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Voice disorders in children starting school education

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ABSTRACT:

Introduction: Voice disorders in children especially in the school-age period comprise a major and challenging medical, social and educational issue. There is a lack of epidemiological data regarding children's voice in Poland which limits the development of preventive and medical pediatric procedures in our country.

Objective: The aim of study was to determine the prevalence of voice disorders in children starting school education in Mazovia.

Material and method: The study was a retrospective analysis of survey data from parents of children attending the first grade of primary school. The survey consists of five questions describing the voice. A statistical analysis of 7891 questionnaires was carried out.

Results: Analysis of the survey showed a prevalence of dysphonia in 12.8% children aged 7 starting primary school. In this study, voice disorders were observed more often in boys (14.6%) than girls (10.8%). The authors presented the correlation between voice disorders and the expression of emotions.

Conclusions: Studies have shown that the percentage of children with voice disorders is significant in our country. The survey regarding voice in school children in Mazovia shows preliminary results of voice disorders in the pediatric population in Poland.

KEYWORDS: childhood dysphonia, survey, voice disorders

INTRODUCTION

In view of the growth of civilization and the impending stress of everyday life, the number of functional voice disorders is increasing each year. Changes in the voice can often serve as an indicator and a manifestation of deep emotional conflict both in adults and children. Voice disorders in the population of preschool and school-age children are a particularly complex medical problem as they generate a number of social, psychological and educational difficulties [1–4]. We do not know the number of people with voice disorders in Poland such studies have not been conducted in our country to date. Experience from literature data indicates that this disease occurs in 6–23% of school-aged children [5–8]. The unspecified epidemiological situation in the field of voice disorders in our country acts as a brake to the development of preventive actions and effective therapy, and thus generates undue costs associated with rehabilitation and therapeutic procedures and various types of health services.

PURPOSE

The aim of this study was evaluation of the frequency of voice disorders in children commencing their education in the Masovian Voivodeship.

MATERIAL AND METHOD

The research was part of a hearing screening project carried out by the Institute of Physiology and Pathology of Hearing in the school year 2017/2018 which included first grade students of primary schools from 4 cities with poviat rights (Ostrołęka, Płock, Radom, Siedlce) and 37 poviats. Upon approval to participate in the study, the parent/guardian received a short survey to fill in regarding voice and speech disorders among children entering school. In this article are presented exclusively data regarding voice disorders. The questions regarding voice disorders were:

1. Do you think your child has voice problems?
2. Is the child's voice often hoarse?
3. Does hoarseness appear even when the child has no infection and is healthy?
4. Does the child speak with effort?
5. Does the child speak loudly and is the child loud?

The possible answers were *yes* and *no*.

The questions used in the study were part of the interview included in the standard clinical procedure for patients with voice disorders developed for work in the clinical setting. The first three were designed so that the parent could adequately assess any possible voice

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Tab. I. Distribution of answers about voice disorders.

	YES		NO	
Question	n	%	n	%
1. Do you think your child has voice problems?	493	6.5	7124	93.5
2. Is the child's voice often hoarse?	631	8.3	6996	91.7
3. Does hoarseness appear even when the child has no infection and is healthy?	572	7.5	7039	92.5
4. Does your child speak with effort?	319	4.2	7289	95.8
5. Does the child speak loudly and is the child noisy?	2704	35.6	4900	64.4

n – *number of people*

disorders in their child. In turn, the fourth and fifth questions were ancillary in determining the relationship between occurring voice disability and emotions or hearing function in children.

A total of 7,891 surveys were obtained, but not all were complete, whereby 7,631 surveys regarding seven-year-old children commencing education were qualified for further analysis.

Statistical analysis consisted in determining the incidence of voice disorders in children in pursuit for a relationship between voice disorders and factors such as child gender, effortless voice formation, and excessively loud speaking. The $\chi 2$ Test for Independence was used to verify the hypothesis regarding the existence of a relationship between variables and the contingency factor ϕ to estimate the strength of the relationship. A standard level of significance of 0.05 was adopted. Statistical analysis was performed using IBM SPSS Statistics (version 24).

RESULTS

The study group included 3,658 girls (47.9%) and 3,973 boys (52.1%). Preliminary analysis has already shown that unfortunately parents did not always answer all the questions in the survey. Question 1 was answered by 7,617 respondents, question 2 by 7,627, question 3 by 7,611, question 4 by 7,608, and question 5 by7604 respondents. A percentage distribution of answers to individual questions was prepared, which is shown in the table below (Tab. I.).

The percentage of affirmative answers in the first three questions was similar, and ranged from 6.5% to 8.3%. Among these three questions, the highest percentage of answers yes appeared in question 2, which may indicate that parents most often associate voice disorders in children with hoarseness, and the formula of the question is understandable and correctly defines the undertaken problem. Question 2 extended the scope of Question 1, and additional information about possible voice problems other than hoarseness resulted from Question 3.

Furthermore, the analysis indicates that a relatively small percentage of children (4.2%) had difficulty speaking in an exertional manner. On the other hand, much more children 35.6% talked excessively loudly and could be described as noisy.

Tab. II. The incidence of voice disorders in girls and boys.

	HAS VOICE DISORDERS	DOES NOT HAVE VOICE DISORDERS
Girls	394 (10.8%)	3264 (89.2%)
Boys	579 (14.6%)	3394 (85.4%)

Further analysis adopted the approach that the indicator of voice disorders in children would be at least one positive answer of the parent to the first three questions.

It was found that 973 parents (12.8%) gave at least one affirmative answer to the first three questions of the survey. Guided by the adopted criterion, it was determined that the voice disorders index in the studied group of children was 12.8%. The differentiation in the frequency of voice disorders based on the child's gender was subsequently analyzed (Tab. II.).

From the data presented in Tab. II. it follows that the parents of boys more often than those of girls observed voice disorders in their children.

Caregivers gave an affirmative answer regarding the occurrence of voice disorders in 14.6% of boys, while in girls the rate was 10.8%. The relationship between the gender of children and the occurrence of voice disorders turned out to be statistically significant: $\chi 2 = 24.75$; $p < 0.001$, although the strength of this relationship was not great, as evidenced by the contingency factor $\phi = 0.057$.

The next stage was prepared at a distribution of voice disorders in children who according to parents spoke with difficulty, and children who spoke loudly and were noisy (Tab. III.).

From the data presented in Tab. III. it follows that more than half of the children (57.1%) speaking with difficulty had voice disorders. In turn, in the group of children who produced effortless voice, the percentage of voice disorders was much lower 10.8%. The relationship between speaking with effort and occurrence of voice disorders was statistically significant: $\chi 2 = 588.36$; $p < 0.001$; $\phi = 0.278$. The analysis also indicates that 22.7% of children who speak loudly and are noisy had a voice disorder, while the group of children who talked with natural loudness had a lower percentage of voice disorders 7.3%. The relationship between speaking volume and the occurrence of voice disorders was statistically significant: $\chi 2 = 374{,}79$; $p < 0{,}001$; $\phi = 0.222$.

In summary, the analysis shows that 12.8% of children commencing education display voice disorders that should be regarded as a significant health, educational and social problem. It was found that dysphonia is more common in boys than girls, and a strong expression of emotions reflected in the voice (effortless voice formation, loud speaking) predisposes to the occurrence of voice disorders.

Tab. III. Voice disorders in children speaking with effort and too loudly.

	HAS VOICE DISORDERS	DOES NOT HAVE VOICE DISORDERS
Speaks with effort	182 (57.1%)	137 (42.9%)
Does not speak with effort	787 (10.8%)	6502 (89.2%)
Speaks loudly, is noisy	615 (22.7%)	2089 (77.3%)
Does not speak loudly, is not noisy	356 (7.3%)	4544 (92.7%)

DISCUSSION

In each period of human life, the voice is the basis of interpersonal communication and impacts various areas of everyday life. In schoolchildren, communication disorders are a challenging and significant interdisciplinary issue that affects the broadly understood process of communication of children in a school environment, the child's academic performance, social maturity as well as adaptation factors and child's behavior [8–10]. Voice disorders in the population of school children are usually associated with overuse of the voice, i.e. speaking too loudly, singing or shouting, and incorrect production of voice, and/or are psychogenic [9–11]. The etiology of these disorders is not homogeneous. An important element is overuse of the voice, which occurs in 45% of children [11]. The results of our research showed that 35% of the surveyed children were noisy and spoke too loudly, and the dominant group – as emphasized by numerous authors – were boys [6]. In children's dysphonia, how the voice is emitted and the quality of the produced voice change [12–14]. The most common type among children is hyperfunctional dysphonia [13, 14]. In this type of dysphonia, the voice is altered, often hoarse, dull, rough, produced with effort and excessive tension of the muscles of the neck, including the external muscles of the larynx and submental muscles. Children are very noisy, they speak loudly, speak a lot and at a fast pace, with inaccurate and careless articulation [9, 10, 15, 16]. A high percentage of answers to question 5 may indicate that emotions are a very important and inseparable element involved in the creation of verbal messages in children. The voice plays a pivotal role in the process of expressing emotional states in a child. On the one hand, it is a reflection of internal emotional states, on the other hand, it is emotions that influence how it is produced and its quality. It is from them that muscle tone within the vocal folds and the entire vocal tract, the position of the larynx and its readiness to produce sounds depend. The voice defines various emotional states of the child differently. Emotional immaturity and the influence of numerous external stimuli may be associated with excessive muscular tension, covering all structures involved in voice formation and consolidation of an incorrect form of transmission of information, which often constitutes a background for functional voice disorders in children [2, 3, 13, 17].

The prevalence of voice disorders in children is difficult to be established, and various authors estimate it most often in the range of 6% to 23% [5, 8, 10]. However, there are other reports of a surprisingly low or high percentage of children with voice disorders. From a study by McKinnon et al. conducted in Australia in a group of over 10,000 schoolchildren, it appears that only 0.12% of children with voice disorders and 1.06% of children with speech disorders were identified in the study population [18]. In turn, based on a study conducted in Iran among 504 children aged 10 to 12 years, Mohammadzadeh et al. found that 53.2% of children display voice disorders [16]. This broad range of percentages of voice disorders in children is mainly associated with methodological differences in studies, different age groups of children, and studies of different cultural areas. The outturns of surveys obtained in this study show that voice disorders in children are a substantial problem, taking into account the consequences that may be entailed by them not only in the medical aspect, but also social and educational [19, 20]. Most of the surveys available in the literature evaluated hoarseness in children. The analysis carried out in this study confirmed that parents, when asked to describe the problem in their children, most often selected question 2 regarding hoarse voice (99.9%). According to Carding, who conducted an analysis on a very large group of children (n = 7389), the rate of voice disorders in the group of 8-year-old children based on survey data obtained from parents was 11% [21]. The result obtained in this study on a large homogeneous group (n = 7631) determined the frequency of voice disorders in children aged 7 at a comparable level of 12.8%. The majority of authors believe that schoolchildren (7–12 years old) with voice disorders constitute a group in which secondary changes usually occur in the form of vocal nodules causing chronic hoarseness [19–22]. Literature data show that vocal nodules often occur in up to 59.3% of children [16]. Voice changes are more common in boys than girls [20, 22, 23]. Research by Kallvik has demonstrated that among 217 children aged 6–10 a changed hoarse voice occurs in 12%, including 15.8% of boys and 7.8% of girls [20]. Analysis of the obtained results also confirmed the more frequent occurrence of dysphonia in boys (14.6%) than in girls (10.8%) commencing education.

Several authors raise the problem of voice disorders as an important cause of various types of school failure, including contact with peers [8, 21–24]. For that reason, the relationship between voice disorders and the sphere of emotional expression in a child is very significant. Therefore, in this paper an analysis of the relationship between the voice disorder index (questions: 1, 2, 3) and features such as noisiness, loud speaking or excessive tension during voice formation (questions: 4, 5) was made. The results showed a relationship between the analyzed characteristics. The development of a child's emotional profile is associated with the impact of various spheres of influence: innate, hereditary, biological, personal and the wide-reaching external environment. Emotional immaturity resulting from possible negative experiences in the first years of life, becomes more evident in late childhood, when a child enters school age and has to complete many tasks associated with commencing education to meet the expectations of school and parents. This requires adequate maturity of the central nervous system structures, which will ensure: age-appropriate emotional-social and intellectual development as well as sufficient motor coordination, an increase in free attention and an ability to focus on the subject of interest [15, 23]. The role of emotions in shaping the child's mental health silhouette, the development of cognitive

functions and social attitudes is enormous and indisputable. Thus, discussing the problem of voice disorders as a major element of the communication process with the outside world, one cannot omit the emotions that are an important factor in the development and functioning of the child, but also a substantial element in the development of voice disorders in children with hyperfunctional dysphonia. More and more researchers are observing the coexistence of childhood dysphonia and difficulties in auditory processing [24, 25]. Researchers wonder whether the failure of voice rehabilitation in children may be explained by a disturbance of the auditory processing function, including: location of the sound source and lateralization, temporal processing or speech understanding in the presence of a jamming signal. Own experience and research of other authors indicate that auditory functions and emotions are crucial elements in the development of functional voice disorders in children [26, 27]. Voice screening conducted in numerous centers around the world confirms the need for preventive measures to minimize the unfavorable outcomes of voice disorders in child development and their impact on quality of life [27–29]. The epidemiological analysis carried out in Mazovia is the first such extensive study in our country and is a representative exponent of the real indicator of voice disorders in children in Poland. The initiative taken to estimate the magnitude of the problem is an opportunity to outline a further prophylactic and diagnostic strategy in the Polish pediatric population.

CONCLUSIONS

Surveys of the voice in Mazovia made in possible to obtain preliminary epidemiological data for the population of Polish children commencing education. They demonstrated that the percentage of children with voice disorders is significant and important in the medical and social aspect. Data obtained in the study demonstrate the need to expand the existing initiatives and conduct nationwide voice screening in our country.

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