

Amanda Santiago de Gouveia¹ 

Mariani Maria de Freitas Oliveira¹ 

Ana Lúcia Goulart¹ 

Marisa Frasson de Azevedo¹ 

Jacy Perissinoto¹ 

Development of speech and hearing skills in prematures adequate and small for gestational age: chronological age between 18 and 36 months

Desenvolvimento de linguagem e das habilidades auditivas em prematuros adequados e pequenos para a idade gestacional: idade cronológica entre 18 e 36 meses

Keywords

Language Development
Premature
Low Weight
Hearing
Language

Descritores

Desenvolvimento da Linguagem
Prematuridade
Baixo Peso
Audição
Linguagem

ABSTRACT

Purpose: This study aimed to identify whether the development of hearing abilities in the first year of life is related to the development of language in preterm neonates with chronological age between 18 and 36 months, verifying if the language performance varies according to the weight/gestational age ratio. **Methods:** Retrospective and longitudinal study approved by the Institution's Ethics Committee. The sample consisted of 66 preterm infants of both sexes, aged 18-36 months, divided into two groups: AIG Group 39 neonates with weight appropriate to the gestational age, 26 with normal hearing and 13 with altered hearing; and PIG group 27 neonates small for gestational age, 18 with normal and 9 with altered hearing. Results from the development of auditory skills in the first year of life and evaluation of the reception, expression and total of language (Menezes, 2003) were obtained from neonatal follow-up records. We used the ANOVA and the Equality Test of Two Proportions as statistical procedures. **Results:** In each group, we observed a significant difference in the Reception and Total language in children with normal and altered auditory development. Children with normal hearing development presented a higher percentage of language adequacy. The language performance did not differ in relation to the weight / gestational age adequacy. **Conclusion:** Changing auditory abilities in the first year of life interfered more in language development than the gestational age / weight ratio.

RESUMO

Objetivo: O estudo teve por **objetivo** identificar se o desenvolvimento das habilidades auditivas no primeiro ano de vida relaciona-se com o desenvolvimento de linguagem em neonatos pré-termo com idade cronológica entre 18 e 36 meses verificando se o desempenho de linguagem varia em função da relação peso/idade gestacional. **Método:** Estudo retrospectivo e longitudinal aprovado pelo Comitê de Ética da Instituição. Amostra composta por 66 neonatos prematuros de ambos os sexos de 18 a 36 meses de idade, distribuídos conforme a adequação peso/idade gestacional em dois grupos: (a) GAIG: 39 neonatos com peso adequado à idade gestacional, sendo 26 com desenvolvimento auditivo normal e 13 com alterado; (b) GPIG: 27 neonatos pequenos para a idade gestacional, 18 com desenvolvimento auditivo normal e 9 com alterado. A partir das consultas aos prontuários do serviço de acompanhamento dos neonatos, verificaram-se os resultados do desenvolvimento das habilidades auditivas no primeiro ano de vida e avaliação da recepção, expressão e total de Linguagem (Menezes, 2003). Adotados como procedimentos estatísticos o ANOVA e o teste de Igualdade de Duas Proporções. **Resultados:** O desempenho de linguagem não diferiu nos grupos GAIG e GPIG. Quando considerados o desenvolvimento auditivo normal e o alterado, em GAIG e GPIG, observou-se diferença significante na Recepção e Total de linguagem. As crianças com desenvolvimento auditivo normal apresentaram um maior percentual de adequação de linguagem. **Conclusão:** A alteração das habilidades auditivas no primeiro ano de vida interferiu mais no desenvolvimento da linguagem do que a relação peso/idade gestacional.

Correspondence address:

Amanda Santiago de Gouveia
Departamento de Fonoaudiologia,
Universidade Federal de São Paulo –
UNIFESP
Rua Botucatu, 802, Vila Clementino, São
Paulo (SP), Brasil, CEP: 04023-062.
E-mail: amanda.santiago.gouveia@
gmail.com

Received: November 23, 2018

Accepted: August 19, 2019

Study conducted at the Departamento de Fonoaudiologia, Escola Paulista de Medicina – EPM, Universidade Federal de São Paulo – UNIFESP - São Paulo (SP), Brasil.

¹ Escola Paulista de Medicina – EPM, Universidade Federal de São Paulo – UNIFESP - São Paulo (SP), Brasil.

Financial support: nothing to declare.

Conflict of interests: nothing to declare.



This is an Open Access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

INTRODUCTION

According to the World Health Organization (WHO), prematurity is a birth that occurs before 37 gestational weeks. At birth, the newborn is subjected to a classification that correlates weight to gestational age, which can be classified as Small for Gestational Age (SGA), Adequate for Gestational Age (AGA), and Large for Gestational Age (LGA).

The literature shows that preterm infants have worse performance in language tests and skills such as gross motor, fine-adaptive motor and personal-social compared to term children⁽¹⁻³⁾. On the other hand, some studies report that the language impairment not as a condition related to prematurity but related to factors such as gestational age⁽⁴⁻⁷⁾ and birth weight⁽⁴⁻⁸⁾. These last two variables are believed to negatively influencing the development of pre-linguistic skills and language outcomes in preterm children⁽⁷⁾.

In the case of preterm infants, the process of language acquisition and development depends on adequate maturation of the central auditory pathway. The inadequate maturation of the central auditory pathway directly influences language development of these children.

Some studies^(7,9) indicate that prematurity is a risk factor and may influence the process of central auditory system maturation, damaging the hearing of premature children. There is a relationship between hearing maturation and language development in low birth weight preterm infants. Premature newborns with impaired hearing development may have worse language performance⁽¹⁰⁾.

Thus, this study hypothesizes that premature children with central hearing impairment and/or delayed hearing development and low birth weight had a higher occurrence of delayed language development.

The study aimed to identify if the development of hearing skills in the first year of life is related to language development in preterm newborns with chronological age between 18 and 36 months, checking whether language performance varies according to the weight/gestational age ratio.

METHODS

The Research Ethics Committee (CEP) approved this longitudinal retrospective study under the following approval number: 111090/2016. The Free and Informed Consent Form was considered not necessary since the research includes data collected from a care service.

Sixty-six premature newborns, 32 males, and 34 females, with chronological age between 18 and 36 months, followed up from birth to three years old by a multidisciplinary family assessment and guidance team, participated in this study. We identified the children evaluated in the follow-up routine of their development of hearing and the Speech-Language Pathology Research Center of Children and Adolescents of Public Institution of São Paulo, aged in the range of interest of this study. We selected the most

recent and matching chronological age records of the children with more than one hearing and language assessment.

We consulted the medical records of preterm infants born from 2012 to 2015, who attended the hearing and language monitoring and we selected them according to the inclusion criteria.

The inclusion criteria included preterm infants with completed protocols regarding the assessment of hearing and language in the receptive and expressive aspects, in the routine of a multi-professional outpatient clinic of preterm infants in a teaching hospital.

We excluded children with sensorial-neural hearing loss and/or conductive hearing loss. We excluded thirty-one of the 97 children due to incomplete data in the medical records or because they were more than six months old at the time of their hearing and language assessments.

Initially, we analyzed the medical records data for the presence and absence of each of the selected instruments. The variables of interest for the child were birth weight, weight adequacy for gestational age (SGA and AGA - small and adequate for gestational age, respectively), the result of the hearing development evaluation - developmental delay, central alteration suspicious⁽⁹⁾, and the results of receptive, expressive and total language evaluation⁽¹¹⁾. Then, we performed a comparative analysis between the instruments to identify signs of language disorders. At another time, we also performed a correlation analysis between auditory and language alterations per sample group.

We divided the participants into two groups, considering the relation between the adequacy of weight/gestational age. The groups were then organized into four subgroups, considering the hearing development (Table 1):

SGA - composed of premature children SGA

SGA.A - composed of SGA children with impaired hearing development

FIG.S - composed of SGA children with normal hearing development

AGA - composed of premature children AGA

AGA.A - composed of AGA children with impaired hearing development

AGA.S - composed of AGA children with normal hearing development

In the sample, there were no LGA neonates, although it was not an exclusion criterion.

The Assessment of Hearing Skills Development was performed by Hearing Behavior Observation, including assessments of sound localization skills, maternal voice detection, command recognition, and cochlear-eyelid reflex research, which is performed with intense sound stimulus (agogô - 100dBNPS). The answer is considered present when there is a contraction of the orbicularis oculi muscle, observed by eyelid movement.

Non-typical signs such as exacerbated reaction, absence of cochlear-eyelid reflex, lack of habituation to repeated stimuli, inconsistent responses to pure tones, increased response latency, and hearing recognition failure may provide indicators of retro-cochlear changes⁽⁹⁾.

The visual reinforcement audiometry was performed from 6 months old with a pediatric Interacoustic PA-1 audiometer at 500Hz to 4000Hz sound frequencies at decreasing intensities of 80, 60, 40, and 20 dBHL until the expected minimum response levels for the age were obtained⁽⁹⁾.

From the Language Assessment performed in the monitoring routine, we considered the standard results obtained in the Language Development Assessment⁽¹¹⁾ in its reception, expression and total aspects, from the standard quantitative results table. For the diagnosis of language classification, we adopted Adequate and Altered according to the standard presented for reception, expression and total. For this study, the diagnosed severe, moderate and mild disorders proposed by the LDA for language diagnosis were grouped in the altered category. The LDA test gives us a numerical score, which was then converted into such classifications.

We used the ANOVA (Analysis of variance) parametric test to compare the groups with normal and altered hearing development in each neonate subgroup (SGA and AGA) to analyze whether birth weight adequacy would influence language development. The Two Proportion Equality test was used to analyze whether there was a difference in the percentage of children diagnosed with language delay between children with and without hearing impairment, regardless of the weight variable. We used the confidence interval for the Mean to compare the groups with normal and altered hearing development about language diagnosis.

We defined a significance level for this work (when we admit to erring in the statistical conclusions, that is, the statistical error in the analyses) of 0.05.

RESULTS

Twenty-seven of the 66 children had the pediatric diagnosis SGA and 39 had AGA. Regarding language diagnosis, 36% presented alteration, and 64% were adequate. Regarding the hearing development, 33% presented alteration and 67% were adequate (Table 1).

As for hearing, there was a difference in the language reception variable between the subgroups with normal and altered hearing development in both the SGA and AGA groups (Table 2).

A difference in total language was also verified for the subgroups with normal and altered AGA hearing development (Table 3).

The diagnosis of language reception (Table 2) and total language reception (Table 3) differed between the groups with normal and altered hearing development in both AGA and SGA infants. The group with normal hearing development always presented a higher percentage of language adequacy than the group with altered hearing development. There was no statistical difference between groups (SGA and AGA) in expressive language (Table 4).

Table 1. Sample characterization

	SGA		AGA		TOTAL	
	N	%	N	%	N	%
Total altered Language	9	14	15	23	24	36
Total Adequate Language	18	27	24	36	42	64
Altered Hearing	9	14	13	20	22	33
Normal hearing	18	27	26	39	44	67

Table 2. Changes in language reception about hearing development in each group

Reception Diagnosis	With change		Without change		P-value
	N	%	N	%	
AGA Adequate Language	4	30.8	22	84.6	<0.001
Altered Language	9	69.2	4	15.4	
SGA Adequate Language	2	22.2	16	88.9	<0.001
Altered Language	7	77.8	2	11.1	

Table 3. Changes in the total language about hearing development in each group

Total Diagnosis	With change		Without change		P-value
	N	%	N	%	
AIG Adequate	5	38.5	19	73.1	0.036
Altered	8	61.5	7	26.9	
PIG Adequate	2	22.2	15	83.3	0.002
Altered	7	77.8	3	16.7	

Table 4. Changes in language expression about hearing development in each group

Expression Diagnosis	With change		Without change		P-value
	N	%	N	%	
AGA Adequate	6	46.2	19	73.1	0.098
Altered	7	53.8	7	26.9	
SGA Adequate	4	44.4	14	77.8	0.083
Altered	5	55.6	4	22.2	

DISCUSSION

We found no difference between preterm newborns/SGA and preterm newborns/AGA (Table 3) regarding language development, similar to another study⁽¹²⁾. The literature reported that SGA preterm infants have a significant delay in total language development^(7,8). However, in this study, language differences occurred more frequently in AGA neonates. Such differences may be attributed to the development of hearing skills that, in this study, were more altered in AGA neonates, probably due to other common complications in preterm infants⁽¹²⁾.

The result of the total language differed between the groups with and without alteration of the development of the hearing abilities only in the AGA neonates. The group with normal hearing development presented a higher percentage of language adequacy than the group with altered hearing development. This finding corroborates with the previously obtained result⁽⁹⁾, which found a correlation between hearing development and language performance in premature infants.

In this study, the development of expressive language did not differ between groups of neonates, unlike a previous study⁽²⁾ that

preterm newborns/SGA present a higher occurrence of a delay in the development of expressive language. Such differences could be explained by the sample size that had 118 in the study cited, and the type of instrument used that was the Expressive Vocabulary Checklist (EVCL), for language assessment.

Thus, we found no differences in the language development of preterm infants with adequate weight for gestational age or small weight for gestational age. The differences in language obtained, especially at reception, varied depending on the development of hearing skills in the first year of life. This finding showed the need for a hearing and language monitoring in preterm infants regardless of their weight/gestational age ratio. The results obtained need to be confirmed with further studies.

CONCLUSIONS

There was no difference in language development between children diagnosed with SGA and those diagnosed with AGA.

However, there was a relationship between the development of hearing skills in the first year of life and language development in preterm children with chronological age between 18 and 36 months. The group with normal hearing development had better results in language assessment, especially at Reception, regardless of AGA or SGA classification.

REFERENCES

1. Imgrund CM, Loeb DF, Barlow SM. Expressive language in preschoolers born preterm: results of language sample analysis and standardized assessment. *J Speech Lang Hear Res.* 2019;62(4):884-95. http://dx.doi.org/10.1044/2018_JSLHR-L-18-0224. PMID:30986137.
2. Isotani SM, Azevedo MF, Chiari BM, Perissinoto J. Linguagem expressiva de crianças nascidas pré-termo e termo aos dois anos de idade. *Pró-Fono Rev Atualização Científica.* 2009;21(2):155-60. <http://dx.doi.org/10.1590/S0104-56872009000200012>.
3. Ribeiro CC, Pachelli MR, Amaral NC, Lamônica DA. Habilidades do desenvolvimento de crianças prematuras de baixo peso e muito baixo peso. *CoDAS.* 2017;29(1):e20160058. <http://dx.doi.org/10.1590/2317-1782/20162016058>. PMID:28146204.
4. Soares ACC, Silva K, Zuanetti PA. Variáveis de risco para o desenvolvimento da linguagem associadas à prematuridade Risk factors for language development associated with prematurity. *Audiol Commun Res.* 2017;22:1745-1. <http://dx.doi.org/10.1590/2317-6431-2016-1745>.
5. Silva LV, Araújo LB, Azevedo VMGO. Assessment of the neuropsychomotor development in the first year of life of premature infants with and without bronchopulmonary dysplasia. *Rev Bras Ter Intensiva.* 2018;30(2):174-80. <http://dx.doi.org/10.5935/0103-507X.20180023>. PMID:29995082.
6. Beltrame VH, Moraes AB, Souza APR. Perfil sensorial e sua relação com risco psíquico, prematuridade e desenvolvimento motor e de linguagem por bebês de 12 meses. *Rev Ter Ocup Univ Sao Paulo.* 2018;29(1):8-18. <http://dx.doi.org/10.11606/issn.2238-6149.v29i1p8-18>.
7. Rechia IC, Oliveira LD, Crestani AH, Biaggio EP, Souza AP. Efeitos da prematuridade na aquisição da linguagem e na maturação auditiva: revisão sistemática. *CoDAS.* 2016;28(6):843-54. <http://dx.doi.org/10.1590/2317-1782/20162015218>. PMID:28001276.
8. Fernandes LV, Goulart AL, Santos AM, Barros MC, Guerra CC, Kopelman BI. Neurodevelopmental assessment of very low birth weight preterm infants at corrected age of 18-24 months by Bayley III scales. *J Pediatr.* 2012;88(6):471-8. PMID:23172131.
9. Azevedo M, Vieira R. Desenvolvimento auditivo de crianças normais e de alto risco. Plexus Editora; 1995.
10. Luiz CBL, Garcia MV, Perissinoto J, Goulart AL, Azevedo MF. Relação entre as habilidades auditivas no primeiro ano de vida e o diagnóstico de linguagem em prematuros. *Rev CEFAC.* 2017;18(6):1316-22. <http://dx.doi.org/10.1590/1982-021620161864616>.
11. Menezes ML. Avaliação do desenvolvimento da linguagem, idealizado, padronizado e validado no Brasil para avaliar o desenvolvimento da linguagem da criança brasileira. 2003.
12. Oliveira LN, Lima MCMP, Gonçalves VMG. Acompanhamento de lactentes com baixo peso ao nascimento: aquisição de linguagem. *Arq Neuropsiquiatr.* 2003;61(3):802-7. <http://dx.doi.org/10.1590/S0004-282X2003000500019>.

Author contributions

ASG and MMFO are responsible for research, data collection, and analysis of the results; ALG is responsible for the pediatric department of UNIFESP and by the outpatient clinic where the children were evaluated; JP is the advisor and MFA is the co-advisor of this project.