

NITRATE REDUCTASE ACTIVITY IN DENTAL PLAQUE OF CHILDREN AND ADOLESCENTS

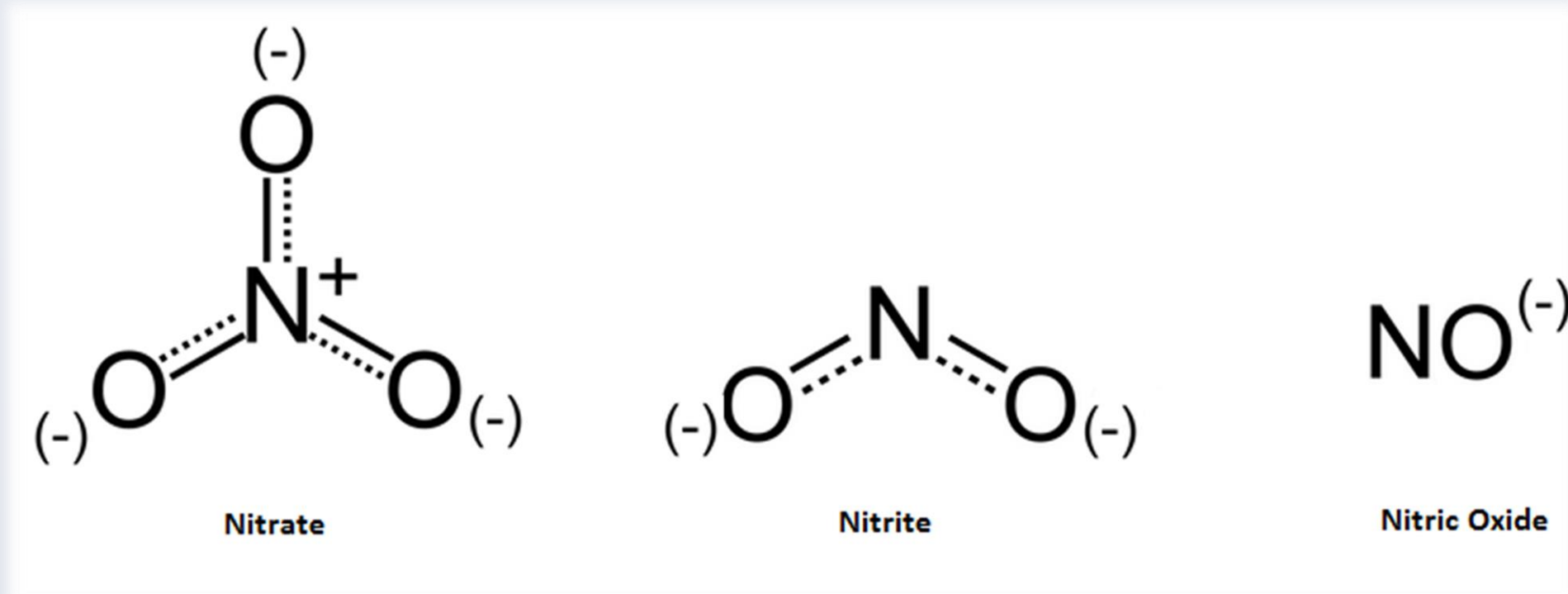
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INTRODUCTION

- As diet and nutrition become the forefront of preventative medicine, oral health nutrition has also focused on functional foods with protective effects such as stimulating saliva, increasing plaque pH, possessing low acidogenicity and commensal bacterial relationships.
- One such example are the **dietary nitrates** present in leafy green vegetables.
- Nitrates can be reduced to nitrites by **nitrate reductase** (NR) produced exclusively by facultative and anerobic commensal oral bacteria harbored in plaque and saliva when sloughed off from the tongue dorsum.
- Nitrite is further reduced by gut bacteria to nitric oxide, absorbed into the blood and acts as a vasodilator lowering blood pressure and **benefiting cardiovascular health**.



Oral Cavity: Nitrate (NO_3^-) \rightarrow Nitrite (NO_2^-)

Gut: $2 \text{NO}_2^- + 2\text{H}^+ \rightarrow \text{NO}_2^- + \text{NO}^-$ (Nitric oxide) + H_2O

- Nitrate reductase has been studied in adults, but limited information is available on NR activity in children's oral cavity.

HYPOTHESIS/ OBJECTIVES

Hypothesis:

- Nitrate reducing commensal oral bacteria can be detected in children's dental plaque and may contribute to overall health.
- Children with permanent dentition have higher NR activity in dental plaque than children with primary dentition.

Objectives:

- Determine the presence of NR activity in dental plaque of children and adolescents.
- Compare the presence of NR activity in the dental plaque of children with complete primary and permanent dentition.

MATERIALS & METHODS

Children Supragingival Dental Plaque Collection

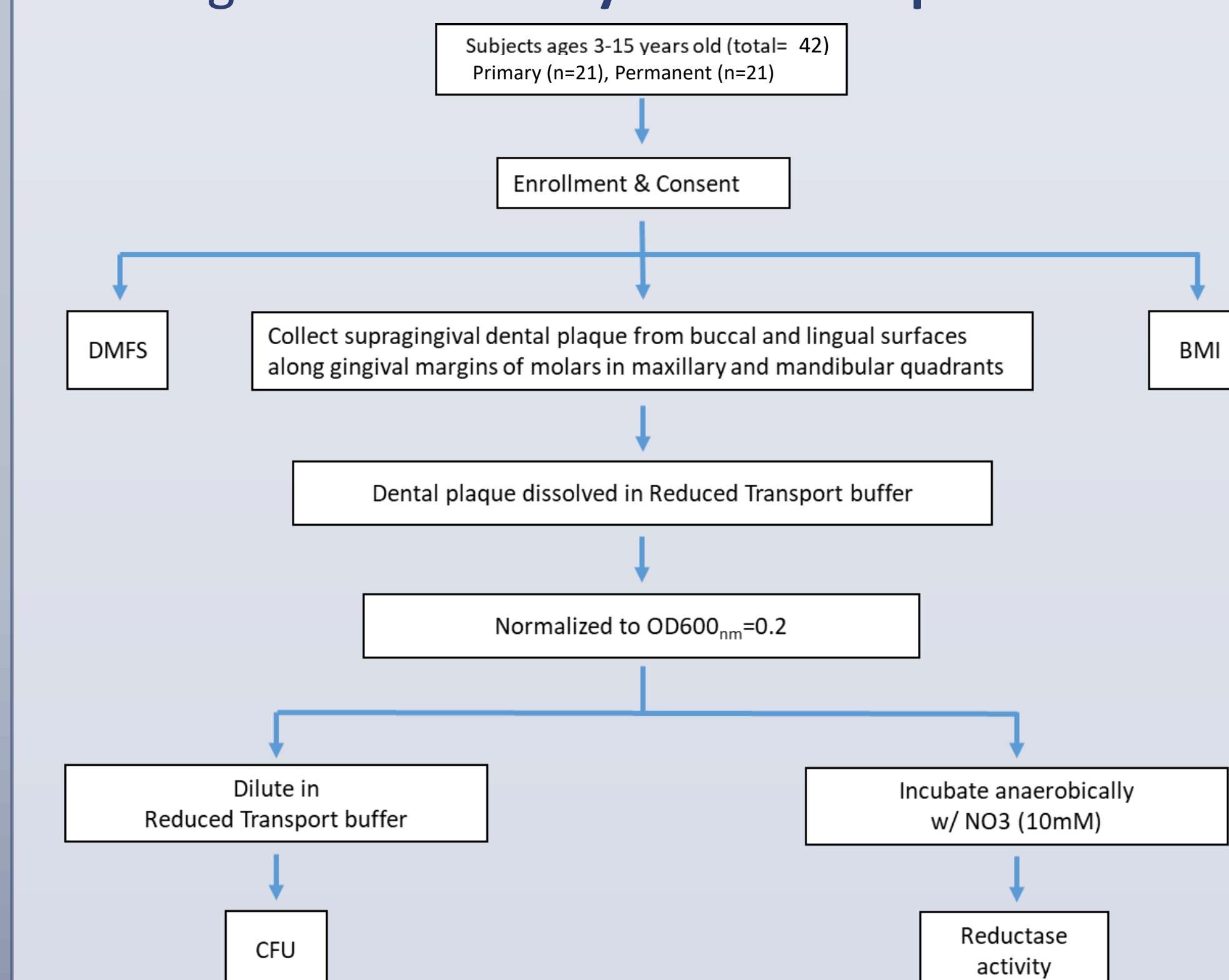
- 42 healthy 3–15-year-old** children with **primary (N=21)** and **permanent (N=21)** dentitions participated in the study.
- Informed consent** was obtained from participants fitting inclusion criteria.
- Supragingival plaque** samples from buccal and lingual surfaces of maxillary and mandibular first and second (primary/ permanent) molars were collected and stored on ice for further NR tests.

BMI, dmfs/ DMFS

- Participant's body mass index (**BMI**) were recorded. **DMFS/dmfs** was collected based on **radiographs and odontogram charting** in participant's EHR (UIC IRB #2021-0536).

In-vitro NR Activity and Data Analysis

- NR activity in dental plaque samples was assayed using the **Griess** method. Comparison of NR activity between the two groups was performed using **Mann Whitney-U and independent t-test**.

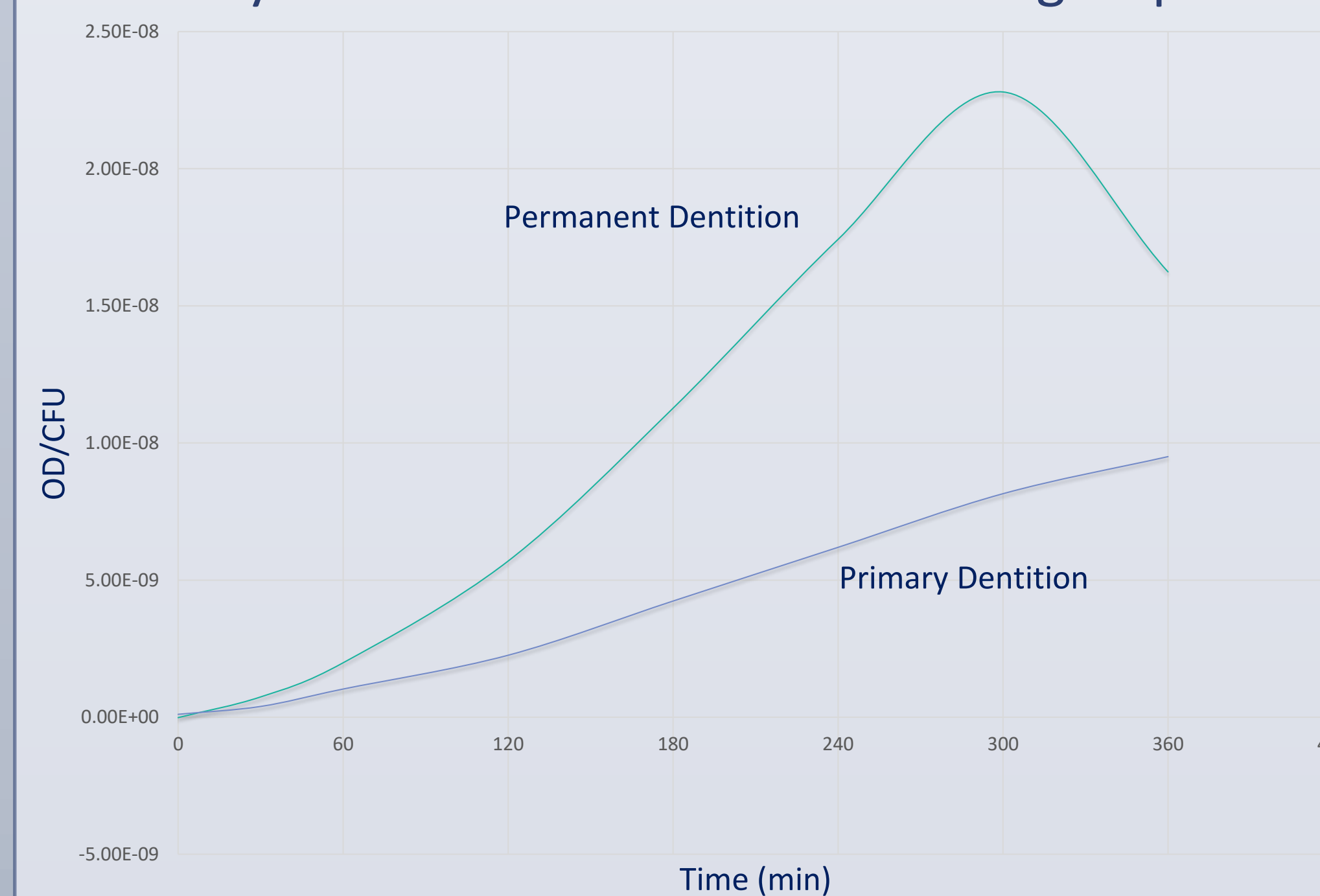


Inclusion Criteria:

3-15 years of age
Complete primary/ permanent dentition
Patient of record at UIC COD
Guardian and participant consent, assent
Good general health (ASA I)
Good gingival health
Cooperative behavior for data sample collection
Dental plaque present
Existing dental radiographs
No current orthodontic treatment
No antibiotic therapy in last 30 days
No antimicrobial mouth rinse in past 21 days

RESULTS

- A total of **42** patients met study inclusion criteria.
- NR activity was detected in all** participants' dental plaque.
- Statistically significant difference in dental plaque NR activity** was observed between children with permanent dentition than those with primary dentition ($p<0.05$).
- Higher NR activity** in dental plaque of children with **permanent** dentition than children with primary dentition
- Higher viable colony cell count** (CFU) in dental plaque of children with **primary** dentition than children with permanent dentition
- No correlations in DMFS/dmfs or BMI with NR activity were noted between the two groups

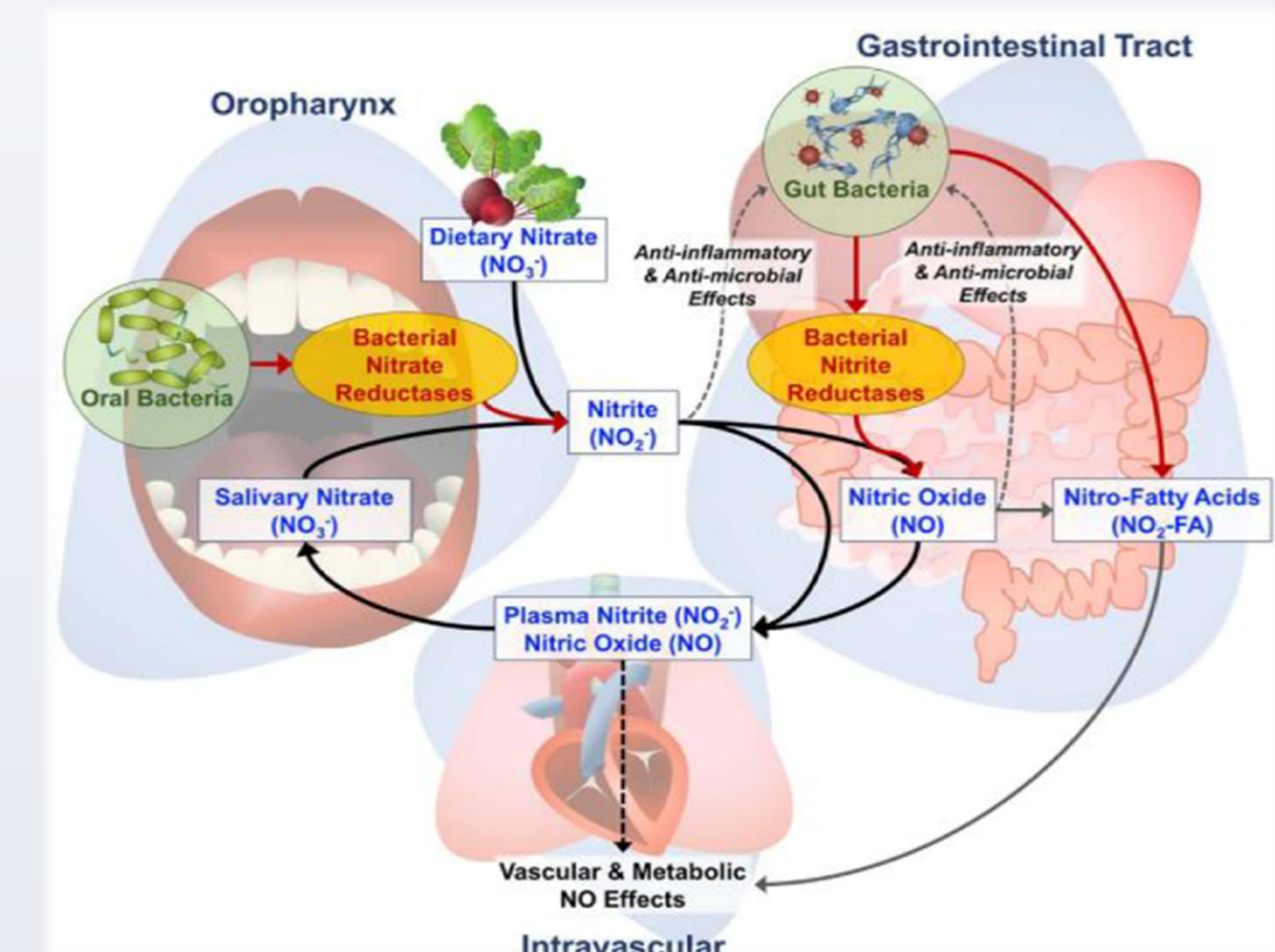


Graph: NR Activity corrected by CFU (OD/CFU) in Primary and Permanent Dentition of Children

Demographic Data	Primary Dentition	Permanent Dentition
Mean Age	3.95 years	12.67 years
Median Age	4.00 years	12.00 years
Gender	F	38.1% (n=8)
	M	61.9% (n=13)
		57.1% (n=12)
		42.9% (n=9)

BMI Percentile	Primary Dentition	Permanent Dentition
Mean	49.7	68.0
Median	33.5	89.0
Underweight	0.0% (n=0)	0.0% (n=0)
Healthy	71.4% (n=15)	47.6% (n=10)
Overweight	9.5% (n=2)	23.8% (n=5)
Obese	45.4% (n=4)	28.6% (n=6)

CONCLUSIONS



Entero-salivary Pathway of NR

- We have found **nitrate reductase activity** in the **dental plaque** of children and adolescents, which supports available literature.
- Unlike other studies, we were able to **compare the differences between the two groups**.
- Nitrate** in the **diet** represents a **promising compound** to stimulate **oral health**
- Nitrite-producing commensal bacteria in the oral cavity may **indirectly** affect the **environment** of the oral cavity and **microbial composition**
- Ingestion** of nitrate-containing fruits and vegetables should have a **positive** impact on **oral and systemic health**
- Nitrate may be considered as a **prebiotic** and nitrate-producing bacteria as **probiotics**
- The **identification** of specific oral microflora and their **association** with children's vascular health **warrant further investigation**.

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