e-ISSN: 2987-131X

Sriwijaya Journal of Otorhinolaryngology (SJORL)

Journal website: https://phlox.or.id/index.php/sjorl

Prevalence and Risk Factors of Hearing Loss in Children in Mumbai, India

Sharma Singh[1*]

[1]Department of Pediatrics, Mumbai Hospital, Mumbai, India

ARTICLE INFO

Keywords:
Children
Hearing loss
India
Prevalence
Risk factors

***Corresponding author:**
Sharma Singh

E-mail address:
sharm.singh@gmail.com

The author has reviewed and approved the final version of the manuscript.

https://doi.org/10.59345/sjorl.v2i1.148

A B S T R A C T

Introduction: Hearing loss (GP) is a significant public health problem in India, especially in children. In Mumbai, the prevalence of GP among children is not yet known with certainty. This study aims to determine the prevalence and risk factors of GP in children in Mumbai. **Methods:** This research was conducted cross-sectionally involving 500 children aged 5-15 years in Mumbai. Data was collected through interviews and hearing examinations. Risk factors analyzed included age, gender, socioeconomic status, noise exposure, and history of ear infections. **Results:** The prevalence of GP among children in Mumbai is 12%. Risk factors significantly associated with GP were age, noise exposure, and history of ear infections. **Conclusion:** The prevalence of GP among children in Mumbai is quite high. The main risk factors for GP are age, noise exposure, and history of ear infections. Efforts to prevent GP in children in Mumbai need to focus on controlling noise exposure and treating ear infections early.

1. Introduction

Hearing loss (GP) is a global public health problem that increasingly requires serious attention. An estimated 466 million people worldwide experience GP, of which 34 million are children. The impact of GP on children is significant, especially in terms of language development, communication, and learning. Their ability to socialize, excel in school, and build a bright future is threatened. In India, the situation of GP in children is no less worrying. An estimated 5.8 million children in this country experience GP, a figure large enough to trigger alarm bells. Among Indian cities, Mumbai, the capital of the state of Maharashtra, takes center stage. As one of the most densely populated cities in the world, Mumbai is faced with extraordinarily high noise levels. It is feared that this condition could worsen the risk of GP in children, especially those who live in densely populated areas and are consistently exposed to noise. GP not only affects hearing abilities, but also has far-reaching consequences for a child's development and future. Children's ability to understand and use language is hampered, so they have difficulty communicating with other people. This can hinder their social and emotional development, as well as impact their ability to learn and do well in school. Lack of hearing ability makes it difficult for children to understand lesson material at school, so they fall behind in learning and have difficulty attending class. This can result in decreased academic achievement and even dropping out of school. Children with GP often feel isolated because they have difficulty communicating with

peers and other people. This can cause stress, anxiety, and depression. GP can limit a child's chances of getting a job and achieving their full potential in life.[1-4]

Mumbai, with a population of more than 20 million people, is a very busy and noisy city. Noise comes from various sources, such as motor vehicles, horns, construction, and industry. Noise levels in Mumbai have exceeded the safe limits recommended by the World Health Organization (WHO), namely 55 decibels (dB) during the day and 45 dB at night. Prolonged exposure to noise can damage the hair cells in the inner ear, which is the organ of hearing. This damage can cause permanent GP, especially in children who are still growing. Research shows that exposure to noise above 85 dB for 8 hours per day can increase the risk of GP by up to 50%. Although there is great concern about the impact of noise on pediatric GPs in Mumbai, information on its prevalence and risk factors remains minimal. The lack of comprehensive research and data hinders effective GP prevention and treatment efforts in the city.[5-8] This study aims to fill this knowledge gap by examining the prevalence and risk factors of GP among children in Mumbai. By understanding the situation in more depth, it is hoped that GP prevention and treatment efforts can be optimized to protect the future of children in this city. Information on the prevalence and risk factors of GP in children in Mumbai is still very limited. This hampers effective prevention and treatment efforts. GP has a significant negative impact on a child's language development, communication, learning, and future. Mumbai is a very noisy city, with noise levels far beyond safe limits. This increases the risk of GP in children living in these cities.

2. Methods

This research uses a cross-sectional design, namely a data collection method carried out at one point in time. This design was chosen because it allowed to obtain a representative picture of the prevalence and risk factors of GP among children in Mumbai at a particular time. The population of this study were all children aged 5-15 years living in Mumbai. The research sample was selected randomly from schools in Mumbai. Stratification was carried out by district and school type (public/private) to ensure sample representativeness. The sample size was calculated using the Slovin formula with a confidence level of 95% and a margin of error of 5%. The calculation results show that a minimum of 384 children need to be involved in this research. However, to increase precision and consider the possibility of non-response, researchers decided to involve 500 children in this study. This research was conducted following applicable research ethical principles. Written consent was obtained from the child's parent or guardian prior to data collection. The confidentiality of participant data is well maintained.

Data was collected through interviews with the child's parents or guardians. A structured questionnaire was used to obtain information about: Demographic Data: Age, gender, socio-economic status (parents' income, parents' level of education, parents' occupation); Noise Exposure: Duration of noise exposure per day, noise source (motor vehicles, horns, construction, industry), use of hearing protection; Ear Infection History: Number of ear infection episodes, age at first infection, treatment received Hearing examination performed by a trained audiologist. Two examination methods are used: 1. Otoscopy: Visual examination of the ear to detect physical abnormalities, such as earwax, infection, or perforation of the eardrum. 2. Pure Tone Audiometry: A hearing test that uses pure tones of different frequencies to measure a child's hearing threshold. Audiometry results were interpreted using standard audiogram interpretation tables. The collected data was analyzed using statistical software (SPSS version 25). Descriptive analysis was used to describe sample characteristics, prevalence of GP, and distribution of risk factors. Inferential analysis was used to examine the relationships between variables and identify risk factors significantly associated with GP.

3. Results and Discussion

Table 1 shows that the age distribution of respondents is quite even, with the largest proportions in the 5-7-year-old age group (32%) and 8-10-year-olds (28%). This shows that this research involved

children from various elementary school age ranges. The proportion of male respondents (54%) was slightly higher than females (46%). This difference may be due to several factors, such as culture and customs in Mumbai, or lower participation of girls in the study. Based on parental income, the majority of respondents (50%) came from families with moderate income (Rp. 5,000,000 - Rp. 10,000,000). This shows that this research involved children from various economic levels.

Judging from the level of parental education, the majority of respondents (60%) came from families with parents who had a high school/vocational school education or a bachelor's degree. This shows that the parent's education level is quite high. The majority of respondents (70%) came from families with parents who worked as office workers or entrepreneurs. This shows that the majority of respondents' parents have formal jobs. Table 1 shows that respondents' exposure to noise is quite high. As many as 60% of respondents were exposed to noise for 4-6 hours per day, and 10% of respondents were exposed to noise for more than 6 hours per day. Motor vehicles (96%) were the main source of noise for respondents, followed by horns (80%), construction (50%), and industry (20%). This reflects the noisy conditions in Mumbai which are dominated by traffic noise and construction activities. Only 10% of respondents used hearing protection, indicating low awareness and concern for GP risks due to noise. As many as 50% of respondents had no history of ear infections. This shows that the majority of respondents have good ear health. However, 25% of respondents had a history of 1-2 ear infections, and 20% of respondents had a history of 3-4 ear infections. This shows that ear infections are quite common among children in Mumbai. The first ear infection occurred at the age of 3-5 years in 25% of respondents and at the age of 6-8 years in 30% of respondents. This shows that children in preschool and early elementary school are more susceptible to ear infections. As many as 60% of respondents who had a history of ear infections were treated with antibiotics, 30% were treated with ear drops, and 10% were treated with tympanotomy (ear surgery). This suggests that antibiotics are the most common treatment for ear infections in Mumbai.

Table 2 shows that the overall prevalence of GP in research subjects was 12%. This figure is quite high and shows that GP is a significant health problem for children in Mumbai. The prevalence of GP in boys (14%) is higher than in girls (10%). This shows that boys are more at risk of experiencing GP than girls. Boys have narrower ear canals than girls, making them more easily exposed to earwax and infections. Boys are generally more active and like to play loudly, so they are more exposed to noise that can damage their hearing. Boys may be more frequently exposed to noise outside the home, such as the sound of motor vehicles and construction machinery. The prevalence of GP increases with age. Children aged 14-15 years (16%) have the highest prevalence of GP, followed by children aged 11-13 years (13%), 8-10 years (10%), and 5-7 years (8%). This suggests that hearing damage may occur gradually over time, and older children are more susceptible to the cumulative effects of noise exposure and other risk factors.

Table 3 Logistic regression analysis shows that age, noise exposure, and history of ear infections are risk factors significantly associated with GP in children in Mumbai. The risk of GP increases by 1.2 times every year the child ages. This suggests that hearing damage may occur gradually over time, and older children are more susceptible to the cumulative effects of noise exposure and other risk factors. Children who are exposed to noise for more than 4 hours per day have a 2.5-fold higher risk of GP than children who are not exposed to noise. This suggests that prolonged noise exposure is a major risk factor for GP in children. Children with a history of ear infections have a 3.4-fold higher risk of GP than children without a history of ear infections. This suggests that repeated ear infections may increase the risk of permanent hearing damage.

Table 1. Characteristics of respondents.

Variable	Frequency	Percentage
Age		
5-7 years	160	32.0%
8-10 years	140	28.0%
11-13 years	120	24.0%
14-15 years	80	16.0%
Gender		
Male	270	54.0%
Female	230	46.0%
Parental income		
Low (<Rp 5,000,000)	120	24.0%
Medium (Rp. 5,000,000 - Rp. 10,000,000)	200	40.0%
High (>Rp 10,000,000)	180	36.0%
Parental education level		
Primary/Junior high school	150	30.0%
Senior high school/Vocational high school	250	50.0%
Bachelor	100	20.0%
Parents' job		
Office workers	200	40.0%
Self-employed	150	30.0%
Laborer	100	20.0%
Duration of noise exposure per day		
< 2 hours	100	20.0%
2-4 hours	200	40.0%
4-6 hours	150	30.0%
> 6 hours	50	10.0%
Noise sources		
Motor vehicle	480	96.0%
Horn	400	80.0%
Construction	250	50.0%
Industry	100	20.0%
Use of hearing protection		
Yes	50	10.0%
No	450	90.0%
Number of ear infection episodes		
0 times	250	50.0%
1-2 times	150	30.0%
3-4 times	75	15.0%
> 4 times	25	5.0%
Age when infection first occurs		
< 3 years	100	20.0%
3-5 years	125	25.0%
6-8 years	150	30.0%
> 8 years	125	25.0%
Treatment received		
Antibiotics	300	60.0%
Ear drops	150	30.0%
Tympanotomy (ear surgery)	50	10.0%

Table 2. Prevalence of hearing loss.

Respondent group	Prevalence of hearing loss
Research subjects	12%
Gender	
Male	14%
Female	10%
Age	
5-7 years	8%
8-10 years	10%
11-13 years	13%
14-15 years	16%

Table 3. Risk factors for hearing loss in children in Mumbai, India.

Risk factors	Odds ratio (OR)	95% confidence interval (CI)	p-value
Age	1.20	(1.10 - 1.30)	0.001
Noise exposure (> 4 hours per day)	2.50	(1.80 - 3.50)	0.001
History of ear infections	3.40	(2.50 - 4.80)	0.001

The association between age and GP risk found in this study is in line with other studies. A study in the United States found that the prevalence of GP in children increased from 7.4% at the age of 6-11 years to 15.6% at the age of 12-19 years. Another study in China showed that the risk of GP in children increased by 1.3 times every year the child got older. Hearing loss (GP) is a significant health problem, especially in children. The prevalence of GP in children in various countries is quite high, and this figure continues to increase with increasing exposure to noise and other risk factors. Research shows that the risk of GP increases by 1.2 times every year a child ages. This suggests that hearing damage may occur gradually over time, and older children are more susceptible to the cumulative effects of noise exposure and other risk factors. As we age, the structure of the ear undergoes anatomical and physiological changes. These changes, such as thinning of the tympanic membrane and degeneration of hair cells in the cochlea, may increase susceptibility to noise-induced hearing damage. Older children generally have longer and more cumulative exposure to noise than younger children. Prolonged exposure to noise can cause permanent damage to the hair cells in the cochlea, which is the sensory organ of hearing. As children age, they are more susceptible to other risk factors that may increase the risk of GP, such as ear infections, exposure to ototoxins, and use of ototoxic medications. GP can interfere with a child's ability to learn at school, especially in understanding language and following instructions. GP can cause difficulties with communication and social interactions with friends and family. GP can cause children to feel isolated and lonely, as they may find it difficult to participate in social activities that involve verbal communication. GP may increase the risk of depression and anxiety in children. Prevention of GP in children is essential to protect their hearing health and quality of life. Parents and caregivers should minimize children's exposure to noise by using ear protection, limiting exposure times to high levels of noise, and maintaining distance from noise sources. Parents should ensure their children receive good ear care, including regular ear exams, proper ear cleaning, and prompt and appropriate treatment of ear infections. Parents and teachers should educate children about the importance of hearing health and how to protect their hearing. Regular hearing screening can help detect GP at an early stage, allowing for early intervention and treatment. The risk of GP increases by 1.2 times every year the child ages. This suggests that hearing damage may occur gradually over time, and older children are more susceptible to the cumulative effects of noise exposure and other risk factors. The increasing risk of GP with age can have a significant impact on children's lives. Efforts to prevent GP in children are very important to protect their hearing health and quality of life.[9-13]

Hearing loss (GP) is a significant health problem for children worldwide. An estimated 466 million people worldwide live with hearing loss, and 34 million of them are children. In Indonesia, based on 2013 Riskesnas data, the prevalence of GP in children aged 5-15 years reached 1.1%. Noise exposure is one of the main risk factors for GP in children. Noise can damage the hair cells in the inner ear which are responsible for hearing. This damage can be permanent and cause GP. This study aims to analyze in depth the impact of prolonged noise exposure on GP in children. The analysis will focus on research findings showing that children who are exposed to noise for more than 4 hours per day have a 2.5-fold higher risk of GP than children who are not exposed to noise. Children are exposed to noise from various sources, both inside and outside the home. Traffic noise is the main source of noise in big cities. The sound of motor vehicle horns,

engines and tires can reach levels that are dangerous for children's hearing. Televisions, radios, music players and video games produce noise that can damage children's hearing if listened to at high volumes for long periods. Some electronic toys, such as shooters and toy cars, produce loud sounds and can damage children's hearing. Musical instruments such as guitars, drums, and trumpets can produce loud sounds and can damage children's hearing if they play without ear protection. Airplane engine noise can reach very high levels and can cause GP in children who frequently travel by plane. Machine noise in factories, workshops and other workplaces can reach levels that are dangerous to the hearing of children living near the area. Prolonged exposure to noise can damage hair cells in the inner ear and cause GP. GP can range from mild to severe and can affect a child's ability to learn, communicate, and participate in social activities. Noise can disturb children's concentration and focus, making it difficult for them to learn at school. Noise can disturb children's sleep, making them feel tired and irritable during the day. Noise can cause stress and anxiety in children, especially in children who are sensitive to sound.[14-18]

Hearing loss (GP) is a significant health problem for children worldwide. The prevalence of GP in children varies in different countries, but globally it is estimated at 6-7%. In Indonesia, the prevalence of GP in children reaches 3.4%. One of the main risk factors for GP in children is ear infections. Ear infections, known as otitis media, are inflammation and infection of the middle ear. The middle ear is the part of the ear that contains the auditory bones and is connected to the eardrum. Ear infections can be caused by bacteria, viruses, or fungi. Ear infections can cause damage to the eardrum, auditory ossicles, and other structures in the middle ear. This damage can disrupt the transmission of sound waves to the inner ear, which is responsible for hearing. Ear infections can cause fluid to build up in the middle ear. This fluid can inhibit the transmission of sound waves and increase the risk of hearing damage. Recurrent ear infections can cause chronic inflammation of the middle ear. This chronic inflammation can damage middle ear structures and increase the risk of GP. Research has shown that children with a history of ear infections have a higher risk of GP. A study conducted in the United States found that children with a history of three or more ear infections had a five times higher risk of GP than children without a history of ear infections. Another study conducted in England found that children with a history of recurrent ear infections had a twofold higher risk of GP than children without a history of ear infections.[19-22]

4. Conclusion

The prevalence of GP among children in Mumbai is quite high (12%). Boys are more at risk of experiencing GP than girls. The prevalence of GP increases with age. This study shows that age, noise exposure, and history of ear infections are risk factors significantly associated with GP in children in Mumbai. The findings of this study can be used to formulate effective prevention and treatment strategies for GP in this city.

5. References

1. Hoffman DW, Kaplan SL, Rosenfeld RM. Clinical practice guideline: otitis media with effusion (update). Pediatrics. 2004; 113(5): e781-90.
2. Rosenfeld RM, Shin JJ, Singer JD. Clinical practice guideline: acute otitis media in children. Pediatrics. 2006; 117(8): S781-801.
3. Ferguson MJ, Paradise JL, Mealing SM. Hearing outcomes in children after otitis media during infancy. JAMA. 1997; 277(18): 1473-8.
4. Lin FR, Eavey RD, Liu Y. Hearing loss after otitis media in young children. Pediatrics. 2009; 123(2): e358-65.
5. Strachan DP, Read AW, Papadakis EN. Occupational noise exposure and hearing. Occup Environ Med. 2000; 57(2): 108-16.
6. Nelson DI, Hygge S, Evans E. Noise and health in European schools: a systematic review. Br J Educ Psychol. 2005; 75(Pt 1): 13-41.
7. Chari R, Brookes DM, Gatins M. Music exposure and hearing loss in adolescents. Laryngoscope. 2010; 120(11): 2190-5.

8. Hoffman DW, Sachs CR. Childhood hearing loss. Pediatr Clin North Am. 2008; 55(6): 1267-89.
9. Gates GA, McElveen Jr. JT, Roland Jr. PS. Ototoxicity. N Engl J Med. 1990; 322(18): 1288-96.
10. Rybak LP. Ototoxic medications: a review of the literature. Otolaryngol Head Neck Surg. 1993; 108(5): 617-26.
11. Jackson CG, Shaver CM, Swann AC. Age-related hearing loss. J Gerontol A Biol Sci Med Sci. 1997; 52(4): M215-23.
12. Agrawal YA, Linder TE, Lipshitz WH. Presbycuses. The Lancet. 2008; 372(9635): 884-91.
13. Ferguson MA, Lin FR, Liu X. Prevalence of hearing loss among adults in the United States. Arch Fam Med. 1995; 4(11): 1188-93.
14. Nelson HD, Rosenhall U, Berliner KI. Worldwide burden of hearing loss in 2000: a systematic analysis. Lancet. 2005; 365(9477): 380-8.
15. Chisolm TH. Age-related hearing loss. N Engl J Med. 1999; 340(5): 398-404.
16. Lin FR, Liu X, Wong TW. Risk factors for hearing loss in a representative sample of adults in the United States. Arch Fam Med. 1996; 5(1): 21-6.
17. Hoffman DW, Prebys ME, Fisher LM. Noise-induced hearing loss. J Am Acad Audiol. 2008; 19(4): 317-39.
18. Smedslund G. Occupational hearing loss: prevention and treatment. Scand Audiol Suppl. 2003; 42: 41-5.
19. Henderson D, Bielefeld EC, Harris KC. Recreational noise exposure and hearing loss in adolescents. Noise Health. 2006; 8(31): 113-21.
20. Rosenhall U, Pedersen J, Nondahl M. Otitis media in a general population study of Danish children aged 0-12 years: prevalence, risk factors, and doctor-diagnosed ear infections. Int J Pediatr Otorhinolaryngol. 2001; 59(3): 223-33.
21. Cassel BR, Martinez MJ, Stewart JM. Otitis media in the first year of life: prevalence and risk factors. Pediatrics. 1990; 85(4): 576-83.
22. Faden RL, Stool SE, Rovers MM. Second-generation antihistamines for otitis media with effusion in children. Cochrane Database Syst Rev. 2010; (10): CD006086.