

Prevalence of Dental Caries and its Impact on the Academic performance of Sudanese Basic school children, AL-Sahafa Residential Area (2013-2014)

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Abstract: Background: Early childhood caries is a chronic disease, if not prevented or treated at its early stages can lead to serious complications amongst which is a negative impact on the academic performance of the child. **Objectives:** To determine the relationship between children's dental caries experience and school attendance and performance. **Methods:** A Descriptive Cross-sectional study was conducted on 380 school children of different basic levels in Al-Sahafa residential area in Khartoum. Questionnaires were sent to parents and the dmft/DMFT of the children was examined using the WHO criteria 1997. Variables assessed included school absences and performance. **Results:** Dental caries was significantly related to poor academic performance, both dmft and DMFT were significant in relation to academic performance, p -value= 0.008 and 0.023 respectively. Majority of the population had low dmft (51.6%) and DMFT (66.1%) yet strong association was found. **Conclusion:** Children with poor dental health status were more likely to experience pain, miss school and perform poorly in school. These findings suggest that improving the caries index for the children can be a way to improve their educational level. [Miska H. El-Sayed, Khadiga H. Osman and AL Bashir I. E. **Prevalence of Dental Caries and its Impact on the Academic performance of Sudanese Basic school children, AL-Sahafa Residential Area (2013-2014)**. *J Am Sci* 2015;11(4):195-203]. (ISSN: 1545-1003). <http://www.jofamericanscience.org>. 22

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1.1 Introduction

Dental caries is one of the most leading childhood diseases, and people are more prone to it throughout their lives. Dental caries is not self-limiting disease, it can advance until the tooth is destroyed⁽¹⁾, and if not treated it can cause pain, infection and impairment of eating, and disturbance of sleeping.⁽²⁾ Furthermore, severe caries can affect children's quality of life and growth.⁽³⁾ The consequences of high caries levels also include a higher risk of emergency dental visits, increased days with limited activity and absence from school and a reduced ability to learn⁽⁴⁾.

Dental caries could be problematic in a diverse manner in a child's life and should be undertaken seriously because not only does it affect and destruct the teeth but may also lead to more widespread health issues such as slower pace of growth in infants than caries-free infants. Furthermore, children with dental caries may be severely underweight because of associated pain and their inability to eat⁽⁵⁾ a matter which may be associated with iron deficiency⁽⁶⁾. The consequences of dental caries reflects the quality of life of the child and could negatively affect the child's character.

1.2 Literature Review

The term dental caries is used to describe the results, signs, and symptoms of a localized chemical dissolution of the tooth surface caused by metabolic procedures taking place in the biofilms (dental plaque) that cover the affected area.⁽⁷⁾ Dental caries initiates with white-spot lesions in the upper deciduous incisors along the margin of the gingiva. If treatment is not received the caries can progress leading to complete loss of the crown⁽⁸⁾. Children who are affected with caries as infants or toddlers have a much greater likelihood of developing caries in both the primary and the permanent dentitions⁽⁹⁾

1.2.1 Prevalence

Developing countries, such as China¹⁰ (53%), India¹¹ (53%) and South Africa¹²(46%), report greater caries prevalence, as compared to developed countries like England¹³ (32%) and Italy (22%).¹⁴In Sudan the prevalence of caries was found to be low. The school children with the higher socioeconomic status formed the high risk group.⁽¹⁵⁾

1.2.2 Factors Causing Dental Caries

The etiology of dental caries is multifactorial and has been well established. The disease is frequently associated with a poor diet and bad nutritional habits⁽¹⁶⁾. It is an infectious disease, in which bacteria comprise a major risk factor. The species *Streptococcus mutans* and *Streptococcus*

sobrinus, are the most common causative agents. Lactobacilli also contribute in the development of caries lesions. They play an important role in lesion advancement, but not its initiation. Early attainment of MS is a key event in the natural history of the disease⁽¹⁷⁾.

Vertical transmission of Mutans streptococci from caregiver to child has been reported⁽¹⁸⁾. The major reservoir of Mutans streptococci is the mother, from whom the child obtains it during a period of around 2 years of age. At this time, the child is probably most prone to acquiring Mutans streptococci⁽¹⁸⁾. Successful infant colonization of maternally transmitted mutans streptococci may be linked to numerous factors, which include the amount of the inoculum, the rate of small-dose inoculations, and the minimum virulent dose. Mothers with high numbers of mutans streptococci in their saliva are at high risk of infecting their infants very early in life⁽¹⁹⁾. The duration between MS colonization and caries lesion development is approximately 13-16 months⁽²⁰⁾.

1.2.3 Nutritional Risk Factors

There is plentiful epidemiological evidence that dietary sugars, especially sucrose, are a factor affecting dental caries prevalence and progression. The acid production from sucrose metabolism disrupts the balance of the microbial community, favoring the growth of mutans streptococci and lactobacilli and sucrose is a unique cariogenic carbohydrate because it also serves as a substrate for extracellular glucan synthesis⁽²¹⁾. Glucan polymers are believed to enable MS to both adhere firmly to teeth and to inhibit diffusion properties of plaque or increase plaque porosity resulting in greater acid production adjacent to the tooth surface.⁽²²⁾

1.2.4 Environmental Risk Factors

A systematic review concluded that children were most likely to develop caries if MS was acquired at an early age, although this may be partly recompensed for by other factors, such as good oral hygiene and a non-cariogenic diet⁽²³⁾. Development of oral hygiene habits may be subtle to the economic environment in which children live. Such environmental factors include caregivers' social status⁽²⁴⁾, poverty, ethnicity, deprivation, number of years of education, and dental insurance coverage. Despite the widespread decline in caries prevalence and severity in permanent teeth in high-income countries over recent decades, disparities remain, and many children still develop dental caries⁽²⁵⁾. This relatively new area of research has been called "life-course epidemiology"⁽²⁶⁾.

Children with a history of dental caries, whose primary caregiver or siblings have severe dental

caries, are regarded as being at increased risk for the disease.⁽²⁷⁾

1.2.5 Treatment

Treatment of dental caries can be attained through various intervention methods, depending on the progression of the disease, the child's age, as well as the social, behavioral, and medical history of the child. Examining a child by his or her first year is ideal in the prevention and intervention of dental caries.⁽²⁸⁾ During this initial visit, performing a risk assessment can provide standard data necessary to counsel the parent on the prevention of dental decay. Children at low risk may not need any restorative treatment. Children at moderate risk may require restoration of advancing and cavitated lesions, while initial (white spot) and enamel proximal lesions should be treated by preventive techniques and observed for progression. Children at high risk, however, may need earlier restorative intervention of enamel proximal lesions, as well as intervention of progressing and cavitated lesions to reduce continual caries development.⁽²⁸⁾

Stainless steel (preformed) crowns are pre-fabricated crown forms which can be modified to individual primary molars and cemented in place to offer a definitive restoration.⁽²⁹⁾ They have been indicated for the restoration of primary and permanent teeth with caries, cervical decalcification, and/or developmental defects (e.g., hypoplasia, hypocalcification), when failure of other available restorative materials is likely (e.g., interproximal caries extending beyond line angles, patients with bruxism), following pulp therapy, for restoring a primary tooth that is to be used as an abutment for a space maintainer, or for the intermediate restoration of fractured teeth.⁽²⁹⁾ Another approach of treating dental caries in young children is Atraumatic Restorative Treatment (ART). The ART is a procedure used to remove carious tooth tissues using hand instruments alone and restoring the cavity with an adhesive restorative material.⁽³⁰⁾ Currently, the restorative material that is used is glass ionomer. ART is a simple technique with many benefits, such as it diminishes pain and fear during dental treatment. It does not need electricity and it is more cost-effective than the customary approach using amalgam. It is an alternative treatment available to a large part of the world's population. In addition, it is mostly indicated for use in children, as it is reportedly atraumatic because no rotary instruments are used and in most cases no local anesthesia is needed.⁽³¹⁾

1.2.6 Preventive Measures

1.2.6.1 Fluoridated Toothpaste

The impact of tooth brushing in the prevention of tooth decay has long been considered self-evident. A convincing evidence exists for the decay-

preventing benefit of tooth brushing with fluoride-containing toothpaste.⁽³²⁾

1.2.6.2 Visible Plaque Elimination

Studies demonstrate a correlation between visible plaque on primary teeth and caries risk.⁽³³⁾ Most interesting is a recent study of 39 children, aged 12 to 36 months that found a positive correlation between the baseline MS and plaque regrowth, suggesting that the presence of plaque on the anterior teeth of young children is related to MS colonization.⁽³⁴⁾ Therefore, plaque control measures act as a preventive method against dental caries.

1.2.6.3 Fluoride Use

Many studies have been published supporting the effectiveness of fluoride varnish to prevent dental caries in the primary dentition.⁽³⁵⁾

For children 1–7 years of age, the frequent addition of small amounts of fluoride to oral fluids is important. Drinking of fluoridated water is highly recommended, and the regular use of fluoridated dentifrices is also an effective means of minimizing the prevalence of dental caries. Fluoride supplements have been recommended for preventing caries.⁽³⁶⁾

1.2.6.4 Deterrent Measures Against Vertical Transmission of Mutans Streptococci

Considerable data illustrate that children's oral cavity is colonized with Mutans streptococci generally as result of their transmission from the child's primary care giver. As a result of these findings there have been a minimum of eleven reports of interventions on mothers using various combinations of treatments, including antimicrobial agents, fluoride, xylitol chewing gum and restorative care in order to reduce Mutans streptococci and consequently caries in their offspring.⁽³⁷⁾

1.2.7 Outcome of Untreated Dental Caries in Children

Among the numerous problems compromising the oral health of child patients, tooth decay is the affection that most frequently evokes aesthetic and functional complaints in a child's clinical routine, affecting his/her quality of life, therefore, dental treatment may offer a positive psychosocial impact on these patients, not only for recovering their oral health, but also for enhancing a better life. The negative influence of caries on children's lives includes: symptoms and functional alterations, such as chewing and speech impairment, schooling factors, such as preschool absenteeism, psychological issues, such as trouble sleeping, and irritability, among other factors related to social interaction, such as smiling and refraining from speaking. School performance may also decline.^(38, 39) It has also been estimated that sixty million school hours are lost each year due to tooth pain.⁽⁴⁰⁾ Children 5 to 7 years of age in the United States have been estimated to lose more than

7 million school hours annually because of dental problems and/or visits, many of which are sequels of caries that began when they were preschoolers.⁽⁴¹⁾

A pilot study of children (n=77) ages 35-66 months referred for treatment under general anesthesia was conducted in Montréal Canada.⁽⁴²⁾ Caregivers, interviewed before and after treatment, reported that prior to treatment, 48% of the children complained of pain, 43% had problems eating, 35% had problems sleeping and 5% had negative reports from school. After treatment, most of the problems resolved and the authors concluded that severe caries had a serious impact on the children's quality of life and that treatment eliminated many of these problems.⁽⁴²⁾

Our recent study was conducted in basic school children identified to have dental caries in Sudan. Caries is a widespread disease affecting many people in Sudan and other developing countries and hence more studies need to be conducted in order to identify the route of its cause and to tackle its numerous drawbacks. One of these drawbacks include the negative impact of the dental caries on the performance of a child in school.

Children with dental caries may suffer from severe pain which may require that they miss school to seek dental treatment. Frequent attacks of pain may lead to increase in absenteeism causing the child to fall behind academically. If early dental caries is the main culprit to absenteeism then more needs to be done in order to address the problem. Therefore studies such as this one should be conducted to prove whether there is an association between dental caries and performance in school, a problem that has not been paid its full due attention in Sudan.

The General objective of this study was to determine the impact of early childhood caries on the academic performance of the basic school children and the specific objectives were:

- To determine the dmft/DMFT of the children.
- To assess the academic performance of the children.
- To determine the number of school absence due to dental pain/ infection or due to regular check-up.
- To assess the association between dmft /DMFT and academic performance.
- To assess the association between dmft / DMFT and school absence.

2. Material and Methods

A descriptive cross-sectional school based study was performed at different basic schools in Khartoum – Al-Sahafa district. The study was conducted on school children who are in the basic level of education and are 5-15 years of age. Children with

physical/mental disabilities, medical problems or children whom they didn't join from the start of the school year, were excluded.

The stratified cluster sampling technique was used for recruitment of the participants. The total number of school children for males and females in Al-Sahafa district was identified and this represented the sample frame from which the sample size estimation was obtained using the equation.

$$n = \frac{Z^2 P(1-p)}{d^2}$$

Where n= sample size

Z= Z statistic for a level of confidence
(1.96)

P= expected prevalence or proportion

d= precision (0.05)

The sample size was calculated by applying an estimated dental caries prevalence (p) of 50%⁽¹⁵⁾ and was found to be 385.

The children were selected randomly from each class of the selected schools.

The data for the study was collected using a well-constructed, close-ended questionnaire which included an examination form for estimation of the dmft/DMFT using the WHO criteria (1997)⁽⁴³⁾ and an informed consent. The questionnaire was distributed to children to be filled and signed by their parents and they were collected in the next day. All questionnaires were signed by parents, no refusal to participate was received. Academic performance of examined students was obtained from the school administrator. Dental examination was done using gloves in an upright standard chair with natural daylight, sterile mirrors, probes, tweezers, and kidney dishes were used in order to measure the dmft/DMFT index. Cotton was required for means of isolation. A strict infection control protocol was taken upon handling these tools.

The data obtained was processed and analyzed using Statistical Package for Social Sciences/SPSS (version 21). Chi square test was used for correlations in which p-value equal to or less than 0.05 was considered to be significant.

For ethical considerations an approval letter from the ethical committee of the University of Medical Sciences of technology (UMST) was obtained and a written consent for the use of data was taken from the principal of the schools in which the identity of candidates in the study was concealed. All children with caries were referred to the dental hospital for treatment and an oral health education was given to the students after the data collection.

Table 1 show that the majority (30.6%) of the study population were of age 8 – 11 years.

Table 2 shows that the males (51.6%) of the study population were reasonably equal to the females(48.4%).

Figure 1 illustrates that the majority (82.37%) of the study population do not visit the dental clinic for regular dental checkup while only 17.63% go for regular dental checkup.

Figure 2 shows as expected that the main reason for ignoring regular dental checkup is due to financial disability (42.50%), 26.88% ignore regular dental checkup as they don't perceive the need to, however 26.88% ignore because of absence of pain and 10.63% due to absence of tooth decay while 4.6% had no reason for ignoring dental checkup.

Figure 3 shows that most of the study population attend to their dental appointments during the school day (36.84%), followed by attending at the evening time (28.6%) and 18.16% schedule their appointments during vacations.

Figure 4 illustrates that more than half(57.63%) of the study population missed school hours due to dental pain about 1-3 times per year,38.4% of the study population had never missed school days due to dental pain while only a few missed 4-6 of school days and 1.73% missed 7-9 days of school days due to pain.

Figure 5 reveals that almost half (51.32%) of the study population had not missed school days due to routine dental checkup meanwhile the rest missed school days at various frequencies due to routine dental checkup, the majority(44.8%) of which missed 1-3 school days per year.

Figure 6 shows that the majority (64.21%) of the study population missed about 1-3 school days due to non-dental causes while 24.74% never missed school days.

Figure 7 shows that almost all of the study population revise at home (96.84%) with the exception of 3.16% whom don't revise at home.

Table 3 shows that majority of the study population had low dmft (51.6%) and DMFT (66.1%).

Table 4 shows that 30.5% have excellent performance while only 12.9% have a poor academic performance.

Table 5 shows the association between academic performance and dmft/DMFT, in which significant association was found. (sig. 0.008 and 0.023) respectively.

Table 6 shows the association between absenteeism and dmft/DMFT, in which no significant association was found, (sig. 0.712 and 0.975) respectively.

3. Results

Table (1): Distribution of study sample according to (age)

Age	Frequency	Percent
5-7	59	15.5
8-11	116	54
12-15	205	30.6

Table (2): distribution of study sample according to (Gender)

Gender	Frequency	Percent
Male	196	51.6
Female	184	48.4
Total	380	100.0

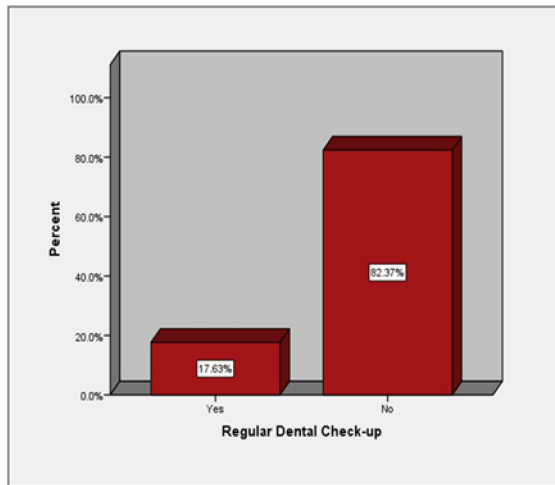


Figure (1): distribution of study sample according to (regular dental checkup)

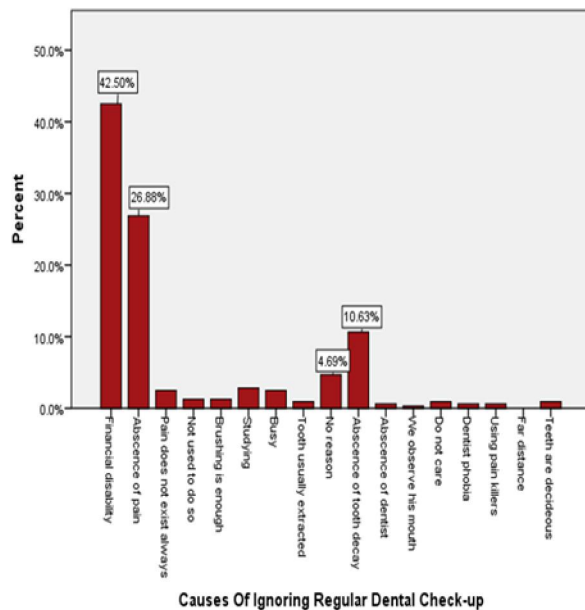


Figure (2): distribution of study sample according to (causes of ignoring dental checkup)

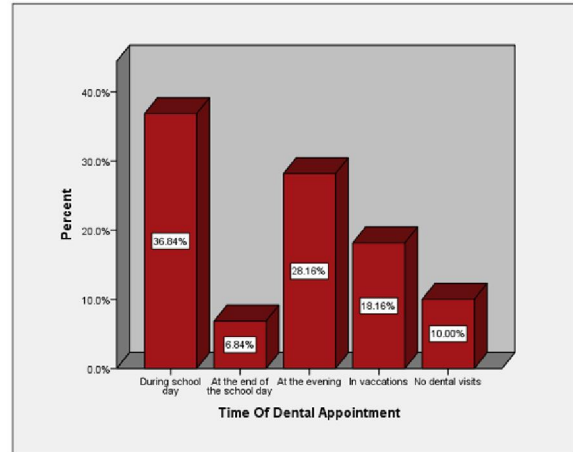


Figure (3): distribution of study sample according to (time of dental appointment)

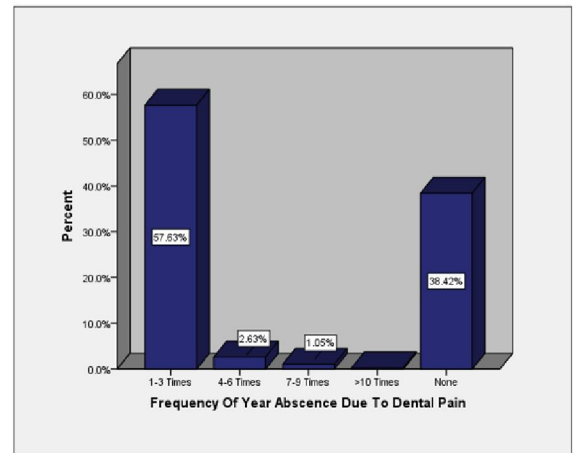


Figure (4): distribution of study sample according to (frequency of year absence due to pain)

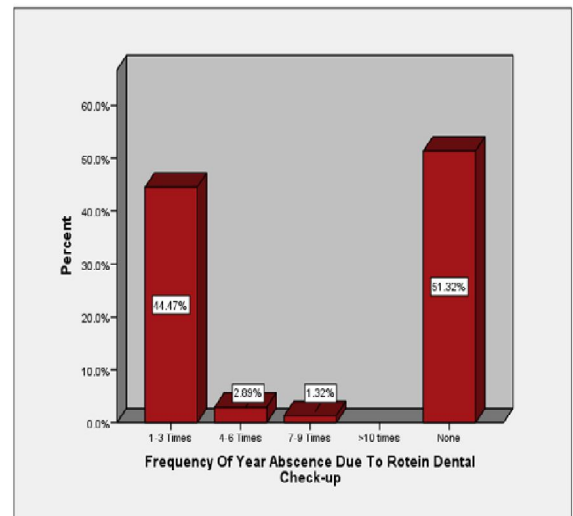


Figure (5): distribution of study sample according to (frequency of year absence due to routine dental checkup)

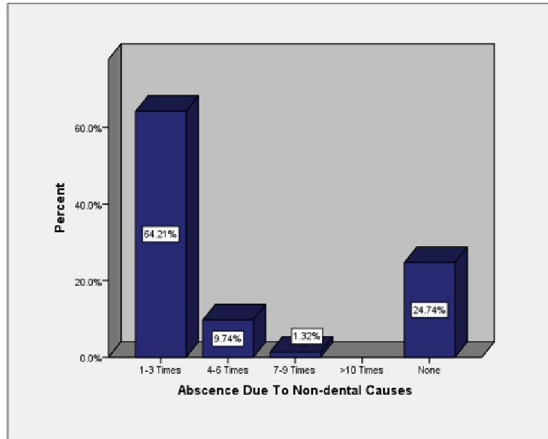


Figure (6): distribution of study sample according to (absence due to non-dental causes)

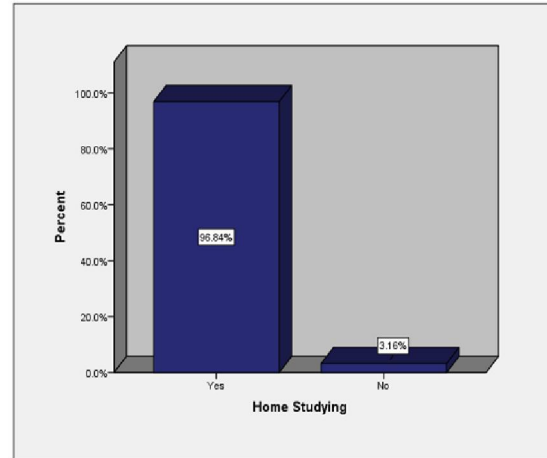


Figure (7): distribution of study sample according to (home studying)

Table 3: distribution of study sample according to (dmft/DMFT)

	dmft				DMFT			
	Frequency	Percent	Valid percent	Cumulative percent	Frequency	Percent	Valid percent	Cumulative percent
Low(0-4)	196	51.6	63.0	63.0	251	66.1	68.4	68.4
Moderate (5-9)	99	26.1	31.8	94.9	86	22.6	23.4	91.8
High (>9)	16	4.2	5.1	100.0	30	7.9	8.2	100.0
Total	311	81.8	100.0		367	96.6	100.0	
Missing system	69	18.2			13	3.4		
Total	380	100.0			380	100.0		

Table (4): distribution of study sample according to (academic Performance)

	Frequency	Percent
Poor	49	12.9
Accepted	57	15.0
Good	91	23.9
Very Good	67	17.6
Excellent	116	30.5
Total	380	100.0

Table 5: association between academic performance and dmft/DMFT

Academic Performance	Academic Performance			
	Pearson Correlation	dmft	DMFT	
	Sig. (2-tailed)	.150 **	.008	-.119*
N	380	311	367	

Table 6: association between absenteeism and dmft/DMFT

Absenteeism	Absenteeism			
	Pearson Correlation	dmft	DMFT	
	Sig. (2-tailed)	.021	.712	.975
N	380	311	367	

4. Discussion

The present study examined the impact of Early Childhood caries on the academic performance of children, aiming to address a chronic wide-spread disease in Sudan which has not been given enough insight despite its occurrence.

Al-Sahafa district was chosen as a representative of the target population as it is a big and heterogeneous area which serves as a good representative.

This study was conducted by examination and a self-reported questionnaire. The sample size was 385 basic level students. Five of them were excluded due

to the fact that four of them complained of diseases (epilepsy, cleft lip and palate, hearing complication and vision problems) and the last one is excluded from the study criteria (age > 15 years).

One of the most important ways to prevent dental caries from occurring is by regular dental check-ups. It prevents the child from suffering from pain that is accompanied by caries when not detected at its early stages, as prevention is always better than cure. However most of the study population (82.37%) don't visit the dentist for routine check-ups for various reasons, financial disabilities was found to be the mainstream for ignoring routine checkup and this could be due to the fact that the study was carried out in an under developed country, this followed by a minority whom ignore routine check-ups for a diversity of other reasons such as absence of pain and caries. This reflects the lack of knowledge of the parents or guardians on this matter as examination revealed presence of caries. The lack of awareness of the parents could be because they don't have the appropriate knowledge or tools to detect caries at their early stages.

Some (36.84%) of the study population attend to their dental visits during school hours which causes them to miss valuable school hours and fall behind from their colleagues. About 1-3 school days were missed during the academic year due to dental pain (57.6%), routine check-up (44.47%) and 64.21% were absent due to non-dental causes. This absence could have a recognizable impact on the academic aspect of the child's life therefore one of the aims was to study the association between absenteeism and the academic performance of the child. However school absences caused by pain or infection were not found to be significant in relation to academic performance. This could be explained by considering that students receive home studying guided by parents which was also confirmed by our study as the results showed that 96.84% revise at home with their guardians meanwhile only 3.16% don't revise at home which can no doubt improve the academic performance. These findings underscore the likelihood that school absence is not a stand-alone factor in considerations of school performance, providing further evidence that children experiencing pain or infection may have a diminished educational experience because their discomfort may inhibit their ability to perform well while at school. Then again, students could be suffering from dental pain yet they still attend even though they might find it difficult in paying attention in class and in performing their classwork. On the other hand dental caries has a diversity of impacts as it is a chronic disease, if left untreated will lead to pain and infection which can lead to further difficulties in eating, sleeping and learning.⁽⁴⁴⁾ Other effects could be

loss of weight, malnutrition due to difficulty in eating because of stimulated pain and might even lead to anemia on the long run as well as restriction of daily activities and last but not least esthetic disturbance especially if affecting the anterior teeth.

The main aim in this study was to study the effect of dental caries on the academic performance of school children aged 5-15 years. The presence of dental caries was examined using the WHO criteria for dmft and accordingly the majority of the sample size was found to have low dmft/DMFT (0-4). These findings highlight the importance of prevention and treatment of dental caries not only to reduce dental pain but also to improve the likely extended benefits for child educational achievement. A fact that our findings proved accurate as the majority had low dmft/Dmft yet significance was found in association to school performance. This finding is in accordance to the study conducted by some Investigators whom performed clinical dental examinations on students and matched their dental health data with academic achievement and attendance records provided by the school district. They found that children who had toothaches in the past 6 months were almost 4 times more likely to have a grade point average that was lower than the students without a recent toothache.⁽⁴⁵⁾

This study is agreement with another study carried out by Garg N, Anandakrishna L and Chandra P in India in the year 2012 to assess the impact of poor oral health (assessed using df-t index) on school performance (assessed by marks obtained) in which the students were divided into categories based on their marks excellent, average and below average and was found to be statistically significant (p value < 0.001).⁽⁴⁶⁾

Before undergoing this study, it was assumed that caries had an effect on a child's school performance, however, upon completing this study this assumption was confirmed to be true. Thus, it is strongly recommended that more effort should be done in this topic, and more studies should be done in depth to provide more information and increase awareness. The limitation of this study is that it has been conducted in a limited area in Khartoum. More reliable results could be obtained if it is generalized to a wider area in Khartoum state to include more school children.

5. Conclusion:

This study shows that dental caries has an impact on the academic performance. No association was found between absenteeism due to dental problem and academic performance.

We declare that we do not have any conflict of interest in conduction of our research

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