

**PENGARUH STATUS GIZI TERHADAP WAKTU ERUPSI GIGI**

**PERMANEN MOLAR SATU MANDIBULA**

**(Literature Review)**

**Karya Tulis Ilmiah**

Untuk memenuhi Sebagian Persyaratan  
Mencapai Gelar Sarjana Kedokteran Gigi



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**PENGARUH STATUS GIZI TERHADAP WAKTU ERUPSI GIGI PERMANEN MOLAR  
SATU MANDIBULA: KAJIAN LITERATURE REVIEW**

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“Jangan Bandingkan Prosesmu Dengan Orang Lain, Karena Tidak Semua Bunga  
Tumbuh Mekar Bersamaan”

### **PERSEMBAHAN**

*Karya Tulis Ini Dipersembahkan Kepada*

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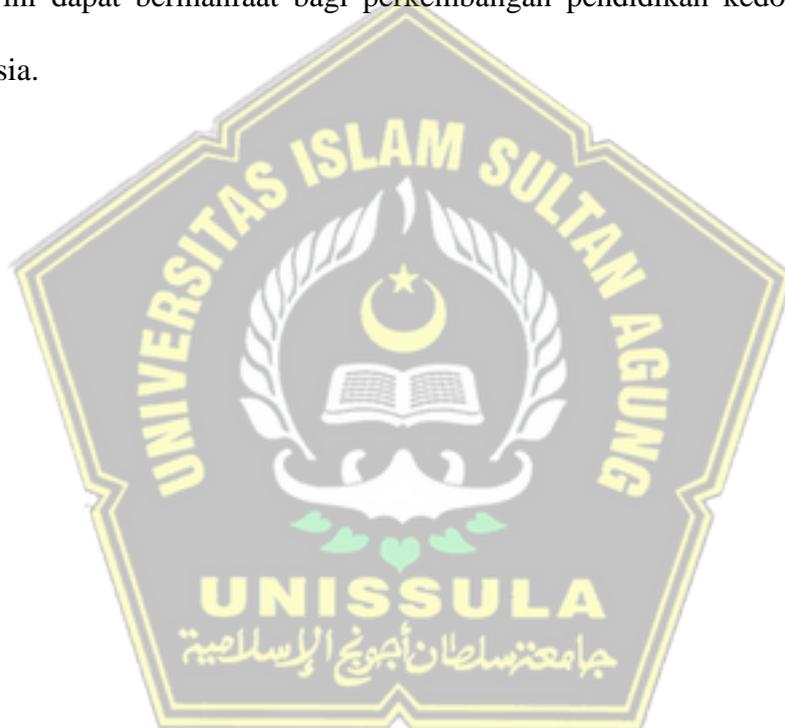
Karya tulis ilmiah ini disusun untuk memenuhi tugas akhir mencapai gelar Sarjana Kedokteran Gigi. Dalam penyusunan karya tulis ini, peneliti mendapatkan banyak masukan, bantuan, bimbingan dan dukungan dari berbagai pihak. Melalui kesempatan ini penulis menyampaikan terima kasih yang tulus kepada:

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## DAFTAR SINGKATAN

|        |   |
|--------|---|
| ABK    | : Anak berkebutuhan khusus  |
| BB/PB  | : Berat badan menurut panjang badan   |
| BB/U   | : Berat Badan menurut Umur  |
| BB/TB  | : Berat badan menurut tinggi badan  |
| BMI    | : <i>Body Mass Index</i>  |
| FDI    | : <i>Federation Dental International</i>  |
| FPM    | : <i>First Permanent Molar</i>  |
| HIV    | : <i>Human Immunodeficiency Virus</i>   |
| IMT/U  | : Indeks Massa Tubuh menurut Umur   |
| M1     | : Molar satu  |
| NHANES | : <i>National Health and Nutrition Examination Survey Home Examination Survey</i> |
| PB/U   | : Panjang Badan menurut Umur  |
| OPG    | : Grafik orto-pento   |
| SDN    | : Sekolah Dasar Negeri  |
| SPM    | : <i>Second Permanent Molar</i>   |
| SFR    | : <i>Salivary flow rate</i>   |
| TB/U   | : Tinggi Badan menurut Umur   |
| WHO    | : <i>World Health Organization</i>  |

## ABSTRAK

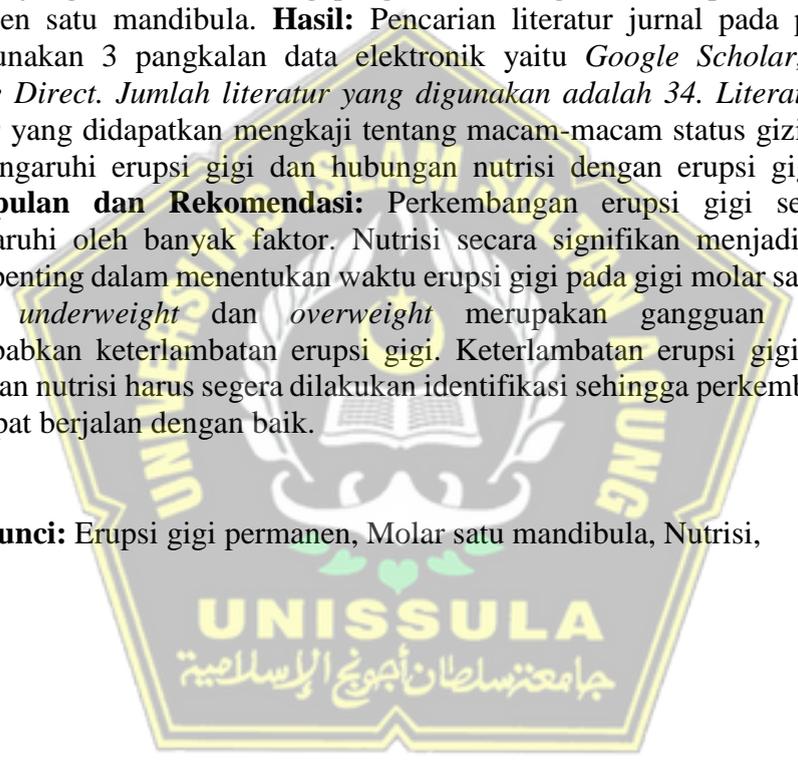
**Latar Belakang:** Nutrisi merupakan faktor utama dalam pemenuhan proses tumbuh kembang anak sehingga dapat berkembang secara optimal sesuai dengan usianya. Peran dari nutrisi adalah meningkatkan fungsi jaringan, memperbaiki sel-sel yang rusak, mempengaruhi pertumbuhan skeletal hingga maturitas tulang, serta perkembangan gigi karena zat gizi yang dibutuhkan pada jaringan dan organ tubuh fungsinya sama dengan rongga mulut. Salah satu perkembangan pada rongga mulut adalah erupsi gigi. Erupsi gigi merupakan suatu proses Bergeraknya gigi yang sedang berkembang dan melalui tulang alveolar serta mukosa yang menutupi rahang menuju kedalam rongga mulut dan mencapai dataran oklusal.

**Tujuan:** Mengkaji literatur yang berkaitan tentang pengaruh status gizi terhadap waktu erupsi gigi permanen satu mandibula.

**Hasil:** Pencarian literatur jurnal pada penelitian ini menggunakan 3 pangkalan data elektronik yaitu *Google Scholar*, NCBI, dan *Science Direct*. Jumlah literatur yang digunakan adalah 34. *Literature research articles* yang didapatkan mengkaji tentang macam-macam status gizi, faktor yang mempengaruhi erupsi gigi dan hubungan nutrisi dengan erupsi gigi permanen.

**Kesimpulan dan Rekomendasi:** Perkembangan erupsi gigi secara normal dipengaruhi oleh banyak faktor. Nutrisi secara signifikan menjadi faktor yang cukup penting dalam menentukan waktu erupsi gigi pada gigi molar satu. Gangguan nutrisi *underweight* dan *overweight* merupakan gangguan yang sering menyebabkan keterlambatan erupsi gigi. Keterlambatan erupsi gigi dikarenakan gangguan nutrisi harus segera dilakukan identifikasi sehingga perkembangan erupsi gigi dapat berjalan dengan baik.

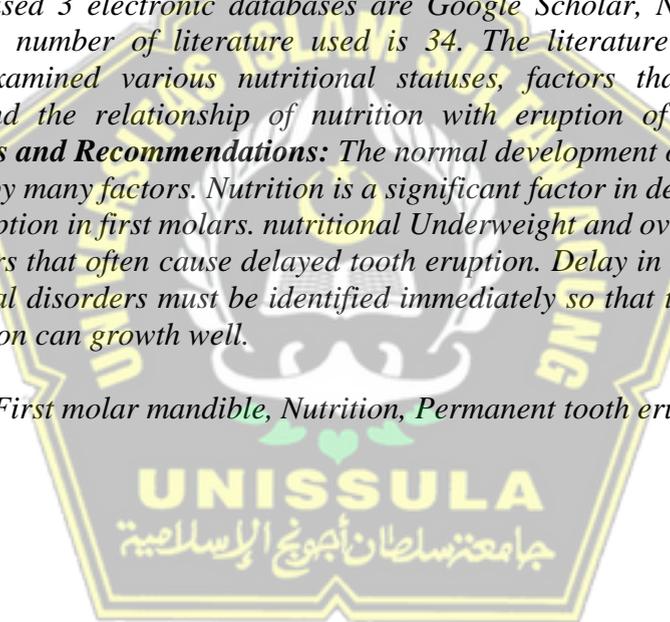
**Kata kunci:** Erupsi gigi permanen, Molar satu mandibula, Nutrisi,



## **ABSTRACT**

**Background:** Nutrition is the main factor in fulfilling the child's growth and development process so that it can develop optimally according to their age. The role of nutrition is to improve tissue function, repair damaged cells, affect skeletal growth to bone maturity, and tooth development because the nutrients needed in body tissues and organs function the same as the oral cavity. One of the developments in the oral cavity is tooth eruption. Tooth eruption is a process of developing tooth movement and through the alveolar bone and jaw toward the mucosal covering into the oral cavity and reach the occlusal plane **Objective:** Review of literature relating about the effect of nutritional status on first molar permanent tooth eruption of the mandible. **Results:** The journal literature search in this study used 3 electronic databases are Google Scholar, NCBI, and Science Direct. The number of literature used is 34. The literature research articles obtained examined various nutritional statuses, factors that influence tooth eruption and the relationship of nutrition with eruption of permanent teeth. **Conclusions and Recommendations:** The normal development of tooth eruption is influenced by many factors. Nutrition is a significant factor in determining the time of tooth eruption in first molars. nutritional Underweight and overweight disorders are disorders that often cause delayed tooth eruption. Delay in tooth eruption due to nutritional disorders must be identified immediately so that the development of tooth eruption can growth well.

**Keywords:** First molar mandible, Nutrition, Permanent tooth eruption,



## **BAB I**

### **PENDAHULUAN**

#### **1.1 Latar Belakang**

Nutrisi merupakan faktor utama dalam pemenuhan proses tumbuh kembang anak sehingga dapat berkembang secara optimal sesuai dengan usianya. Peran nutrisi lainnya adalah untuk meningkatkan fungsi jaringan, memperbaiki sel-sel yang rusak, mempengaruhi pertumbuhan skeletal hingga maturitas tulang, serta perkembangan gigi karena zat gizi yang dibutuhkan pada jaringan dan organ tubuh fungsinya sama dengan rongga mulut. Nutrisi yang diperlukan dalam proses pembentukan gigi dan perkembangan gigi adalah protein, mineral (kalsium, fosfor, fluor), dan vitamin (A, C, dan D) nutrisi-nutrisi inilah yang dapat mempengaruhi gigi selama masa pertumbuhan, maturasi dan setelah erupsi (Zakiyah *et al.*, 2017; Yudiya *et al.*, 2020). Keberadaan protein dalam tubuh sangat berperan pada tahap perkembangan periode prenatal dan postnatal (Evangelista *et al.*, 2018). Defisiensi protein dalam jumlah yang banyak pada tahap tumbuh kembang dapat menyebabkan ukuran gigi yang lebih kecil daripada ukuran normal, penurunan kualitas struktur gigi, kerusakan jaringan periodontal, proses penyembuhan luka yang lebih lambat dan resiko tinggi terjadinya infeksi rongga mulut (Pflipsen *et al.*, 2017). Vitamin D membantu tubuh dalam penyerapan dan regulasi kalsium, fungsi utamanya yaitu mineralisasi tulang dan gigi serta erat kaitannya dengan kalsium dan fosfor, vitamin D mengatur kadar kalsium dan fosfor dalam darah (Raghavan *et al.*, 2019). Defisiensi

vitamin A pada pembentukan gigi primordial dapat mengganggu fungsi sel-sel ameloblast. Defisiensi vitamin C juga dapat menyebabkan terjadi gangguan pembuluh darah di pulpa gigi dan jaringan sekitarnya, sehingga pembentukan gigi dapat terhambat dan erupsi mengalami keterlambatan (Priyatmoko *et al.*, 2019).

Status gizi merupakan keadaan tubuh akibat konsumsi makanan dan penggunaan zat gizi. Status gizi merupakan perwujudan nutrisi seseorang yang dapat ditunjukkan dari bentuk fisik kurus, normal, dan gemuk akibat dari keseimbangan antara pemasukan dan penggunaan zat gizi yang dapat diukur menggunakan antropometri berdasarkan IMT/U dengan mengambil data umur, berat badan, dan tinggi badan anak (Sitinjak, *et al.*, 2019). Pada penelitian sebelumnya, status gizi memiliki peran yang signifikan bagi kematangan tulang dan pertumbuhan skeletal, demikian juga pada perkembangan gigi karena zat gizi yang dibutuhkan pada jaringan dan organ tubuh fungsinya sama dengan rongga mulut (Dimaisip-Nabuab *et al.*, 2018); Priyatmoko *et al.*, 2019). Perkembangan serta pertumbuhan pada gigi dan mulut dipengaruhi oleh zat gizi baik secara local maupun sistemik (Sitinjak, *et al.*, 2019). Mengkaji atau menilai status gizi dapat dilakukan dengan 2 cara, yaitu penilaian status gizi secara langsung dan tidak langsung. Penilaian status gizi secara langsung dengan cara antropometri, pemeriksaan klinis, pemeriksaan dengan biokimia, dan pemeriksaan dengan biofisika. Penilaian status gizi secara tidak langsung dengan cara *survey* konsumsi makanan, pengukuran status gizi dengan statistik vital, dan pengukuran status gizi dengan

faktor ekologi (Lailasari *et al.*, 2018).

Erupsi gigi adalah suatu proses Bergeraknya gigi yang sedang berkembang dan melalui tulang alveolar serta mukosa yang menutupi rahang menuju kedalam rongga mulut dan mencapai dataran oklusal (Kristiani *et al.*, 2017; Raghavan *et al.*, 2019). Pembentukan benih gigi mulai sejak janin berusia 7 minggu dan berasal dari lapisan ektodermal serta mesodermal. Lapisan ektodermal berfungsi membentuk email dan odontoblast, sedangkan mesodermal membentuk dentin, pulpa, sementum, membrane periodontal dan tulang alveolar (Alshukairi, 2019). Mekanisme erupsi gigi permanen melalui beberapa tahap yaitu pertama, tahap pertumbuhan terdapat tahap inisiasi yang merupakan permulaan pembentukan bud gigi dari jaringan epitel mulut, tahap proliferasi yaitu pembiakan dari sel-sel dan perluasan dari organ enamel atau cap stage, tahap histodiferensiasi yaitu spesialisasi dari sel-sel yang mengalami perubahan histologis dalam susunannya, tahap morfodiferensiasi yaitu susunan dari sel-sel pembentuk sepanjang *cemento enamel junction*, tahap aposisi yaitu pengendapan dari matriks enamel dan dentin dalam lapisan tambahan. Kedua, tahap kalsifikasi yang merupakan pengerasan dari matriks oleh pengendapan garam-garam kalsium, kalsifikasi dimulai didalam matriks yang sebelumnya telah mengalami deposisi dengan jalan presipitasi dari satu bagian ke bagian lainya dengan penambahan lapis demi lapis. Ketiga, tahap erupsi merupakan pergerakan gigi ke dalam rongga mulut. Keempat, tahap atrisi yaitu ausnya permukaan gigi karena lamanya pemakaian waktu gigi digunakan. Kelima, tahap resorpsi yang merupakan

penghapusan dari akar-akar gigi susu oleh osteoclast (Yu et al., 2020). Keterlambatan erupsi gigi permanen dapat terjadi secara local (oleh karena trauma dan meyeluruh oleh karena endokrin), gangguan nutrisi dan penyakit sistemik (Bagewadi *et al.*, 2016).

Menurut Permenkes nomer 2 tahun 2020 tentang standar antropometri anak, Indeks Masa Tubuh menurut umur (IMT/U) digunakan untuk menentukan kategori gizi buruk, gizi kurang, gizi baik, berisiko gizi lebih, gizi lebih dan obesitas. Standar Antropometri Anak didasarkan pada parameter berat badan dan panjang/tinggi badan yang terdiri atas 4 indeks, meliputi berat badan menurut umur (BB/U), panjang/tinggi badan menurut umur (PB/U atau TB/U), berat badan menurut panjang/tinggi badan (BB/PB atau BB/TB) dan indeks massa tubuh menurut umur (IMT/U). Indeks massa tubuh menurut umur (IMT/U) anak usia 5 tahun sampai dengan 18 tahun sebagaimana dimaksud pada ayat (1) huruf e digunakan untuk menentukan kategori gizi buruk (*severely thinness*), gizi kurang (*thinness*), gizi baik (*normal*), gizi lebih (*overweight*) dan obesitas (*obese*) (Hayuningtyas *et al.*, 2020).

Data penelitian terdahulu yang berhubungan dengan pengaruh status gizi terhadap waktu erupsi gigi permanen molar satu mandibular, untuk hasil penelitian yang dilakukan dapat disimpulkan bahwa terdapat pengaruh yang signifikan antara status gizi dengan erupsi gigi molar pertama permanen siswa kelas 1 SDN di kecamatan wilayah kota administrasi kabupaten Jember. Pada kategori anak yang kurus erupsi giginya cenderung tertunda jika

dibandingkan dengan anak yang normal dan gemuk. Status gizi anak dapat diketahui dari hasil IMT/U, dan diperoleh hasil bahwa semakin tinggi nilai IMT anak maka erupsi gigi molar pertama permanennya juga semakin cepat erupsi (Zakiyah, *et al.*, 2017)

Waktu erupsi pada gigi merupakan faktor penting dalam menentukan diagnosis, deteksi maloklusi sejak dini, pedoman perencanaan orthodontik dan mengetahui usia pada anak (Arid *et al.*, 2018). Waktu erupsi gigi permanen pada anak pertama kali ditandai dengan erupsi gigi M1 mandibula pada anak usia 6-7 tahun, erupsi gigi M1 permanen juga mempunyai peran penting untuk menyediakan dukungan oklusi yang cukup agar sistem pengunyahan tidak terganggu dan koordinasi pertumbuhan pada wajah anak (Uwitonze *et al.*, 2020). Gigi molar satu mandibula juga menjadi gigi permanen pertama yang rawan terkena karies karena paparan lingkungan di dalam mulut (Girish Babu *et al.*, 2019). Ketika gigi tersebut terkena karies mempunyai potensi untuk dilakukan pencabutan, hal ini dapat menimbulkan masalah baru yang lebih kompleks mulai dari bergesernya gigi geligi disekitar molar satu mandibula hingga mempengaruhi oklusi dan sendi pada rahang dan mengganggu proses mastikasi yang dapat mempengaruhi penyerapan nutrisi dari makanan sehingga nutrisi tersebut tidak terserap dengan baik oleh tubuh (Dimaisip-Nabuab *et al.*, 2018) .

Alasan penulis menulis *literature review* mengenai pengaruh status gizi terhadap waktu erupsi gigi permanen molar satu mandibula adalah untuk memberikan referensi publikasi serta pengetahuan tentang pentingnya

mengetahui status gizi pada anak dan relasinya terhadap waktu erupsi pada gigi permanen molar satu mandibula, sehingga para pembaca dan orang tua dapat melakukan tindakan dan upaya dalam pemeliharaan pertumbuhan gigi pada anak.

Berdasarkan uraian diatas penulis tertarik untuk melakukan review lebih lanjut mengenai pengaruh status gizi terhadap waktu erupsi gigi permanen satu mandibula.

## **1.2 Rumusan Review**

1. Bagaimana pengaruh status gizi terhadap waktu erupsi gigi permanen molar satu mandibula?
2. Bagaimana mengetahui pentingnya waktu erupsi gigi yang tepat dan sesuai usia pada permanen molar satu mandibula?

## **1.3 Tujuan Review**

### **1.3.1 Tujuan Umum**

Tujuan umum tinjauan *literature review* ini adalah untuk mengetahui pengaruh status gizi anak terhadap waktu erupsi gigi permanen molar satu mandibula.

### **1.3.2 Tujuan Khusus**

1. Untuk mengetahui bagaimana pengaruh status gizi anak yang kurang terhadap waktu erupsi gigi permanen molar satu mandibula.

2. Untuk mengetahui bagaimana pengaruh status gizi anak yang sesuai terhadap waktu erupsi gigi permanen molar satu mandibula.
3. Untuk mengetahui bagaimana pengaruh status gizi anak yang berlebih terhadap waktu erupsi gigi permanen molar satu mandibula



## **BAB II**

### **METODE PENELITIAN**

#### **2.1 Pencarian Literatur**

##### **2.1.1 Keyword**

Kata kunci yang digunakan untuk mencari literatur yakni :  
*Eruption time of mandibular first molar permanent tooth, relationship between nutrition status and tooth eruption time.*

##### **2.1.2 Pencarian Informasi**

Database yang digunakan untuk mencari literatur meliputi *Google Scholar, Science Direct, dan NCBI*. Selanjutnya jurnal tersebut diseleksi sesuai dengan kriteria inklusi dan eksklusi. Data jurnal yang didapatkan akan dikumpulkan pada aplikasi *Mendeley*, yang merupakan perangkat lunak untuk membantu penulis manajemen referensi.

#### **2.2 Kriteria Inklusi Dan Eksklusi**

##### **2.2.1 Kriteria Inklusi**

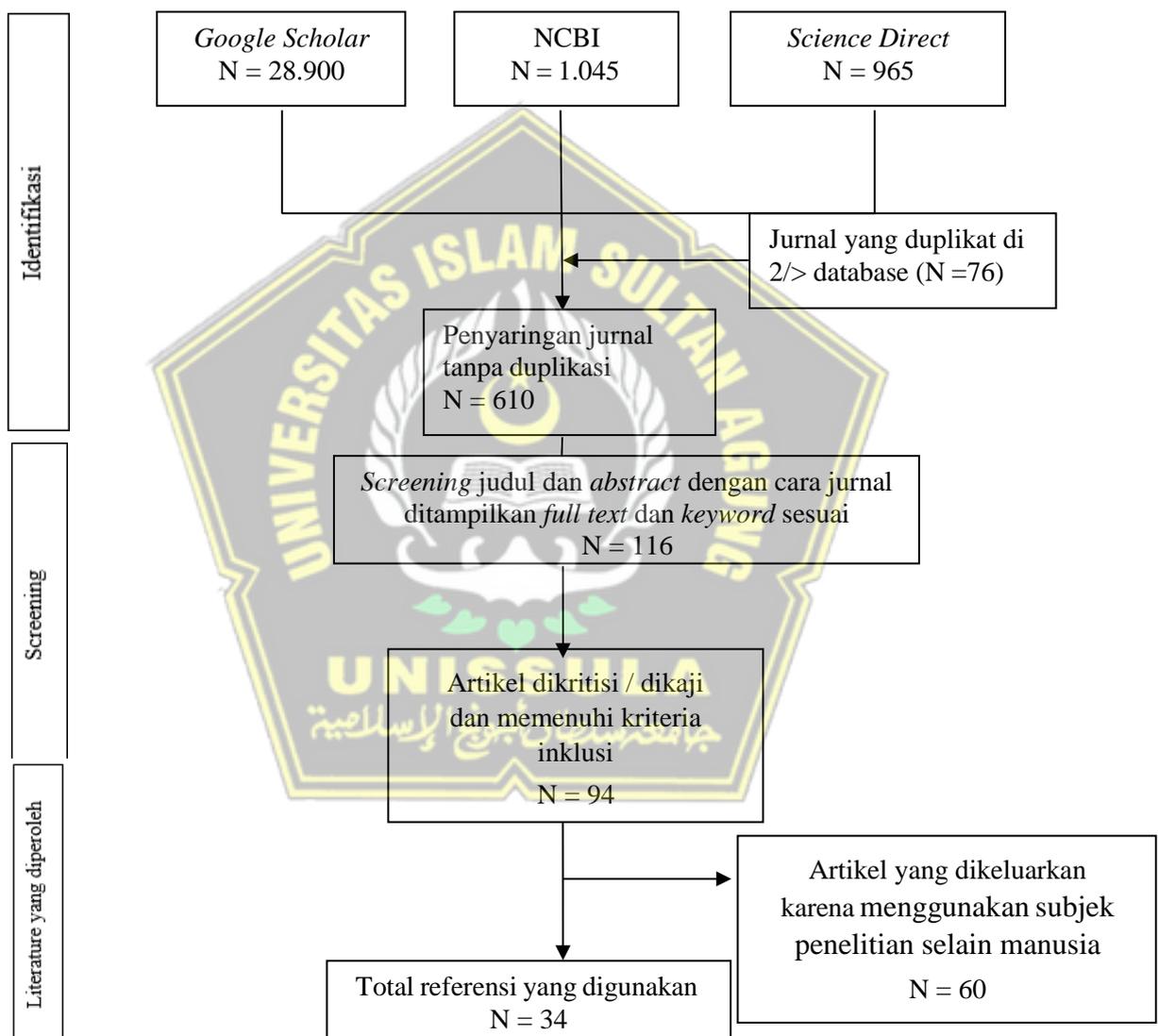
1. Jurnal original artikel penelitian.
2. Jurnal yang dipublikasikan dapat diakses secara *free full text*.
3. Jurnal yang dipublikasikan secara nasional maupun internasional.
4. Jurnal yang diterbitkan dari tahun 2016 hingga 2021.

##### **2.2.2 Kriteria Eksklusi**

1. Jurnal yang tidak menggunakan subjek penelitian manusia.
2. Jurnal yang terduplikasi lebih dari 2 database.

3. Jurnal yang tidak mencantumkan metode penelitian dengan jelas, seperti tidak mencantumkan jenis penelitian observasional atau eksperimental.

### 2.3 Alur Pencarian Literatur



Gambar 2. 1 Alur Pencarian

N : Jumlah Literatur yang Diperoleh

a. Pencarian Data

Dalam penelitian ini peneliti melakukan penelusuran literatur publikasi pada basis data elektronik Google Scholar, NCBI (Pubmed) dan Science Direct dengan menggunakan kata kunci yang digunakan untuk mencari literatur yaitu *Eruption time of mandibular first molar permanent tooth, relationship between nutrition status and tooth eruption time*. Selanjutnya jurnal tersebut diseleksi sesuai dengan kriteria inklusi dan eksklusi. Data jurnal yang didapatkan akan dikumpulkan pada aplikasi *Mendeley*, yang merupakan perangkat lunak untuk membantu penulis memanajemen referensi.

b. *Screening* Referensi

*Screening* merupakan penyaringan atau pemulihan data yang bertujuan untuk memilih masalah penelitian yang sesuai dengan topik yang diteliti, dengan cara melihat kesesuaian judul literatur jurnal dan abstraknya sesuai dengan topik pada *literature review* peneliti. Adapun topik yang sedang diteliti dalam penelitian ini adalah pengaruh status gizi terhadap waktu erupsi gigi permanen molar satu mandibula.

c. Pengkajian Kriteria Inklusi

Setelah dilakukan proses *screening* peneliti mendapatkan jumlah awal literatur yang dimiliki, untuk selanjutnya dilakukan pengkajian data jurnal

yang memenuhi kriteria inklusi peneliti sebagai berikut :

1. Jurnal original artikel penelitian.
2. Jurnal yang dipublikasikan dapat diakses secara *free full text*.
3. Jurnal yang dipublikasikan secara nasional maupun internasional.
4. Jurnal yang diterbitkan dari tahun 2016 hingga 2021.

d. Pengkajian Kriteria Eklusi

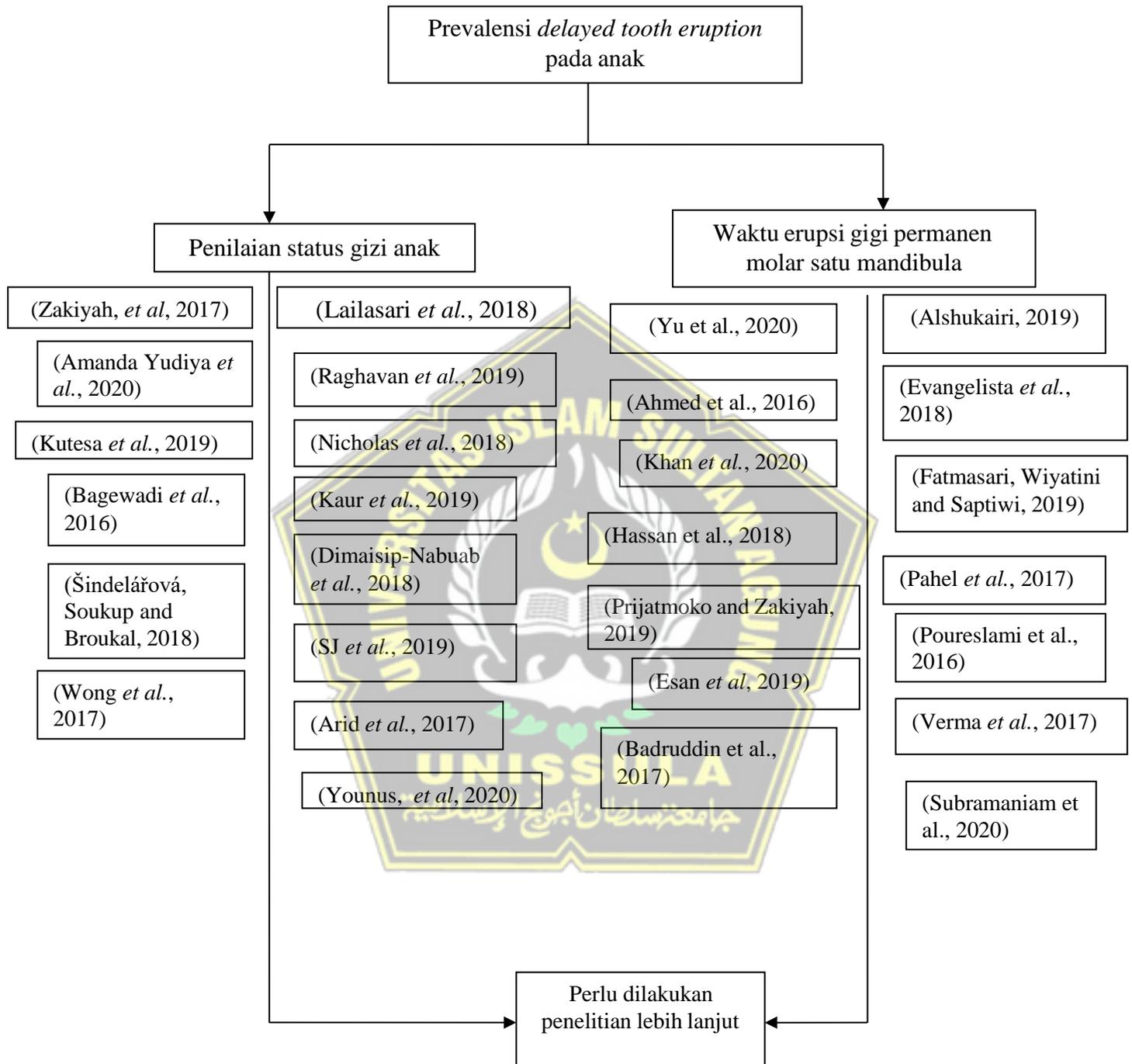
Pengkajian kriteria eklusi merupakan menghilangkan atau mengeluarkan jurnal yang tidak memenuhi kriteria inklusi. Kriteria eklusi pada penelitian ini sebagai berikut :

1. Jurnal tidak menggunakan subjek penelitian manusia.
2. Jurnal yang terduplikasi lebih dari 2 databases
3. Jurnal yang tidak mencantumkan metode penelitian dengan jelas, seperti tidak mencantumkan jenis penelitian observasional atau eksperimental.

Hasil temuan pencarian *Literature Review*

| Pangkalan Data        | Temuan Literatur | Literatur Terpilih |
|-----------------------|------------------|--------------------|
| <i>Google Scholar</i> | 58               | 16                 |
| <i>Science Direct</i> | 32               | 10                 |
| NCBI                  | 24               | 8                  |
| Jumlah                | 114              | 34                 |

## 2.4 Peta Literature Review



Gambar 2. 2 Peta *Literature Review*

### BAB III

#### HASIL DAN PEMBAHASAN

#### 3.1 Hasil

Pencarian literatur jurnal pada penelitian ini menggunakan 3 pangkalan data elektronik yaitu *Google Scholar*, *NCBI*, dan *Science Direct*. Hasil dari pencarian literature tersebut antara lain *Google Scholar* sebanyak 58 jurnal, *NCBI* sebanyak 24 jurnal, dan *Science Direct* sebanyak 32 jurnal sesuai dengan *keywords*. Jurnal tersebut kemudian di *screening* dan didapatkan 34 jurnal. Artikel jurnal tersebut kemudian diseleksi sesuai kriteria inklusi dan eksklusi sehingga didapatkan literature sebanyak 34 jurnal yang terdiri dari 30 jurnal internasional dan 4 jurnal nasional.

**Tabel 3. 1 Hasil Kajian *Literature Review***

| No | Judul   | Pengarang                       | Tujuan Penelitian   | Metode penelitian (meliputi: subjek, rancangan, instrumen, cara penelitian)   | Hasil Penelitian   |
|----|---|---------------------------------|---|---|--|
| 1  | Childhood body mass index is associated with early dental development and eruption in a longitudinal sample from the Iowa Facial Growth Study | (Nicholas <i>et al.</i> , 2018) | Tujuan dari penelitian ini adalah untuk menguji apakah variasi BMI memiliki pengaruh longitudinal pada perkembangan gigi dan waktu erupsi gigi. | Subjek → Sampel kami terdiri dari 77 anak dari Iowa<br>Growth Study berusia 3-5 tahun yang diikuti selama 14 tahun<br>Rancangan → Penelitian longitudinal<br>Cara Penelitian → Subjek memasuki penelitian antara usia 3 dan 5 tahun dan diikuti terus menerus selama 14 tahun berikutnya. Catatan lengkap diambil pada subjek setiap 3 bulan sampai usia 5, setiap 6 bulan antara 5 dan 12 tahun, dan kemudian setiap tahun setelah usia 12. Catatan tersebut meliputi riwayat kesehatan, tinggi badan, | Penelitian sebelumnya menemukan bahwa anak-anak dengan nilai BMI yang lebih tinggi cenderung memiliki perkembangan gigi yang lebih lanjut untuk usia mereka ( $P \setminus 0,001$ ). BMI pada usia 4 tahun merupakan prediktor untuk waktu perkembangan gigi pada usia 12 ( $P \setminus 0,052$ ). Prekositas laju perkembangan gigi dipercepat di seluruh pertumbuhan. Skor perkembangan gigi secara keseluruhan juga berkorelasi dengan usia erupsi gigi untuk gigi taring rahang bawah dan gigi |

|   |   |  |   |   |  |
|---|---|--|---|---|--|
|   |   |  |   | <p>berat badan, kesan algi dari kedua lengkungan, lengkap rontgen mulut, radiografi sefalometri lateral. dan radiografi sefalometri posteroanterior.<sup>26</sup> Untuk menilai erupsi gigi, kami memeriksa radiografi periapikal dan cephalogram posteroanterior untuk setiap subjek. Perkembangan gigi dinilai oleh 1 pengamat (K.K.) dari radiografi periapikal menggunakan metode Demirjian pada usia kurang lebih 4, 8, dan 12 tahun. Usia ini dipilih sebagai titik waktu representatif untuk gigi sulung penuh (usia 4), gigi bercampur awal (usia 8 tahun), dan gigi bercampur akhir (usia 12).</p> | <p>premolar pertama (P \ 0,001). Nilai BMI yang tinggi pada usia muda memprediksi perkembangan gigi lanjutan di kemudian hari, menunjukkan efek BMI jangka panjang pada gigi. pematangan dan menyiratkan perlunya intervensi ortodontik dini pada anak-anak obesitas. Hasil ini menguatkan penelitian sebelumnya, membangun bukti lebih lanjut bahwa erupsi gigi yang relatif dini merupakan konsekuensi lain dari obesitas pada masa kanak-kanak.</p>   |
| 2 | <p>Association between Mean Age of Eruption of the Permanent Teeth and Body Mass Index among School-going Children of 7-17 Years of Age in Chennai City</p> | <p>(Ragha van <i>et al.</i>, 2019)</p> | <p>Tujuan dari penelitian ini adalah untuk mengetahui hubungan antara rata-rata usia erupsi gigi permanen dan Indeks Massa Tubuh (IMT) antara anak usia 7-17 tahun yang bersekolah di kota Chennai.</p> | <p>Subjek → 400 anak sekolah dari usia 7-17 tahun di kota Chennai. Cara Penelitian → Dilakukan oleh satu penguji dan rata-rata 50 anak diperiksa per hari. Pemeriksaan klinis dilakukan untuk menilai status erupsi gigi permanen yang dikategorikan sesuai dengan kriteria yang diberikan oleh Phakala et al (1991). Tinggi dan berat badan individu dicatat dan BMI selanjutnya dihitung.</p>   | <p>Sebanyak 196 (49,1%) laki-laki dan 204 (50,9%) perempuan dinilai. Di antara 400 anak yang dinilai 19 (4,8%) kurus, 321 (80,5%) termasuk kategori normal, 40 (10%) berisiko kelebihan berat badan dan 19 (4,8%) obesitas. Secara keseluruhan, anak perempuan ditemukan mengalami erupsi gigi permanen lebih awal dibandingkan dengan laki-laki. Juga, ditemukan bahwa usia rata-rata erupsi meningkat dengan meningkatnya BMI yang mengindikasikan</p> |

|   |  |                            |   |  |  |
|---|--|----------------------------|---|--|--|
|   |  |                            |   |  | erupsi tertunda pada anak-anak obesitas  |
| 3 | Time of Emergence of Permanent Teeth and Impact of Nutritional Status among 4-15 Years Old Children and Teenagers in Basrah City /Iraq | (Ahmed et al., 2016)       | Tujuan dari penelitian ini adalah untuk mengetahui waktu munculnya gigi permanen rahang atas dan bawah (kecuali molar tiga) dan untuk mengevaluasi pengaruh status gizi dengan pengukuran antropometri terhadap waktu erupsi gigi permanen, telah dilakukan pemeriksaan berdasarkan variasi rahang dan jenis kelamin. | Subjek → empat sampai lima belas tahun anak-anak dan remaja dari taman kanak-kanak dan sekolah di kota Basrah di wilayah selatan Irak. Jumlah sampel terdiri dari 1807 anak dan remaja yang dikumpulkan secara acak dari Taman Kanak-kanak, Sekolah Dasar dan Sekolah Menengah Pertama di Kota Basrah. Rancangan → cross-sectional<br>Cara Penelitian → Pengukuran antropometri tinggi dan berat badan digunakan untuk tujuan penilaian status gizi. Indeks tersebut meliputi: Berat untuk usia, Tinggi untuk usia dan Berat untuk tinggi; masing-masing dianggap sebagai nilai standar deviasi (Z-score) sebagai indikator utama dari underweight, stunting dan wasting. Signifikansi statistik perbedaan rata-rata variabel terdistribusi normal (skor indeks nutrisi z) antara 2 kelompok dinilai dengan uji-t sampel independen. | Hasil penelitian menunjukkan perbedaan yang signifikan ( $p < 0,05$ ) antara waktu munculnya gigi rahang atas dan bawah pada anak perempuan dan laki-laki, dengan kemunculan lebih awal pada anak perempuan, juga gigi rahang bawah muncul sebelum gigi berlawanan rahang atas pada kedua jenis kelamin kecuali untuk gigi premolar. Hasil penelitian menunjukkan bahwa di antara anak-anak dan remaja yang bergizi baik yang dijelaskan berdasarkan tinggi badan untuk indikator status gizi, sebagian besar gigi erupsi secara signifikan lebih awal daripada yang kerdil kecuali gigi seri lateral yang erupsi lebih awal pada anak laki-laki yang terhambat daripada anak laki-laki yang cukup gizi tetapi perbedaan tersebut tidak diterima secara signifikan. Perbedaan terbesar median usia erupsi gigi permanen antara gizi baik dan pendek ditemukan pada anak perempuan pada gigi molar kedua. |
| 4 | Timing of permanent tooth emergence is associated with overweight/obesity  | (Evangalista et al., 2018) | Tujuan dari penelitian ini adalah untuk mengevaluasi hubungan   | Subjek → 192 anak, berusia 9 hingga 12 tahun, dari sekolah umum di Manaus, Amazonas-Brazil   | 127 anak diklasifikasikan sebagai berat badan normal dan 65 diklasifikasikan   |

|   |  |   |   |   |   |
|---|--|---|---|---|---|
|   | y in children from the Amazon region   |   | antara waktu munculnya gigi permanen dengan kelebihan berat badan dan obesitas pada anak dari wilayah Amazon Brazil.                                | Cara Penelitian → Pemeriksaan klinis dilakukan dan erupsi gigi dievaluasi sesuai dengan jumlah gigi erupsi permanen. Skor z indeks massa tubuh dihitung. Untuk analisis statistik, kelompok 'Kelebihan berat badan / obesitas' dibandingkan dengan kelompok 'Berat badan normal' dalam kasus dengan rasio kontrol 1: 2. Uji-t berdasarkan usia digunakan untuk perbandingan rata-rata antara kelompok. Analisis regresi linier menggunakan usia dan jenis kelamin sebagai co-varian digunakan | sebagai kelebihan berat badan / obesitas (49 kelebihan berat badan dan 16 obesitas). Kondisi kelebihan berat badan / obesitas dikaitkan dengan jenis kelamin, di mana anak laki-laki memiliki kesempatan lebih tinggi untuk menunjukkan kondisi berat badan yang lebih tinggi (OR = 1,84; CI 95% 1,06-3,37; p = 0,04). Rerata jumlah gigi permanen lebih tinggi pada kelompok kelebihan berat badan / obesitas (p <0,001). Analisis regresi linier menunjukkan bahwa status gizi, jenis kelamin dan usia berhubungan erat dengan jumlah erupsi gigi permanen (p <0,05). |
| 5 | Is nutritional and socioeconomic status related with tooth eruption of first incisive permanent mandibular among school and special need students? | (Fatma sari, Wiyatni and Saptiwi, 2019) | Tujuan penelitian adalah untuk mengetahui hubungan lama erupsi gigi I1 rahang bawah berdasarkan status gizi dan ekonomi pada siswa sekolah dan ABK. | Subjek → 58 anak usia 6-7 tahun, terbagi dalam dua kelompok 29 siswa sekolah dan 29 siswa berkebutuhan khusus<br>Rancangan → observasional analitik dengan pendekatan cross sectional<br>Cara penelitian → Kuisioner digunakan untuk mengukur status ekonomi, status gizi diukur dari tinggi badan dan berat badan yang ditimbang serta dilakukan wawancara untuk mengetahui waktu erupsi gigi. Spearman dan Mann Whitney digunakan sebagai alat statistik.                                   | Ada perbedaan status gizi dan ekonomi siswa normal dan berkebutuhan khusus (Sig: 0,045 dan 0,04). Ada perbedaan waktu erupsi gigi kedua kelompok dengan signifikansi 0,03. Ada hubungan status gizi dan ekonomi dengan waktu erupsi gigi (Sig: 0,001 dan 0,04). Sebagian besar siswa sekolah berstatus gizi normal dengan erupsi gigi tepat waktu sedangkan pada siswa berkebutuhan khusus berstatus gizi, erupsi gigi tertunda. Anak dengan status gizi dan  |

|   |   |                                  |   |  |  |
|---|---|----------------------------------|---|--|--|
|   |   |                                  |   |  | ekonomi yang baik akan mempengaruhi pertumbuhan fisiknya. Anak berkebutuhan khusus biasanya memiliki penyakit sistemik yang mempengaruhi pertumbuhannya. Status gizi dan ekonomi berhubungan dengan erupsi II rahang bawah pada sekolah normal dan siswa berkebutuhan khusus.  |
| 6 | Changes in the Sequence of Eruption of Permanent Teeth; Correlation between Chronological and Dental Age and Effects of Body Mass Index of 5–15-year-old Schoolchildren | (Khan <i>et al.</i> , 2020)      | Untuk mengetahui perubahan urutan dan usia erupsi gigi permanen pada anak usia 5–15 tahun, menghubungkan usia gigi dan kronologisnya. | Subjek → Sebanyak 1.477 anak sekolah berusia antara 5 tahun dan 15 tahun<br>Rancangan → cross-sectional<br>Cara Penelitian → subjek diperiksa untuk waktu erupsi, indeks massa tubuh (BMI), dan temuan oral lainnya. Usia gigi dihitung untuk 10% dari total sampel menggunakan metode Willem dari grafik ortopento (OPG) dan dikorelasikan dengan usia kronologis mereka. | Usia rata-rata keseluruhan anak-anak ditemukan 10,09 tahun (laki-laki: 9,87; perempuan: 10,33). Secara umum, waktu erupsi rata-rata untuk anak laki-laki ditemukan lebih rendah dibandingkan dengan anak perempuan. Ketika usia gigi dikorelasikan dengan BMI, usia gigi pada anak-anak obesitas dalam 5-6 tahun dan anak-anak dengan berat badan kurang dalam 10–11 tahun ditemukan jauh di depan usia kronologis mereka yang sebenarnya. |
| 7 | Correlation between permanent teeth eruption and nutrition status of 6-7-years-old children   | (Lailasari <i>et al.</i> , 2018) | Penelitian ini bertujuan untuk mengetahui hubungan jumlah erupsi gigi permanen dengan status gizi pada anak usia 6-7                  | Subjek → 57 anak berusia 6-7 tahun di SD Tanjungsari 2<br>Rancangan → penelitian <i>cross-sectional</i><br>Cara Penelitian → Status gizi dihitung berdasarkan Indeks Massa Tubuh (IMT) menurut umur dari pengukuran  | Uji korelasi didapatkan nilai $\rho = 0,037$ yang menunjukkan adanya hubungan bermakna antara jumlah gigi permanen erupsi dengan status gizi anak usia 6-7 tahun. Koefisien korelasi Spearman diperoleh nilai $r = 0,277$ , dengan   |

|   |  |                                    |   |   |  |
|---|--|------------------------------------|---|---|--|
|   |  |                                    | tahun   | antropometri berat badan dan tinggi badan. Penilaian status gizi dilakukan dengan aplikasi WHO Anthroplus® v1.0.4. Analisis statistik dilakukan dengan menggunakan uji korelasi Spearman dan uji beda Mann-Whitney  | demikian menunjukkan kekuatan lemah dan arah korelasi positif.   |
| 8 | Effect of Diet on Eruption Times for Permanent Teeth of Children in Effect of Diet on Eruption Times for Permanent Teeth | (Khan, Baloch and Science s, 2020) | Tujuan penelitian ini adalah untuk mengetahui hubungan antara waktu erupsi gigi permanen dengan konsumsi daging, nasi, sayur mayur dan susu pada anak Peshawar. | Subjek → 1945 anak (mereka yang memiliki setidaknya satu gigi baru saja erupsi) dipilih dari 21 sekolah (dipilih secara acak) di daerah perkotaan dan pinggiran kota Peshawar. 1066 (54,8%) anak adalah perempuan dan 879 (45,2%) adalah laki-laki. Cara Penelitian → Anak-anak dengan persetujuan dari orang tua mereka menjalani pemeriksaan mulut dan mereka yang memiliki "gigi baru saja erupsi" di rongga mulut dipilih untuk penyelidikan lebih lanjut. Anak-anak ini kemudian dikelompokkan sesuai gigi yang 'erupsi', gigi yang 'baru erupsi' dan 'belum erupsi'. Seiring dengan waktu erupsi, dikumpulkan pula informasi mengenai jenis kelamin, tinggi badan, berat badan dan pola makan (konsumsi daging, sayur, nasi dan susu) dalam keluarga. | Waktu erupsi rata-rata gigi insisivus sentral kanan bawah (41) paling rendah sedangkan gigi molar dua rahang bawah kanan (47) adalah gigi terakhir yang erupsi. Pada subjek penelitian yang mengkonsumsi daging dalam frekuensi tinggi menunjukkan bahwa terdapat beberapa gigi yang mengalami erupsi dini. Pada subjek penelitian yang mengkonsumsi sayuran menunjukkan bahwa beberapa gigi erupsi gigi permanen mengalami keterlambatan tetapi pada uji hipotesis tidak ada hubungan yang signifikan antara waktu erupsi gigi permanen dengan konsumsi daging, nasi, sayur dan susu pada anak. |
| 9 | Assesment of Eruption of Permanent Teeth According To Age And Its Relation   | (Hassan et al., 2018)              | Tujuan dari penelitian ini adalah untuk mengetahui penilaian  | Subjek → 300 anak sekolah dengan berbagai macam latar belakang sosio-ekonomi dengan frekuensi subjek laki-  | Terlihat bahwa anak-anak sebagian besar berada pada kategori berat badan normal selain anak usia 8 & 10  |

|    |  |                              |  |  |  |
|----|--|------------------------------|--|--|--|
|    | With Body Mass Index In Local Population                                 |                              | erupsi gigi permanen menurut umur dan hubungannya dengan indeks massa tubuh pada populasi lokal.                                 | laki ke perempuan masing-masing tetap 150 (50%) dan 150 (50%). Kategori usia adalah dari 5 sampai 15 tahun. Rancangan → cross-sectional<br>Cara Penelitian → Pengumpulan data dilakukan dengan mengukur tinggi badan, berat badan dan pemeriksaan mulut masing-masing anak   | tahun dimana anak kurus terlihat berlebihan. Ditemukan bahwa hampir semua gigi mengalami keterlambatan erupsi sesuai dengan waktu erupsi normal tetapi karena jumlah sampel yang tidak cukup besar sehingga tidak dapat disimpulkan bahwa setiap anak di wilayah kami akan mengalami erupsi yang tertunda. Dalam sampel kami, variasi tertinggi terlihat pada gigi molar dua kiri rahang bawah di mana terdapat erupsi yang tertunda.  |
| 10 | A Contemporary Examination of First and Second Permanent Molar Emergence | (Pahel <i>et al.</i> , 2017) | Untuk mengetahui ubungan indeks massa tubuh (IMT) dengan munculnya FPM / SPM dalam sampel yang mewakili anak-anak dan remaja AS. | Subjek → Analisis FPM ( <i>First Permanent Molar</i> ) mencakup usia 4 hingga 8 tahun (n = 3.102 mewakili ~ 20 juta anak), dan analisis SPM ( <i>Second Permanent Molar</i> ) mencakup usia 9 hingga 13 tahun (n = 2.774 mewakili ~ 19 juta anak / remaja)<br>Rancangan → cross-sectional<br>Cara penelitian → Data didapatkan dari 3 siklus terbaru NHANES (2009 hingga 2010, 2011 hingga 2012, dan 2013 hingga 2014). NHANES didasarkan pada sampel probabilitas kompleks bertingkat dari populasi AS yang tinggal di komunitas. Bobot survei memungkinkan untuk menghasilkan perkiraan yang mewakili secara nasional dari seluruh | Empat puluh delapan persen anak usia 6 tahun dan 98% anak usia 8 tahun memiliki semua FPM yang muncul, sedangkan kemunculan SPM lebih bervariasi. Orang kulit hitam (vs. kulit putih) dan wanita (vs. pria) mengalami kemunculan FPM dan SPM lebih awal. Kelebihan berat badan / obesitas dikaitkan dengan munculnya FPM lebih awal, terutama di antara wanita kulit hitam. Obesitas tetapi tidak kelebihan berat badan dikaitkan dengan munculnya SPM lebih awal. Secara keseluruhan, kelebihan berat badan / obesitas menyebabkan 6 sampai 12 bulan percepatan |

|    |   |                          |   |   |  |
|----|---|--------------------------|---|---|--|
|    |   |                          |   | populasi AS yang tidak dilembagakan   | gigi.  |
| 11 | Nutrition for oral health and oral manifestations of poor nutrition and unhealthy habits  | (Pflipse n et al., 2017) | Untuk meninjau peran nutrisi untuk kesehatan mulut dan manifestasi oral dari nutrisi yang buruk dan kebiasaan yang tidak sehat  | Tinjauan pustaka peran nutrisi tertentu dalam kesehatan mulut serta efek berbahaya dari kebiasaan tidak sehat   | Vitamin, mineral, dan nutrisi lainnya sangat penting untuk pertumbuhan, perkembangan, pemeliharaan, dan perbaikan gigi dan jaringan mulut yang sehat serta sistem tubuh secara umum. Kekurangan nutrisi dan kebiasaan tidak sehat dapat menyebabkan atau berkontribusi pada penyakit mulut seperti penyakit scurvy, celah langit-langit, hipoplasia email, dan mineralisasi yang buruk   |
| 12 | Association of Nutritional Status on Salivary Flow Rate, Dental Caries Status and Eruption Pattern in Pediatric Population in India | (Kaur et al., 2019)      | Tujuan penelitian ini adalah untuk menilai pengaruh nutrisi terhadap salivary flow rate (SFR) (tidak distimulasi dan distimulasi), status karies gigi, dan pola erupsi pada anak sehat dan kurang gizi. | Subjek → 363 peserta dalam rentang usia 5-12 tahun, terdiri dari 192 laki-laki dan 171 perempuan yang bersekolah di sekolah negeri dan swasta, diikutsertakan dalam penelitian ini. Cara penelitian → Peserta penelitian dikategorikan ke dalam kelompok sehat (Kelompok I, n = 37) dan kelompok malnutrisi (Kelompok II: Malnutrisi tinggi badan untuk usia [n = 30] dan Kelompok III: Berat badan kurang gizi untuk usia [n = 30]) sebagai per klasifikasi malnutrisi kronis. SFR, status karies gigi, dan pola erupsi dicatat untuk semua kelompok | Nilai SFR yang tidak distimulasi ditemukan $0,53 \pm 0,15$ ml / menit (Kelompok I), $0,14 \pm 0,04$ ml / menit (Kelompok II), dan $0,21 \pm 0,20$ ml / menit (Kelompok III). Untuk SFR terstimulasi, nilainya adalah $1,94 \pm 0,44$ ml / menit (Kelompok I), $1,17 \pm 0,48$ ml / menit (Kelompok II), dan $1,07 \pm 0,52$ ml / menit (Kelompok III). Status karies gigi tercatat 2,43 (Grup I), 6,4 (Grup II), dan 4,66 (Grup III). Partisipasi dengan pola erupsi tertunda masing-masing 8,10%, 23,30%, dan 16,60% untuk Kelompok I, Kelompok II, dan Kelompok III. |
| 13 | Delayed tooth eruption and its  | (Alshu kairi,            | Artikel ini mengulas  | Tinjauan pustaka tentang erupsi gigi yang tertunda  | Variasi dalam erupsi gigi yang normal  |

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|    | pathogenesis in paediatric patient: a review  | 2019)                           | tentang erupsi gigi yang tertunda dan patogenesisnya  | dan patogenesisnya  | merupakan temuan yang umum, tetapi penyimpangan yang signifikan dari norma yang ditetapkan harus mengingatkan dokter untuk menyelidiki lebih lanjut kesehatan dan perkembangan pasien. Erupsi gigi yang tertunda mungkin merupakan indikasi dari kondisi sistemik atau indikasi dari perubahan fisiologi dari komponen kraniofasial.  |
| 14 | Socioeconomic and nutritional factors associated with age of eruption of third molar tooth among Ugandan adolescents<br>Annet | (Kutesa <i>et al.</i> , 2019)   | Penelitian ini bertujuan untuk mengetahui pengaruh faktor sosial ekonomi dan gizi terhadap usia erupsi gigi molar tiga rahang bawah pada orang Uganda usia 10-20 tahun. | Subjek → pasien gigi berusia 10-20 tahun keturunan Uganda yang dirawat di Rumah Sakit Mulago antara Januari dan Desember 2017. Rancangan → <i>cross sectional</i> . Cara penelitian → Informasi latar belakang diperoleh dari partisipan dengan menggunakan kuesioner berupa wawancara lisan. Pengukuran antropometri dilakukan dengan menggunakan pita pengukur dan timbangan, sedangkan radiografi gigi digunakan untuk mengetahui stadium erupsi gigi molar tiga rahang bawah. | Partisipan dalam kategori indeks massa tubuh kelebihan berat badan secara statistik terkait secara signifikan dengan usia erupsi molar ketiga rahang bawah ( $P < 0,05$ ) dibandingkan dengan rekan normal mereka. Tidak ada hubungan yang signifikan secara statistik antara status sosial ekonomi dan usia erupsi gigi molar ketiga ( $P > 0,05$ ). Usia erupsi secara statistik lebih tinggi pada laki-laki daripada perempuan ( $P > 0,05$ ). |
| 15 | Comparison of chronology of teeth eruption with body mass index among school children at Mangalore: A cross-sectional         | (Bagewadi <i>et al.</i> , 2016) | Untuk menentukan usia erupsi pada gigi permanen yang berbeda dan membanding   | Subjek → 2.928 anak dengan rentang usia 5,5 hingga 15 tahun dilibatkan dalam penelitian ini. Anak-anak dibagi menjadi 20 kelompok usia kronologis dengan  | Ada 1.526 laki-laki yang merupakan 52,1% dan 1402 perempuan merupakan 47,9% dari total sampel dari 2.928 anak. Usia rata-rata erupsi gigi insisivus sentral rahang  |

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|    | study   |  | kan usia erupsi dengan BMI pada sekelompok anak dari sekolah tertentu di Mangalore   | interval setengah tahun<br>Rancangan → <i>cross-sectional</i><br>Cara penelitian → Semua anak diperiksa oleh penguji tunggal dengan bantuan asisten terlatih. Gigi diperiksa di bawah cahaya alami dengan cermin mulut. Perbandingan dibuat antara usia erupsi rata-rata pada pria dan wanita menggunakan uji-t independen  | atas, gigi seri lateral rahang atas, gigi kaninus rahang atas dan rahang bawah, gigi premolar rahang atas dan rahang bawah, gigi molar dua rahang atas dan rahang bawah ditemukan memiliki statistik yang signifikan dengan BMI. Usia rata-rata erupsi gigi pada wanita ditemukan lebih awal daripada pada pria, dengan pengecualian pada molar satu rahang atas yang lebih awal pada pria. |
| 16 | Role of Body Composition on the Eruption Time of First Permanent Molars                             | (Priyatnoko and Zakiyah, 2019)         | Tujuan dari penelitian ini adalah untuk mengetahui peran komposisi tubuh terhadap waktu erupsi gigi geraham permanen pertama pada anak usia 6 dan 7 tahun yang tinggal di Kota Administrasi Jember, Indonesia. | Subjek → Sebanyak 234 siswa laki-laki SD usia 72-84 bulan dipilih dengan pendekatan stratified random sampling<br>Rancangan → studi observasional analitik dengan pendekatan cross sectional<br>Cara Penelitian → Persen lemak tubuh total dihitung dari BMI menggunakan persamaan Deurenberg dan dikelompokkan ke dalam subkelompok kurus dan gemuk menggunakan pendekatan skor z analitik. Pemeriksaan mulut dilakukan untuk mengumpulkan data erupsi gigi permanen pertama | Studi ini menemukan bahwa anak-anak subkelompok kurus menunjukkan erupsi tertunda di semua 4 molar permanen pertama. Subkelompok lemak menunjukkan erupsi yang dipercepat di keempat molar permanen pertama. Penelitian ini menyimpulkan bahwa komposisi tubuh berperan penting dalam waktu erupsi gigi permanen dimana anak gendut mengalami percepatan erupsi gigi permanen pertama.      |
| 17 | Nutritional status, dental caries and tooth eruption in children: a longitudinal study in Cambodia, | (Dimaisip-Nabuab <i>et al.</i> , 2018) | Tujuan dari penelitian ini adalah untuk menilai hubungan antara karies   | Subjek → 1449 anak dari sekolah dasar negeri berusia 6-7 tahun - 20 sekolah di Kamboja, 18 sekolah di Indonesia, dan 44 sekolah di Lao  | Tingkat karies gigi dan infeksi odontogenik pada gigi sulung secara signifikan tertinggi pada anak dengan berat badan kurang, serta   |

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|    | Indonesia and Lao PDR  |  | gigi pada gigi primer dan permanen dan status gizi (termasuk berat badan kurang, berat badan normal, kelebihan berat badan dan stunting) pada anak-anak dari Kamboja, Indonesia dan Laos selama periode 2 tahun. Tujuan kedua adalah menilai apakah status gizi mempengaruhi erupsi gigi permanen. | PDR<br>Rancangan → Cohort<br>Cara penelitian → Data digunakan dari Fit for School - Health Outcome Study: studi kohort dengan masa tindak lanjut selama 2 tahun. Karies gigi dan infeksi odontogenik dinilai menggunakan kriteria Organisasi Kesehatan Dunia (WHO) dan indeks pufa. Pengukuran berat badan dan tinggi badan diubah menjadi skor-z BMI-untuk-usia dan tinggi-untuk-usia dan dikategorikan ke dalam status berat badan dan stunting mengikuti prosedur standar WHO | pada anak yang terhambat, dan paling rendah pada anak dengan berat badan berlebih. Karies gigi pada anak usia enam sampai tujuh tahun juga secara signifikan dikaitkan dengan peningkatan kemungkinan menjadi kurus dan terhambat 2 tahun kemudian. Hubungan ini tidak ditemukan secara konsisten untuk karies gigi dan infeksi odontogenik pada gigi permanen. Berat badan kurang dan pendek secara signifikan dikaitkan dengan jumlah erupsi gigi permanen yang lebih rendah pada anak-anak pada usia enam hingga tujuh tahun dan 2 tahun kemudian. |
| 18 | The relationship of obesity to the timing of permanent tooth emergence in Czech children | (Šindelářová, Soukup and Brouka 1, 2018) | Tujuan dari penelitian kami adalah untuk menyelidiki hubungan potensial antara munculnya gigi permanen secara prematur dan obesitas pada populasi anak di Ceko.  | Subjek → Sampel yang digunakan untuk survei epidemiologi ini adalah 1370 anak pra dan sekolah dasar (terdiri dari 696 perempuan (50,8%) dan 674 laki-laki (49,2%)), pada tahun 2013/2014 dan di seluruh Republik Ceko. Rancangan → cross-sectional<br>Cara Penelitian → Subjek diberi pemeriksaan gigi epidemiologi selama 2 menit langsung di ruang kelas mereka oleh penulis utama secara pribadi. Semua gigi yang muncul, usia (dalam   | Perbedaan yang signifikan secara statistik ditemukan untuk gigi permanen berikut (menggunakan sistem dua digit FDI): 13, 14, 15, 16, 17, 41, 44, 45, 46, 47, 33, 35, 37, 21, 24, 25, 26, 27 untuk anak perempuan dan 12, 13, 14, 15, 16, 41, 43, 44, 45, 22, 25, 32, 34, 35, 36 untuk anak laki-laki. Gigi ini diamati muncul lebih awal pada anak-anak obesitas. Korelasi serupa (meskipun tidak signifikan secara statistik) diamati antara waktu munculnya gigi  |

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|    |  |                                   |   | akurasi hingga dua poin desimal), jenis kelamin dicatat dan berat badan (dengan akurasi 0,5 kg) dan tinggi (dengan akurasi 0,5 cm) diukur menggunakan timbangan digital elektronik   | yang tersisa dan BMI anak.   |
| 19 | Relationship between body mass index with eruption of third permanent molar teeth                                  | (SJ <i>et al.</i> , 2019)         | Tujuan dari penelitian ini adalah untuk mengetahui hubungan antara status gizi dengan erupsi permanen gigi molar tiga umur 13-26 tahun. | Subjek → 100 peserta berusia 13-26 tahun<br>Rancangan → cross-sectional<br>Cara Penelitian → kuesioner yang telah dirancang dan diuji sebelumnya, pengukuran antropometri dan pemeriksaan klinis dari para peserta di tahun 2019 di Assam Medical College  | Dalam penelitian ini, persentase erupsi gigi molar tiga lengkap di antara peserta dengan kategori Indeks Massa Tubuh (BMI) yang berbeda seperti kurus, normal dan kelebihan berat badan masing-masing adalah 7, 16 dan 2. Temuan ini menunjukkan adanya hubungan antara status gizi dengan erupsi gigi molar permanen ketiga   |
| 20 | Does Timing of Eruption in First Primary Tooth Correlate with that of First Permanent Tooth? A 9-year Cohort Study | (Poureslami <i>et al.</i> , 2016) | Untuk mengeksplorasi pengaruh variasi waktu munculnya gigi dengan mempertimbangkan status sosial ekonomi (SES)                          | Subjek → Anak-anak dipilih dengan mempertimbangkan kriteria inklusi berikut: bayi sehat cukup bulan, lahir dari kehamilan dan persalinan tanpa komplikasi; berat lahir 2500 gram atau lebih; kesehatan fisik dan mental lengkap dan tidak ada riwayat medis yang membingungkan. 307 bayi yang memenuhi kriteria inklusi dirujuk ke Departemen Pediatric Dentistry di Tabriz University of Medical Sciences untuk pemeriksaan gigi komprehensif.<br>Rancangan → Cohort<br>Cara Penelitian → 307 subjek diperiksa setiap dua bulan sekali selama tahun pertama dan kedua | Di antara 267 subjek menyelesaikan semua tindak lanjut, waktu erupsi untuk gigi sulung dan permanen pertama menunjukkan korelasi langsung yang kuat; dalam satu bulan keterlambatan atau erupsi awal gigi sulung pertama mengakibatkan keterlambatan 4,21 bulan atau erupsi awal gigi permanen yang muncul pertama ( $r = 0,91$ , $n = 267$ , $P < 0,001$ ). Tidak ada korelasi signifikan yang diamati antara waktu erupsi gigi sulung pertama dan permanen pertama dan SES ( $P = 0,67$ , $P = 0,75$ , masing-masing). |

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|    |   |                             |   | kehidupan dan kemudian dengan interval enam bulan sampai gigi permanen pertama tumbuh. Waktu erupsi gigi sulung dan permanen dicatat untuk setiap anak. Bentuk skala Kuppusswamy yang dimodifikasi digunakan untuk menilai SES   |   |
| 21 | Nutritional status is associated with permanent tooth eruption chronology | (Arid <i>et al.</i> , 2017) | Tujuan penelitian ini adalah untuk mengevaluasi apakah status gizi mempengaruhi kronologi erupsi gigi permanen pada anak Brazil | Subjek → 160 anak usia 6-13 tahun<br>Cara penelitian → subjek diperiksa oleh dokter gigi anak dan jumlah gigi permanen yang erupsi dievaluasi. Pengukuran antropometri dari anak-anak ditentukan, lalu menjadi beberapa kelompok: kurus, eutrofik, kelebihan berat badan dan obesitas. Hubungan antara erupsi gigi tertunda dan kelompok status gizi dievaluasi menggunakan uji chi-square. Uji Shapiro-Wilk digunakan untuk memverifikasi normalitas data. Untuk membandingkan rata-rata jumlah gigi tunda menurut status gizi dilakukan uji Kruskal-Wallis dengan beberapa perbandingan dengan uji Dunn. | Lima puluh enam anak mengalami keterlambatan erupsi gigi pada setidaknya satu gigi permanen dan erupsi gigi yang tertunda lebih sering terjadi pada anak dengan berat badan kurang dibandingkan pada anak eutrofik ( $p = 0,0091$ ) |
| 22 | Tooth eruption and obesity in 12-year-old children                        | (Wong <i>et al.</i> , 2017) | Penelitian ini bertujuan untuk menyelidiki hubungan antara jumlah gigi permanen erupsi dan obesitas pada                        | Subjek → Sampel acak dari 806 anak sekolah berusia 12 tahun di Hong Kong<br>Cara penelitian → Pemeriksaan rongga mulut dilakukan dan status erupsi gigi permanen dinilai. Tinggi badan, berat badan, <i>waist</i>  | Responnya 82,9% (68/806). Tiga ratus empat puluh enam (50,9%) anak mengalami 28 gigi erupsi. Gigi molar kedua memiliki tingkat noneruption tertinggi (17,5-35,8%). Jumlah rata-rata dan standar                                     |

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|    |   |                                | anak-anak berusia 12 tahun dalam sebuah penelitian berbasis populasi.   | <i>circumference</i> (WC), lingkar pinggul, dan <i>triceps skinfold thickness</i> (TRSKF) diukur untuk menilai status adipositas rasio W/H indeks massa tubuh (IMT) untuk obesitas umum. Hubungan antara jumlah gigi permanen erupsi dan status adipositas diperiksa dalam analisis bivariat dan analisis kovarian.   | deviasi (SD) gigi permanen erupsi adalah 26,4 (2,4). Nilai rata-rata dan SD adalah 31,1 (6,3) untuk W / H, 19,8 (3,7) untuk BMI, 70,4 (9,4) untuk WC, dan 11,8 (4,5) untuk TRSKF. Setelah memperhitungkan faktor sosiodemografi, analisis kovarian mengidentifikasi bahwa W / H, BMI, dan WC, berhubungan positif dengan jumlah gigi permanen yang erupsi ( $P < 0,01$ ).       |
| 23 | The effect of body mass index on tooth eruption and dental caries | (Younus, Ahmed and Kala, 2020) | Untuk menentukan kemungkinan hubungan antara BMI dan karies gigi atau erupsi gigi permanen (insisivus sentral dan molar)                                  | Subjek → Sebanyak 218 anak usia 6 tahun (116 laki-laki, 102 perempuan) dari sekolah dasar negeri di Kota Erbil<br>Rancangan → cross sectional<br>Cara penelitian → Penilaian karies gigi dilakukan dengan menggunakan kriteria WHO untuk gigi sulung dan indeks (DMFT) yang rusak, hilang dan terisi. BMI digunakan untuk mengklasifikasikan status obesitas. | Secara keseluruhan, 27,98% anak diklasifikasikan kelebihan berat badan, 59,17% normal, dan 12,84% berat badan kurang. DMFT adalah 5.247, sedangkan 12.39% anak bebas karies. Anak-anak dengan berat badan normal mengalami erupsi gigi permanen dan indeks karies rendah. Anak dengan berat badan kurang memiliki lebih sedikit erupsi gigi dan indeks karies yang lebih tinggi |
| 24 | Does nutrition have an effect on the timing of tooth formation ?  | (Esan et al, 2019)             | Penelitian ini menyelidiki pengaruh status gizi (diukur sebagai BMI, tinggi badan, berat badan, lingkar lengan atas, dan lingkar kepala) pada pembentukan | Subjek → 642 (270 laki-laki, 372 perempuan) peserta Afrika Selatan Kulit Hitam yang sehat berusia 5-20 tahun<br>Rancangan → prospective cross-sectiona<br>Cara penelitian → Tinggi badan dan BMI diubah menjadi skor-z menggunakan skor-z WHO untuk tabel usia.   | Terdapat kemajuan yang signifikan dalam usia pencapaian tahap akhir (H) untuk sebagian besar gigi permanen pada kelompok kelebihan berat badan (rata-rata BMI laki-laki 22,9; perempuan 27,94) dibandingkan dengan kelompok berat badan kurang ( $p < 0,05$ ).  |

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|    |  |                              | gigi permanen.  | Para peserta dikelompokkan menjadi kurus / pendek untuk usia (<-2), normal ( $\geq$ -2-2,0) dan kelebihan berat badan / obesitas / tinggi untuk usia (> 2). Radiografi panoramik anak-anak dinilai menggunakan delapan tahap pembentukan gigi permanen Demirjian dan usia diperkirakan menggunakan metode Demirjian. Analisis regresi probit digunakan untuk menghitung usia rata-rata pencapaian tahap perkembangan gigi rahang bawah kiri (I2-M2).  | Regresi binomial negatif menunjukkan bahwa usia, tinggi, dan BMI adalah prediktor yang signifikan dari skor kematangan akhir untuk laki-laki ( $p < .05$ ), sedangkan usia, tinggi badan, berat badan, BMI dan HC adalah prediktor yang signifikan untuk wanita ( $p < .0,05$ ).  |
| 25 | Eruption Chronology in Children: A Cross-sectional Study | (Verma <i>et al.</i> , 2017) | Tujuan dari penelitian ini adalah untuk menentukan standar acuan yang tepat untuk waktu erupsi gigi sulung pada bayi dan anak prasekolah di kota Bhopal dan untuk mengetahui peran dari berbagai faktor yang mempengaruhi erupsi gigi sulung. | Subjek → bayi dan anak-anak prasekolah (4–36 bulan) menghadiri rumah sakit pemerintah atau swasta setempat, dan pusat vaksinasi di kota Bhopal<br>Rancangan → cross-sectional<br>Cara penelitian → Pemeriksaan oral dilakukan di bawah cahaya alami yang memadai<br>pengeju tunggal menggunakan kaca mulut dan probe. Gigi yang ada di rongga mulut dicatat dengan menggunakan sistem nomenklatur Federation Dentaire Internationale dalam format yang telah dibuat sebelumnya. Gigi dianggap erupsi, bila ada bagian mahkotanya telah menembus gingiva dan terlihat di rongga mulut. Tinggi badan, berat | Terdapat hubungan yang signifikan antara erupsi gigi dan berat lahir, kebiasaan makan, status sosial ekonomi, dan indeks massa tubuh (IMT). Ketika IMT dibandingkan dengan usia yang sesuai gigi yang ada pada anak-anak, diamati bahwa kelompok anak dengan berat badan kurang parah memiliki jumlah gigi yang sesuai dengan usianya paling sedikit (28,9%) dibandingkan dengan kelompok normal (42,3%), kurus (43%), dan kelebihan berat badan (40%), sedangkan saat membandingkan anak-anak yang kelebihan berat badan dengan kelompok lain, diamati bahwa, mereka |

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|    |  |                           |   | badan, berat badan lahir, dan pertanyaan tertutup lainnya dalam kuesioner ditanyakan dari orang tua.   | memiliki lebih banyak jumlah gigi yang sesuai dengan usia (40%) daripada anak dengan berat badan kurang parah (28,9%). Juga dicatat bahwa jumlah gigi mereka lebih sedikit daripada kelompok normal dan kurus.   |
| 26 | Factors Associated with Primary Teeth Eruption Pattern in Children Under Three Years Old in Beji Depok, West Java        | (Badru ddin et al., 2017) | Tujuan dari penelitian ini adalah untuk mengkaji faktor-faktor yang berhubungan dengan pola erupsi gigi sulung  | Subjek→ Lima Posyandu berpartisipasi dalam penelitian ini, dan 335 ibu dengan anak di bawah tiga tahun dengan buku kesehatan lengkap dipilih.<br>Rancangan→cross-sectional<br>Cara penelitian → Fase erupsi gigi sulung diperiksa dengan metode Hulland. Usia erupsi dihitung untuk usia rata-rata, usia mulai, dan durasi setiap erupsi gigi. | Ada perbedaan yang bermakna pada usia awal dan lama proses erupsi pada kelompok menurut status gizi ibu ( $p < 0,05$ ) dan anak ( $p < 0,01$ ). Proses erupsi memakan waktu lebih lama untuk diselesaikan pada wanita dibandingkan pada pria ( $p < 0,05$ ). Tingkat pendidikan dan pekerjaan ibu juga signifikan. Hasil penelitian menunjukkan bahwa pola erupsi dipengaruhi oleh status gizi ibu dan anak, jenis kelamin anak, serta tingkat pendidikan dan pekerjaan ibu. |
| 27 | Association of Eruption Timing of First Permanent Molars and Incisors with Body Mass Index of Children in Bengaluru City | (Subramania et al., 2020) | Tujuan dari penelitian ini adalah untuk mengetahui hubungan waktu erupsi gigi molar satu dan gigi seri permanen rahang atas dan rahang atas dengan IMT anak-anak di kota Bengaluru. | Subjek→ 3166 anak sekolah (1636 laki-laki dan 1530 perempuan) berusia antara 5 dan 10 tahun di kota Bengaluru<br>Rancangan→cross-sectional<br>Cara penelitian → Pemeriksaan oral dilakukan untuk mencatat keberadaan gigi molar satu dan gigi seri permanen. Tinggi dalam meter dan berat dalam kilogram setiap anak dicatat dan BMI           | Gigi permanen pertama yang tumbuh adalah gigi molar satu rahang bawah pada usia $5,76 \pm 1,3$ tahun. Anak perempuan menunjukkan usia erupsi yang lebih awal pada semua gigi kecuali gigi seri sentral bawah. Hubungan terbalik yang signifikan secara statistik terlihat antara BMI dan waktu erupsi gigi yang diperiksa (P   |

|    |  |                                     |  |  |  |
|----|--|-------------------------------------|--|--|--|
| 28 | Hubungan Stunting Terhadap Keterlambatan Erupsi Gigi Kaninus Atas Permanen pada Anak Usia 11-12 Tahun                                  | (Yudiy a, Adhani and Hamdani, 2020) | Untuk menganalisis hubungan stunting terhadap keterlambatan erupsi gigi kaninus atas permanen pada anak usia 11-12 tahun di SDN Sungai Tiung Kecamatan Cempaka Kota Banjarbaru | dihitung. Subjek →seluruh siswa stunting di Sekolah Dasar Negeri Sungai Tiung Kecamatan Cempaka Di Kota Banjarbaru usia 11-12 tahun sebanyak 51 orang, berdasarkan hasil perhitungan sampel diperoleh sebanyak 32 orang Rancangan →Observsional analitik cross-sectional Cara Penelitian →Pemeriksaan pertama adalah status gizi, yaitu mengukur tinggi badan anak dengan menggunakan microtoise dengan presisi 0,1 cm yang disesuaikan dengan usia dan dimasukkan pada tabel Z-score WHO 2007. Pengambilan sampel anak dengan status gizi stunting. Setelah itu, dilakukan pemeriksaan rongga mulut dan gigi- geligi menggunakan instrumen kaca mulut, dan senter untuk membantu penerangan. Semua hasil dicatat, dikumpulkan, dihitung, diolah data, disusun, dan dianalisis menggunakan program komputer. Pengumpulan | <0,05). Berdasarkan hasil penelitian, anak yang memiliki tinggi badan sangat pendek (28,1%) dan pendek (71,9%) dan erupsi gigi normal (25%) dan tidak erupsi (75%). Analisis uji Spearman menunjukkan bahwa nilai signifikansi sebesar 0,512 ( $p > 0,05$ ) yang berarti tidak terdapat hubungan antara stunting dengan keterlambatan erupsi gigi. Kesimpulan: |
| 29 | Dependence of Deciduous Tooth Eruption Terms and Tooth Growth Rate on the Weight-Height Index at Birth in Macrosomic Children over the | (Garma sh, 2019)                    | Tujuan dari penelitian ini adalah untuk mempelajari pengaruh kelebihan berat badan saat lahir (makrosomia  | Subjek →Rekam medis anak yang lahir antara 1977 dan 2013 telah dianalisis. Basis data telah dikumpulkan di salah satu klinik Kota Kharkiv. Kelompok Utama terdiri dari rekam medis anak-anak (laki-  | Hasil penelitian menunjukkan perlambatan laju pertumbuhan gigi sulung pada anak yang lahir dengan makrosomia, serta peningkatan jumlah kasus (dengan faktor 2  |

|    |   |                        |   |   |   |
|----|---|------------------------|---|---|---|
|    | First Year of Life  |                        | janin) terhadap proses erupsi gigi dan pertumbuhan gigi selama tahun pertama kehidupan pada anak-anak di populasi Kota Kharkiv (Ukraina).                             | laki dan perempuan secara terpisah) yang lahir dengan makrosomia janin. Semua rekam medis Kelompok Utama telah dibagi menjadi subkelompok dengan mempertimbangkan jenis kelamin dan koefisien pembangunan yang harmonis (seimbang). Grup Pembanding terdiri dari rekam medis anak-anak yang juga lahir dalam kisaran cukup bulan, tetapi dengan berat dan tinggi badan yang sesuai dengan usia kehamilan (normosomia janin).<br>Cara Penelitian → Untuk menentukan waktu rata-rata erupsi gigi pertama, serta laju pertumbuhan gigi sulung untuk masing-masing kelompok yang diteliti, kami menggunakan hipotesis tentang ketergantungan linier antara jumlah gigi yang erupsi dan usia anak. | sampai 4 kali) penyimpangan waktu erupsi gigi dibandingkan dengan norma regional. Laju pertumbuhan gigi sulung terkecil dan jumlah gigi terkecil pada usia satu tahun tercatat pada laki-laki makrosomik dan perempuan makrosomik dengan tubuh panjang dan berat lahir relatif berkurang, serta pada anak perempuan makrosomik dengan obesitas intrauterin. Gadis makrosomik dengan akselerasi intrauterin dengan obesitas di latar belakang memiliki laju pertumbuhan gigi rata-rata terbesar dan persentase kasus erupsi dini terbesar di antara semua subkelompok. |
| 30 | Hubungan Status Gizi dengan Erupsi Gigi Molar Pertama Permanen Rahang Bawah pada Anak Usia 6-7 Tahun di SD Negeri 12 Manado | (Guna wan et al, 2019) | Penelitian ini bertujuan untuk mengetahui hubungan status gizi dengan erupsi gigi molar pertama permanen rahang bawah pada anak usia 6-7 tahun di SD Negeri 12 Manado | Subjek → siswa yang berusia 6-7 tahun berjumlah 73 orang, terdiri dari 27 siswa laki-laki, dan 46 orang perempuan<br>Rancangan → analytic descriptive dengan pendekatan cross sectional<br>Cara penelitian → Pada penelitian ini dilakukan pengukuran status gizi melalui indeks massa tubuh (IMT/U) dan memeriksa erupsi gigi 36 dan 46. Analisa hasil   | Hasil analisis bivariat terhadap hubungan antara status gizi dan erupsi gigi molar pertama permanen rahang bawah menggunakan uji Kolmogorov-Smirnov dan uji Fisher's exact menunjukkan nilai $p=0,989$ dan $p=0,275$ ( $>0,05$ ) yaitu tidak terdapat hubungan antara status gizi dengan erupsi gigi molar pertama permanen rahang  |

|    |  |  |  |   |   |
|----|--|--|--|---|---|
|    |  |  |  | penelitian menggunakan analisis univariat dan bivariat kemudian diolah menggunakan uji Chi-square   | bawah pada anak usia 6-7 tahun di SD Negeri 12 Manado   |
| 31 | Pengaruh Status Gizi terhadap Erupsi Gigi Molar Pertama Permanen Siswa Kelas 1 SDN di Kecamatan Wilayah Kota Administrasi Jember | (Zakiyah, Priyatmoko and Novita, 2017a)  | Mengetahui pengaruh status gizi terhadap jumlah gigi molar pertama permanen yang erupsi pada siswa kelas 1 SDN di kecamatan wilayah kota administrasi kabupaten Jember | Subjek → Populasi penelitian ini yaitu seluruh siswa kelas 1 SDN yang berjenis kelamin laki-laki dan berusia 72 bulan – 84 bulan di kecamatan wilayah kota administrasi Jember yaitu sebanyak 238 siswa.<br>Rancangan → observasional analitik dengan pendekatan cross sectiona<br>Cara penelitian → Penilaian status gizi menggunakan rumus Adolphe Quetelet (IMT) dan disesuaikan dengan usia anak. Pemeriksaan rongga mulut siswa secara visual untuk mengetahui jumlah erupsi giginya. Pengaruh antara variabel penelitian di uji menggunakan uji analisis chi-square | Prosentase gigi molar pertama permanen yang sudah erupsi pada subjek kurus sebesar 4,6%, subjek normal sebesar 44,1%, dan subjek gemuk sebesar 31,9%. Prosentase gigi molar pertama permanen yang belum erupsi berdasarkan gambar 1 yang ditunjukkan pada subjek kurus sebesar 18,1%, subjek normal sebesar 1,3%, dan subjek gemuk sebesar 0%. Kesimpulannya ada perbedaan yang bermakna antara status gizi siswa dengan erupsi gigi molar pertama permanen |
| 32 | Hubungan Status Gizi dengan Erupsi Gigi Molar Pertama Tetap pada Murid Kelas 1 SDN Cisit 02 Kabupaten Garut                      | (Kristiani, Primawati and Fatimah, 2017) | Penelitian ini bertujuan untuk mengetahui hubungan status gizi dengan erupsi gigi molar pertama tetap pada murid kelas 1 SDN Cisit 02 Kabupaten Garut                  | Subjek → Murid kelas 1 SDN Cisit 02 Kabupaten Garut yang berjumlah 24 orang berumur antara 6-9 tahun sedangkan sampel penelitian adalah total sampling<br>Rancangan → <i>cross sectional</i><br>Cara Penelitian → Melakukan pengisian formulir status gizi dan pengisian formulir erupsi gigi molar pertama tetap   | Tidak ada korelasi bermakna antara status gizi dengan erupsi gigi molar pertama tetap murid kelas 1 SDN Cisit 02 Kabupaten Garut Tahun 2016 dilihat dari p value 0,665 (>0,05)  |
| 33 | The inter  | (Shojae                                  | Penelitian ini   | Subjek → 2025 anak  | Dalam penelitian ini,   |

|    |  |                                     |  |  |  |
|----|--|-------------------------------------|--|--|--|
|    | relationships among growth parameters (weight, height) and ectopic eruption of permanent first molars of children aged 6-9 years in Kerman, Iran | ipoor et al., 2018)                 | dilakukan untuk mengevaluasi prevalensi EE dari Molar Pertama Permanen di Kerman, Iran, dan kemudian menentukan hubungan antara parameter pertumbuhan (tinggi dan berat) dan anomali perkembangan ini. | usia 6-9 tahun di Kerman, Iran<br>Rancangan → cross-sectional<br>Cara Penelitian → Pemeriksaan dilakukan dengan penggunaan tongue depressor di bawah cahaya yang cukup. Tinggi dan berat badan ditentukan dalam kelompok kontrol (tanpa EE dari Molar Permanen Pertama) dan kasus (dengan EE dari Molar Permanen Pertama), dan kemudian dimasukkan dalam checklist yang relevan. | prevalensi EE dari Molar Permanen Pertama adalah 2,8% pada anak-anak berusia 6 hingga 9 tahun di Kerman. Tingkat anomali perkembangan ini lebih tinggi pada anak laki-laki dibandingkan dengan anak perempuan dan lebih tinggi pada rahang atas daripada rahang bawah; namun, perbedaannya tidak signifikan ( $P > 0,05$ ). Prevalensi EE lebih tinggi pada anak-anak dengan usia rata-rata lebih rendah dan tinggi dan berat rata-rata lebih rendah, yang signifikan secara statistik ( $P < 0,05$ ). |
| 34 | Association of nutritional status and dental health among 3–6-year-old children of a South Indian population                                     | (Girish Babu <i>et al.</i> , 2019). | Tujuan dari penelitian ini adalah untuk mengetahui hubungan status nutrisi dengan keadaan kesehatan gigi dan mulut pada anak umur 3-6 tahun  | Subjek → anak umur 3-6 tahun. Rancangan → cross sectional<br>Cara Penelitian → status gizi diukur menggunakan BMI. Keadaan gigi dan mulut dilihat dari karies, enamel hipoplasia, keadaan oral mukosa sesuai standart WHO.   | Didapatkan data bahwa prevalensi anak paling besar mengalami gangguan status nutrisi kekurangan gizi dengan prevalensi terbanyak pada anak 3-4 tahun. Kekurangan nutrisi berdampak pada 61.07% keadaan kesehatan gigi dan mulut pada anak.   |

## 3.2 Pembahasan

### 3.2.1 Faktor-Faktor yang Mempengaruhi Erupsi Gigi Permanen

Erupsi gigi permanen merupakan suatu proses dari perkembangan gigi melalui jaringan lunak pada rahang dan mukosa menuju rongga mulut. *Pattern* merupakan suatu pola erupsi gigi. *Pattern* erupsi gigi

dipengaruhi oleh faktor sistemik dan faktor lokal. Gangguan *pattern* erupsi gigi terjadi dikarenakan posisi pertumbuhan gigi yang tidak normal yaitu posisinya yang berada pada sisi labial, lingual atau gigi mengalami rotasi dan hal ini menyebabkan gigi lain yang mengalami erupsi menjadi kekurangan ruang. Waktu erupsi gigi juga dipengaruhi oleh faktor general dan lokal. Gangguan waktu erupsi gigi dapat berdampak buruk pada terjadinya maloklusi gigi (Alshukairi, 2019; Amanda Yudiya *et al.*, 2020).

- a. Faktor lokal yang mempengaruhi *pattern* erupsi gigi adalah :
- *Physical obstruction, physical obstruction* merupakan obstruksi yang biasa terjadi karena beberapa faktor seperti adanya *supernumery teeth, mucosal barrier*, luka pada jaringan dan adanya tumor.
  - *Hyperplasia Gingiva, hyperplasia gingiva* merupakan gangguan yang terjadi dikarenakan hormon yang tidak seimbang, faktor genetik, dan kekurangan vitamin C sehingga menimbulkan gangguan jaringan ikat dan aseluler kolagen dan berdampak pada gangguan erupsi gigi.
  - *Traumatic injuries, traumatic injuries* dapat menyebabkan erupsi *ektopic* atau beberapa gangguan pada normal odontogenesis melalui dilaserasi atau *physical displacement*.
  - *Ankylosis, ankylosis* merupakan suatu gangguan pada sementum atau dentin yang berdampak pada gangguan tulang

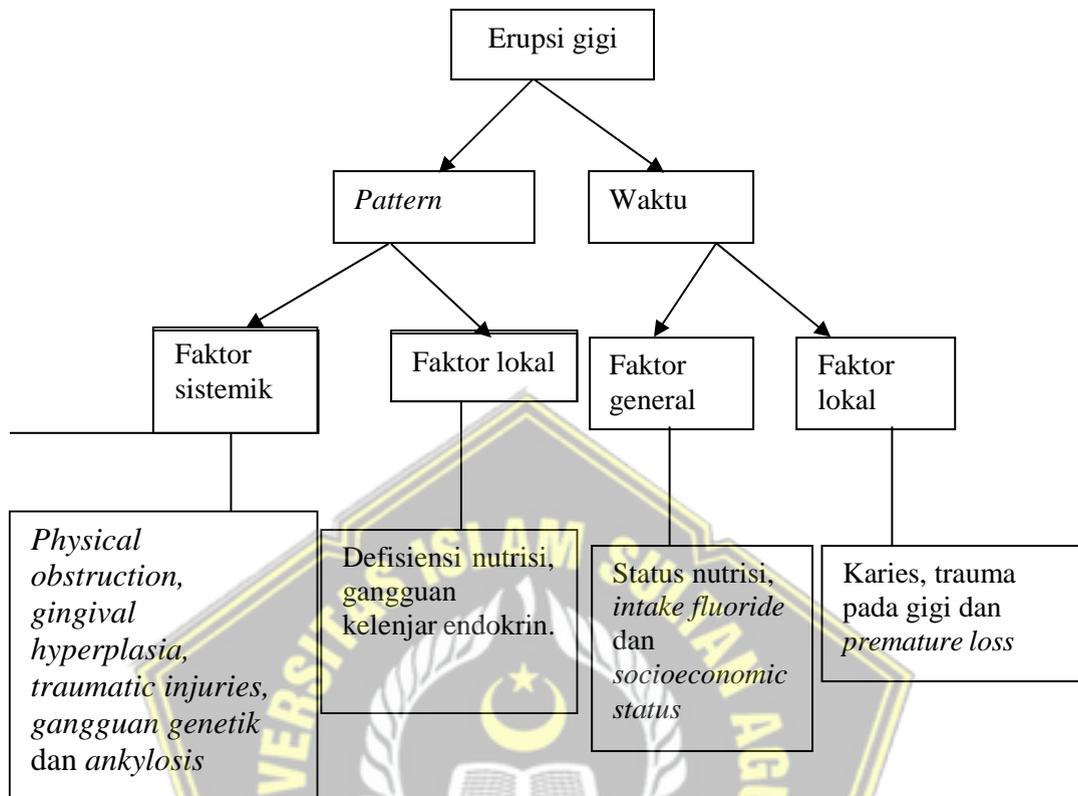
alveolar sehingga menyebabkan terjadinya gangguan erupsi gigi (Lailasari *et al.*, 2018; Alshukairi, 2019).

- b. Faktor sistemik yang mempengaruhi pattern erupsi gigi adalah :
- Defisiensi nutrisi, defisiensi nutrisi merupakan keadaan tubuh yang kekurangan zat-zat yang berfungsi untuk metabolisme tubuh. Hal ini berdampak pada perubahan pada tubuh dan berdampak pada gigi.
  - Gangguan pada kelenjar endokrin. Gangguan kelenjar endokrin menyebabkan perubahan pada seluruh tubuh termasuk perkembangan gigi. Perubahan dentofacial juga terkait dengan gangguan tyroid. Gangguan kelenjar pituary terbukti menyebabkan gangguan keterlambatan gigi. Pasien dengan HIV juga mengalami gangguan erupsi gigi.
  - Gangguan genetik, hal yang umum terjadinya keterlambatan erupsi adalah pada *Apert syndrome*. *Supernumerary teeth* adalah gangguan yang sering muncul pada penderita *Apert syndrome* (Alshukairi, 2019; Khan *et al.*, 2020).
- c. Faktor general yang mempengaruhi waktu erupsi gigi adalah :
- Status gizi, status gizi berdampak pada perkembangan dan pertumbuhan gigi sehingga hal ini mempengaruhi waktu erupsi gigi.

- *Intake fluoride*, asupan fluoride yang sesuai dalam tubuh akan mendukung perkembangan dan pertumbuhan gigi dengan baik.
- *Socioeconomic status*, tingkat ekonomi seseorang berpengaruh terhadap kecukupan nutrisi pada anak dan kemampuan dalam mendapatkan layanan fasilitas kesehatan yang memadai (Priyatmoko *et al.*, 2019).

d. Faktor lokal yang mempengaruhi waktu erupsi gigi adalah :

- Karies pada gigi, karies pada gigi sulung berpengaruh pada waktu erupsi gigi dikarenakan karies dapat memicu terjadinya gangguan pada perkembangan gigi secara normal.
- Trauma pada gigi, trauma pada gigi dapat memicu terjadinya erupsi *ectopic* dan gangguan dari normal odontogenesis seperti dilaserasi.
- *Premature loss*, *premature loss* menyebabkan gangguan *pattern* gigi sehingga menyebabkan keterlambatan erupsi (Girish Babu, Subramaniam and Madhusudan, 2019; Subramaniam and Pagadala, 2020).



Gambar 3. 1 Faktor yang mempengaruhi waktu dan pattern erupsi gigi

### 3.2.2

#### Pengaruh Status Gizi terhadap Waktu Erupsi Gigi Permanen

Gigi permanen yang erupsi terdapat 3 tahapan yaitu :

1. Stage 0, pada stage ini gigi belum terlihat didalam rongga mulut.
2. Stage 1, pada stage 1 setidaknya 1 cups dari gigi terlihat di rongga mulut.
3. Stage 2, pada stage 2 seluruh permukaan oklusal terlihat tetapi tidak semua bagian oklusal.
4. Stage 3, stage 3 ditandai dengan gigi yang sudah dapat melakukan oklusi dengan atau oklusal plane terlihat apabila gigi antagonis belum erupsi (Bagewadi *et al.*, 2016; Zakiyah, Prijatmoko and

Novita, 2017).

Tahapan erupsi secara fisiologis juga dibagi menjadi 5 tahapan yaitu tahapan pra-erupsi yang merupakan munculnya bibit gigi dan berkembang ke segala pada tulang alveolar sebelum erupsi, tahapan intra-osseus yaitu terjadinya resorpsi tulang di sekitar mahkota gigi yang sedang erupsi yang berguna untuk menjadi pendukung akar gigi, tahapan penetrasi mukosa ditandai dengan terbentuknya *epital junction* gigi, tahapan pra oklusal yang merupakan fase pertumbuhan akar dan tahapan pra erupsi ditandai dengan gigi yang mencapai permukaan oklusal (Zakiyah, Prijatmoko and Novita, 2017).

Erupsi gigi dapat berjalan secara normal atau mengalami gangguan seperti erupsi yang terlalu cepat dan terlalu lambat. Erupsi gigi yang mengalami gangguan disebabkan oleh banyak faktor salah satunya gangguan status gizi pada anak. Gangguan status gizi pada anak dapat berupa malnutrisi / kekurangan nutrisi dan obesitas / kelebihan nutrisi (Kristiani, Primawati and Fatimah, 2017; Lailasari *et al.*, 2018).

Malnutrisi pada anak seperti defisiensi zat besi, asam folat, vitamin C, vitamin B12, vitamin D, karbohidrat, protein, magnesium, kalsium, lemak dan lain lain dapat mempengaruhi masalah pertumbuhan dan perkembangan pada tubuh. Malnutrisi juga berdampak pada pertumbuhan dan perkembangan dikarenakan peran nutrisi pada jaringan di rongga mulut tidak ada perbedaan dengan jaringan di bagian tubuh lain, sehingga kekurangan nutrisi pada saat

perkembangan dan pertumbuhan gigi dapat mengakibatkan keterlambatan erupsi gigi (Pflipsen and Zenchenko, 2017; Lailasari *et al.*, 2018).

Pada penelitian yang dilakukan pada anak menunjukkan bahwa obesitas berpengaruh pada waktu erupsi gigi permanen. Obesitas dapat menyebabkan alterasi metabolisme secara hormonal dan *puberty* dini. Mekanisme tersebut memungkinkan alterasi pada erupsi gigi permanen. Anak yang obesitas mengalami erupsi gigi permanen terlalu dini atau waktu erupsi gigi permanen yang lebih cepat. Dalam hal ini jenis kelamin juga berpengaruh pada waktu erupsi gigi permanen. Anak laki-laki dan perempuan yang mempunyai status gizi sama, analisis menyebutkan bahwa perempuan mempunyai waktu erupsi yang lebih cepat daripada anak laki-laki. Hal ini terjadi dikarenakan anak perempuan mengalami proses maturasi yang lebih cepat daripada laki-laki termasuk dalam hal perkembangan gigi (Evangelista *et al.*, 2018; Nicholas *et al.*, 2018).

Obesitas merupakan suatu gangguan status gizi pada seseorang yang diukur dengan menggunakan *Body Mass Index* (BMI), tinggi badan, berat badan, umur dan jenis kelamin. BMI score analisis digunakan untuk melakukan evaluasi pada kesehatan anak dan dapat digunakan juga untuk menganalisis hubungan status gizi terhadap banyak aspek seperti gigi, skeletal, dan perkembangan motorik (Evangelista *et al.*, 2018; Šindelářová, Soukup and Broukal, 2018;

Garmash, 2019).

### **3.2.3 Pengaruh Status Gizi terhadap Waktu Erupsi Gigi Permanen Molar Satu Mandibula**

Masa anak-anak adalah suatu periode pertumbuhan manusia yang unik dan berkelanjutan. Perubahan fisik pada anak dikarenakan suatu pertumbuhan dapat mempengaruhi status kesehatan dan nutrisi anak. Adanya ketidakseimbangan antara asupan gizi yang dibutuhkan mengakibatkan permasalahan status gizi pada anak seperti kelebihan gizi / kekurangan gizi. Permasalahan status gizi pada anak dapat dipengaruhi oleh banyak hal yaitu kondisi sosial ekonomi, kurangnya persediaan pangan, sanitasi buruk, serta kurangnya pengetahuan masyarakat tentang gizi dan menu seimbang (Kristiani, Primawati and Fatimah, 2017; Fatmasari, Wiyatini and Saptiwi, 2019).

Status gizi sangat berpengaruh pada kondisi kesehatan gigi dan mulut anak. Status gizi dianalisis dengan menggunakan skor BMI, berikut merupakan status gizi seseorang berdasarkan BMI.

Tabel 3. 2 Status gizi berdasarkan skor BMI

| No | Kategori          | Skor BMI | Status Gizi                 |
|----|-------------------|----------|-----------------------------|
| 1. | <i>High BMI</i>   | >97      | Obesitas                    |
|    |                   | 90-97    | <i>Overweight</i>           |
| 2. | <i>Middle BMI</i> | 75-90    | <i>Risk of overweight</i>   |
|    |                   | 25-75    | Normal                      |
|    |                   | 10-25    | <i>Risk of underweight</i>  |
| 3. | <i>Low BMI</i>    | 3-10     | <i>Underweight</i>          |
|    |                   | <3       | <i>Severely underweight</i> |

Selain status gizi yang disebutkan di tabel 3.1 stunting juga merupakan salah satu gangguan nutrisi yang terbukti berpengaruh pada erupsi gigi. Stunting merupakan suatu gangguan pertumbuhan secara linear yang tidak sesuai dengan usia. Stunting biasanya disebabkan karena malnutrisi berupa defisiensi zinc, dan defisiensi metabolik growth hormon (Amanda Yudiya *et al.*, 2020).

Pada tahapan pertumbuhan zat gizi yang dibutuhkan yaitu protein, kalsium, dan fosfor yang sangat penting pada masa pertumbuhan. Kekurangan zat-zat tersebut akan berdampak pada terjadinya reterdasi pertumbuhan dan maturasi dari tulang sehingga dapat menyebabkan adanya keterlambatan erupsi gigi dikarenakan zat-zat gizi seperti kalsium, protein dan fosfor merupakan zat esensial dalam pertumbuhan (Esan and Schepartz, 2019; Amanda Yudiya *et al.*, 2020).

Kecukupan nutrisi dalam tubuh dipengaruhi oleh beberapa faktor

seperti cara mengkonsumsi makanan, waktu pemberian makanan dan jenis makanan yang diberikan yang semuanya akan berpengaruh pada kesehatan gigi dan mulut. Zat gizi seperti fosfor dan kalsium adalah bahan utama yang berfungsi dalam pembentukan dentin dan enamel pada gigi. Saat tubuh kekurangan fosfor dan kalsium maka pembentukan dentin dan enamel dapat terganggu. Zat gizi lain seperti magnesium juga mempunyai peran penting dalam pencegahan kerusakan pada gigi yaitu dengan cara menahan kalsium didalam enamel. Fluor berperan dalam mineralisasi dan pengerasan pada gigi. Pembentukan struktur gigi yang baik dan sempurna didukung oleh gizi yang seimbang (Ahmed and Al-Dahan, 2016; Amanda Yudiya *et al.*, 2020).

Secara garis besar gigi manusia dibagi menjadi 2 yaitu gigi sulung dan gigi permanen. Gigi sulung yang biasanya tumbuh pada usia 6 bulan sampai 2 tahun. Gigi sulung berjumlah 20 gigi. Usia berhubungan erat dengan pertumbuhan gigi, saat menjelang usia lebih dari 6 tahun gigi sulung akan digantikan oleh gigi permanen. Pergantian gigi sulung ke gigi permanen tidak hanya dipengaruhi oleh usia saja tetapi juga dipengaruhi status gizi. Status gizi menentukan erupsi gigi permanen dapat tumbuh normal, mengalami keterlambatan atau erupsi terlalu cepat. Gigi permanen mempunyai jumlah 32 gigi. Setiap jenis gigi permanen mempunyai karakteristik dan fungsi masing-masing. Jenis gigi permanen ada 4 yaitu gigi insisivus (gigi bagian depan), gigi

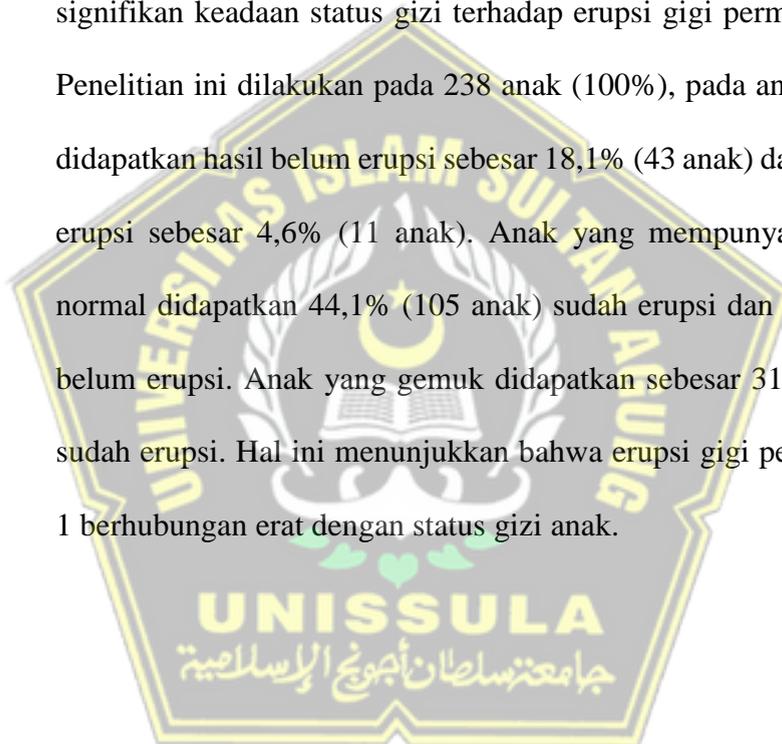
caninus (gigi taring), gigi premolar (gigi geraham depan) dan gigi molar (gigi geraham belakang) (Kristiani, Primawati and Fatimah, 2017; SJ *et al.*, 2019).

Gigi molar (gigi geraham belakang) mempunyai ciri khas tersendiri yaitu tumbuh / erupsi tanpa menggantikan gigi sulung. Gigi molar dibagi menjadi 2 yaitu gigi molar 1 dan gigi molar 2 yang berjumlah 3 gigi pada setiap rahang (Kristiani, Primawati and Fatimah, 2017). Gigi molar pertama permanen merupakan gigi permanen yang pertama kali erupsi dan normalnya erupsi pada usia 6 – 7 tahun. Pada rentang usia 6-7 tahun yang merupakan periode dari gigi molar pertama permanen untuk erupsi. Gigi molar pertama permanen ini merupakan gigi terbesar di antara gigi geligi yang lain dan sangat penting untuk merangsang pertumbuhan rahang di masa usia dini (Priyatmoko and Zakiyah, 2019). Gigi molar 1 yang pertama erupsi adalah gigi pada bagian rahang bawah dan yang terakhir erupsi adalah molar 2 rahang atas. Sebagian besar gigi rahang bawah (gigi insisivus sentral, insisivus lateral, caninus, molar 1 dan molar 2) muncul secara signifikan lebih awal daripada gigi rahang atas untuk status gizi yang sama (Ahmed and Al-Dahan, 2016; Bagewadi *et al.*, 2016).

Urutan erupsi pada gigi permanen biasanya berbeda antara rahang atas dan rahang bawah. Namun, gigi permanen pertama kali yang tumbuh dimulai dari gigi molar pertama. Ada kesepakatan di antara para ilmuwan tentang rentang waktu erupsi yang dapat ditoleransi tetapi

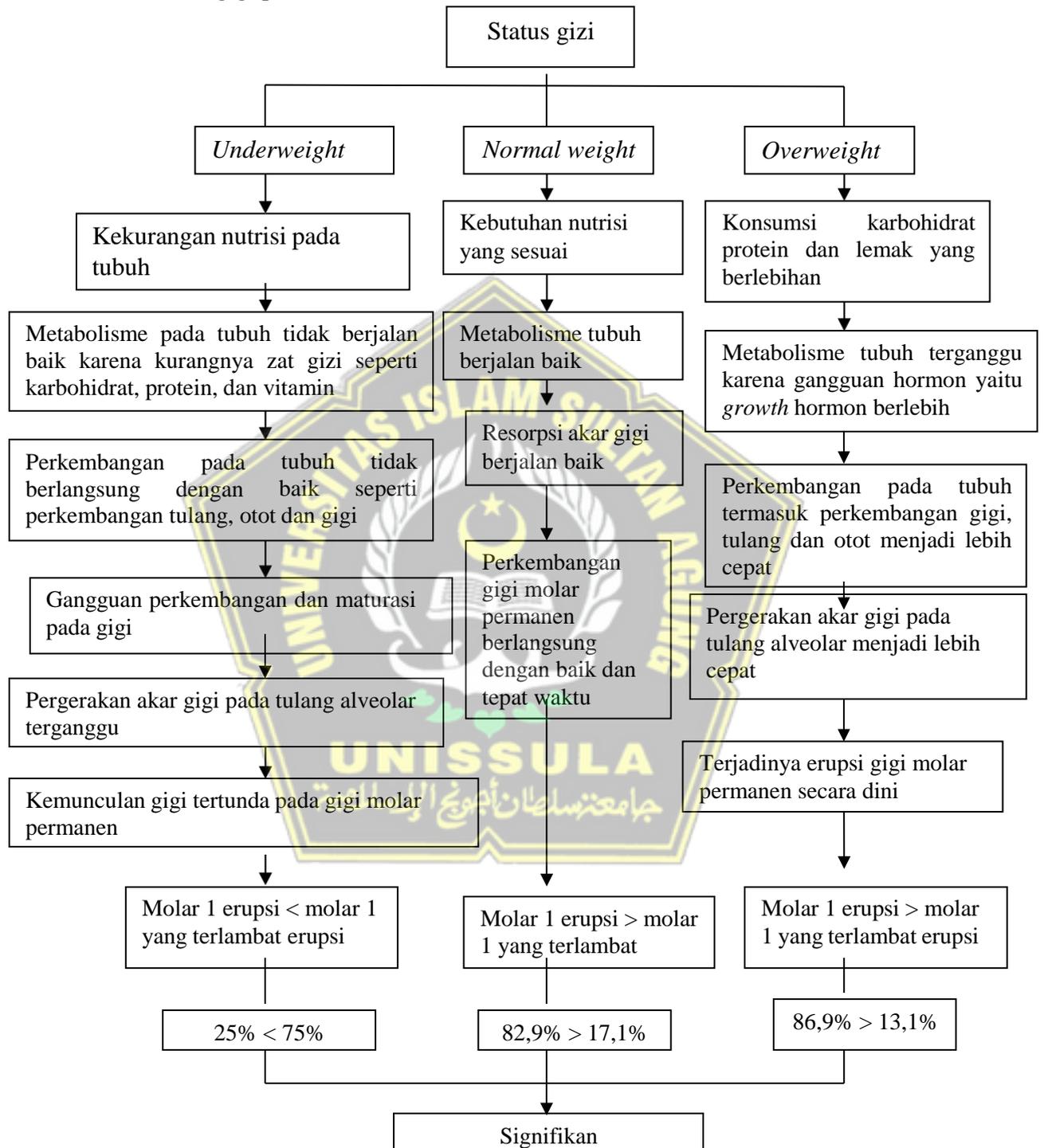
penyimpangan yang signifikan dari waktu erupsi normal perlu diperhitungkan dan segera dilakukan perawatan orthodontik pada periode gigi bercampur (Zakiyah, Prijatmoko and Novita, 2017; Kutesa *et al.*, 2019).

Pada penelitian terdahulu yang dilakukan oleh (Zakiyah, Prijatmoko and Novita, 2017) menunjukkan bahwa terdapat hubungan signifikan keadaan status gizi terhadap erupsi gigi permanen molar 1. Penelitian ini dilakukan pada 238 anak (100%), pada anak yang kurus didapatkan hasil belum erupsi sebesar 18,1% (43 anak) dan sudah erupsi sebesar 4,6% (11 anak). Anak yang mempunyai berat badan normal didapatkan 44,1% (105 anak) sudah erupsi dan 1,3% (3 anak) belum erupsi. Anak yang gemuk didapatkan sebesar 31,9% (76 anak) sudah erupsi. Hal ini menunjukkan bahwa erupsi gigi permanen molar 1 berhubungan erat dengan status gizi anak.



Berikut ini merupakan bagan hubungan status gizi terhadap erupsi

gigi permanen molar



Gambar 3. 2 Status gizi terhadap erupsi gigi permanen molar 1

Proses erupsi gigi adalah proses pergerakan gigi yang dimulai dari tempat pembentukan gigi didalam tulang alveolar kemudian gigi menembus gingiva sampai akhirnya gigi mencapai dataran oklusal di dalam rongga mulut. Proses erupsi gigi dimulai sebelum tanda pertama mineralisasi, dimana proses erupsi gigi terus menerus berlangsung tidak hanya sampai terjadi kontak dengan gigi antagonisnya, tetapi juga sesudahnya meskipun gigi telah difungsikan, proses erupsi gigi berakhir bila gigi telah tanggal. Proses erupsi gigi dibagi dalam tiga tahap yaitu tahap pra-erupsi, tahap prafungsional dan tahap fungsional (Priyatmoko *et al.*, 2019).

Waktu erupsi gigi adalah waktu munculnya tonjol gigi atau tepi insisal dari gigi ketika menembus gingiva. Waktu erupsi gigi sangat bervariasi, hal ini dapat terjadi karena beberapa faktor antara lain jenis kelamin, faktor lokal, kondisi sistemik, dan kelainan genetik. Waktu erupsi gigi dapat dibedakan atas masa gigi sulung, masa gigi bercampur, dan masa gigi permanen. Gigi permanen yang pertama erupsi adalah gigi molar pertama rahang bawah dan terkadang gigi insisivus pertama rahang bawah erupsi secara bersamaan atau mendahului gigi molar pertama pada usia 6 tahun (Alshukairi, 2019).

Anak dengan status gizi *overweight* memiliki asupan konsumsi karbohidrat protein dan lemak yang berlebih, selain itu jarak waktu makan yang pendek menyebabkan peningkatan aktivitas mastikasi yang dapat mempengaruhi otot dan perkembangan rahang. Aktivitas fungsional yang terjadi secara terus menerus menyebabkan pertumbuhan jaringan ikat disekitar *dental folikel*, peningkatan permeabilitas *vascular* di sekitar ligament periodontal dan peningkatan interaksi antar sel *osteoblast* dan *osteoclast*. Pergerakan akar gigi pada tulang alveolar juga menjadi lebih cepat sehingga terjadinya mendorong gigi molar satu mandibula permanen secara aktif bergerak kearah oklusal sampai akhirnya gigi berhasil mencapai dataran oklusal

didalam rongga mulut (Dimaisip-Nabuab *et al.*, 2018).

Hal ini sejalan dengan hasil penelitian terdahulu yang menunjukkan terdapat hubungan signifikan keadaan status gizi terhadap waktu erupsi gigi molar pertama permanen. Penelitian ini dilakukan pada 238 anak berjenis kelamin laki-laki yang berusia 72 – 84 bulan dengan berbagai status gizi. Pada kelompok anak yang *underweight* sebanyak 43 anak (18,1%) gigi molar pertama permanen belum erupsi. Kelompok anak yang *normal weight* didapatkan sebanyak 3 anak (1,3 %) belum erupsi. Kelompok anak yang *over weight* tidak ada molar satu permanen yang belum erupsi. Hal ini menunjukkan bahwa erupsi gigi permanen berhubungan erat dengan status gizi anak (Uwitonze *et al.*, 2020).

Rendahnya konsumsi protein pada anak *underweight* dapat mengganggu metabolisme yodium yang pada akhirnya mengganggu stimulasi metabolisme sel, termasuk tumbuh kembang rahang. Kekurangan yodium dapat memperlambat produksi hormon tiroid sehingga menyebabkan terjadinya hipotiroid. hipotiroid dapat mengganggu pertumbuhan tulang, termasuk rahang. Manusia dengan kondisi hipotiroid dapat menurunkan tingkat konsentrasi IGF-I dan IGFBP-3 sehingga proses tumbuh kembang secara normal dapat terganggu seperti pertumbuhan tulang. Tulang alveolar yang tidak dalam kondisi baik akan berpengaruh pada pergerakan akar di tulang alveolar. Status gizi *underweight* berpengaruh pada erupsi gigi karena adanya kekurangan nutrisi pada tubuh. Kekurangan nutrisi menyebabkan Metabolisme pada tubuh tidak berjalan baik karena kurangnya zat gizi seperti karbohidrat, protein, dan vitamin. Saat tubuh kekurangan zat gizi berdampak terhadap perkembangan pada tubuh tidak berlangsung dengan

baik seperti perkembangan tulang, otot dan gigi. Gangguan ini dapat berupa gangguan perkembangan dan maturasi pada gigi. Adanya gangguan perkembangan dan maturasi pada gigi akan menyebabkan pergerakan akar gigi pada tulang alveolar menjadi terganggu. Kemunculan gigi akan tertunda pada gigi molar permanen dan molar 1 menjadi terlambat erupsi (Bagewadi *et al.*, 2016).

Status gizi *normal weight* pada anak membuat kebutuhan nutrisi sesuai dan terpenuhi. Kebutuhan gizi yang sesuai membuat metabolisme tubuh berjalan dengan baik Resorpsi akar gigi juga akan berjalan baik. Resorpsi akar gigi yang terjadi tanpa gangguan akan berdampak pada perkembangan gigi molar permanen berlangsung dengan baik dan tepat waktu (Evangelista *et al.*, 2018).

Keadaan gizi yang berlebihan atau *overweight* disebabkan karena konsumsi karbohidrat protein dan lemak yang berlebihan. Karbohidrat dan lemak berlebih menyebabkan gangguan hormon. Metabolisme tubuh menjadi terganggu karena gangguan hormon yaitu hormon berlebih. Metabolisme yang terganggu menyebabkan perkembangan pada tubuh termasuk perkembangan gigi, tulang dan otot menjadi lebih cepat. Pergerakan akar gigi pada tulang alveolar juga menjadi lebih cepat sehingga terjadinya erupsi gigi molar permanen secara dini (Sitinjak, *et al.*, 2019).

Mekanisme erupsi gigi merupakan proses yang panjang dan berkesinambungan. Pembentukan gigi sangat membutuhkan zat gizi yang baik untuk membentuk dentin dan email seperti kalsium serta fosfor. Proses erupsi dimulai dari gigi yang dibentuk hingga keluar dari

tulang alveolar dan muncul di rongga mulut. Erupsi gigi terdiri dari beberapa tahapan. Tahapan erupsi gigi dimulai dari gigi yang muncul mulai bergerak ke arah vertikal dan keluar dari tulang alveolar. Gingiva akan mengalami pergerakan ke arah apeks sehingga dapat mendorong mahkota menjadi lebih panjang serta membentuk *cups* dan akar menjadi lebih pendek dikarenakan adanya perubahan perubahan epitel pada daerah akar, serta proses ini disebut *gingiva emergence* (Kutesa *et al.*, 2019; Amanda Yudiya *et al.*, 2020).

### **3.2.4 Manfaat Mengetahui Waktu Erupsi Gigi Permanen Molar Satu Mandibula Pada Gigi Anak**

Proses anak menuju dewasa merupakan proses yang kompleks dari perkembangan biologis. Perkembangan skeletal, kalsifikasi, dan erupsi gigi merupakan hal yang penting untuk diperhatikan. Erupsi gigi permanen yang menyebabkan gangguan dikarenakan ketidaktepatan waktu erupsi harus dilakukan identifikasi secara dini untuk melakukan diagnosis, rencana perawatan orthodontik, dan prosedur pencegahan pada tindakan kedokteran gigi. Setiap individu mempunyai etnik, ras, genetika, faktor hormonal, geografik area, jenis kelamin, status sosial, dan status gizi yang beragam sehingga menyebabkan waktu erupsi gigi permanen yang berbeda-beda pada setiap individu (Girish Babu, Subramaniam and Madhusudan, 2019; Khan *et al.*, 2020).

Gigi merupakan bagian penting dari dentomaxillofacial yang kompleks. Gigi adalah *biological marker* dari proses maturasi dan sangat

penting dalam kehidupan seseorang. Erupsi gigi merupakan tanda proses paling akhir dari pembentukan gigi. Mengetahui waktu erupsi gigi permanen pada anak merupakan hal yang penting. Erupsi gigi yang mengalami keterlambatan dapat menyebabkan gangguan pada hubungan oklusal gigi sehingga terjadinya maloklusi gigi dan gangguan mastikasi. Keterlambatan erupsi gigi pada daerah anterior dapat memberikan dampak negatif pada psikologis anak dikarenakan mempengaruhi aspek estetik. Keterlambatan erupsi gigi pada daerah posterior seperti gigi permanen molar satu dapat menyebabkan adanya keterlambatan perawatan orthodontik saat lengkung gigi tidak normal, dikarenakan saat melakukan perawatan orthodontik harus menunggu semua gigi erupsi terlebih dahulu (Lailasari *et al.*, 2018; Khan *et al.*, 2020; Subramaniam and Pagadala, 2020).

Memperhatikan waktu erupsi gigi permanen molar 1 adalah hal yang penting karena erupsi gigi yang lebih cepat pada anak dengan gangguan status gizi seperti obesitas atau *overweight* dapat menyebabkan peningkatan resiko kerusakan gigi yang lebih tinggi. Perawatan kerusakan gigi pada anak juga lebih sulit bagi dokter gigi dikarenakan kecemasan anak yang mempunyai tingkat kecemasan tinggi terhadap perawatan gigi (Pahel *et al.*, 2017; Šindelářová, Soukup and Broukal, 2018).

Perlunya mengetahui faktor yang berhubungan dengan erupsi gigi juga merupakan hal yang perlu diperhatikan. Mendiagnosis dan

melakukan perawatan maloklusi pada waktu yang tepat seperti menentukan faktor status gizi terkait erupsi gigi lebih awal / lebih lambat. Pengetahuan waktu erupsi gigi dan faktor yang mempengaruhinya penting dalam antropologi forensik untuk estimasi usia individu. (Šindelářová, Soukup and Broukal, 2018; Alshukairi, 2019)



## BAB IV

### KESIMPULAN DAN REKOMENDASI

#### 4.1 Kesimpulan

Perkembangan erupsi gigi secara normal dipengaruhi oleh banyak faktor. Nutrisi secara signifikan menjadi faktor yang cukup penting dalam menentukan waktu erupsi gigi pada gigi molar satu. Gangguan nutrisi *underweight* dan *overweight* merupakan gangguan yang sering menyebabkan keterlambatan erupsi pada gigi.

Keterlambatan erupsi gigi dapat disebabkan karena banyak faktor. Setiap faktor mempunyai mekanisme dan dampak yang berbeda dalam mempengaruhi keterlambatan erupsi gigi.

#### 4.2 Rekomendasi

Keterlambatan erupsi gigi dikarenakan gangguan nutrisi harus segera dilakukan identifikasi sehingga perkembangan erupsi gigi dapat berjalan dengan baik sesuai dengan usianya.

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ORIGINAL RESEARCH PAPER

# Relationship between body mass index with eruption of third permanent molar teeth

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## ABSTRACT

**Objective:** The aim of the study is to investigate the relationship between the nutritional status and the permanent eruption of the third molar teeth aged 13-26 years.

**Introduction:** It is known that chronology of dental development is less variable than the bone development and the method applied for this particular period of life is a reliable indicator of age. Though eruption of teeth may be affected by dietary variation, the eruption time for teeth are fairly constant. **Materials and methods:** It is a cross-sectional prospective study conducted among the people aged 13-26 years through a questionnaire over 100 participants. **Results:** A total of 51% male and 49% female were participated in this study. Out of 25 participants of complete third molar eruption, majority 52% (13) participants were belonging to female. In this study, the percentage of complete third molar eruption among the participants with different Body Mass Index (BMI) categories like underweight, normal and overweight were 7, 16 and 2 respectively. **Conclusion:** These findings suggest a relationship between nutritional status with eruption of third permanent molars. As the complete eruption of third molar is less with underweight and obese individuals, initiatives should be undertaken for health promotion among the common people regarding oral health and healthy eating. **Keywords:** Height; weight; dentition; obesity; malnutrition.

## INTRODUCTION

One of the greatest problems for India is undernutrition among children. Malnutrition, the condition resulting from faulty nutrition, weakens the immune system and causes significant growth and cognitive delay. Growth assessment is the measurement that best defines the health and nutritional status of children.<sup>1</sup> A balanced diet contains all the elements is very necessary for the growth of the teeth.<sup>2</sup> So, nutritional

deficiencies can delay the process of eruption of permanent teeth.<sup>3</sup>

On the other hand, dental development is relatively independent from another systems of maturation.<sup>4</sup> Though eruption of teeth may be affected by dietary, climatic, racial and geographical variation, the eruption time for deciduous and permanent teeth are fairly constant. Eruption of teeth is one of the changes observed easily among the various dynamic changes that occur from formation of teeth to the final shedding of it. There is a significant time lag between cutting of a tooth into the mouth and completion of eruption of teeth.<sup>5</sup>

As it is a debatable to know whether nutritional status has any role in the process of dentition or not, this paper has aimed to know the relationship between the nutritional status with eruption of permanent third molar teeth of aged 13-26 years.

## MATERIALS AND METHODS

It is was a cross-sectional prospective study conducted over 100 participants aged 13-26 years. Here, we have investigated

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# Assesment of Eruption of Permanent Teeth According To Age And Its Relation With Body Mass Index In Local Population

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**ABSTRACT:** Objectives of the present study was to find out the assessment of eruption of permanent teeth according to age and its relation with body mass index in local population.

Three hundred School children were included in this study. The study was conducted from 1st March to 31st May 2016. The schools selected for research were Pak Turk International School (Isra University), Isra School (Hadi Nagar) and Government primary School, Village Haji Ismail Khan Chand (Hala Naka). Data was collected by measuring the height, weight and oral examination of each child. The height and weight were later used to calculate the child's B.M.I. A sample of 300 children was studied; 100 each of different socioeconomic school. The Mean age and standard deviation was  $9.86 \pm 2.057$  years respectively. Frequency of male to female subjects remained 150 (50%) and 150 (50%) respectively. Age category was from 5 to 15 years of age. It was seen that children were mostly in the normal weight category other than children of age 8 & 10 where underweight children were seen in excess.

It was found that almost all teeth had slight delayed eruption according to the normal eruption time but since the sample size was not big enough therefore we cannot conclude that every child in our region will have delayed eruption. In our sample the highest variation was seen in mandibular left second molar where delayed eruption was present.

**KEY WORDS:** B.M.I., eruption, permanent teeth, socioeconomic status, age

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## INTRODUCTION

Eruption time of the teeth and order are essential aspects in treatment planning, mainly when patients require orthodontic treatment, it also plays a pivotal role in forensic dentistry as it can help to find the age of an adolescent.<sup>1,2</sup> Exfoliation of primary teeth and in turn the eruption of new teeth, is a constant age-related progression by which the teeth arise through the upper and lower jaws and the overlying mucosa to enter into the oral cavity and in turn occlude with the teeth of the opposite arch.<sup>1,3</sup>

The permanent teeth usually emerge between the ages of 6-14 years, not including the 3rd molars that usually are seen emerging at the ages of 17-21 years.<sup>4,5</sup> As teeth are the most stable structures in the human body, it can be of paramount importance in forensic medicine where estimation of age is usually required for criminal investigations and also in persons who do not have proper birth certificates whether above or below 18 years of age.<sup>6,7</sup> Body Mass Index

(BMI) is a reliable table for measurement of obese people and for those who are overweight especially teenagers and small kids. BMI is reliant on age and gender in kids and teenagers and is for the most part stated to as particular for a specific age<sup>8</sup> but, no sound research has been performed in Pakistan on the assessment of eruption of permanent teeth according to age and its relation with body mass index. The basis behind this research investigation was to provide adequate knowledge of timing in emergence of permanent tooth, especially in our part of the world where because of poverty, majority of the children are either underweight or

| Permanent Tooth | Maxillary | Mandibular |
|-----------------|-----------|------------|
| Central         | 7         | 6          |
| Lateral         | 8         | 7          |
| Canine          | 11        | 10         |
| 1st Premolar    | 10        | 10         |
| 2nd Premolar    | 11        | 11         |
| 1st Molar       | 6         | 6          |

malnourished.<sup>9</sup> Hence, this will give an idea that BMI does play a role in eruption sequence. It also plays a pivotal role in Forensic dentistry as it can help to find the age of an

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# A Contemporary Examination of First and Second Permanent Molar Emergence

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## Abstract

The emergence of first permanent molars (FPMs) and second permanent molars (SPMs) is an important developmental milestone influencing caries risk and the timing of sealant placement. Emergence times have been shown to vary by sex and race/ethnicity, while recent reports suggest a positive association with adiposity. Amid the changing demographics of the US population and the rising rates of pediatric overweight/obesity, we sought to examine the association of body mass index (BMI) with FPM/SPM emergence in a representative sample of US children and adolescents. We used cross-sectional data from 3 consecutive cycles of the National Health and Nutrition Examination Survey (2009 to 2014). The FPM analysis included ages 4 to 8 y ( $n = 3,102$  representing ~20 million children), and the SPM analysis included ages 9 to 13 y ( $n = 2,774$  representing ~19 million children/adolescents). The Centers for Disease Control and Prevention's growth chart data were used to calculate age- and sex-specific BMI percentiles, as measures of adiposity. Initial data analyses relied on descriptive statistics and stratified analyses. We used multivariate methods, including survey linear and ordinal logistic regression and marginal effects estimation to quantify the association between pediatric overweight/obesity and FPM/SPM emergence, adjusting for age, sex, and race/ethnicity. Forty-eight percent of 6-y-olds and 98% of 8-y-olds had all FPMs emerged, whereas SPM emergence varied more. Blacks (vs. whites) and females (vs. males) experienced earlier emergence of FPMs and SPMs. Overweight/obesity was associated with earlier FPM emergence, particularly among black females. Obesity but not overweight was associated with earlier SPM emergence. Overall, overweight/obesity accounted for 6 to 12 mo of dental acceleration. This study's results emanate from the most recent US-representative data and affirm that FPM/SPM emergence varies by race/ethnicity and sex and is positively influenced by BMI. Future research should further elucidate these associations with detailed eruption data and examine the implications of this variation for clinical care.

**Keywords:** dental public health, obesity, pediatric dentistry, sealants, tooth development, caries risk

## Introduction

The emergence of first permanent molars (FPMs) and second permanent molars (SPMs) is an important developmental milestone with important implications for the development of functional occlusion, dental caries risk, and the timing of sealant placement. Understandably, many population-based studies on the timing of permanent molar emergence in the United States have been connected to the evaluation of school-based and school-linked dental sealant programs. In such programs, there is well-documented variation in the timing of FPM/SPM emergence by race/ethnicity and sex. For example, Kutty and Ashton (1989) examined the timing of eruption of FPMs and SPMs to better time sealant placement for 4,879 Ohio school-children in grades 1 to 3, 6 to 8, and 11 from 1987 to 1988, finding that FPMs and SPMs both erupted earlier among females. Furthermore, black children had FPMs erupted at the same time as whites, but SPMs erupted earlier among blacks.

More recently, Phipps et al. (2013) examined the timing of emergence and the presence of caries lesions on FPMs among American Indian and Alaska Native schoolchildren, using Indian Health Service oral health surveillance data for 2011 to 2012. They found that 27% of kindergarten children already had all FPMs erupted. The greatest increase in erupted FPMs and dental caries experience occurred for children in the first grade, leading to the conclusion that a school-based sealant

program for American Indian and Alaska Native children should begin in kindergarten and continue into first grade. Both studies examined and reported emergence according to school grade rather than age, limiting the potential for inference regarding the latter.

Beyond racial and ethnic variation in tooth emergence, recent evidence suggests that increased adiposity, as measured by body mass index (BMI), is associated with dental acceleration and earlier tooth emergence (Hilgers et al. 2006; Weddell and Hartsfield 2011; Must et al. 2012). Dental acceleration is of special relevance because of the rising prevalence of overweight and obesity among children and adolescents in the

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A supplemental appendix to this article is available online.

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## The relationship of obesity to the timing of permanent tooth emergence in Czech children

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### ABSTRACT

**Background:** The aim of this study was to investigate the influence of BMI on the timing of permanent tooth emergence in Czech children.

**Objectives:** In this cross-sectional study, 1370 Czech children were examined. The age, gender, weight, height, all emerged permanent teeth (except third molars) of each child were all recorded. A tooth is defined as having emerged when at least any part of it has penetrated the gingiva.

**Methods:** A logistic regression model was used to calculate the median emergence age per tooth for both genders separately and BMI was used as a factor variable to detect statistically significant differences in the times of tooth emergence within pairs of BMI groups. The data were statistically processed using IBM SPSS Statistics 23 (SPSS Inc., Chicago, IL).

**Results:** Statistically significant differences were found for the following permanent teeth (using the FDI two-digit system): 13, 14, 15, 16, 17, 41, 44, 45, 46, 47, 33, 35, 37, 21, 24, 25, 26, 27 for girls and 12, 13, 14, 15, 16, 41, 43, 44, 45, 22, 25, 32, 34, 35, 36 for boys. These teeth were observed to emerge earlier in obese children. A similar correlation (although not statistically significant) was observed between the time of emergence of the remaining teeth and the BMI of the child.

**Conclusion:** The data in this research highlight significant differences in emergence times of permanent teeth due to the influence of BMI in Czech children. These findings are important for dental treatment planning.

### ARTICLE HISTORY

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### KEYWORDS

Obesity; BMI; tooth emergence; permanent teeth; Czech children

### Introduction

Overweight and obesity are the most common nutritional disorders in industrialized countries, and they continue to increase in prevalence [1]. Childhood obesity has become a growing problem in paediatrics particularly due to the changing nutritional habits of children during their later years. Childhood obesity is defined as an accumulation of excess body fat in children. Childhood obesity is related to obesity in adulthood and contributes to a higher prevalence of obesity-related chronic diseases in the adult population such as diabetes, high blood pressure, heart disease, sleep apnoea, and cancer [2].

The most widely used method for evaluating an individual's anthropometric and nutritional status is body mass index (BMI), which is defined as the body mass divided by the square of body height ( $\text{kg}/\text{m}^2$ ). Individuals are classified based on BMI as overweight/obese using the universal cut-offs of 25 and  $30 \text{ kg}/\text{m}^2$  [3]. BMI for children is strongly influenced by age during childhood and adolescence, therefore BMI-for-age rather than BMI has been used to establish reference standards and in the evaluation of overweight/obesity in childhood and adolescence in many countries [4]. The raw measurement of BMI for children is based on accepted BMI reference standards (the percentile growth chart) ideally

drawn from charts derived from the population to which they apply [5]. In the Czech Republic, the growth reference data have been regularly updated through nation-wide anthropological surveys of children and adolescents (NAS) [6]. Growth charts for BMI are based on 1991 NAS data, because the rates of those children defined as overweight (over 90th percentile) and those defined as obese (over 97th percentile) have increased in the last quarter century. To construct BMI percentile charts based on recent data would lead to a shift towards higher values for the 90th and 97th percentiles and even for the 50th percentile in some age groups which would be misleading. For this reason, the 1991 percentile has been used [6].

Although the time of emergence of permanent dentition is genetically controlled [7], various external factors such as physical constitution and nutrition [8] can also affect the process of dental development and can accelerate craniofacial growth [9] as well. The other factors influencing the emergence of permanent teeth can be climate [10], socioeconomic status, premature birth, habits during pregnancy [11], circadian rhythm [12], premature loss of deciduous teeth [13], and fluoride intake [14].

The majority of foreign studies focus on the influence of weight on the emergence time of deciduous teeth [15–18].

# Delayed tooth eruption and its pathogenesis in paediatric patient: a review

## Abstract

Human eruption is a unique developmental process in the organism. Delayed tooth eruption is the emergence of a tooth into the oral cavity at a time that deviates significantly from norms established for different races, ethnicities, and sexes. The eruption time of primary teeth is very important for planning and diagnosing of certain growth developments. The present article gave a review on delayed tooth eruption and its pathogenesis.

**Keywords:** delayed tooth eruption, oral cavity, eruption

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## Introduction

Tooth eruption is the process by which developing teeth emerge through the soft tissues of the jaws and the overlying mucosa to enter the oral cavity, contact the teeth of opposing arch, and function in mastication.<sup>1</sup> The term "eruption" is derived from the Latin word "eruptio", which means output with momentum.<sup>2</sup> It is a continuous process that ends only with the loss of tooth. Eruption of deciduous teeth, their exfoliation followed by eruption of permanent dentition is an orderly, sequential, and age-specific event and is considered as an important milestone during child's development.<sup>3</sup> Parents consider eruption of first primary teeth as an important developmental milestone that has to be achieved by the child.<sup>4,5</sup> Eruption is a physiologic process that strongly influences the normal development of the craniofacial complex.<sup>6,7</sup>

**Pathogenesis and aetiology:** The process of normal eruption and the source of eruptive forces are still controversial topics. Some local and systemic factors may affect the pattern of eruption. Others factors affect the timing of eruption.

**Local conditions** causing delayed eruption include:

**Physical obstruction:** These obstructions can result from many different of causes, such as supernumerary teeth, mucosal barrier, scar tissue, and tumors. It has been reported to occur in 28% to 60% of white people with supernumerary teeth.<sup>8</sup>

**Mucosal barrier** has also been suggested as an etiologic factor in delayed teeth eruption.<sup>9,12</sup>

**Gingival hyperplasia** due to hormonal imbalance, hereditary causes, vitamin C deficiency or phenytoin drugs cause increase of dense connective tissue and the acellular collagen that can affect the normal tooth eruption.<sup>13</sup>

**Traumatic injuries** can lead to ectopic eruption 35,36 or some disruption in normal odontogenesis in the form of dilacerations<sup>14,15</sup> or physical displacement of the permanent germ.<sup>16,17</sup>

**Cystic transformation** of a nonvital deciduous incisor might also cause delay in the eruption of the permanent successor.<sup>18</sup>

**Ankylosis**, the fusion of the cementum or dentin to the alveolar bone, is the most common local cause of delayed deciduous tooth exfoliation.<sup>19-24</sup>

Arch-length deficiency is often mentioned as an etiologic factor for crowding impactions.<sup>15,20</sup>

**Systemic conditions include:**

The effect of **nutritional deficiency** on tooth eruption have been reported.<sup>24-26</sup>

**Disturbance of the endocrine glands** usually has a profound effect on the entire body, including the dentition. The denofacial changes in cretinism are related to the degree of thyroid deficiency.<sup>7-22</sup> In pituitary dwarfism, eruption and shedding of teeth are delayed, as is the growth of the body in general.<sup>27,28,31</sup> Retardation of dental growth and development in **preterm babies** has been reviewed by Seow and identified as a cause of delayed Tooth Eruption.<sup>32</sup> Patients with human immunodeficiency virus (**HIV infection**) showed delayed tooth eruption. A study of dental manifestations in 70 children perinatally infected with HIV reported that delayed dental eruption.<sup>33</sup> In a study of children with **cerebral palsy**, Pope and Curzon found that unerupted deciduous and permanent teeth were more common in them compared with the controls. The first permanent molar erupted significantly later. No etiology or implicated mechanisms were elaborated.<sup>34</sup> Other systemic conditions associated with impairment of growth, such as **anemia** (hypoxic hypoxia,<sup>35</sup> histotoxic hypoxia, and anemic hypoxia<sup>35</sup>) and **renal failure**,<sup>36</sup> have also been correlated with delayed Tooth Eruption and other abnormalities in dentofacial development.

**Genetic disorders.** A generalized developmental delay in permanent tooth formation is seen in Apert syndrome.<sup>37,38</sup> Supernumerary teeth have been found to be responsible for delayed Tooth Eruption in Apert syndrome,<sup>37,39</sup> cleidocranial dysostosis,<sup>40</sup> and Gardner syndrome.<sup>41</sup>

## Factors affecting the eruption time

Several studies have shown variations in the ages at which individual primary teeth erupt as well as variations of eruption pattern between different ethnic and racial groups.<sup>7,8</sup> Other suggested factors, which affect the eruption time, may include gestational period, diseases, nutritional status, growth and climate. In addition to genetic factors, environmental factors such as maternal smoking , height and weight of a new born at the time of birth and nutrition status has shown to play a role in the eruption of the first primary tooth. A few reports have focused on the discerning effect of nutrition in early age of a child, including breast milk.

## Hubungan Status Gizi dengan Erupsi Gigi Molar Pertama Tetap pada Murid Kelas 1 SDN Cisit 02 Kabupaten Garut

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### ABSTRAK

Masa anak-anak merupakan periode dari pertumbuhan dan proses pertumbuhan manusia, pada masa ini terjadi perubahan yang sangat unik dan berkelanjutan. Perubahan fisik karena pertumbuhan yang terjadi akan mempengaruhi status kesehatan dan gizinya. Ketidakseimbangan antara asupan kebutuhan atau kecukupan akan menimbulkan masalah gizi, baik itu berupa masalah gizi lebih maupun gizi kurang. Penelitian ini bertujuan untuk mengetahui hubungan status gizi dengan erupsi gigi molar pertama tetap pada murid kelas 1 SDN Cisit 02 Kabupaten Garut.

Metode dalam penelitian ini adalah *cross sectional*, yaitu dengan melakukan pemeriksaan status gizi dan pemeriksaan intra oral erupsi gigi molar pertama tetap pada satu waktu tertentu. Subyek penelitian adalah murid kelas 1 SDN Cisit 02 Kabupaten Garut yang berjumlah 24 orang berumur antara 6-9 tahun sedangkan sampel penelitian adalah total sampling. Alat ukur yang digunakan berupa formulir status gizi dan formulir erupsi gigi molar pertama tetap.

Hasil penelitian dalam penelitian ini adalah tidak ada korelasi bermakna antara status gizi dengan erupsi gigi molar pertama tetap murid kelas 1 SDN Cisit 02 Kabupaten Garut Tahun 2016 dilihat dari *p value* 0,665 ( $>0,05$ ), maka dapat disimpulkan tidak ada hubungan status gizi dengan erupsi gigi molar pertama tetap murid kelas 1 SDN Cisit 02 Kabupaten Garut Tahun 2016.

Kata Kunci: Status Gizi, Erupsi Gigi M1.

### ABSTRACT

Childhood is the period of growth and the process of human growth, during this time there is a very unique and sustainable change. Physical changes due to the growth that occurs will affect health status and nutrition. Imbalances between the intake of needs or adequacy will cause nutritional problems, whether it be more nutritional problems and less nutrition. This study aims to determine the correlation of nutritional status with the eruption of the first permanent molar on grade 1 students SDN Cisit 02 Garut regency.

The method in this research is *cross sectional*, that is by checking nutrient status and intra oral examination of an eruption of the first molar still at one time. The subject of this research is 1st-grade students of SDN Cisit 02 Garut regency which is 24 people between 6-9 Year while the research sample is total sampling. Measuring tool used in the form of nutritional status form and permanent molar first eruption form remains.

The result of this research is there is no correlation between the nutritional status with the eruption of first molars still the first grade students of SDN Cisit 02 Garut Regency Year 2016 seen from *p value* 0,665 ( $> 0,05$ ), hence can be concluded no relation status Nutrition with the eruption of first molars remains a grade 1 student of SDN Cisit 02 Garut Regency Year 2016.

Keyword: Nutrient Status, Eruption M1 Teeth.

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# Association between Mean Age of Eruption of the Permanent Teeth and Body Mass Index among School-going Children of 7–17 Years of Age in Chennai City

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## ABSTRACT

**Aim:** The aim of this study was to determine the association between mean age of eruption of the permanent teeth and body mass index (BMI) among 7–17-years-old school-going children in Chennai city.

**Materials and methods:** This cross-sectional study was conducted among 400 school-going children of age 7–17 years. It was carried out by a single examiner and an average of 50 children was examined per day. Clinical examination was done to assess the eruption status of the permanent teeth which was categorized according to the criteria given by Pakkala et al.<sup>1</sup> Individual height and weight were noted and further BMI was calculated.

**Results:** A total of 196 (49.1%) boys and 204 (50.9%) girls were assessed. Among the 400 children assessed, 19 (4.75%) were underweight, 321 (80.25%) belonged to normal category, 41 (10.25%) were at the risk of overweight, and 19 (4.75%) were obese. Overall, female children were found to have earlier eruption of the permanent teeth compared to males. Also, it was found that the mean age of eruption increased with increasing BMI indicating delayed eruption in obese children.

**Conclusion:** The present study shows a significant association between BMI and mean age of eruption of the permanent teeth among school-going children of 7–17 years of age in Chennai city. Further longitudinal multicentric studies are recommended to determine the exact relationship between BMI and dental development.

**Keywords:** Body mass index, Children, Eruption, Permanent teeth.

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## INTRODUCTION

Tooth eruption is defined as the movement of the tooth from its site of development in alveolar bone to the occlusal plane in the oral cavity.<sup>1</sup>

Tooth eruption in the oral cavity occurs over a broad chronological age range and is influenced by various factors such as genetics, gender, nutrition, pre-term birth, socioeconomic factors, height and weight, craniofacial morphology, hormonal factors, and systemic diseases.<sup>2,3</sup> Studies have also reported differences in the eruption of the permanent teeth between ethnic groups, nutritional factors, and congenital abnormalities such as supernumerary teeth, Down's syndrome, cleidocranial dysplasia, and environmental trends.<sup>4-7</sup>

Eruption of the teeth is found to be positively related to somatic growth (height and weight) of individual. Of all the factors that influence tooth eruption, nutrition is believed to play a positive role in accelerating the process. Many authors across the globe have also reported that poor nutrition during the growing period will in turn have adverse influence on the dental development including delay in the eruption of both deciduous and permanent teeth, congenital dental anomalies, and poor oral health.<sup>5-10</sup>

Body mass index has been one of the most common indicators to determine and compare somatic growth among large group of people, especially children. Also, it is one of the most common and simplest methods to assess the nutrition status of an individual. Body mass index, usually measured as Quetelet Index, is defined as person's weight in kilograms divided by the square of the height in meters.<sup>3,4</sup> It is usually calculated using the formula:

$$BMI = \frac{\text{weight (kg)}}{\text{height m}^2}$$

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Unlike BMI assessments for adults, assessments for children and teenagers take the growth- and gender-specific differences into account. Among children, specific BMI values are referred to as "BMI for age," as given by the Centers for Disease Control and Prevention (CDC).<sup>4,5</sup> Literature evidence show that children with lesser height and weight for their age have delayed the eruption of teeth than their normal counterparts.

Hilgers et al. studied the relationship between obesity and dental development in 104 children and showed that dental development significantly accelerates with increase in BMI.<sup>11</sup> A 4-year longitudinal study on 110 Mexican elementary school children concluded that overweight children had more erupted teeth with lesser incidence of caries than children with lower BMI.<sup>12</sup> Sadeghianrizi studied the relationship between craniofacial development and obesity using lateral cephalometrics and

## Role of Body Composition on the Eruption Time of First Permanent Molars

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### Abstract

Body Composition has been known to have a significant role in the bone maturity process. Heavy children showed to have a more mature phase in the development of their metacarpal bones compared to those of thin children at the same age groups. However, the study on the role of body composition on the eruption times of first permanent molars among children is limited. The aim of this study is to determine the role of body composition on the eruption time of first permanent molars among 6 and 7 years old children living in Jember administration city, Indonesia. Two hundred and thirty four children, age between 6 to 7 years old, were participated in this study. Body composition was assessed by measuring their BMI. The percent total body fat (%TBF) was calculated from BMI using the Deurenberg equation and grouped into thin and fat subgroup using the approach of analytic z score. Oral examinations were conducted to collect the first permanent teeth eruption data. This study found that thin subgroup children showed delayed eruption in all 4 first permanent molars. The fat subgroup showed accelerated eruption in all 4 first permanent molars. This study concluded that the body composition played a significant role in the eruption time of permanent teeth in which fat children experience acceleration of first permanent molars eruption. Chronological age was a weak predictor of first permanent molars eruptive times.

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Keywords: Body composition, %FM, Chronological tooth eruption.

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### Introduction

Dental eruption is a unique developmental process and the aetiology of the mechanism is not fully understood yet. The order of permanent dentition eruption is usually different between upper and lower jaw. However, the first permanent dentition to erupt is usually begin by the first molar. There is an agreement among the scientists on acceptable range of eruptive times. However, significant deviation from the norms eruptive times should be put into account when orthodontic treatment is required in the mix dentition period. Number of physiological and pathological factors can influence tooth eruption. Studies on the dental eruptive times were mostly involve in age and gender different, genetic factors, racial and ethnicity.<sup>1,2,3</sup> Permanent teeth

tend to appear earlier in girls.<sup>1,4,5</sup> Eruptive times of permanent dentition is also influenced by nutritional status.<sup>4</sup> Under nutrition children show to have fewer number of permanent teeth eruption compare to those of normal weight children.<sup>6,7</sup>

Assessment of body composition is an integral part of nutritional status assessment. Body composition have been explored in various normal and pathological condition. The role of body composition in either physiological and pathological processes including in the field of dental caries have been explored<sup>8,9</sup> and studies of the influences of body composition on bone mass have also been widely reported. Body composition per se lean body mass, body fat has been reported as the most significant predictors of bone mass in preadolescent.<sup>10</sup> While Smith RJ (1980) earlier researcher who studied the relation between body composition and bone maturity using the metacarpal radiology found that there is significant role of body composition and bone maturity.<sup>11</sup> However, study on the role of body composition on the eruptive times of first permanent molars is limited,<sup>12</sup> especially within Asian ethnicity. This study is aimed to determine

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RESEARCH ARTICLE

Open Access



# Nutritional status, dental caries and tooth eruption in children: a longitudinal study in Cambodia, Indonesia and Lao PDR

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## Abstract

**Background:** Untreated dental caries is reported to affect children's nutritional status and growth, yet evidence on this relationship is conflicting. The aim of this study was to assess the association between dental caries in both the primary and permanent dentition and nutritional status (including underweight, normal weight, overweight and stunting) in children from Cambodia, Indonesia and Lao PDR over a period of 2 years. A second objective was to assess whether nutritional status affects the eruption of permanent teeth.

**Methods:** Data were used from the Fit for School - Health Outcome Study: a cohort study with a follow-up period of 2 years, consisting of children from 82 elementary schools in Cambodia, Indonesia and Lao PDR. From each school, a random sample of six to seven-year-old children was selected. Dental caries and odontogenic infections were assessed using the World Health Organization (WHO) criteria and the def-a-index. Weight and height measurements were converted to BMI-for-age and height-for-age z-scores and categorized into weight status and stunting following WHO standardised procedures. Cross-sectional and longitudinal associations were analysed using the Kruskal Wallis test, Mann Whitney U-test and multivariate logistic and linear regression.

**Results:** Data of 1499 children (mean age at baseline = 6.7 years) were analyzed. Levels of dental caries and odontogenic infections in the primary dentition were significantly highest in underweight children, as well as in stunted children, and lowest in overweight children. Dental caries in six to seven-year old children was also significantly associated with increased odds of being underweight and stunted 2 years later. These associations were not consistently found for dental caries and odontogenic infections in the permanent dentition. Underweight and stunting was significantly associated with a lower number of erupted permanent teeth in children at the age of six to seven-years-old and 2 years later.

**Conclusions:** Underweight and stunted growth are associated with untreated dental caries and a delayed eruption of permanent teeth in children from Cambodia, Indonesia and Lao PDR. Findings suggest that oral health may play an important role in children's growth and general development.

**Trial registration:** The study was retrospectively registered with the German Clinical Trials Register, University of Freiburg (trial registration number: DRKS00004485; date of registration: 26th of February, 2013).

**Keywords:** Dental caries, Tooth eruption, Underweight, Overweight, Growth, Children

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# Dependence of Deciduous Tooth Eruption Terms and Tooth Growth Rate on the Weight-Height Index at Birth in Macrosomic Children over the First Year of Life

Olga Garmash\*

## ABSTRACT

The aim of this research is to study the effect of body overweight at birth (fetal macrosomia) on the processes of tooth eruption and tooth growth during the first year of life in children in the Kharkiv City (Ukraine) population. One of the research tasks is to examine the features of deciduous teeth eruption in children who were born with macrosomia with different values of the weight-height index at birth. Materials and methods. The medical records of the children born between 1977 and 2013 have been analyzed. The database has been collected in one of the Kharkiv City clinic. The Main Group is comprised of the medical records of the children (separately for boys and girls) born with fetal macrosomia. All the medical records of the Main Group have been divided into subgroups taking into account the gender and the harmonious (well-balanced) development coefficient. The Comparison Group is comprised of the medical records of the children also born within the normal term range, but with weight and height that correspond to the gestation age (fetal normosomia). To determine the average time of the first tooth eruption, as well as the deciduous teeth growth rate for each of the groups under the study, we have used the hypothesis about a linear dependence between the number of erupted teeth and the age of the child. The statistical data processing and verification of the consistency of this hypothesis is performed using the multiple linear regression analysis with the STATISTICA 6.0 software package (Multiple Regression module). The number of delayed eruption and premature eruption cases observed is calculated along with the corresponding confidence intervals for the significance level,  $p$ , of less than 0.05, taking into account the binomial distribution of the random variable. The results of the study indicate a slowed growth rate of deciduous teeth in children born with macrosomia, as well as an increased number of cases (by a factor of 2 to 4 times) of deviations in the timing of teeth eruption compared to regional norms. The smallest growth rate of deciduous teeth and the smallest number of teeth at the age of one year are registered in macrosomic boys and macrosomic girls with a long body and a relatively reduced birth weight, as well as in macrosomic girls with intrauterine obesity. The macrosomic girls with intrauterine acceleration with obesity at the background have the largest average tooth growth rate and the largest percentage of premature eruption cases among all subgroups. Conclusions. The somatometric features of fetal macrosomia suggest the influence on the number of teeth that erupt by a certain age. The data on the deviation from the generally accepted terms of teeth eruption in children born with macrosomia, can be the basis for developing new and improving existing prevention programs aimed at preserving dental health.

## KEYWORDS

fetal macrosomia; height-weight index; deciduous teeth

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## Factors Associated with Primary Teeth Eruption Pattern in Children Under Three Years Old in Beji Depok, West Java

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### Abstract

There are many factors associated with the eruption pattern of primary dentition. One factor is maternal and child health during the first three years of the child's life. This is because primary dentition begins to develop during the fourth month of pregnancy and continues to the last primary tooth eruption in the oral cavity at three years old. There are limited studies about primary dentition eruption in Indonesia. Then the aim of this study is to assess factors related to primary teeth eruption patterns. One hundred and seventy-two mothers and children under three years old, who had a mother and child health book, were selected in Beji Depok. The primary tooth eruption phase was examined using the Hulland method. The eruption age was computed for mean age, starting age, and the duration of each tooth eruption. There were significant differences in the starting age and duration of the eruption process in the groups according to maternal ( $p < 0.05$ ) and child ( $p < 0.01$ ) nutritional status. The eruption process took longer to complete in females than males ( $p < 0.05$ ). The mother's educational level and occupation were also significant. The study showed that the eruption pattern was influenced by maternal and child nutritional status, the child's gender, and the mother's educational level and occupation.

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**Keywords:** Nutritional status; primary teeth; eruption factors.

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### Introduction

The emergence of tooth crowns in the oral cavity, which grow in an axial direction from the jaw bone penetrating the gingiva up to its functional position and reaching its occlusion contact—is called tooth eruption.<sup>1</sup> Tooth eruption reflects the growth of the body in general; when tooth eruption is delayed, the growth of the human body in general can also be said to be constrained.<sup>2</sup>

There are many factors associated with eruption patterns of primary dentition. Khalifa et al. showed that primary tooth eruption is affected by gestational age, postpartum nutrition, premature birth, and the severity of neonatal disease.<sup>3</sup> Additionally, socio demographic factors

such as race and gender also impact on tooth eruption. Maternal nutrient intake during pregnancy directly affects tooth development during the period of fetal growth. Therefore, the nutritional status of pregnant women will determine the oral health of her child.<sup>4</sup>

Maternal and child health during the first three years of a child's life is critical because primary dentition starts to develop during the fourth month of pregnancy and continues until the last primary tooth erupts in the oral cavity at three years old.

There are limited studies about primary dentition eruption in Indonesia. We are still using eruption tables of Caucasian children as standard. Knowledge of the chronology and pattern of tooth eruption is very useful for improving standard criteria for preventive dental health care and for diagnosing and implementing dental health care in children.<sup>4</sup>

Therefore, this study assesses factors related to primary tooth eruption patterns.

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# Comparison of chronology of teeth eruption with body mass index among school children at Mangalore: A cross-sectional study

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## ABSTRACT:

**Introduction:** The development and eruption of the teeth, chronologies of human dentitions, dental age, and tooth formation standards are important aspects applied to dental practice. Body mass index (BMI) gives an indication about the nutritional status of the child. It is relevant to know whether BMI has influenced chronology of tooth eruption pattern. **Aim:** To determine the eruption age of the different permanent teeth and compare eruption age with BMI in a group of children from selected schools in Mangalore. **Materials and Methods:** A cross-sectional study was designed in which 2928 children ranging in age from 5.5 to 15 years were included in the study. The children were divided into 20 chronological age groups with half year intervals. All the children were examined by a single examiner with the help of a trained assistant. The teeth were examined under natural light with mouth mirror. The comparison was made between mean eruption ages in males and females using the independent t-test. **Results:** There were 1526 males constituting 52.1% and 1402 females constituting 47.9% of the total sample of 2928 children. The mean age of eruption of maxillary central incisor, maxillary lateral incisor, maxillary and mandibular canines, maxillary and mandibular premolars, maxillary and mandibular second molars were found to have statistical significant with BMI. The mean age of eruption of the teeth in females was found to be earlier than in males, with the exception of the maxillary first molar which is earlier in males. **Conclusion:** Different categories of BMI were underweight, normal weight, risk of overweight and overweight, wherein overweight children had early eruption of teeth. Girls had early eruption time compared to boys.

## Key words:

Body mass index, children, eruption time, permanent teeth

## INTRODUCTION

Evolution of the human race has seen many changes in the living habits, food habits, and oral hygiene habits over a span of thousands of years, which may have influenced the eruption of teeth as well.<sup>[1]</sup> Studies have also reported differences in the eruption of permanent

teeth between ethnic groups, gender socioeconomic and nutritional factors, fluorides congenital abnormalities such as supernumerary teeth, Down's syndrome, cleidocranial dysplasia and environmental and secular trends.<sup>[1]</sup> The existing eruption schedules for permanent and deciduous dentition are based on studies in the

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# Eruption Chronology in Children: A Cross-sectional Study

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## ABSTRACT

**Aims and objectives:** The purpose of this study is to determine the appropriate reference standard for eruption timing of primary teeth in infants and preschool children of Bhopal city and to determine the role of various factors affecting the eruption of primary dentition.

**Materials and methods:** A cross-sectional study was conducted among the infants and preschool children (4–36 months) attending the local government or private hospitals, and vaccination centers. Prior to the study, Institutional Ethical Committee clearance and informed written consent from the parents were obtained. The data were collected from full-term infants and preschool children of 4 to 36 months from Bhopal city.

Oral examination was done under adequate natural light by a single examiner using mouth mirror and probe. Teeth present in the oral cavity were noted by using Federation Dentaire Internationale system of nomenclature in the preformed proforma. The teeth were considered as erupted, when any part of its crown had penetrated the gingiva and was visible in the oral cavity. Height, weight, birth weight, and other close-ended questions in questionnaire were asked from parents.

**Results and conclusion:** The data collected were statistically analyzed and it was observed that significant relation exists between tooth eruption and birth weight, feeding habits, socio-economic status, and body mass index (BMI). Based on the findings, it may be concluded that Indian children experienced delayed eruption of primary teeth when compared with children of different countries and standard norms.

**Keywords:** Delayed eruption, Eruption, Tooth.

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## INTRODUCTION

Tooth eruption is the process by which developing teeth emerge through the soft tissues of the jaws and the overlying mucosa to enter the oral cavity, contact the teeth of opposing arch, and function in mastication.<sup>1</sup>

The term "eruption" is derived from the Latin word "eruptio," which means output with momentum.<sup>2</sup> It is a continuous process that ends only with the loss of tooth. Eruption of deciduous teeth, their exfoliation followed by eruption of permanent dentition is an orderly, sequential, and age-specific event and is considered as an important milestone during child's development.<sup>3</sup>

Evolution of the human race has seen many changes in the living habits, food habits, and oral hygiene habits over a span of thousands of years, which may have influenced the eruption of teeth as well.<sup>4</sup> Tooth eruption recognized as an aspect of human growth and development could possibly be influenced by number of factors that can be both physiological and pathological like growth, caries, malnutrition, genetics, etc.<sup>5</sup>

Estimation of eruption schedule can be a very valuable asset in diagnosis and treatment planning during developmental years.<sup>6</sup> Significant deviations from accepted norms of eruption time are often observed in clinical practice. Premature eruption has been noted, but delayed tooth eruption is the most commonly encountered deviation from normal eruption time.

In a developing country like India, a large number of people are illiterate and have no knowledge or records of their date of birth which is required by law-enforcing agencies in matters like criminal responsibilities, identification, consent, employment, etc. Age estimation is also required for admission purposes at the time of schooling, joining services, and during retirement. Hence, scientific determination of age is very important.<sup>7</sup>

Sequential and timely eruption of teeth is critical in overall development of the child. Variations can occur due to various reasons, but eruption delay of more than 2 years should be investigated.

Malnutrition and poor nutrition in early childhood affects tooth eruption and results in the delayed emergence of the teeth.

So a study was undertaken with the aim to determine the tooth eruption chronology and sequence of eruption in primary dentition and to assess the role of various factors in teeth eruption.

# Socioeconomic and nutritional factors associated with age of eruption of third molar tooth among Ugandan adolescents

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## Introduction

Third molar growth and development shows variability especially in terms of its size, shape, agenesis and eruption patterns.<sup>11</sup> It is a tooth which continues to develop during late adolescence and beyond. It is thus serving as

## Abstract

This study aimed to establish the influence of socioeconomic and nutritional factors on the age of eruption of the mandibular third molar among Ugandans aged 10–20 years. **Materials and Methods:** This was a cross-sectional study carried out in a dental clinic of Mulago Hospital between January and December 2017. The background information was obtained from the participants using a questionnaire in the form of an oral interview. The anthropometric measurements were obtained using a tape measure and a weighing scale, while dental radiographs were used to determine the eruption stages of the mandibular third molar. **Statistical Analysis:** The data were analyzed using STATA 13 and summarized using descriptive statistics and multivariate analyses. Statistical significance was inferred at  $P < 0.05$ . **Results:** Participants in the overweight body mass index category were statistically significantly associated with the age of the mandibular third molar eruption ( $P < 0.05$ ) compared to their normal counterparts. There was no statistically significant association between socioeconomic status and age of eruption of third molar teeth ( $P > 0.05$ ). Age of eruption was statistically significantly higher among males than females ( $P > 0.05$ ). **Conclusion:** The findings of the present study reveal that overweight influences early eruption of the mandibular third molar tooth, although there is no trend between socioeconomic status and the age of eruption of the mandibular third molar.

**Key words:** Adolescents, age of eruption, nutritional status, socioeconomic status, third molar

an important tool for age estimation during the transition period between adolescence and adulthood. It is also widely used to determine the timing of orthodontic treatment and the selection of treatment modalities in growing children.

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# Is Nutritional and Socioeconomic Status Related with Tooth Eruption of First Incisive Permanent Mandibular among School and Special Need Students?

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## ABSTRACT

Permanent tooth replacement is an important process which stimulate children growth and development. The first permanent eruption tooth is first Incisive of lower jaw (I1 LJ). The eruption time of each child is different, divided into premature loss, on time and delayed which influenced by several factors include nutrition of children and parents socioeconomic status (SES). Purpose of research was to find relation of eruption time of I1 LJ based on nutritional and economic status on school and special need students. Research design was analytic observational with cross sectional approach. Sample was 58 children aged 6-7 years old, divided into two groups 29 school students and 29 students with special need. Questionnaire was used to measure economic status, nutrition status measured by weighed height and weight and also an interview was done to find time tooth eruption. Spearman and Mann Whitney was used as a statistical tool. There was a difference of nutritional and economic status of normal and special need students (Sig: 0.045 and 0.04). There was a different of timing tooth eruption of both groups with Significance of 0.03. There was a relation of nutritional and economic status with timing of tooth eruption (Sig: 0.001 and 0.04). Most of school students had normal nutritional status with on time tooth eruption while on students with special need had o nutritional status, delayed tooth eruption. Children with good nutrition and economic status will influence their physical growth. Children with special need usually has systemic disease which influence their growth. Nutritional and economic status related with timing of I1 LJ on school and special need students.

**Keywords:** *Nutritional, economic status, First Incisive Permanent Lower Jaw, Eruption, students with special need*

## INTRODUCTION

Dental eruption is a state of tooth appearance between gums in the oral cavity. Tooth eruption begins after the formation of crown followed by root formation during the tooth life and continues even though the tooth has reached occlusion with its antagonist.<sup>1</sup> Permanent teeth eruptions is gradually with age. The first permanent tooth appears in the oral cavity is the first permanent Incisive mandible at the age of 6-7 years.<sup>2</sup> Every child's

teeth eruptions are not always the same, some are too fast, some are on time and some are delayed. Teeth that appear prematurely are called premature and teeth that appear late are called retardations.<sup>3</sup> Factors affecting tooth eruption include heredity, race factor, gender, nutrition, premature birth, socioeconomic , height and weight, hormones, and systemic diseases. <sup>4</sup>In one study there was a significant correlation between nutritional status with permanent teeth eruption in elementary school students with good, fat and overweight nutritional status more have permanent teeth erupted on time according to age compared to those skinny. <sup>5</sup>A research conducted by Clements and Thomas found students with higher social economic background show earlier tooth eruption than students with low social economic status. <sup>6</sup>Growth of students are divided into normal and special need students. Students with special needs are those who need special care related to their speciality permanent or temporary. <sup>7</sup>Studies earlier were conducted at students

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# Childhood body mass index is associated with early dental development and eruption in a longitudinal sample from the Iowa Facial Growth Study

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**Introduction:** Children with high body mass index (BMI) values have been demonstrated to have precocious dental development. Research has largely focused on cross-sectional data sets, leaving an incomplete understanding of the longitudinal relationship between BMI and dental maturation. **Methods:** We used a pure longitudinal growth series to examine the relationship between dental development and childhood BMI. Periapical radiographs from 77 children from the Iowa Growth Study were used to estimate dental development for those with high BMI values. **Results:** We confirmed prior studies in finding that children with higher BMI values were more likely to have advanced dental development for their ages ( $P < 0.001$ ). BMI at age 4 years was predictive for the timing of dental development at age 12 ( $P = 0.052$ ). The precocity of the rate of dental development accelerated across growth. Overall dental development scores also correlated with the age of dental eruption for the mandibular canines and first premolars ( $P < 0.001$ ). **Conclusions:** High BMI values at young ages predict advanced dental development at later times, suggesting a long-term effect of BMI on dental maturation and implying the need for earlier orthodontic interventions in obese children. These results corroborate those of previous studies, building further evidence that relatively early dental eruption is another consequence of childhood obesity. (*Am J Orthod Dentofacial Orthop* 2018;154:72-81)

Childhood obesity is a pressing national health concern, with more than 30% of children and adolescents in the United States estimated to be overweight or obese.<sup>1</sup> Although the poor are statistically more likely to be overweight or obese,<sup>2-5</sup> childhood obesity among all socioeconomic groups has been on the rise<sup>6,7</sup> (but see the study of Ogden et al<sup>1</sup> for a discussion of how this trend has recently plateaued in some age groups). High body mass index (BMI) in childhood has many important health—and public

health—implications, and researchers have asked the question: how does this influence dental development? Over the last decade, a number of studies have addressed this topic,<sup>8-17</sup> and nearly all have found an association between being overweight or obese and having earlier tooth development (although not all studies have shown this difference to be clinically significant<sup>16,17</sup>). For example, in one of the first studies to investigate this topic, Hilgers et al<sup>8</sup> found that being overweight was associated with an average of a year and a half of advancement in dental development, and being obese had a similar effect. These researchers also found that both boys and girls who were overweight or obese had precocious dental development, a result that has been corroborated by several other studies in different populations.<sup>11,14,18,19</sup> Moreover, thin children were found to have the slowest rate of dental eruption, and overweight children have the most advanced dental eruptions. This pattern exists as a gradient, where being “at risk” for being overweight (having a BMI value at the upper extreme of scores in the normal-weight range) implicates a more precocious dental development than values in children with lower or

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All authors have completed and submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest, and none were reported.

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# Association of Eruption Timing of First Permanent Molars and Incisors with Body Mass Index of Children in Bengaluru City

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## Abstract

**Background:** Tooth eruption is influenced by various factors which include physiological and genetic factors. The first permanent teeth to erupt are the permanent first molars at the age of 6 years. The timing of eruption of permanent teeth can be affected by the body mass index (BMI) which is a predictor of the overall growth of the child. **Aim:** The aim of the study was to determine the association of eruption timing of the mandibular and maxillary first permanent molars and incisors with BMI of children in Bengaluru city. **Materials and Methods:** In this cross-sectional study, 3166 schoolchildren (1636 boys and 1530 girls) between the ages of 5 and 10 years were selected. Oral examination was carried out to record the presence of the permanent first molars and incisors. The height in meters and weight in kilograms of each child were recorded and the BMI was calculated. Statistical Package for Social Sciences for Windows, Version 22.0, Released 2013, IBM Corp., Armonk, NY, USA, was used to analyze the data. The median age of eruption was calculated by using Probit analysis. Independent sample Student's *t*-test was used to compare the distribution of erupted teeth between girls and boys at different age groups. The association between BMI and eruption timing was derived using Pearson's correlation coefficient. **Results:** The first permanent tooth to erupt was the mandibular first molar at the age of  $5.76 \pm 1.3$  years. Girls showed an earlier age of eruption of all the teeth except the mandibular central incisors. A statistically significant inverse association was seen between BMI and eruption timing of the teeth examined ( $P < 0.05$ ). **Conclusion:** The median eruption timing of the mandibular permanent first molar and incisors was earlier than that of the maxillary counterparts. Children with higher BMI values showed earlier eruption timing of the permanent teeth examined.

**Keywords:** Body mass index, eruption, incisor, molar, permanent, tooth

## INTRODUCTION

Eruption of a tooth occurs when the forming tooth migrates from its intraosseous location in the jaw to its functional position within the oral cavity.<sup>[1,2]</sup> Permanent teeth are biological markers of maturity and their eruption is an important milestone in a child's development. The clinical maturation stage of permanent dentition is determined by the number of permanent teeth that have erupted in a child's mouth by a specific age.<sup>[1]</sup>

The chronology of eruption as given by Logan and Kronfeld in 1933 is still being widely used as a standard of reference for eruption timing of permanent teeth.<sup>[2]</sup> The existing eruption schedule for permanent and deciduous dentition is based on studies conducted on Caucasians. These standards of eruption cannot be applied to the Indian population as the eruption

timings were derived from a very small sample of Caucasian population. The Indian population differs from the Western population genetically, racially, and environmentally. The timing of tooth emergence in the oral cavity can be attributed to genetic and environmental causes. They can be further divided into two categories: general and local factors. The general factors include body composition, nutrition, fluoride intake, socioeconomic status, and season of birth. Early loss of primary teeth and its sequelae, dental caries, and trauma to both primary and developing permanent teeth are the local factors.<sup>[1,2,4]</sup>

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## Hubungan Status Gizi dengan Erupsi Gigi Molar Pertama Permanen Rahang Bawah pada Anak Usia 6-7 Tahun di SD Negeri 12 Manado

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**Abstract:** Nutritional status is resulted from consumption of food and use of nutrients. If nutrient intake is not fulfilled, the growth pattern of children, generally and specifically in permanent tooth eruption, would be disturbed or associated with delayed eruption. This study was aimed to determine the relationship between nutritional status and first permanent mandibular molar eruption in children aged 6-7 years at SD Negeri 12 (elementary school) Manado. This was an analytical study using a cross-sectional design. Samples were obtained by using total sampling method. This study was conducted by measuring nutritional status using BMI-for-age and by examining the 36 and 46 tooth eruption. Data were analyzed univariately and bivariately, and then were further analyzed by using the Kolmogorov-Smirnov test. Of 60 subjects, 61.7% were classified as normal nutritional status and 95% belonged to the category of erupted first permanent mandibular molar. The Kolmogorov-Smirnov test and the Fisher's exact test showed the p-values of 0.989 and 0.275 ( $>0.05$ ). **Conclusion:** There is no relationship between nutritional status and first permanent mandibular molars eruption in children aged 6-7 years at SD Negeri 12 Manado. **Keywords:** nutritional status, first permanent mandibular molars eruption

**Abstrak:** Status gizi merupakan keadaan tubuh akibat konsumsi makanan dan penggunaan zat gizi. Jika asupan zat gizi tidak terpenuhi maka pola pertumbuhan anak, baik secara umum maupun khusus pada erupsi gigi permanen akan terganggu atau terlambat erupsi. Penelitian ini bertujuan untuk mengetahui hubungan status gizi dengan erupsi gigi molar pertama permanen rahang bawah pada anak usia 6-7 tahun di SD Negeri 12 Manado. Jenis penelitian ialah analitik dengan desain potong lintang. Pengambilan sampel menggunakan metode total sampling. Pada penelitian ini dilakukan pengukuran status gizi melalui indeks massa tubuh (IMT/U) dan memeriksa erupsi gigi 36 dan 46. Analisa hasil penelitian menggunakan analisis univariat dan bivariat kemudian diolah menggunakan uji Chi-square. Dari 60 subyek penelitian, 61.7% tergolong status gizi normal dan 95% tergolong dalam kategori gigi molar pertama permanen rahang bawah telah erupsi. Hasil analisis bivariat terhadap hubungan antara status gizi dan erupsi gigi molar pertama permanen rahang bawah menggunakan uji Kolmogorov-Smirnov dan uji Fisher's exact menunjukkan nilai  $p=0,989$  dan  $p=0,275$  ( $>0,05$ ). **Simpulan:** Tidak terdapat hubungan antara status gizi dengan erupsi gigi molar pertama permanen rahang bawah pada anak usia 6-7 tahun di SD Negeri 12 Manado. **Kata kunci:** status gizi, erupsi molar pertama permanen rahang bawah.

Status gizi merupakan keadaan tubuh akibat konsumsi makanan dan penggunaan zat gizi. Jika gizi yang dibutuhkan tidak

terpenuhi atau asupan gizi berlebihan maka akan terjadi gangguan gizi. Gangguan gizi dapat dikelompokkan sebagai berikut: berat

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**HUBUNGAN STUNTING TERHADAP KETERLAMBATAN ERUPSI GIGI  
KANINUS ATAS PERMANEN PADA ANAK USIA 11-12 TAHUN**

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**ABSTRACT**

**Background:** Stunting is a linear growth disorder that is not age-appropriate due to malnutrition. The causes of stunting is zinc deficiency. Reduce synthesis and secretion of IGF-I as the effect of GH metabolites inhibition. These substances are essential nutrients in growth, canine eruption which is delayed due to lack of arch length due to growth disorders. **Purpose:** to analyze the relation between stunting and the delay of permanent upper canine teeth's eruption in children aged 11-12 years at the Elementary School in Sungai Tiung Village. **Materials and methods:** The research method used observational analytic with cross sectional approach. The sample was selected using simple random sampling using the correlation analytic formula and the results obtained were 32 samples. **Result:** Based on this study, children who had very short and short stature were 71.9% and 28.1%, 25% had normal tooth eruption and 75% had no eruption. The Spearman test analysis showed that the significance value was 0.512 ( $p > 0.05$ ) which meant there was no relationship between stunting and tooth eruption delay. **Conclusion:** There was no relationship between the incidence of stunting to the delay of eruption of the permanent upper canine teeth in Elementary School Cempaka District, Banjarbaru.

**Keywords:** Canine teeth, Stunting, Tooth eruption

**ABSTRAK**

**Latar Belakang:** Stunting adalah gangguan pertumbuhan linear yang tidak sesuai dengan umur karena terjadinya malnutrisi. Penyebab terjadinya stunting adalah defisiensi zinc, efek metabolit GH yang dihambat sehingga sintesis dan sekresi IGF-I menjadi berkurang. Zat tersebut merupakan zat gizi esensial dalam pertumbuhan, erupsi kaninus yang mengalami keterlambatan terjadi karena kurangnya panjang lengkung rahang akibat gangguan pertumbuhan. **Tujuan:** Untuk menganalisis hubungan stunting terhadap keterlambatan erupsi gigi kaninus atas permanen pada anak usia 11-12 tahun di SDN Sungai Tiung Kecamatan Cempaka Kota Banjarbaru. **Metode:** Metode penelitian yang digunakan adalah observasional analitik dengan pendekatan cross sectional. Sampel dipilih menggunakan simple random sampling menggunakan rumus analitik korelasi dan didapatkan hasil sebanyak 32 orang sampel. **Hasil:** Berdasarkan hasil penelitian, anak yang memiliki tinggi badan sangat pendek (28,1%) dan pendek (71,9%) dan erupsi gigi normal (25%) dan tidak erupsi (75%). Analisis uji Spearman menunjukkan bahwa nilai signifikansi sebesar 0,512 ( $p > 0,05$ ) yang berarti tidak terdapat hubungan antara stunting dengan keterlambatan erupsi gigi. **Kesimpulan:** Tidak terdapat hubungan antara kejadian stunting terhadap keterlambatan erupsi gigi kaninus atas permanen pada anak SDN Kelurahan Sungai Tiung 1, 2, dan 3 Kecamatan Cempaka Kota Banjarbaru.

**Kata kunci :** Erupsi gigi, Gigi kaninus, Stunting

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Pengaruh Status Gizi terhadap Erupsi Gigi Molar Pertama Permanen Siswa Kelas 1 SDN di Kecamatan Wilayah Kota Administrasi Jember  
(The Influence of Nutritional Status towards the First Permanent Molar Tooth Eruption Among 1<sup>st</sup> Grade Students in Jember Elementary School )

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**Abstract**

**Background:** Tooth eruption is a continuous processes where the teeth grow, develop, and erupt. These processes were affected by many factors, such as nutritional status which can be examined by anthropometry assessment. Many studies have been conducted to understand the relationship between nutritional status and tooth eruption, how ever study associated with the relation of nutritional status and the eruption of first permanent molars in Jember district area has never been done before. **Purpose:** To determine the influence of nutritional status towards the number of the first permanent molar tooth eruption among 1<sup>st</sup> grade students in Jember district area. **Methods:** This is analytic observational study with a cross sectional approach. We used stratified random sampling technique and 238 1<sup>st</sup> grade students were participate as volunteers. The nutritional status was assessed by Adolphe Quetelet (BMI) formula corrected for age. Intraoral examination was conducted to count the number of the first permanent molar tooth eruption. The data was analyzed using chi-square. **Result:** There is significant difference between the first permanent molar tooth eruption and nutritional status among 1<sup>st</sup> grade students in Jember district area ( $p = 0,000$ ). **Conclusion:** Nutritional status has significant influence the number of the first permanent molar teeth eruption.

**Keywords:** nutritional status, tooth eruption.

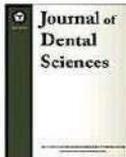
**Abstrak**

**Latar Belakang:** Erupsi gigi merupakan proses tumbuh kembang gigi berupa pergerakan gigi ke arah rongga mulut secara terus menerus. Erupsi gigi dipengaruhi oleh sejumlah faktor, salah satunya adalah status gizi yang merupakan perwujudan nutrisi seseorang yang dapat diukur dengan antropometri. Penelitian tentang status gizi dengan erupsi gigi telah banyak dilakukan, namun penelitian tentang pengaruh status gizi terhadap erupsi gigi molar pertama permanen di kecamatan wilayah kota administrasi Jember masih belum pernah dilakukan. **Tujuan:** Mengetahui pengaruh status gizi terhadap jumlah gigi molar pertama permanen yang erupsi pada siswa kelas 1 SDN di kecamatan wilayah kota administrasi kabupaten Jember. **Metode:** Penelitian dengan metode observasional analitik dengan pendekatan *cross sectional*. Teknik pengambilan sampel menggunakan *stratified random sampling* dan diperoleh sampel 238 siswa. Penilaian status gizi menggunakan rumus Adolphe Quetelet (IMT) dan disesuaikan dengan usia anak. Pemeriksaan rongga mulut siswa secara visual untuk mengetahui jumlah erupsi giginya. Pengaruh antara variabel penelitian di uji menggunakan uji analisis *chi-square*. **Hasil:** Ada perbedaan yang bermakna antara status gizi siswa dengan erupsi gigi molar pertama permanen. **Kesimpulan:** Status gizi mempengaruhi jumlah erupsi gigi molar pertama permanen.

**Kata kunci:** erupsi gigi, status gizi.

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## ORIGINAL ARTICLE

# Tooth eruption and obesity in 12-year-old children

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## KEYWORDS

body mass index;  
tooth eruption;  
triceps skinfold  
thickness;  
waist circumference;  
waist-hip ratio;  
weight-height ratio

**Abstract** *Background/purpose:* There is a need to comprehensively investigate the relationship between tooth eruption and obesity. The study aimed to investigate the relationship between erupted permanent tooth number and obesity among 12-year-old children in a population-based study.

*Materials and methods:* A random sample of 806 12-year-old schoolchildren in Hong Kong was recruited. Oral examinations were conducted and the eruption status of the permanent teeth was assessed. Body height, body weight, waist circumference (WC), hip circumference, and triceps skinfold thickness (TRSKF) were measured to assess the adiposity statuses [weight-height ratio (W/H) and body mass index (BMI) for general obesity; WC and waist-hip ratio (WHR) for central obesity; and TRSKF for peripheral obesity]. The relationships between erupted permanent tooth number and adiposity statuses were examined in bivariate analysis and analysis of covariance.

*Results:* The response rate was 82.9% ( $n = 668/806$ ). Three hundred and forty-six (50.9%) children had 28 teeth erupted. Second molars had the highest rate of noneruption (17.5–35.8%). The mean number and standard deviation (SD) of erupted permanent tooth were 26.4 (2.4). The mean value and SD were 31.1 (6.3) for W/H, 19.8 (3.7) for BMI, 70.4 (9.4) for WC, 0.82 (0.06) for WHR, and 11.8 (4.5) for TRSKF, respectively. After accounting for sociodemographic factors, analysis of covariance identified that W/H, BMI, WC, and WHR were positively associated with the number of erupted permanent teeth ( $P < 0.01$ ).

*Conclusion:* Erupted permanent tooth number was positively associated with obesity (general and central) among a population-based sample of 12-year-old children in Hong Kong.

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## ORIGINAL ARTICLE

## Association of nutritional status and dental health among 3–6-year-old children of a South Indian population

K. L. Girish Babu, Priya Subramaniam<sup>1</sup>, K. S. Madhusudan<sup>1</sup>Department of Dentistry, Hassan Institute of Medical Sciences, Hassan, <sup>1</sup>Department of Pedodontics and Preventive Dentistry, The Oxford Dental College, Hospital and Research Centre, Bengaluru, Karnataka, India**Abstract**

**Background:** Nutrition promotes healthy development and maintenance of oral health. Chronic malnutrition affects tooth exfoliation and renders the permanent teeth susceptible to caries.

**Aim:** To assess the nutritional status and dental health in 3–6-year-old children.

**Materials and Methods:** A cross-sectional epidemiological study was conducted on a representative sample of 1459 children, aged 3–6 years, and visiting the Integrated Child Development Centers (anganwadi) of T. Narasipura Taluk, Mysore, India. Nutritional status was evaluated by measuring body mass index (BMI) and mid-upper arm circumference (MUAC). Oral examination was carried out using a noninvasive technique with the child sitting in an upright position under good natural light. Dental caries, enamel hypoplasia, and oral mucosal status were recorded according to the WHO criteria.

**Results:** Nutritional status according to BMI showed 41% of children to be underweight and according to MUAC only 0.82% of children were undernourished. A highest (41.7%) number of underweight children were seen in 3–4 years age group, with a higher number of females being affected. The prevalence of dental caries was 61.07% and was highest in 3–4 years age group. More number of females were affected with dental caries than males. The prevalence of enamel hypoplasia was 8.7%. Association of dental health status with BMI was significant with dental caries.

**Conclusions:** Forty-one percent of children were underweight and the prevalence of underweight children increased with age. The prevalence of dental caries and enamel hypoplasia were 61% and 8.7%, respectively.

**Key words:** Anganwadi, body mass index, dental caries, dental health, enamel hypoplasia, Integrated Child Development Center, malnutrition, mid-upper arm circumference

**Introduction**

Malnutrition is a serious public health problem and is a primary contributing factor to childhood morbidity and premature mortality worldwide. The complexity of malnutrition transcends health issues, impacting growth and development, productivity, and overall quality of life for millions of people. In comparison to other regions of the world,<sup>[1,2]</sup> there is a high prevalence of underweight children in South Asia.<sup>[1,3]</sup> Malnutrition is widespread

in rural, tribal, and urban slum areas. The causes for malnourishment seen in children can be attributed to overpopulation, poverty, large family size, poor maternal

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# Nutritional status is associated with permanent tooth eruption chronology

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Either obesity and underweight are public health concerns that affect the development of children. **Aim:** The aim of this study was to evaluate whether the nutritional status affects permanent tooth eruption chronology in Brazilian children. **Methods:** A hundred sixty children were examined by a pediatric dentistry and at the clinical examination, the number of erupted permanent teeth was evaluated. The anthropometric measurements of the children were determined, and they were divided into groups: underweight, eutrophic, overweight and obese. The association between delayed tooth eruption and nutritional status groups was evaluated using chi-square test. The Shapiro-Wilk test was used to verify the normality of the data. To compare the mean number of delayed teeth according to nutritional status' groups Kruskal-Wallis test with multiple comparison by Dunn's test was performed. **Results:** Fifty-six children had delayed tooth eruption in at least one permanent teeth and delayed tooth eruption was more common in underweight children than in eutrophic children ( $p=0.0091$ ). **Conclusion:** In conclusion, our study suggests that underweight Brazilian children have a higher incidence of delayed eruption.

**Keywords:** Tooth eruption. Nutritional status. Children. Dentistry

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# Does nutrition have an effect on the timing of tooth formation?

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## Abstract

**Background:** The effect of nutritional status on the timing of permanent tooth formation is not well understood, despite clear evidence that systemic stresses result in enamel defects during tooth formation.

**Aim:** This study investigated the effect of nutritional status (measured as BMI, height, weight, mid-upper arm circumference, and head circumference) on permanent tooth formation.

**Method:** This was a prospective cross-sectional study involving 642 (270 males, 372 females) healthy Black South African participants aged 5–20 years. The height and BMI were converted to z-scores using WHO z-score for age tables. The participants were grouped into underweight/short for age (<−2), normal (z = −2 to 2.0) and overweight/obese/tall for age (>2). Panoramic radiographs of the children were assessed using Demirjian's eight stages of permanent tooth formation and age was estimated using Demirjian's method. Probit regression analysis was used to calculate the mean age of attainment of the developmental stages for the left mandibular teeth (I2–M2).

**Results:** There was significant advancement in the age of attainment of the final (H) stage for the majority of permanent teeth in the overweight (mean male BMI 22.9; female 27.94) group compared to the underweight ( $p < .05$ ). Negative binomial regression indicated that age, height, and BMI were significant predictors of the dental maturity score for males ( $p < .05$ ), while age, height, weight, BMI and HC were significant predictors for females ( $p < .05$ ).

**Conclusion:** Nutritional status had a significant effect on the timing of tooth formation in males and females in the study population. The effect was mainly noticeable for children in the extremes of the spectrum of BMI z-scores.

## KEYWORDS

BMI, height, nutrition, tooth formation, weight

## 1 | INTRODUCTION

Tooth formation is generally regarded as highly heritable and immune from environmental stresses relative to other aspects of human growth and development (Demirjian, 1986; Demirjian, Buschang, Tanguay, & Patterson, 1985). The timing of tooth formation and emergence were found to be highly correlated within monozygotic twins

compared to dizygotic twins (Garn, Lewis, & Polacheck, 1960). Consequently, the timing of dental development events is considered to be similar across populations and dental atlases are used globally for anthropological and forensic purposes.

There is abundant evidence that systemic stresses during the period of tooth formation lead to enamel hypoplasias and molar incisor hypomineralization (Goodman, Arnelagos, & Rose, 1980). The

## Time of Emergence of Permanent Teeth and Impact of Nutritional Status among 4-15 Years Old Children and Teenagers in Basrah City /Iraq

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Zeyneb A. Al-Dahan, B.D.S., M.Sc. <sup>(b)</sup>

### ABSTRACT

**Background:** The timing of eruption of permanent teeth is of considerable importance to the dental health planning for diagnostic, preventive and therapeutic measures for children and teenagers. The purposes of this study were to determine timing of maxillary and mandibular permanent teeth emergence (except third molars) and to evaluate the effect nutritional status by anthropometric measures on the eruption time of permanent teeth, investigations had been done according to jaw and gender variations.

**Materials and Methods:** This study was conducted among four to fifteen years old children and teenagers from kindergarten and schools in Basrah city in the south region of Iraq. The total sample composed of 1807 children and teenagers that were collected randomly from kindergartens, primary and secondary schools in Basrah city.

The data were statistically analyzed by using probit model in order to compute the median 5<sup>th</sup> and 95<sup>th</sup> percentile range of emergence. Anthropometric measures of height and weight were used for the purpose of assessment of nutritional status. The indices include: Weight for age, Height for age and Weight for height; each was considered as in term of standard deviation score (Z-score) as primary indicator of underweight, stunting and wasting respectively. The statistical significance of differences in mean of a normally distributed variable (nutritional indices z score) between 2 groups was assessed by independent samples t-test.

**Results:** The results showed significant differences ( $p < 0.05$ ) between the timing of maxillary and mandibular teeth emergence in girls and boys, with earlier emergence in girls, also the mandibular teeth emerge before their maxillary opposing teeth in both sexes except for premolars.

The prevalence of malnutrition according to height for age, weight for age, and weight for height nutritional status indicators were found to be 7.4 %, 3.7 % and 1.5% respectively.

The results showed that among well-nourished children and teenagers described by height for age nutritional status indicator, most teeth were significantly erupted earlier than stunted except the lateral incisor which erupted earlier in stunted boys than well-nourished boys but the difference was not significantly accepted. The greatest difference of median eruption age of permanent teeth between well-nourished and stunted found in girls in the second molar tooth.

**Conclusions:** Records indicated that the Iraqi children exhibit variation in their times of permanent teeth emergence when compared with other studies, and among well-nourished children and teenagers described by height for age nutritional status indicator, most teeth were significantly erupted earlier than stunted children and teenagers.

**Keywords:** Permanent Teeth, Tooth eruption, nutritional status. (J Bagh Coll Dentistry 2016; 28(4):134-140)

### INTRODUCTION

Tooth eruption is a continuous biological activity by which evolving teeth emerge across jaws and the overlying mucosa into the oral cavity <sup>(1)</sup>. The school age period from childhood to adolescent is a critical life stage when health and oral health behaviors develop <sup>(2)</sup>.

Many factors associated with eruption have been widely investigated. Suggested factors which causing differences might include race <sup>(3)</sup> gender <sup>(4,5)</sup> hereditary factors <sup>(6,7)</sup> and nutritional status <sup>(8,9)</sup>. Many studies have been conducted throughout the world concerning dental development and timing of permanent teeth emergence, all of which agreed that a wide margin of variation existed between population groups <sup>(10-12)</sup>.

Also There are many studies conducted in different population and among different ethnic groups all over the world that relate the eruption time with the weight and height as an anthropometric measures of nutritional status <sup>(13,14)</sup>.

Khan in 2006 found that children who are within the standard range of height and weight show normal eruption time as compared to those who are below the average <sup>(15)</sup>. In a study for the eruption time of permanent teeth in Pakistani children; the eruption of the teeth is found to be positively related to somatic growth (height and weight) of individuals <sup>(16)</sup>. The application of epidemiological methods as a research tool and knowledge about the procedures used for computing the times of permanent teeth emergence from cross-sectional data are necessary to produce a standard tables of teeth emergence time for each population <sup>(17)</sup>. Various statistical procedures have been used for the analysis of data on teeth emergence time, which is usually being expressed as the arithmetic means by using

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# Association of Nutritional Status on Salivary Flow Rate, Dental Caries Status and Eruption Pattern in Pediatric Population in India

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## Abstract

**Aims:** The purpose of the study was to assess the effect of nutrition on salivary flow rate (SFR) (unstimulated and stimulated), dental caries status, and eruption pattern in healthy and malnourished children. **Materials and Methods:** The study participants were categorized into healthy (Group I,  $n = 37$ ) and malnourished groups (Group II: Malnourished height-for-age [ $n = 30$ ] and Group III: Malnourished weight-for-age [ $n = 30$ ] as per classification of chronic malnutrition. SFR, dental caries status, and eruption pattern were noted for all groups. **Statistical Analysis:** Analysis of variance (ANOVA) was used to analyze the differences in unstimulated and stimulated SFR and dental caries among three groups. The lowest square difference was used for *post hoc* comparison and Pearson's correlation to investigate the association between SFR and dental caries. The statistical significance was set at  $P < 0.05$ . **Results:** The unstimulated SFR values were found to be  $0.53 \pm 0.15$  ml/min (Group I),  $0.14 \pm 0.04$  ml/min (Group II), and  $0.21 \pm 0.20$  ml/min (Group III). For stimulated SFR, the values were  $1.94 \pm 0.44$  ml/min (Group I),  $1.17 \pm 0.48$  ml/min (Group II), and  $1.07 \pm 0.52$  ml/min (Group III). Dental caries status was recorded to be 2.43 (Group I), 6.4 (Group II), and 4.66 (Group III). The participants with delayed eruption pattern were 8.10%, 23.30%, and 16.60% for Group I, Group II, and Group III, respectively. **Conclusion:** The values for unstimulated and stimulated SFR were significantly less, but dental caries status and delayed eruption were found to be more in malnourished groups as compared to the normal group.

**Keywords:** Dental caries, eruption pattern, malnutrition, salivary flow rate

## INTRODUCTION

Marginal nutritional status during infancy and early childhood adversely affects various aspects of growth and development. Malnutrition is a general term for a medical condition caused by an improper or insufficient diet. It is most often referred to as undernutrition resulting from inadequate consumption, poor absorption, or excessive loss of nutrients, but the term can also encompass overnutrition due to overeating or excessive intake of specific nutrients. It continues to be a major health burden in developing countries and globally the most important risk factor for illness and death, with hundreds of millions of pregnant women and young children particularly affected. Stunting has been diagnosed as the most common cause of malnutrition. The national family health survey in India reported the prevalence of underweight in children younger than 3 years in 2005–2006 to be nearly 46%, a figure representing a marginal decline from

the rates recorded in 1992–1993 (51%) and 1998–1999 (47%). Malnutrition can be diagnosed by anthropometric (height and weight) measurements and physical examination, with weight-for-age being the most widely used index for assessment of undernutrition in clinical practice and the only one used by integrated child development services program in India.

Although a number of studies have been done to evaluate the effect of various parameters such as socioeconomic status, malocclusion, brushing frequency, and fluoride exposure on caries status, literature search has revealed very few studies

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## The inter relationships among growth parameters (weight, height) and ectopic eruption of permanent first molars of children aged 6-9 years in Kerman, Iran

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### Original Article

#### Abstract

**BACKGROUND AND AIM:** Ectopic eruption (EE) of the permanent first molars (PFMs) results from a discrepancy between the jaw growth rate and the growth rate of these teeth. The present study was undertaken to evaluate the prevalence of EE of PFMs in Kerman, Iran, and then determine the relationship between growth parameters (height and weight) and this developmental anomaly.

**METHODS:** In the present study, 2025 children aged 6-9 years were examined to determine the prevalence of eruption of PFMs. Examinations were carried out with the use of tongue depressors under adequate light. Height and weight were determined in the control (without EE of PFM) and the case (with EE of PFM) groups, and then registered in the relevant checklist. Descriptive statistical methods were used for the analysis of qualitative data at a confidence interval (CI) of 95%. Chi-squared test was used for comparisons between the two groups in relation to age and gender.

**RESULTS:** In the present study, prevalence of the EE of PFMs was 2.8% in 6 to 9-year-old children in Kerman. The rate of this developmental anomaly was higher in boys compared to girls and higher in the maxilla than in the mandible; however, the differences were not significant ( $P > 0.05$ ). The prevalence of EE was higher in children with a lower mean age and a lower mean height and weight, which was significant statistically ( $P < 0.05$ ). EE was more common unilaterally than bilaterally, but the difference was not significant ( $P > 0.05$ ). In addition, there was no significant relationship between cleft palate or lip and EE ( $P > 0.05$ ).

**CONCLUSION:** Children in the lower than normal height and weight percentile are more susceptible to the EE developmental anomaly.

**KEYWORDS:** Height; Weight; Ectopic Eruption

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Ectopic eruption (EE) is a disturbance of tooth eruption, in which a tooth moves in a path other than its normal path; and if it is not diagnosed on time, it will lead to occlusal problems.<sup>1</sup> Several factors have a role in EE, including a small dental arch, premature eruption of permanent first molars (PFMs), and deviation from the normal path of eruption. The prevalence of EE of PFM has been reported to range from 1.6% to 6%. It

occurs more commonly in boys than girls and in the maxilla than in the mandible. In children with cleft lip and/or cleft palate, EE is more prevalent than healthy children; it is also more prevalent in the family members of an afflicted individual than the general population. In 66% of cases, the PFM with EE is released from its locked position and erupts to reach the occlusal level, which is referred to as reversible EE (jump). In the irreversible state (hold), the PFM remains in

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## Research Report

## The effect of body mass index on tooth eruption and dental caries

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## ABSTRACT

**Background:** Children were compared to their siblings, cousins or peers regarding the eruption of their permanent teeth. Genetic and environmental factors can affect dental development and, therefore, the body mass index (BMI) could be considered as a factor that may influence dental development. **Purpose:** To determine any possible association between BMI and either dental caries or the eruption of permanent teeth (central incisor and molar). **Methods:** A cross-sectional study was completed for six-year-old school children. A total of 218 children (116 boys, 102 girls) from public elementary schools in Erbil City were entered into the study. Dental caries assessments were carried out using the WHO criteria for decayed, missing and filled primary teeth and indices (DMFT). BMI was used to classify obesity status. **Results:** Overall, 27.98% of the children were classified as overweight, 59.17% as normal and 12.84% as underweight. The DMFT was 5.247, while 12.39% of the children were caries-free. **Conclusions:** Children of normal weight had most permanent teeth erupted and a low caries index. Underweight children had fewer erupted teeth and a higher caries index. The complex relationship between body composition and oral health should be considered in paediatric patients.

**Keywords:** body mass index; DMFT; eruption of central incisors and molars

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## INTRODUCTION

Eruption of the teeth is positively related to the somatic growth (height and weight) of an individual. Many studies worldwide describe how poor nutrition during the growth period adversely influences aspects of dental development, including delaying the eruption of deciduous and permanent teeth. The prevalence of overweight and obese children is increasing worldwide, including in Europe.<sup>1</sup> This marked increase in body weight was described by the World Health Organisation (2003) as a 'global epidemic disease'. Obesity can be defined as a condition in which the energy intake becomes higher than the required energy, leading to deposition of body fat. This accumulation of extra fat within the body may have either environmental or genetic causes.<sup>2</sup> Being overweight causes health problems in children, both directly and over time, including: type II diabetes, metabolic problems, high blood pressure, hypercholesterolaemia, hyperandrogenism, orthopaedic complications, sleep disorders, cardiovascular disease and behavioural issues.<sup>3</sup>

The obesity trend in children and adolescents between six and seventeen years old in the US is characterised by differences in relation to age, gender, race-ethnicity, income and level of education. Representative surveys performed from 1963–1994 to measure weight and height showed 11% of the population to be obese in the period from 1988–1994. This level of obesity was not related to race-ethnicity, income or education. Obesity levels became higher over time, with the largest increase in the period from 1976–1994. The reasons for this fast increase in obesity in the US population is unclear but could be a sign of societal influence.<sup>4</sup>

According to the IOTF (International Obesity Task Force), the level of obesity in Italian children between eight and nine years of age varies from 16.6% in the south of Italy to about 7.5% in the north.<sup>5</sup> In France, 15.8% of children from seven to nine years old are overweight, with nearly 2.8% being obese.<sup>6</sup> This study presents the distribution of children according to BMI (categorised as underweight, normal weight or overweight) in Erbil City primary schools,

## EFFECT OF DIET ON ERUPTION TIMES FOR PERMANENT TEETH OF CHILDREN IN PESHAWAR

HASHAM KHAN,<sup>1</sup> NAZEER KHAN,<sup>2</sup> MUJEEB-UR-REHMAN BALOCH,<sup>3</sup> SARFARAZ ALI ABBASI<sup>4</sup>

### ABSTRACT

*The objective of this study was to find out any association between eruption times of permanent teeth and consumption of meat, rice, vegetables and milk in children of Peshawar. A team consisting of "a dentist and an assistant" visited randomly selected schools. Children with consent from their parents underwent oral check-ups and those having a "just erupted tooth" in the oral cavity were chosen for further investigation. These children were then examined for being 'erupted', 'just erupted' and 'unerupted' teeth. Along with the time of eruption, information regarding gender, height, weight and dietary habits (consumption of meat, vegetable, rice and milk) in the family were also collected. Out of 1945 children, 1066 (54.8%) were females with mean age of 8.98 ( $\pm 2.16$ ) years and 879 (45.2%) were males with mean age of 10.2 ( $\pm 2.63$ ) years. The mean eruption time of mandibular right central incisor (#11) was lowest while right mandibular second molar (#47) was the last tooth to erupt. There were no significant associations between eruption times of permanent teeth and consumption of meat, rice, vegetable and milk by the children. However, more frequent use of meat showed a trend of early eruption and more frequent use of vegetables showed a trend towards late eruption of permanent teeth.*

**Key words:** Eruption times, permanent teeth, effect of diet, school children

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### INTRODUCTION

Eruption of a tooth is a natural biological phenomenon, where the tooth emerges from alveolar bone to its functional position. Permanent teeth start emerging into mouth at about 6<sup>th</sup> year of age. The time and sequence of eruption differ in various ethnic groups. The eruption timings are said to be dependent on diet, gender, height, weight, socioeconomic status, craniofacial growth & morphology, pre-mature extraction of primary teeth, fluoride intake and environmental factors.<sup>1</sup> Therefore, it is recommended to determine timings and sequence of eruption separately in children of various ethnic groups.<sup>2</sup> It is also recommended to repeat this exercise after certain period of time to find out the effects of changing dietary habits and life style on the timings and sequence of eruption in permanent teeth.<sup>3</sup> The data obtained through eruption timings and

sequence studies have vital use in the fields of Pediatric Dentistry, Orthodontics, Forensic Dentistry and Oral Surgery.<sup>4</sup>

Several studies have been conducted recently in Africa (Nigeria<sup>5</sup>, Sudan<sup>6</sup> and South Africa<sup>7</sup>), America (USA<sup>8,9</sup>, Mexico<sup>10</sup>, Brazil<sup>11</sup>), Asia (Pakistan<sup>2,12</sup>, Saudi Arabia<sup>13,15</sup>, Iraq<sup>16</sup>, Filipine<sup>17</sup>, Malaysia<sup>18</sup>, India<sup>19,21</sup>, Sri Lanka<sup>22</sup>, Jordan<sup>23</sup>, Nepal<sup>24</sup>, Syria<sup>25</sup>, and Turkey<sup>26,27</sup>), Australasia (New Zealand<sup>28</sup>) and Europe (Spain<sup>29</sup>, Lithuania<sup>30</sup>, Czechoslovakia<sup>31</sup>, United Kingdom<sup>32</sup> and Greece<sup>33</sup>) to determine eruption timings of permanent teeth. However, very few studies have investigated the association between the timings of eruption and dietary habits. Only one study has been conducted to determine the association between eruption timings of permanent teeth and dietary habits.<sup>34</sup> This study was conducted before partition of subcontinent in 1946 on children of rice-eating areas (Madras, South India) and wheat-eating areas (Lahore, North-west India). Since then, major changes have occurred in dietary habits during last 70 years. The objective of this study was to find out any association between eruption timings of permanent teeth and the type of food consumed in children of Peshawar, the Capital city of Khyber Pakhtunkhwa Province Pakistan.

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## Does Timing of Eruption in First Primary Tooth Correlate with that of First Permanent Tooth? A 9-year Cohort Study

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### Abstract

**Background and aims.** Predicting the teeth eruption time is a valuable tool in pediatric dentistry since it can affect scheduling dental and orthodontic treatments. This study investigated the relationship between the eruption time of first primary and permanent teeth and the variation in the eruption time considering socioeconomic status (SES) in a 9-year population-based cohort study.

**Materials and methods.** 307 subjects were examined at bimonthly intervals during the first and second years of life and then at six-month intervals until the eruption of first permanent tooth. Eruption times of primary and permanent teeth were recorded for each child. A modified form of Kuppaswamy's scale was used to assess the SES.

**Results.** Among 267 subjects completed all follow-ups, the eruption time for first primary and permanent teeth indicated a direct strong correlation; in that one month delayed or early eruption of first primary tooth resulted in 4.21 months delayed or early eruption of first appearing permanent tooth ( $r = 0.91$ ,  $n = 267$ ,  $P < 0.001$ ). No significant correlation was observed between the eruption time of first primary and first permanent teeth and SES ( $P = 0.67$ ,  $P = 0.75$ , respectively).

**Conclusion.** The eruption timing for the first primary tooth had a correlation with the first permanent tooth eruption timing, while SES did not have any influence on eruption times.

**Key words:** Deciduous, dentition, permanent, tooth eruption.

### Introduction

The chronology and sequence of eruption of human primary and permanent teeth are important milestones during a child's development. Estimation

of eruption schedule is a very valuable tool in child's dental health planning including diagnostic, preventive and therapeutic measures in pediatric dentistry and orthodontics.<sup>1</sup> Information on tooth emergence is also the key indicator of maturity in the diagnosis of

# Changes in the Sequence of Eruption of Permanent Teeth; Correlation between Chronological and Dental Age and Effects of Body Mass Index of 5–15-year-old Schoolchildren

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## ABSTRACT

**Aim:** To determine the changes in the sequence and age of eruption of permanent teeth in 5–15-year-old schoolchildren, correlating their dental and chronological age.

**Materials and methods:** A total of 1,477 schoolchildren aged between 5 years and 15 years were examined for the eruption timing, body mass index (BMI), and other oral findings. Dental age was calculated for 10% of the total sample using the Willem's method from their ortho-pento graphs (OPGs) and correlated with their chronological age.

**Results:** The maxillary teeth erupted earlier than mandibular teeth. Males were found to mature earlier than females. The sequence of eruption observed was: males (maxilla) 1-6-2-4-3-5-7 and (mandible) 1-6-2-3-4-5-7; females (maxilla) 6-1-2-4-3-5-7 and (mandible) 1-6-2-3-4-5-7. The chronological age and the dental age were found to be different in the age range of 9–10 years female; 10–11 years male; and in 13–14 years both male and female. Also when the dental age was correlated with the BMI, the dental age of obese children in 5–6 years and underweight children in 10–11 years were found to be far ahead of their actual chronological age.

**Conclusion:** This study opens an expected door for a large sample size to be tested in various local populations with different ethnicity and race as there can be changing trend in the eruption pattern.

**Clinical significance:** Changing trends in the sequence and age of eruption of the permanent teeth definitely need to be looked into. As this change, if firmly established in future, can help pedodontist in better planning of space management, interceptive as well as full-mouth orthodontic treatment which largely depends on this sequence being true in most of the cases.

**Keywords:** Body mass index, Changing trends, Chronological age, Dental age, Eruption sequence, Willem's method.

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## INTRODUCTION

A child in his process to become an adult passes through a complex system of biological development of varied origin, intensity, and importance such as skeletal growth, calcification, and eruption of teeth. Tooth is synchronous with growth and development of the craniofacial complex, and marks as an important milestone in a child's development.<sup>1</sup>

Average time of emergence of permanent teeth is important to be established for diagnosis, orthodontic treatment planning, and preventive dentistry procedures.

Individuals with variations like ethnicity, race, gene pool, hormonal factors, geographical area, gender, social status, nutrition, and growth tend to exhibit difference in eruption patterns and timing of eruption of individual teeth. The normal tooth eruption patterns that were recorded for a Western society cannot be applied to an Indian scenario. The literature related to eruption age of Indian children appears to be meager.

Some of the earliest studies are of Shourie<sup>2</sup> who reported the tooth eruption age for schoolchildren in the age group of 6–21 years. Kaul, Saini, and Saxena in 1975 reported the eruption ages for permanent teeth of North Indian (Chandigarh) children.<sup>3</sup> And the classic study by Amrit Tewari and Harpinder Singh Chawla in 1978<sup>4</sup> among North Indian children marked a greater significance in the study of sequence and eruption age of permanent teeth, which is still being followed as the gold standard.

Eruption of the teeth was found to be positively related to somatic growth (height and weight) of individuals. Height and

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weight are the physical markers of growth and development that are utilized the most in diagnostic procedures and also in evaluation of development in growth. Because of the changes in the environment leading to increasing trend of sedentary lifestyle and a high consumption of energy-rich food and drinks resulted in conditions like overweight and obesity in children. However, with the changing trends, variations in the sequence and eruption age need to be reanalyzed and should lead to developing a new standard table for tooth eruption, which is personalized to the local citizens in which they are to be applied.

# Nutrition for oral health and oral manifestations of poor nutrition and unhealthy habits

Matthew Pflipsen, MD ■ Yevgeniy Zenchenko, MD

The availability of proper nutrients is critical for the growth, development, maintenance, and repair of healthy dentition and oral tissues. Deficiencies particularly relevant to the dental practice are those in folate and other B complex vitamins; vitamins A, C, and D; calcium; fluoride; and protein. A lack of these nutrients affects nearly every structure in the oral cavity, causing or contributing to scurvy, cleft palate, enamel hypoplasia, poor mineralization, caries, and other pathoses. Damage to the dentition can also be observed in individuals with unhealthy habits; for example, a diet high in sugars will promote processes such as demineralization and caries. Diabetes also can result from a poor diet and is associated with periodontitis and oral candidiasis. Finally, the use of tobacco products and excessive alcohol intake damage the dentition and contribute to a variety of oral diseases, including stomatitis, malnutrition, and squamous cell carcinoma. Knowledge of these relationships will enable the dentist to question patients about dietary habits and provide guidance to encourage a healthy lifestyle.

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GENERAL DENTISTRY  
SELF-INSTRUCTION

Exercise No. 412, p. 44

Subject code: Health and Nutrition (150)



**N**utrition is critical to the oral health of the individual. From gestation through the end of life, nutrition influences the integrity and function of the dentition and supporting oral structures and has a direct effect on health in general. A well-balanced diet is key to ensuring that individuals receive the nutrients they need (Box).<sup>1</sup> If the diet does not supply enough of the vitamins, minerals, and other nutrients needed to support healthy tissues, malnutrition develops. In addition, some commonly prescribed medications are associated with nutritional deficiencies (Table 1).<sup>2,6</sup>

Poor nutrition and unhealthy habits "can affect the development and integrity of the oral cavity as well as the progression of oral diseases."<sup>7</sup> Proper nutrition and avoidance of unhealthy habits helps avoid oral pathoses associated with nutritional deficiency, excess free sugar intake, diabetes, alcohol consumption, or tobacco use. Dentists who are knowledgeable about nutrition are equipped to ask patients relevant questions about dietary habits that may affect oral and systemic health and to provide guidance that promotes healthy lifestyles. This article will review the roles of specific nutrients in oral health as well as the harmful effects of unhealthy habits.

## Vitamins

### Folate and B complex vitamins

Folate (vitamin B<sub>9</sub>) is a critical component of certain biochemical reactions necessary to synthesize DNA and to power the amino acid metabolism required for cell division. It is an essential vitamin and cannot be created in the human body. Due to its role in nucleic acid synthesis and the rapid cell creation of the growing fetus, the demands for folate increase during pregnancy.<sup>8</sup> For this reason it is recommended that all women of child-bearing age, even if not currently pregnant, take a daily supplement containing 0.4-0.8 mg of folic acid.<sup>9</sup> Although folate deficiency is most often associated with neural tube defects, recent studies have found a reduced occurrence of cleft lip with or without cleft palate when pregnant women take supplemental folic acid.<sup>10,11</sup>

Because B vitamins frequently exist in the same foods, they are commonly referred to as the *B complex vitamins*. A deficiency in one is likely to be accompanied by deficiencies in others. Although they may be accompanied by disparate systemic signs, deficiencies in B<sub>1</sub>, B<sub>2</sub>, B<sub>6</sub>, and B<sub>12</sub> will typically manifest in the oral cavity as stomatitis, glossitis, and oral ulcers. Risk factors for vitamin B deficiencies include older age, medications, chronic alcohol abuse, malabsorptive syndromes, and vegetarian and vegan diets.

### Vitamin C

Another essential nutrient, vitamin C is required for the synthesis of collagen, which almost exclusively constitutes the



# Timing of Permanent Tooth Emergence is Associated with Overweight/Obesity in Children from the Amazon Region

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The aim of this study was to evaluate the association between timing of permanent tooth emergence with overweight and obesity in children from Brazilian Amazon region. The studied population consisted of 192 children, 09 to 12 year-old, from public schools at Manaus, Amazonas-Brazil. Clinical examination was performed and the tooth emergence was evaluated according to the number of permanent erupted teeth. Body mass index z-score was calculated. For the statistical analysis 'Overweight/obese' group was compared with 'Normal weight' group in a case to control ratio 1:2. The t-test based on age was used for means comparison between the groups. A linear regression analysis using age and gender as co-variants was used. The established alpha was 5%. One hundred twenty-seven children were classified as normal weight and 65 were classified as overweight/obese (49 were overweight and 16 were obese). Overweight/obesity condition was associated with the gender, in which boys had a higher chance to present higher weight conditions (OR=1.84; CI 95% 1.06-3.37; p=0.04). The mean number of permanent teeth was higher in the overweight/obesity group (p<0.001). Linear regression analysis demonstrated that nutritional status, gender and age were strongly associated with number of permanent erupted teeth (p<0.05). In conclusion, our study demonstrated that timing of permanent tooth emergence is associated with overweight/obesity in children from Manaus, Brazil.

**Key Words:** tooth emergence; nutritional status; children.

## Introduction

Childhood overweight/obesity is one of the most serious public health challenges of the 21st century and has been increasing during the past years. According to the World Health Organization (WHO) over 42 million children are considered overweight or obese. It is well known that obesity is associated to adversely health issues, including earlier puberty (1). Overweight children are taller than non-overweight children at the same age (2).

Tooth emergence is the result of an intricate process, characterized by the movement of the tooth, during odontogenesis, through the alveolar bone and gingival mucosa until the tooth emergence in the proper position in the dental arches<sup>1</sup>. The mechanisms involved in the timing of tooth emergence are not completely understood and are influenced by many regulatory aspects (1,2).

Several studies have already shown that the timing of tooth emergence can be influenced by the nutritional status, such as malnourished, overweight and obesity (3-11). Although previous studies in different populations demonstrated that obese and overweight children have more permanent erupted teeth when compared with their controls (3,5-7,9-11), none of these studies were performed

in a population of children from the Amazon forest region, which has a completely different genetic, environmental and cultural background. Thus, the aim of this study was to evaluate if overweight and obesity is associated with timing of permanent tooth emergence in children from the Brazilian Amazon region.

## Material and Methods

### Participants

The study was approved by The Human Ethics Committee of Amazon State University (N° 923.569). Informed written consent was obtained from the parents and age appropriate assent document were used for all children.

Children from four public schools from Manaus city were evaluated. Manaus is the capital city of the state of Amazonas state that is locate in the Northern Region of Brazil. Manaus is situated in the middle of the Amazon rainforest and the total population comprises 2,094,391 inhabitants. The ancestry of the inhabitants of Manaus is composed mainly by European and Native American, and the remaining of African descendant (12).

The parents or legal guardians answered a questionnaire about information regarding their child's medical history

## Correlation between permanent teeth eruption and nutrition status of 6-7-years-old children

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### ABSTRACT

**Introduction:** Tooth eruption is influenced by various factors, one of them is nutritional factors. This study was aimed to determine the relationship between the number of permanent teeth erupted with nutritional status in 6-7-years-old children. **Methods:** This research was cross-sectional and correlational data analysis. The study was conducted towards as much as 57 children aged 6-7 years old. The sampling method was the purposive sampling technique conducted in Tanjungsari 2 State Elementary School, Sumedang Regency. The nutritional status was calculated based on the Body Mass Index (BMI) according to age from the anthropometric measurements of body weight and height. Assessment of nutritional status was performed using the WHO Anthroplus® v1.0.4 application. Statistical analysis was performed using the Spearman correlation test and Mann-Whitney difference test. **Results:** The correlation test has obtained the value of  $p = 0.037$ , which showed a significant relationship between the number of permanent teeth erupted with nutritional status of 6-7-years-old children. The Spearman correlation coefficient has obtained the value of  $r = 0.277$ , thus showed the weak strength and positive direction of the correlation. **Conclusion:** There is a relationship between the nutritional status and the number of permanent teeth erupted in children aged 6-7 years old in the Tanjungsari Sub-district of Sumedang Regency. The higher the nutritional status of a child, the more number of permanent teeth erupted.

**Keywords:** 6-7-years-old children, nutritional status, permanent teeth eruption.

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### INTRODUCTION

Tooth eruption is the tooth movement in the jaw bone towards its functional position in the oral cavity. This eruption process continues until the tooth has contact with the antagonistic teeth.<sup>1</sup> Clinically, tooth eruptions are characterised by the appearance of the crown or when the cusp

penetrates the gingival part.<sup>2</sup> The permanent tooth begins to erupt at the age of 6-7 years old, which is an eruption of mandibular first premolar, mandibular first incisors, and maxillary first molar.<sup>3</sup>

Permanent tooth eruption is a complex process influenced by various factors, such as genetics, gender, premature birth, hormones, systemic diseases, nutrition, socio-economic, and

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