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Original article

FREQUENCY AND DISTRIBUTION OF LAMBDACISM AND RHOTACISM IN 5-6 YEARS OLD CHILDREN

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Abstract

Introduction: In the child's speech development, speech sound appears first. Speech sound is the primary means of expression and articulation disorders can hinder the comprehensibility of children's speech. The improper speech can limit the child's inclusion in the social and educational environment.

Materials and methods: A retrospective analysis was carried out on a random sample selected from preventive examinations for early diagnosis of impairments of hearing, speech and sounds in children aged 5-6 years. In the selected sample (n=275) of boys and girls, from rural or urban area, the frequency and distribution of lambdacism, rhotacism, or both disorders together were analyzed. The data was statistically and descriptively analyzed, and presented in tables and figures.

Results: In the analyzed sample, greater presence of lambdacism was observed before lambdacism-rhotacism and rhotacism. Most commonly the articulation disorder appearred alone, as lambdacism or rhotacism, followed by lambdacism-rhotacism, i.e., both disorders together. The disorders were more common among boys than among girls.

Conclusion: The study offers useful information about the prevalence of lambdacism, rhotacism and lambdacism-rhotacism in children of different gender and place of residence. The obtained findings can help in better understanding of the situation and establishing timely diagnosis and planning of the rehabilitation that will enable easier and faster integration of the children in the social and educational environment without long-lasting consequences.

Keywords: lambdacism, rhotacism, articulation, speech sound, speech

Introduction

From a public health point of view, it is important to monitor the state of articulation disorders in preschool children due to the potential problems in social integration and psychosocial development of these children. While most children are ready for verbal communication by preschool age, some do not have speech and language abilities equal to their peers. The speech and language abilities of these children may limit their involvement in the social and educational environment. Therefore, speech and language abilities have an important role in the society and in achieving verbal communication.

Speech is formed and developed as a need for realising the language system, while language forms and develops as a result of speech. Speech sound, word and sentence are the basic elements of speech. The first place is taken by the speech sound because it appears first in the speech development of a child and is the basic means of expression. Therefore, children should be encouraged and trained for the proper articulation, which is the initial basis for

speech. On the other hand, articulation disorder is a type of speech sound disorder that can impact an individual's ability to speak clearly and be understood by others. The articulation disorders represent an atypical production of speech sounds which cause substitution, omission, additions or distortions that can interfere with the speech intelligibility[1]. Articulation disorders involve difficulty in forming individual speech sounds properly. The term "speech sound disorders" is a broad, comprehensive term that refers to "any combination of difficulties with perception, motor production, and/or the phonological representation of speech sounds and speech segments (including phonotactic rules that govern syllable shape, structure, and stress, as well as prosody) that impact speech intelligibility"[2]. A variety of causes such as hearing impairments, orthodontic anomalies, disorders of auditory perception and the role of imitation, motor dyspraxia and lazy tongue (tongue-tie or ankyloglossia), can cause a delay or disturbance in the development of normal articulation.

There are several types of articulation disorders depending on which sound or group of sounds the child has difficulties with, namely: sigmatism (inability or difficulty in pronouncing the sounds /S/, /Z/, /Sh/, /Zh/, /Ch/, /Dzh/, /C/, /Dz/, /Kj/, /Gj/), kapacism (inability or difficulty in pronouncing the sound /K/), gammacism (inability or difficulty in pronouncing the sound /G/), lambdacism (inability or difficulty in pronouncing the sounds /L/ and /Lj/), rhotacism (inability or difficulty in pronouncing the sound /R/), tetacism (inability or difficulty in pronouncing the sound /T/), deltacism (inability or difficulty in pronouncing the sound /D/), etacism (inability or difficulty in pronouncing the sound /E/) and tetism (replacement of sounds /S/, /C/, /Sh/, /Ch/, /Kj/ and /K/ with sound /T/ and replacement of sounds /Z/, /Zh/, /Dzh/ and /Gj/ with /D/).

In different languages, there are sounds that are similar, some identical, but the words are not, so by words (and other things) languages differ and are learnt. Still, the terms for articulation disorders of certain sounds or group of sounds are universal, i.e. internationalised. However, that does not necessarily mean that impairment of a certain sound in one language will be considered impairment in another. This is so because every language has its phonology. For example, rhotacism, i.e., the pronunciation of the French /R/ is not preferred in the Macedonian language, but it is the norm in the French language. Some research shows that the most common types of articulation disorders include sigmatism, lambdacism and rhotacism, either alone or in combination[3,4], i.e., the most common error sounds are /S/, /L/ and /R/.

The aim of this study was to examine the state of articulation of the Macedonian language sounds /L/, /Lj/ and /R/ in children aged 5 and 6 years, that is, to determine the frequency and distribution of incorrect articulation, and their frequency and distribution among male and female children, from urban and rural areas.

Materials and methods

A retrospective analysis of data collected from preventive examinations was carried out by an expert team (specialist orthodontist and clinical speech therapist-specialist) from the Public Health Institution "Center for Rehabilitation of Verbal Communication Pathology-Skopje" (hereinafter referred to as "the Center"). The Center carries out preventive examinations in the direction of early diagnosis of obstacles in the development of hearing, speech and speech sounds in children from 4-6 years of age. The assessment of children's articulation is carried out by the Center's expert team during spontaneous speech and model speech. By model speech, test words and sentences are first examined where there is a common presence of a certain sound or sounds, which are suspected of their pathology and, naturally, of the isolated sound itself. In words, the sound is in different positions (initial, medial and final). With a visual examination of the visible organs that participate in the articulation, the existence of deviations and the quality of the oral system is determined.

In this study, a random sample of data (n=275) on children aged 5 and 6 years was selected from preventive examinations which the Center has at its disposal. Taking into account the COVID-19 pandemic in the period 2019-2023, the selected sample is from data from preventive examinations carried out in the period March-November 2018. From the sample, only data on children who had exclusively lambdacism, rhotacism, or lambdacism combined with rhotacism were analyzed. The sample consisted of data on boys (n=144) and girls (n=131), i.e., children living in an urban area (n=144) or a rural area (n=131). Children were with normal intellectual development, without mental retardation or impaired hearing. Data were taken from preventive examinations carried out in kindergartens and elementary schools from one urban settlement and seven rural settlements, all located in the city of Skopje, Republic of North Macedonia.

By means of a descriptive method, the following parameters were analyzed: age, gender, place of residence, type of articulation disorder, i.e., inability to correctly produce the following speech sounds of the Macedonian language /L/, /Lj/ and /R/.

The obtained data were statistically and descriptively analyzed, and herein are presented in tables and figures. The categorical (attributive) variables are presented with absolute and relative numbers. The numerical (quantitative) variables are presented with mean, minimum values, maximum values and standard deviation.

The statistical analysis of the obtained data was done with the programs Statistica for Windows 7.0 and SPSS 17.0. To compare the analyzed variables between male and female respondents, and place of residence, non-parametric (Pearson Chi-square test) and parametric (Student's t-test) tests were used. The statistical significance was defined at $p<0.05$.

Results

The analyzed results were divided into two groups: results of the total sample (n=275) and results of the sample with lambdacism, rhotacism and lambdacism-rhotacism (n=101).

a) Total sample results (n=275)

Out of the total analyzed sample (n=275), children who had lambdacism or rhotacism independently, i.e., isolated as one articulation disorder, were first identified, and then children who had both disorders simultaneously (lambdacism - rhotacism). 37% of the children (n=101) had the above-mentioned disorders, alone or in combination, i.e., the occurrence of an isolated articulation disorder, lambdacism or rhotacism was more frequent 28% (n=77) than both together lambdacism-rhotacism, 8.7% (n=24) (Figure 1).

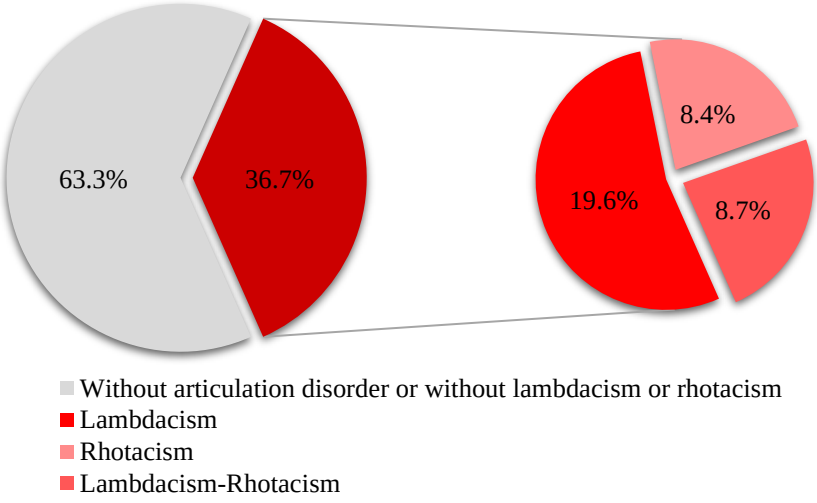

Fig. 1. Distribution of lambdacism, rhotacism or lambdacism- rhotacism and the form in which they appear (isolated or combination of two)

In the total sample, according to the type of articulation disorder, the most commonly found was lambdacism with 19.6% (n =54). The combination of rhotacism and lambdacism was present in 8.7% (n=24) of children, while 8.4% (n=23) had rhotacism only.

With reference to children's gender, out of the total analyzed sample, 41.7% of the boys had one articulation disorder (lambdacism; rhotacism; or lambdacism- rhotacism) and 31.3% of the girls. In boys compared to girls, the frequency of lambdacism and lambdacism-rhotacism was higher, while the frequency of rhotacism was almost the same in both genders (Figure 2).

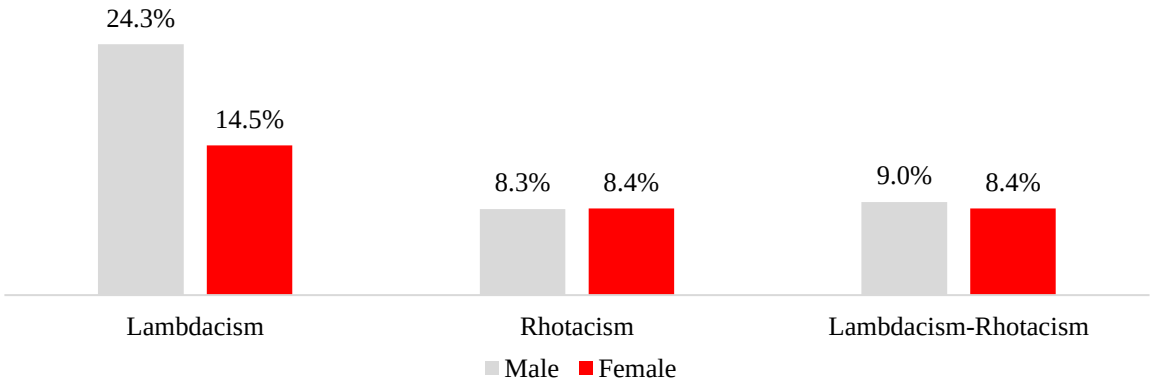

Fig. 2. Frequency of lambdacism, rhotacism or lambdacism-rhotacism in children, by gender

The difference in the distribution of children with or without lambdacism, rhotacism or lambdacism-rhotacism between the males and females was confirmed as statistically not significant (p=0.075) (Table 1).

Table 1. Distribution of lambdacism, rhotacism or lambdacism-rhotacism in children, by gender

Lambdacism, Rhotacism or Lambdacism-Rhotacism	Male		Female		p-value
	n	(%)	n	(%)	
With	60	(42)	41	(31)	p=0.075
Without	84	(58)	90	(69)	

p (Pearson Chi-square test)

Regarding children's place of residence, out of the total analyzed sample one articulation disorder (lambdacism, rhotacism or lambdacism-rhotacism) was present in 32.8% of children from rural areas and 40.3% of children from urban areas. In rural areas, there was a higher frequency of lambdacism among children, in contrast to children from urban areas, while in urban areas, rhotacism and lambdacism-rhotacism were more common among children (Figure 3).

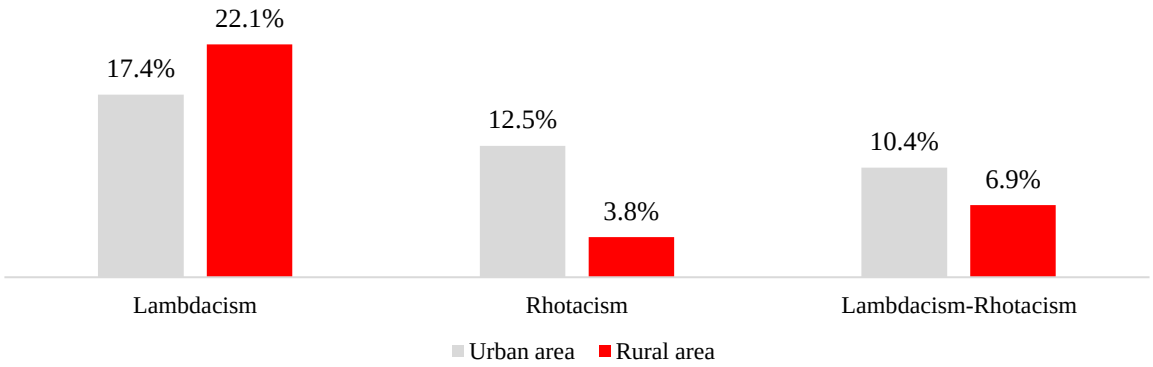

Fig. 3. Frequency of lambdacism, rhotacism or lambdacism-rhotacism in children, according to their place of residence (urban or rural area)

The difference in the distribution of children with or without lambdacism, rhotacism or lambdacism-rhotacism by place of residence (urban and rural area) was confirmed as not statistically significant (p=0.200) (Table 2).

Table 2. Frequency and distribution of lambdacism, rhotacism or lambdacism-rhotacism in children according to their place of residence (urban or rural area)

Lambdacism, Rhotacism or Lambdacism-Rhotacism	Rural area		Urban area		p-value
	n	(%)	n	(%)	
With	43	(33)	58	(40)	p=0.200
Without	88	(67)	86	(60)	

p (Pearson Chi-square test)

Only data about children with confirmed lambdacism, rhotacism or lambdacism-rhotacism were taken into consideration for further analysis.

b) Results obtained for children with lambdacism, rhotacism, or lambdacism-rhotacism (n=101)

Children (n=101) who were diagnosed with lambdacism, rhotacism or lambdacism-rhotacism had an average age of 5.76±0.42 years. The distribution of lambdacism, rhotacism or lambdacism-rhotacism among children showed that the largest number of them had lambdacism, 53.5% (n=54). A combination of rhotacism and lambdacism was present in 23.8% of children (n=24), while only rhotacism was present in 22.8% (n=23) (Figure 4).

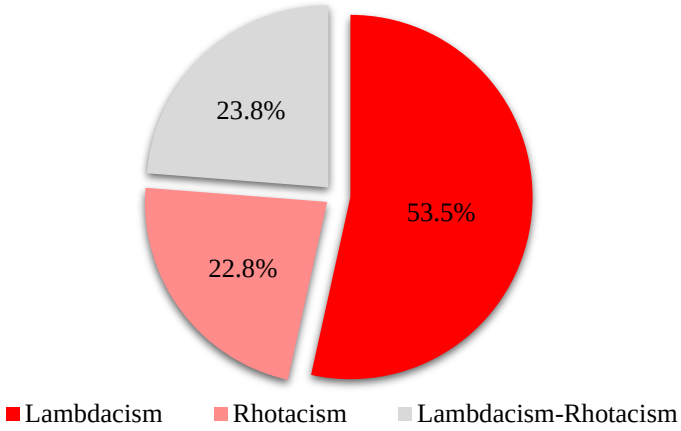

Fig. 4. Distribution of lambdacism, rhotacism or lambdacism-rhotacism in children, and their appearance (isolated or in combination of two disorders)

Distribution by gender

The distribution of children with lambdacism, rhotacism or lambdacism-rhotacism by gender showed that 59.4% were boys and 40.6% girls (Table 3).

Table 3. Distribution of children with lambdacism, rhotacism or lambdacism-rhotacism by gender

Gender	Lambdacism		Rhotacism		Lambdacism-Rhotacism		Total	
	n	%	n	%	n	%	n	%
Male	35	64.8%	12	52.2%	13	54.2%	60	59.4%
Female	19	35.2%	11	47.8%	11	45.8%	41	40.6%
Total	54	100.0%	23	100.0%	24	100.0%	101	100.0%

In boys, the disorder was more often independent, i.e., lambdacism or rhotacism (78%) than in combination lambdacism-rhotacism (22%). Also, in girls, the disorder occurred much more often independently (73%) than combined (27%).
The average age of boys with lambdacism, rhotacism or lambdacism-rhotacism was 5.78±0.41 years, and of girls 5.73±0.45. The difference was no statistically significant (p=0.27703).

Distribution by place of residence

The distribution of children with lambdacism, rhotacism or lambdacism-rhotacism according to the place of residence showed that 57.4% (n=58) were from an urban area, and 42.6% (n=43) from a rural area. Rhotacism alone or in combination with lambdacism occurred much more often in children from an urban area than in children from a rural area. This was not the case with lambdacism, a disorder that in the analyzed sample occurred more often among children from rural area (Table 4).

Table 4. Distribution of children with lambdacism, rhotacism or lambdacism-rhotacism by place of residence

Place of residence	Lambdacism		Rhotacism		Lambdacism-Rhotacism		Total	
	n	%	n	%	n	%	n	%
Urban area	25	46.3%	18	78.3%	15	62.5%	58	57.4%
Rural area	29	53.7%	5	21.7%	9	37.5%	43	42.6%
Total	54	100.0%	23	100.0%	24	100.0%	101	100.0%

Among children living in an urban area, the disorder occurred much more often independently (74%) as rhotacism or lambdacism than in combination as lambdacism-rhotacism (26%). Among children from rural areas, lambdacism or rhotacism occurred independently much more often (56%) than both disorders together (44%).
The average age of children from an urban area with lambdacism, rhotacism or lambdacism-rhotacism was 5.74±0.44 years, and of children from a rural area 5.79±0.41. The difference was not statistically significant (p=0.28).

Discussion

Much research has been done on articulation disorders in children, including the frequency and distribution of lambdacism and rhotacism, independently as isolated cases, or both disorders combined. Each author investigates, analyzes and presents the results with his own approach. When comparing the results regarding articulation disorders, it is important to have in mind that each language has its own phonological composition of speech sounds i.e. the disorder of a certain speech sound in one language is not necessarily considered as a disorder in other language as well[5]. Therefore, the possibilities to make a complete comparison of the results obtained in our study with some other research in which the same or similar methods and size of the examined sample were used were limited. However, partial and limited comparisons for certain results were possible. The results obtained in our study are in accordance with the research of other authors, but sometimes they are different.

In our study, lambdacism, rhotacism and lambdacism-rhotacism was established in 36.7% of the total analyzed sample (n=275). Stanković-Milićević *et al*.[6] established atypical articulation in 31.96% of examined children in their study involving a sample of 316 respondents, all aged 5. The most common type of atypical articulation in their study was lambdacism, followed by rhotacism and sigmatism, while the least common were tetacism and deltacism. These results coincide with the results in our study concerning lambdacism and rhotacism with the only difference that Stanković-Milićević *et al*. included atypical articulation sigmatism, tetacism and deltacism as well. Georgievska Jancheska[5], who conducted a study

with a sample of 738 children aged 4 to 6 years, determined the presence of atypical articulation in 39.2% with the most frequent representation of lambdacism, followed by rhotacism-lambdacism and rhotacism.

According to the results obtained for the total examined sample (n=275) and in relation to the frequency of occurrence of a certain articulation disorder, either alone or in combination, most of the children had lambdacism (19.6%), followed by lambdacism-rhotacism (8.7%), and the smallest number of children had rhotacism (8.4%). In a sample of 76 children studied by Filić, Kolundžić and Vidović[3], most of the children had sigmatism, lambdacism and rhotacism. Farago *et al*.[4], suggest that the most common articulation disorders are sigmatism, rhotacism and lambdacism. Jurišić[7], on the other hand, examined phonological-articulation disorders of 31 children, who spoke two languages and were aged 6 to 11. Her study revealed that sigmatism and rhotacism were the two most common disorders in the examined sample. Sigmatism was present in 19.35% of respondents, and if the combined disorders were added, then sigmatism was present in 26% of respondents. Rhotacism was present in 12.9% of respondents, that is, 16% of respondents when rhotacism was added to the combined articulation disorders. According to Filipova, Levenska and Ikadinović-Talevska[8], who examined a sample of 324 respondents, articulation problems were most common in the speech of preschool children in the municipality of Negotino (Republic of North Macedonia). Their results showed that lambdacism was most commonly encountered, and also combined articulation problems, i.e., speech problems with more sounds. Apart from the study of Filipova, Levenska and Ikadinović-Talevska, the key difference with other studies is that in our study the most common articulation disorder is lamdacism, which is not the case in other studies.

Our results showed that lambdacism more commonly appeared alone as isolated articulation disorder than in combination with rhotacism, or rhotacism alone, with regard to the total examined sample (n=275). The study of Junuzović-Žunić, Banović and Bratovčić[9] found that respondents, aged 4 to 6, most often had an articulation disorder from a combined type (sigmatism - rhotacism; sigmatism - lambdacism; sigmatism - lambdacism - rhotacism) with a frequency of 34.4%. Alić, Radić and Kantić[10], who analyzed a sample of 150 respondents, aged 3-10, established a different type of articulation disorders. Most of the respondents in their research had a combination of articulation disorders (32.67%). These results differ from our obtained results, where the occurrence of isolated articulation disorders (28%) was more common than the combination of two disorders (8.7%).

Our findings showed that the occurrence of one articulation disorder, either alone or in combination (lambdacism, rhotacism, or lambdacism-rhotacism) was more common among boys (41.7%) than among girls (31.3%). Vila and Opsenica[11] suggest that delay in speech development, articulation disorders and similar conditions occur more often in males than females. This is consistent with our results, but not with those of Stanković-Milićević *et al*. [6] who established that the frequency was higher among girls, totaling at 35%, while 28.84% among boys.

The results of our study, and in relation to the total examined sample (n=275), revealed that the occurrence of lambdacism, rhotacism or lambdacism-rhotacism was more common among children living in an urban area (40.3%) than among children living in rural areas (32.8%). According to Ristić[12], who conducted a study involving 1,030 students, aged 7 years, from schools located in cities and suburban areas, speech pathology was significantly more common among children studying in schools in the city (32.3%) than among children from suburban schools (10.3%), which was explained to be a consequence of the modern way of life and insufficient time devoted to children. Although the study of Junuzović-Žunić and Ibrahimagić[1] included children with sigmatism and sigmatism combined with lambdacism and rhotacism, there was no statistically significant difference between the groups according

to their place of residence (urban or rural area). They add that one of the reasons may be the fact that there are more and more newly opened facilities for speech rehabilitation in rural areas. Furthermore, the advancement of today's technology allows quick and easy access to information that points us to the problems of children with speech disorder and the importance of timely involvement of children in treatments. By reviewing the literature with classic research on articulation disorders and perceptual, articulatory, cognitive, and social variables, Winitz concluded that social variables contributed to much of the variance in speech acquisition (Shriberg *et al*.[13]). According to Hoff-Ginsberg[14] , the social class of the mother, the way she interacts with the child and the time she spends interacting with the child significantly influence the child's speech development. Burt *et al*.[15] state that there is no statistically significant difference in the articulation characteristics of speech sounds in children from different socio-demographic backgrounds.

It is worth pointing out that future research should include a larger number of respondents so that the results obtained can have greater relevance. Also, the frequency of certain types of articulation disorder should be investigated and analyzed in relation to the respondents' age, then information on whether the child was born prematurely, and involvement of the child in hearing or speech rehabilitation.

Conclusion

This study offers useful information on the prevalence of lambdacism, rhotacism and lambdacism-rhotacism in children of different gender and place of residence. Obtained findings can help in better understanding of the situation and timely diagnosis and planning of the rehabilitation that will enable easier and faster integration of the children in the social and educational environment without leaving lasting consequences.

Conflict of interest statement. None declared.

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