DIFFERENCES IN THE PREVALENCE OF MOLAR-INCISOR HYPOMINERALIZATION BETWEEN URBAN AND RURAL AREAS

(PERBEDAAN PREVALENSI HIPOMINERALISASI MOLAR-INSISIVUS PADA AREA PERKOTAAN DAN PEDESAAN)

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ABSTRACT

Dental enamel defects are developmental anomalies commonly found in primary and permanent teeth. One of the developmental anomalies of enamel structure is the hypomineralization of molar and incisor teeth. Molar-incisor hypomineralization (MIH) is a localized autosomal recessive disease or amelogenesis imperfecta that may be associated with enamel-forming genes such as AMBN and TUFT1. The etiology of MIH can be attributed to prenatal, perinatal, and postnatal factors, such as low birth weight, antibiotic use, toxins from breastfeeding, infections during pregnancy, premature birth, birth complications, and a family history of enamel defects. This research is an observational analytical study with a cross-sectional design. The sampling technique used in this study is probability sampling, specifically simple random sampling in elementary school children in the urban area of Cimahi City and the rural area of West Bandung Regency. The study's results in the urban area of Cimahi City revealed 297 respondents, aged 8-12 years old, with a prevalence of MIH in the urban area (9.8%), indicating that 29 children

experience MIH. In the rural area of West Bandung Regency, 293 respondents of elementary school children aged 8-12 years were included, showing a prevalence of MIH in the rural area (14.7%), indicating that 43 children have MIH. The research results suggest that the prevalence of MIH in rural areas is higher compared to the prevalence of MIH in urban areas, with a probability value of 0.069, which is greater than 0.05 ($P > 0.05$). Therefore, statistically, there is a non-significant difference in the prevalence of MIH between Cimahi City and West Bandung Regency.

Keywords: enamel defect; MIH; Molar-Incisor Hypomineralization, prevalence

ABSTRAK

Defek email merupakan anomali perkembangan gigi yang umumnya ditemukan pada gigi sulung dan permanen. Salah satu anomali perkembangan struktur email adalah hipomineralisasi gigi molar dan insisivus. MIH adalah penyakit resesif autosom atau amelogenesis imperfecta terlokalisasi yang mungkin terkait dengan gen pembentuk email seperti AMBN dan TUFT1. Etiologi MIH bisa disebabkan akibat dari penyakit prenatal, perinatal, dan postnatal, seperti berat lahir rendah, minum antibiotik, racun dari menyusui, seperti infeksi selama kehamilan, lahir prematur, komplikasi kelahiran, dan riwayat defek email dari keluarga. Penelitian ini merupakan penelitian analitik observasional dengan desain cross sectional. Teknik pengambilan sampel yang digunakan pada penelitian ini adalah probability sampling yaitu simple random sampling pada anak Sekolah Dasar di Area Pekotaan Kota Cimahi dan pedesaan Kabupaten Bandung Barat. Hasil penelitian di area perkotaan Kota Cimahi didapatkan 297 responden anak Sekolah Dasar usia 8-12 tahun, Prevalensi MIH pada area perkotaan (9,8%) atau 29 anak mengalami MIH. Hasil penelitian di area pedesaan di Kabupaten Bandung Barat didapatkan 293 responden anak Sekolah Dasar usia 8-12 tahun, Prevalensi MIH pada area pedesaan (14.7%) atau 43 anak mengalami MIH. Hasil penelitian menunjukkan bahwa prevalensi MIH di desa lebih tinggi dibandingkan prevalensi MIH di kota, dengan nilai probabilitas sebesar 0.069, yang lebih besar dari 0.05 ($P > 0.05$), sehingga secara statistik menunjukkan perbedaan yang tidak signifikan dalam prevalensi MIH antara Kota Cimahi dan Kabupaten Bandung Barat.

INTRODUCTION

The 2018 Basic Health Research (Riskesdas) results indicate that 57.6% of the Indonesian population has dental and oral health problems, but, regrettably, only 10.2% receive health services. The prevalence of caries in young children is very high, reaching 93%, with only 7% being caries-free. Meanwhile, the prevalence of caries in Cimahi is high at 49.41%. Based on these results, it is evident that the oral health of children in Indonesia, particularly in Cimahi, is still considered poor.[1]

Most published dental research focuses on caries and periodontal diseases. However, many types of dental disorders still need attention, and the limited available data poses a challenge to providing adequate explanations about enamel defects. Enamel defects are developmental anomalies commonly found in deciduous and permanent teeth. One such developmental anomaly is molar-incisor hypomineralization (MIH). Koch et al. called it "cheese molars" after the first epidemiological study.[2,3]

MIH is an autosomal recessive disease or localized amelogenesis imperfecta that may be related to enamel-forming genes such as AMBN and TUFT1. The etiology of MIH can be attributed to prenatal, perinatal, and postnatal factors, such as low birth weight, antibiotic consumption, toxins from breastfeeding, infections during pregnancy, premature birth, birth complications, and a family history of enamel defects. Certain medications, such as chemotherapy, antibiotics, asthma medications, and anticonvulsants, can also cause MIH.[4–9]

Risk factors for MIH include fever in the first year of birth, cyanosis, chickenpox, otitis media, digestive diseases, tonsillitis, allergies, ear infections, urinary tract infections, and asthma. Other systemic diseases associated with MIH include malnutrition, brain damage, cystic fibrosis, epilepsy, dementia, and lead poisoning.[10]

The first MIH case dates back to the late 1970s. In 2021, these lesions were given a new name (MIH), defining "systemic hypomineralization" that can affect one or more permanent first molars with or without permanent incisors. The main characteristic of MIH is porous enamel, which is easily damaged by bite force, leading to open tooth tissue that can promote the development of carious lesions. Hence, MIH is associated with tooth damage.[11]

Reported MIH prevalence varies widely, ranging from approximately 2.4% to 40.2% worldwide. The lowest MIH prevalence (2.5%) was observed in children in China, while the highest prevalence (40.2%) was reported in Brazil. In India, the first study in Gandhinagar reported a prevalence of 9.8%. In South Indian cities such as Salem, Bangalore, and Tiruchengode, prevalences of 7.2%, 0.48%, and 5.25% were reported. This wide variation is due to changes in population, genetics, environment, and socioeconomic factors within the population. According to a study by Praptiwi YH et al. in 2019, the prevalence of MIH in elementary school children in Indonesia is relatively high at 19.1%. A study in Germany compared the prevalence of MIH in rural and urban areas, with a prevalence of 9.4% in rural areas and 17.4% in the city of Frankfurt.[12,13]

There is a significant difference between rural and urban communities. Generally, education levels in rural areas are lower than in urban areas, possibly related to public dental and oral health knowledge. Economic development in rural communities is lower than in urban areas, such as per capita income in rural areas. A study in the rural regions of Ciamis Regency found that 47.5% of pregnant women had good knowledge, while in urban areas of Depok City, 81.7% of pregnant women had good knowledge.[14–16]

This research is focused on children aged 8-12 years because at least one first permanent molar has fully or partially erupted. It is better to detect this issue at an early age, as there is a risk of tooth enamel degeneration in later years and the development of caries. In this study, mandibular molars are more affected because they erupt earlier.[17] Limited information on the prevalence and etiology of developmental enamel disorders in children in Indonesia makes it difficult to prevent further damage during tooth development. The geographical differences between West Bandung Regency rural areas and Cimahi City urban areas have prompted the researchers to investigate the differences in the prevalence of molar-incisor hypomineralization in children aged 8 to 12 years.

METHOD

The method employed in this research is observational analytical research with a cross-sectional design, which involves collecting data at a single point without follow-up. This research aims to determine the difference in the prevalence of Molar-Incisor Hypomineralization (MIH) among children aged 8-12 years in the urban area of Cimahi City and the rural area of West

Bandung Regency through direct examinations.

The subjects of this study are elementary school children in Cimahi City and West Bandung Regency aged 8-12 years. The sampling technique used in this research is probability sampling, which is precisely simple random sampling. This technique involves randomly selecting sample members from a population considered homogeneous. The researcher conducted random sampling using the web tool randomized.org.

RESULT

Data analysis was conducted to understand the background and clarify the research data. The following is a description of the characteristics of respondents based on age and gender.

Table 1. Frequency distribution based on children's age

Characteristic	Frequency (N)	Percentage (%)
Age		
8 Years	118	20.0
9 Years	129	21.9
10 Years	245	41.5
11 Years	61	10.3
12 Years	37	6.3
Total	590	100.0

The analysis presented in Table 1 shows that based on the age of the children, the majority are 10 years old, with 245 individuals (41.5%), followed by 9 years old with 129 individuals (21.9%), 8 years old with 118 individuals (20.0%), 11 years old with 61 individuals (10.3%), and 12 years old with 37 individuals (6.3%).

Table 2. Frequency distribution based on area

Characteristic	Frequency (N)	Percentage (%)
Area		
Urban	297	50.3
Rural	293	49.7
Total	590	100.0

The analysis results presented in Table 2 indicate that, based on the area, most children are in the urban areas, with 297 individuals (50.3%), and those in the rural areas are 293 individuals (49.7%).

Table 3. Frequency distribution based on mih categories in the city

Characteristic	Frequency (N)	Percentage (%)
MIH Urban		
Yes	29	9.8
No	268	90.2
Total	297	100.0

The analysis results presented in Table 3 indicate that, based on the urban area MIH categories, the majority fall into the normal category or do not experience MIH, with 268 individuals (90.8%), while 29 individuals (9.8%) experience MIH.

Table 4. Frequency distribution based on mih categories in rural areas

Characteristic	Frequency (N)	Percentage (%)
MIH Rural		
Yes	43	14.7

No	250	85.3
Total	293	100.0

The analysis results presented in Table 4 indicate that, based on the MIH categories in rural areas, the majority fall into the normal category or do not experience MIH, with 250 individuals (85.3%), while 43 individuals (14.3%) experience MIH.

Table 5. Distribution of MIH category across regions based on gender

Gender	Area				Total
	Urban		Rural		
	N	%	N	%	
Male	14	48.3	21	48.8	35
Female	15	51.7	22	51.2	37
Total	29	100.0	43	100.0	72

The analysis results presented in Table 5 show that the MIH category is based on gender. Out of the 29 individuals with MIH in the city, the majority are females (51.7%), and out of the 43 individuals with MIH in rural areas, the majority are also females (51.2%).

Table 6. Distribution of MIH category across regions based on severity

Region	Severity				Total
	Mild		Severe		
	N	%	N	%	
Urban	18	62.1	11	37.9	29
Rural	32	74.4	11	25.6	43
Total	50	69.4	22	30.6	72

The analysis results in Table 6 show the MIH category based on the region: out of the 29 individuals with MIH in the urban areas, the majority have mild severity (62.1%). In contrast, the rest have severe severity (37.9%). Out of the 43 individuals with MIH in rural areas, the majority have mild severity (74.4%), while the rest have severe severity (25.6%).

Table 7. Differences in the prevalence of MIH in urban and rural areas

Region	MIH				Total	P-value
	No		Yes			
	N	%	N	%		
Urban	268	45.4	29	4.9	297	0.068
Rural	250	42.4	43	7.3	293	
Total	518	87.8	72	12.2	590	

Chi-Square Test

Using the Chi-Square test, a bivariate analysis was conducted to determine the difference in prevalence based on the rural and urban residence groups. The research results yielded a probability value of 0.068, greater than 0.05 (P>0.05). It indicates a non-significant difference in Molar-Incisor Hypomineralization (MIH) prevalence between the urban area of Cimahi City and the rural area of West Bandung Regency.

DISCUSSION

Based on the results of the research on the difference in the Prevalence of Molar-Incisor Hypomineralization in Urban and Rural Areas, it was found that the examination results of MIH were conducted on 590 respondents, with 270 male respondents and 320 female respondents.

In the urban area of Cimahi City, the research found 297 elementary school-aged respondents (8-12 years old), with a prevalence of MIH in the metropolitan area being 9.8%, or 29 children experiencing MIH. Females had a higher prevalence (51.7%) compared to males (48.3%), with mild severity being more prevalent (62.1%) than severe severity (37.9%).

In the rural area of West Bandung Regency, the research found 293 elementary school-aged respondents (8-12 years old), with a prevalence of MIH in the rural area being 14.7%, or 43 children experiencing MIH. Females had a higher prevalence (51.2%) compared to males (48.8%), with mild severity being more prevalent (74.4%) than severe severity (25.6%).

Based on the Chi-square test results, a p-value of 0.068 was obtained, which means P>0.05. Therefore, it can be concluded that statistically, there is a non-significant difference in the prevalence of MIH between the urban and rural areas. It

may be due to prenatal, perinatal, and postnatal factors, such as low birth weight, antibiotic use, toxins from breastfeeding, infections during pregnancy, premature birth, birth complications, family history of enamel defects, and certain medications such as chemotherapy, antibiotics, asthma, and anticonvulsants. Prenatal factors often investigated include the relationship with maternal smoking during pregnancy, stress, and birth weight. However, further prospective research is needed to examine these relationships. The ameloblasts' function is susceptible to changes in the surrounding environment, including changes caused by systemic diseases. The mechanism by which these factors cause specific changes in ameloblasts that result in MIH is still unclear. Therefore, it is crucial for parents, especially mothers, to pay attention to health and nutritional needs during pregnancy and postpartum.[9,18]

According to Elfrink and Weerheijm, in 2012, the prevalence of MIH was studied in various countries. Based on available data, it varies significantly between 2.8% and 40.2%. This variability can be attributed to multiple factors, including differences in respondent selection, assessment criteria, and examination conditions (clinical or radiographic, in a dentist's chair or classroom).[19] In Germany, the reported

prevalence of MIH by Petrou M-A GM, Bissae A-R, and Splieth CH in 2012 was 9.9%. The prevalence of MIH in Germany differs between different cities and birth years. While the majority of affected teeth were assessed with MIH severity level 1 (Wetzel and Reckel scale) in 2002/2003, the first permanent molars with hypomineralization were influenced by MIH severity level 2 (Wetzel and Reckel scale) in most cases in 2014/2015.[20]

Salma et al. (2020) suggest treating this condition should involve a long-term prognosis and current clinical findings. Addressing aesthetic issues should be done as conservatively as possible, considering factors such as the patient's age, aesthetic concerns, and the severity of the condition.[21]

CONCLUSION

Based on the data obtained from the research on the difference in the prevalence of MIH based on rural and urban residence groups, it can be concluded that the prevalence of MIH in the city is 40.3%, and the prevalence of MIH in the village is 59.7%. Out of 29 MIH cases in the city, the majority are females (51.3%), while out of 43 cases in the village, the majority are females (51.2%). Based on the region, most MIH cases in the city (62.1%) and in the village (74.4%) have mild severity. The

research results indicate that the prevalence of MIH in the village is higher than the prevalence of MIH in the city, with a probability value of 0.069, which is greater than 0.05 (P>0.05), statistically indicating a non-significant difference in the prevalence of MIH between Cimahi City and West Bandung Regency.

CONFLICT OF INTEREST

The authors reported no potential conflict of interest.

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