and homogeneity of variances to pass the criteria of this evaluation. If the value of p were ≤0.01, a statistical significant difference, the Tukey`s Test was applied to verify statistically significant difference between groups. When the sample did not correspond to the previous criteria, the Kruskal-Wallis test was applied, and if the value of p was ≤ 0.01, the Tukey`s Test was applied to verify between which groups this difference occurred.

Characterization of the sampling

The chronological age of the participants of both EG and CG2 varied from 38 to 63 months (average of 49.4 for the EG and CG2). The mental age of the EG and the mental and chronological age of the children of the CG1 varied from13 to 50 months (average of 29.4 for CG1 and EG). Regarding the gender, 42.8% were boys and 57.2% were girls. The participants` socioeconomic status[27] was matched between the groups and distributed between the social classes B1 (40%), B2 (50%), and C1 (10%). Regarding education, all participants attended public kindergartens. The children of the EG were inserted in groups of children with the same chronological age and attended speech therapy weekly.

RESULTS

After the statistical treatment, a statistically significant difference was verified in the comparison between the three groups regarding the skill naming correctly the image presented (DUW). Such information can be observed in Table 1.

Analyzing which groups had a statistically significant difference between each other, it was possible to verify that both the EG and the CG1 had a statistically significant inferior performance when compared, separately, to the CG2, the children with typical development paired by the chronological age. Thus, the EG obtained a similar performance, showing no statistical difference compared to the CG1, which was paired by mental age (Table 2).

In Table 3, it was possible to verify a statistically significant difference for the no designation (ND) in the comparison between the three groups by ANOVA.

Table 4 shows the Tukey`s Test results which was conducted to verify which groups showed the statistically significant differences found in Table 3. The same result was verified for the no designation of images (ND) and the correct naming of images (DUW), that is, GE had a similar performance, without a statistically significant difference compared to the CG1, paired by the mental age; however, it had a statistically significant inferior performance when compared to the CG2, group paired by chronological age.

As the distribution of the scores in the skill processes of substitution did not present homogeneity, the Kruskal-Wallis test was performed. In this skill statistical analysis, there was no statistically significant difference between the groups and; therefore, the performance of the Tukey`s Test was not necessary (**Table** 5).

DISCUSSION

Children with DS presented language performance below the expected for their chronological age, including their lexical skills. This study centered in the expressive vocabulary and in the importance of age be considered in the evaluation of children with DS, since an intellectual degradation is predicted in this

Table 1. Mean, standard deviation and value of p in the analysis of the skill Designation of Usual Words

Group	Mean	Standard Deviation	Value of "p"
EG	12.2	16	
CG1	26.6	23.9	<0.001*
CG2	55.7	13.5	

Caption: EG - experimental group; CG1 - comparative group 1; CG2 - comparative group 2; *statistical significant difference after the statistical test ANOVA.

Table 2. Difference of the performance between the groups for the Designation of Usual Words

Groups	Mean of the difference	Value of "p"
EG x CG-1	14.4	0.109**
EG x CG-2	43.5	<0.001*
CG1 x CG-2	29.2	<0.001*

Caption: EG - experimental group; CG1 - comparative group 1; CG2 - comparative group 2; *statistical significant difference after the statistical Tukey´s test;
**difference not statistically significant after the application of the statistical Tukey´s Test.

Table 3. Median and value of p in the analysis of the skill No Designation

Group	Median	25%	75%	Value of "p"
EG	48.2	18	99.5	
CG1	11.2	1	62.6	<0.001*
CG2	2	0.5	2.5	

Caption: EG - experimental group; CG1 - comparative group 1; CG2 - comparative group 2; *statistical significant difference after the statistical test Kruskal-Wallis.

Table 4. Difference of the performance between the groups for No Designation

Groups	Mean of the difference	Value of "p"
EG x CG-1	122.5	>0.001**
EG x CG-2	284.0	<0.001*
CG1 x CG2	161.5	<0.001*

Caption: EG - experimental group; CG1 - comparative group 1; CG2 - comparative group 2; *statistically significant difference after the statistical Tukey´s test;
**difference not statistically significant after the application of the statistical Tukey´s Test.

Table 5. Median and value of p in the analysis of the ability Processes of Substitution

Group	Median	25%	75%	Value of "p"
EG	36.5	0.5	57.9	
CG1	39.4	28.4	56.4	0.928**
CG2	42.9	32.7	52.3	

Caption: EG - experimental group; CG1 - comparative group 1; CG2 - comparative group 2; *statistically significant difference after the statistical test Kruskal-Wallis.

population, and the language development is coherent with the cognitive skills[4-8,17].

After the statistical treatment, this study hypothesis was confirmed for correct designation (DUW) (Table 2) and no designation (ND) (Table 4). Children with Down syndrome showed a statistically significant inferior performance in these two skills, only when compared to children with typical development of the same chronological age. Considering the mental age, although the EG presents more modest scores, there was no statistically significant difference.

It is worth to emphasize that children with DS had superior chronological ages compared to the children with typical development when paired by mental age, which implies longer experience and stimulation throughout life. This would justify a good performance and good scores in lexical skills. It is necessary to emphasize the children with DS underwent speech therapy; they were enrolled in regular schools and paired with the comparative groups by the socioeconomic status.

Another study on lexical development, considering the mental age, showed that children with Down syndrome had a statistically significant inferior performance in the skill correct designation (DUW) compared to children with typical development[28]. Analyzing the methodology and sample, it is possible to verify that the amount of participants in the studies was different, as well as the division between the groups. The addition of a group in the study interferes in the statistical test to be used and in the sample distribution. The general variability of the sample changes significantly with the addition of the group comprised of children with typical development of the same chronological age, since its performance is very superior compared to the other two groups. This implies directly in the result of the statistical test ANOVA, used in this study, as it evaluates the relation of the variability of each group to the general variability of the sample.

As the results of the participants did not show homogeneity for the skill processes of substitution (PS), which includes the emission of onomatopoeia, words with the same semantic load or visually similar to the image presented, functionality of the object, or performance of representative gestures, it was necessary to apply the Kruskal-Wallis test instead of the analysis of variance ANOVA. No statistically significant difference was verified between the three groups evaluated. Literature highlights the heterogeneity in the performance pattern of children with DS[2,10-16,29].

Children with DS recognized the images and, within their possibilities, they demonstrated their knowledge in a distinct way and, most of the time, using gestures. Several studies affirm the receptive vocabulary of children with DS is better than their expressive vocabulary[5,9,12,22,23,30,31], and the gestures work as a bridge between the understanding and the expression by means of the verbal language[19,20].

In the qualitative analysis, regarding the PS, it was verified that children with typical development, of both groups, presented an oral pattern of reply, with the presence of grammar category change, substitution for hyperonym, hyponym, synonym, for words that designate semantic attributes, for designation of functions, affective paraphrases, among others. Children with DS presented more replies with the production of representative gestures and onomatopoeia. The gestures were generally produced with or without speech production that often expressed a similar concept to the target word, suggesting the conceptual knowledge of these children is better than the skills to express by speech. The study by Stefanini et al. (2007)[24] also addressed this question.

Intellectual development is a child's ability to think and understand himself and his world. It thus encompasses the integration between the sensory, motor, social and linguistic inputs so that it understands how its body and its behavior affect the environment, as well as the environment influences your body and behavior. Thus, one can verify the complex relationship between language and cognition such as, for example, the fact that children first set up conceptual representations, then add linguistic representations to talk about their experience, but they will need to keep both types of representations for new learning and coping situations in daily life[32].

It is emphasized that the current state of the art of Cognitive Neuroscience has pointed out the need for a true interdisciplinary approach to the study of the relationship between cognition and language and mind-brain comprehension, overcoming some dichotomies and controversies in the past[33].

CONCLUSION

The performance of the children with Down syndrome regarding the expressive vocabulary was significantly inferior compared to the performance of children with typical development of the same gender and chronological age (GC2) for usual word designation

and no designation. For substitution processes, the difference was not statistically significant.

In comparison with children with typical development of the same gender and mental age (CG1), there was no statistically significant difference for any of the skills (usual word designation, no designation, and process of substitution).

In the comparison between the two comparative groups, it was verified that the group with higher chronological age (CG2) presented a performance significantly superior to the group with lower chronological age (CG1) for usual word designation and no designation and did not present significant difference for processes of substitution as it occurred in the comparison between the experimental group (EG) and the comparative group, paired by chronological age (CG2).

In this study, the EG had language/ linguistic performance closer to the G1 indicating that the mental age pairing would make it possible to equate the two types of representations to understand the performance of the child in front of a task. It can also guide the experimental design with the control of one of the variables (cognition) that influence the development of the language as well as to program interventions based on more specific indicators.

The age considered in the evaluation, chronological or mental, of children with Down syndrome will influence the results, that is, it is recommendable to consider the level of intellectual functioning of the children as a guide for the evaluation of the language and the comprehension of the neuropsychological functions recruited by several tasks proposed in the instruments of intellectual and language evaluation.

This aspect is extremely relevant if we consider that, in the Brazilian process of educational inclusion, children with DS will be attending school classrooms with children of the same chronological age.

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