COMPARISON BETWEEN THE ACQUISITION OF /K/ AND /G/ AND OF THE PHONETIC SEQUENCES [K^W] AND [G^W] IN BRAZILIAN PORTUGUESE – INTERVENING VARIABLES AND PHONOLOGICAL STATUS

Comparação da aquisição de /k/ e /g/ e das sequências fonéticas [k^w] e [g^w] no pb – variáveis intervenientes e status fonológico

Roberta Freitas Dias[1], Silvana Gonçalves Lopes[2], Paula Tavares Marchetti [3], Sheila Jacques Oppitz[4], Juliana Cardoso[5], Carolina Lisbôa Mezzomo[6]

ABSTRACT

Purpose: to analyze and to compare the acquisition of the phonetic sequences [k^w] and [g^w] and of the plosives /k/ and /g/ by children with typical speech development, considering the intervening linguistic and extralinguistic variables. **Methods:** the amount of analyzed words was 3193, after 213 interviews with children who present typical phonological development. The Phonological Assessment of Child was used and all words which contain the phonetic sequences [k^w] e [g^w] and the phonemes /k/ e /g/ were selected. The analyzed dependent variables were: correct and incorrect production of the referred phonemes. The intervening variables were: sex, age, tonicity, number of syllables in the word, preceding syllabic context, following syllabic context, position in the word, sonority and segment complexity. The statistical program VARBRUL was used with significance level of 5%. **Results:** the selected variables for the correct production of [k^w] e [g^w] were age and position in the word. To the production of /k/ and /g/, the variables were sex, age, preceding syllabic context, following syllabic context and sonority. In the analysis of all words which were the *corpus* of this research, the statistic program selected the complexity of the segment as relevant in the acquisition of the analyzed segments. The highest probability of correct production was found for the phonemes /k/ and /g/. **Conclusion:** the fact that different variables are significant for the acquisition of /k,g/ and of [k^w, g^w] showed a reason for different children's phonological therapy organization, regarding the mentioned sounds. It seems that the sequences [k^w] and [g^w] may be considered as complex segments of Brazilian Portuguese, because the complexity of the segment was selected as statistically significant in the studied *corpus*.

KEYWORDS: Language Development; Speech; Linguistics; Verbal Behavior, Child

(1) Universidade Federal de Santa Maria - UFSM, Santa Maria, RS, Brazil.

(2) Universidade Federal de Santa Maria - UFSM, Santa Maria, RS, Brazil

(3) Universidade Federal de Santa Maria - UFSM, Santa Maria, RS, Brazil

(4) Speech-language therapy course of Universidade Federal de Santa Maria - UFSM, Santa Maria, RS, Brazil.

(5) Speech-language therapy course of Universidade Federal de Santa Maria - UFSM, Santa Maria, RS, Brazil.

(6) Speech-language course and the Post-Graduation Program in Human Communication Disorders, Universidade Federal de Santa Maria - UFSM, Santa Maria, RS, Brazil.

Source of research assistance: CAPES/CNPq grant

Conflict of interest: non-existent

INTRODUCTION

The phonological acquisition of a language occurs gradually, until children are about seven years old. This acquisition includes the settlement of the phonetic and phonological inventories and the domain of the language rules which are part of children's routine. From one year and six months old to seven years old there is the highest expansion of the phonological system, with improvements of the phonetic inventory which is used in the most complex syllable structures and in polysyllable words[1].

The acquisition and the expansion of the phonological system of a certain language may by analyzed and explained through the Auto Segmental Phonology. This theory estimates that there are three different types of segments to be acquired in different languages inventories: simple segments, complex segments and contour segments. The simple segments present only a root node, with only one oral articulation feature ([p] - labial and [t] - coronal). Complex segments present a root node and they present, at least, two articulation features ([ɬ] – velarized lateral – characterized by coronal and dorsal points). The contour segments present edge effects. It means that they present edges that oppose themselves by the presence and absence of the same feature in the same segment ([tʃ] and [dʒ] – affricate consonants with edges [+-continuous])[2,3].

In this study, it was specifically investigated the acquisition of the phonetic sequences [k^w] and [g^w], considered, by some authors, as complex segments with secondary labial articulation[4], and the acquisition of the dorsal plosive phonemes (/k/ and /g/). About the acquisition of dorsal plosives, several studies observe that the acquisition occurs between two and three years old in Brazilian Portuguese (BP)[1,5-8].

Even if the dorsal plosives are acquired after coronal plosives (/t/ and /d/) and labial plosives (/p/ and /b/), such segments can be considered as precocious in BP[9]. Words as *gato* [‘gatu] (cat) and *casa* [‘kaza] (house), produced according to the target form may be observed in initial stages of phonological acquisition[8,9]. On the other hand, the sequences [k^w] and [g^w], which occur in words like *quarto* (room) and *água* (water) are commonly produced as [‘katu] e [‘aga][9], what evidences their phonological complexity, reflecting later acquisition when compared with /k/ and /g/.

In a study regarding European Portuguese (EP) about phonological nature – segmental and syllabic – of the phonetic structures consonant-glide-vowel (CGV), it was observed that Portuguese children process the sequences [k^w] and [g^w] like /k^w/ and /g^w/. According to the author, the segmental status of this phonetics structure is of complex consonants (labialized velars, with secondary labial articulation), but the syllable status is of non-syllable onsets[10].

Three hypotheses were created and discussed by the author before analyzing EP data. The first considers that the sequences [k^w] and [g^w] constitute a branching nucleus (Figure, 1a), the second previews the glide positioning in complex onset (Figure 1b) and the third, observed by the author, attributes to the mentioned sequences status of complex segment (Figure 1c)[10].

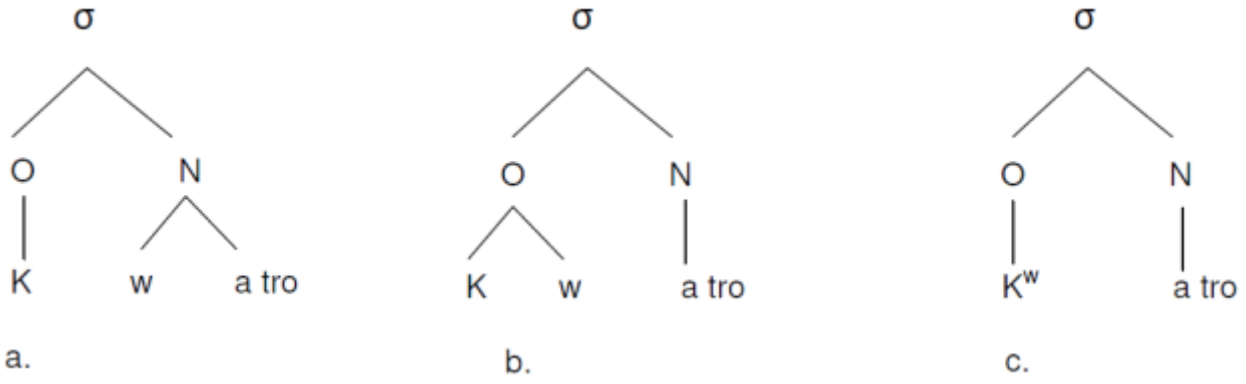


Figure 1 – Hypotheses for the sequences [k^w] and [g^w] analyzed in EP: a. branched nucleus; b. glide in complex onset and c. complex segment (BONILHA, 2007)

In data of BP, the probability that the sequences [k^w] and [g^w] are considered as complex segments, or labialized dorsal, was also observed[4], as previously referred. On the contrary, when analyzed through the Optimality Theory, these sequences were seen as two simple segments /ku/ and /gu/ in the input, performed in complex onset, not as complex segments (Figure 1b)[9].

To understand and to consider the sequences [k^w] and [g^w] as complex segments of BP, hypotheses of this study, implies the increase of the language phonological inventory, and later acquisition of that sequences because of their phonological complexity. The system presents the plosive dorsal /k/ and /g/ and the dorsal labialized /k^w/ and /g^w/[9]. As it is observed, the literature brings some data

which discuss this issue. However, there is not a consensus about this topic by the authors.

Aiming at contributing for this theoretical discussion, this study analyzed speech data of 213 interviews from different children, in transversal collection, with discerning analysis of the acquisition of the sequences [kʷ] and [gʷ], compared with the acquisition of the plosive phonemes /k/ and /g/. Such analysis may contribute to a more sophisticated view about data of the BP phonological inventory, as well as subsidize the Speech-language clinic with information which can be relevant to understand the phonological acquisition and, as a consequence, the treatment of speech disorders.

Thus, the purpose of this study was to analyze and to compare the acquisition of the phonetic sequences [kʷ] and [gʷ] and of the plosives /k/ and /g/ in children with typical speech development, considering the intervening linguistic and extralinguistic variables in this process.

METHODS

The words corpus analyzed in this study is part of the data basis from a research project approved by the institutional Research Ethics Committee (REC), n. 064/2004.

This research was transversal, exploratory and quantitative. The corpus consisted of 3193 words, selected after speech samples from 213 interviews with different children, with typical phonological development, monolingual speakers of BP.

These subjects belong to a data basis from a center of language and speech studies at a University. To be part of this data basis, the subjects could neither be or have been treated by speech-language therapists or present evident neurological, psychological and/or cognitive alterations. All of them frequented the University nursery. The typical phonological development was confirmed with language and speech observational evaluation, using pictures and toys, and comparison with the literature which defines the typical phonological acquisition profiles of the analyzed dialect[1,6-8,11].

To form the referred data basis, interviews were performed every fifteen days with children with ages between 1:0 and 4:11;29, for a period of six months, having as instrument the Child's Phonological Assessment – CPA[12]. Through this evaluation, it is possible to obtain spontaneous naming of 125 words represented by five thematic pictures. The instrument was reproduced in toys for younger children who are not interested in the pictures. The recording of each speech sample was transcribed (restricted phonetic transcription) by the interviewer and it was reviewed by two evaluators who are participants of undergraduate research projects in the institution where the research was performed.

For this research, it was performed a survey of all words which present the sequences [kʷ] and [gʷ] and the phonemes /k/ and /g/ in positions of initial onset and medial onset, in all interviews which are part of the data basis. The corpus consisted of 3067 words containing the phonemes /k/ and /g/ and 126 words containing [kʷ] and [gʷ]. After the survey of these words, they were codified according to their production: correct production (*faca* (knife) = ['faka], *gato* (cat) = ['gatu], *quarto* (room) = ['kʷatʃu], *água* (water) = ['agʷa]) or incorrect production (*porco* (pig) = ['potu], *gurias* (girls) = [ku'ʃias], *quarto* (room) = ['katu], *água* (water) = ['aga]). As intervenient variables in the production of the phonemes and of the referred phonetic sequences, the extralinguistic variables gender and age, and the linguistic variables tonicity, number of syllables in the word, precedent syllabic context, following syllabic context, word position and sonority were considered.

Regarding the variable age, as for data with [kʷ] and [gʷ], as for data with /k/ and /g/, eighteen age groups were considered with ages between 1:1 and 4:11;29. About gender, 107 boys and 106 girls participated in this research.

In relation to the linguistic intervenient variables, it was considered:

- tonicity: pretonic [*abaca<u>x</u>i* (pineapple), *ga<u>l</u>inha* (chicken), *qua<u>dra</u>do* (square), *guar<u>dar</u>* (to keep)] and post-tonic [*<u>bi</u>co* (pecker), *<u>fo</u>go* (fire), *<u>á</u>gua* (water), language gap]
- number of syllables: monosyllables [*cor* (color), *gol* (goal), *qual* (which), language gap]; disyllables [*suco* (juice), *pegou* (caught), *quadro* (picture), *língua* (language)]; trisyllables [*panqueca* (pancake), *garagem* (garage), *guardado* (kept), *quadrado* (square)] and polysyllables [*bonequinha* (little doll), *tartaruga* (turtle), *quadradinho* (little square), *aguardando* (waiting)].
- precedent syllabic context: zero [*0cabelo* (hair), *0galinha* (chicken), *0quatro* (four), *0guaraná* (type of drink)]; *coronal* vowel [*bon**e**ca* (doll), *carr**e**gar* (carry), ***E**quador*, ***i**gual* (equal)]; dorsal vowel [***a**qui* (here), ***a**gora* (now), ***á**gua* (water), ***a**quário* (aquarium)]; labial vowel [*b**o**ca* (mouth), *f**o**go* (fire), language gap, *Ur**u**guai*) and consonant [***a**rco* (arch), *ber**g**amota* (bergamot), *lí**n**gua* (tongue), ***en**quanto* (while)].
- following syllabic context: coronal vowel [*aqu**i*** (here), *fogu**e**te* (rocket), *sequ**ê**ncia* (sequence), *agu**i**nha* (a little water)]; dorsal vowel [*c**a**fé* (coffee), *g**a**rrafa* (bottle), *qu**a**ndo* (when), *gu**a**rda* (guard)] and labial vowel [*banc**o*** (bank), *ag**o**ra* (now), *aqu**o**so* (wet), *agu**o**u* (irrigated)].

- word position: initial onset [***c**abelo* (hair), ***g**ato* (cat), ***qu**arto* (room), ***gu**araná* (type of drink)] and medial onset [*xí**c**ara* (cup), *fo**g**o* (fire), *en**qu**anto* (while), *i**gu**al* (equal)].
- Sonority: voiced [***g**ato* (cat), ***gu**ardar* (keep)] and voiceless [***c**ola* (glue), ***qu**ase* (almost)].

After the analysis of those variables, it was performed an analysis of all the words of the corpus, in order to verify the influence of the segment complexity. To do so, the segments were categorized as simple (/k/ and /g/) and complex [k^w] and [g^w], according to the hypothesis of the study.

To analyze the data, the Statistical Program VARBRUL[13] was used in Windows environment (Varbwin). This program provides frequencies and probabilities about the investigated phenomena. So, it is broadly used in studies about sociolinguistics and language acquisition.

The probabilistic analysis performed by the program is binary. It attributes relative weights (probabilities) to the variants of the independent variables, in relation to two variants[13]. In this study, the dependent variables were correct and incorrect phonemes production and analyzed sequences. The Varbwin attributes significance values to the linguistic variables through interaction among them, such as gender versus age; sonority versus number of syllables. Thus, the program does not attribute significance value (p value) to the variants which are into the variables, but it determines relative weights or higher or lower probability of interference by the variants in the investigated phenomena.

In this software, the relative weights or probabilities come from statistical interaction which contains all variables which were selected as significant. For this study, values with relative weight under .50 were considered as not favorable for the correct production of the phonemes and studied sequences. The probabilities from .50 to .59 were considered as neutral. Finally, values equal or higher than .60 were considered as favorable for the correct production of the phonemes /k/ and /g/ and of the sequences [k^w] and [g^w].

The data were initially submitted to statistical analysis in two separate files (/k/ with /g/ and [k^w] with [g^w]). After the obtained results for the isolated rounds, the data were analyzed as a unique corpus, with all data (with /k/, /g/, [k^w], [g^w]) in order to investigate the variable segment complexity.

RESULTS

About the acquisition of the phonemes /k/ and /g/, the statistical program selected as relevant in the correct production of those segments, in increasing order of significance, the variables: following syllabic context, sonority, precedent syllabic context, age and gender (Table 1).

Both extralinguistic variables were selected by the program as statistically significant for the correct production of the phonemes /k/ and /g/. The results showed that the probability of correct production of these phonemes occurred in intermediate and final age groups. The highest probability of correct production occurred in the group 3:9 – 3:10;29. Regarding gender, the girls obtained higher probability of correct production of the analyzed phonemes, when compared with the boys.

There is higher probability of correct production of /k/ and /g/ when they are followed by dorsal vowel (***c**afé* - coffee, *g**a**lo* - cock). The variant voiceless (*cola* – glue) presented higher probability of correct production in relation to its voiced pair (***g**ola* – collar). Other variants, when preceded by coronal and dorsal vowels (*bon**e**ca* - doll, ***a**qui* - here, *carr**e**gou* - carried and ***a**gora* - now) presented higher probability of correct production for /k/ and /g/.

The variables tonicity, number of syllables and word position were not selected by the program as significant for the correct production of the segments /k/ and /g/ (Figure 2). However, it was noticed that the correct production of these segments occurred more frequently in post-tonic syllables (*xícara* - cup, *fogo* - fire – 92%), monosyllables (*cai* - falls, *gol* - goal – 93%) and in medial onset (*por**c**o* - pig, *tartaru**g**a* - turtle – 92%). Although they occurred in high percentages, there was no significance when compared with the other variants, from each selected variables.

Table 1 – Variables statistically significant to the correct production of the phonemes /k/, /g/ and of the phonetic sequences [k^{w}] , [g^{w}] **

Variables	Variants	/k/ and /g/			[kw] and [gw]		
		Frequency		Relative weight	Frequency		Relative weight
AGE	1:1-1:2;29	4/4	100%	#	*	*	*
	1:3 – 1:4;29	3/4	75%	.09	*	*	*
	1:5-1;6;29	4/4	100%	#	*	*	*
	1:7 – 1:8;29	14/18	78%	.29	0/1	0	#
	1:9 – 1:10;29	71/92	77%	.24	*	*	*
	1:11 – 2:0;29	119/139	86%	.34	2/3	67%	.36
	2:1 – 2:2;29	**187/189**	**99%**	**.80**	12/14	86%	.52
	2:3 – 2:4;29	198/207	96%	.56	**13/14**	**93%**	**.66**
	2:5 – 2:6;29	214/225	95%	.59	**10/11**	**91%**	**.66**
	2:7 – 2:8;29	**203/205**	**99%**	**.87**	5/8	63%	.26
	2:9 – 2:10;29	291/304	96%	.53	3/4	75%	.39
	2:11 – 3:0;29	213/241	88%	.35	7/12	58%	.17
	3:1 – 3:2;29	239/301	79%	.20	5/5	100%	#
	3:3 – 3:4;29	162/212	76%	.19	10/10	100%	#
	3:5 – 3:6;29	272/319	85%	.23	13/13	100%	#
	3:7 – 3:8;29	177/198	89%	.29	9/9	100%	#
	3:9 – 3:10;29	**254/255**	**100%**	**.96**	**18/20**	**90%**	**.64**
	3:11-4:0;29	150/150	100%	#	2/2	100%	#
GENDER	Female	**1623/1680**	**97%**	**.69**			
	Malez	1152/1387	83%	.27			
PRECEDENT SYLLABIC CONTEXT	Zero	1473/1651	89%	.44			
	Coronal vowel	**348/361**	**96%**	**.74**			
	Dorsal vowel	**251/261**	**96%**	**.75**			
	Labial vowel	298/321	93%	.56			
	Consonant (coda)	405/473	86%	.35			
SONORITY	Voiceless	**2293/2526**	**91%**	**.52**			
	Voiced	482/541	89%	.39			
FOLLOWING SYLLABIC CONTEXT	Coronal vowel	498/560	89%	.43			
	Dorsal vowel	**1157/1263**	**92%**	**.56**			
	Labial vowel	1120/1244	90%	.48			
WORD POSITION	Initial onset				61/75	81%	.36
	Medial onset				**48/51**	**94%**	**.70**
Significance				0,019			0,021

Legend: # - Knockout, * - no occurrence.
Statistical program: Varbrul; Significance: 5% (p<0.05)
Observation: the Knockouts reveal the existence of categorical data, what shows that some of the factors do not present variation.

For the sequences [k^{w}] and [g^{w}], the variables word position and age were selected. It was observed that those phonetic sequences are produced with more probability in intermediate and final age groups and also when in medial onset (*á**g**ua* – water). It is emphasized that in the age groups 2:3 to 2:4;9 and 2:5 – 2:6;29, the probability of correct production was higher (Table 1).

For the sequences [k^{w}] and [g^{w}], analyzed in this study, the variables gender, tonicity, number of syllables, precedent syllabic context, following syllabic context and sonority were not selected by the statistical program (Figure 3). The results reveal that the highest frequencies of correct production occurred for girls (91%). Regarding the linguistic variables, the highest frequencies of correct production were verified in post-tonic syllables (*á**g**ua* – water - 96%), disyllable words (*quarto* - four, *guarda* - guard – 88%), coronal following vowel (*agu**i**nha* – a little water - 100%), when the sequence plosive was voiced (*i**gu**al* - equal – 91%), and when preceded by dorsal vowel (***á**gua* - water – 96%).

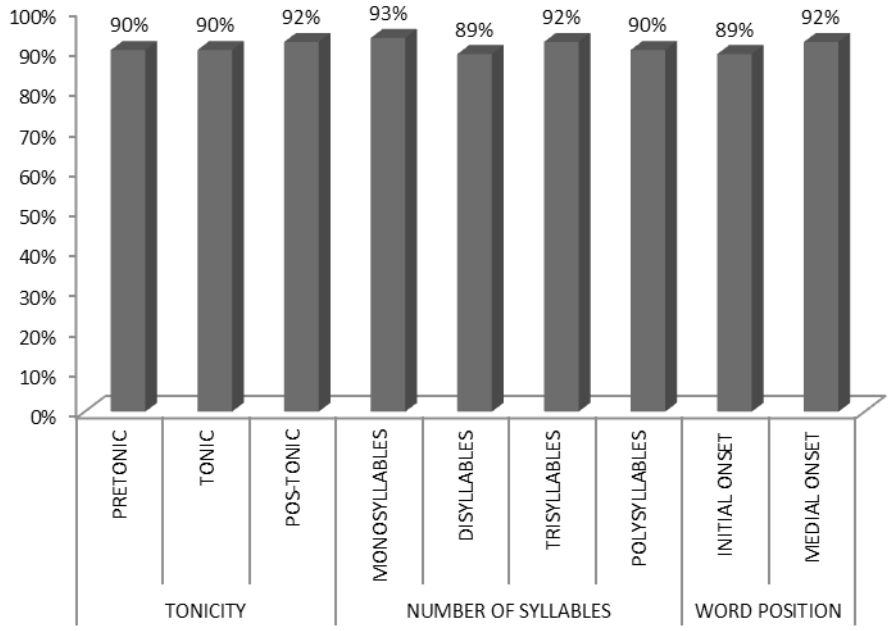
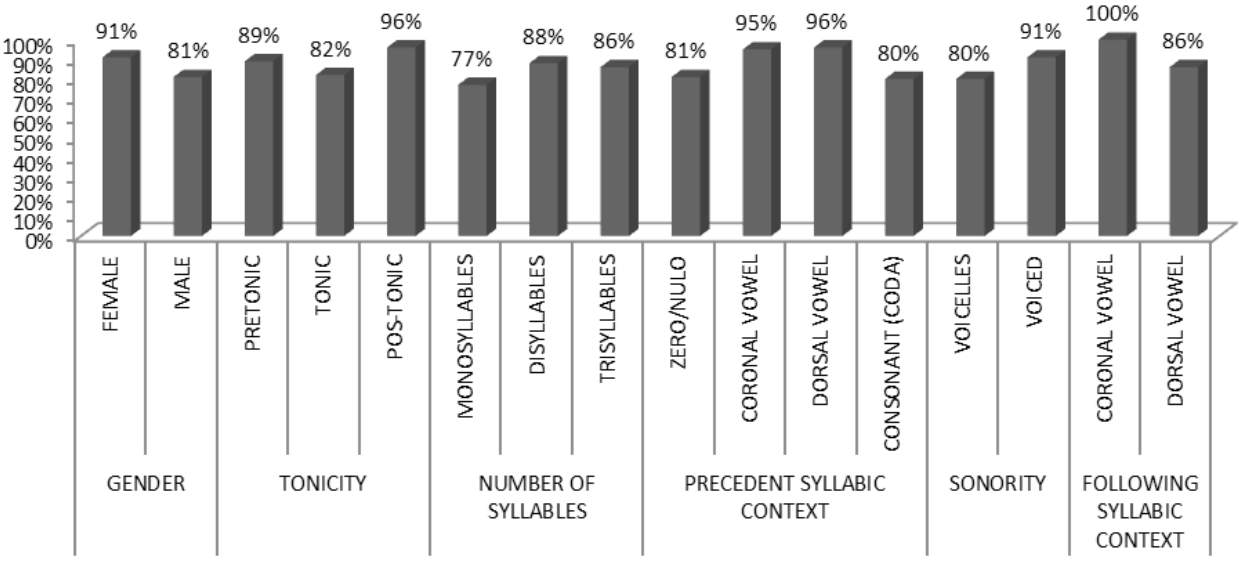


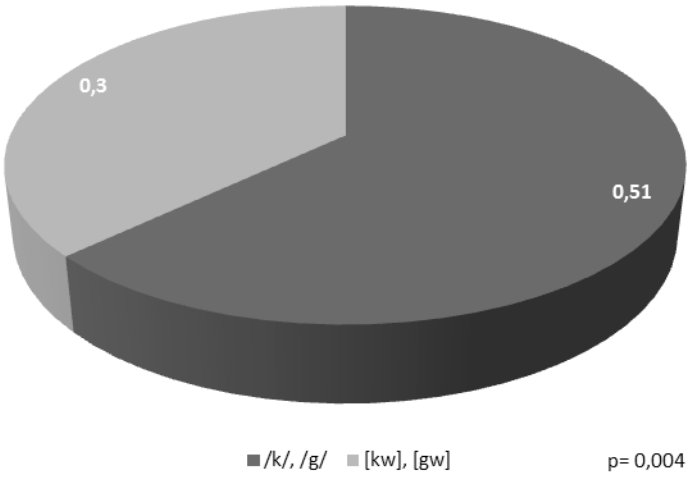
Figure 2 – Frequency of correct production of the phonemes /k/ and /g/ from the not statistically significant variables



Observation: There was no occurrence of the variants polysyllable (variable number of syllables) and labial vowel in the precedent and following syllabic contexts.

Figure 3 – Frequency of correct production of the phonetic sequences [k^w] and [g^w] from the not statistically significant variables

When analyzing the corpus of words from this study in its totality, analyzing the words with /k/, /g/ and [k^w] [g^w], the statistical program selected the variable complexity of the segment as statistically relevant for the correct production of the phonemes /k/ and /g/ compared with the sequences [k^w], [g^w] (Figure 4). The obtained results show that the sequences [k^w] and [g^w] presented lower probability of correct production when compared with /k/ and /g/. About percentage, they were effectively produced in 87% of the possibilities, while the phonemes /k/ and /g/ were produced in 90% of the cases.



Statistical program: Varbrul; Significance: 5% (p<0.05)

Figure 4 – Probability of correct production considering the variable *segment complexity* ******

DISCUSSION

Although only a few age groups presented high probability to correct production of the phonemes /k/ and /g/ and of the sequences [k^w] and [g^w], it was clearly noticed that the studied phenomena was not linear. The frequencies of production evidenced that there are moments of higher correct production of those elements, followed by decrease of this production, with a posterior increase. This behavior, during the acquisition of a certain phoneme, was observed in several studies in BP[14-19].

During a child's phonological development, such behavior may be consequence of the reorganization of the linguistic knowledge characterized by the acquisition of more complex grammatical elements, such as semantics, syntax and morphology[12,14]. It was also noticed that there is no production of the sequences [k^w] and [g^w] in the first studied age groups. On the other hand, there is expressive initial production of /k/ and /g/, followed by reduction, what may express reorganization of the phonological system.

The extralinguistic variable gender was selected only for the correct production of the phonemes /k/ and /g/. The influence of this variable in verbal skills was broadly investigated by literature[6,17,20-24]. In a great part of these studies, the results revealed that girls are more perspicacious than boys for those skills, presenting better performance. Thus, in the present study, the girls presented significantly more probability of correct production of the phonemes /k/ and /g/. For the sequences [k^w] and [g^w], the variable gender was not selected, but the frequencies of correct production were also higher for girls.

The most favorable linguistic factors for the acquisition of certain phonemes have been investigated in typical and atypical data of BP. This information is relevant, mainly for clinical phonology[25-28].

In this study, the statistical program selected as favorable linguistic variables the correct production of the phonemes /k/ and /g/, the precedent and following phonological contexts, as well as sonority.

The favorable environments for the acquisition of dorsal plosives were investigated in a group of children with phonological disorder. The selected variables were age group and tonicity for the phoneme /k/, and precedent context, disorder severity and age group for /g/[28]. With this information, it was observed that the precedent context may influence the production of dorsal plosives, as for typical as for atypical data. In the present study, the precedent and following syllabic contexts showed that the probability of correct production of the phonemes /k/ and /g/ increases when there is presence of the dorsal vowel /a/. This finding seems to confirm the hypothesis that when adjacent phonemes involve the same active articulator movement (in this case the back of the tongue), the probability of correct production of them is higher[17].

About the sonority, the occurrence of correct production for the phoneme /k/ was also higher when compared with the phoneme /g/ in atypical speech data[28,29]. Such ascertainment was also proved with the results obtained in this study. The acquisition of the phoneme /g/ after the phoneme /k/ was evidenced in studies about phonological acquisition[5,8] and the fact that the voiced feature for the plosives is more marked or more complex, may justify the results obtained in these studies[29].

About tonicity, although it was not selected in this study, it was observed that the post-tonic word position presented higher frequency of correct production for /k/ and /g/, what was also detected in atypical data in relation to the phoneme /k/[28]. The post-tonic position is referred as the second most accurate syllable in the phonemic production, because it is the weak part of the metrical foot. Usually, the head of the metrical foot (stressed syllable) is the one with the highest phonemic precision and the tonic syllable (out of the foot) is the most vulnerable and susceptible to repair strategies. In the word *boneca* (doll), for example, the syllables "ne" and "ca" would be initially and more carefully produced, because they are, respectively, in tonic and post-tonic position and they are important in the word identification, because of perceptual salience.

The number of syllables and word position were also not selected by the program for /k/ and /g/. However, the monosyllable words and the position of medial onset presented the highest frequencies of correct production for those phonemes. This results, although they do not have statistical power, may be compared with findings from other studies which detected that as lower the number of syllables is, higher the probability of correct production will be[17,30]. Besides, on the contrary, the initial onset position seems to favor the acquisition of certain BP structures to the detriment of the medial onset[11,30]. On the other hand, it seems that the syllable position, compared with the manner and place of articulation of the phonemes which compose a certain language present little influence in phonological acquisition[11].

For the sequences [k^w] and [g^w], not only the age was selected as significant, as previously mentioned, but also the word position. The position medial onset presented higher probability of correct production of those elements. This result agrees with what was observed for the phonemes /k/ and /g/ and, as previously referred, agreeing with other studies about BP[11,30].

The not selected linguistic variables for those sequences were tonicity, number of syllables, precedent syllabic context, following syllabic context and sonority. The fact that five, from the six variables which were considered in this study were not selected may be related to characteristics and phonotactic restrictions of the language. These characteristics were also presented in studies about the sequences [k^w] and [g^w] in BP[4,9]. About the following syllabic context, it was detected that the vowel /a/ occupies this position in most words which contain the sequence [g^w]. Although in lower percentage, many of the words with the sequence [k^w] are also followed by the dorsal vowel[4,9]. However, in this study, it was noticed that the dorsal vowel presented higher frequency only for the precedent context, with the highest percentage for followed context with coronal vowels.

Even if they were not selected by the statistical program, it is emphasized that the highest frequencies of [k^w] and [g^w] correct production for the variables tonicity and sonority occurred in the variants post-tonic and voiceless, which were also highlighted for the phonemes /k/ and /g/. The dissyllable words were favorable for the correct production of these sequences, what is related to BP restrictions, because there are only a few words containing [k^w] and [g^w].

When the statistical program was used with the total corpus of words (with /k/, /g/, [k^w] and [g^w]) the variable segment complexity was selected. The probability of correct production of the analyzed elements was higher for the simple segments (/k/ and /g/), when compared with the sequences [k^w] and [g^w], confirming the main hypothesis of this research. This finding reinforces the hypothesis that [k^w] and [g^w] may be considered as complex segments - /k^w/ and /g^w/ [4,10]. So, the discussion about the inclusion of these segments in the phonological inventory of BP is an aspect to be considered, because it will be able to result in valuable contributions for the comprehension of typical and atypical phonological acquisition, as well as of clinical phonology.

CONCLUSION

The study about the acquisition of the phonetic sequences [k^w] and [g^w] compared with the acquisition of the dorsal plosives /k/ and /g/ evidenced the possibility of such sequences be considered as complex segments in BP - /k^w/ and /g^w/ in simple onset, once the segment complexity was statistically significant.

Besides, the only common variable selected by the statistical program for the correct production of the studied elements was age. For the phonemes /k/ and /g/, the variables following syllabic context, sonority, precedent syllabic context, age and sex were selected. For the sequences [k^w] and [g^w], age and word position were selected. Thus, the fact that different variants are significant to the acquisition of /k, g/ and [k^w, g^w] showed a different phonological treatment in children, regarding those sounds.

The variables tonicity, number of syllables and word position for the phonemes /k/ and /g/ and gender, tonicity, number of syllables, precedent syllabic context, following syllabic context and sonority for the sequences [k^w] and [g^w] were not selected by the statistical program. Nevertheless, the frequencies of correct production of these variables' variants agree with literature.

The intervening factors in the production of the phonemes of BP have been broadly investigated, giving instruments to the clinical Speech-language therapist in the evaluation and choice of linguistic targets to be used in speech disorders therapy. In this sense, the data obtained in this study should contribute with clinical phonology.

ACKNOWLEDGEMENT

To the Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) for the support with the development of this research, to the Fundo de Incentivo a pesquisa (FIPE) and to the Fundo de Incentivo à Extensão (FIEX).

RESUMO

Objetivo: analisar e comparar a aquisição das sequências fonéticas [k^{w}] e [g^{w}] e das plosivas /k/ e /g/ em crianças com desenvolvimento típico de fala, considerando variáveis intervenientes linguísticas e extralinguísticas. **Métodos:** analisou-se 3193 palavras, a partir de 213 entrevistas de crianças com desenvolvimento fonológico típico. Utilizou-se a Avaliação Fonológica da Criança, sendo selecionadas todas as palavras contendo as sequências fonéticas [k^{w}] e [g^{w}] e os fonemas /k/ e /g/. As variáveis dependentes analisadas foram: produção correta e produção incorreta dos segmentos referidos. As variáveis intervenientes: *sexo*, *idade*, *tonicidade*, *número de sílabas na palavra*, *contexto silábico precedente*, *contexto silábico seguinte*, *posição na palavra*, *sonoridade* e *complexidade do segmento.* Utilizou-se o pacote computacional VARBRUL, com nível de significância de 5%. **Resultados:** as variáveis selecionadas para a produção correta de [k^{w}] e [g^{w}] foram a *idade* e a *posição na palavra*. Para /k/ e /g/ foram o *sexo*, a *idade*, *contexto silábico precedente*, *contexto silábico seguinte* e *sonoridade.* Ao analisar todas as palavras que compuseram o *corpus* dessa pesquisa, o programa selecionou a *complexidade do segmento* como relevante na aquisição dos segmentos analisados, sendo maior probabilidade de produção correta para os fonemas /k/ e /g/. **Conclusão:** o fato de variáveis distintas serem significantes à aquisição de /k, g/ e ao [k^{w}, g^{w}] mostrou um tratamento fonológico diferenciado das crianças frente a esses sons. Parece que as sequências [k^{w}] e [g^{w}] podem ser consideradas segmentos complexos do PB, uma vez que a *complexidade do segmento* foi selecionada como estatisticamente significante no *corpus* estudado.

DESCRITORES: Desenvolvimento da Linguagem; Fala; Linguística; Comportamento Verbal; Criança

REFERENCES

1. Wertzner HF. Fonologia: desenvolvimento e alterações. In: Ferreira LP, Befi-Lopes DM, Limongi SCO. (Org.). Tratado de Fonoaudiologia. São Paulo: Rocca, 2004.

2. Bisol L (Org.). Introdução a estudos de fonologia do português brasileiro. Porto Alegre: EdiPUCRS, 2010.

3. Neto ACFS. Realizações palatalizadas de /t/ e de /d/: Segmentos de contorno ou segmentos Complexos? O caso se Sergipe. Interdisciplinas. 2010;(10):141-9.

4. Bisol L. A sílaba e seus constituintes. In: Neves MH. (Org.). Gramática do Português Falado. Campinas: Editora da Unicamp, 1999.

5. Mota H. Aquisição segmental do Português: uma modelo implicacional de complexidade de traços. Letras de Hoje. 1997;32(4):23-47.

6. Ferrante C, Borsel JV, Pereira MMB. Aquisição fonológica de crianças de classe sócio econômica alta. CEFAC. 2008;10(4):452-60.

7. Galea DES. Percurso da aquisição dos encontros consonantais, fonemas e estruturas silábicas em crianças de 2:1 a 3:0 anos de idade. 2009. Rev Soc Bras Fonoaudiol. 2009;14(1):151.

8. Toreti G, Ribas LP. Aquisição fonológica: descrição longitudinal dos dados de fala de uma criança com desenvolvimento típico. Letrônica. 2010;3(1)42-61.

9. Lamprecht RR, Bonilha GFG. A aquisição de [kw] e [gw] sob o enfoque de restrições. In: Bonilha GFG, Keske-Soares M. Estudos em Aquisição Fonológica. Volume I. Santa Maria: UFSM, PPGL-Editores, 2007.

10. Freitas MJ. Sons de ataque: segmentos complexos, grupos segmentais e representações fonológicas na aquisição do português europeu. Letras de Hoje. 2001;36;(3):67-83.

11. Lamprecht RR. A aquisição da fonologia do Português na faixa etária dos 2:9 – 5:5. Letras de Hoje. 1993;28(2):107-17.

12. Yavas M, Hernandorena CLM, Lamprecht RR. Avaliação fonológica da criança. Porto Alegre: Artes Médicas, 2001.

13. Cedergren HJ, Sankoff, D. Variable rules: performance as a statistical reflexion of competence. Language. 1974;50(2):332-55.

14. Forrest K, Weismer G, Elbert M, Dinnsen D. Spectral Analysis of Target-appropriate /t/ and /k/ Produced by Phonologically disordered and Normally Articulating Children. Clin Linguist Phon. 1994;8(4):267-81.

15. Keske-Soares M, Pagliarin KC, Ghisleni MRL. Aquisição não-linear durante o processo terapêutico. Letras de Hoje. 2008;43(3):22-6.

16. Guimarães DMLO. Aquisição segmental do português: uma abordagem Dinâmica. Fórum Linguístico. 2008;5(1):29-46.

17. Athayde ML, Baesso JS, Dias RF, Giacchini V, Mezzomo CL. O papel das variáveis extralinguísticas idade e sexo no desenvolvimento da coda silábica. Rev Soc Bras Fonoaudiol. 2009;14(3):293-9.

18. Mezzomo CL, Quintas VG, Savoldi A, Bruno LB. Aquisição da coda: um estudo comparativo entre dados transversais e longitudinais. Rev Soc Bras Fonoaudiol. 2010;15(3):401-7.

19. Sosa AV, Stoel-Gammon C. Lexical and Phonological Effects in Early Word Production. J Speech Lang Hear Res. 2012;55:596-608.

20. Meneses MS, Lozi GP, Souza LR, Assencio-Ferreira VJ. Consciência fonológica: diferenças entre meninos e meninas. Rev CEFAC. 2004; 6(3):242-6.

21. Andreazza-Balestrin C, Cielo CA, Lazzarotto C. Relação entre desempenho em consciência fonológica e a variável sexo: um estudo com crianças pré-escolares. Rev Soc Bras Fonoaudiol. 2008;13(2):154-60.

22. Moura SRS, Mezzomo CL, Cielo CA. Estimulação em consciência fonêmica e seus efeitos em relação à variável sexo. Pró-Fono. 2009;21(1):51-6.

23. Dias RF, Melo RM, Mezzomo CL, Mota HB. Variáveis extralinguísticas, sexo e idade, na consciência do próprio desvio de fala. Pró-Fono. 2010;22(4):439-44.

24. Mezzomo CL, Vargas DZ, Cuti LC, Lopes SG. As variáveis intervenientes na produção do onset complexo mediante uma análise silábica. CEFAC. No prelo. 2012.

25. Keske-Soares M, Pagliarin KC, Ceron MI. Terapia fonológica considerando as variáveis linguísticas. Rev Soc Bras Fonoaudiol. 2009;14(2):261-6.

26. Checalin MA, Ghisleni MRL, Ferreira-Gonçalves G, Keske-Soares M, Mota HB. A regressão observada no tratamento do desvio fonológico. Pró-Fono. 2010;22(3):363-6.

27. Wiethan FW, Mota HB. Ambientes favoráveis para a produção de /z/, /ʃ/ e /ʒ/: análise e comparação das mudanças ocorridas no sistema fonológico. CEFAC. 2012. (ahead of print).

28. Brancalioni AR, Bonini JB, Gubiani MB, Keske-Soares M. Ambientes favorecedores para produção dos fonemas plosivos /k/ e /g/. Distúrb Comum. 2012;24(1):101-7.

29. Berticelli A, Mota HB. Ocorrência das estratégias de reparo para os fonemas plosivos, considerando o grau do desvio fonológico. CEFAC. 2012. (ahead of print).

30. Rechia IC, Souza APR, Mezzomo CL. Processos de apagamento na fala de sujeitos com dispraxia verbal. 2010. CEFAC;12(3):421-6.

Received on: July 11, 2012
Accepted on: November 09, 2012

Mailing address:
Roberta Freitas Dias
Rua Antero Correa de Barros, 244, Bairro Centro
Santa Maria, RS
CEP: 97010-120
E-mail: robertafdias@hotmail.com