

PREVALENCE OF PHONOLOGICAL ARTICULATION DISORDERS IN PRESCHOOL CHILDREN IN THE CITY OF SKOPJE

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ABSTRACT

Introduction: Speech communication is a complex process based on the function of the central nervous system, and also on the speech mechanisms conditioned and controlled by auditory perception, verbal memory, intellectual activity and peripheral speech apparatus.

The aim of this study was to determine the prevalence of the most common phonological articulation disorders in preschool children, from 4-6 years old.

Materials and methods: A cross-sectional study was conducted during 2018, on a representative sample of 550 preschool children aged 4 - 6 years, who attend preschool institutions-kindergartens in the city of Skopje. The study used standardized articulation tests: The Global Articulation Test (GAT) and the Triple Test (vocals, plasia, affricative, fricative, nasal, and lateral), and a questionnaire filled out by a social worker at the kindergarten about the socioeconomic status and the child's health condition.

Results: Using GAT, we found that 260 (47.3%) children didn't manifest any phonological articulation disorders, but 290 (52.7%) had disorders. The analysis of gender-based data showed a higher percentage of speech disorders in 57% of boys and 46.9% of girls. The highest percentage of speech disorder is sigmatism with 24.5% in boys and 20.4% in girls, rhotacismus was found in 17.8% in boys and 16.5% in girls. Lambdacism with 8.3% was found in boys and 4.2% in girls. A mixed form (sigmatism, rotacism, and lambdacism) was also found in 2.4% of boys and 3.5% of girls.

Conclusions: The calculated prevalence of phonological articulation disorders in preschool children aged 4-6 years is 52.7%, (57.9% in boys and 46.9% in girls), or every second child in kindergarten has some form of speech disorder. These findings indicate that the treatment of speech disorders should begin in the appropriate services as soon as possible, because the early detection and treatment of speech disorders enable child's normal intellectual development. The treatment should be started in the preschool period, to allow the start of the educational process without any speech problems.

Keywords: speech disorders, preschool children, cross-sectional study, global articulation test, triple test

INTRODUCTION

Nowadays, many means of communication are available, but, without doubt, speech is the most beautiful, the most suggestive means by which person's thoughts express desires, emotions and ideas. In children, the first vocal elements appear related to the intonation and rhythm of the mother's speech, through the vocal play, through which they later upgrade their voices. In the adult world the child is engaged through speech, in a way that overcomes the knowledge of the previous generations, and as a coded form by acquiring new knowledge through verbalization and affective experience of the personality. The speech base should be ready at the age of three, but that does not mean that the child pronounces all the sounds correctly. Further, speech develops in such a way that the child has adopted what is the most basic and necessary for communication with the environment. The first words contain occlusions, both labial and dental, and their nasal variants. Speech, as the basis of the human communication, is a complex psychophysical process. Certain intellectual level, emotional capacity and instrumental skills are necessary for the realization of the speech [1].

Language can be learned by listening and trying to repeat what is heard. Speech communication is a complex process based on the function of the central nervous system (CNS), as well as the language mechanisms which are conditioned and controlled by auditory perception, verbal memory, intellectual activity, but also by the peripheral speech apparatus. If some deviations from this integrated complex system of its perfect functioning appeared, speech disorders would occur. Assessment for speech therapy and rehabilitation is necessary at the moment when the type of speech disorder is determined. The damage may be in different level of expressions, greater or less, and can make communication difficult to the point of impossibility.

Speech language disorders can be classified in five basic types [2, 3]:

- Phonological-articulation disorders (dyslalia, stigmatism, rhotacism, lambdacisms, tethacism).
- Language disorders (alalia, developmental aphasia, childhood aphasia-loss of already formed speech in childhood conditioned by various mechanical, biological, and tumor diseases of the CNS).
- Speech and rhythm disorders

- Voice disorders (aphonia, dysphonia, omni-
phonia) and
- Reading and writing disorders.

The main etiological causes for speech disorders can be related to biological, organic, psychological and environmental factors. Regardless of the age, there is the possibility of life changes through public health interventions conducted by speech and language therapists. Investing in speech and language therapy interventions is a cost-effective measure that sets out the needs for people's communication, health and well-being in the first place [4].

It was calculated, that each pound invested in speech and language therapy for children with communication needs generates 6.4 pounds by increasing lifelong earnings, compared to each pound invested in autism therapy, which generates only 1.46 through savings over a lifetime [5].

The aim of this study was to determine the prevalence of the most common phonological articulation disorders in preschool children aged 4-6 years living in the city of Skopje, the biggest city and capital of North Macedonia.

MATERIAL AND METHODS

Study design

A cross-sectional study was conducted during 2018 on a sample of preschool children, aged 4 - 6 years, who attend preschool institutions in the city of Skopje. According to the statistical yearbook in 2016, a total of 34,386 children were cared for in kindergartens in the Republic of North Macedonia. Based on that, we determined that the representative sample should consist of 550 children.

We used standardized articulation tests, such as the Global Articulation Test (GAT) [6] and the Triple Test (vocals, plasia, affricative, fricative, nasal, and lateral) [6]. At the same time, we applied a questionnaire that was filled in by the social workers in the kindergartens on the child's socio-economic status and health condition.

Test data and queries are entered and databases are formed in the Excel document. The statistical analysis of the formed statistical series consists of descriptive and analytical phase. The structure of the statistical series with attributive features is analyzed by determining the coefficients of relations, proportions and rates. The structure of statistical series with numerical features is analyzed by determining the

measures of central tendency (average values - arithmetic average) and dispersion measures (standard deviation). The analysis of the relationship between two series with attributive variables, and testing of the differences between two attributive series, was done using nonparametric tests (Pearson Chi-square, Difference test).

RESULTS

In the cross-sectional study, we included 550 children from preschool institutions in Skopje. The average age of children was 5.2 ± 0.5 g, in the range of 4 to 7 years (Fig. 1). The largest percentage were children aged 5 to 6 years - 75.5%, followed by children aged ≥ 6 years - 16.9% and with 7.6% are children under 5 years of age.

The male gender is represented with 52.7%, and the female gender with 47.3%. The percentage difference is statistically insignificant for $p > 0.05$ (Difference test, $p = 0.0917$), the difference is due to coincidence in our sample, therefore it is a homogeneous group by gender.

In most of the children, 68.5% of the mothers and 74.2% of the fathers had higher education, followed by the respondents in which the mother had secondary education (30.7%) and the father in 23.5%.

The distribution of participants according to the parental employment showed that 83.3% of participant's mothers and 88.9% of the fathers were employed. Unemployed were only 9.3% of the fathers, and 16.4% of the mothers.

The analysis of the disorder history showed that 519 children (94.4%) didn't have any disease, and 31 (5.6%) children were diagnosed with some disease. Concerning the type of disease, in 54.8% of the participants an autistic spectrum disorder was confirmed (statistically insignificant compared to other diseases, Difference test, $p = 0.0727$), in 32.2% asthma was registered, in 6.4% Diabetes mellitus (DM) type 1 was confirmed, hearing impairment in one child and jaw deformity in one child. (Table 1).

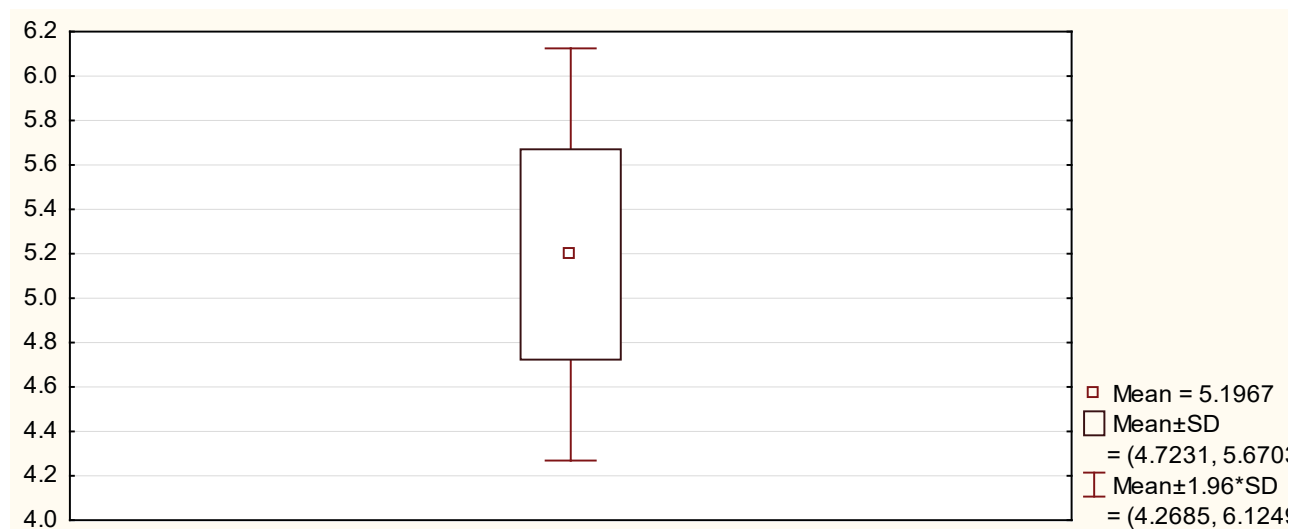


Figure 1. Average age of participants in the study

Distribution of examinees according to the family number showed, that 12 (2.2%) children lived with one parent, while 97.8% of them lived with two parents. More than half of the examinees (56.4%) live in a family of 4 members, 26.9% in a family with 3 members, 15.3% in a family with more than 5 members and 5 children in a family of only 2 members.

Table 1. Analysis of disease diagnosed in the participants

	Number	%	Disease	Number	%
No disease	519	94.4			
With disease	31	5.6	Autism	10	54.8
			jaw deformity	1	3.2
			DM type 1	2	6.4
			hearing impairment	1	3.2
			Asthma	17	32.2

Global articulation test

The results obtained with the global articulation test GAT showed that 260 (47.3%) children didn't have speech disorders, and 290 (52.7 %) children had some form of speech disorder. Gender analysis has shown bigger percentage in boys with speech disorders 57%, versus 46.9% in girls. The difference between boys and girls was statistically significant (Pearson Chi-square: 6.66463, $df=1$, $p=.009836$).

Table 2. Gender data analysis for speech disorders identified with GAT

gender	boys		girls	
	number	%	number	%
No disorders	122	42.1	138	53.1
With disorders	168	57.9	122	46.9
total	290	100.0	260	100.0

Table 3. Gender analysis for speech disorders identified with triple test

Gender	boys		girls	
	number	%	number	%
No disorders	122	42.1	138	53.1
Sigmatism	71	24.5	53	20.4
Rhotacism	55	19.0	43	16.5
Lambdacisms	24	8.3	11	4.2
Sigmatism-rhotacism	6	2.1	4	1.5
Rhotacism-lambdacism	3	1.0	1	0.4
Sigmatism-lambdacism	2	0.7	1	0.4
Stigmatism, rhotacism and lambdacism	7	2.4	9	3.5
Total	290	100.0	260	100.0

Having a number of 122 (42.1%) boys and 138 (53.1%) girls who didn't have speech disorders, the difference with the number of children with confirmed disorder was statistically significant for $p<0.05$ (Difference test, $p=0.0101$). Sigmatism was the most frequent in boys with 24.5% and 20.4% in girls, and the difference was statistically significant. Rhotacism was found in 17.8% of boys and in 16.5% of girls. Lambdacism was found in 8.3% of boys and in 4.2% of girls. The rest of the disorders were present in less than 2.0%. The mixed form of stigmatism, rhotacism and lambdacisms was detected in 2.4% of the boys and in 3.5% of the girls.

DISCUSSION

This is the first cross-sectional study for determination of the most frequent phonological articulation disorders in preschool children at the

age of 4-6 years, performed in 2018 on representative sample. This study confirmed that these disorders are present in a high percentage in preschool children and further action to decrease this number and reduce the consequences is needed.

Shimic M. (2015) performed the study in Zagreb on 101 subjects and found speech disorders in 40% of boys, and in 13% of girls. The most frequent disorders in girls were rhotacism, lambdacism, rhotacism and lambdacism, sigmatism, and in boys sigmatism; sigmatism and lambdacism; sigmatism and rhotacism; sigmatism, lambdacism and rhotacism. These findings are very similar with our findings [7].

Junuzovikj-Zunikj L and Ibrahimagikj A (2012) performed the study on 1,600 preschool children, at the age from 3-7 years and analyzed speech disorders. They found that sigmatism is the most frequent disorder and they concluded that prevalence of sigmatism decreased with chronological age of children [8].

Razmovska et al. (1997) studied speech disorders in slightly deaf children and found incorrect pronunciation of some voices, poor intonation of speech, especially in high-frequency spectrum voices (S-Z-C rarely the sounds Sh-Zh). The sigmatism is the most pronounced as a consequence of the deafness in the occlusal (addental) sigmatism where the sounds C and Z lose the screaming sound and get a certain resemblance to the sounds T and D (Ts, Tz) [9].

Stevovikj-Otasevikj J. (2016) in her doctoral dissertation conducted in Belgrade, with 60 participants, divided the examinees in two groups: an experimental group of 30 children with already diagnosed expressive speech disorder and a control group of 30 children with well-developed expressive speech. They concluded that the expressive speech disorder is more prevalent among males (76.7%), compared to females (23.3%). Differentiation of visual lateralization is worse in children with expressive speech disorder compared to children without expressive speech disorder. Auditory discrimination of voices (phonemic hearing) is better in children without the presence of expressive speech disorder, compared to children with expressive speech disorder [10].

The articulation is conditioned by several factors, but for the clear pronunciation of the voices, the anatomical and functional role of the speech organs is of special importance, concludes Georgievska-Janceska (2012). The changes in the orofacial area contribute to a clear and distinct

pronunciation of voices. Depending on the severity and type of malformation of the speech organs, the pronunciation of a certain group of voices may be endangered, among which the most common are disorders in the pronunciation of fricatives, sonants, affricates and plosives [11].

Poposka A. (2009) used four relevant tests: global articulation test, articulation test, articulatory test for analytical assessment of phonological-articulatory deviations and test for speech intelligibility in study performed on 35 children diagnosed with early dysphasia, as well as a control group of 35 children with normal speech development. Children with developmental dysphasia have on average 20 accepted sounds, the most common voice location is the medial, while the most common type of voice deviation is substitution. The analytical approach in the assessing voice quality in verbal and vocabulary context proved the deviation from the physiology of pronunciation by more than one degree, which in turn occurs as a consequence of poor auditory memory, poor auditory discrimination, poor phonological awareness and inelasticity of peripheral speech organ [12].

Poposka A. and Filipova S. (2010) used two tests in their study comprising 71 subjects aged between 6 and 8 years, 35 subjects with developmental dysphasia and 36 subjects with dyslalia. The first test is a global articulatory test and it provides a good detection procedure for phonological articulatory disorders, while the second test is an analytical assessment of the articulatory and acoustic characteristics of damaged voices. They concluded that distortion-type voice impairment was more common in children with dyslalia, while substitution was more common in children with developmental dysphasia. In children with dyslalia, the voices from the fricative group are the most often damaged, while in children with developmental dysphasia, there are voice deviations in almost all voice groups. In both groups, a deviation in the articulation of the voices due to the wrong place of voice formation was confirmed [13].

McLeod S. and Harrison L. J. (2009) conducted a longitudinal study of 4,983 children (aged 4-5 years) in Australia, using interviews and parent questionnaires, teacher questionnaires, and direct assessment. Direct assessment confirmed that 13.0% of children had 1-2 SDs below the mean of the adapted Peabody Picture Vocabulary Test -III, and another 1.7% had > 2 SDs below average. The results of parents and teachers were

significantly correlated with the results obtained through direct assessment. They concluded that several indicators of speech and language disorders in various contexts have confirmed the high prevalence of this condition in early childhood and the simultaneous need for services of a speech therapist / special educator [14].

Norbury et al. (2016) find that 7.6% of children, which means two children in each class with 30 students actually start school with speech impairments, and 2.3% of the children start school with developmental disabilities in speech and another pathological condition. The overall estimate of the prevalence of the language disorder population is 9.92% (95% CI 7.38, 13.20). The prevalence of language disorder from unknown origin is 7.58% (95% CI 5.33, 10.66), while the prevalence of language impairment associated with intellectual disability and / or existing medical diagnosis is 2.34% (95% CI 1.40, 3.91). Children with language disorders show an increase in certain social, emotional and behavioral problems compared to their peers, and 88% did not make the expected academic progress [15].

Karevska A. and Trajkovski V. in their study conducted in 2005 concluded that the etiology of speech impairments is diverse and complex, speech impairments most often occur in male respondents, mental retardation is associated with speech impairments in favor of syndromic etiology, orthodontic examination showed that any anomaly has influence on speech and leads alone or in combination with other etiological factors to speech impairment, and genetic factors play an important role in the occurrence of speech impairments [16].

Angst OVM et al. (2015) in their paper on the prevalence of phonological articulatory disorders in children attending kindergarten and going to school, concluded that the most common disorder was the disorder of orofacial myology (31.30%), followed by speech disorder (21.37%), and language disorder (4.58%). The analyzed sample showed a high prevalence of speech disorders. These results indicate the importance of the role of the speech therapist in schools for the correction of pathological speech. They found that the uniformity of the sample did not cause a link between speech disorders and social factors, which indicates the need to conduct research with more diverse samples [17].

Demerdzieva and Pop-Jordanova [18] found in their study that 43.48 % of children in the third year, 35.71% of children in the fourth year and

45.45 % in the fifth year had speech disorders. In their evaluated sample, 65.81% of children didn't speak at the time during the first assessment, although in some children at the age of 3-5 years speech therapy was started. Untreated speech and language delay can persist in 40%–60% of the children and these children are at a higher risk of social, emotional, behavioral, and cognitive problems in adulthood. The most concerning fact is the increased incidence of attention and social difficulties at later age, especially in teenage children, in whom speech and language impairments persist during 5 and half years of age have [19].

CONCLUSION

The prevalence of phonological articulation disorders in children aged 4-6 years was in general 52.7%; 57% in boys and 46.9% in girls. The most common speech disorders were sigmatism, rhotacism, lambdacism. The influence and the connection of the socio-economic status of children and parents with the occurrence of phonological articulation disorders should be the subject of future research work, as well as the awareness of parents about speech disorders in their children and access to speech therapy services.

Speech disorders in preschool children are an important public health issue because these children, when they start at school, they will be a vulnerable group that requires not only speech-related intervention but also, in some cases, emotional and behavioral support. These findings indicate that the treatment of speech disorders should begin in appropriate services (speech therapy or special education and rehabilitation), because early detection and treatment of speech disorders gives the child more confidence to build the intellect. The treatment should begin while the child is in preschool, to allow the beginning of the educational process without speech and articulation disorders.

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Резиме

ПРЕВАЛЕНЦИЈА НА ФОНОЛОШКО-АРТИКУЛАТИВНИ НАРУШУВАЊА КАЈ ПРЕТШКОЛСКИ ДЕЦА ВО ГРАД СКОПЈЕ

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Вовед: Говорната комуникација е сложен процес, кој се темели на функцијата на централниот нервен систем, а исто така, и на говорните механизми условени и контролирани со аудитивна перцепција, вербално помнење, интелектуална активност и со периферниот говорен апарат.

Целта на студијата беше да се утврди преваленцијата на најчестите фонолошко-артикулативни нарушувања кај децата во предшколска возраст, од 4 до 6 години.

Материјал и методи: Студија на пресек е спроведена во текот на 2018 година на репрезентативен примерок од 550 деца на предшколска возраст, од 4 до 6 години, кои посетуваат предучилишни установи – детски градинки во градот Скопје. Во истражувањето се применети стандардизирани тестови за артикулација: Глобален артикулационен тест (ГАТ) и Тријажен тест (вокали, плозиви, африкати, фрикативи, назали и латерали), и прашалник што го пополни социјалниот работник во градинката за социоекономскиот статус на детето и за неговата здравствена состојба.

Резултати: Со примена на ГАТ утврдивме дека кај 260 (47,3 %) деца не постои нарушување на говорот, додека кај 290 (52,7 %) нарушување на говорот постои. Анализата на податоците според полот покажа повисок процент на нарушување на говорот кај машките деца 57 %, а кај женските деца тој изнесува 46,9 %. Во најголем процент застапена е говорната промена сигматизам со 24,5 % кај машкиот пол и 20,4 % кај женскиот пол, ротацизмот е застапен со 17,8 % кај машкиот пол и со 16,5 % кај женскиот пол. Ламбдацизам со 8,3 % е застапен кај машкиот и со 4,2 % кај женскиот пол. Застапена е и мешана форма (сигматизам, ротацизам и ламбдацизам) кај 2,4 % од учесниците во студијата од машки пол и кај 3,5 % кај женскиот пол.

Заклучоци: Преваленцијата на говорно-артикулативните нарушувања кај децата од 4 до 6 години изнесува 52,7 %, и тоа кај машките деца 57%, а кај женските деца – 46,9 % или секое второ дете во градинка има говорно нарушување. Овие наоди индицираат дека треба да се започне со третман на говорните нарушувања колку што е можно порано, затоа што раната детекција и третман ќе овозможат нормален интелектуален развој кај детето. Третманот треба да започне на претшколска возраст, за детето да го започне образовниот процес без говорни нарушувања.

Клучни зборови: говорни нарушувања, претшколски деца, студија на пресек, глобален артикулационен тест, тријажен тест