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Dentistry Section

Impact of the COVID-19 Pandemic Lockdown on Oral Health and Behaviour Change among Children in the Eastern Province of Saudi Arabia

TAREK EZZELDIN[1], YASMIN ALZAYER[2], JAWHARA ALJANDAN[3], BAYAN ALSAHWAN[4], INTISAR AHMAD SIDDIQUI[5]

ABSTRACT

Introduction: The Coronavirus Disease-2019 (COVID-19) pandemic has been concomitant to a number of alterations in children's dental health. The indoor activities and intermittent eating during the COVID-19 pandemic lockdown had an impact on oral hygiene practices and behavioural change in children.

Aim: To assess the impact of the COVID-19 pandemic lockdown on oral health and behaviour change among children in the eastern province of Saudi Arabia.

Materials and Methods: This cross-sectional study was conducted in Department of Paediatric Dentistry, Dammam Specialised Dental Center, Dammam, Eastern Province, Saudi Arabia, from 6th October 2021 to 8th March 2022, among 510 children. A well-structured questionnaire consisting of 24 closed-end items related to socio-demographic data, children's behavioural change during lockdown and oral health practices in the eastern province of Saudi Arabia was tailored. All parents or legal guardians of children aged between 6 and 12 years old were asked to sign a written informed permission to complete a questionnaire voluntarily. Statistical analysis was executed by using Statistical Package for Social Sciences version 22.0 (IBM Product, USA).

Results: Of 510 children to be evaluated for the impact of the COVID-19 pandemic lockdown, 284 (55.7%) mothers, 209 (41%) fathers, and 17 (3.3%) caregivers were the respondents. Although one-half of the children 273 (53.5%) had no change in oral health attention, 72 (14.1%) had increased, while 165 (32.5%) had decreased oral health attention during the COVID-19 pandemic lockdown. There were three significant predictors of children's oral health behaviour during the COVID-19 pandemic lockdown including frequency of tooth brushing increased (OR=18.7), decreased brushing (OR=28.3), consumption of sugary meals (OR=4.6), and noticing of caries, toothache, bad breath, bleeding/swelling of the gingiva (OR=3.1).

Conclusion: Study findings demonstrated that the COVID-19 pandemic caused considerable behavioural and psychological alterations in children. The frequency of brushing, dental visits, and sugar consumption all decreased significantly.

Keywords: Bad breath, Brushing, Coronavirus Disease 2019, Dental visits, Gingival health, Sugary meals

INTRODUCTION

The World Health Organisation (WHO) classified Coronavirus Disease 2019 (COVID-19) as pandemic on 11th March 2020. The disease was initially reported to the WHO China Office in December 2019 as pneumonia of unknown origin. A new coronavirus, Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2), was discovered in January 2020, and its genome was sequenced [1]. Saudi Arabia, like other countries, has witnessed and begun to take preventative measures to prevent a sudden and abrupt increase in the number of cases [2], which has resulted in a significant lifestyle change with ramifications for many aspects of health, stress, and anxiety [3].

The COVID-19 pandemic has forced children to restrain themselves at home in all countries around the world for several months. During quarantine, social distance plays an essential role in the reduced spread of disease among the population, so the country tends to lockdown, school is closed, and the child starts online class [4]. Despite the benefits of lockdown, a recent study addressed several consequences that impact child psychology like stress, anxiety, sleep, and appetite change during the lockdown [5]. Also, in some situations, it is important to recognize oral health and behaviour in addition to caregiver mental attitudes during the lockdown [6].

As this unexpected public incident had an impact on daily living as well as many aspects of health care, particularly dentistry. The dental clinics were considered high-risk place to spread the virus because of the dental aerosols produced during treatment and the close proximity between dentists and patients. As a result, the majority of dental clinics have halted their regular oral health clinics [7]. Consequently, the COVID-19 pandemic had an impact on children's gingival health and oral hygiene habits, resulting in a considerable increase in the number of junior high school students who require dental care [8-10].

Despite the fact, previous research studies have mainly focused on exploring the consequences of the COVID-19 pandemic on behavioural change in routine oral hygiene practice instead of exclusive oral health features, oral hygiene maintenance and dental problems during the pandemic [8,9,11]. Hence, there has been a lack of comprehensive research studies that may cover the effect of lockdown on both aspects, i.e., children's oral health and behavioural change in the Eastern Province of Saudi Arabia, where a strict lockdown was imposed, social distancing was enforced, and educational, sports, and entertainment activities were suspended for the entire population. Thus, the present study aimed to investigate the impact of the COVID-19 pandemic lockdown on oral health and behaviour change among children in the Eastern Province of Saudi Arabia.

MATERIALS AND METHODS

This cross-sectional study was conducted in Department of Paediatric Dentistry, Dammam Specialised Dental Center, Dammam, Eastern Province, Saudi Arabia, from 6th October 2021 to 8th March 2022, among 510 children. The ethical approval was obtained from the Institutional Review Board (Research No. DEN-03).

Inclusion and Exclusion criteria: All parents or legal guardians of children aged between 6 and 12 years old of either genders,

physically healthy to perform their routine activities, oral healthcare, and to be noticed for their behaviour were asked to sign a written informed permission to complete a questionnaire voluntarily. The participants who were not willing to participate were excluded from the study. Sample size calculation: Anticipating proportion (p-value=0.272) of covid-19 fear on child's behaviour [12], on 5% margin of error and 95% confidence of interval, the minimum required sample size calculated was 305 individuals. A total of 510 parents or caregivers participated in online as well as paper format questionnaire with complete responses. Non probability consecutive sampling technique was used for selection of the participants.

Questionnaire

A well-structured questionnaire consisting of 24 closed-end items was devised by following questionnaire of similar study carried out after pilot testing in Wuhan city of China [11]. The questionnaire was tailored for the present study and distributed in Arabic and English versions.

- The first eight items (1-8 items) of the questionnaire were related to socio-demographic characteristics of the participants including place of residence, nationality, relationship, child's age, gender, type of school and number of siblings.
- Further, eight items (9-16 items) were concerned to the effect of lockdown. The subjective measurements of change in behaviour were standardised on verbal scales of one-item question with Likert scale about presence of particular characteristics same as before or varied.
- The last eight items i.e. 17-24 were related to oral hygiene behaviour in terms of attention towards oral health, tooth brushing habits, change in sweet food and drinks consumption, and oral health status described by parents if noticed any dental problems.

Item's validity and reliability was tested by using Cohen's kappa coefficient based on random selected of 5% data of children's oral health attention and behavioural change provided with k=0.749, p-value <0.001, that revealed high validity of survey tool.

STATISTICAL ANALYSIS

Data were analysed by using Statistical Package for Social Sciences (SPSS IBM product of Chicago, USA) version 22.0. All categorical variables in our study including demographic characteristics, child's behaviour, and oral health status during COVID-19 pandemic lockdown were presented as frequencies and percentages. A logistic regression model was prepared by taking oral health attention during COVID-19 pandemic lockdown as binary variable i.e. change (increase or decrease) and no change. The covariates related to oral health status and practices were considered as panel variables to see how the COVID-19 pandemic lockdown affects oral health. A statistically significant outcome was defined as a p-value ≤0.05.

RESULTS

As per the first and third items of the questionnaire, a total of 510 participants who gave consent to participate and resided in the Eastern province of Saudi Arabia were included in the study. Of 510 children to be evaluated for the impact of the COVID-19 pandemic lockdown, 284 (55.7%) mothers, 209 (41%) fathers, and 17 (3.3%) caregivers were the respondents. Gender distribution among the children was almost similar i.e. 49.4% males and 50.6% females, but a preponderance of Saudi nationals (94.9%) was found. The mean age of children was 7.91±1.81 years. Most of the children (36.7%) were aged 6-7 years. The majority of the children (74.7%) had two or more siblings; nevertheless, 64.1% were studying in public-administrated schools [Table/Fig-1].

The majority of the children 398 (78.02%) had full-time social distancing during the lockdown, whereas 471 (92.4%) were taking online classes, whereas 39 (7.6%) children were not engaged with any academic activity during the lockdown. Most of the children had adopted their routines for their studies and playtime accordingly. Although one-half of the children had no change in behaviour during the COVID-19 pandemic lockdown, 12.5% had aggression, 23.5% anxiety, and 13.1% feared being infected by COVID-19. Thus, 255 (50.0%) of children were performing physical activity in some way at home. A majority of children 358 (70.2%) were engaged with cellular phones, computers, or television as a source of entertainment. Sleeping schedule and appetite changes during social distancing were reported at 407 (79.8%) and 273 (53.5%), respectively [Table/Fig-2].

Demographic characteristics	Categories	n,%
Respondent's relationship with the child	Father	209 (41.0)
	Mother	284 (55.7)
	Caregiver	17 (3.3)
Gender of child	Male	252 (49.4)
	Female	258 (50.6)
Nationality	Saudi	484 (94.9)
	Non-Saudi	26 (5.1)
Age of the child (years)	6-7	187 (36.7)
	8-9	111 (21.8)
	10-12	127 (24.9)
	>12	85 (16.7)
Number of siblings	None	41 (8.0)
	One	88 (17.3)
	Two	129 (25.3)
	>2	252 (49.4)
Type of school where child study	Private	183 (35.9)
	Public	327 (64.1)

[Table/Fig-1]: Demographic characteristics of children.

Child's behaviour	Categories	n,%
Full time social distancing during lockdown?	Yes	398 (78)
	No	112 (22)
Taking an online class during lockdown?	Yes	471 (92.4)
	No	39 (7.6)
Established schedules for study and playtime?	Yes	375 (73.5)
	No	135 (26.5)
Noticed any different behaviour in the child?	Aggressiveness	64 (12.5)
	Anxiety	120 (23.5)
	Fear	67 (13.1)
	No change	259 (50.8)
Children perform any type of physical activity at home?	Yes	255 (50)
	No	255 (50)
Source of entertainment for the child?	Cell phone, computer, TV	358 (70.2)
	Watching movies with the family	56 (11)
	Reading	22 (4.3)
	Others#	74 (14.5)
Sleep changes during the social distancing?	Yes	407 (79.8)
	No	103 (20.2)
Change in his or her appetite during social distancing?	Yes	273 (53.5)
	No	237 (46.5)

[Table/Fig-2]: Impact of the COVID-19 pandemic lockdown on behaviour change in children.
Other source of entertainment: Indoor games, play with toys, intake of favourite foodstuff, chocolates and beverages.

Although almost one-half of the children 273 (53.5%) had no change in oral health attention, 72 (14.1%) had increased, while 165 (32.5%) had decreased oral health attention during the COVID-19 pandemic lockdown. Increased consumption of sugary meals, including soft drinks, sweets, sugars, and flavored infant formula during the pandemic was noticed in 330 (64.7%) children. The frequency of a child's brushing habit during COVID-19 lockdown was once a day, more than 2 days, and not every day, as reported at 282 (55.3%), 137 (26.9%), and 91 (17.8%), respectively. Despite the fact that 359 (70.4%) of parents supervised their children's tooth brushing, 483 (94.7%) use toothpaste, and 377 (73.9%) confirm that their toothpaste contains fluoride. Almost one-half 251 (49.2%) of respondents noticed caries, toothaches, bad breath, and bleeding/swelling of the gingiva [Table/Fig-3].

Child's oral health behaviour	Categories	n,%
Oral health attention during COVID-19 lockdown.	Increased	72 (14.1)
	Decreased	165 (32.4)
	No change	273 (53.5)
How many times does your child brush their teeth during COVID-19 lockdown.	>2/ day	137 (26.9)
	Once/ day	282 (55.3)
	Not every day	91 (17.8)
Any change in brushing frequency during COVID-19 lockdown?	Increased	51 (10)
	Decreased	153 (30)
	No change	306 (60)
Consumption of sugary meals increased during the pandemic, such as (soft drinks, sweets, sugars, flavored infant formula)?	Yes	330 (64.7)
	No	103 (20.2)
	No change	77 (15.1)
Do parents help and supervise in brushing their children's teeth?	Yes	359 (70.4)
	No	119 (23.3)
	No change	32 (6.3)
Does the child use toothpaste?	Yes	483 (94.7)
	No	15 (2.9)
	Don't know	12 (2.4)
Does the toothpaste contain fluoride?	Yes	377 (73.9)
	No	38 (7.5)
	Don't know	95 (18.6)
Noticed caries, toothache, bad breath, bleeding/swelling of the gingiva?	Yes	251 (49.2)
	No	259 (50.8)

[Table/Fig-3]: Impact of the COVID-19 pandemic lockdown on oral health care of children.

Logistic regression analysis based on children's attention towards oral health as a binary variable used to evaluate the impact of the COVID-19 pandemic lockdown on oral health behaviour as a covariate. There were three significant predictors of change in children's oral health behaviour during the COVD-19 pandemic lockdown, including frequency of tooth brushing increased (OR=18.7), decreased brushing (OR=28.3), consumption of sugary meals (OR=4.6), and increased oral health issues like caries, toothache, bad breath, bleeding/swelling of the gingiva (OR=3.1). These findings revealed that in COVID-19 lockdown, tooth brushing increased 19 times and decreased 28 times compared to the normal brushing habit, that sugary meals were consumed five times more frequently, and that oral health issues increased by three times [Table/Fig-4].

Oral health behaviour	Categories	Oral health attention			p-value
		Change (n=237)	No change (n=273)	OR (95% CI)	
How many times did the child brush during COVID-19 lockdown?	Once/ day	117 (49.4)	165 (60.4)	Ref.	
	>2/ day	57 (24.1)	80 (29.3)	3.2 (1.9-5.2)	0.001
	Not every day	63 (26.6)	28 (10.3)	1.0 (0.7-1.5)	0.982
Any change in brushing frequency during COVID-19 lockdown?	Increased	42 (17.7)*	9 (3.3)	18.7 (8.6-40.6)	0.001
	Decreased	134 (56.5)*	19 (7.0)	28.3 (16.2-49.4)	0.001
	No change	61 (25.7)	245 (89.7)	Ref.	
Consumption of sugary meals increased during the pandemic?	Yes	180 (75.9)*	150 (54.9)	4.6 (2.5-8.3)	0.001
	No	41 (17.3)	62 (22.7)	2.5 (1.3-5.0)	0.008
	No change	16 (6.8)	61 (22.3)	Ref.	
Do parents help and supervise in brushing their children's teeth?	Yes	164 (69.2)	195 (71.4)	1.2 (0.6-2.6)	0.582
	No	60 (25.3)	59 (21.6)	1.5 (0.7-3.3)	0.327
	No change	13 (5.5)	19 (7.0)	Ref.	
Does the child use toothpaste?	Yes	218 (92.0)	265 (97.1)	0.3 (0.1-1.0)	0.040
	No	11 (4.6)	4 (1.5)	Ref.	
	Don't know	8 (3.4)	4 (1.5)	0.7 (0.1-3.8)	0.707
Does the toothpaste contain fluoride?	Yes	173 (73.0)	204 (74.7)	1.1 (0.7-1.7)	0.769
	No	22 (9.3)	16 (5.9)	1.7 (0.8-3.7)	0.156
	Don't know	42 (17.7)	53 (19.4)	Ref.	
Noticed caries, toothache, bad breath, bleeding/ swelling of the gingiva?	Yes	152 (64.1)*	99 (36.3)	3.1 (2.2-4.5)	0.001
	No	85 (35.9)	174 (63.7)	Ref.	

[Table/Fig-4]: Relationship of oral health attention with oral health status and practice during COVID-19 pandemic lockdown.
*Significant at p≤0.05. Values given in parentheses are percentages.
Ref. is the reference category for odd ratio calculation.

DISCUSSION

When compared to the normal brushing habit, tooth brushing increased 19 times and decreased 28 times during the COVID-19 lockdown, sugary meals were consumed five times more frequently and oral health issues increased by three times in the present study. Despite the fact that earlier research have looked at changes in general population behaviours [12,13], this is the first study to look at changes in behavioural and psychosocial difficulties related to oral health in children during a pandemic [5,11,12] as presented in [Table/Fig-5].

It is becoming more difficult to ensure appropriate oral hygiene and maintain proper oral health habits throughout the COVID-19 epidemic [14]. Previous studies suggest that, during the off-campus period, students start to lose the routine good habits obtained during the school period, resulting in a decline in health-related activities such as oral hygiene and physical activity [8,15]. This can be explained by the fact that individuals adopt fewer rigid behaviours on days when the daily routine is not followed [16,17].

Food-related habits may have been impacted by a number of psychological changes associated to COVID-19. According to the results, this study revealed that consumption of sugary meals increased during the pandemic. These results are comparable with the study that has shown that during the lockdown in Italy, individuals tend to increase their consumption of processed "comfort foods," such as chocolate, chips, and snacks [18]. One possible reason for these findings is that parents struggled to provide complete and healthy meals for their children since they had to balance smart work and family life. Because they could not cook for themselves, eating habits deteriorated, especially among younger and less autonomous youngsters.

From the analysis of the observed caries, toothaches, bad breath, and bleeding/swelling of the gingiva in the present study, it revealed that the lockdown was an obstacle in well-timed dental treatment and lead towards deteriorate condition. Sugar consumption plays a crucial part in the etiology of caries, according to the pathogenesis model based on the "ecological plaque theory." Increased

Author and year of study	Place of study	No. of subjects	Age of children	Parameters assessed and results	Conclusion
Present study	Saudi Arabia	510	6-12 years	Anxiety=23.5% Sleep= 79.8% Behavioural alterations=49.2% Sugar consumption=64.7 Appetite change=53.5% Oral Health attention=46.5% Frequency of brushing=74.3% Noticed dental issues=49.2%	The COVID-19 pandemic caused considerable behavioural and psychological alterations in children. The frequency of brushing, dental visits, and sugar consumption all decreased significantly.
Fransico R, et al.,2020 [12]	Italy, Spain and Portugal	1480	3-18 years	Anxiety=30.1% Moods=23.3% Sleep=13% Behavioural alterations=26% Feeding=32.5% Cognitive alterations=35.6%	Only psychological factors were evaluated, proportion of changes are less compared to the present study.
Liu Chang et al., 2020 [11]	Wuhan (China)	4495	3-6 years	Oral health attention=40.9% Brushing frequency change =20.6% Fear to be infected =89% Dental caries=60.8% Toothache=35.5% Halitosis=18.3%	Only oral health and hygiene factors were evaluated, the proportion of changes are higher and some are consistent to the present study.
Brondani B et al., 2021[5]	Brazil	290	10-15 years	Brushing frequency change =39.1% Sugar consumption= 29% Self-perceived dental treatment need=45.9% Sleep disturbance=10.6%	Only oral health and hygiene factors were evaluated, the proportion of changes are less than the present study.

[Table/Fig-5]: Comparison of present study findings with the reported studies [5,11,12].

fermentable sugar intake resulted in low pH conditions in biofilms, resulting in the selection of an acid-tolerant bacterial community and cariogenic species [19].

The findings in this study showed that 50.8% of children's parents did not notice any change in their behaviour during the COVID-19 lockdown, but the anxiety was approximately only 23.5%. However, a previous study conducted in Brazil showed that anxiety was present in about 52% of the children. While studies developed in Italy and Spain report that approximately 85.7% of parents report negative effects on the emotional state and behaviour of their children during lockdown [4,20] that may be related to the impact of the news of the highest number of cases and deaths in the world in these two countries.

In this study, 70.2% of children spent their time exposed to cellphones, computers, or television. Also, in previous studies developed in Italy and Spain, the majority of children spent their time using an iPad, television, or computer. Consequently, this may lead to a lack of physical activity and increase the risk of psychological problems among children and adolescents, which, in the long term, may have a significant impact on the health of the population [18,20].

Furthermore, this new era of COVID-19 fear may have a negative impact on the prevention-based approach to dentistry, as it may drive patients to the dental clinic exclusively for urgent or curative treatments, ignoring the preventive assistance that is so vital for oral health. Patients should be evaluated every 6 months or atleast once a year, according to specialists. Early intervention can reduce the need for invasive procedures like tooth extraction. Patients who see their dentist on a regular basis avoid pain and oral pathology, as well as the negative consequences of infection spread [21].

Limitation(s)

Considering a limited-time pandemic lockdown, a short-term predesigned questionnaire based study was planned instead of newly designed questionnaire based study after pilot testing. There were employed most of the subjective measurements instead of following standard criteria or analogue scales for measurement of psychological factors and self-perceived oral health evaluations.

CONCLUSION(S)

Findings of present study demonstrated that the COVID-19 pandemic caused considerable behavioural alterations in children. The frequency of brushing decreased and sugar consumption increased significantly. Furthermore, educating parents about oral health and disease is essential to become more knowledgeable about prevention rather than intervention. Also, there is an adverse association between lockdown, emotional and behavioural well-being among children during the lockdown period, which emphasize the potential role of parents in children's behavioural and emotional modifications in addition to following preventive measures and self-care with regards to life style and oral healthcare. In this way, the children's behaviour can be studied in future research in relation to post COVID-19 era and their capability to perform better as compared to their past experience of COVID-19 pandemic.

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PARTICULARS OF CONTRIBUTORS:
1. Consultant (Paediatric Dentistry) and Medical Director (Complete Saudi Board Program), Department of Paediatric Dentistry, Dammam Specialised Dental Center, Dammam Medical Complex, Dammam, Eastern Province, Saudi Arabia.
2. Consultant Prosthodontics, Department of Prosthodontics, Dammam Specialised Dental Center, Dammam Medical Complex, Dammam, Eastern Province, Saudi Arabia.
3. Saudi Board Resident, Department of Paediatric Dentistry, Dammam Specialised Dental Center, Dammam Medical Complex, Dammam, Eastern Province, Saudi Arabia.
4. Resident, Department of Paediatric Dentistry, Dammam Specialised Dental Center, Dammam Medical Complex, Dammam, Eastern Province, Saudi Arabia.
5. Lecturer, Department of Dental Education, College of Dentistry, Imam Abdulrahman Bin Faisal University, Dammam, Saudi Arabia.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. Intisar Ahmad Siddiqui,
Building No. 7404, Petromin King Faisa Road, Dammam,
Saudi Arabia, Eastern Province, Saudi Arabia.
E-mail: iasiddiq@iau.edu.sa

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