Diet, Oral Hygiene Practices and Dental Health in Autistic Children in Riyadh, Saudi Arabia

Ebtissam Z Murshid

Department of Pediatric Dentistry and Orthodontics, College of Dentistry King Saud University Riyadh, Saudi Arabia.

Abstract

Studies reporting the dietary habits of children with ASD in relation to dental health are scarce, and similar studies are non-existent in Saudi Arabia.

Purpose: to report baseline information about the diet, oral hygiene and dental health of a group of autistic children in Riyadh.

Methodology: 450 self-administered cross-sectional questionnaires were distributed to parents of autistic children enrolled in three major autistic rehabilitation centers.

Results: parents reported that (70.9%) of the children preferred food that is high in sugar and (96.7%) consumed soft drinks regularly. Parents reported their children brushing once 34.0% or twice 29.0% a day, and 28.8% brushed on an irregular basis. 82.6% of the children had no gingival bleeding during brushing. 51.5% of the children had no previous dental visits or dental treatment, 48.5% had undergone dental treatment using different behavioral management techniques.

Conclusion: Children in this study showed frequent consumptions of foods with high sugar contents and soft drinks, which coupled with improper oral hygiene practices and insufficient dental visits, may have contributed to the risk of developing dental caries and teeth erosion. Frequent tooth brushing, low-sugar diets and early dental visits for check-ups and regular fluoride applications are highly recommended for ASD children.

Key Words: Autism, Children, Saudi Arabia, Diet, Oral Hygiene Practices

Introduction

Autism was first described in 1943 by Leo Kanner. Kanner reported his observations of a group of children as they expressed impaired social and behavioral interactions, verbal and nonverbal communication deficiencies, and developmental retardation [1,2]. Since that time, numerous studies have been conducted to understand autism. In 2003, Medina [3] and Friedlander [4] were able to expand on Kanner's findings by discovering that children with autism show repetitive and stereotyped patterns of behavior and different behavioral disturbances, such as self-mutilation, aggression, seizures and psychiatric and mental disturbances [3,5]. Later, researchers added that autism varies significantly in character and severity. It occurs in all ethnic and socioeconomic groups and it is a spectrum of disorders rather than just one. Groups at higher risk of developing Autism Spectrum Disorders (ASD) include boys, siblings of those with autism and children with other developmental disorders. Describing children with Autism Spectrum Disorders (ASD) is easier than diagnosing them [6,7].

In clinical practice, diagnosis becomes difficult and complicated since it is based on a set of behaviors, not a cause or mechanism. Even more difficult is the treatment of diagnosed cases [8-10]. Special educators and therapists working with autistic cases reported that no single treatment is best and treatments are usually tailored to each child's individual needs. Intensive and continuous special educational programs and behavioral therapy early in life can help modify children's behavior and aid the acquisition of self-care and better social and communication skills [11-13]. Behavioral modifications can be achieved by using multidisciplinary therapeutic approaches, such as Applied Behavior Analysis, Verbal Behavior, Relationship Development Intervention, Speech Therapy, Sensory Integration Therapy, Auditory Integration Therapy, and pharmacological treatment in addition to nutritional and dietary changes [14-16].

Among the non-pharmacological approaches used in the treatment of ASD cases is dietary modification/alteration. Several studies showed that dietary alterations such as the use of a gluten- free, casein-free (GFCF) diet, and the elimination of food preservatives and additives (in particular, artificial flavors and colors) may lead to improvements in behavioral and physiological symptoms in some children [17-21]. It has been proposed that these proteins and components have an effect on those who are sensitive to them, such as children with ASD and Attention Deficit Hyperactivity (ADHD), producing the associated behavioral, emotional and perspective changes [22-26]. Diets low in refined carbohydrates and diets that are sugar-free were reported to effectively reduce the hyperactivity of children. Different studies reported a relation between the quantities of sugar consumption and amounts of destructive, aggressive, restless and hyperactive behaviors in the general population as well as in children with hyperactivity problems such as ASD and ADHD [15,27-34]. This is because sugar, a simple carbohydrate, is a readily available fuel source that enters the blood quickly after ingestion, triggering a rush of adrenaline. It is this rush of adrenaline that most likely leads to hyperactive behavior following high dietary sugar intakes [30,34]. Foods that contain calcium and magnesium, like vegetables, nuts and seeds, can be calming and improve behavior and concentration [32,34]. Controlling the diet of children diagnosed with ASD is not only important from a behavioral aspect but is also highly significant from a dental aspect. In dentistry, diet is considered to be a vital factor in maintaining good oral health. Many studies show a significant association between a high sugar diet and dental caries in children [35-37]. Reviewing literature shows paucity in studies reporting dietary habits of children with ASD and their dental health in general, and no previous studies in Saudi Arabia. Therefore, in this study, the purpose is to report baseline information about dietary habits, oral hygiene practices and the dental health status of a group of autistic children in Riyadh, Saudi Arabia.

Corresponding author: Ebtissam Zakaria Murshid, Department of Pediatric Dentistry and Orthodontics, College of Dentistry King Saud University Riyadh, Saudi Arabia, Tel: 9665-0544-90399; Fax: 9661-467-9015; e-mail: ezmurshid@hotmail.com

Materials and Methods

This study was approved by the Ethical Committee of Human Studies at King Saud University, College of Dentistry Research Center, and informed consent was obtained from the parents or legal guardians before the start of the study. A self-administered questionnaire was formulated in simple Arabic language and presented to a group of parents with autistic children visiting the dental school at King Saud University. Taking into consideration the comments of the pilot group of parents, a modified version of the questionnaire was distributed to three of the major autistic rehabilitation centers in Riyadh (the capital of Saudi Arabia). The centers were registered with the Saudi Autistic Society (SAS). Each center represents different areas of Riyadh (south, north and east). The authorities of each center were contacted and ethical approval was obtained before distributing the questionnaires to the parents of the autistic children enrolled in the three centers.

A cover letter of invitation to participate in the study was sent with the questionnaires. The letter included an explanation of the purpose, the importance of the study and a short introduction of the principal investigator. The questionnaires collected demographic information such as age, gender and the child's daily eating habits (such as the preferences and frequency of consuming sugary foods and soft drinks in addition to the number of snacks). Parents were also asked to answer questions regarding the oral health of the child, if they practiced regular tooth brushing, the frequency of brushing their children's teeth and if the child has/had any dental problems like bleeding gums or pain.

The total number of questionnaires distributed was 450. The copies were distributed taking in consideration the number of children enrolled in each center. Every family was assured of the confidentiality of the collected data and that the resultant information would be used only for the research purposes. The questionnaires were distributed to all the families with the help of the staff members working in the three selected centers during the month of May of 2012. All the answered questionnaires were collected by the author. The collected data was analyzed using Statistical Package for Social Sciences (SPSS) software for frequencies distribution of all variables in number and percentage.

Results

The total questionnaires distributed were 450 (200 copies to the North center, 150 to the East center and 100 to the South center according to the number of children enrolled in each center and the parents' initial agreement to enroll in the survey). A total of 344 questionnaires were returned with an overall response rate of 76.4%. The children were between the ages of 3 and 14 years old with 75.9% males and 24.1% females. The parents' responses showed that most of the children (70.9%) preferred foods that are high in sugar such as chocolate, candy, cookies, cakes and different Arabic deserts. Only 29.1% of the children did not consume high-sugar foods. The results of the parents' responses regarding their children's sugary food consumption rates showed that 20.1% of the children were consuming foods high in sugar once a day, 25.9% were consuming at least two servings of sweet snacks per day, and 14.2% were consuming sweet snacks on an irregular basis, while 10.8% of the children were allowed to have sweet snacks 3 times or more per day. Only 27.9% of the children do not consume sweet foods (*Table 1*).

Soft drink consumption by the children was reported by almost all of the parents (96.7%). Only 1.5% of the parents never served soft drinks to their children and 1.7% didn't answer or didn't know. One third (30.2%) of the children consumed soft drinks on an irregular basis. The rest of the children were consuming soft drinks either once a day (21.2%), twice a day (33.4%) or 3 times or more per day (11.9%) (*Table 1*).

The children's consumption of non-sweet snacks (sandwiches, salads, crackers, etc..) between regular meals was reported by 28.8% of the parents as sometimes and more than a quarter (26.2%) of the parents as once. 31.7% reported as twice, and 7.8% reported as 3 times or more per day. Only 19 (5.5%) of the responding parents did not know (*Table 1*).

The parents' responses in regards to their children's oral hygiene practices show that, almost one-third of the parents (32.6%) reported their children either did not practice tooth brushing (3.8%) or brushed on an irregular basis (28.8%). The rest of the children reported brushing once or twice a day, 34.0% and 29.0% respectively. Only 4.4% of the children brushed 3 times or more. Regarding the oral health conditions of the children as described by the parents, results showed that 82.6% of the children had no gingival bleeding during brushing and only 17.4% had gingival bleeding according to their parents' responses. Reviewing the parents' responses to the questions regarding dental experience indicated that more than half of the children (51.5%) had no previous dental experiences, treatments or visits. Whereas, 48.5% of the children had dental problems and had been treated (*Table 2*). Parents were asked to choose the dental treatment to be received by their children and the methods of treatments. The results showed that 7.8% of the children needed only full mouth prophylaxis and topical fluoride application, and 3.7% needed further treatment like fissure sealants (FS) and preventive resin restorations (PRR). More dental treatment was received by 10.1% of the children using nitrous oxide. About 25% of the children received treatment under General anesthesia due to extensive dental treatment needs.

Discussion

The need for obtaining baseline information regarding the dental health of children with Autism/Autistic Spectrum Disorders (ASD) in Saudi Arabia is becoming essential. Literature shows paucity in studies reporting autistic children's health in general and their dental health specifically. The focus of this study was to collect information on a group of autistic children in the capital of the kingdom providing data regarding diet, behavior, oral hygiene practices and dental needs of that group of children to help policy makers in designing effective oral health educational programs specifically for children with ASD and similar disabilities.

The decision to choose three different centers was based on the desire to accumulate information from different areas of the city and different socioeconomic areas of this large city. Riyadh is the capital and the largest city of Saudi Arabia. It includes the majority of the autism rehabilitation centers according to the SAS website. Questionnaires were formulated in simple Arabic and designed with multiple choice answers which could be answered in few minutes. The cooperation and enthusiasm of the staff in the three selected centers had a great effect on the response rate of the parents.

The children's preference of sweet and high-sugar foods was reported by most parents in this study. The high frequency of sweet food consumption was similar to other studies conducted in healthy children in Saudi Arabia [38-41]. Similar findings of preferences for sweet food among children with ASD were reported from Saudi Arabia and other parts of the world [42-44].

Table 1. *Distribution of parents' responses according to their children's diet habits (N=344).*

Questions	Frequency	Percentage
Does your child prefer sweet food?		
Yes	244	70.9
No	100	29.1
How many times does your child consume sweet food per day?		
Never	96	27.9
Sometimes	49	14.2
once/day	69	20.1
twice/day	89	25.9
3 times+	37	10.8
Don't Know/ missing answer	4	1.2
How many times does your child consume soft drinks per day?		
Never	5	1.5
Sometimes	104	30.2
once/day	73	21.2
twice/day	115	33.4
3 times+	41	11.9
Don't Know/ missing answer	6	1.7
How many times does your child consume non-sweet snacks per day?		
Sometimes	99	28.8
once/day	90	26.2
twice/day	109	31.7
3 times+	27	7.8
Don't Know/ missing answer	19	5.5

Table 2. *Distribution of participants according to their children's oral hygiene practices and dental experiences (N=344).*

Questions	Frequency	Percentage
How many times does your child practice tooth brushing		
Never	13	3.8
not regularly	99	28.8
once/day	117	34.0
2per day	100	29.0
>3 per day	15	4.4
Does your child have any gum bleeding during brushing?		
No	284	82.6
Yes	60	17.4
Does your child had any dental pain or dental problems/ dental visits		
No (history of dental pain or dental visits)	177	51.5%
Yes (history of dental visits)	167	48.5%
Child visit dental clinic for check up, prophylaxis and Fluoride application was done in a regular clinic	27	7.8%
Child was co-operative and different dental treatment (e.g..Fissure sealants, Preventive Resin Restoration.) was done in the clinic using Tell–Show-Do technique	13	3.7%
Child was un-cooperative and simple fillings were done using Nitrous –Oxide	35	10.1%
Child was un co-operative and needs extensive dental treatment under general anesthesia	85	24.7%
Missing answer	7	2.0%

The parents' responses showed a high consumption level of carbonated soft drinks by their children. Almost all children frequently consumed soft drinks. Similar findings were found among regular school children in Saudi Arabia [36,39,45,46]. A review of the literature shows no published data to compare regarding soft drink consumption in children with ASD in the kingdom.

The frequency of consuming snacks between meals was found to be high in this group of children. The consumption of multiple snacks during the day is capable of changing the salivary pH level in the oral cavity. Sugar and other fermentable carbohydrates, after being hydrolyzed by salivary amylase, provide substrate for the actions of oral bacteria, which in turn lower plaque levels and salivary pH. The resultant action is the beginning of tooth demineralization and cavity production [47,48]. Many factors can affect the caries process, including the form and texture of foods or fluids, the duration of exposure, nutrient composition, sequence and frequency of eating, salivary flow, presence of buffers, and oral hygiene status. Studies have confirmed the direct relation between intake of dietary sugars and dental caries across the life span [47-50]. The frequency of snack consumption by ASD children in this study put them at high risk of developing dental caries. If we add frequent and high consumption of soft drinks and sugary foods, the risk is likely higher.

In this study, parents' responses towards the frequency of tooth brushing were admirable if we take into consideration the behavior and poor motor skills of some ASD children, which made tooth brushing a challenge to their parents. Repeating the procedure daily can make the situation overwhelming. The continuous daily brushing may be an explanation for the low percentages of gingival bleeding during brushing according to the parents' responses. This indicates that this group of children may not have severe gingivitis. Only a very small number of individuals did not practice brushing at all. A similar positive attitude of Saudi parents in regards to oral hygiene practices was found in children with other disabilities and international parents of autistic children [51-54]. Other studies reported mild to severe gingival inflammation in their autistic groups [55-57]. This can be related to differences in the participating groups' ages, effects of medications used and complaints with tooth brushing.

The large number of children that had not been previously subjected to dental visits can possibly be explained by lower dental caries rates according to their parents' reports. Data from previous studies conducted in children with ASD shows lower caries rates or no significant differences in comparison to healthy children [42,51,52,56,57,59-63]. Accordingly, it is possible that the parents in this study didn't observe any signs of dental problems in their children, and were not encouraged to seek dental visits. Results of other studies conducted in Riyadh, but with children with different disabilities, showed that parents seek dental treatment for their children only at signs of pain or dental problems [52,53]. In addition, the decreased pain sensitivity and higher pain tolerances of the ASD children could be another reason for not visiting the dental clinic. It has been published that the pain tolerance or expression in children with ASD is different from the healthy children and hard to differentiate [56-60]. The results of the number of children with no previous history of dental visits in this study supported with a previous study in 2011 where 53.7% of the children hadn't visited a dental clinic before for a variety of reasons. The absence of dental pain or complaint was reported by a large number of parents as a reason for not visiting the dentist [58].

The other half of the children who had the chance to visit the dental clinic were there for different reasons such as check-ups, preventive measures and other types of dental treatment. As expected, different behavioral management techniques were used to control the behavior of the children during the dental procedures. Reviewing the number of children receiving simple dental fillings or other extensive dental treatment represented approximately one third of the study group, which can be considered as an endorsement of other reported studies of low dental caries rate in ASD children.

The results of this study and other similar studies should be carefully analyzed before reaching any definitive conclusions. Parents' responses in this study were self-reported. If we take into consideration that some ASD children may not have had the ability to communicate that something is painful, they may have expressed it as negative behavior. Other children may talk about discomfort, but can't articulate where they feel the pain. This is especially important in children with ASD show an increased threshold to tolerating major pain [65,66]. In addition, the general assumption that the children had low caries rates was largely inaccurate, because only one half of the parents had the chance to visit and report their experiences in the pediatric dental clinic. It is possible that the other half of children could have had higher, similar, or lower dental caries rates. However, while the parents' feedback was vital to our investigation, their reporting alone was insufficient in providing the data we needed. Additional clinical assessing ASD children's dental needs should be conducted in Saudi Arabia to provide sufficient evidence of their oral health status.

Conclusions

The results of this study show that most of the children preferred to consume a diet high in sugar and frequent snacks, which put them at higher risk of developing dental caries. According to the parents report, a large number of children in this study didn't show signs of dental pain or dental problems, which could be due to decreased pain sensitivity and higher pain tolerances or probably due to low dental caries rate. Almost half of the children in the study had the chance to visit the dental clinic for different types of preventive measures and dental treatments.

Recommendations

It is important for parents to know the possible harmful effects of the frequent consumption of cariogenic food and soft drinks, as the children are exposed to risk factors of developing dental caries and teeth erosion.

Frequent tooth brushing, regular dental visits and fluoride application are highly recommended for parents to follow as preventive measures. A gradual and slow exposure of children to the dental office and staff is highly recommended in young age to train children to accept dental treatment and to avoid unanticipated behavior.

Acknowledgments

The author would like to thank all the staff members and the directors of the three following centers for their help in distributing and collecting the questionnaires. The mother of prince Faisal Bin Fahad Center for Autism, a special academy for special needs and the brotherhood center. The author would like to thank also Mr. Ibrahim AL-Hassan for his help with data entry and analysis.

References

1. Kanner L. Autistic disturbances of affective contact. *Nervous Child*. 1943; **2**: 217-250.

2. Kanner L. Early infantile autism. *Journal of Pediatrics*.1994; **25**: 211-217.

3. Medina AC, Sogbe R, Gomez-Rey Am, Mata M. Factitial oral lesions in an autistic paediatric patient. *International Journal of Paediatric Dentistry*. 2003; **13**:130-137.

4. Friedlander AH, Mahler ME, Paterno VI,Yagiela JA. The pathophysiology, medical management and dental implications of autism. *Journal of California Dental Association*. 2003; **31**: 681,682,684, 686-691.

5. Gomez-Rey Am, Mata M. Medina AC, Sogbe R. Factitial oral lesions in an autistic paediatric patient. *International Journal of Paediatric Dentistry*. 2003; **13**: 130-137.

6. Friedlander AH, Mahler ME, Paterno VI and Yagiela JA. The neuropathology, medical management and dental implications of autism. *The Journal of American Dental Association*. 2006; **137**: 1517-1527.

7. Freitag CM. The genetics of autistic disorders and its clinical relevance: a review of the literature. *Journal of Molecular Psychiatry*. 2007; **12**: 2–22.

8. Filipek PA, Accardo PJ, Baranek GT. The screening and

diagnosis of autistic spectrum disorders. *Journal of Autism and Developmental Disorders*. 1999; **29**: 439–484.

9. London E. The role of the neurobiologist in redefining the diagnosis of autism. *Brain Pathology*. 2007; **17**: 408–411.

10. Dover CJ, Le Couteur. How to diagnose autism. *Archives of Disease in Childhood*. 2007; **92**: 540–545.

11. Shreck KA, Metz B, Mulick JA, Smith A. Making it fit: A Provocative Look at Models of Early Intensive Behavioral Intervention for Children with Autism. *The Behavior Analyst Today*. 2000; **1**: 27-32.

12. Delmolino L, Weiss MJ. The Relationship between Early Learning Rates and Treatment Outcome for Children with Autism Receiving Intensive Home-Based Applied Behavior Analysis. *The Behavior Analyst Today*. 2006; **7**: 96–105

13. Myers SM, Johnson CP. Management of children with autism spectrum disorders. *Pediatrics*. 2007; **120**: 1162–1182.

14. Prinz RJ, Roberts WA, Hantman E. Dietary correlates of hyperactive behavior in children. *Journal of Consulting and Clinical Psychology*. 1980; **48**: 760-769.

15. Prinz RJ et al. Sugar consumption correlates significantly with observed restlessness and destructive-aggressive behavior. *Journal of Behavioral Ecology*. 1981; **2**: 1.

16. Herbert MR. Contributions of the environment and environmentally vulnerable physiology to autism spectrum disorders. *Current Opinion in Neurology*. 2010; **23**: 103-110.

17. Knivsberg AM, Reichelt KL, Hoien T, Nodland M. A randomized, controlled study of dietary intervention in autistic syndromes. *Nutritional Neuroscience*. 2002; **5**: 251–261.

18. Levy SE, Mandell DS, Merhar S, Ittenbach RF,Pinto-Martin JA. Use of complementary and alternative medicine among children recently diagnosed with autistic spectrum disorder. *Journal of Developmental and Behavioral Pediatrics*. 2003; **24**: 418-423.

19. Wong HH, Smith RG. Patterns of complementary and alternative medical therapy use in children diagnosed with autism spectrum disorders. *Journal of Autism and Developmental Disorders*. 2006; **36**: 901-909.

20. Patel K, Curtis L. A comprehensive approach to treating autism and attention-deficit hyperactivity disorder: A pre-pilot study. *Journal of Alternative and Complementary Medicine*. 2007; **13**: 1091–1097.

21. Millward C, Ferriter M, Calver S, Connell-Jones G. Gluten and casein-free diets for autistic spectrum disorder. *Cochrane Database of Systematic Reviews*. 2008: CD003498.

22. Reichelt KL, Knivsberg A, Lind G, Nodland M. Probable etiology and possible treatment of childhood autism. *Brain Dysfunction*. 1991; **4**: 308-319.

23. Whiteley P, Rodgers J, Shattock P. Feeding patterns in autism. *Autism*. 2000; **4**: 207-211.

24. Bateman B, Hutchinson E, Warner JO et al. The effects of a double blind, placebo controlled, artificial food colourings and benzoate preservative challenge on hyperactivity in a general population sample of preschool children. *Archives of Disease in Childhood*. 2004; **89**: 506–511.

25. Schab DW, Trinh NT. Do Artificial Food Colors Promote Hyperactivity in Children with Hyperactive Syndromes? A Meta-Analysis of Double-Blind Placebo-Controlled Trials. *Journal of Developmental & Behavioral Pediatrics*. 2004; **25**: 423–434.

26. Sinn N. Nutritional and dietary influences on attention deficit hyperactivity disorder. *Nutrition Reviews*. 2008; **66**: 558-568.

27. Shannon WR. Neuropathic manifestations in infants and children as a result of anaphylactic reactions to foods contained in their diet. *Amercian Journal of Disease of Children*. 1922; **24**: 89-94.

28. Feingold B. Hyperkinesis and learning disabilities linked to artificial food colors and flavors. *American Journal of Nursing*. 1975; **5**: 797–803.

29. Prinz RJ et al. Sugar consumption correlates significantly with observed restlessness and destructive-aggressive behavior. *Journal of Behavioral Ecology*. 1981; **2**:1.

30. Wolraich ML, Wilson DB, White JW. The effect of sugar on behavior or cognition in children. A meta-analysis. *Journal of the American Medical Association*. 1995; **274**: 1617-1621.

31. Rapp D. Does diet affect hyperactivity? *Journal of Learning Disabilities*. 1979; **12**: 42-50.

32. Kaplan BJ, McNicol J, Conte RA, Moghadam HK. Dietary replacement in preschool-aged hyperactive boys. *Pediatrics*.1989; **83**: 7–17.

33. Boris M, Mandel FS. Foods and additives are common causes of the attention-deficit hyperactivity disorder in children. *Annals of Allergy, Asthma and Immunology*. 1994; **72**: 462-468.

34. Schnoll R, Burshteyn D, Cea-Aravena J. Nutrition in the treatment of attention deficit hyperactivity disorder: A neglected but important aspect. *Journal for Applied Psychophysiology and Biofeedback*. 2003; **28**: 63-75.

35. Gibson S, Williams S. Dental caries in pre-school children: associations with social class, tooth brushing habit and consumption of sugars and sugar-containing foods. *Caries Research*.1999; **33**: 101–113.

36. Al-Malik MI, Bedi R, Holt RD. The relationship between erosion, caries and rampant caries and dietary habits in preschool children in Saudi Arabia. *International Journal of Paediatric Dentistry*. 2001; **11**: 430–439.

37. Sohn BA, Burt MR. Sowers Carbonated Soft Drinks and Dental Caries in the Primary Dentition. *Journal of Dental Research*. 2006; **85**: 262-266.

38. Akpata ES, Al-Shammery Arm,Saeed HI. Dental caries, sugar consumption and restorative dental care in 12–13-year-old children in Riyadh, Saudi Arabia. *Community Dentistry and Oral Epidemiology*.1992; **20**: 343–346.

39. Al Ghanim NA, Adenubi JO, Wyne AA, Khan NB. Caries prediction model in pre-school children in Riyadh, Saudi Arabia. *International Journal of Pediatric Dentistry.*1998; **8**: 115–122.

40. Al-Tamimi S, Peterson P. Oral health situation of school children, mothers and schoolteachers in Saudi Arabia. *International Dental Journal*.1998; **48**: 180–186.

41. Al-Sadhan SA. Oral health practices and dietary habits of intermediate school children in Riyadh, Saudi Arabia. *Saudi Dental Journal*. 2003; **15**: 81-87.

42. Al-Khadra TA. Prevalence of dental caries and oral hygiene status among autistic children in Riyadh, Saudi Arabia. *Egyptian Dental Journal*. 2011; **57**: 1299.

43. O'Brien G,Whitehouse AM. A psychiatric study of deviant eating behavior among mentally handicapped adults. *British Journal of Psychiatry*. 1990; **157**: 281-284.

44. Klein U, Nowak AJ. Characteristics of patients with autistic disorder (AD) presenting for dental treatment a survey and chart review. *Special Care in Dentistry*. 1999; **19**: 200-207.

45. Al-Majed I, Maguire A, Murray JJ. Risk factors for dental erosion in 5–6 year old and 12–14 year old boys in Saudi Arabia. *Community Dentistry and Oral Epidemiology*. 2002; **30**: 38–46.

46. Madani KA, Jambi HA, Bin Sadiq BM, Malky SA, Salah MK. Factors associated with soft drink consumption in school-aged girls in Saudi Arabia. *International Journal of Food Safety, Nutrition and Public Health*. 2008; **1**: 150–158.

47. Keyes PH, Jordan HV. Factors influencing initiation, transmission and inhibition of dental caries. In: Mechanisms of hard tissue destruction. Harris RJ (Editor). New York: Academic Press. 1963; 261–283.

48. Johnson DA. Effects of diet and nutrition on saliva composition. In: *Cariology for the nineties*. Bowen WH, Tabka LA (Editors). Rochester, NY: University of Rochester Press. 1993; 367–381.

49. Milosevic A, Kelly M, McClean A. Sports supplement drinks and dental health in competitive swimmers and cyclists. *British Dental Journal*. 1997; **182**: 303–308.

50. American Dietetic Association. Position paper: nutrition and oral health. *Journal of American Dietetic Association*. 2003; **5**: 615–625.

51. Adenubi JO, Martinez JN. Dental Health Care at the

Disabled Children's Rehabilitation Center in Riyadh. *Saudi Dental Journal*. 1997; **9**: 9-13.

52. Al-Johara A, Al-Hussyeen AA, Al-Sadhan SA. Oral hygiene practices and dietary habits among children with Down 's syndrome in Riyadh, Saudi Arabia. *Saudi Dental Journal*. 2006; **18**: 141-148.

53. Wyne A. Oral health knowledge in parents of Saudi cerebral palsy children. *Neurosciences*. 2007; **12**: 306-311.

54. Fukuta O, Maruyama H, Suzuki Y, Yanase H, Atsumi N, Kurosu K. The behavior of mothers during dental treatment for their handicapped children relationship between mother's behavior and child patient's factors. *Shoni Shikagaku Zasshi*. 1989; **27**: 637-644.

55. Jaber MA. Dental caries experience, oral health status and treatment needs of dental patients with autism. *Journal of Applied Oral Science*. 2011; **19**: 212-217.

56. Murshid E. Oral health status, dental needs habits and behavioral attitude towards dental treatment of a group of autistic children in Riyadh, Saudi Arabia. *Saudi Dental Journal*. 2005; **17**: 132-139.

57. Vajawat M, Deepika P C. Comparative evaluation of oral hygiene practices and oral health status in autistic and normal individuals. *Journal of International Society of Preventive and Community Dentistry*. 2012; **2**: 58-63.

58. Murshid E. Characteristics and Dental Experiences of Autistic Children in Saudi Arabia: Cross-sectional Study. *Journal of Autism & Developmental Disorders*. 2011; **41**: 1629-1634.

59. Namal N, Vehit HE, Koksal S. Do autistic children have higher levels of caries? A cross- sectional study in Turkish children. *Journal of Indian Society of Pedodontics and Preventive Dentistry*. 2007; **25**: 97-102.

60. Loo CY, Graham RM, Hughes CV. The caries experience and behavior of dental patients with autism spectrum disorder. *Journal of the American Dental Association*. 2008; **139**: 1518-1524.

61. Shapira J, Mann J, Tamari I, Mester R, Knobler H et al. Oral health status and dental needs of an autistic population of children and young adults. *Special Care in Dentistry*.1989; **9**: 38-41.

62. De Moor R, Martens L. Dental care in autism. *Revue belge de médecine dentaire*. 1997; **52**: 44-55.

63. Fahlvik-Planefeldt C, Herrstrom P. Dental care of autistic children within the non- specialized Public Dental Service. *Swedish Dental Journal*. 2001; 25: 113-118.

64. Fanurik DB, Koh JLC, Schmitz MLC, Harrison RDA, Conrad TMA. Children with cognitive impairment: Parent report of pain and coping. *Journal of Developmental and Behavioral Pediatrics*. 1999; **20**: 228-234.

65. Nagamitsu S, Matsuishi T, Kisa T, Komori H, Miyazaki M, Hashimoto T, Yamashita Y, Ohtaki E, Kato H. CSF beta-endorphin levels in patients with infantile autism. *Journal of Autism and Developmental Disorders*. 1997; **27**: 155-163.

66. Nader R, Oberlander TF, Chambers CT, Craig KD. Expression of pain in children with autism. *Clinical Journal of Pain*. 2004; **20**: 88-97.