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ORIGINAL RESEARCH

Sugary Snack and Drink Consumption and Tooth Retention Among Residents with Disabilities in Thai Foster Homes: A Cross-Sectional Study

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Purpose: To examine the association between sugary snack and drink consumption frequency and tooth retention among residents with disabilities living in Thai foster homes.

Patients and Methods: We employed a cross-sectional design using secondary data from a World Health Organization (WHO)-based oral health survey conducted in October 2025 across two government-run foster homes in Thailand (parent survey n = 301). The analytic sample included 247 residents aged 13–59 years with permanent dentition and complete tooth-level records. Remaining teeth were calculated using a 28-tooth definition (excluding third molars) and classified into three ordinal groups. High-frequency sugary snack/drink intake (>1 time/day vs. ≤1 time/day) was measured via interviewer-administered questionnaire, and tooth-retention category was modeled using ordinal logistic regression.

Results: High-frequency sugary snack/drink consumption was reported by 88.7% of residents. After adjustment, this exposure was not associated with tooth-retention category (adjusted odds ratio [aOR] 0.83; 95% confidence interval [CI] 0.26–2.62). However, age was strongly associated with lower retention (aOR 0.90 per year; 95% CI 0.87–0.92), and partial caregiver assistance was independently associated with reduced retention (aOR 0.47; 95% CI 0.24–0.92).

Conclusion: In this cross-sectional study of residents with disabilities in Thai foster homes, high-frequency sugary snack/drink consumption was not independently associated with tooth-retention category after adjustment. Age and partial caregiver assistance were associated with lower tooth retention, indicating a need to strengthen routine preventive support for residents with greater functional dependency alongside facility-level strategies to limit free-sugar exposure.

Keywords: dietary sugars, disabled persons, foster home care, health equity, tooth loss

Introduction

Oral health is a fundamental component of general health and quality of life. Tooth loss remains common worldwide, contributing to functional limitations, poorer dietary intake, and adverse health outcomes.[1–3] Globally, people with disabilities are living longer due to advances in healthcare, leading to increased cumulative exposure to chronic conditions and greater long-term care needs, including oral healthcare. This population is widely recognized as a health disparity group, where inequities in access and quality of care may compound oral disease risk.[4–7]

Tooth retention typically follows a strong age gradient, reflecting the cumulative effects of dental caries and periodontal disease. Maintaining a functional dentition is a critical public health goal as it supports chewing ability, social participation, and broader health outcomes.[2,8–10] As a cumulative and functionally meaningful indicator, tooth retention can capture the downstream consequences of long-term oral disease and care barriers, including early tooth loss that may occur in institutional settings even among younger residents.

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Dietary sugar is a well-established upstream driver of dental caries, which can ultimately lead to tooth loss. International guidance recommends limiting free sugars to less than 10% of total energy intake, with reductions below 5% suggested for additional benefits.[11] Evidence supports a dose-response relationship between sugar exposure and caries risk, particularly when consumed frequently throughout the day.[12–14] In Thailand, sugar-related dietary behaviors have been linked to adverse oral health indicators, supporting the relevance of examining consumption patterns in this setting.[15]

Despite Thailand's universal health coverage, oral health inequities among people with disabilities persist, and disability-specific surveillance remains limited. National surveys indicate substantial unmet healthcare needs due to barriers such as transportation, caregiver availability, distance, and costs.[16] Published Thai evidence highlights persistent access barriers and high treatment need among people with disabilities, but clinical data from adolescents and adults in institutional or foster care settings remain limited for prevention and service planning.[17–19]

Foster homes for people with disabilities are long-term residential environments where daily routines, caregiver support, and the food environment shape oral health trajectories. Institutional living may constrain dietary choices and concentrate exposures, while variations in functional ability affect oral hygiene practices. Nutrition-focused interventions in group-home settings illustrate the importance of structured environmental support for healthier behaviors.[20] Furthermore, caregiver oral health literacy within Thai foster homes may influence preventive practices and service utilization.[21]

Therefore, this study aimed to evaluate the association between sugary snack and drink consumption frequency and permanent tooth retention among adolescents and adults with disabilities living in Thai foster homes. By quantifying sugar-related dietary patterns alongside clinically assessed dentition outcomes, we aim to provide setting-specific evidence to inform prevention planning and caregiver-support strategies, with the broader goal of sustaining tooth retention and quality of life for aging residents.

Material and Methods

Study Design and Data Source

This study was a cross-sectional analysis of secondary data derived from deidentified questionnaire and clinical examination records from a facility-based oral health survey of institutionalized residents with disabilities in Thailand. The parent survey was approved by the Human Research Ethics Committee of the Faculty of Dentistry, Chulalongkorn University (approval no. HREC-DCU 2025–056). All procedures were performed in accordance with the Declaration of Helsinki and the International Council for Harmonisation – Good Clinical Practice (ICH-GCP) guidelines. Written informed consent was obtained from all participants or their legal guardians prior to data collection.

Study Setting and Participants

The parent oral health survey was conducted in October 2025 in two government-run, sex-segregated foster homes for people with disabilities in Nonthaburi province (n = 301) (N Sermsuti-Anuwat, Faculty of Dentistry, Chulalongkorn University, personal communication, 2025). The facility indicator reflects institutional context rather than biological sex. The parent dataset has also been used in a separate unpublished analysis focusing on dental caries, treatment needs, and oral hygiene; the present analysis addresses tooth retention and sugary snack/drink consumption frequency as distinct outcomes and exposures. For this study, the dataset was restricted to adolescents and adults (13–59 years) to align with a permanent tooth retention definition based on a 28-tooth dentition. We excluded 49 children aged 7–12 years and 5 participants with incomplete permanent tooth-level records, yielding an analytic sample of 247 residents. The derivation of the analytic sample is shown in Figure 1.

Sample Size Consideration

The parent survey sample size was estimated a priori using G*Power version 3.1, targeting differences in untreated caries across age groups (medium effect size, two-sided $\alpha = 0.05$, power = 80%), requiring a minimum of 246 participants. The present study included all eligible participants with complete permanent-dentition data; no separate sample-size calculation was undertaken.

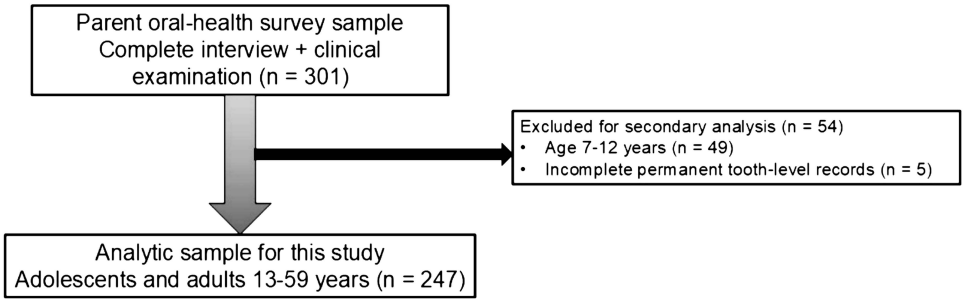

Figure 1 Study sample derivation.
Notes: Flow diagram showing the parent survey sample (n = 301), exclusions (children aged 7–12 years and incomplete permanent tooth records), and the analytic sample included in the present analysis (n = 247).

Oral Examination and Dentition Assessment

Clinical examinations were performed by trained dental personnel following standardized WHO protocols.[1] Tooth status was recorded using standardized diagnostic codes. Examiners were calibrated against a pediatric dentist serving as the reference examiner. In the parent survey, inter-examiner reliability for dentition status was substantial to almost perfect, and the intraclass correlation coefficient for the Simplified Oral Hygiene Index (OHI-S) was 0.882 (95% CI 0.384–0.980).

Outcomes

The primary outcome was ordinal tooth retention. Permanent tooth retention was defined as the number of remaining permanent teeth based on a 28-tooth dentition excluding third molars (teeth 18, 28, 38, and 48). This exclusion reduced misclassification in adolescents due to eruption variability.

Teeth were classified as "not remaining" if recorded as missing due to caries (code 4), missing for other reasons (code 5), unerupted (code 8), or excluded (code 9). All other codes were treated as present. The total number of remaining teeth (range 0–28) was categorized as 0–19, 20–25, and 26–28 teeth to improve discrimination in this relatively young population. Oral hygiene was assessed using OHI-S (good, fair, poor) among dentate participants, while chewing problems were assessed via caregiver-assisted interview (never, sometimes, often).

Exposure and Covariates

The primary exposure was sugary snack and drink consumption frequency, obtained from interviewer-administered questionnaires completed with participant and/or caregiver assistance. Respondents reported how often the resident consumed sugary snacks and sugar-sweetened drinks, recorded as times per day and dichotomized as high frequency (>1 time/day) versus lower frequency (≤1 time/day). Covariates included age (continuous years), facility context (male vs. female institution), disability type (intellectual, physical, compound), caregiver assistance (none vs. partial), tooth-brushing frequency (<2 vs. ≥2 times/day), and chewing problems. These variables were selected based on plausible associations with diet, self-care capacity, and tooth retention. OHI-S was summarized descriptively but excluded from primary regression models as it is undefined for edentulous participants and may lie on the causal pathway.

Statistical Analysis

Participant characteristics were summarized using mean (standard deviation [SD]) or median (interquartile range [IQR]) for continuous variables and frequencies and percentages for categorical variables. After exclusions, there were no missing data, so analyses used the full analytic sample (n = 247). Standard SPSS model-fitting and goodness-of-fit outputs were also examined. Multicollinearity among covariates was assessed, and no evidence of it was found. We evaluated associations between ordered tooth-retention categories and predictors using ordinal logistic regression (proportional odds model), reporting odds ratios (OR) and 95% confidence intervals (CI). An OR < 1 indicates lower odds of being in a higher retention category. The proportional odds (parallel lines) assumption was assessed using the

SPSS Test of Parallel Lines and was not violated ($\chi^2(8) = 13.31$, $p = 0.102$) in the final model. Chewing problems were treated as a three-level ordinal predictor. Because the sample was drawn from only two facilities, cluster-robust standard errors were not used; instead, we adjusted for facility and interpreted confidence intervals conservatively. All tests were two-sided with significance at $p < 0.05$. Analyses were performed using IBM SPSS Statistics (version 30).

Bias

Selection bias is possible as foster-home residents may not represent community-dwelling people with disabilities. Residual confounding is likely as data on lifetime service use, fluoride exposure, comorbidities, and duration of residence were unavailable. Caregiver-assisted responses may also introduce measurement error in self-reported behaviors.

Results

Participant Characteristics

The mean age was 25.0 years (SD 11.3). Most participants resided in the male facility (54.7%) and had intellectual disabilities (91.1%). High-frequency sugary snack/drink consumption (>1 time/day) was reported by 219 participants (88.7%). Toothbrushing ≥2 times/day was reported by 86.6%, and 40.5% required partial caregiver assistance. Chewing problems were reported as "never" by 52.2%, "sometimes" by 40.5%, and "often" by 7.3%. OHI-S was classified as poor in 58.3% of dentate participants. Overall, remaining teeth had a mean of 25.5 (SD 4.7) and a median of 27 (IQR 25–28). The majority (74.5%) were in the highest retention category (26–28 teeth), while 19.4% had 20–25 teeth and 6.1% had 0–19 teeth. Detailed characteristics are shown in Table 1.

Table 1 Participant Characteristics Overall and by Sugary Snack or Drink Frequency (n = 247)

Characteristic	≤ 1/day (n = 28)	> 1/day (n = 219)	Overall (n = 247)
Age, mean (SD)	22.0 (10.3)	25.4 (11.4)	25.0 (11.3)
Age group			
13–18 years	16 (57.1)	87 (39.7)	103 (41.7)
19–39 years	8 (28.6)	98 (44.7)	106 (42.9)
40–59 years	4 (14.3)	34 (15.5)	38 (15.4)
Facility			
Male facility	22 (78.6)	113 (51.6)	135 (54.7)
Female facility	6 (21.4)	106 (48.4)	112 (45.3)
Disability			
Intellectual disability	26 (92.9)	199 (90.9)	225 (91.1)
Physical disability	0 (0.0)	12 (5.5)	12 (4.9)
Compound disability	2 (7.1)	8 (3.7)	10 (4.0)
Caregiver assistance			
No caregiver assistance	19 (67.9)	128 (58.4)	147 (59.5)
Partial caregiver assistance	9 (32.1)	91 (41.6)	100 (40.5)
Toothbrushing frequency			
≥2 times/day	23 (82.1)	191 (87.2)	214 (86.6)

(*Continued*)

Table 1 (Continued).

Characteristic	≤ 1/day (n = 28)	> 1/day (n = 219)	Overall (n = 247)
<2 times/day	5 (17.9)	28 (12.8)	33 (13.4)
Chewing problems (frequency)			
Never	19 (67.9)	110 (50.2)	129 (52.2)
Sometimes	9 (32.1)	91 (41.6)	100 (40.5)
Often	0 (0.0)	18 (8.2)	18 (7.3)
OHI-S			
Good	3 (10.7)	14 (6.5)	17 (6.9)
Fair	9 (32.1)	74 (33.8)	83 (33.6)
Poor	16 (57.1)	128 (58.4)	144 (58.3)
OHI-S not applicable (edentulous)	0 (0.0)	3 (1.4)	3 (1.2)
Remaining teeth (0–28), mean (SD)	26.5 (2.2)	25.4 (4.7)	25.5 (4.7)
Remaining teeth (0–28), median (IQR)	27 (26–28)	27 (25–28)	27 (25–28)
Remaining teeth category			
0–19 teeth	0 (0.0)	15 (6.8)	15 (6.1)
20–25 teeth	5 (17.9)	43 (19.6)	48 (19.4)
26–28 teeth	23 (82.1)	161 (73.5)	184 (74.5)

Note: Data are n (column%) unless otherwise stated. Bold labels indicate variable group headings. Facility refers to sex-segregated foster homes (male and female). The ≤1/day group was small (n = 28), and most participants reported >1/day (n = 219); the outcome distribution was also imbalanced (majority 26–28 teeth). Symbols: ≤, less than or equal to; ≥, greater than or equal to.
Abbreviations: IQR, interquartile range; OHI-S, Simplified Oral Hygiene Index; SD, standard deviation.

Association Between Sugary Snack/Drink Consumption and Tooth Retention

In regression analysis (Table 2), high-frequency sugary snack/drink consumption was not associated with tooth-retention category in crude analysis (OR 0.57; 95% CI 0.21–1.56; p = 0.277) or after multivariable adjustment (aOR 0.83; 95% CI 0.26–2.62; p = 0.754).

Residents in the female facility had lower tooth retention in unadjusted analysis (OR 0.55; 95% CI 0.31–0.97; p = 0.039), but this association was not significant after adjustment (p = 0.534). Older age was strongly associated with lower odds of being in a higher retention category (aOR 0.90 per year; 95% CI 0.87–0.92; p < 0.001). Partial caregiver assistance was independently associated with lower tooth retention (aOR 0.47; 95% CI 0.24–0.92; p = 0.027). Chewing problems were not associated with retention after adjustment.

Discussion

In this foster-home sample, high-frequency sugary snack and drink consumption was common (88.7%) yet was not independently associated with tooth-retention category after adjustment. This null association was interpreted cautiously because exposure contrast was limited in the institutional food environment, tooth loss reflects cumulative past exposures, and the lowest-retention group was small. Reverse causation was also possible if residents with fewer teeth modified their diet toward softer foods and drinks. The observed age gradient in tooth retention was biologically plausible and consistent with cumulative oral disease processes. Although the present analysis did not demonstrate an independent association between sugar frequency and tooth retention, limiting free-sugar intake remains a core recommendation for caries prevention based on established evidence and international guidance.[11–13]

Table 2 Ordinal Logistic Regression for Tooth-Retention Category (0–19, 20–25, 26–28)

Predictor	Crude OR (95% CI)	p-Value	Adjusted OR (95% CI)	p-Value
High-frequency sugary snack/drink (>1 time/day vs ≤1 time/day)	0.57 (0.21–1.56)	0.277	0.83 (0.26–2.62)	0.754
Age (per 1-year increase)	**0.90 (0.88–0.93)**	**< 0.001**	**0.90 (0.87–0.92)**	**< 0.001**
Facility (female facility vs male facility)	**0.55 (0.31–0.97)**	**0.039**	0.81 (0.41–1.59)	0.534
Disability type (physical vs intellectual)	1.09 (0.29–4.10)	0.894	1.62 (0.35–7.44)	0.533
Disability type (compound vs intellectual)	0.65 (0.16–2.65)	0.550	2.24 (0.45–11.17)	0.327
Caregiver assistance (partial vs none)	**0.55 (0.31–0.97)**	**0.040**	**0.47 (0.24–0.92)**	**0.027**
Toothbrushing frequency (< 2 times/day vs ≥ 2 times/day)	1.08 (0.46–2.51)	0.867	0.88 (0.33–2.29)	0.787
Chewing problems (per-category increase: never→sometimes→often)	0.70 (0.45–1.08)	0.107	0.82 (0.50–1.36)	0.448

Note: Bold values indicate statistical significance ($p < 0.05$). Odds ratios (ORs) < 1 indicate lower odds of being in a higher tooth-retention category. The arrow (→) indicates increasing levels for the ordinal chewing-problem variable (never → sometimes → often). The adjusted model included all variables listed. P-values are two-sided. The proportional odds assumption was assessed using the SPSS Test of Parallel Lines ($\chi^2(8) = 13.31$, $p = 0.102$); standard SPSS model-fitting and goodness-of-fit outputs were also examined.

Abbreviations: OR, odds ratio; CI, confidence interval.

Partial caregiver assistance was independently associated with lower tooth retention. This variable likely reflects greater functional limitation and dependency, rather than indicating caregiver inadequacy, and it may identify residents who require more consistent hands-on preventive support and facilitated access to professional care.[6,7,17,18]

Institutional conditions may shape how dietary risks translate into oral outcomes. Facility procurement and donations can constrain food choice, and chewing problems may encourage selection of softer, energy-dense items. Within this context, facility-level diet policies and procurement guidance that favor lower-sugar options, palatable lower-sugar soft-texture alternatives, and water as the default beverage are practical strategies aligned with broader prevention evidence.[20,22]

Taken together, these findings highlight two complementary targets for prevention in foster homes: (1) environment-level strategies that reduce pervasive sugar exposure, and (2) strengthened routine oral hygiene support for residents with greater dependency. Implementation can include structured caregiver training, supervised toothbrushing protocols, and clear referral pathways within Thailand's disability-inclusive health-system direction.[17–19,21] Recommendations are presented as programmatic actions consistent with existing guidance and should be evaluated in future multi-institution studies with more detailed dietary measurement and appropriate clustering methods.

Limitations

This study was constrained by the variables collected in the parent survey. The cross-sectional design precluded causal inference, and current consumption frequency may not reflect historical exposure relevant to cumulative tooth loss. Sugar intake was measured using a simplified frequency category without quantity or timing, which may have introduced nondifferential misclassification and biased associations toward the null. The distribution of both exposure and outcome was imbalanced, with near-universal high-frequency sugar intake and a small proportion in the lowest-retention group, contributing to statistical imprecision. Key determinants such as lifetime dental service use, fluoride exposure, medications, comorbidities, and residence duration were unavailable, leaving potential residual confounding. Because the study included only two sex-segregated facilities, the facility variable captured institutional context rather than biological sex, and within-facility clustering could not be robustly modeled. Future studies that include more institutions, residents with higher dependency levels, and more detailed dietary measures are needed to better characterize pathways from sugar exposure to tooth loss.

Conclusion

In this cross-sectional study of adolescents and adults with disabilities in Thai foster homes, high-frequency sugary snack/drink consumption was common but was not independently associated with tooth retention after adjustment, likely reflecting limited exposure variability, statistical imprecision, and the cohort's young age. Partial caregiver assistance identified a subgroup with poorer tooth retention. Programmatic efforts in foster homes may combine facility-level approaches to limit free-sugar exposure with strengthened routine preventive support for residents with greater functional dependency; however, longitudinal and multi-facility studies are required to evaluate causal pathways and intervention effects.

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Disclosure

The authors report no conflicts of interest in this work.

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