

Oral Health Status in Children with Autism Spectrum Disorder: A Comparative Cross-Sectional Study from Venezuela

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Abstract

Purpose: To compare dental caries, caries experience, oral hygiene status, malocclusion, and oral habits between children with autism spectrum disorder (ASD) and children without ASD attending university dental clinics in Venezuela.

Methods: A comparative cross-sectional study included 168 children aged 3–14 years (87 with ASD and 81 controls). We assessed dental caries experience using the dmft index for primary dentition and the DMFT index for permanent dentition, as reported in the original statistical analysis. We also compared oral-hygiene status, malocclusion, and oral habits between groups. Unadjusted analyses used the Mann–Whitney U and chi-square tests. Regression models for the principal binary and ordinal outcomes were adjusted for age and sex.

Results: Children with ASD were older than controls (8.98 ± 2.51 vs. 7.47 ± 1.84 years; $p < 0.001$). In the original dentition-specific analysis, mean dmft was 2.88 ± 4.19 in children with ASD and 8.44 ± 2.70 in controls ($p = 0.008$), while mean DMFT was 2.68 ± 2.92 and 7.01 ± 3.98 , respectively ($p < 0.001$). Oral-hygiene category remained associated with group after adjustment for age and sex (aOR 0.13, 95% CI 0.07–0.26; $p < 0.001$). Oral habits were less frequent in the ASD group (42.5% vs. 63.0%) and remained associated after adjustment (aOR 0.40, 95% CI 0.21–0.78; $p = 0.007$). Malocclusion was present in 44.8% of the ASD group and 53.1% of controls and was not significantly associated with group after adjustment (aOR 0.58, 95% CI 0.30–1.11; $p = 0.101$).

Conclusion: In this university-based clinical sample, children with ASD showed lower dmft and DMFT values and a more favorable oral-hygiene distribution than controls. Fewer oral habits among children with ASD persisted after adjustment for age and sex, whereas overall malocclusion did not differ significantly after adjustment. The dentition-specific caries-index comparisons were unadjusted and should be interpreted in light of the age difference between groups.

Introduction

Autism spectrum disorder (ASD) comprises a heterogeneous group of neurodevelopmental conditions characterised by persistent difficulties in social communication and interaction, together with restricted and repetitive patterns of behaviour, interests, or activities. Differences in sensory processing, behavioural flexibility, and adaptive functioning are also common and may affect daily activities, healthcare experiences, and access to professional care (Barbosa et al. 2024; Ostrowski et al. 2024).

The prevalence of ASD has increased substantially over recent decades, although estimates vary according to diagnostic criteria, surveillance systems, population characteristics, and access to diagnostic services. Recent global estimates indicate a substantial public health burden, while prevalence remains insufficiently characterised in many low- and middle-income countries (Ostrowski et al. 2024; World Health Organization 2025). These epidemiological differences emphasise the importance

of generating population-specific data, particularly in regions where information on ASD and its associated healthcare needs remains limited.

Oral healthcare may represent a particular challenge for children with ASD. Sensory hypersensitivity, communication difficulties, behavioural inflexibility, anxiety related to unfamiliar environments, and difficulty tolerating physical contact or dental procedures may interfere with both daily oral hygiene and professional dental care (Barbosa et al. 2024; Piraneh et al. 2022). Dependence on caregivers for oral hygiene, toothbrushing difficulties, food selectivity, medication-related effects, and barriers to accessing appropriately adapted dental services may further influence oral health in this population (Piraneh et al. 2022; Mahabala et al. 2025).

Food selectivity deserves particular consideration. Restricted dietary repertoires, reluctance to try new foods, and sensory-related feeding difficulties are frequently reported among children with ASD (Wenzell et al. 2024). Although a direct relationship with dental caries cannot be assumed, differences in food composition, consistency, and frequency of intake may represent additional factors influencing oral health.

Several oral conditions have consequently been investigated among children and adolescents with ASD, including dental caries, plaque accumulation, gingival inflammation, malocclusion, bruxism, traumatic dental injuries, deleterious oral habits, and self-injurious behaviours (Barbosa et al. 2024; Sami et al. 2024). Nevertheless, the available evidence remains heterogeneous. Systematic and umbrella reviews demonstrate considerable variability in caries experience, oral hygiene indices, periodontal conditions, bruxism, and other oral outcomes among individuals with ASD (Barbosa et al. 2024; Sami et al. 2024; da Silva et al. 2017).

Recent comparative studies further illustrate this variability. Some investigations have reported poorer plaque control, greater toothbrushing difficulties, and a higher frequency of harmful oral behaviours among children with ASD while simultaneously observing lower dental caries experience than among typically developing controls (George et al. 2024). Other studies have reported both lower caries experience and more favourable oral hygiene indices among children with ASD (Narula et al. 2024). These apparently contrasting findings suggest that oral health in ASD is multifactorial and may vary according to age, behavioural characteristics, dietary patterns, caregiver involvement, preventive practices, socioeconomic circumstances, and access to specialised dental services.

Despite the growing international literature on oral health among children with ASD, evidence from Latin America remains comparatively limited, and contemporary epidemiological information from Venezuela is particularly scarce (Morales-Chávez 2017). Moreover, relatively few studies have simultaneously compared multiple dimensions of oral health—including dental caries, oral hygiene, malocclusion, oral habits, and behavioural characteristics—between children with ASD and children without ASD within the same clinical setting.

Therefore, the aim of the present study was to compare the oral health status of children with autism spectrum disorder with that of children without ASD attending university dental clinics in Venezuela. We evaluated dental caries experience, oral hygiene status, malocclusion, oral habits, and selected behavioural and clinical characteristics to better understand this population's oral health profile.

Materials and Methods

Study design and participants

A comparative cross-sectional study was conducted among children with and without autism spectrum disorder (ASD) attending university dental clinics in Venezuela.

The study included 168 participants in two groups. The ASD group comprised 87 children diagnosed with Autism Spectrum Disorder who attended the Autism Clinic of the Faculty of Dentistry at Santa Maria University, Caracas, Venezuela. The control group consisted of 81 children without an ASD diagnosis who attended the Paediatric Dentistry Clinic of the same institution during the same study period.

Data collection was carried out between September 2023 and June 2026. Children aged 3 to 14 years were eligible for inclusion. According to age, participants were classified into three groups: 3–5 years, 6–12 years, and 13–14 years.

Eligibility criteria

Children aged 3 to 14 years whose parents or legal guardians signed an informed consent form were eligible. Participants were excluded if they had systemic diseases, neurological disorders, or syndromes other than ASD that could influence the oral examination; if they could not cooperate sufficiently for the clinical evaluation; or if they did not provide informed consent.

Clinical examination

Clinical examinations were performed by the two authors, both qualified paediatric dentists working in the same university clinical setting, using a plane mouth mirror (No. 5), a WHO periodontal probe and a dental explorer under artificial light, with each participant positioned in a dental chair. Before data collection, the two examiners reviewed and standardised the diagnostic criteria and clinical procedures, with particular attention to caries detection and classification. Inter-examiner calibration was undertaken before data collection using the same 25 children, who were independently assessed by both examiners for the presence or absence of dental caries. The examiners agreed in 24 of 25 assessments (96% observed agreement): both recorded caries in 18 children and absence of caries in six children, with one discordant assessment. Cohen's kappa for caries presence/absence was 0.90, indicating high inter-examiner reliability. During the main study, both authors participated in the clinical assessments in the same university clinical setting.

Before the clinical examination, all children underwent behavioural adaptation using the Tell–Show–Do technique, complemented with visual supports (pictograms) to facilitate understanding of the dental

procedures and reduce anxiety.

Variables assessed

The following oral health variables were evaluated:

Oral hygiene was assessed clinically using the Simplified Oral Hygiene Index (OHI-S). For the principal between-group regression analysis, the recorded ordered oral-hygiene category (good, fair, poor) was used as the outcome.

Dental caries experience was assessed using the dmft index (decayed, missing due to caries, and filled primary teeth) for primary dentition and the DMFT index (Decayed, Missing due to caries, and Filled permanent Teeth) for permanent dentition. The original statistical analysis reported these indices separately by dentition. Occlusal assessment included the presence and type of malocclusion. Oral habits recorded in the databases included bruxism, atypical swallowing, nail biting, lip biting, mouth breathing, tongue thrust/sucking, and combinations of habits.

Statistical analysis

Statistical analyses were performed using IBM SPSS Statistics version 27 for the original dentition-specific caries analyses and Python 3.13.5 using SciPy 1.17.0 and statsmodels 0.14.6 for the subsequent age- and sex-adjusted analyses of the principal outcomes. Categorical variables are presented as frequencies and percentages and quantitative variables as mean $\pm$ standard deviation. Between-group comparisons of dmft and DMFT were performed using the Mann–Whitney U test. Age was also compared using the Mann–Whitney U test, and unadjusted associations between study group and categorical outcomes were evaluated using Pearson's chi-square test. Because age differed significantly between groups, regression models for oral-hygiene category, malocclusion, and oral habits were adjusted for age and sex. Binary logistic regression was used for malocclusion and oral habits, and ordinal logistic regression was used for the ordered oral-hygiene category (good, fair, poor). Adjusted odds ratios (aORs) with 95% confidence intervals (CIs) are reported. All tests were two-sided and statistical significance was set at $p < 0.05$.

The caries indices are reported using standard English-language nomenclature: dmft for primary dentition and DMFT for permanent dentition. The dentition-specific dmft and DMFT results were taken from the original statistical analysis, which explicitly reported the two indices separately. Because the individual Excel databases available for the subsequent multivariable reanalysis contain only one caries-index field per participant, separate patient-level age- and sex-adjusted regression models for dmft and DMFT could not be reconstructed from those files. Accordingly, the dmft and DMFT comparisons are presented as unadjusted Mann–Whitney analyses.

Ethical considerations

The Bioethics Committee of the Faculty of Dentistry, Universidad Santa María approved the study protocol (Approval No. CBFIOUSM-3042025). We obtained written informed consent from the parents or legal guardians of all participants before enrolment. The study complied with the ethical principles of the Declaration of Helsinki, and the researchers maintained participant confidentiality and anonymity throughout the investigation.

Results

The study included 168 participants: 87 children with ASD and 81 controls. Children with ASD were significantly older than controls (mean age 8.98 ± 2.51 vs. 7.47 ± 1.84 years; Mann–Whitney U test, $p < 0.001$). In the ASD group, 75/87 (86.2%) were male and 12/87 (13.8%) female. Among controls, 66/81 (81.5%) were male and 15/81 (18.5%) female; nine control records initially left blank for sex were confirmed by the investigators to be male and were coded accordingly (Table 1).

Table 1. Demographic characteristics of the definitive individual-level study databases
Dental caries experience (dmft and DMFT)

Characteristic	Total sample	ASD group	Control group	Notes
n	168	87	81	
Age, mean $\pm$ SD (years)	8.25 ± 2.33	8.98 ± 2.51	7.47 ± 1.84	$p < 0.001$ (Mann–Whitney U)
Male, n (%)	141 (83.9)	75 (86.2)	66 (81.5)	$\chi^2 = 0.67$; $p = 0.414$
Female, n (%)	27 (16.1)	12 (13.8)	15 (18.5)	

The mean dmft score for primary dentition was 5.82 ± 4.42 in the overall sample, 2.88 ± 4.19 in children with ASD, and 8.44 ± 2.70 in controls. The between-group difference was statistically significant (Mann–Whitney U = 9.0; $p = 0.008$). For permanent dentition, mean DMFT was 4.50 ± 4.08 overall, 2.68 ± 2.92 in the ASD group, and 7.01 ± 3.98 in controls; this difference was also statistically significant (Mann–Whitney U = 1,056.50; $p < 0.001$). Thus, both dentition-specific caries-experience indices were lower in the ASD group in the original unadjusted analysis.

Oral hygiene

Oral-hygiene category differed substantially between groups. Good hygiene was recorded in 39/87 (44.8%) children with ASD and 6/81 (7.4%) controls; fair hygiene in 38/87 (43.7%) and 37/81 (45.7%), respectively; and poor hygiene in 10/87 (11.5%) and 38/81 (46.9%), respectively ($\chi^2 = 40.38$, $p < 0.001$). In ordinal logistic regression adjusted for age and sex, ASD group membership was associated with lower odds of being in a worse hygiene category (aOR 0.13, 95% CI 0.07–0.26; $p < 0.001$).

Malocclusion

Malocclusion was recorded in 39/87 (44.8%) participants with ASD and 43/81 (53.1%) controls. The unadjusted between-group association was not statistically significant ($\chi^2 = 1.15$, $p = 0.285$). After adjustment for age and sex, ASD status remained unassociated with overall malocclusion (aOR 0.58, 95% CI 0.30–1.11; $p = 0.101$).

Specific occlusal traits were recorded in the source databases, but because the definitive reanalysis focused on the prespecified overall malocclusion outcome and the coding structure differed between the two databases, category-specific inferential comparisons were not used as primary results.

Table 2. Principal oral-health outcomes, including dentition-specific caries indices and age- and sex-adjusted analyses

Outcome	ASD group (n=87)	Control group (n=81)	Unadjusted comparison	Age- and sex-adjusted estimate (95% CI)	p value
dmft (primary dentition), mean $\pm$ SD	2.88 $\pm$ 4.19	8.44 $\pm$ 2.70	U = 9.0; $p = 0.008$	Not reconstructed from individual files	—
DMFT (permanent dentition), mean $\pm$ SD	2.68 $\pm$ 2.92	7.01 $\pm$ 3.98	U = 1,056.50; $p < 0.001$	Not reconstructed from individual files	—
Oral hygiene: good, n (%)	39 (44.8)	6 (7.4)	$\chi^2 = 40.38$; $p < 0.001$	aOR 0.13 (0.07–0.26)	< 0.001
Oral hygiene: fair, n (%)	38 (43.7)	37 (45.7)			
Oral hygiene: poor, n (%)	10 (11.5)	38 (46.9)			
Malocclusion present, n (%)	39 (44.8)	43 (53.1)	$\chi^2 = 1.15$; $p = 0.285$	aOR 0.58 (0.30–1.11)	0.101
Oral habits present, n (%)	37 (42.5)	51 (63.0)	$\chi^2 = 7.02$; $p = 0.008$	aOR 0.40 (0.21–0.78)	0.007

Data are presented as n (%) or mean $\pm$ SD. ASD, autism spectrum disorder; aOR, adjusted odds ratio; CI, confidence interval; dmft, decayed, missing due to caries, and filled primary teeth; DMFT, Decayed, Missing due to caries, and Filled permanent Teeth.

Adjusted models for oral hygiene, malocclusion, and oral habits include study group, age, and sex. Dentition-specific dmft and DMFT comparisons are unadjusted Mann–Whitney analyses from the original statistical report because the individual databases used for multivariable reanalysis do not contain separate patient-level dmft and DMFT fields.

Oral habits and behavioural characteristics in participants with ASD

Oral habits were recorded in 37/87 (42.5%) participants with ASD and 51/81 (63.0%) controls ($\chi^2 = 7.02$, $p = 0.008$). After adjustment for age and sex, ASD group membership remained associated with lower odds of recorded oral habits (aOR 0.40, 95% CI 0.21–0.78; $p = 0.007$).

Self-injurious behaviours were identified in 14.9% ($n = 13$) of participants with ASD. Of these, 12 were male, and one was female. Biting different body parts and skin pinching were the most frequently reported behaviours. No statistically significant association was observed between self-injurious behaviour and sex ($p = 0.489$). Stereotypic behaviours were also identified in 14.9% ($n = 13$) of participants with ASD, whereas 85.1% ($n = 74$) presented no stereotypies. Object biting was the most frequently recorded stereotypy, followed by rocking and repetitive hand movements.

A specific diet was reported in 20.7% ($n = 18$) of participants with ASD, whereas 79.3% ($n = 69$) were not following a specific diet. Regarding food consistency, 86.2% ($n = 75$) consumed a mixed diet and 13.8% ($n = 12$) a soft diet. Enamel defects were identified in 6.9% ($n = 6$) of participants with ASD. No statistically significant association was found between diet and sex ($p = 0.707$). Regarding language, 77.0% ($n = 67$) had normal speech, 10.3% ($n = 9$) had deficient speech, 8.1% ($n = 7$) were non-speaking, and 4.6% ($n = 4$) presented dyslalia involving the “R” or “L” sounds. Lip incompetence was present in 26.4% ($n = 23$). No statistically significant association was found between language characteristics and sex ($p = 0.291$).

Discussion

The present study provides a multidimensional comparison of oral health between children with ASD and children without ASD attending university dental clinics in Venezuela. The original dentition-specific analysis showed lower dmft and DMFT values in the ASD group. In the subsequent multivariable reanalysis, a more favourable oral-hygiene distribution and fewer oral habits among children with ASD persisted after adjustment for age and sex. In contrast, overall malocclusion was not significantly associated with ASD status after adjustment. These findings reinforce that oral health in ASD does not follow a uniform pattern and may reflect a complex interaction of individual, behavioural, family, environmental, and healthcare-related factors (Barbosa et al. 2024; Sami et al. 2024; da Silva et al. 2017; da Motta et al. 2026).

One of the most notable findings was the lower caries experience observed in children with ASD. Mean dmft in primary dentition was 2.88 ± 4.19 in the ASD group compared with 8.44 ± 2.70 in controls, while mean DMFT in permanent dentition was 2.68 ± 2.92 versus 7.01 ± 3.98 , respectively. Both between-group comparisons were statistically significant in the original unadjusted analyses. Although children with ASD may encounter potential risk factors for oral disease—including toothbrushing difficulties, sensory sensitivities, food selectivity, medication use, behavioural challenges, and barriers to professional dental care—the available evidence does not consistently demonstrate greater caries experience in this population (Sami et al. 2024; da Silva et al. 2017; da Motta et al. 2026).

Recent comparative studies have likewise reported lower caries experience in some ASD samples. Narula et al. reported lower dmft and DMFT scores among children with ASD compared with children without systemic conditions (Narula et al. 2024). George et al. observed lower caries experience in children with ASD despite poorer plaque control and a greater frequency of harmful oral behaviours (George et al. 2024). These external findings are directionally consistent with the lower dmft and DMFT values observed in the present sample, although direct comparison is limited by differences in study design and population characteristics.

The recent systematic review and meta-analysis by da Motta et al. (2026) further illustrates the complexity of this relationship. The authors evaluated 25 studies comparing individuals with and without ASD. No statistically significant between-group differences were found for most conventional caries indicators, including DMFT and dmft, although differences emerged when caries experience was evaluated at the tooth-surface level (da Motta et al. 2026). Together with previous systematic and umbrella reviews (Sami et al. 2024; da Silva et al. 2017; Lam et al. 2020) these findings suggest that ASD diagnosis alone is unlikely to adequately explain caries experience and that differences between populations may reflect interactions among behavioural, dietary, socioeconomic, preventive, and healthcare-related factors.

The lower caries experience observed in the present ASD group may potentially be associated with characteristics of this clinical population. We recruited participants with ASD from a specialised university Autism Clinic, and incorporated behavioural adaptations and visual supports into their dental evaluation. Structured routines, caregiver involvement, dietary characteristics, preventive exposure, or contact with specialised dental services could potentially contribute to the observed pattern. However, these factors were not systematically quantified in the present study and therefore should be considered possible explanations rather than demonstrated mechanisms.

Caregiver involvement may be particularly relevant. Parents and caregivers frequently assume a central role in daily oral hygiene among children with ASD, while sensory, behavioural, physical, and functional difficulties may interfere with routine toothbrushing. A recent scoping review identified numerous caregiver-related challenges that can result in deviations from recommended home oral hygiene practices (Hariyani et al. 2024). Evidence from intervention studies also indicates that parental involvement and tailored educational strategies can improve oral hygiene outcomes (Rajaei et al. 2025).

Access to professional dental care represents another relevant contextual factor. Families of children with ASD may encounter structural and behavioural barriers to routine dental attendance, including transportation, financial or insurance limitations, lack of support, and difficulties identifying professionals or services able to accommodate the child's individual needs (Imanpour and Ullah 2024). These factors are particularly relevant when interpreting findings obtained from a specialised university clinic, because children already receiving specialised dental care may not be representative of the wider ASD population.

Oral hygiene represented another important finding. Children with ASD showed a significantly more favourable distribution of the recorded oral-hygiene categories, with a higher proportion classified as good and a markedly lower proportion classified as poor than controls. In the age- and sex-adjusted ordinal model, ASD group membership remained associated with lower odds of being in a worse oral-hygiene category.

This finding is directionally consistent with Narula et al. (2024), who reported more favourable OHI-S scores among children with ASD. However, other studies have described different patterns. George et al. (2024) observed poorer plaque control among children with ASD despite their lower caries experience, while Prynda et al. (2025) reported poorer oral hygiene among children with ASD. These apparently contradictory findings reinforce the substantial heterogeneity observed across ASD populations.

Sensory hypersensitivity, resistance to toothbrushing, communication difficulties, behavioural characteristics, and dependence on caregivers may negatively affect daily oral hygiene in some children with ASD. Conversely, structured routines, caregiver supervision, individualised behavioural strategies, and participation in preventive dental programs may facilitate oral hygiene in others (Hariyani et al. 2024; Rajaei et al. 2025). Therefore, ASD should not be interpreted as a direct determinant of either favourable or unfavourable oral hygiene.

The potential for improvement through tailored preventive strategies is particularly relevant. Recent evidence indicates that educational, behavioural, visual, and video-based approaches may improve toothbrushing behaviours and oral hygiene outcomes in children with ASD (Rajaei et al. 2025; Tirupathi and Afnan 2025). These findings support individualised and behaviourally adapted preventive strategies rather than assuming that ASD inevitably results in inadequate oral hygiene.

Salerno et al. (2025), in the European Archives of Paediatric Dentistry, evaluated oral-health-related quality of life among children and adolescents with ASD and neurotypical peers and examined the potential relevance of participation in an oral preventive regimen. Although the outcomes evaluated differ from those of the present study, their findings reinforce the broader importance of preventive oral healthcare and family-centred approaches in this population.

Overall malocclusion was present in 44.8% of children with ASD and 53.1% of controls in the definitive databases. Unlike the earlier aggregate analysis, this difference was not statistically significant in the individual-level reanalysis and remained nonsignificant after adjustment for age and sex. This finding emphasises the importance of basing inference on the definitive patient-level dataset and of evaluating specific occlusal traits separately when coding is sufficiently harmonised across groups.

Evidence regarding malocclusion in ASD remains heterogeneous. A systematic review and meta-analysis by da Motta et al. (2022) reported associations between ASD and several occlusal characteristics, including Angle Class II and III relationships, anterior open bite, and increased overjet. More recently, Farzanegan et al. (2024) compared 162 children with ASD with 162 controls and identified differences in malocclusion complexity and specific occlusal characteristics. Differences between these findings and

those of the present study may reflect variations in age, diagnostic criteria, orthodontic indices, parafunctional behaviours, and population characteristics. Further studies using harmonised definitions of individual occlusal traits are warranted.

Oral habits were significantly less frequent among children with ASD than among controls (42.5% vs. 63.0%), and the association persisted after adjustment for age and sex. Within the ASD group, nail biting was the most frequently recorded isolated habit, followed by mouth breathing and bruxism, while some participants presented multiple habits simultaneously. This finding differs from studies reporting higher frequencies of harmful oral behaviours among children with ASD. George et al. (2024), for example, observed significantly more mouth breathing, lip biting, bruxism, nail biting, object biting, and self-injurious behaviours among children with ASD than among controls.

Bruxism deserves particular attention. A systematic review and meta-analysis by Granja et al. (2022), including 17 studies and 3,850 participants, found higher pooled odds of bruxism among individuals with ASD. However, the certainty of the evidence was rated very low, limiting the strength of the conclusions. Thus, the relatively low frequency of bruxism observed in the present sample does not necessarily contradict the existing evidence but further illustrates variation among ASD populations.

Self-injurious and stereotypic behaviours were each identified in approximately 15% of children with ASD in the present study. Biting different body parts and skin pinching were among the most frequently reported self-injurious behaviours, while object biting, rocking, and repetitive hand movements were among the most frequently reported stereotypies. George et al. (2024) similarly documented a greater frequency of self-injurious and harmful oral behaviours among children with ASD compared with controls. These manifestations are clinically relevant because repetitive biting and self-directed behaviours may contribute to traumatic oral and perioral injuries and may complicate preventive and restorative dental treatment. Behavioural assessment should therefore form part of the comprehensive dental evaluation of children with ASD rather than limiting assessment exclusively to conventional dental indices.

Dietary characteristics also warrant consideration. In the present sample, 20.7% of children with ASD followed a specific diet and 13.8% consumed a predominantly soft diet. Food selectivity is frequently reported among children with ASD. Wenzell et al. (2024), in a clinical sample of 103 children with ASD, identified food selectivity in 45.6% and found significant associations with disruptive mealtime behaviour and hyperactivity/noncompliance. However, because detailed dietary composition, frequency of fermentable carbohydrate intake, and sugar exposure were not quantified in the present investigation, no direct relationship between dietary characteristics and caries can be established.

Several limitations should be considered when interpreting these findings. First, the comparative cross-sectional design precludes establishing temporal or causal relationships between ASD and the oral health outcomes evaluated. Second, participants were recruited from university-based dental clinics, including a specialised Autism Clinic, which may limit generalisability to the broader Venezuelan paediatric population, particularly children with limited access to specialised dental services.

A particularly important issue was the age difference between groups. Children with ASD were older on average than controls (8.98 ± 2.51 vs. 7.47 ± 1.84 years; $p < 0.001$). We therefore fitted age- and sex-adjusted models for oral-hygiene category, malocclusion, and oral habits. The associations for oral hygiene and oral habits persisted after adjustment, whereas overall malocclusion remained nonsignificant. The dmft and DMFT comparisons are unadjusted because the individual databases available for multivariable reanalysis did not contain the two dentition-specific indices as separate patient-level variables. Consequently, the caries-index findings require cautious interpretation in view of the age and dentition differences between groups.

Other potentially relevant confounders—including socioeconomic status, caregiver education, ASD severity, toothbrushing frequency and assistance, fluoride exposure, detailed dietary characteristics, medication use, previous preventive interventions, and frequency of dental attendance—were not comprehensively incorporated into the comparative analyses. In addition, although the original statistical report separately documented dmft and DMFT, the individual Excel databases retained for the subsequent multivariable reanalysis contained only one caries-index field per participant. This prevented reconstruction of separate adjusted dmft and DMFT models and represents an important data-structure limitation. Inter-examiner calibration for caries presence/absence showed 96% observed agreement and a Cohen's kappa of 0.90. However, this calibration statistic applies to the binary detection of caries and does not quantify agreement for the numerical dmft and DMFT scores; this should be considered when interpreting dentition-specific caries indices.

Despite these limitations, the present study has several strengths. It includes a clinically characterised sample of 168 children evaluated within the same university setting and examines multiple dimensions of oral health rather than focusing exclusively on dental caries. The study evaluated dental caries, oral hygiene, malocclusion, oral habits, self-injurious behaviours, stereotypies, dietary characteristics, enamel defects, and communication-related characteristics, providing a broad clinical description of children with ASD. Furthermore, the study contributes contemporary evidence from Venezuela, where epidemiological information concerning oral health among children with ASD remains scarce.

Taken together, the findings reinforce the concept that oral health in children with ASD is heterogeneous and should not be inferred solely from the presence of the neurodevelopmental condition. The contrast between the present findings and those reported in other populations highlights the potential contribution of modifiable factors, including caregiver involvement, preventive exposure, oral hygiene routines, dietary characteristics, and access to specialised dental services. Longitudinal and multicentre studies incorporating appropriately matched comparison groups and adjustment for potential confounders are needed to clarify these relationships.

Conclusion

Within the limitations of this comparative cross-sectional study, children with ASD showed lower dmft and DMFT values than controls in the original dentition-specific analyses, together with a more

favourable oral-hygiene distribution and fewer oral habits. The oral-hygiene and oral-habit associations persisted after adjustment for age and sex, whereas overall malocclusion did not differ significantly between groups after adjustment.

The adjusted findings for oral hygiene and oral habits reduce concern that these observed differences were explained solely by the age imbalance between groups. However, the dmft and DMFT comparisons were unadjusted, and their interpretation should therefore account for the different age and dentition distributions of the two groups.

Individualised preventive dental care, caregiver involvement, behavioural adaptation, and regular dental and orthodontic surveillance remain important components of comprehensive oral healthcare for children with ASD. Future multicentre studies should record dmft and DMFT as separate patient-level variables and use multivariable models incorporating age, dentition stage, socioeconomic and behavioural factors.

Declarations

Conflict of interest

The authors declare no competing interests.

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