

Exploring the Relationship Between Dietary Behaviors, Salivary pH, and Caries Risk in Children

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BACKGROUND

- Dental caries is the most prevalent chronic disease among U.S. children and shares dietary and behavioral risk factors with systemic conditions such as obesity and diabetes
- Salivary pH reflects the oral environment susceptibility to demineralization, while caries risk assessment tools such as Cambra incorporate salivary and clinical indicators to evaluate caries risk
- Relationships between dietary behaviors, salivary pH, caries burden, and systemic health markers remain understudied in young children



Figure 1. Multifactorial Process of Caries
Adapted from Nelson and Velan (2014)

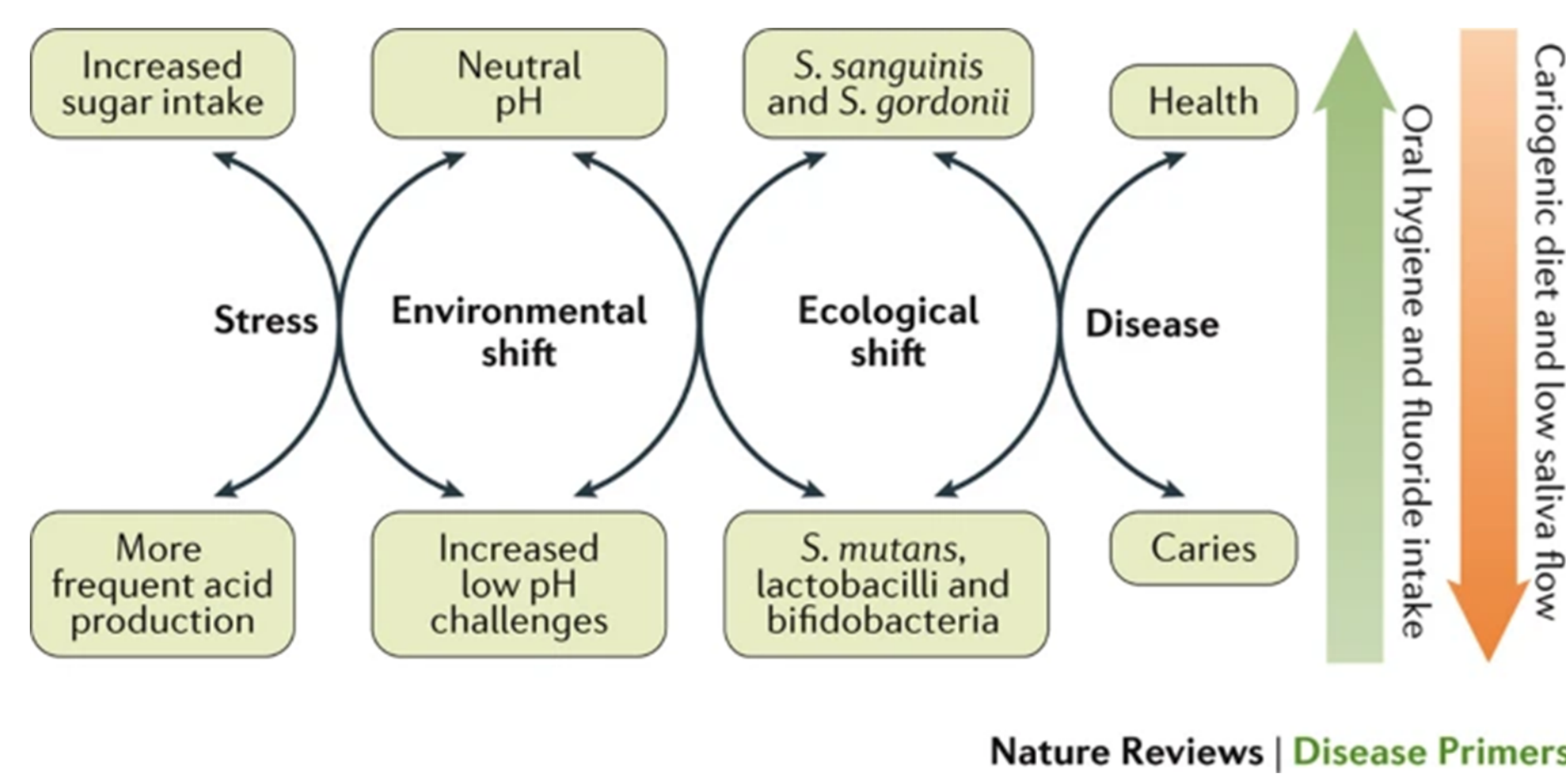


Figure 2. Ecological plaque hypothesis to explain the aetiology of dental caries
Source: Reprinted/Adapted from Pitts et al. (2017)

OBJECTIVES

To examine relationships between parent-reported dietary behaviors, salivary pH, and clinical indicators of children's oral and systemic health:

1. Evaluate whether cariogenic dietary behaviors (e.g., between-meal snacking, sugary snack intake) are associated with salivary pH level
2. Determine whether salivary pH differs by Cambra caries risk classification (high v low)
3. Assess associations between cariogenic dietary behaviors and markers of oral health (total dmfs, plaque index, hygiene index) and systemic health (BMI-for-age percentile, blood pressure, heart rate)
4. Examine whether elevated blood pressure is associated with higher BMI-for-age percentile and greater caries burden, as potential indicators of overlapping oral and systemic risk

MATERIALS & METHODS

Participants

- Well-children, with and without dental caries
 - recruited during routine dental appointments at the Columbia pediatric dentistry clinics
 - ages: 3-6 years
 - without conditions limiting ability to consume regular diet by mouth
- Parent/caregiver ≥18 years

Data Collection

- Saliva and plaque samples before prophylaxis
- Electronically administered surveys
- Clinical assessment

Key Variables

- Salivary pH
- Dietary Behaviors
- Anthropometrics: height, weight
- Cardiovascular measures: blood pressure (BP), heart rate (HR)
- Cambra score
- Oral hygiene index
- Plaque index
- Total dmfs (decayed, missing, or filled tooth surfaces)

RESULTS

- Data from 25 children were included in the analysis (9 caries-free)
- Mean child age was 4.8 years (median: 4 years)
- Mean pH score: 7.16 (range: 6-9)
- Associations between parent-reported cariogenic dietary behaviors (between-meal snacking, sugary snacks/beverages) were not significantly associated with salivary pH ($p > .20$) or clinical markers of oral (dmfs, plaque index) and systemic (BMI percentile, BP, heart rate) health ($p > .05$)
- No significant difference in salivary pH was observed between Cambra high and low-risk groups ($p = .25$)
- Systolic BP was positively correlated with BMI percentile ($p = .036$)
- No significant associations were observed between BP and caries burden (dmfs)

RESULTS

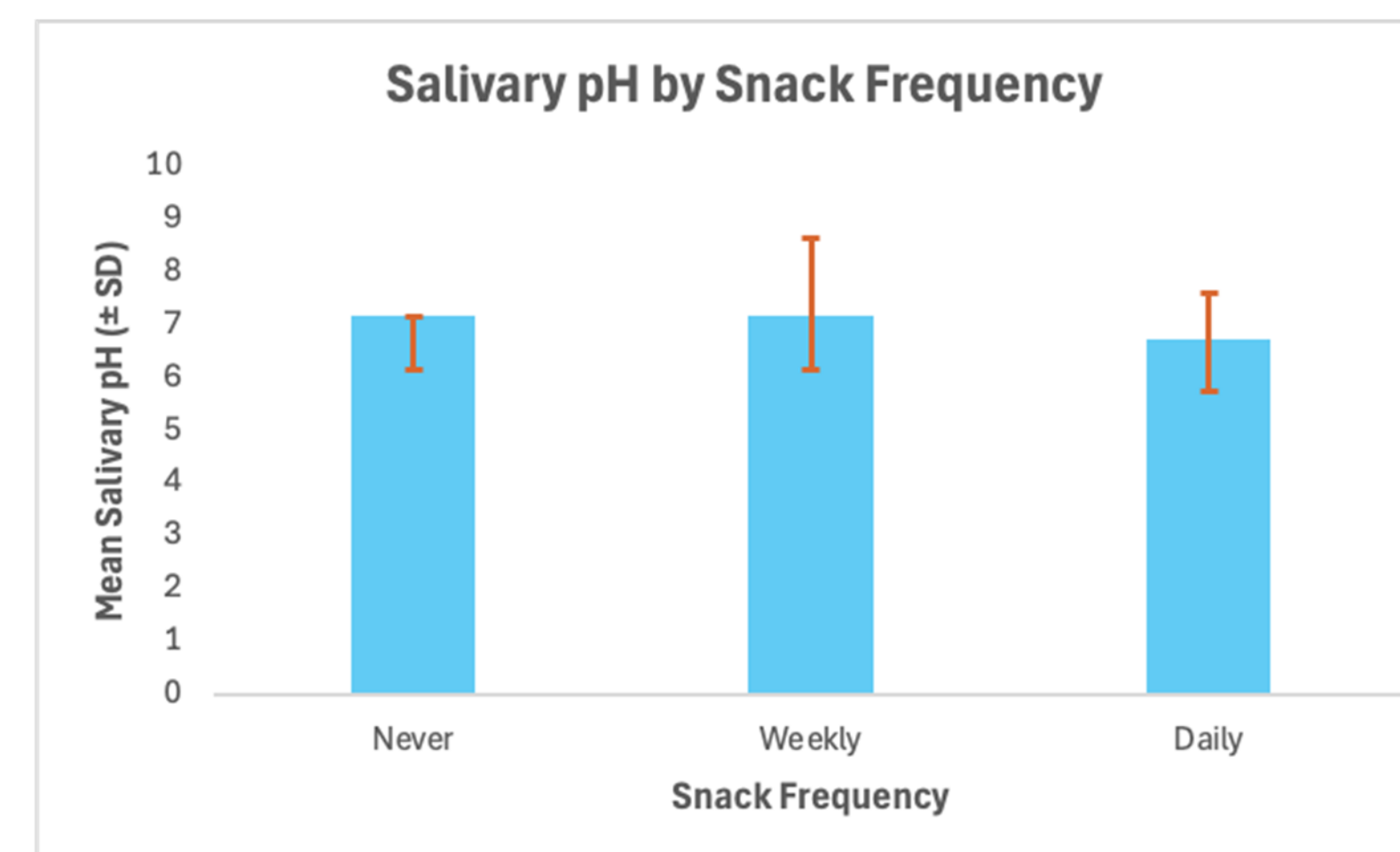


Figure 3. Salivary pH by Snack Frequency

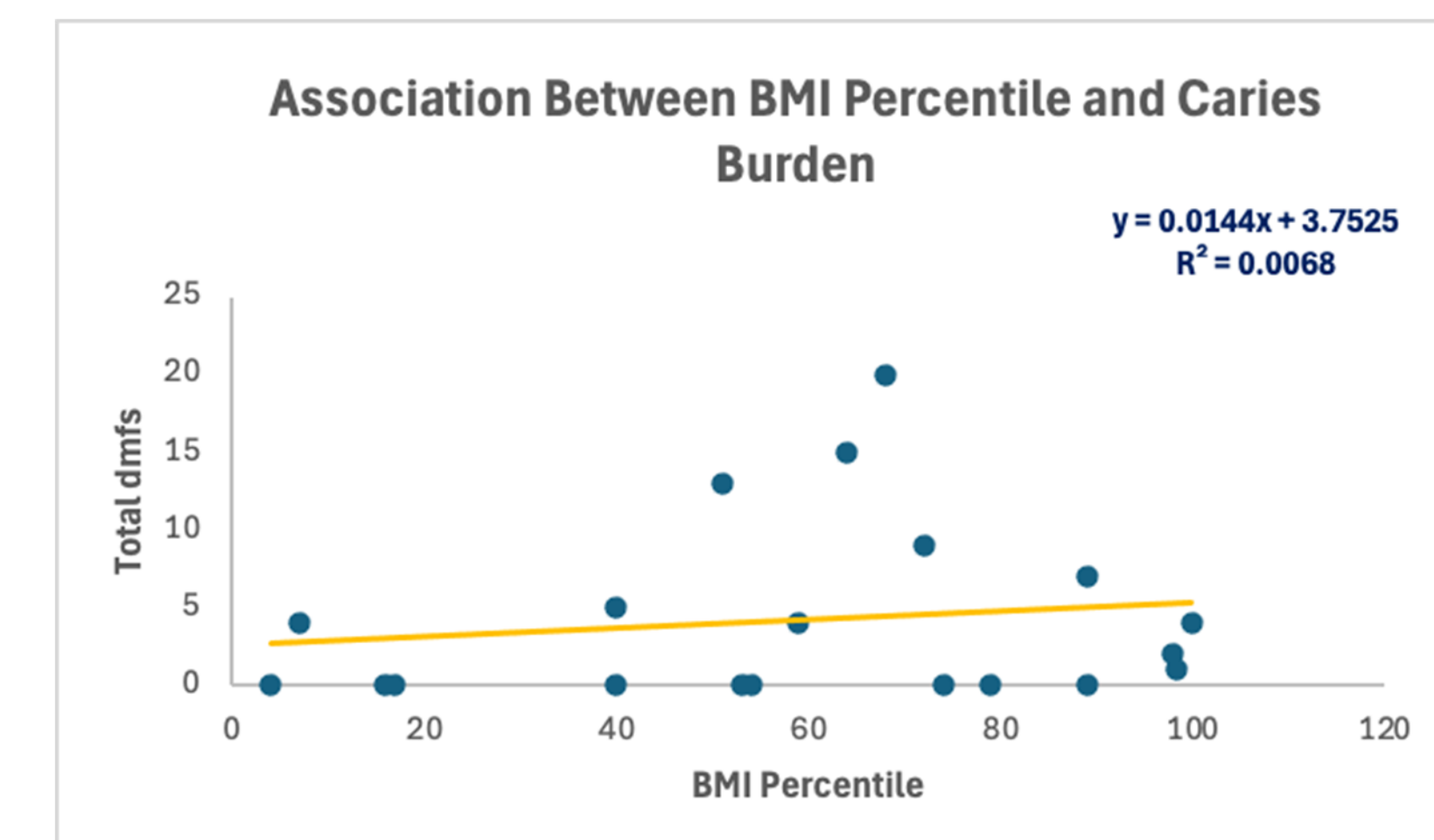


Figure 4. Association Between BMI Percentile and Caries Burden

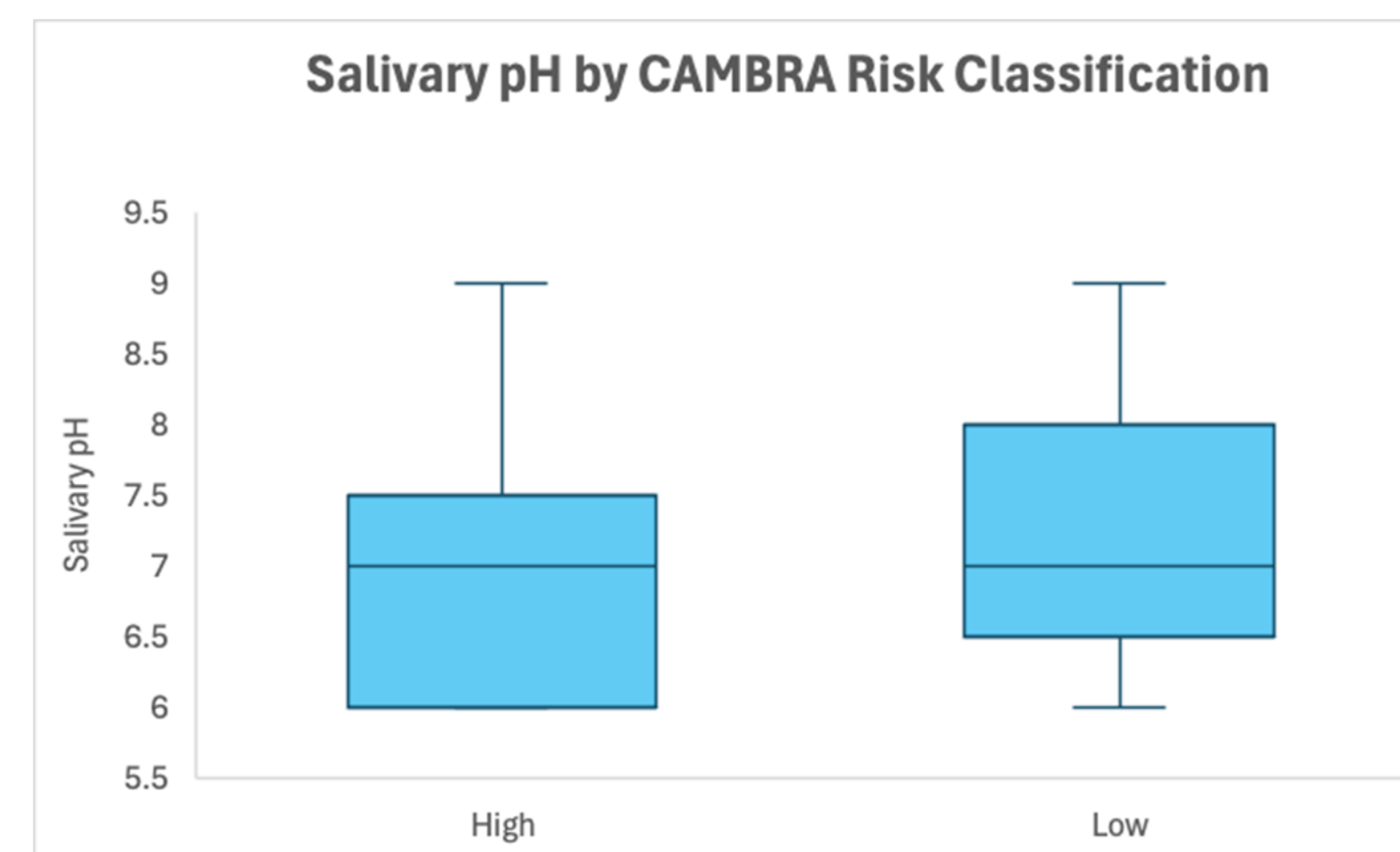


Figure 5. Salivary pH by Cambra Risk Classification

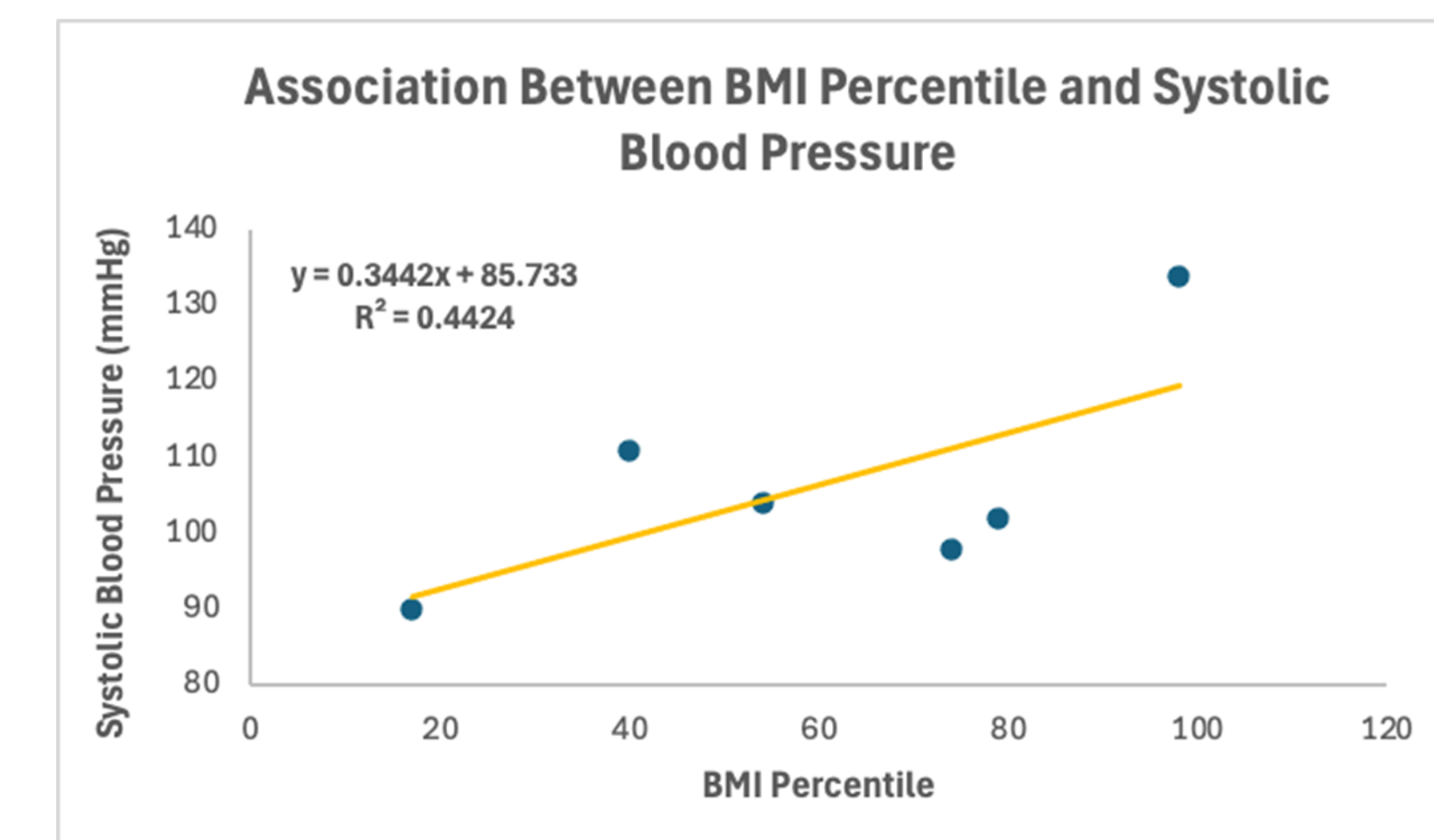


Figure 6. Association Between BMI Percentile and Systolic Blood Pressure

DISCUSSION

- Although frequent sugar intake is a known risk factor for dental caries, no association between reported dietary behaviors and salivary pH or caries risk indicators was observed in this study, possibly reflecting the small sample size and reliance on self-reported diet.⁶
- The absence of a clear relationship between BMI percentile and caries burden is consistent with previous studies reporting mixed or inconsistent associations between childhood obesity and dental caries, suggesting that both conditions may share overlapping but complex behavioral and environmental determinants.³
- Similar salivary pH values across snack frequency groups may reflect the limitations of single resting pH measurements, which may not capture transient pH fluctuations following carbohydrate exposure.⁵
- The observed positive association between BMI percentile and systolic blood pressure aligns with established evidence linking childhood adiposity with early cardiometabolic risk, reinforcing the importance of evaluating oral health research within broader pediatric health frameworks.¹

Limitations:

- Findings are limited by small sample size; results should be interpreted cautiously
- Time since last dietary exposure prior to saliva collection was not collected, which may have impacted salivary pH confounding association analyses
- Parent-reported measures of dietary behaviors had limited response option variability and may not accurately reflect usual dietary patterns, making associations difficult to assess

CONCLUSIONS

- This pilot study explored potential relationships between dietary behaviors, oral health indicators, and systemic health markers in young children.
- Findings highlight the multifactorial nature of early childhood health and the complex interactions between diet, oral health, and broader health outcomes.
- Integrating oral health measures with systemic health indicators may help inform future research examining shared risk factors for chronic diseases.
- Given the shared nature of dietary risks for oral and systemic chronic diseases, larger studies are needed to further evaluate how dietary exposures influence both oral and systemic health trajectories in pediatric populations that may benefit from early behavioral intervention.

REFERENCES

1. Falkner B, et al. The relationship of body mass index and blood pressure in primary care pediatric patients. *Journal of Pediatrics*. 2006;148(2):195-200. <https://doi.org/10.1016/j.jpeds.2005.10.011>
2. Fisher-Owens SA, et al. Influences on children's oral health: a conceptual model. *Pediatrics*. 2007;120(3):e510-e520. <https://doi.org/10.1542/peds.2007-0204>
3. Hooley M, Skouteris H, Boganin C, Satur J, Kilpatrick N. Body mass index and dental caries in children and adolescents: a systematic review. *International Journal of Pediatric Dentistry*. 2012;22(6):418-430. <https://doi.org/10.1111/j.1365-263X.2012.01214.x>
4. Nelson, Travis, and Elizabeth Velan. "Evaluating Caries Risk." *Dimensions of Dental Hygiene*, vol. 12, no. 2, 4 Feb. 2014, pp. 53-56, 59. <https://dimensionsofdentalhygiene.com/article/evaluating-carries-risk/>. Figure 1
5. Pitts, N. B., Zero, D. T., Marsh, P. D., Ekstrand, K., Weintraub, J. A., Ramos-Gomez, F., Tagami, J., Twetman, S., Tsakos, G., & Ismail, A. I. (2017). Dental caries. *Nature Reviews Disease Primers*, 3(1), Article 17030. <https://doi.org/10.1038/nrdp.2017.30> - Figure 2
6. Sheiham A, James WPT. A reappraisal of the quantitative relationship between sugar intake and dental caries. *BMC Public Health*. 2014;14:863. <https://doi.org/10.1186/1471-2458-14-863>