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Worldwide prevalence of molar-incisor hypomineralization: A literature review

Norailys Pérez Navarro[1] ✉, Burak Buldur[2]

Highlights

This study investigated the global prevalence of MIH in children aged 3-18 from 1987 to 2023, highlighting the need for standardized diagnostic criteria and regional data.

The study found a global MIH prevalence of 9.4%, with significant regional variations, including the highest rate in America (17.7%) and the lowest in Africa (4.9%).

These results emphasize the necessity for targeted regional strategies in MIH prevention and management, addressing the diverse prevalence rates and improving overall dental health outcomes for affected children.

[1] *Former professor. Assistant Professor in the Department of Pediatric Dentistry and Comprehensive General Stomatology. Faculty of Medical Sciences, Cuba*
[2] *Professor, Department of Pediatric Dentistry, Sivas Cumhuriyet University, Turkiye*

Correspondence:
Department of Pediatric Dentistry and Comprehensive General Stomatology. Faculty of Medical Sciences, Cuba
E-mail address:
norailyspnavarro@gmail.com

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Abstract

Molar-incisor hypomineralization (MIH) is a qualitative enamel defect with a multifactorial etiology, affecting at least one permanent first molar and often associated with permanent incisors and other teeth. MIH is prevalent worldwide, particularly among children under 10 years of age. However, its prevalence rates vary significantly even within the same country. This study aimed to determine the global prevalence of MIH from 1987 to 2023, focusing on children aged 3 to 18 years, using the 2003 EAPD classification. A comprehensive literature review was conducted using PubMed, MEDLINE, CENTRAL, Web of Science, SciELO, LILACS, and Google Scholar, covering studies from 1987 to July 2023 that included sample sizes of more than 1,000 children. A total of 80 studies met the inclusion criteria, with most participants aged between 6 and 12 years. Of these studies, 69 (86.2%) utilized the 2003 EAPD classification. Globally, 17,980 children out of 179,800 examined presented MIH, resulting in a prevalence of 9.4%. Regional prevalence varied: in Asia, 8,812 out of 81,954 children (10.7%) had MIH; in Africa, 344 out of 6,904 children (4.9%); in America, 2,193 out of 12,324 children (17.7%); and in Europe, 6,631 out of 90,042 children (7.3%). The American region reported the highest prevalence of MIH at 17.7%, while Europe and Asia showed similar rates close to the global prevalence (7.3% and 10.7%, respectively). Africa reported the lowest prevalence at 4.9%, but the number of studies conducted there was limited. Overall, MIH has a moderate global incidence with significant regional variations.

Keywords: Child; Molar-Incisor Hypomineralization; Prevalence; Tooth Demineralization

INTRODUCTION

Molar-incisor hypomineralization (MIH) is a qualitative enamel defect of multifactorial etiology, where at least one permanent first molar is affected and may be associated with permanent incisors and other teeth. The opacity in the MIH can vary from white to brown and this is a characteristic of this defect that occurs mainly on the cusps of the molars and buccal surfaces of the incisors.[1]

Abnormalities in tooth structure in MIH can affect both the primary and permanent dentition, with varying degrees of severity, depending on the stage of odontogenesis at which the disturbing factor occurred [1]

The EAPD recommends studying the prevalence of MIH in children aged at least 8 years, since eruptive delay is considered a possible indicator of this disease. Therefore, it may happen that, in studies that include children under 8 years of age, not all the first molars and permanent incisors have erupted. And it is confirmed that the dental examination will be performed on wet teeth, and has been the case in most MIH studies since this date. It is very important to meet this criterion as there are reports of a high prevalence of MIH on examinations in dry teeth compared to wet teeth [2]

MIH has a high incidence worldwide, especially among children under 10 years of age. However, studies have shown that MIH rates have varied widely even within the same country.[3]

There is much divergence in the literature on the prevalence of MIH. The purpose of this study was to review the scientific literature where the study samples are of more than 1000 children, to determine the worldwide prevalence of MIH.

METHODS

Study Design

A comprehensive literature review was conducted to determine the worldwide prevalence of molar-incisor hypomineralization (MIH) from 1987 to July 2023. The review focused on studies that included children aged 3 to 18 years and aimed to utilize the 2003 European Academy of Paediatric Dentistry (EAPD) classification criteria for MIH.

Data Sources and Search Strategy

The literature search was performed across multiple databases, including PubMed, MEDLINE, CENTRAL, Web of Science, SciELO, LILACS, and Google Scholar. These databases were chosen for their extensive coverage of medical and scientific research, ensuring a comprehensive collection of relevant studies.

Inclusion criteria

1. Population: Studies involving children aged 3 to 18 years
2. Sample Size: Studies with a sample size of more than 1,000 children
3. Outcome Measure: Studies reporting the prevalence of MIH
4. Time Frame: Studies published between 1987 and July 2023
5. Classification Criteria: Preference for studies using the 2003 EAPD classification for diagnosing MIH

Exclusion criteria

1. Studies with a sample size of fewer than 1,000 children
2. Studies not reporting prevalence data for MIH
3. Studies not within the specified age range of 3 to 18 years

4. Studies published before 1987 or after July 2023
5. Studies not using the 2003 EAPD classification criteria[4]

Search Terms and Strategy

The search strategy included a combination of keywords and Medical Subject Headings (MeSH) terms related to MIH. Keywords included "molar-incisor hypomineralization," "prevalence," "children," and "2003 EAPD classification" Boolean operators (AND, OR) were used to combine search terms and refine results.

Data Extraction and Analysis

Data extraction was performed independently by two reviewers to ensure accuracy and reduce bias. The following data were extracted from each study:

1. Author(s)
2. Year of publication
3. Country/region of study
4. Sample size
5. Age range of participants
6. Prevalence of MIH
7. Diagnostic criteria used (with a focus on the 2003 EAPD classification[4])

Discrepancies between reviewers were resolved through discussion and consensus.

RESULTS

Table 1 shows all the world studies on the prevalence of MIH, with a study sample of over 1000 children, in the period from 1987 to 2023. Of the total of all the investigations carried out with samples of more than 1000 children, 191224 were evaluated. Children from different countries and from them present MIH 17980 children for a global prevalence of 9.4%.

It can also be observed that 80 studies with samples of over 1,000 children on the prevalence of MIH from 1987 to 2023 are considered. With an age variation from 3 to 18 years, although in most of the studies the ages that are registered are between 6 and 12 years old. Of them, 69 used the 2003 EAPD classification for 86.2%.

Table 2 shows the world studies on the prevalence of MIH by region (Asia), with a study sample of over 1,000 children during the period from 1987 to 2023, where it is observed that, out of a total of 81,954 children in Asia, 8812 present MHI for 10.7%.

The lowest prevalences occurred in China in 2008, in the study by Cho et al[17] with 2.8%. And in India, in the investigations of Subranamiam et al with 0.48%, (Thakur et al. 2020)[64] with 2.9%, (Ray et al 2020)[65], with 5.7%, (Emmat et al. 2020)[63] with 4.1%, (Tarannum Ravichandra et al. 2021)[74], with 2.1 % and (Khan et al. 2022)[78] with 3.96 %. Most of the studies use the EAPD classification, only one study does not.

Table 3 shows the world studies on the prevalence of MIH by region (Africa), with a study sample of over 1,000 children during the period from 1987 to 2023, where it is observed that, of a total of 6,904 children, 344 present MIH for 4.9%.

It can be observed that, of the four reported studies, those of 2008 in Kenya with 13.71% and that of 2020 in Egypt with 14.2%, present a high prevalence of MCH, while that of Egypt in 2018, reports a low prevalence with 2.3%. The study by Abo El Soud et al[62] in Egypt with 9.98 % is close to the world prevalence of 9.4%. And with these characteristics there are few studies in the region.

Table 1. Worldwide studies on the prevalence of MIH, study sample of over 1000 children (1987-2023)

Year	Region	Country	Author	Sample	Affected MIH	Age (yr)	Prevalence (%)	Selection Criteria
1987	Europe	Sweden	Kocht et al	2226	342	8-13	15.4	Color and surface changes
1997	Europe	Switzerland	Clavadetscher	1671	106	7-8	6.4	___
2003	Europe	Germany	Dietrich et al	2408	1135	10-17	5.6	mDDE
2003	Europe	Denmark	Esmark and Simonsen (1995) in Weerheijm 2003	5277		7	15-25	EAPD 2003
2004	Asia	Slovenia	Kosem et al	2339	327	12-18	14	EAPD 2003
2004	Europe	Greece	Lygidakis et al. in Garg et al. 2012	2640	150	-	5.7	EAPD 2003
2007	Europe	Germany	Preusser et al	1002	59	6-12	5.9	Kocht et al 1987
2007	Europe	Lithuania	Jasulaityte et al	1277	124	6,5-9	9.7	EAPD 2003
2008	Europe	Greece	Lygidakis et al	3518	359	5.5-12	10.2	EAPD 2003
2008	Asia	China	Cho et al	2635	74	12	2.8	EAPD 2003
2008	Africa	Kenya	Kemoli	3591	49	6-8	13.71	DDE
2008	Europe	Bulgaria	Kukleva et al	2960	106	7-14	3.5	_____
2011	Asia	Jordan	Zawaidech et al	3241	570	7-9	17.6	EAPD 2003
2011	Asia	Jordan	Fnaish et al	3660	120	5-12	32 %	EAPD 2003
2011	South America	Argentina	Biondi et al	1098	174	11	15.9	EAPD 2003
2012	Europe	Italia	Condó et al	1500	109	4-14	7.3	EAPD 2003
2012	Europe	Netherlands	Elfrink et al	6161	536	6	8.7	EAPD 2003
2012	Asia	India	Parikh et al	1366	126	8-12	9.2	EAPD 2003
2013	Europe	Turkiye	Sonmez et al	4018	309	7-12	7.7	mDDE
2013	Europe	Germany	Kohlboeck et al	1126	154	10	13.7	EAPD 2003
2013	Southern America	Brazil	Jeremias et al	1151	142	7-12	12.3	EAPD 2003
2014	Europe	Germany	Petrou et al	2395	242	8-9	10	EAPD 2003
2014	Asia	India	Mital et al	1792	113	6-9	6.3	EAPD 2003
2014	Asia	India	Bhaskar et al	1173	111	8-13	9.4	EAPD 2003

Table 1. Continued

2014	Southern America	Uruguay-Argentina	López Jordi	1090	176 135	7-17	Buenos Aires/16.15 Montevideo/12.30	EAPD 2003
2014	Asia	Iraq	Noori and Hussein	2346	426	7-9	18.2	EAPD 2003
2015	Southern America	Brazil	Hanan et al	2062	188	6-10	9.1	EAPD 2003
2015	Europe	Great Britain	Balmer et al	3233	355	12	11	mDDE
2015	Southern America	Brasil	Rodríguez et al	1179	294	7-14	2.5	mDDE
2015	Asia	India	Kirthiga et al	2000	178	11-16	8.9	EAPD 2003
2015	Europe	Greece	Kevrekidou (a) et al	2335	490	8-14	21	EAPD 2003
2015	Asia	India	Krishnan et al	4989	364	9-14	7.3	EAPD 2003
2015	Asia	Singapore	Ng et al	1083		7,7	12,5	EAPD 2003
2015	Asia	Iraq	Karimi et al	1081	102	8-12	9.5	EAPD 2003
2016	Southern America	Brazil	Tourino et al	1181	240	8-9	20.4	EAPD 2003
2016	Asia	India	Mishra et al	1369	190	8-12	13.9	EAPD 2003
2016	Asia	India	Yannam et al	2864	277	8-12	9.7	EAPD 2003
2016	Asia	India	Subramaniam et al	2500	12	7-9	0.48	EAPD 2003
2016	Europe	Albania	Hysi et al	1575	220	8-10	14	EAPD 2003
2017	América Central	Mexico	Gurrusqui et al	1156	183	6-12	15.8	EAPD 2003
2017	Asia	South Korea	Shin et al	1371	189	14-16	13.8	EAPD 2003
2017	Asia	Iran	Salem et al	1043	207	6-13	19.93	EAPD 2003
2017	Asia	Iran	Salari et al	1028	263	7-12	25.6	EAPD 2003
2018	Asia	Japan	Saitoh et al	4496	890	7-9	19.8	EAPD 2003
2018	Europe	Turkiye	Koruyucu	1511	215	8-11	14.2	EAPD 2003
2018	Europe	Germany	Kuhnisch et al	1302	224	15	17.2	EAPD 2003
2018	Africa	Egypt	Saber et al	1001	23	8-12	2.3	EAPD 2003
2018	Europe	Austria	Buchgraber et al	1111	78	6-12	7	EAPD 2003

Table 1. Continued

2018	South America	Brazil	Vargas Ferreira et al	1206	318	8-12	26.4	mDDE
2019	Europe	Poland	Glodkowska	1437	38 165	6-12	2.7-11.5	EAPD 2003
2019	Asia	India	Goswami et al	1026	172	6-12	1.17	EAPD 2003
2019	Europe	Turkiye	Kilinc et al	1237	142	9-10	11.5	EAPD 2003
2019	South America	Colombia	Mejía et al	1075	120	6-15	11.2	EAPD 2003
2019	Asia	India	Rai et al	1525	200	8-12	13.12	EAPD 2003
2019	Asia	India	Goyal et al	3013	238	3-6	7.9	EAPD 2003
2019	Africa	Egypt	Abo ELSoud et al	1312	130	8-12	9.98	EAPD 2003
2020	Asia	India	Emmaty et al	5318	218	8-15	4.1	EAPD 2003
2020	Asia	India	Thakur et al	2000	58	8-16	2.9	EAPD 2003
2020	Asia	India	Ray et al	1525	87	8-12	5.7	EAPD 2003
2020	Asia	Iran	Shojaeepour et al	2507	129	8-12	5.14	EAPD 2003
2020	Asia	Jordan	Hamdanet et al	1412	186	8-9	13-17	EAPD 2003
2020	Africa	Egypt	Osman et al	1000	142	10	14.2	EAPD 2003
2021	Europe	Greece	Kevrekidou et al	1156	244	14-16	22.9	EAPD 2003
2021	Asia	Saudi Arabia	Arheiam et al	1047	162	8-10	15.5	EAPD 2003
2021	Southern America	Brazil	De Lira	1126	223	6-12	3.9	EAPD 2003
2021	Asia	China	Yi et al	6523	652	12-15	10	EAPD 2003
2021	Europe	Germany	Amend et al	2103	97 186	6-12	9.4 17.4	EAPD 2003
2021	Asia	India	Tarannum Ravichandra et al	2250	47	8-14	2.1	EAPD 2003
2021	Asia	United Arab Emirates	Padmanabhan	1200	253	8-12	21.16	EAPD 2003
2022	Europe	Italia	Nisii et al	3611	63	7-8	18.2	EAPD 2003
2022	Asia	India	Verma et al	5585	441	8 y 16	7.6	EAPD 2003
2022	Asia	India	Khan et al	2300	910	8 y 12	3.96	EAPD 2003
2022	Europe	Switzerland	Abdelaziz et al	30000	198	4-12	6.6	EAPD 2003
2023	Europe	Switzerland	Grieshaber et al	1252	185	7-15	14.8	EAPD 2003

Table 1. Continued

2023	Asia	Switzerland	Al-Nerabiech et al	1138	452	8-11	39.9	EAPD 2003
2023	Asia	Israel	Berestein et al	1209	68	3-13	10.3	EAPD 2003
		Total		191224	17980		9.4 %	

Table 2. Worldwide studies on the prevalence of MIH by region (Asia), study sample of over 1000 children (1987-2023)

Year	Region	Country	Author	Sample	Affected MIH	Age (yr)	Prevalence (%)	Selection Criteria
2004	Asia	Slovenia	Kosem et al	2339	327	12-18	14	EAPD 2003
2008	Asia	China	Cho et al	2635	74	12	2.8	EAPD 2003
2011	Asia	Jordan	Zawaidech et al	3241	570	7-9	17.6	EAPD 2003
2011	Asia	Jordan	Fnaish et al	3660	120	5-12	32 %	EAPD 2003
2012	Asia	India	Parikh et al	1366	126	8-12	9.2	EAPD 2003
2014	Asia	India	Mital et al	1792	113	6-9	6.31	EAPD 2003
2014	Asia	India	Bhaskar et al	1173	111	8-13	9.46	EAPD 2003
2014	Asia	Iraq	Noori and Hussein	2346	426	7-9	18.2	EAPD 2003
2015	Asia	India	Kirthiga et al	2000	178	11-16	8.9	EAPD 2003
2015	Asia	India	Krishnan et al	4989	364	9-14	7.3	EAPD 2003
2015	Asia	Singapore	Ng et al	1083	135	7,7	12,5	EAPD 2003
2015	Asia	Iran	Karimi et al	1081	102	8-12	9.5	EAPD 2003
2016	Asia	India	Mishra et al	1369	190	8-12	13.9	EAPD 2003
2016	Asia	India	Yannam et al	2864	277	8-12	9.7	EAPD 2003
2016	Asia	India	Subramaniam et al	2500	12	7-9	0.48	EAPD 2003

Table 2. Continued

2017	Asia	South Korea	Shin et al	1371	189	14-16	13.8	EAPD 2003
2017	Asia	Iran	Salem et al	1043	207	6-13	19.93	EAPD 2003
2017	Asia	Iran	Salari et al	1028	263	7-12	25.6	EAPD 2003
2018	Asia	Japan	Saitoh et al	4496	890	7-9	19.8	EAPD 2003
2019	Asia	India	Goswami et al	1026	172	6-12	1.17	EAPD 2003
2019	Asia	India	Rai et al	1525	200	8-12	13.12	EAPD 2003
2019	Asia	India	Goyal et al	3013	238	3-6	7.9	EAPD 2003
2020	Asia	India	Thakur et al	2000	58	8-16	2.9	EAPD 2003
2020	Asia	India	Emmatty et al	5318	218	8-15	4.1	EAPD 2003
2020	Asia	India	Ray et al	1525	87	8-12	5.7	EAPD 2003
2020	Asia	Iran	Shojaeepour et al	2507	129	8-12	5.14	EAPD 2003
2020	Asia	Jordan	Hamdanet et al	1412	186	8-9	13-17	EAPD 2003
2021	Asia	Saudi Arabia	Arheiam et al	1047	162	8-10	15.5	EAPD 2003
2021	Asia	China	Yi et al	6523	652	12-15	10	EAPD 2003
2021	Asia	India	Tarannum Ravichandra et al	2250	47	8-14	2.1	EAPD 2003
2021	Asia	United Arab Emirates	Padmanabhan	1200	253	8-dic	21.16	EAPD 2003
2022	Asia	India	Verma et al	5585	441	8 y 16	7.6	EAPD 2003
2022	Asia	India	Khan et al	2300	910	8 y 12	3.96	EAPD 2003
2023	Asia	Syria	Al-Nerabiech et al	1138	452	8-11	39.9	EAPD 2003

Table 2. Continued

2023	Asia	Israel	Berestein et al	1209	68	3-13	10.3	EAPD 2003
		Total		81954	8812		10.7 %	

Table 3. Worldwide studies on the prevalence of MIH by region (Africa), study sample of over 1000 children (1987-2023)

Year	Region	Country	Author	Sample	Affected MIH	Age (yr)	Prevalence (%)	Selection Criteria
2008	Africa	Kenya	Kemoli	3591	49	6-8	13.71	DDE
2018	Africa	Egypt	Saber et al	1001	23	8-12	2.3	EAPD 2003
2019	Africa	Egypt	Abo ELSoud et al	1312	130	8-12	9.98	EAPD 2003
2020	Africa	Egypt	Osman et al	1000	142	10	14.2	EAPD 2003
			Total	6904	344		4.9 %	

Table 4 shows the world studies on the prevalence of ICH by region (America), with a study sample of over 1,000 children during the period from 1987 to 2023, where it is observed that, out of a total of 12,324 children, 2,193 present MIH for 17.7%.

Most studies show a high prevalence. Only 2 studies in Brazil show a low prevalence, those by Rodríguez et al[36] in (2015) with 2.5%, and that of De Lira in (2021)[71] with 3.9%.

Of the total number of studies, two are not guided by the 2003 EAPD criteria, which are those of Rodríguez et al[36] in (2015) and that of Vargas Ferreira et al[55] in (2018), in Brazil.

Table 5 shows the global studies on the prevalence of MIH by region (Europe), with a study sample of over 1,000 children during the period from 1987 to 2023, where it is observed that, out of a total of 90.042 children, 6.631 presented MIH for 7.3%.

Half of the studies show a prevalence of less than 10% and in the other half the prevalence was greater than 10%. They show a low prevalence, the studies of Clavadetscher in (1997)[11] in Switzerland with 6.4%, in Germany the works of Dietrich et al[12] in (2003) with 5.6 % and those of Preusser et al[14] in (2007) with 5.9 %, in Greece Lygidakis (a) et al[5] in (2004) with 5.7 % and in Bulgaria Kukleva et al [19] in (2008) with 3.58 %.

Table 6 shows the total number of world studies on the prevalence of MIH by region), in study samples of over 1000 children during the period from 1987 to 2023, where it is observed that, when making a comparison between the regions studied, the The American region has a higher percentage of cases of MIH with 17.7%, and that in Europe and Asia the values found are similar with 7.3 and 10.7% respectively, and both approached the global prevalence of 9.40%. Africa is the region with the lowest prevalence (4.9%), but very few studies are found in the region.

Table 4. Worldwide studies on the prevalence of MIH by region (America), study sample of over 1000 children (1987-2023)

Year	Region	Country	Author	Sample	Affected MIH	Age (yr)	Prevalence (%)	Selection Criteria
2011	South America	Argentina	Biondi et al	1098	174	11	15.9	EAPD 2003
2013	Southern America	Brazil	Souza et al	1151	142	7-12	12.3	EAPD 2003
2014	South America	Uruguay-Argentina	López Jordi	1090	176 135	7-17	Buenos Aires/16.15 Montevideo/12.30	EAPD 2003
2015	Southern America	Brasil	Hanan et al	2062	188	6-10	9.12	EAPD 2003
2015	Southern America	Brazil	Rodríguez et al	1179	294	7-14	2.5	mDDE
2016	Southern America	Brazil	Tourino et al	1181	240	8-9	20.4	EAPD 2003
2017	Central America	Mexico	Gurrusqui et al	1156	183	6-12	15.8	EAPD 2003
2018	Southern America	Brazil	Vargas Ferreira et al	1206	318	8-12	26.4	mDDE
2019	South America	Colombia	Mejía et al	1075	120	6-15	11.2	EAPD 2003
2021	Southern America	Brazil	De Lira	1126	223	6-12	3.9	EAPD 2003
			Total	12324	2193		17.7 %	

Table 5. Worldwide studies on the prevalence of MIH by region (Europe), study sample of over 1000 children (1987-2023)

Year	Region	Country	Author	Sample	Affected MIH	Age (yr)	Prevalence (%)	Selection Criteria
1987	Europa	Sweden	Kocht et al	2226	342	8-13	15.4	Color and surface changes
1997	Europa	Switzerland	Clavadetscher	1671	106	7-8	6.4	____-
2003	Europa	Denmark	Esmark and Simonsen (1995) in Weerheijm 2003	5277	79-131	7	15-25	EAPD 2003
2003	Europa	Germany	Dietrich et al	2408	1135	10-17	5.6	mDDE
2004	Europa	Greece	Lygidakis et al. in Garg et al 2012	2640	150	-	5.7	EAPD 2003
2007	Europa	Germany	Preusser et al	1002	59	6-12	5.9	Kocht et al 1987
2007	Europa	Lithuania	Jasulaityte et al	1277	124	7-9	9.7	EAPD 2003
2008	Europa	Greece	Lygidakis (b) et al	3518	359	5.5-12	10.2	EAPD 2003
2008	Europa	Bulgaria	Kukleva et al	2960	106	7-14	3.58	_____
2012	Europa	Italia	Condó et al	1500	109	4-14	7.3	EAPD 2003
2012	Europa	Netherlands	Elfrink et al	6161	536	6	8.7	EAPD 2003
2013	Europa	Turkiye	Sonmez et al	4018	309	7-12	7.7	mDDE
2013	Europa	Germany	Kohlboeck et al	1126	154	10	13.7	EAPD 2003
2014	Europa	Germany	Petrou et al	2395	242	8-9	10.1	EAPD 2003
2015	Europa	Great Britain	Balmer et al	3233	355	12	11.0	mDDE
2015	Europa	Greece	Kevrekidou et al	2335	490	8-14	21	EAPD 2003
2016	Europa	Albania	Hysi et al	1575	220	8-10	14	EAPD 2003
2018	Europa	Turkiye	Koruyucu	1511	215	8-11	14.2	EAPD 2003

Table 5. Continued

2018	Europa	Germany	Kuhnisch et al	1302	224	15	17.2	EAPD 2003
2018	Europa	Austria	Buchgraber et al	1111	78	6-12	7	EAPD 2003
2019	Europa	Poland	Glodkowska	1437	38 165	6-12	2.7-11.5	EAPD 2003
2019	Europa	Turkiye	Kilinc et al	1237	142	9-10	11.5	EAPD 2003
2021	Europa	Germany	Amend et al	2103	97 186	6-12	9.4 17.4	EAPD 2003
2021	Europa	Greece	Kevrekidou et al	1156	244	14-16	22.9	EAPD 2003
2022	Europa	Italia	Nisii et al	3611	63	8	18.2	EAPD 2003
2022	Europa	Switzerland	Abdelaziz et al	30000	198	4-12	6.6	EAPD 2003
2023	Europa	Switzerland	Grieshaber et al	1252	185	7-15	14.8	EAPD 2003
			Total	90042	6631	7.3 %		

Table 6. Total worldwide studies on the prevalence of ICH by region, in study samples of over 1000 children (1987-2023)

Region	Sample	Affeceted MIH	Age (yr)	Prevalence (%)	Selection Criteria
Asia	81954	8812	3-18	10.7 %	EAPD 2003
Africa	6904	344	6-12	4.9 %	EAPD 2003
America	12324	2193	6-17	17.7 %	EAPD 2003
Europe	90042	6631	4-17	7.3 %	EAPD 2003
Total	191224	17980		9.4 %	

DISCUSSION

Of the 80 selected studies, 69 used the 2003 EAPD classification for 86.2% (Table 1). In other words, most of the studies on MIH are already using the 2003 EAPD classification. Lopes et al[7], 2021 confirm that the estimates of the studies that use this classification are significantly different from the studies with alternative classifications (categorized like others")

The global prevalence of 9.4% will only be valid for studies that have the aforementioned characteristic. (Table 1). Of the 80 papers evaluated in this review (Table 1), the ones closest to the worldwide prevalence of 9.4% in Europe are those

of: (Jasulaityte et al. 2008)[15], with 9.7% in Lithuania, (Lygidakis et al. (b), 2008)[16], with 10.2 % in Greece, Condó et al[23] in Italy in 2012 with 7.3%, in Germany there are those of (Petrou et al. 2014)[29] with 10.1%, (Amend et al. 2021)[73], with 9.4%. In Great Britain there was the work of (Balmer et al. 2015)[35], with 11%, in Austria Buchgrabe (2018)[54] with 7%, Sonmez et al[26], in Turkey in 2013 with 7.7%, and Elfrink et al[24] 2012 in the Netherlands with 8.7%.

In Asia there are the works of: (Parikh et al. 2012)[25], India with 9.2 %, (Bhaskar and Hegde)[31] with 9.4 %, (Yannam et al. 2016)[44] with 9.7 %, (Kirthiga et al 2015)[37] with 8.9%, (Krishnan et al 2015)[39] with 7.3%, (Goyal et al 2019)[61] with 7.9%, (Verma et al 2022)[77] in India with 7.6% and (Karimi et al 2015)[41] in Iran with 9.5%. In China there is the work of (Yi et al. 2021)[72], with 10%. In Turkey that of (Kilinc et al. 2019)[58], with 11.5 %, in Israel that of (Berestein et al. 2023)[82] with 10.3 %. And In America, the work of (Mejía et al. 2019)[59], (11.5%) in Colombia and the work of Hanan et al[34], in 2015 in Brazil with 9.12%.

Similar results were obtained by Abo ELSoud et al[62] (2019) with (9.98%), in the cities of the Suez Canal sector. According to (Einollahi et al. 2020)[84], in studies carried out in European populations they have reported that the prevalence of ICH was 10% among the Swedes and the Dutch, 6% among the Germans, 16% among the Italians, 5% among Bulgarians and 28% among Danes. On the other hand (Sara et al. 2023)[85], in the Middle East, they stated that the frequency of MIH reported varies from 2.3% to 40.7%, with a mean prevalence of 15.05%. And (Salgadom et al. 2016)[2]. (Zhao et al. 2018)[86] and (Dave and Taylor 2018)[87], found an overall pooled prevalence of ICH of 14.2%. Bukhari et al[9] in (2022), found a global mean prevalence of 15%. And Schwendicke et al[88] in (2018) revealed that the global prevalence of 99 studies from 43 countries, included in their study was 13.1%.

It was also evaluated which studies had a percentage lower than 9.4% (Table 1), and there were a total of 24 studies that had that figure. Of these, 16 studies presented the lowest figures, and among them we have those by (Clavedetscher 1997)[11], (6.4%) and (Lygidakis et al[16](b),2008), (5.7%), (Dietrich et al. 2003)[12] (5.6%), (Preusser et al. 2007)[14], (5.9%) both in Germany, that of (Cho et al. 2008)[17], in China (2.8%), that of (Kukleva et al. al. 2008)[19], (3.58) in Bulgaria, (Rodríguez et al. 2020)[36], (2.5%) and (de Lira et al. 2021)[71], (3.9%) in Brazil, (Saber et al. 2018)[53], (2.3%) in Egypt, and India: (Subramanian et al. 2016)[45], (0.48%), (Goswani et al. 2019)[57], (1.17%), (Emmaty et al. 2020)[63], (4.1%), (Thakur et al. 2020)[64], (2.9%), (Ray et al. 2020)[65], (5.7%), (Tarannum Ravichandra et al[74] 2021), (2 ,1%) and (Khan et al[78] 2022), (3.9%), in Iran (Shojaeepour et al[66] 2020) with 5.14%. These studies correspond to the study by McCarra et al[89] (2022), where the global prevalence was 6.8%.

The investigations in this study were stratified by region (Tables 1-5), and it was observed that in Asia with this characteristic there are 34 studies for a total population of 81,954 children and of these, 8,812 present MIH for 10.7% in the region. In Africa, only 4 studies were counted with a total population sample of 6904 children, of which 344 children present MIH for 4.9%. This result had a fairly representative sample, but there are only 4 studies. In America, 10 works were registered, with a total sample of 12,324 children and of them 2,193 presented MIH for 17.7%. And in Europe there are 27 jobs with a total sample of 90,042 children, of which 6,631 presented MIH for 7.3%. This was also corroborated by (Zhao et al. in 2018)[86] and (Lopes et al. 2021)[7], who refer that the highest result of MH prevalence was in America and the lowest was in Africa. However, it was possible to

corroborate that in the United States the investigations of (Hartsock et al. 2020)[90], (Ahmed et al. 2021)[91], (Davenport et al. 2019)[92], had prevalences that were close to the global prevalence of this study.

By stratifying the data based on continents, it allows prevalence rates to be representative of the global burden of MIH for each region. When summarizing all the regions studied (Table 6), a total sample of 191,224 children was given, of which 17,980 presented MIH for a 9.4% global prevalence. And when making a comparison between the regions studied, it was observed that the American region has a higher percentage of cases of MIH with 17.7%, and that in Europe and Asia the values found were similar with 7.3 and 10.7% respectively, and both approached the global prevalence of 9.4%. In this regard, the study carried out by Shetty et al[93] (2023), grouping 7 regions of India, with a total of 25,273 children, with an estimated 10% of MIH of the total prevalence in the region.

In this study it was possible to verify the total prevalence and by regions of the ICH in the world, in studies with samples of over 1000 children, where it had variations between the different regions.

CONCLUSIONS

It is concluded that MHI has a moderate incidence worldwide, although there are regions where the prevalence is high, and this was verified in studies with samples of over 1000 children from 1987 to 2023, with an age variation from 3 up to 18 years of age, and using the 2003 EAPD classification.

When making a comparison between the regions studied, it can be observed that there were variations between the regions and that the American region has a higher percentage of cases of MIH and in Europe and Asia the values found are similar, and both are close to the global prevalence. A global prevalence of MIH are 9.4%.

REFERENCES

1. Paglia L. Molar Incisor Hypomineralization: paediatricians should be involved as well! Eur J Paediatr Dent 2018;19:173-181

2. Salgadom A, García V, Torres A, Mateos M, Ribas D, et al. Prevalencia del síndrome de hipomineralización incisivo-molar: revisión de la literatura. Odontol Pediatr 2016;24:134-148

3. Barros CR, Cavalcanti AL. Molar incisor hypomineralization: A challenge of pediatric dentistry? J Oral Res 2018;7:84-85

4. Weerheijm K, Duggal M, Mejare I, Papagiannoulis L, Koch G, Martens LC. Judgement criteria for molar incisor hypomineralisation (MIH) in epidemiologic studies: a summary of the European meeting on MIH held in Athens. Eur J Paediatr Dent 2003;4:110–123

5. Garg N, Jain AK, Saha S, & Singh J. Essentiality of early diagnosis of molar incisor hypomineralization in children and review of its clinical presentation, etiology and management. Int J Clin Pediatr Dent 2012;5:190–196

6. Koruyucu M, Özel S, Tuna EB. Prevalence and etiology of molar-incisor hypomineralization (MIH) in the city of Istanbul. J Dent Sci 2018;13:318–328

7. Lopes LB, Machado V, Mascarenhas P, Mendes JJ, Botelho J. The prevalence of molar-incisor hypomineralization: a systematic review and meta-analysis. Sci Rep 2021;11:22405

8. Afshari E, Dehghan F, Vakili MA, Abbasi M. Prevalence of Molar-incisor hypomineralization in Iranian children - A systematic review and narrative synthesis. BDJ open 2022;8:15-22

9. Bukhari ST, Alhasan HA, Qari MT, Sabbagh HJ, Farsi NM. Prevalence and risk factors of molar incisor hypomineralization in the Middle East: A systematic review and meta-analysis. J Taibah Univ Med Sci 2022;18:696–710

10. Koch G, Hallonsten AL, Ludvigsson N, Hansson BO, Holst A, Ullbro C. Epidemiologic

study of idiopathic enamel hypomineralization in permanent teeth of Swedish children. Community Dent Oral Epidemiol 1987;15:279–285

11. Lygidakis, N. A., Dimou, G., & Briseniou E. Molar-incisor-hypomineralisation. Retrospective clinical study in Greek children. I. Prevalence and defect characteristics. Eur Arch Paediatr Dent 2008;9:200–206

12. Dietrich G, Sperling S, Hetzer G. Molar-Incisor-Hypomineralisation in a group of children and adolescents living in Dresden (Germany). Eur J Paediatr Dent 2003;3: 133-137

13. Kosem R, Senk Erpic A, Kosir N, Kastelec D. Prevalence of enamel defects with emphasis on molar-incisorhypomineralisation in Slovenian children and adolescents. Barcelona, Spain. 7th Congress of the EAPD. 2004.

14. Preusser S, Ferring V, Wleklinski C, Wetzel WE. Prevalence and severity of molar incisor hypomineralization in a region of Germany -- a brief communication. J Public Health Dent 2007;67:148-150

15. Jasulaityte L, Weerheijm KL, & Veerkamp JS. Prevalence of molar-incisor-hypomineralisation among children participating in the Dutch National Epidemiological Survey. Eur Arch Paediatr Dent 2008;9:218–223

16. Lygidakis NA, Dimou G, Briseniou E. Molar incisor hypomineralisation (MIH). Retrospective clinical study in Greek children. I. Prevalence and defect characteristics. Eur Arch Paediatr Dent 2008;9(4):200–6.

17. Cho SY, Ki Y, & Chu V. Molar incisor hypomineralization in Hong Kong Chinese children. Int J Paediat Dent 2008;18:348–352

18. Kemoli AM. Prevalence of molar incisor hypomineralisation in six to eight year-olds in two rural divisions in Kenya. East African Med J 2008;85:514–519

19. Kukleva, MP., Petrova, SG, Kondeva, VK, Nihtyanova, TI. Molar incisor hypomineralisation in 7-to-14-year-old children in Plovdiv, Bulgaria--an epidemiologic study. Folia Médica 2008;50:71–75

20. Zawaideh FI, Al-Jundi SH, & Al-Jaljoli MH. Molar incisor hypomineralisation: prevalence in Jordanian children and clinical characteristics. Eur Arch Paediatr Dent 2011;12:31–36

21. Fnaish MM, Alawneh AM, Da'ameh M, Al-Share AA. Dental anomalies in children in north Jordan. Pakistan Oral Dent J 2011;31:309e314

22. Biondi AM, Córtese SG, Babino L, & Toscano MA. Molar incisor hypomineralization: Analysis of asymmetry of lesions. Hipomineralización Molar Incisiva: Análisis de la asimetría de las lesiones. Acta Odontol Latinoamericana 2019;32:44–48

23. Condò R, Perugia C, Maturo P, & Docimo R. MIH: epidemiologic clinic study in paediatric patient. ORAL & implantology 2012;5:58–69

24. Elfrink ME, Ghanim A, Manton DJ, Weerheijm KL. Standardised studies on Molar Incisor Hypomineralisation (MIH) and Hypomineralised Second Primary Molars (HSPM): a need. Eur Arch Paediatr Dent 2015;16:247–255

25. Parikh D, Ganesh M, Bhaskar V. Prevalence, and characteristics of Molar Incisor Hypomineralisation (MIH) in the child population residing in Gandhinagar, Gujarat, India. Eur Arch Paediatr Dent 2012;13:21–26

26. Sönmez H, Yıldırım G & Bezgin T. Putative factors associated with molar incisor hypomineralisation: An epidemiologicalstudy. Eur Arch Paediatr Dent 2013;14:375–380

27. Kohlboeck G, Heitmueller D, Neumann C, Tiesler C, Heinrich J, Heinrich-Weltzien R, Hickel R, Koletzko S, Herbarth O, Kühnisch J, & GINIplus Study Group, LISAplus Study Group.Is there a relationship between hyperactivity/inattention symptoms and poor oral health? Results from the GINIplus and LISAplus study. Clinical oral investigations 2013;17:1329–1338

28. Jeremias F, de Souza JF, Silva CM, Cordeiro RdeC, Zuanon AC, & Santos-Pinto L. Dental caries experience and Molar-Incisor Hypomineralization. Acta Odontol Scand 2013;71:870–876

29. Petrou MA, Giraki M, Bissar AR, Basner R, Wempe C, Altarabulsi MBet al. Prevalence of Molar-Incisor-Hypomineralisation among school children in four German cities. Int J Paediat Dent 2014;24:434–440

30. Mittal NP, Goyal A, Gauba K, Kapur A. Molar incisor hypomineralisation: Prevalence and clinical presentation in school children of the northern region of India. Eur Arch Paediatr Dent 2014;15:11–18

31. Bhaskar S, Hegde S. Molar-incisor hypomineralization: prevalence, severity, and clinical characteristics in 8- to 13-year-old children of Udaipur, India. J Indian Soc Pedod Prev Dent 2014;32:322–329

32. López Jordi MC, Cortese SG, Álvarez L, Salveraglio I, Ortolani AM, Biondi AM. Comparison of the prevalence of molar incisor hypomineralization among children with different health care coverage in the cities of Buenos Aires (Argentina) and Montevideo (Uruguay)]. Salud Colectiva 2014;10:243–251

33. Noori AJ, Hussein SA. Molar-incisor hypomineralisation (MIH) among Kurdish children in Sulaimani City, Iraq. Sulaimani Dent J 2014;1:45e50

34. Hanan S. Simone OAF, Ary OM, Loiola C, Santos PL, Cilence Z et al. Molar-incisor hypomineralization in schoolchildren of Manaus, Brazil. Pesqui Bras Odontopediatr Clín Integr 2015;15:309–317

35. Balmer R, Toumba KJ, Munyombwe T, Godson J, Duggal MS. The prevalence of incisor hypomineralisation and its relationship with the prevalence of molar incisor hypomineralisation. Eur Arch Paediatr Dent 2015;16:265–269

36. Rodrigues F, Ribeiro P, Thomaz E, Lima G, Neves P, Ribeiro C. Molar-incisor hypomineralization in school children of São Luis, Brazil Maranhão: Prevalence and associated factors. Pesqui Bras Odontopediatr Clín Integr 2015;15:271–278

37. Kirthiga M, Poornima P, Praveen R, Gayathri P, Manju M, Priya M. Prevalence and severity of molar incisor hypomineralization in children aged 11-16 years of a city in Karnataka, Davangere. J Indian Soc Pedod Prev Dent 2015;33:213–217

38. Kevrekidou A, Kosma I, Arapostathis K, Kotsanos N. Molar Incisor Hypomineralization of Eight- and 14-year-old Children: Prevalence, Severity, and Defect Characteristics. Pediatr Dent 2015;37:455–461

39. Krishnan R, Ramesh M, Chalakkal P. Prevalence and characteristics of MIH in school children residing in an endemic fluorosis area of India: an epidemiological study. Eur Arch Paediatr Dent 2015;16:455–460

40. Ng JJ, Eu OC, Nair R, Hong CH. Prevalence of molar incisor hypomineralization (MIH) in Singaporean children. Int J Paediat Dent 2015;25:73–78

41. Karimi M, Yousefimoradi A. Prevalence of molar incisor hypomineralization in eight to twelve-year-old students of Kermanshah. 2015. Kermanshah University of medical Sciences. in Afshari E, Dehghan F, Vakili MA, Abbasi M. Prevalence of Molar-incisor hypomineralization in Iranian children: A systematic review and narrative synthesis. BDJ open 2022;8:15-22

42. Tourino LF, Corrêa-Faria P, Ferreira RC, Bendo CB, Zarzar PM, Vale MP. Association between Molar Incisor Hypomineralization in Schoolchildren and Both Prenatal and Postnatal Factors: A Population-Based Study. PloS One 2016;11:e0156332

43. Mishra A, Pandey RK. Molar Incisor Hypomineralization: An Epidemiological Study with Prevalence and Etiological Factors in Indian Pediatric Population. Int J Clin Pediatr Dent 2016;9:167–171

44. Yannam S, Amarla D, Rekha C Prevalence of molar incisor hypomineralization in school children aged 8-12 years in Chennai. J Indian Soc Pedod Prev Dent 2016;34:134–138

45. Subramaniam P, Gupta T, & Sharma A. Prevalence of molar incisor hypomineralization in 7-9-year-old children of Bengaluru City, India. Contem Clin Dent 2016;7:11–15

46. Hysi D, Kuscu OO, Droboniku E, Toti C, Xhemnica L, Caglar E. Prevalence and aetiology of Molar-Incisor Hypomineralisation among children aged 8-10 years in Tirana, Albania. Eur J Paediatr Dent 2016;17:75–79

47. Gurrusquieta BJ, Núñez VM, López ML. Prevalence of Molar Incisor Hypomineralization in Mexican Children. J Clin Pediatr Dent 2017;41:18–21

48. Shin J, Kim J, Kim S. Prevalence and Clinical Features of Molar-Incisor Hypomineralization in

Adolescents in Yangsan. Korean Acad Pediatr Dent 2017;44:210-219

49. Salem K, Azarbaan S. An investigation of prevalence predictive factors of Molar-Incisor Hypomineralization in Rasht. Iran J Mashhad Dent Sch 2017; 41:31–40.

50. Salari A, Khanmohammadi R, Seraj B. Prevalence of Molar-incisor hypomineralization in 7-12-year-old children in Tehran. 2016. Tehran University of Medical Sciences in Afshari, E., Dehghan, F., Vakili, M. A., & Abbasi, M. Prevalence of Molar-incisor hypomineralization in Iranian children: A systematic review and narrative synthesis. BDJ open 2022;8:15

51. Saitoh M, Nakamura Y, Hanasaki M, Saitoh I, Murai Y, Kurashige Y et al Prevalence of molar incisor hypomineralization and regional differences throughout Japan. Environ Health Prev Med 2018;23:55-62

52. Kühnisch J, Kabary L, Malyk Y, Rothmaier K, Metz I, Hickel R et al. Relationship between caries experience and demarcated hypomineralised lesions (including MIH) in the permanent dentition of 15-year-olds. Clin Oral Investig 2018;22:2013–2019

53. Saber F, Waly N, Moheb D. Prevalence of molar incisor hypomineralisation in a group of Egyptian children using the short form: a cross-sectional study. Eur Arch Paediatr Dent 2018;19:337–345

54. Buchgraber B, Kqiku L, Ebeleseder KA. Molar incisor hypomineralization: proportion and severity in primary public-school children in Graz, Austria. Clin Oral Investig 2018;22:757–762

55. Vargas-Ferreira F, Peres MA, Dumith SC, Thomson WM, Demarco FF. Association of Pre-Peri- and Postnatal Factors with Developmental Defects of Enamel in Schoolchildren. The Journal of clinical pediatric dentistry 2018;42:125–134

56. Glodkowska N, Emerich K. Molar Incisor Hypomineralization: prevalence and severity among children from Nothern Poland. Eur J Paediatr Dent 2019;20:59–66

57. Goswami M, Bhushan U, Pandiyan R, Sharma S. Molar Incisor Hypomineralization-An Emerging Burden: A Short Study on Prevalence and Clinical Characteristics in Central Delhi, India. Int J Clin Pediatr Dent 2019;12:211–214

58. Kılınç G, Çetin M, Köse B, Ellidokuz H. Prevalence, aetiology, and treatment of molar incisor hypomineralization in children living in Izmir City (Turkey). Int J Paediat Dent 2019;29:775–782

59. Mejía JD, Restrepo M, González S, Álvarez LG, Santos-Pinto L, Escobar A. Molar Incisor Hypomineralization in Colombia: Prevalence, Severity and Associated Risk Factors. J Clin Pediat Dent 2019;43:185–189

60. Rai PM, Jain J, Raju AS, Nair RA, Shashidhar K, Dsouza S. Prevalence of Molar Incisor Hypomineralization among School Children Aged 9 to 12 Years in Virajpet, Karnataka, India. Maced J Med Sci 2019;7:1042–1046

61. Goyal A, Dhareula A, Gauba K, Bhatia SK. Prevalence, defect characteristics and distribution of other phenotypes in 3- to 6-year-old children affected with Hypomineralised Second Primary Molars. Eur Arc Paediatr Dent 2019;20:585–593

62. Abo ElSou AA, Mahfouz SM. Prevalence and severity of molar incisor hypomineralization in school children of Suez canal region: cross-sectional study. Egypt Dent J 2019;65:909-915

63. Emmatty TB, Eby A, Joseph MJ, Bijimole J, Kavita K, Asif I. The prevalence of molar incisor hypomineralization of school children in and around Muvattupuzha, Kerala. J Indian Soc Pedod Prev 2020;38:14–19

64. Thakur H, Kaur A, Singh N, Singh R, & Kumar S. Prevalence and Clinical Characteristics of Molar-Incisor Hypomineralization in 8-16-year-old Children in Industrial Town of Solan District of Himachal Pradesh. Int J Clin Pediatr Dent 2020;13:230–234

65. Ray P, Mohanty UK, Sethi,D, Mahakur M,Sharma G. Prevalence and Treatment Need of Molar Incisor Hypomineralisation in 8-12 Year Old School Going Children of Cuttack, Odisha,J Clin of Diagn ReS 2020;14:ZC05-ZC09

66. Shojaeepour S, Jalali F, Shokrizadeh M, Riahi Madvar R, TorabiPariziM, Shojaeipour R. Assessing the prevalence ofmolar-incisor hypomineralization and its effects on oral health-related quality of life in children aged 8-12 years in

the city of Kerman, Iran Saeedeh. J Oral Heal Oral Epidemiol 2020;9:143-148

67. Hamdan M, Abu-Ghefreh EA, Al-Abdallah M, Rajab LD. The prevalence and severity of molar incisor hypomineralization (MIH) among 8 year-old children in Amman, Jordan. Egypt Dent J 2020;66:1989-1997

68. Osman S, Elmasry E, Abd Al Gawad R. Prevalence of molar incisor hypominerlization among a group of Egyptian children: a cross sectional study. Egypt Dent J 2020;66:2021-2028

69. Kevrekidou A, Kosma I, Kotsanos I, Arapostathis KN, Kotsanos N. Enamel opacities in all other than Molar Incisor Hypomineralisation index teeth of adolescents. Int J Paediatr Dent 2021;31:270–277

70. Arheiam A, Abbas S, Ballo L, Borowis E, Rashwan S, El Tantawi M. Prevalence, distribution, characteristics and associated factors of molar-incisor hypo-mineralisation among Libyan schoolchildren: a cross-sectional survey. Eur Arch Paediatr Dent 2021;22:595–601

71. de Lira A de LS, Sousa FJ, de Sousa FDC, de Fontenele MKV, Ribeiro CKC, Ferreira LEG. Prevalence and predisponent factors of molar-incisor hypomineralization in primary dentition. Braz J Oral Sci 2021;20:e211202

72. Yi X, Chen W, Liu M et al. Prevalence of MIH in children aged 12 to 15 years in Beijing, China. Clin Oral Investig 2021;5:355–361

73. Amend S, Nossol C, Bausback-Schomakers S, Wleklinski C, Scheibelhut C, Pons-Kühnemann J et al. Prevalence of molar-incisor-hypomineralisation (MIH) among 6-12-year-old children in Central Hesse (Germany). Clin Oral Investig 2021;25:2093–2100

74. Tarannum, Ravichandra KS, Muppa R, Srikanth K, Kantipudi MJ, Ram KC. Molar Incisor Hypomineralization Prevalence in the Schoolchildren of Gannavaram Mandal, Krishna District, Andhra Pradesh, India: A Cross-sectional Study. Int J Clin Pediatr Dent 2021;14:737-740

75. Padmanabhan V, Anas R, Osama R. Molar Incisor Hypomineralization Prevalence and Distribution in School Going Children in UAE. J Pediatr Dent 2021;7:115-120

76. Nisii F, Mazur M, De Nuccio C et al. Prevalence of molar incisor hypomineralization among school children in Rome, Italy. Sci Rep 2022;12:7343

77. Verma S, Dhinsa K, Tripathi AM, Saha S, Yadav G, Arora D. Molar Incisor Hypomineralization: Prevalence, Associated Risk Factors, Its Relation with Dental Caries and Various Enamel Surface Defects in 8-16-year-old Schoolchildren of Lucknow District. Int J Clin Pediatr Dent 2022;15:1–8

78. Khan A, Garg N, Mayall SS, et al. Prevalence, Pattern, and Severity of Molar Incisor Hypomineralization in 8–12-year-old Schoolchildren of Moradabad City. Int J Clin Pediatr Dent 2022;15:168–174

79. Abdelaziz M, Krejci I, Banon J. Prevalence of Molar Incisor Hypomineralization in over 30,000 Schoolchildren in Switzerland. J Clin Pediatr Dent 2022;46:1–5

80. Grieshaber A, Waltimo T, Haschemi AA, Erb J, Steffen R, Bornstein MM, & Kulik EM. Prevalence of and factors associated with molar-incisor hypomineralisation in schoolchildren in the canton of Basel-Landschaft, Switzerland. Clin Oral investig 2023;27:871–877

81. Al-Nerabieah Z, AlKhouli M, Dashash M. Prevalence and clinical characteristics of molar-incisor hypomineralization in Syrian children: a cross-sectional study. Sci Rep 2023;13:8582

82. Berenstein Ajzman G, Dagon N, Iraqi R, Blumer S, Fadela S. The Prevalence of Developmental Enamel Defects in Israeli Children and Its Association with Perinatal Conditions: A Cross-Sectional Study. Children 2023;10:903

83. Souza JF, Jeremias F, Costa-Silva CM, Santos-Pinto L, Zuanon AC, Cordeiro RC. A etiology of molar-incisor hypomineralisation (MIH) in Brazilian children. Eur Arch Pediat Dent 2013;14:233-238

84. Einollahi M, Hekmatfar S, Molaei M. Association between molar incisor hypomineralization and both prenatal and postnatal factors in 8 -10 years old children in ardebil. J Evolution Med Dent Sci 2020;9:3606-3610

85. Sara T, Hussain A, Majd T, Heba J, Najat M. Prevalence and risk factors of molar incisor hypomineralization in the Middle East: A systematic review and meta-analysis. J Taibah Univ Med Sci 2023;18:1-12

86. Zhao D, Dong B, Yu D, Ren Q, Sun Y The prevalence of molar incisor hypomineralization: evidence from 70 studies. Int J Paediatr Dent 2018;28:170–179

87. Dave M, & Taylor G. Global prevalence of molar incisor hypomineralisation. Evidence-based Dentistry 2018;19:78–79

88. Schwendicke F, Elhennawy K, Reda S, Bekes K, Manton DJ, Krois J. Global burden of molar incisor hypomineralization. J Dent 2018;68:10–18

89. McCarra C, Olegário IC, O'Connell AC, Leith R. Prevalence of hypomineralised second primary molars (HSPM): A systematic review and meta-analysis. Int J Paediatr Dent 2022;32:367–382

90. Hartsock LA, Burnheimer J, Modesto A, & Vieira AR . A Snapshot of the Prevalence of Molar Incisor Hypomineralization and Fluorosis in Pittsburgh, Pennsylvania, USA. Pediatr Dent 2020;42:36–40

91. Ahmed AT, Soto-Rojas A, Dean J, Eckert GJ, & Martinez-Mier EA. Demarcated Primary Second Molar Hypomineralization: Prevalence Data and Associated Sociodemographic Determinants from Indiana. Pediatr Dent 2021;43:443–450

92. Davenport M, Welles AD, Angelopoulou MV, Gonzalez C, Okunseri C, Barbeau L et al. Prevalence of molar-incisor hypomineralization in Milwaukee, Wisconsin, USA: a pilot study. Clin Cosmet Investig Dent 2019;11:109–117

93. Shetty A, Konuri A, Bhat N, Moorkhot S, Raveendran A, Kumar SEP et al. Effects of maternal vitamin deficiency on the microstructure of the maternal hippocampus and behavior in offspring. JTUMED 2023;18:1108–1114

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