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Patterns in Oral Hygiene and Dietary Habits in School Children during the COVID-19 Pandemic

Anne-Marie Agius¹, Gabriella Gatt² , Arthur R G Cortes³ , Nikolai J Attard⁴

ABSTRACT

Aim: To assess oral hygiene and dietary patterns in school children participating in a school-based preventive oral health program during the COVID-19 pandemic.

Materials and methods: In this cross-sectional study, an anonymous questionnaire exploring oral hygiene and dietary patterns during the COVID-19 pandemic was completed by parents of school children. Data were compared among different schools, school years, and between genders using nonparametric tests. Associations among further nominal and categorical variables related to oral hygiene and dietary habits were also assessed using the chi-square test.

Results: Only 26% ($n = 32$) of parents reported that their children brushed their teeth the recommended amount of twice or more per day during the pandemic. In addition, 17.2% of the parents reported less brushing than before the pandemic. A total of 40 parents (32.8%) reported that their child consumed unhealthy beverages once a day or more. Comparison between genders revealed that male participants were drinking significantly healthier than female ($p = 0.038$). Sugary foods were consumed once a day or more by 63.1% of children. No significant differences were found between public and church schools. Significant direct associations were found between changes in dietary habits and brushing frequency ($p = 0.017$), between parental concern regarding the interruption of the school program and decreased brushing frequency ($p = 0.005$), and negative changes in dietary habits ($p = 0.013$).

Clinical significance: Within the limitations of this study, the present significant findings observed during the pandemic support the importance of school programs in promoting oral hygiene and healthy dietary habits of children.

Keywords: Children, COVID-19, Diet, Oral health, Oral hygiene.

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INTRODUCTION

Dental caries affects 60–90% of school children and most adults¹ and is the fourth most expensive disease to treat.² Apart from the financial burden imposed, caries has global societal and individual burdens on children such as missed school days, social withdrawal, pain, attention deficit at school, poor academic performance, sleep deprivation, poor esthetics, malnutrition, and growth retardation.³⁻⁷

Caries in permanent teeth ranked first out of 354 diseases with chronic sequelae while caries in the deciduous dentition ranked twelfth.^{8,9} The main risk factors for caries are: a sugar-rich diet, low fluoride availability, and poor oral hygiene. The high prevalence, substantial burden, and preventability of dental caries make it a top public health priority.

Schools are identified as the ideal setting for introduction of health policies for school-aged children.¹⁰ This is because children spend most of their time at school, and are there exposed to a constant routine, life skills, and good habits to then take back home to their families. Many schools worldwide have adopted school programs such as supervised tooth brushing or mouth rinsing, fluoride varnish programs, and healthy lunch policies to prevent dental caries as well as other general diseases.

Supervised tooth brushing and supervised mouth rinsing have both been found to be effective at reducing caries in children,¹¹⁻¹⁴ and while evidence for brushing with a fluoride toothpaste is now indisputable, supervised mouth rinsing was also found to reduce caries by 27% caries at meta-analysis level.¹⁴

Despite the strong evidence in favor of school oral health programs, these have only been introduced on the Maltese islands

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last year—specifically in three church schools and two state schools in Gozo (an island that is part of the Maltese archipelago) as part of a research study. The urgent need for such programs was felt even more strongly after recent studies found that the deft of 3-year olds in Malta and Gozo was 1.44 (with one third of them being at risk for caries) and the deft of 5-years old was found to be 3.77.¹⁵ This was also confirmed to be the case in Gozo.¹⁶ Furthermore, Malta ranked last of all European countries for toothbrushing habits in 11- and 15-years-old children and Malta also has an obesity problem as can be seen in the Health Behaviours in School Aged Children report (HBSC) in 2017/2018.¹⁷ This also shows the importance of diet as a common risk factor for both caries and general health.¹⁸

The school programs introduced in Gozo in 2019 came to an abrupt halt as per a legal notice issued by the Superintendence

of Public Health on 12th March 2020¹⁹ in response to the Maltese islands being hit by the COVID-19 pandemic. Physical attendance at schools was suspended as a precautionary move to reduce further transmission²⁰ and children stayed at home with their parents. This further emphasizes the important role of prevention of oral diseases in children during the pandemic.²¹

The aims of this study were to investigate the effects of the COVID-19 pandemic on school children's oral hygiene and dietary habits and their parents' views on the recently introduced school oral health program.

MATERIALS AND METHODS

Sample

This cross-sectional study was conducted in public and church schools in Gozo (Malta), where a questionnaire was distributed to the parents of children who were participating in a school preventive oral health program. This study was approved by the local Ethics Committee (Protocol number: DSG/2018-19/006). All participants consented prior to participating in this study. The STROBE guidelines for cross-sectional studies and the Helsinki Declaration guidelines were also carefully observed during the research. Not responding to the questionnaire was considered an exclusion criterion.

Questionnaires

An anonymous questionnaire consisting of 11 close-ended and three open-ended questions on oral hygiene and dietary changes during the COVID-19 pandemic induced school closures was filled by the parents of the children included in this study. Questions aimed to gather both quantitative and qualitative data (Table 1). Most questions were close-ended in the form of multiple-choice questions, checklists, or scales.²² In the same questionnaire, there were also three open-ended questions to allow parents to express themselves better and discuss any issues or topics that were not covered within the other questions (Table 1).

A link to the anonymous questionnaire hosted on Google Forms was forwarded to the parents by the relative schools to ensure anonymity and protection of their personal data.

Responses were automatically gathered into Google Forms and a data sheet was generated in Excel. These data were then cleaned and labeled. The resulting quantitative data were tabulated and used for statistical analyses, whereas the qualitative data were analyzed by assessing trends from the number of times each answer featured in the data collected.

Statistical Analyses

Sample size was previously calculated with the uncorrected chi-square to give the study a statistical power of 80% within a significance level of 5%. Due to the presence of categories and ranks, all questionnaire quantitative data were compared using nonparametric tests. Kruskal-Wallis test was used to compare results among participants from different study years. In addition, Mann-Whitney *U* test was used to compare results between participants from public and church schools, and between different genders. Chi-square tests were used to compare the proportions of categorical variables (toothbrushing frequency, mouth rinsing frequency, dietary habits, and parental concern) in various groups. A $p < 0.05$ significance level was used for all the tests. All statistical tests were performed with the same software (SPSS 22.0; SPSS Inc., Chicago, IL, USA).

RESULTS

The online questionnaire was accepted and received by four church schools and three state schools for students in years three, four, and five (ages 8, 9, and 10, respectively). A total of 122 out of 294 parents/guardians of participants responded to the questionnaire on their child's behalf.

There were 54.9% ($n = 67$) female and 45.1% ($n = 55$) male child participants.

Oral Hygiene Practices

When asked about their child's oral hygiene behaviors while at home, only 26% ($n = 32$) of parents reported that their children brushed their teeth the recommended frequency of twice or more per day. Another 50% ($n = 61$) of parents reported that their child brushed once per day while the rest brushed less than once a day and some occasionally. With regards to mouth rinsing, 49.2% ($n = 60$) of parents reported that their child never used a mouthrinse, while another 27.9% ($n = 34$) used it only occasionally (less than once a week).

A total of 15 (12.3%) parents reported that their child was brushing more frequently at home during the pandemic while, 86 (70.5%) reported that their child was brushing the same as before, and 21 (17.2%) reported less brushing than before the pandemic induced cessation of the school preventive program (Table 2).

Dietary Habits

When parents were asked about their child's diet, 11.5% ($n = 14$) reported that their child had not consumed unhealthy beverages (i.e., drinks other than water or plain white milk), while 29.5% ($n = 36$) said that they had consumed unhealthy beverages only occasionally. A total of 40 parents (32.8%) reported that their child consumed unhealthy beverages once a day or more (Table 2). A significant difference was found between the child's gender and consumption of unhealthy beverages with boys consuming more of them than girls ($p = 0.038$, Mann-Whitney *U* test). With regards to sugar containing food, 11.5% ($n = 14$) of parents reported that their child consumed sugary foods only occasionally or never, while 63.1% ($n = 77$) reported consumption of sugary food once a day or more.

Chi-square test analysis for independence indicated a significant association between reported unfavorable changes in dietary habits and decreased brushing frequency and conversely a significant association between positive changes in diet and increased brushing frequency in children during interruption of the program due to the pandemic ($p = 0.017$; Fig. 1). Regarding the experience of dental pain in the most recent 3 months, 10.7% ($n = 13$) replied "yes" while the rest said "no".

Parental Opinion about Interruption of the School Preventive Program

The majority of participants answered favorably when asked whether they thought that the school oral health preventive program helped their child understand more about the importance of oral health (66%, $n = 80$). A total of 29 (24%) participants replied "maybe" and 13 (11%) replied "no" (Fig. 2). A total of 62 (50.8%) participants were concerned that the school oral health project had to stop abruptly due to the COVID-19 pandemic, while the rest were not. There was no significant difference between replies received from different schools, different year groups, or different areas of residence.

Table 1: Questionnaire for parents of school children participating in a school oral health program

<i>Category</i>	<i>Questions</i>	<i>Answers</i>
Demographics	Gender of your child	Male/female/other
	Area of residence	Short answer question
Oral hygiene habits	School	St. Francis School Bishop Conservatory Laura Vicuna St. Theresa School Sannat Primary School Xewkija Primary School Nadur Primary School
	Year group of child	Year 3 Year 4 Year 5
	How often does your child brush his/her teeth?	Never Occasionally Once a week More than once a week Once a day Twice a day More than twice a day
	How often does your child use mouthwash?	Never Occasionally Once a week More than once a week Once a day Twice a day More than twice a day
	Since schools stopped as one of the COVID-19 measures, do you think your child brushes?	MORE than when s/he was at school The same as before LESS than when s/he was at school
Oral hygiene habits	How often does your child consume beverages/drinks that are NOT water or plain white milk?	Never Occasionally Once a week More than once a week Once a day Twice a day More than twice a day
	How often does your child consume foods that contain sugar?	Never Occasionally Once a week More than once a week Once a day Twice a day More than twice a day
	Did your child's diet change throughout these last 3 months? If yes, how?	Short answer question
Feedback	Has your child had any dental pain in the past 2/3 months?	Yes/No
	Do you feel that the oral health project helped your child understand the importance of taking care of their mouth and brush more?	Yes/No/Maybe
	Were you concerned that the oral health project had to stop abruptly because of the COVID-19 pandemic?	Yes/No
	What advantages do you see in continuing the project when school starts?	Short answer

In reply to the final open-ended question, participants commented about the advantages/disadvantages of the school preventive oral health project restarting when school resumes and various common themes emerged. Most parents reported that their child now understands the importance of oral health much better,

is less reluctant to brush his/her teeth, that it makes a big difference that professionals and teachers are teaching their children these life skills (as children tend to follow instruction of nonfamily members more), and that their children were performing oral hygiene practices at an additional time during the day. Only four of the parents

Table 2: School children's oral hygiene and dietary habits during the COVID-19 pandemic

Question	Never	Occasionally	Once/week	>Once/week	Once/day	Twice/day	>Twice/day
How often does your child brush his/her teeth?	0 (0%)	15 (12.3%)	3 (2.5%)	11 (9.0%)	61 (50%)	30 (24.6%)	2 (1.6%)
How often does your child use mouthwash?	60 (49.2%)	34 (27.9%)	0 (0%)	9 (7.4%)	16 (13.1%)	3 (2.5%)	0 (0%)
How often does your child consume beverages/drinks that are NOT water or plain white milk?	14 (11.5%)	36 (29.5%)	17 (13.9%)	15 (12.3%)	24 (19.7%)	9 (7.4%)	7 (5.7%)
How often does your child consume foods that contain sugar?	1 (0.8%)	13 (10.7%)	8 (6.6%)	23 (18.9%)	49 (40.2%)	17 (13.9%)	11 (9.0%)

Once/week = once a week
 >Once/week = more than once a week
 Once/day = once a day
 Twice/day = twice a day
 >Twice/day = more than twice a day

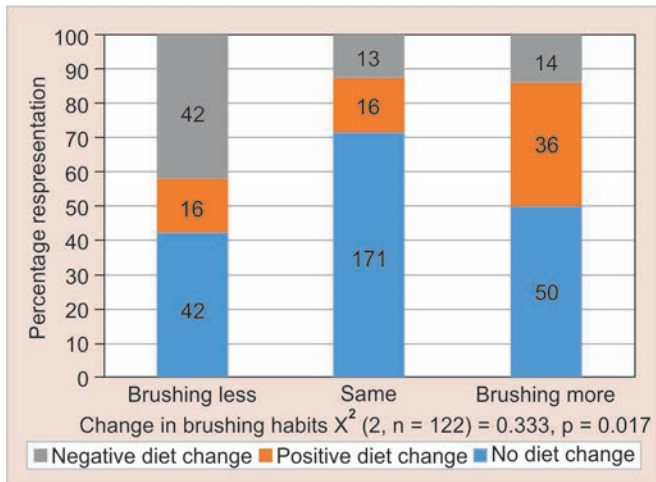


Fig. 1: Dietary and brushing habit changes

expressed concern regarding the project resuming if schools re-open during the pandemic due to the possibility of cross-contamination and children failing to keep ideal hygiene standards.

The responses were analyzed and categorized into positive (91%, $n = 111$), neutral (5.7%, $n = 7$), and negative (3.3%, $n = 4$) answers according to the main theme of the text.

Parental Concerns and Changes in Habits

Results showed that those parents that were most concerned about the interruption of the school preventive program were those whose children exhibited less frequent brushing ($p = 0.005$; Fig. 3) and negative changes in dietary habits ($p = 0.013$; Fig. 4) during closure of the schools. Results were statistically significant.

DISCUSSION

This cross-sectional study was carried out *via* a questionnaire distributed in May 2020, 2 months after a legal notice was issued on 12th March 2020 directing schools to stop face-to-face teaching and switch to online schooling from their homes due to the COVID-19 pandemic. The children that were invited to participate in this study were those attending those schools that were already participating in a preventive oral health program in primary school children (supervised toothbrushing vs supervised mouth rinsing). This study was being carried out by the authors of this article.

Out of 294 parents invited to participate, 122 responded to the questionnaire. The authors relied on the participating schools to forward the link to an anonymous questionnaire *via* email to the children's parents. Headteachers of participating schools reported that they expected a low response rate since the parents were

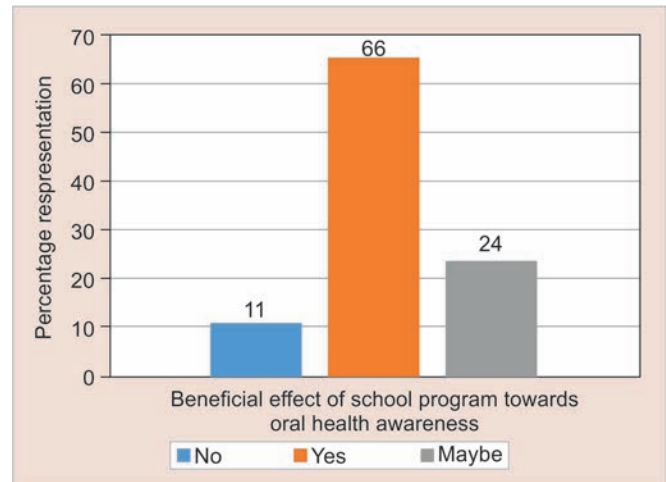


Fig. 2: Parental opinion of the beneficial effect of the school program on child's oral health awareness

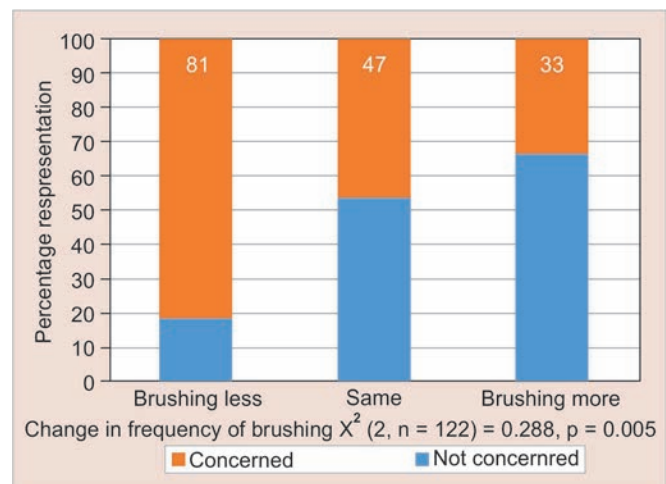


Fig. 3: Association between parental concern about interruption of school program and change in brushing frequency

adapting to the novel homeschooling schedules of their children besides their other daily commitments. This observation is in agreement with a study that confirmed that stress caused by trying to cope with homeschooling, work, and financial obligations causes changes in health behaviors.²³ The authors asked the schools to send reminders to the parents *via* email several times to improve the response rate.

In line with the HSC report¹⁷ and a study carried out in Gozo,¹⁶ only 26% of parents reported that their child brushed their



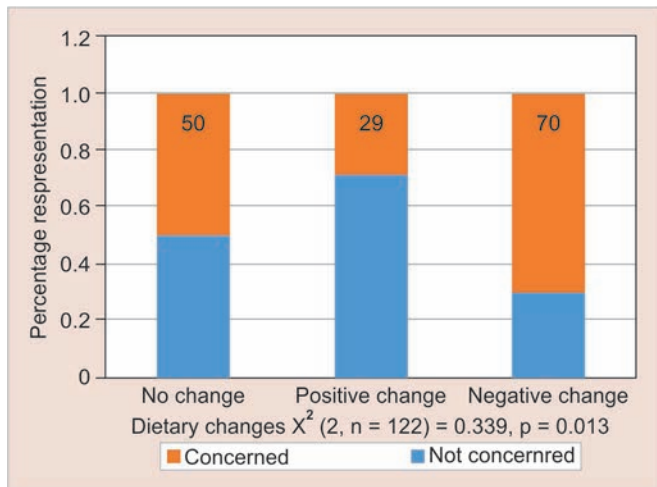


Fig. 4: Association between parental concern about interruption of school program and dietary changes

teeth the recommended amount, that is, twice a day or more. The majority of participants (70.5%) reported that their child's home brushing habits remained the same as before the pandemic while others (17.2%) reported that brushing actually decreased during the pandemic. This indicates that 88% of children were not compensating for the missing brushing session that was previously happening at school. Additionally, a substantial number of parents (49.2%) reported that their child never used a mouthwash, while a further 27.9% reported that it is used only occasionally. Again, home habits were not compensating for the missed school mouth washing exercise. All the children in the sample were 7 years of age or older; which according to the literature,¹⁴ is the recommended age for the introduction to a fluoridated mouthwash in the oral hygiene regime.

One third of parents (33%) reported that their children consumed unhealthy beverages on a daily basis, once a day or more. Furthermore, boys consumed significantly more unhealthy beverages than the girls analyzed herein ($p = 0.038$). This is in agreement with previous literature which describes how boys require 10% more sourness and 20% more sweetness than girls to be able to recognize taste. This induces males to favor more extreme flavors and thereby to consume more drinks other than plain water.²⁴ Previous studies consequently report that boys were more prone to early childhood caries than girls,²⁵ and show a higher tendency to erosive wear,²⁶⁻²⁸ especially in the 8–15 years old age groups.²⁹ Early childhood caries is also correlated with parental stress and anxiety. Sugary foods were being consumed more frequently with 63.1% of participants reporting consumption frequencies of once a day or more. This is also in agreement with studies reporting dietary habits during the COVID-19 pandemic. These found that there was a tendency for increased food consumption overall,³⁰ increased unhealthy food consumption,³¹ more frequent snacking throughout the day,²³ and an increased risk for childhood obesity.³²

These findings contrast with recommendations to minimize snacking on unhealthy foods and to improve dietary and oral hygiene habits during the pandemic to avoid the need for treatment and prevent new caries lesions.³³ This could be explained by the increased workload being experienced by parents trying to home school their children while working and keeping up with house duties.

Eleven percent of children experienced dental pain in the 2 months since schools shut down due to the pandemic. This can

be explained by the fact that parents were probably reluctant and fearful of taking their children to the dentist during the pandemic outbreak, which is in line with a similar study.³⁰ According to local guidelines,²⁵ dentists in Malta were only providing emergency dental treatment during the first 4 months of the pandemic outbreak. This could have led to worsening of active carious lesions and initiation of new ones.

Results of this study show that the advantages of a school based oral health preventive program, the importance of good oral hygiene, and the development of good oral hygiene and dietary habits are recognized by parents. Most parents (65.6%) stated that the school preventive oral health project helped their child learn more about the importance of oral health and 91% of participants outlined advantages to continuing the oral health project when schools restart so that their children continue to learn and benefit from the exercise.

The results of this study also highlighted how it was those families where dietary habits and oral hygiene habits were not ideal that recognized the need for the support of a school based preventive program. Additionally, this study shows how negative changes in dietary habits are statistically significantly associated with poorer oral hygiene practices. The concept of school based preventive programs is to target these children and help reduce inequalities.¹² Those who already practice good habits are bound to be those who shall benefit least.

The oral health status of children is influenced by differing social dimensions.³⁴ The present study, however, showed strong similarities in trends between participants from different localities, schools, school types (state and church), and year groups. Their responses were alike and there were no significant differences between the children's reported habits. Furthermore, the present findings are also in contrast with a previous study concluding that different localities and schooling types may reflect varying socio-economic status and thereby different levels of oral health literacy.³⁵ The present findings support previous evidences that the reopening of schools is important to safeguard both mental and physical health of children.³⁶

Among the limitations of this study are the response rate due to the presumed constraints experienced by the parents during this turbulent period and the fact that the authors had to rely directly on the school administrators to circulate the questionnaire *via* email. Although this was the most readily available, safe, and reliable tool to reach the participants at home, it negated the authors direct control of the questionnaire's dissemination.

CONCLUSION

Within the limitations of this study, the present significant findings observed during the pandemic support the importance of school programs in promoting oral hygiene and healthy dietary habits of children. Parents expressed strong support for the school based oral health program to help children improve their oral hygiene and dietary habits.

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