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Prevalence of molar incisor hypomineralisation among school children in a Nigerian rural community

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Abstract

Background: Molar incisor hypomineralisation is a qualitative defect of enamel. The diagnosis of molar incisor hypomineralisation is clinical and it can be challenging to manage.
Objective: To determine the prevalence of molar incisor hypomineralisation among public school children aged 12 – 15 years in a south-eastern Nigerian rural community.
Methodology: A cross sectional descriptive study of 12-15 year old school children was done in a rural public technical college and three public secondary schools selected in Nkanu–West and Udi local Government Area of Enugu State respectively. Socio-demographic data was obtained using semi--structured questionnaire. Tests of association between dependent variables and independent variables were conducted using Fisher's exact test. Inferential analysis to determine predictors of molar incisor hypomineralisation was done using logistic regression analysis (binary). Statistical analysis was done using SPSS Version 25. P values ≤ 0.05 were accepted as being statistically significant.
Results: One hundred and forty (47.3%) males and one hundred and fifty six (52.7%) females were seen and examined. The mean age of the children was 13.56 ± 1.1. The prevalence of molar incisor hypomineralisation was 2.4%. Molar incisor hypomineralisation was seen more in males than females. There was no significant association between MIH, sex (p = 0.71) and age (p = 0.59). There was significant association between MIH and socioeconomic status (p= 0.05). Socio-economic status was a predictor for molar incisor hypomineralisation (P = 0.04, OR = 0.20, 95% CI = 0.043- 0.944)
Conclusion: Molar incisor hypomineralisation can affect the quality of life of children. Visit to dental clinic is recommended.

Keywords: Adolescents, community, enamel defect, hypomineralisation, rural school

Introduction

Molar incisor hypomineralisation (MIH) is a qualitative defect of enamel involving at least one of the first permanent molars (FPMs) with or without involvement of at least one of the permanent incisors.[1-2] The diagnosis of molar incisor hypomineralisation is clinical and it can be challenging to manage.[3] The affected teeth with molar incisor hypomineralisation are susceptible or predisposed to dental caries and difficult to anaesthetise[3] with local anaesthetics like lidocaine. Environmental factors, genetic factors and some others factors[1-5] that disrupt normal amelogenesis of the affected teeth have been reported to play a role in its aetiology. The prevalence of molar incisor hypomineralisation among children had been reported from Saudi Arabia,[2] Romania,[1] Tunisia,[4] Kenya,[3] Egypt,[5] Nigeria[6-8] and other countries. The prevalence of

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molar incisor hypomineralisation was 40.5% among 8-10 years old children in Saudi Arabia,[2] 35.4% among 7–12 years old children in Tunisia[4] and 17.7% among Nigerian school children.[8] This variation in prevalence of molar incisor hypomineralisation could be as a result of the geographic location of the study, place and method of recruitment of study participants, influence of genetic, environmental and systemic factors in the formation of molar incisor hypomineralisation. Epidemiological studies on molar incisor hypomineralisation among Nigerian children in underserved or un-served rural areas will add to the existing literature. The aim of this study is to determine the prevalence of molar incisor hypomineralisation among school children attending public technical college and public secondary school in a rural community in south-east Nigeria.

Methods

A cross sectional descriptive study was done in Nkanu west and Udi local government areas in Enugu state. Enugu state is in south eastern region in Nigeria, with seventeen Local Government Areas (LGAs). School children aged 12-15 years attending rural public technical college and public secondary school in Nkanu-West local Government Area and Udi Local Government Area respectively participated in the study. Ethical clearance for this study was sought and obtained from Health Research Ethics committee, University of Nigeria Teaching Hospital (HREC, UNTH). Informed consent was obtained from the parents of the school children and assent was obtained from the school children. Two public secondary school was selected from Nkanu west local government area, while one technical college and one public secondary school was selected from Udi local government area. The school children were randomly selected in each school.

The sample size for this study was calculated using the formula for cross-sectional study:

$N = Z^2pq^9/d^2$,

where N = sample size, p = prevalence, q= 1.0-p

The sample size was calculated using the following values:

Prevalence of molar incisor hypomineralisation was 9.7 % from a previous study in Nigeria.[7]

Confidence interval 95% (z = 1.96), d= Margin of Error tolerated, 5% (0.05), p= 0.097,

q= 1.0-p = 0.903, z = 1.96, d= 0.05

N = 1.96x1.96x0.097x0.903/0.0025 = 134.6

=135 approximately, 10% of non- responders = 13

135 + 13 = 148; one hundred and forty eight children were selected per local government area

The total sample size for the two local government areas was = 148x2=296

Data collection was done in May, 2024. Socio-demographic data (age, sex, socio-economic status) was obtained using semi-structured questionnaire. Socio-economic status was determined by a criteria used in a previous study[10] and socio-economic status designation combines father's occupation with the mother's level of education.[10] Oral examination for the presence or absence of molar incisor hypomineralisation among the first permanent molars with or without permanent incisors was done by a single examiner according to a criteria[3] used among rural children in Kenya. Prior to oral examination, the examiner was trained using clinical pictures of various presentation of molar incisor hypomineralisation. The inclusion criteria was children aged 12–15 years old, attending public technical college and public secondary school in selected rural communities and whose parents had given consent to participate in the study while the exclusion criteria was children who had enamel lesions smaller than 2 mm, those with other developmental defects of enamel (e.g. dental fluorosis, chronological enamel hypoplasia and enamel hypoplasia) and those who refused to participate in the study or were absent from the school at the time of study/data collection. The students were examined while seated in their classroom chair using natural daylight while the teeth were clean and wet. A diagnosis of molar incisor hypomineralisation was only made when at least one first permanent molar was affected, with or without the involvement of the permanent incisors. The code and criteria[3] used was:

Code	Criteria
0	No demarcated opacities, no creamy-white or yellow to yellowish-brown discoloration

on first permanent molars with or without permanent incisors , no atypical restorations on first permanent molars, no history of tooth sensitivity from first permanent molars with or without permanent incisors and no evidence of post-eruptive enamel breakdown on first permanent molars with or without permanent incisors.

1 Presence of demarcated opacities, creamy-white or yellow to yellowish-brown discoloration on first permanent molars with or without permanent incisors, presence of atypical restorations on first permanent molars and history of tooth sensitivity from first permanent molars with or without permanent incisors. Presence of evidence of post-eruptive enamel breakdown on first permanent molars with or without permanent incisors suspected to be as a result of hypomineralisation.

Only teeth designated with number one (Arabic numeral) were considered to have molar incisor hypomineralisation.

Data were entered into Microsoft Excel spreadsheet and the statistical analysis was done using Statistical Package for Social Sciences (SPSS) Version 25. Descriptive analysis was conducted to determine the prevalence of molar incisor hypomineralisation among the public school children in the rural communities. Tests of association between dependent variables (presence of molar incisor hypomineralisation) and the independent variables (socio-economic status, age and sex) was conducted using Fisher's exact test. Inferential analysis to determine predictors of molar incisor hypomineralisation was done using logistic regression analysis (binary logistic regression analysis). The independent variables of the regression model were sex and socio-economic status. P values ≤ 0.05 were accepted as being statistically significant.

Results

One hundred and forty (47.3%) males, 156 (52.7%) females were seen and examined. The age range of the children was 12 to 15 years with mean age of 13.56 ± 1.1. The prevalence of molar incisor hypomineralisation was 2.4%. Molar incisor hypomineralisation was seen more in males than females, more in teeth of both quadrants of the dental arch, and more in teeth of both the maxillary and mandibular dental arch. There was no significant association between MIH, sex (p = 0.71) and age (p = 0.59). There was significant association between MIH and socioeconomic status (p= 0.05). Socio-economic status was a predictor for molar incisor hypomineralisation (P = 0.04, OR = 0.20, 95% CI = 0.043-0.944)

Table 1: Profile of the study participants

Variables	MIH present n = 7	MIH absent n = 289	Total N = 296	p value
Age				
12	**3**	**65**	**68**	**P= 0.59**
13	**1**	**72**	**73**	
14	**2**	**74**	**76**	
15	**1**	**78**	**79**	
Sex				
Male	**4**	**136**	**140**	**P=0.71**
Female	**3**	**153**	**156**	
Socio-economic status				
Low	**4**	**251**	**255**	**P=0.05**
Middle	**3**	**38**	**41**	

Discussion

Molar incisor hypomineralisation (MIH) is a qualitative defect of enamel and factors like dioxins in breast milk,[11] chronic (early) childhood illness, calcium and phosphate metabolic disorders, high fevers during early childhood,[3] genetic factors,[1] environmental and socio-cultural factors[1-5] have been reported to play a role in its aetiology. Some genes reported[12-14] to be linked with molar incisor hypomineralisation are Enamelin (ENAM), Ameloblastin (AMBN), Bone morphogenetic protein 4 (BMP4), matrix metalloproteinase 20 (MMP20) (previously known as enamelysin), tuftelin (TUFT1), Amelogenin (AMELX), tubulin tyrosine ligase like 12 (TTLL12) gene DLX3 (distal-less), FGFR1 (fibroblast growth factor receptor), tuftelin-interacting protein 11 (TFIP11), Bone morphogenetic protein 2 (BMP2) and some other genes.[13,14] Previous study[13] that assessed genome and single-nucleotide polymorphisms (SNPs) in patients and their families reported a link between the rs5979395 SNP of the AMELX gene (Xq22) and molar incisor hypomineralisation.[1,13] A link between FAM83H gene (rs7821494), AMBN gene (rs34367704), BMP2 gene (rs3789334), BMP7 gene (rs6099486), BMP4 gene (rs762642), ENAM gene (rs7664896), MMP20 gene

(rs1711399, rs1711423), DLX3 gene (rs2278163), FGFR1 gene (rs6996321), and AMELX gene (rs5979395) with susceptibility to the development of molar incisor hypomineralisation was also reported.[13]

The prevalence (2.4%) of molar incisor hypomineralisation in this study was close to previous reports of 2.9% among 6-16 years old Nigeria children[6] and 2.3% among 8 to 12 years old Egyptian children[5] seen in a hospital based study. The findings of this study was less than previous reports of 9.7%[7] among 8 to 10 years old Nigerian children seen during a household survey, 13.7% among 6-8 years old Kenyan school children in rural areas,[3] 14.3% among 8-10 years old Romanian children,[1] 35.4% among 7-12 years old Tunisian[4] children and 40.5% among 8-10 years old children in Saudi Arabia[2]. The variations of the prevalence of molar incisor hypomineralisation, from the studies reported with this study, could be as a result of multiple factors[1-5,11-14,16] implicated in the aetiology of molar incisor hypomineralisation, geographic location of the study population, level of awareness on the need for early management of (early) childhood illness, level of vaccination for (early) childhood illness/vaccine preventable diseases[15] among young children and socio-cultural practices.

Molar incisor hypomineralisation was seen more in males than females, this finding was different from previous study in Nigeria,[7] study from rural areas[3] in Kenya and a hospital based study in Egypt.[5] It was similar to previous study from Tunisia[4] and Romania.[1] This variations in sex predilection could be as a result of multiple factors implicated in the mechanism of formation of molar incisor hypomineralisation during the transitional and maturational[5] stages of amelogenesis. In this study, molar incisor hypomineralisation were seen more in teeth of both quadrants of the dental arch and teeth of both the maxillary and mandibular arch. There was no history of tooth sensitivity among the study participants with molar incisor hypomineralisation. Children with molar incisor hypomineralisation that affects their quality of life[16] will benefit from various treatment options available in oral health facilities.

This study was a public school based study in selected rural communities within the selected local government areas, the findings of this study might not represent the adolescents attending private schools in the community, children in communities within the selected local government areas that were not visited, adolescents not present at school during the days of data collection, and out of school children (adolescents not attending any school) in the (visited and non-visited) community. There could be marked or slight variation in the prevalence of molar incisor hypomineralisation among adolescents in the selected rural communities when participants are selected from both public and private schools or during a household survey in the rural communities.

Conclusion

The prevalence of molar incisor hypomineralisation was low. Molar incisor hypomineralisation is a developmental defects of enamel, that can affects the quality of life of children when associated with tooth sensitivity with or without post eruptive breakdown. Visit to dental clinic for clinical assessment and management is recommended.

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Conflicts of interest

There are no conflicts of interest.

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