



REVIEW ARTICLE

# Dental experiences related to oral care of children with autism spectrum disorders in Saudi Arabia: A literature review



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**KEYWORD**

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**Abstract** The burden of autism spectrum disorder (ASD) in Saudi Arabia remains unclear with a dearth of literature, which focus on risk factors, prevalence, or interventions. This study is a review of the published literature related to dental experiences of children with ASD in Saudi Arabia. Twenty-two studies were included in this review, based on the predefined inclusion criteria which examined dental disease prevalence in children with ASD, identified the risk factors and the potential barriers to oral care. Results uncovered a lack of systematically published studies from Saudi Arabia which might have led to the limited development of effective oral health policies in the Kingdom. Identification of research gaps and potential intervention policies are needed to improve the oral health and quality of life of children with ASD in Saudi Arabia.

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## 1. Introduction

Autism spectrum disorders (ASD) is a neuro-developmental disorder with increasing global health concern especially in dentistry. The condition is often detected in children after 3 years of age and characterized by impaired social, communicative, and behavioral developments (Webb & Jones 2009).

CDC 2020 data have reported that the prevalence rate of ASD ranges from 0.1 to 43.6 with an average male: female ratio of 4.1:1, (Autism Prevalence Studies Data Table, CDC dataset, 2020). Globally, around one in every 160 people has been diagnosed with ASD (Mental health in the United States, CDC report, 2003–2004). Studies, from Riyadh and Taif cities, (Yazbak, 2004; Aljarallah et al., 2007; AlZahrani, 2013) have also reported an increase in ASD prevalence in Saudi Arabia (SA). In 2002, Yazbak (2004) reported that 42,500 autism cases had been diagnosed in Saudi Arabia, with numerous cases remaining undiagnosed. Furthermore, Aljarallah et al. in (2007), reported that ASD prevalence was one in every 167 people living in Saudi Arabia. In 2013, Al-Zahrani et al. reported that the prevalence of ASD in children, in Taif, Saudi Arabia, was higher in males (0.031%) than in females (0.004%). However, these studies are limited to few cities of Saudi Arabia with limited sample size. Thus, the prevalence of ASD in the Saudi population is likely underestimated.

Due to their multifaceted and dissimilar clinical manifestations, children with ASD pose unique behavioral challenges for healthcare professionals particularly dentists in provision of effective oral health care. Limited communication skills, exposure to a new environment, anxiety and aggressive behavior of children with ASD complicate their interaction in the dental clinic (Como et al., 2021). Poor manual dexterity and lack of eye contact further complicate the problem (Como et al., 2021). In addition to all these challenges, if dental care practices are not performed regularly or by the same caregiver, patients will possibly reject that practice due to their repetitive behavior and aversion to change (Weil et al., 2011). Parents and caregivers also face difficulties in provision of regular oral hygiene measures due to the uncooperative behavior of children with ASD (Marshall et al., 2007; Weil et al., 2011). These challenges unfavorably impact the quality of life (QoL) of affected children with ASD as well as their caregivers (Lord et al., 2000).

In Saudi Arabia, current ASD research has focused on parents' perception, reporting prevalence, identifying risk factors

and suggested interventions at different levels (Al Shirian and Al, 2015; Elsedfy and Abdelraheem, 2014; Kotha et al., 2018; Salhia et al., 2014; Sulaimani and Gut, 2019, Alqhatani, 2012, Abdulhad et al., 2013, Al Shirian, 2015, Faihan & Nabil, 2016, AlHarbi et al., 2019). Although these studies offer an understanding of the barriers and challenges faced by children with ASD and their caregivers, there is an urgent need to identify gaps in research to determine the required points of intervention in developing policies addressing provision of care for children with ASD.

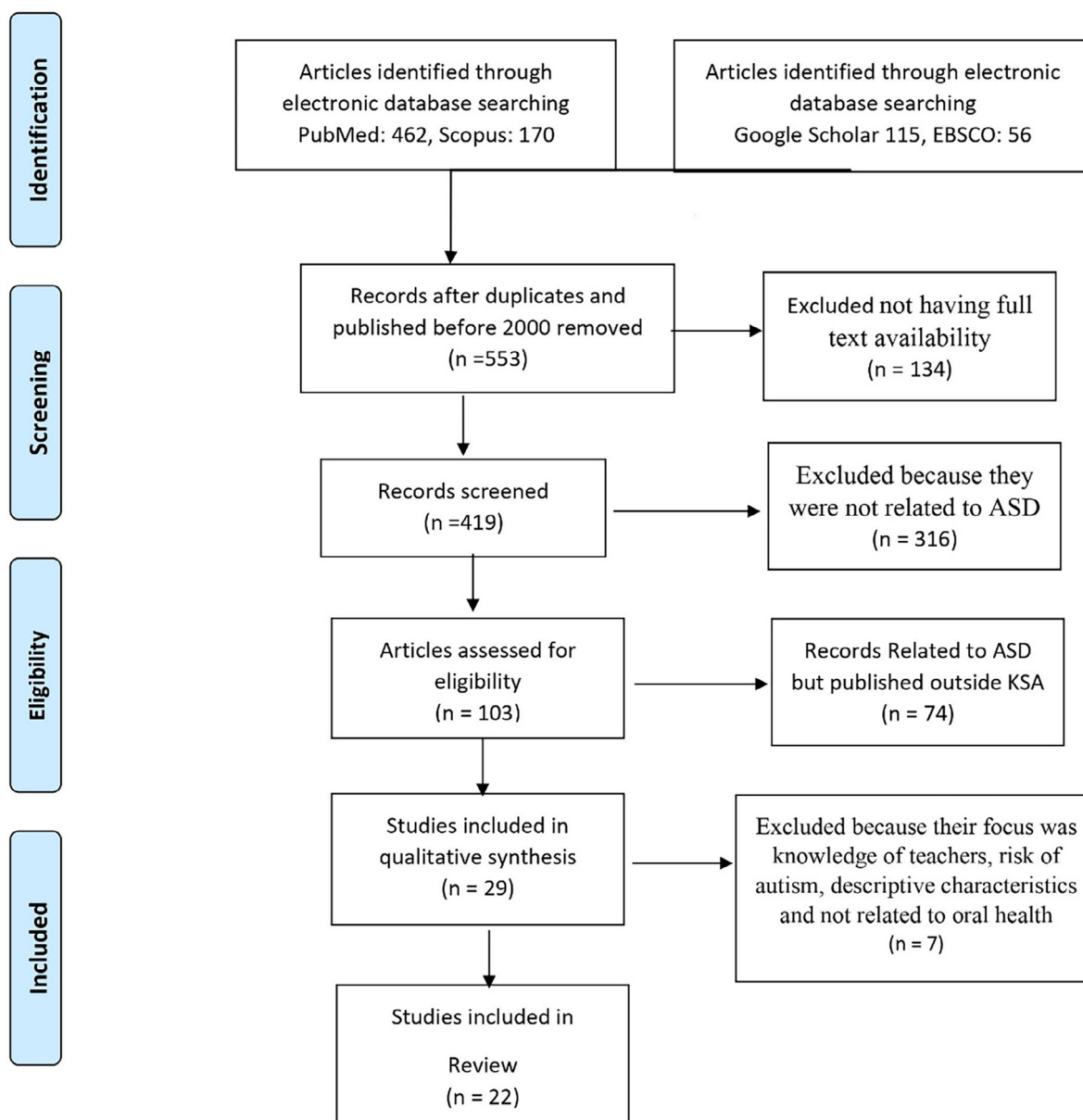
In fact, policymakers in Saudi Arabia are committed to improving access to oral healthcare for children with ASD and to decrease such disparity by identifying the different barriers that pose challenges in authorizing and delivering these services and facilities (Sulaimani and Gut, 2019).

A vital role of dental professionals is to work towards improving the oral health and quality of life of children with ASD. This requires a constant search, aiming for an integral treatment of children with ASD with effective strategies focusing on health promotion without exhausting the patients and their caregivers. This review is aimed to describe the current literature related to the dental experiences in the oral healthcare of children with ASD and adolescents, which will be relevant to support and guide future research, interventions, and policymaking.

## 2. Methodology

An extensive search of PubMed, Google Scholar, SCOPUS, and EBSCO databases was carried out to identify relevant peer-reviewed articles published from across Saudi Arabia until August 2021. This database search was conducted in two phases. The first phase focused on the disease of interest (autism/ASD) and its relation to Oral Health and the second focused on the location of publication (Saudi Arabia). Searches were conducted using the following keywords: Autism, Autism spectrum disorder, Saudi Arabia, Dental caries, Oral health, with the Boolean operator "AND" to narrow down the results and connected terms.

Studies were deemed eligible for inclusion if they were published between January 2000 and August 2021, conducted in Saudi Arabia, published in English, study purpose was to identify potential dental experiences in the oral healthcare of children with ASD and adolescents, and the age of participants



**Fig. 1** Flow-chart documentation process of article selection for review.

was between 0 and 18 years. The study selection process is further illustrated in Fig. 1.

A total of 803 articles were identified from searching the mentioned databases, out of which 250 articles were excluded due to duplication in different search engine, 134 articles were excluded due to not having full text availability -abstracts or conference papers- 316 articles were excluded because they were not related to ASD. In total 103 studies related to oral health of children with ASD were selected for full-text review of which 74 were excluded because they were studies on oral health published outside SA, 7 were excluded because their focus was knowledge of teachers, risk of autism, descriptive characteristics and not related to oral health, therefore, (22) potentially relevant studies were included in this review and are presented in Table 1. Out of these 22 studies, 18 were exploratory studies, 1 was perception-based, 1 was quasi-

experimental study, 1 was case-control study and 1 was an intervention study. The main findings from this review process are listed and elaborated further in the discussion section.

### 3. Discussion

#### 3.1. Oral health practices of children with autism spectrum disorder (ASD)

Children with ASD around the world face a challenge in obtaining suitable dental care in comparison to the general population, which places them at a higher risk for oral health diseases (Delli et al., 2013; Jaber, 2011). Additionally due to their diverse clinical manifestations accompanied by communication disabilities, children with ASD pose a great challenge for dentists (Marshall et al., 2007; Delli et al., 2013; Jaber,

**Table 1** Summary of papers related to Oral health of Children with ASD in Saudi Arabia.

Author, Year	Title	Study type	Location	Focus	Conclusion/Recommendation
Murshid, 2011	Characteristics and Dental Experiences of Autistic Children in Saudi Arabia: Cross-sectional Study	<b>Cross-sectional Study</b>	Riyadh, Jeddah, and Dammam	Reported base line information about characteristics, and dental experiences of Children with ASD.	Most of the children (76.2%) included in the study were diagnosed with autism before the age of 5 years. More than half of the children (53.7%) had no previous dental experience while 33% were treated under general anesthesia.
Pani et al., 2012	Saudi dental students' perception of their education in Special Care Dentistry and its effect on their confidence to render care	<b>Cross-sectional Study</b>	Riyadh	Studied Saudi dental students' perceptions for their education in "special care dentistry" and its effect on their confidence to render care to children with ASD.	Saudi students lack the confidence to render care to individual with SHCN even though they are willing to treat these patients.
Pani et al., 2013	Parental perceptions of the oral health related quality of life of autistic children in Saudi Arabia	<b>Cross-sectional Study</b>	Riyadh	Studied the parental perception to assess the Oral Health Related Quality of Life (OHRQoL) of children with Autism.	The results of this study seem to suggest that childhood autism results in a reduced OHRQoL for both the affected child as well as the family.
Murshid, 2014	Diet, Oral Hygiene Practices and Dental Health in Autistic Children in Riyadh, Saudi Arabia	<b>Cross-sectional Study</b>	Riyadh	Reported baseline information about the diet, oral hygiene and dental health of a group of autistic children in Riyadh.	Findings provided that 96.7% of children preferred high sugar content food and over 28% of the children had irregular brushing habits
Murshid, 2015	Dental knowledge of educators and healthcare providers working with children with autism spectrum disorders	<b>Cross-sectional Study</b>	Riyadh	Evaluated dental knowledge and attitudes toward oral health care among healthcare providers and educators working with children with ASD.	Reported 50.2% of the participants did not offer any toothbrushing advice, and 73.3% never recommended dental checkup visits to parents, and 75.6% never performed dental examinations to children under their care.
Alaki et al., 2016	Parental Perception of Oral Health Related Quality of Life in Children with Autism	<b>Cross-sectional Study</b>	Jeddah	Parental perception about oral health related quality of life and oral health status among case (children with ASD and Normal Children	Study reported children with ASD had significantly higher oral health problems compare to healthy children and presences of extra and intra-oral abnormalities
Diab et al., 2016	Comparison of Gingival Health and Salivary Parameters among Autistic and Non-Autistic School Children in Riyadh	<b>Case-Control Study</b>	Riyadh	conducted a case control study in which they included 50 children with ASD and 50 normal children to compare their oral health. Periodontal issues	Study reported that modified gingival index (MGI), plaque index (PI) and salivary PH, all were found significantly high among case group compared to control
AlKhadra, 2017	Characteristic of Malocclusion among Saudi Special Need Group Children	<b>Cross-sectional Study</b>	Riyadh	Analyzed the characteristics of malocclusions, occlusal traits among Special Health Care Needs (SHCN) children with Down syndrome (DS) and ASD	Down syndrome children had high incidence of class III malocclusion and autistic children had high incidence of class I malocclusion. Overall, the DS children were more prone to malocclusion.
Alamoudi et al., 2017	Dentists' Perception of the Care of Patients with Special Health Care Needs in Jeddah, Saudi Arabia	<b>Cross-sectional Study</b>	Jeddah	The study aimed to explore dentists' perception and level of satisfaction with their dental education in preparing them to provide care to patients with special health care needs (SHCNs)	Study suggested to introduce programs for the dentists to improve their dental care provided to special-needs children. They also recommended to curricula should be adopted which can help to develop skills among dentists to treat children with ASD

**Table 1** (continued)

Author, Year	Title	Study type	Location	Focus	Conclusion/Recommendation
Murshid, 2017	Effectiveness of a preparatory aid in facilitating oral assessment in a group of Saudi children with autism spectrum disorders in Central Saudi Arabia	<b>Interventional Study</b>	Riyadh	They examine 40 children with ASD and found a significantly higher proportion (57%) of those children who did not brush teeth regularly	Parents expressed positive opinions regarding the use of preparatory aids in the dental environment. Approximately half of the ASD children benefit from the preparatory aid used according to the parents' opinion, and the follow up survey showed improvement in the parent's dental knowledge and oral hygiene practices.
Al-Sehaibany 2017	Occurrence of oral habits among preschools children with autism spectrum disorder	<b>Cross-sectional Study</b>	Riyadh	To determine occurrence of oral habits among Saudi preschool children with autism spectrum disorder (ASD) and compare it with healthy preschool children.	Study reported a higher prevalence of bruxism (54.7%), followed by object biting (44.7%) and mouth breathing (26.7%) in the study group.
Kotha et al., 2018	Associations between Diet, Dietary and Oral Hygiene Habits with Caries Occurrence and Severity in Children with Autism at Dammam City, Saudi Arabia	<b>Cross-sectional Study</b>	Riyadh	To achieve the baseline information of the autistic child's oral health status about the diet, dietary and hygiene habits.	Study reported that most of the children were not maintaining oral hygiene properly neither visiting the dentists regularly
Ashour et al., 2018	Association between body mass index and dental caries among special care females children in Makkah City	<b>Cross-sectional Study</b>	Makkah	Studied 275 special health care children including children with ASD were screened for caries prevalence	Significant association between caries frequency and overweight/obesity in special care school children.
Ghoneim, 2018	Health Promotion Toolkit: An Approach for Empowering Families Caring For Children with Developmental Disabilities in Tabuk	<b>Quasi-experimental</b>	Tabuk	Health promotion toolkit was used in a study conducted in Tabuk in which parent having children with ASD	Study found significant outcome in terms of reducing stress and improvement in the care providing by the parents.
Al-Sehaibany 2018	Occurrence of traumatic dental injuries among preschool children with autism spectrum disorder	<b>Cross-sectional Study</b>	Riyadh	To determine the occurrence of traumatic dental injuries (TDIs) among Saudi preschool children with autism spectrum disorder (ASD) and compare it with Saudi preschool children without ASD.	Study reported an increased occurrence of dental trauma in preschool children with ASD. Also found significantly high proportion of children with ASD (25.7%) had traumatic dental injuries (TDI) compared to case group (16.3
Sulaimani and Gut, 2019	Autism in Saudi Arabia: Present Realities and Future Challenges	<b>Perception Study</b>		Conducted research on patients with special needs to the cultural and social barriers and the conception of disabilities in Saudi Arabia	challenges facing by the government-sponsored services which included lack of access, limited availability of services, delayed diagnosis, limited knowledge of individuals and limited resources
AlHumaid et al., 2020	Oral Health of Children with Autism	<b>Cross-sectional Study</b>	Eastern Region	Studies Oral Health care, Dental Caries and Periodontal issues in Children with ASD in Dammam	The results of this study indicate that children with ASD had a caries prevalence of 76% in primary teeth and 68% in permanent dentition and 31% of gingival problems.

(continued on next page)

**Table 1** (continued)

Author, Year	Title	Study type	Location	Focus	Conclusion/Recommendation
AlHammad et al., 2020	Challenges of Autism Spectrum Disorders Families Towards Oral Health Care in Kingdom of Saudi Arabia	<b>Cross-sectional Study</b>	Riyadh	Evaluated knowledge among the parents of children with ASD regarding maintaining their children oral health	knowledge of most parents towards management of oral health of their children w\the ASD was inadequate. Hence, authors recommended to educate the parents about the importance of maintaining oral health
Alshihri et al., 2021	Barriers to Professional Dental Care among Children with Autism Spectrum Disorder	<b>Cross-sectional Study</b>	Riyadh	Aims were to: (1) investigate the parental difficulties toward their ASD children dental care and, (2) analyze factors influencing their access to such services	The main barriers are behavioral problems, cost of dental treatment, insurance shortfall, and difficulty finding a dentist who treats ASD children
Basha et al., 2021	Traumatic dental injuries in special health care needs children and association with obesity	<b>Cross-sectional Study</b>	Taif	Assess the association between traumatic dental injuries (TDIs) and obesity in children with special health care needs	The study showed a significant association between TDI prevalence and increased overjet, inadequate lip coverage, and cerebral palsy. The prevalence of TDI among obese special needs children was statistically significant according to bivariate analysis, but not in a multivariate analysis that adjusted for other variables
Mohamed et al., 2021	Frequency of molar incisor hypo mineralization and associated factors among children with special health care needs	<b>Cross-sectional Study</b>	Taif	Assess the frequency of MIH and associated risk factors among CSHCN. Hypomineralization of teeth	Concluded that there is 24.5% prevalence of MIH among CSHCN with 20% of the autistic children showing significantly higher prevalence
Fageeh et al., 2021	The Role of Applied Behavior Analysis to Improve Knowledge on Oral Hygiene Practices among Cooperative Autistic Children: A Cross-Sectional Study from Jazan, Saudi Arabia	<b>Cross-sectional Study</b>	Jazan	Evaluated the knowledge, attitude and practice of cooperative children with ASD regarding their oral hygiene practice	Study concluded that use of videos significantly improved the knowledge of the children regarding oral health hygiene.

2011). The main impediment to the dental team may be the reduced ability of children with ASD in communication and social interaction which may/may not be associated with an altered intellectual development, repetitive body movements, hyperactivity, attention deficit, decreased frustration threshold, tactile, light, odors and auditory hypersensitivity and a high probability of a self-injurious behavior (Da Silva et al., 2017, Como et al., 2021).

Murshid 2011, studied children with ASD in three major cities (Riyadh, Dammam, and Jeddah) and were asked to provide baseline information on their characteristics and dental experiences. Most of the children in the research were diagnosed with autism before they turned five years old. More than half of the youngsters (53.7%) had never been to the dentist before, and 33 percent were given general anesthetic.

Murshid 2014, studied diet and oral hygiene practices among children with ASD in three major rehabilitation centers for ASD in Riyadh. A self-administered questionnaire was distributed among 450 parents of children with ASD. Findings of the study reported preference for high sugar content food by

96.7% of children and irregular brushing habits in over 28% of the children.

An interventional study by Murshid in 2017, in Riyadh, assessed the positive effect of a preparatory aid utilizing a Children's book about first dental visit. Study sample included 40 children with ASD, of which 57% did not brush regularly, 82% used toothbrush with toothpaste, 10% brushed on their own, 50% had dental problems and 45% showed positive behavior during the initial dental visit. This study reported positive effects of the use of dental aid for behavior modification on children's behavior and simultaneously helped to enhance parents' dental knowledge.

Similarly, Kotha et al. (2018) also conducted a study in Riyadh, Saudi Arabia, in which a self-administered questionnaire was provided to parents seeking their perceptions about their children's oral hygiene habits. Results of the study showed that most of the children were not maintaining oral hygiene properly and were neither visiting the dentists regularly. Authors recommended the need of educating the parents of children with ASD with emphasis on how to maintain good

oral hygiene; how to improve dietary habits and the importance of regular visits to dentist to sustain oral health.

A study conducted in Eastern region of Saudi Arabia to assess parents' attitude and support in delivering oral care to children with ASD (AlHumaid et al., 2020). Study reported poor oral hygiene practices of children with ASD. Authors found that 22.7% of the children with ASD did not use toothbrush and 61% children with ASD did not floss regularly.

AlHammad et al. (2020) evaluated knowledge among parents of children with ASD regarding maintaining their children's oral health. Authors found that the knowledge of most parents towards management of oral health of their children with ASD was inadequate. Hence, authors recommended to educate the parents about the importance of maintaining oral health and consequences otherwise.

A cross-sectional study from Jazan evaluated the knowledge, attitude, and practice regarding oral health of 15 cooperative children with ASD. An Applied Behavioral Analysis application was developed using an avatar to deliver videos of tooth brushing and flossing techniques. Pre and post-administered questionnaire was delivered to Assess the improvement of knowledge of children regarding oral hygiene practices. Study concluded that the use of videos significantly improved the knowledge of cooperative children with ASD regarding oral health hygiene. (Fageeh et al., 2021)

### 3.2. Dental caries

Among children with special healthcare needs (CSHCN), children with ASD favor soft and sweetened foods and tend to pouch food in their mouths. This preference is due to difficulty in the deglutition process caused by poor tongue management, which consequently increases the teeth's susceptibility to dental caries (Jaber 2011; Da Silva et al., 2017; Bandini et al., 2010). This risk is further amplified in children with ASD due to the difficulty in performing basic oral hygiene measures (Jaber, 2011),

A study from Riyadh by Kotha et al. (2018) reported caries prevalence among children with ASD. Authors found that children with ASD who consuming sugar more than two spoons per day were had average dmft score  $5.05 \pm 2.7$  while those who consumed one to two spoons per day had average dmft score  $1.42 \pm 1.7$ . However, the major limitation of the study was its small sample size.

Ashour et al. (2018) conducted a study in Makkah in which 275 special healthcare needs children including children with ASD were screened for caries prevalence. Study showed relatively high dmft,  $3.9 \pm 4$  for 6–11 years children and  $3.2 \pm 4.1$  for 12–17 years children with ASD. However, study included only female special healthcare children.

AlHumaid et al. (2020) conducted a study in the Eastern region of Saudi Arabia in which they examined 75 children with ASD between the ages of 6 to 18 years. Prevalence of dental caries in primary teeth was found in 76% of the children with ASD and 68% children with ASD had caries in permanent teeth.

### 3.3. Periodontal disease

Studies have shown that children with ASD face difficulty in brushing due to lack of manual dexterity (Diab et al., 2016).

In addition to that, parents/caregivers face challenges in performing the daily oral hygiene measures for children with ASD due to their behavioral and communication difficulties (Como et al., 2021). For these reasons, most children with ASD have poor oral hygiene, leading to a high prevalence of gingival and periodontal diseases (Jaber, 2011; Da Silva et al., 2017, Como et al., 2021).

Moreover, side effects of medication, prescribed for children with ASD, such as psychoactive drugs or anticonvulsants are a significant risk factor for generalized gingival/periodontal disease. Among these, antidepressants, stimulants, and antipsychotics are the most implicated (Jaber 2011).

Diab et al. (2016), conducted a case control study in which they included 50 children with ASD and 50 normal children to compare their oral health. Modified gingival index (MGI), plaque index (PI) and salivary PH, all were found significantly high among case group compared to control. Small sample size, single center study and exclusion of dietary habits from questionnaire were the study limitations.

AlHumaid et al. (2020) studied periodontal problems among children with ASD in the Eastern region of Saudi Arabia, Thirty-one percent (31%) of children were reported to have gingival problems which was significantly associated with poor brushing practices.

### 3.4. Dental trauma

Globally, dental trauma rate was found to be higher among children with ASD (Friedlander et al., 2006; Ferreira et al., 2011). Al-Schaibany (2018), in Riyadh, reported an increased occurrence of dental trauma in preschool children with ASD. Primary maxillary central incisors were the most affected teeth, with enamel fracture being the most frequent type of dental injury. This case control study found significantly high proportion of children with ASD (25.7%) having traumatic dental injuries (TDI) compared to the case group (16.3) ( $p = 0.012$ ) with a higher prevalence of bruxism (54.7%), followed by object biting (44.7%) and mouth breathing (26.7%) in the study group.

Recently, Basha et al. (2021) in their study on preschool children in Taif reported similar findings of increased dental trauma in children with special healthcare needs, including children with ASD. Their study recommends emphasis on integrated oral health education programs for schoolteachers and parents or caregivers on prevention of dental trauma and care after injury.

### 3.5. Oral habits

In children with ASD, harmful oral habits such as bruxism, tongue thrusting, lip biting, and gingival picking are common (Weddell et al., 2011). In Saudi Arabia, Al-Schaibany (2017) studied oral habits in children with ASD and reported a higher prevalence of bruxism (54.7%), followed by object biting (44.7%) and mouth breathing (26.7%) in the study group.

### 3.6. Dental malocclusion

Children with ASD are more predisposed to certain types of malocclusions, such as anterior open bite (Olszewaska and Dunin-Wilczyńska, 2011). Alkhadra (2017), in his study on

five rehabilitation centers in and around Riyadh city, showed that children with ASD presented with a higher percentage of Class I malocclusion (40–41%) and a lower percentage of Class III malocclusion (3–4%) compared with Down syndrome patients. Moreover, children with ASD showed an increased mesial shift in their left primary molars.

### 3.7. Hypomineralization of teeth

Mohamed et al. (2021), in Taif reported prevalence of molar incisor hypo mineralization (MIH) and associated risk factors among CSHCN including children with Autism. Overall, 24.5% of CSHCN presented with MIH. Out of the 107 Children with ASD examined, 20% had MIH. Early detection and oral health promotion programs are recommended to create increased awareness and prevention of MIH in CSHCN.

### 3.8. Barriers to oral care

In Saudi Arabia, studies related to the oral health and dental experiences of children with ASD were limited, revealing high prevalence of caries, gingivitis, dental trauma and poor oral hygiene in contrast to general population (Abdulhade and Yahia, 2013; Al-Jadid, 2013; Alqahtani, 2012; AlZahrani, 2013; Elsedfy and Abdelraheem, 2014; Salhia et al., 2014; Al Shirian, 2015; Alharbi et al., 2019; Almanaa et al., 2017; Kotha et al., 2018; Sulaimani and Gut, 2019).

Despite their increased caries risk and urgent treatment need, this special group receives the least routine dental care due to multiple barriers in accessibility at individual, organization and or policy development and application.

**At the individual level,** Pani et al. (2012) assessed Saudi dental students' perceptions of their education in "special care dentistry" and its impact on their confidence to treat care to children with ASD in Riyadh city. The study concluded that although students are willing to treat these patients, they lack the confidence to treat special needs children, corroborating the results of another study on dental students (Alamoudi et al., 2017) in Jeddah, Saudi Arabia.

In another study, Pani et al. (2013) used parental awareness to evaluate the Oral Health-Related Quality of Life (OHR-QoL) for children with ASD in Saudi Arabia and concluded that childhood autism results in a reduced OHRQoL for both the children and their families.

Murshid (2011, 2014, 2015, 2017) studied dental awareness among children with ASD as well as the lack of proper behavior management techniques used by clinicians in the dental offices. Based on these studies, Murshid suggested that the American Academy of Pediatrics' recommendations should be implemented in Saudi Arabia to achieve early diagnosis, while emphasizing the importance of regular dental visits.

Additionally, Alaki et al., 2016 assessed the parental OHR-QoL perception and concluded that parents of children with ASD reported considerable oral health problems, daily routine problems, and parental worries related to their child's oral health.

Difficulties faced by the parents of children with ASD in getting access to dental care for their children was analyzed through a survey conducted on mothers in Riyadh, Saudi Arabia. A total 142 mothers participated in the study and the most common barrier identified in getting dental care was the cost of

the dental procedure (75.4%) followed by finding a dentist who can treat children with ASD (74.6%) and behavior of their children with ASD (41.5%). Conducting awareness programs to increase parental oral health knowledge and professional development of dentists to treat special-needs patients were the recommendations of the study. (Alshihri et al., 2021)

AlHammad et al. (2020) recognizing the barriers encountered by the parents of the children with ASD, recommend collaborative efforts between healthcare providers and dentists to ensure a successful oral healthcare program for children with ASD. Similarly, Ghoneim (2018) recommend oral health promotion programs and behavior modification to reduce parental or care givers stress in ensuring compliance in maintaining oral hygiene practices among cooperative children with ASD.

**At the organizational level,** two studies, Abdulhade and Yahia, 2013; Alqahtani, 2012 assessed schoolteachers and medical students' knowledge about autism in general in Riyadh and Jeddah respectively. Studies concluded that teachers exhibited weak to acceptable levels of knowledge about ASD according to their level of education and differences in working experience with children requiring CSHCN.

**At the policy level,** Alamoudi et al. (2017) in their study in Jeddah, evaluated the dentists' perception about their satisfaction with the quality of education given to them to provide care to the special-needs children. Dentists reported the lack of confidence to treat children with autism. Study suggested introducing programs focusing on management of oral healthcare in special-needs children. in addition to developing curricula designed to develop skills among dentists to treat children with autism.

Sulaimani and Gut (2019) attributed the difficulties encountered in conducting research on patients with special needs to the cultural and social barriers and the conception of disabilities in Saudi Arabia. Authors mentioned the challenges faced by the government-sponsored services which included lack of access, limited availability of services, delayed diagnosis, limited knowledge of individuals and limited resources. Hence, the government should establish multiple interventional strategies combined with required technology to be implemented at national level to ensure awareness and to improved treatment accessibility outcomes for individuals with special needs.

Worldwide, studies regarding barriers to oral care in children with ASD exist from the UK (Barry et al., 2014) and USA (Capozza and Bimstein, 2012); but due to the significant differences in culture/ beliefs and dental awareness, these results cannot be applied in Saudi Arabia. This demands national studies to be conducted and followed up rigorously due to the increase in incidence of autism in Saudi Arabia.

The lack of literature in Saudi Arabia on the barriers and challenges in seeking oral healthcare for children diagnosed with ASD may be due to several factors that included, the parents' willingness to provide information, challenges associated with the understanding and provision of services related to children with ASD, insufficient funds allocated for autism research, and the rigorous efforts it takes to conduct research on these children.

## 4. Limitations

Different databases were searched, and studies were identified across diverse settings in Saudi Arabia. To avoid any bias,



unpublished studies, gray data, and government reports were not included; thus, a few articles may have been overlooked.

## 5. Conclusions

Identifying gaps and seeking solutions for oral health promotion of children with ASD is a fundamental role of dental health organizations and professionals. The results of this study indicate that there is lack of systematic studies from Saudi Arabia for this group of patients. There were no case-control studies probing possible risk factors in Saudi Arabia; most of the studies included inadequate sample sizes; were mainly cross-sectional in design, and/or did not measure the long-term impact of implementing suggested intervention policies leading to limited development of effective oral health protocols for children with ASD. Moreover, the lack of research focusing on dental experiences in the oral healthcare of children with ASD hinders the accurate assessment of dental caries prevalence, risk factor identification, and even effective intervention strategy planning among the Saudi population. Thus, there should be incorporated efforts between dental healthcare organizations and professionals to develop national strategy, that include preparing the junior healthcare providers, to enhance the standards of dental health care provided to children with ASD and to expand research to avert the growing burden of this disease.

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## Ethical statement

- (1) This material is the authors' own original work, which has not been previously published elsewhere.
- (2) The paper is not currently being considered for publication elsewhere.
- (3) The paper reflects the authors' own research and analysis in a truthful and complete manner.
- (4) The paper properly credits the meaningful contributions of co-authors and co-researchers.
- (5) The results are appropriately placed in the context of prior and existing research.
- (6) All sources used are properly disclosed (correct citation). Literally copying of text must be indicated as such by using quotation marks and giving proper reference.

## CRedit authorship contribution statement

**Jehan Al Humaid:** Conceptualization, Data curation, Formal analysis, Supervision, Writing – original draft, Writing – review & editing.

## Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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