

MOLAR INCISOR HYPO-MINERALIZATION; PREVALENCE AND ETIOLOGICAL FACTORS OF SCHOOL CHILDREN IN GHARBIA GOVERNORATE

Mohamed Ghaly* and Ahmed Eldosoky**

ABSTRACT

Aims: The goals of the present study were to determine the prevalence of molar incisor hypo-mineralization (MIH) and identify factors that might increase the risk of developing this condition on a sample of children in Gharbia Governorate.

Settings and Design: This study was conducted as an observational cross-sectional study with a sample size of 1452 children of primary schools in Gharbia Governorate.

Subjects and Methods: The study employed a multi-stage cluster sampling approach. The clinical assessments were performed in a classroom environment, equipped with headlights and disposable dental examination supplies. Each index tooth was evaluated for MIH based on the scoring system defined by the European Academy of Pediatric Dentistry (EAPD). A questionnaire with a validated Arabic version was given to the parents of children to detect the probable etiological factors of MIH.

Results: This study involving 1452 children (49.4% male, 50.6% female) found a 17.2% prevalence of MIH. Key findings include no significant gender difference in MIH prevalence, a higher rate in public schools, and a significant association between MIH and a history of breastfeeding insufficiency, breathing problems, and otitis media.

Conclusions: In schoolchildren of Gharbia Governorate, MIH is common. Our findings revealed no gender-based predilection for MIH. Essentially, only inadequate breastfeeding, breathing problems, and otitis media emerged as significant predictors of the condition.

KEYWORDS: MIH, Prevalence, Risk factors

* Lecturer of Pediatric Dentistry, Faculty of Dentistry, Tanta University.

** Asst. Professor of Oral Health and Preventive Dentistry, Faculty of Dentistry, Tanta University

INTRODUCTION

Understanding of tooth morphology is very important as many dental anomalies' associated with defect of different structures of the teeth. One of these structures is tooth enamel that considers the outer protective layer of the tooth; it is unique among mineralized tissues of ectodermal origin¹. Also it protects the underlying dentin and pulp against mechanical wear². Its structure is characterized by a high proportion of a dense, well-defined crystalline structure, accounting for 87% of its volume and 95% of its weight."³.

However, Developmental disorders that affect tooth enamel are common in both deciduous and permanent dentitions⁴. These defects are classified into hypo- mineralized type as a qualitative defect and hypo plastic type as quantitative defect⁵. Likewise, there are different predisposing factors, attributed to these dis-orders such as, inherited amelogenesis imperfecta, overexposure of fluoride during the mineralized of enamel and trauma to anterior teeth⁶.

Moreover, Goran Koch et al 1987, reported that Hypomineralization can simultaneously impact the 1st permanent molars (FPMs) and incisors. with ultimate incidence and they summarized this condition as 'hypo mineralized permanent 1st⁵.

Also, Weerheijm et al. in 2001 substantiate the development defect that affect FPMs and incisor as molar incisor hypo mineralization They attributed this condition to a systemic origin, characterized by hypomineralization of one to four FPMs commonly observed alongside affected incisors.⁷. Later, Elfrink 2008, observed that the same lesion can affect the second primary molar, hence it is termed as hypomineralized of second primary molars (SPMs)⁴.

Until now the etiology of molar incisor hypo mineralization is still obscure, but it is believed to be multifactorial⁸. It was concluded that the etiological

factor can be divided into prenatal, perinatal and postnatal periods. In prenatal period: it includes maternal health issues, Infections of the urinary tract, maternal anxiety, and smoking⁹. While perinatal risk factors for [MIH] include premature birth, cesarean section, difficult delivery, and hypoxia. Postnatal risk factors encompass early childhood illnesses, breathing problems, infections, fever, antibiotic therapy and extended breastfeeding.¹⁰

Clinically, MIH is characterized by yellowish to brownish discolorations on the enamel surface, often with distinct borders. These areas of weakened enamel are prone to breakdown, exposing the sensitive dentin beneath. This can lead to increased tooth sensitivity, discomfort, and an accelerated rate of dental caries, as children may have difficulty maintaining proper oral hygiene.¹¹.

Consequently, determining the prevalence and etiology of MIH in a given population is crucial, thus seriously will aid in establishment and enforcement of strategies for its management and prevention. Therefore, the primary objective of this study was to assess the prevalence of Molar Incisor Hypomineralization and identify related risk factors among a sample of children residing in Gharbia Governorate.

PARTICIPIANTS AND METHODS

Study Design:

An analytical cross-sectional study design was adopted for this research.

Study Setting:

This research was implemented in some private & public primary schools in Gharbia governorate.

Sample size calculation

The sample size was determined using the Epi Info statistical software package. A literature review indicated that the prevalence of this condition in

similar populations ranged from 2.6% to 40.2%.¹⁹ To ensure 99.9% statistical power with an alpha error of 0.05 and account for a 5% margin of error in the true population prevalence, a minimum sample size of 1452 children was calculated for this cross-sectional study.

Sampling technique:

In this study a multi-stage cluster sampling method was employed. The Gharbia educational system is divided into eleven districts. The study population comprised primary school children in Gharbia Governorate. In the first stage, one village and one city were randomly selected from each of the eleven districts. Subsequently, in the second stage, two primary schools (one public and one private) were randomly chosen from each selected village and city, resulting in a total of 44 schools. Finally, in the third stage, 33 students were randomly selected from grades 3, 4, 5, and 6 within each of the chosen schools.

Inclusion criteria¹⁰

Age: Children aged 8 to 12 years.

1. **Residence:** Children born and currently residing in Gharbia Governorate.
2. **Dental Status:** Children with at least one 1st permanent molar erupted or partially erupted.

Exclusion criteria¹¹

1. **Generalized Tooth Opacities:** Cases with widespread enamel opacities affecting all teeth, such as those seen in various forms of amelogenesis imperfecta.
2. **Fluorosis:** Cases of fluorosis that typically exhibit diffuse and widespread enamel changes, affecting teeth beyond FPMs and incisors.
3. **Uncooperative Behavior:** Children who were uncooperative during the dental examination or those wearing orthodontic appliances.

4. **Incisor Defects with Local Causes:** Defects in the permanent incisors attributed to trauma or infection in the primary teeth.

Ethical considerations

Approval of this study was obtained from the Research Ethics Committee at faculty of dentistry, Tanta University.

Approval of the Ministry of Education, Education affairs, school authorities and parents were first sought before children's participation was taking place. The objectives of the study were explained in details and data confidentiality was assured.

Then written informed consents were obtained from the parents according to the guidelines on human research performed by the Internal Research Ethics Committee, Faculty of Dentistry, Tanta University. (info_REC@dent.tanta.edu.eg)

Examiner reliability:

Prior to study commencement, principal investigators underwent rigorous training in MIH diagnosis. This training focused on identifying index teeth, including FPMs and permanent incisors, as defined within MIH criteria. The training involved scoring photographs of both MIH and other enamel defects, with assessments repeated twice a week to ensure reliability. Inter- and intra-rater reliability was determined to be high, with Kappa statistics demonstrating strong agreement (0.88 and 0.86, respectively). This rigorous training protocol ensured reliable and precise examinations throughout the study.

Clinical examinations

Dental examinations were conducted in a classroom environment, utilizing a headlight and a disposable kit containing a dental mirror, prop, tweezers, and cotton rolls.⁸ Prior to examination, index teeth, including incisors and FPMs, were cleaned. Subsequently, a dental prop was used to

meticulously clean the fissures of the molars.^{9,10}. Each tooth was assessed for MIH using the criteria established by the European Academy of Pediatric Dentistry (EAPD). This assessment included both sound and affected teeth in all participants. Only teeth with at least one-third of their crown erupted were evaluated. The surveyor meticulously inspected the crown surfaces of the first permanent molars (FPMs) and permanent incisors for any signs of enamel opacity. Additionally, the examiner assessed the teeth for extraction due to MIH and post-eruptive enamel breakdown according to the criteria defined by Elfrink et al. (2015)¹².

Children were considered having molar incisor hypo mineralization if the diagnostic criteria are met for one or more FPMs, regardless of incisor involvement.

Questionnaire:

A Self-administrative questionnaire with a validated Arabic version to recognize the probable etiological causes of MIH was given to children's parents who require information on the following¹³:

1. Demographic data
2. Mother's health throughout pregnancy
3. Delivery status
4. Birth weight of the child
5. Feeding practice
6. Medical history of the child during infancy and early childhood (asthma, breathing problems, otitis media, chickenpox, digestive system diseases, renal diseases, tonsillitis, and antibiotic intake)

Data analysis

All data were collected, presented, and statistically analyzed using SPSS version 22. Means, standard deviations, Chi-square test and logistic regression analysis were used. The level of significance used was 5%.

RESULTS

According to the result of the prevalence rates of MIH among school children of Gharbia governorate, it was observed that 17.2 % (n = 250) were affected with MIH, While 82.8% (n = 1202) were normal (Fig. 1)

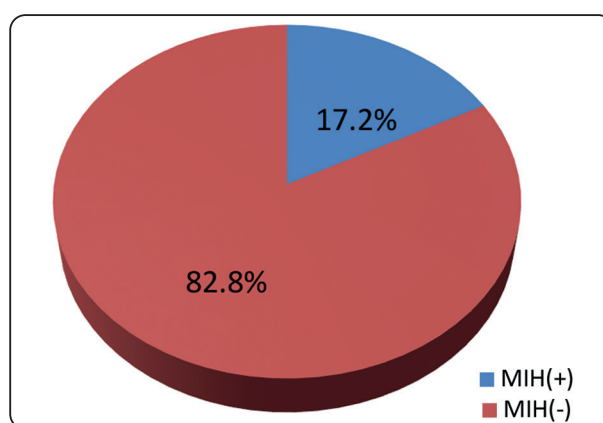


Fig. (1) Total prevalence of MIH among study sample

Table (1) shows the distribution of study participants according to age and gender. The study sample comprises a total of 1,452 children, whose ages ranged from 8 to 12 years. Age group 10 has the highest representation, accounting for 23.4% of the sample. While children aged 8 make up the smallest proportion, with 10% of the sample. Regarding gender, the sample is nearly balanced, with a slight majority of females (756 participants or 50.6%) compared to males (696 participants or 49.4%).

In relation to prevalence of MIH according to demographic variables of study sample, it was found that 118 (16.7%) males had MIH and 578 (83.3%) males were not affected by MIH, while 137 (17.8%) females had MIH and 619 (82.2%) females were not affected by MIH. The results did not reveal any significant differences between males and females in term of prevalence of MIH. (P value = 0.93). Table. 2

TABLE (1) Study sample distribution according to age and gender

Variables	N	(%)
Age		
8	145	10 %
9	324	22.3 %
10	340	23.4 %
11	337	23.2 %
12	306	21.1 %
Gender		
Male	696	49.4%
Female	756	50.6%

TABLE (2) Prevalence of MIH according to demographic variables of study sample

Variables	MIH (+) N (%)	MIH (-) N (%)	P value
Gender			
Male	118 (16.7%)	578 (83.3%)	.93
Female	137 (17.8%)	619 (82.2%)	
Age			
8 years	27 (17.2 %)	120 (83.5%)	.57
9 years	59 (17.3 %)	269 (82.7 %)	
10 years	58 (17%)	282 (83%)	
11years	59 (16.9%)	280 (83. 1%)	
12 years	56 (17.6 %)	242 (82. 4%)	
Type of school			
Public	155 (21.3%)	631(78.7%)	.03*
Private	95 (13.1%)	571(86.9%)	

Regarding to prevalence of MIH according to age, it was found that children with positive MIH at 8, 9, 10, 11 and 12 years old were 27 (17.2 %), 59 (17.3 %), 58 (17%), 59 (16.9%) and 56 (17.6%)

respectively. While children with negative MIH at 8, 9, 10, 11 and 12 years old were 120 (83.5%), 269 (82.7 %), 282 (83%), 280 (83.1%) and 242 (82.4%) respectively.

There was no statistically significant association between age group and MIH prevalence. (P value = 0.57)

According to type of school where children were examined for development of MIH or not, it was found that children in public schools that had MIH were 155 (21.3%), while children in private schools that had MIH were 95 (13.1%).

The results demonstrated a significant difference between children in public schools and children in private schools in term of prevalence of MIH. (P value = 0.03*)

Concerning to etiological factors that were hypothesized to be responsible for development of MIH:

The results illustrated that there wasn't significant difference between Pregnancy problems, Delivery status, and Child's birth weight and development of MIH, as (P value >0, 05) and Odd Ratio (OD) were 0.82, 1.02 and 0.88 respectively. While there was significant difference between Breast feeding and development of MIH as children with history of Breast feeding and had positive MIH were scored as 130(52%) but children with history of Breast feeding and had negative MIH were scored as 730 (60.7%) (Odd Ratio was 0.7005, P value = 0, 01). Table.3

Regarding the medical history of the child during infancy and early childhood and development of molar incisor hypo mineralization, it was revealed that only breathing problems and otitis media were significant predictors of MIH as Odd Ratio (OD) were 0.7019 and 1.6 respectively and P value ≤ 0, 05. While other health variables such as; Asthma, Tonsillitis, Chickenpox, kidney renal diseases, Digestive system diseases and antibiotic intake were not correlated with the occurring of MIH as P value > 0, 05. Table.4

TABLE (3) Development of molar incisor hypo mineralization and Mother's health in pregnancy, Delivery status, Birth weight of the child and Feeding practice using binary logistic regression.

Items	MIH (+) n=250 n (%)	MIH (-) n= 1202 n (%)	OR (95% CI)	p-value
Mother’s health in pregnancy				
Yes	30 (12%)	170 (14.1%)	0.82	0.37
No	220 (88%)	1032 (85.9%)	(0.54 - 1.25)	
Delivery status				
Normal	174 (69.9%)	830 (71%)	1.02	0.84
Abnormal	76 (30.1%)	372 (29%)	(0.76 - 1.38)	
Birth weight of the child				
Normal	168(67.2%)	839(69.8%)	0.88	0.41
Underweight	70 (28%)	346 (28.8%)	(0.66 - 1.18)	
Overweight	12 (4.8%)	17 (1.4)		
Feeding practice				
Natural	130(52%)	730 (60.7%)	0.7005	0.01*
Artificial	120 (48%)	472 (39.3%)	0.53 - 0.92	

TABLE (4) Development of molar incisor hypo mineralization and the medical history of the child during infancy and early childhood using binary logistic regression.

Items	MIH (+) n=250 n (%)	MIH (-) n= 1202 n (%)	OR (95% CI)	p-value
Asthma				
Yes	25(10%)	101 (8.4%)	1.21	0.41
No	225(90%)	1101 (1.6%)	0.76 - 1.92	
breathing problems				
Yes	48(19.2%)	304 (25.3%)	0.7019	0.04*
No	202(79.8%)	898 (75.7%)	0.49 - 0.98	
Otitis media				
Yes	45(18%)	145(12%)	1.6	0.01*
No	205(82%)	1057(88%)	1.1 - 2.3	
Fever				
Yes	90(36%)	445(37%)	0.95	0.76
No	160(64%)	757(63%)	0.72 - 1.27	
Tonsillitis				
Yes	23 (9.2%)	92(7.7%)	1.22	0.41
No	227 (90.8%)	1110(92.3%)	0.75 - 1.97	
Chickenpox				
Yes	20(8%)	103(8.5%)	0.92	0.76
No	230(92%)	1099(91.5%)	0.56 - 1.52	
Renal diseases				
Yes	2(0.8%)	12(1%)	0.79	0.77
No	248(99.2%)	1190(99%)	0.17 - 3.59	
Digestive system diseases				
Yes	15(6%)	60(5%)	1.21	0.52
No	235(94%)	1142(95%)	0.67 - 2.17	
Antibiotic intake				
Yes	92(36.8%)	469(39%)	0.91	0.51
No	158(63.2%)	733(61%)	0.68 - 1.2	

DISCUSSION

Determining the prevalence of Molar Incisor Hypomineralization in Gharbia Governorate is crucial for several reasons. Firstly, it helps assess the educational needs of dentists regarding this condition. Secondly, it allows for increased community awareness about MIH. By accurately understanding the characteristics and prevalence of MIH, early detection becomes possible. This, in turn, enables the timely implementation of appropriate preventive measures, ultimately reducing the risk of further complications.

For this study, multi-stage cluster sampling was chosen over simple random sampling. Simple random sampling involves selecting individuals randomly from the entire population, ensuring equal probability for each possible sample. In contrast, multi-stage sampling divides the population into subgroups to ensure accurate representation of the entire population.¹⁴

The study utilized a self-administered questionnaire, translated and validated in Arabic, to explore potential causes of Molar-Incisor Hypomineralization. Because the questionnaire method is considered a versatile and potent tool for data collection across different research fields. Also it facilitates standardized data collection, organization, and analysis and can offers cost-effectiveness for researchers, accessibility, and the ability to reach a wide range of population, making it possible to efficiently collect thorough insights¹⁵.

The present study found a 17.2% prevalence of MIH among schoolchildren in Gharbia Governorate, Egypt. This finding aligns closely with the 15.2% prevalence reported by Almuallem et al. (2022) in a study of Saudi schoolchildren in Riyadh. Furthermore, the observed prevalence is consistent with findings from other countries, including the UK (15.9%, Balmer et al., 2012), Argentina (15.9%, Biondi et al., 2009), and Turkey (14.2%, Koruyucu et al., 2018).

However, it was inconsistent with results obtained by Saber et al., 2018.¹⁹ A previous study in Egypt assessed the prevalence of MIH in a group of children aged 8 to 12 years. The study found an MIH prevalence of 2.3%, which is slightly lower than the prevalence rates reported in other international studies.

In relation to prevalence rates of MIH among females and males. The results did not reveal any significant differences between males and females in terms of prevalence of MIH. This finding agreed with the results obtained by Almuallem et al., 2022¹³ who concluded that there was no gender predilection for MIH.

Moreover, this finding was also similar to results obtained by Shetty et al., 2022²⁰ who did not report differences in the MIH prevalence between both males and females. On the other hand Saber et al., 2018⁷ documented that the prevalence rates of MIH among males and females were (39.1%) and (60.9%) respectively, thereby the prevalence rates were more in females than in males. While two studies by Padavala and Sukumaran²¹ and Rai et al.,²² revealed a higher prevalence of MIH for males. This could be clarified by small sample size that was included in their studies.

Concerning age, the range of the age that was selected in this study was (8-12) years old considering that most children at this age typically have all of their 1st permanent molars and incisors erupted and it was concluded that there wasn't significant difference among different groups of age in term of prevalence of MIH. This was consistent with results obtained by Almuallem et al., 2022¹³.

In relation to type of school, it was found that prevalence rates of MIH was high in children of public school than children of private school, it could be clarified by lower socio-economic status, low maternal educational level and nutritional deficiency. These results corroborate the findings of Damares Lago et al., 2022²³ who suggested that the

incidence of enamel defects may be influenced by socioeconomic conditions and lower income levels, as the probable result of nutritional deficiencies.

Concerning etiological factors that were hypothesized to be responsible for development of MIH, a statistically significant difference was observed between breast feeding and development of MIH. This finding is consistent with Salem K et al., 2016²⁴ who documented that lack of breast milk could be responsible for development of MIH due to vitamin D inadequacy and disturbance in the metabolism of calcium and phosphorus. On the other hand Fatturi et al., 2019¹⁰ observed that the duration of breast feeding not associated with arising of MIH.

Regarding the medical history of the child during infancy and early childhood and development of molar incisor hypo mineralization, it was revealed that only breathing problems and otitis media significantly increased the likelihood of developing MIH. This could be explained as breathing problems can adversely affect enamel mineralization as it induces hypoxia, which has been demonstrated to alter the pH of the enamel matrix and this justification was supported by Almuallem et al., 2022¹³.

While children with otitis media experience recurrent high fevers and are often treated with antibiotics that were suggested by Koruyucu et al., 2018¹³ as some antibiotics like amoxicillin may affect enamel mineralization consequently MIH will be developed. Nevertheless, Garot et al., 2021²⁵ hypothesized that medical problems are not necessarily responsible for the development of MIH as they revealed that 12.2% of participants with MIH had no identifiable medical history contributing to their condition, therefore they supported that genetic factor had great influence on arising of MIH.

A potential limitation of this study is the use of self-administered questionnaires. The absence of an interviewer to clarify questions and ensure accurate responses may have introduced some bias into the data.

CONCLUSION

It was concluded that, molar incisor hypomineralization is common in schoolchildren of Gharbia Governorate with no sex predilection and only breast-feeding factor, respiratory distress and otitis media were significantly predictors of MIH.

Acknowledgement:

We would like to thank all participants who helped us during this

Conflict of interest :

There was no conflict of interest.

REFERENCES

1. Crombie F, Manton D, Kilpatrick N. Aetiology of molar-incisor hypomineralization: a critical review. *International Journal of Paediatric Dentistry*. 2009;19(2):73-83.
2. Fowler CE, Li M, Mann S, Margolis HC. Influence of surfactant assembly on the formation of calcium phosphate materials—A model for dental enamel formation. *Journal of Materials Chemistry*. 2005;15(32):3317-25.
3. Simmer JP, Hu JC. Dental enamel formation and its impact on clinical dentistry. *Journal of dental education*. 2001;65(9):896-905.
4. Elfrink ME, Schuller AA, Weerheijm KL, Veerkamp JS. Hypomineralized second primary molars: prevalence data in Dutch 5-year-olds. *Caries research*. 2008;42(4):282-5.
5. Koch G, Hallonsten AL, Ludvigsson N, Hansson BO, Hoist A, Ullbro C. Epidemiologic study of idiopathic enamel hypomineralization in permanent teeth of Swedish children. *Community dentistry and oral epidemiology*. 1987;15(5):279-85.
6. Pindborg JJ. Aetiology of developmental enamel defects not related to fluorosis. *International dental journal*. 1982;32(2):123-34.
7. Weerheijm KL, Jalevik B, Alaluusua S. Molar-incisor hypomineralisation. *Caries research*. 2001;35(5):390.
8. Ghanim A, Silva MJ, Elfrink ME, Lygidakis NA, Mariño RJ, Weerheijm KL, Manton DJ. Molar incisor hypomineralisation (MIH) training manual for clinical field surveys and practice. *European Archives of Paediatric Dentistry*. 2017;18(4):225-42.

9. Alaluusua S. Aetiology of molar-incisor hypomineralisation: a systematic review. *European Archives of Paediatric Dentistry*. 2010;11(2):53-8.
10. Fatturi AL, Wambier LM, Chibinski AC, Assunção LR, Brancher JA, Reis A, Souza JF. A systematic review and meta-analysis of systemic exposure associated with molar incisor hypomineralization. *Community dentistry and oral epidemiology*. 2019;47(5):407-15.
11. Shrestha R, Upadhaya S, Bajracharya M. Prevalence of molar incisor hypomineralisation among school children in Kavre. *Kathmandu University Medical Journal*. 2014;12(1):38-42.
12. Elfrink ME, Ghanim A, Manton DJ, Weerheijm KL. Standardised studies on molar incisor hypomineralisation (MIH) and hypomineralised second primary molars (HSPM): a need. *European Archives of Paediatric Dentistry*. 2015;16(3):247-55.
13. Almuallem Z, Alsuhaime A, Alqudayri A, Aljarid S, Mousa Alotaibi M, Alkraid R. Prevalence and possible aetiological factors of molar incisor hypomineralisation in Saudi children: A cross-sectional study. *Saudi Dent J*. 2022; 34 (1): 36
14. <https://cales.arizona.edu/classes/rmr321/Ch4.pdf>
15. Roopa S, Rani MS. Questionnaire designing for a survey. *Journal of Indian Orthodontic Society*. 2012; 46(4):273-7.
16. Balmer, R., Toumba, J., Godson, J., Duggal, M., The prevalence of molar incisor hypomineralisation in Northern England and its relationship to socioeconomic status and water fluoridation. *Int J Paediatr Dent*. 2012;22:250-257
17. Biondi, A.M., Cortese, S.G., Martinez, K., Ortolani, A.M., Sebelli, P. M., Ienco, M., et al. Prevalence of molar incisor hypomineralization in the city of Buenos Aires. *Acta Odontol Latinoam.* , 2009; 24: 81-85.
18. Koruyucu, M., Ozel, S., Tuna, E.B.,. Prevalence and etiology of molar-incisor hypomineralization (MIH) in the city of Istanbul. *J Dent Sci*. 2018;13, 318-328.
19. Saber F, Waly N, Moheb D. Prevalence of molar incisor hypomineralization in Egypt as measured by enamel defect index a cross sectional study. *Future Dental Journal*. 2018 Jun 1;4(1):59-63.
20. Shetty AJ, Dixit UB, Kirubakaran R. Prevalence of molar incisor hypomineralization in India: A systematic review and meta-analysis. *Journal of Indian Society of Pedodontics and Preventive Dentistry*. 2022 Oct 1;40(4):356-67
21. Padavala S, Sukumaran G. Molar incisor hypomineralization and its prevalence. *Contemp Clin Dent* 2018;9:S246-50
22. Rai A, Singh A, Menon I, Singh J, Rai V, Aswal GS. Molar incisor hypomineralization: Prevalence and risk factors among 7-9 years old school children in Muradnagar, Ghaziabad. *Open Dent J* 2018;12:714-22.
23. Damares Lago J, Restrepo M, Giroto Bussaneli D, Patrícia Cavaleiro J, Feltrin de Souza J, Santos-Pinto L, de Cássia Loiola Cordeiro R, Jeremias F. Molar-Incisor Hypomineralization: Prevalence Comparative Study in 6 Years of Interval. *The Scientific World Journal*. 2022;2022(1):4743252.
24. Salem K. Prevalence and predictors of Molar Incisor Hypomineralization (MIH) among rural children in Northern Iran. *Iran J Public Health* . 2016; 45(11):1528–1530.
25. Garot, E., Rouas, P., Somani, C., Taylor, G.D., Wong, F., Lygidakis, N.A.,. An update of the aetiological factors involved in molar incisor hypomineralisation (MIH): a systematic review and meta-analysis. *Eur Arch Paediatr Dent*. Epub ahead of print. PMID.2021;33 :3416-4793.