



## Dental Caries Experience in 12-Year-Old Schoolchildren and Evaluation of The Role of Socioeconomic Variables in Wadmedani Elkobra Locality Sudan (2015)

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### ABSTRACT

*Few studies have investigated the prevalence of dental caries among school children in the past decades in Sudan rendering it difficult to understand the status and pattern of oral health.*

#### Methods

*A school-based cross sectional study was conducted using stratified random cluster sampling in Wadmedani Elkobra locality, Gazira state, which is located in the centre of Sudan.*

*Data was collected through interviews and clinical examination by a single examiner. DMFT was measured according to WHO criteria and data was analyzed using SPSS.*

#### Results

*The mean DMFT for 12-year-olds was found to be 1.17(SD=1.26) with a significant caries index (SiC) of 2.66. Female gender had significantly higher DMFT (1.4) when compared to male gender (0.94). Caries free was 41.38 % (n=331), while the decayed teeth accounted for the largest component of DMFT 97.76%, care index (filled) was 1.7% and extracted 2.03 %. Private schools recorded significant higher DMFT compared to public schools (1.43 vs 1.10)  $p > 0.001$ . In chi-square and (phi and cramers) caries experience (DMFT > 0) was found to be statistically significantly and associated with some socioeconomic variables.*

#### Conclusion

*The prevalence of caries was found to be low.*

### KEYWORDS :

#### 1-1 INTRODUCTION:

Dental caries is the single most common chronic disease of childhood, affecting children worldwide of all social and ethnic groups. Although advances in the understanding of oral disease etiology and prevention have led to a general decline in dental caries, these improvements have not benefited all groups equally. For example, overall caries experience among 2-5 year old children has shown a slight increase in the past two decades, and children from low income and ethnic minority households bear a disproportionate burden of disease. Social, environmental, biological and behavioral factors all contribute to the chronic, complex nature of this disease (10).

In spite of a significant decline in some countries, such as United States, Canada, Australia and some European countries, dental caries continues to be an important public health problem in other parts of the world. Dental caries is the most prevalent disease affecting humans, and its incidence is particularly high during childhood. Children have been the target of oral health promotion policies for a long time. There are, however, few population-based studies evaluating the prevalence and progression of dental caries among adolescents and young adults in some countries (28).

There is also a skewed distribution of dental caries in the 12-year-old age range. In fact, part of the 12-year-old individuals have high or very high DMFT index values while the rest have low DMFT index values or are "caries free" (56). Thus, to identify this part of population with high or very high DMFT index values and to target the still caries-susceptible individuals, a new index, named significant caries index (SiC), was proposed by Bratthall (13) (2000) to bring attention to the children with the highest caries scores in a given population. It is represented by the mean DMFT of the one-third of the individuals having the highest of DMFT values in a specific population (56).

According to Baldani, et al. (8) (2004), the polarization of dental caries is a phenomenon associated with economic deprivation. Socioeco-

nom factors have also been identified as risk indicators to the development of dental caries (78) and that several evidences indicate that caries is polarized among underprivileged groups (29, 35, 40, and 83)

In addition, SiC is considered a good indicator to compare the risk of dental caries between different groups (50). Therefore, SiC was chosen in the present study to evaluate which variables were associated with high and very high DMFT index values in 12 yr old children from the locality of Wadmedani Elkobra, Sudan.

An evaluation of variables related to self-perceived oral health was made because recent evidence have shown that self-perceived need for dental care is strongly associated with fractured fillings, cavities and tooth mobility.

#### 1-2 Rationale:

World wise, the 12 yr old children are no longer a target for epidemiological surveys and preventive programs in oral health.

- In Sudan, few researches related to oral health were conducted in school children and fewer in Wadmedani Elkobra locality.
- children are the part of population most susceptible to dental caries and also the most benefited from prevention programs.
- Improvement in oral health and reduction in DMFT can be attaining by preventive programs (School oral health programs) mainly, rather than curative alone.

#### 1-3 General objectives:

The main purpose of this study is to estimate the prevalence of dental caries using DMFT in 12yr old school children, in Wadmedani Ekobra locality.

#### Specific objectives:

- To evaluate the prevalence of caries-free children using DMFT.
- To calculate the significant caries (SiC) indexes in different caries prevalence children living in Wadmedani Elkobra locality, Sudan.

- To evaluate the role of socioeconomic variables and self-perceived oral health measures in the polarization of dental caries in 12 years old school groups in primary schools.
- To assess the care index.
- To evaluate treatment needed for children.

## Chapter two: Literature review

### Dental caries is defined as:

A destructive process causing decalcification of the tooth enamel and leading to continued destruction of enamel and dentin, and cavitations of the tooth (60).

### 2-1 Etiology of dental caries

#### 2-1-1 Dental plaque and caries:

Dental plaque is an example of a biofilm; thus dental plaque is the community of microorganisms found on a tooth surface as a biofilm, embedded in a matrix of polymers of host and bacterial origin. Plaque is natural and contributes to the normal development of the physiology and defenses of the host (48).

Few microorganisms found in the oral cavity are able to adhere to the teeth and, among these, a limited group is cariogenic. The specific cariogenic microbiota consists of *Streptococcus mutans*, *Lactobacillus* and some *Actinomyces* species. However, during the initial phase of caries disease *S. mutans* is the most frequently associated micro-organism. *S. mutans* has the ability to adhere to teeth and survive in acid environment. Clinical studies have shown that the caries is associated with an increase in the proportions of acidogenic (acid-producing) and acid-uric (acid-tolerating) bacteria, especially mutans streptococci (such as *Streptococcus mutans* and *Streptococcus sobrinus*) and *Lactobacilli*, which are capable of demineralizing enamel<sup>(41)</sup>. Bifidobacteria are also being recognized as potential cariogenic bacteria in advanced lesions. However, although mutans streptococci are implicated strongly with caries, the association is not unique; caries can occur in the apparent absence of these species, while mutans streptococci can persist without evidence of detectable demineralization. In such circumstances, some acidogenic, non-mutans streptococci are implicated with disease.<sup>(41,48,60)</sup>

#### 2-1-2 Source of Cariogenic Pathogens:

Most pathogens associated with conventional medical infections are not normally found in the host in health. They are acquired exogenously by ingestion, inoculation, inhalation, or direct contact. In caries, early studies using conventional bacterial culturing techniques often failed to recover putative pathogens from healthy sites. However, the recent application of more sensitive molecular techniques has led to the frequent detection of low levels of mutans streptococci at a wide range of healthy sites (76). Bacterial typing schemes have shown that identical strains of putative cariogenic bacteria can be found in the plaque of mothers (or close caregivers) and infants, implying vertical transmission of such bacteria (76).

#### 2-1-3 Current Hypotheses to Explain the Role of Plaque bacteria:

Two main schools of thought exist on the role of plaque bacteria in the etiology of caries and periodontal diseases. The "Specific Plaque Hypothesis" proposed that out of the diverse collection of organisms comprising the resident plaque micro flora, only a few species are involved in disease activity. This proposal focused on controlling disease by targeting preventative measures and treatment against a limited number of organisms. In contrast, the "Non-Specific Plaque Hypothesis" considered that disease is the outcome of the overall activity of the total plaque micro flora. In this way, a heterogeneous mixture of microorganisms could play a role in disease.<sup>(68)</sup>

More recently, another hypothesis has been proposed (the "Ecological Plaque Hypothesis") that reconciles the key elements of the earlier two hypotheses. Cariogenic bacteria organisms are only weakly competitive at neutral pH and are present, therefore, as a small proportion of the total plaque community. In this situation, with a conventional diet, the levels of such potentially cariogenic bacteria appear clinically insignificant and the processes of demineralization and remineralization are in equilibrium. If the frequency of fermentable carbohydrate intake increases, longer intervals of low pH persist leading to enamel demineralization (approximately a pH of 5.5).<sup>(77)</sup> The effect of low pH on the microbial ecology of plaque is twofold. First, low pH most

favors the proliferation of acid-tolerating (and acidogenic) bacteria (including mutans streptococci and *Lactobacilli*), while encouraging tooth demineralization. Greater numbers of bacteria such as mutans streptococci and *Lactobacilli* in plaque result in acid being produced at faster rates, thereby enhancing demineralization further. Other bacteria also may produce acid under similar conditions yet at a slower rate, but may be responsible for the initial stages of demineralization, or could cause frank lesions even in the absence of more aggressive cariogenic species in a susceptible host. If aciduric species were not present initially, then the repeated conditions of low pH coupled with the inhibition of competing organisms may increase the likelihood of successful colonization by mutans streptococci or *Lactobacilli*. This general and variable sequence of events helps explain the microbial etiology of caries and the pattern of bacterial succession observed during lesion progression in many clinical studies. Key features of this hypothesis are that (a) the selection of "pathogenic" bacteria is coupled with changes in the environment directly and (b) diseases need not have a specific etiology; any species with relevant traits could contribute to the disease process. Thus, mutans streptococci are among the best adapted organisms to the cariogenic environment (high sugar/low pH), but such traits are not unique to these bacteria. Strains of other species share some of these properties and, therefore, may contribute to enamel demineralization. A key element of the ecological plaque hypothesis is that disease can be prevented not only by targeting the putative pathogens directly, eg, by antimicrobial or anti-adhesive strategies, but also by interfering with the selection pressures responsible for their enrichment.<sup>(48, 58)</sup>

#### 2-2 Impact of dental caries on individual & society:

Impact of poor oral health is detrimental for children because it affects their nutrition, growth and development [19]. Childhood oral disease, if untreated, can lead to pain, development of dento-facial anomalies and other serious health problems, like severe toothache, oral abscess, destruction of bone, and spread of infection via the bloodstream [8,20]. Poor children have nearly 12 times more restricted activity days (poor school attendance) because of dental - related illness than children from higher-income families. Dental caries may affect a child's eating habits and nutritional intake, potentially influencing growth and early childhood development, speaking and school readiness [82]. Caries and its complications affect the quality of life, both physically and physiologically [75]. The premature loss of primary teeth may result in a variety of adverse consequences, such as gastrointestinal disorders, esthetic and psychological problems. Besides, early childhood caries dramatically increases a child's risk for future dental caries [75].

#### 2-3 Risk assessment & prediction for dental caries:

Risk means the probability that an individual will develop dental disease, in a certain period. The risk of dental disease can be assessed by knowing and analyzing all related factors, behavioral or biological. So, due to the multi factorial etiology of dental caries; host, micro flora, diet and time, risk should be assessed by analyzing and integrating several causative factors (69).

"Risk assessment" is used by the clinicians to know what happens to their patients with different risk factors while "prediction" is used by researchers who are trying to predict future disease development. Caries activity (the rate of caries progress in teeth) may be impossible to predict accurately in a population with low disease prevalence (53).

On average, clinicians should predict caries by using clinical and socio-demographic information. In some studies the clinicians based their risk assessments mainly on children's past caries experience, as was also shown in two Finnish studies by Vehkalahti et al. (1997(87)). Past caries experience has been widely confirmed as the best predictor of future caries in children (33).

#### 2.4 Trends in oral health, dental prevention & situation analysis in Sudan:

##### 2.4.1 Trends in oral health:

The improvement in the oral health of children and adults in industrialized countries during the last few decades has been widely reported (4, 17, 36, 37,80and 98) and has been described as "dramatic", "marked", and "substantial" (26). Age-specific analyses from 1966 to 1983 in Norway showed that the caries decline among the 6- to 17-year-olds started at different points of time in various age-groups:

for the 8- to 11- and the 17-year-olds in the late sixties, and for the remaining age-groups after 1971 (11). In Helsinki, the caries decline among children and adolescents was sharp from 1976 to 1986, but very little further reduction has taken place since then (85, 87).

Although the reduction in the mean values of DMFT at the population level gives the impression that caries is no longer a major public health problem, this impression is false.

In the era of high prevalence, caries were described using DMFT indices for age-groups. Nowadays, these indices include an increasing number of caries-free subjects and, on the other hand, only a few high-caries subjects. As this skewed distribution of caries means a high proportion of lesions concentrated in relatively few subjects, therefore, mean DMFT and DT+dt indices should not be used as a data basis when updating preventive strategies (87). Instead, attention should be paid to population distributions within these DMFT and DT+dt indices (13, 85). In Australia, the DMFT index for 12-year-olds was normally distributed in 1977, the mode being DMFT=4, but in 1993, the distribution was uni-modal, with the mode being DMFT=0. In two Finnish towns a strongly skewed distribution of DMFS was seen in 1992-1998, the highest quartile of the 12-year-olds accounting for 79%, and of 15-year-olds for 67% of all DMFS (74). In 1993, 8% of Helsinki 5-year-olds accounted for 76% of all DT+dt in that age-group, and correspondingly for 15-year-olds, 10% accounted for 55% of all decayed teeth (87).

Northern Ireland (N.I.) has the worst oral health in the United Kingdom (U.K.) and its children have among the highest levels of tooth decay in Europe (DHSSPS, 2007)(45). In 2003, 73% of 12 year olds had obvious decay experience in their permanent teeth, compared to the 43% UK average (96), also N.I. is the most deprived country in the UK (DHSSPS, 2007) (45), studies have shown that children from lower socio-economic backgrounds in the UK are more likely to commence tooth brushing later in life and to brush less frequently. Although the oral health status of the US population has greatly improved over the last 30 years, profound and growing disparities exist among certain populations.<sup>(61,62)</sup> The most disadvantaged include people of color, the working-class poor, and people with chronic illnesses and disabilities. National, state, and local data to accurately quantify the nature and magnitude of these disparities in oral health are notably lacking.<sup>(1)</sup>

The surgeon general's report *Oral Health in America* calls for new efforts to eliminate disparities in oral health status and rates of oral disease. In particular, it uncovers the hidden epidemic of dental and oral diseases that largely affects poor people of color and those with chronic illnesses and disabilities.<sup>(61)</sup> The report also stresses the serious consequences that poor oral health has on overall health and well-being. Oral health disparities have been attributed in part to differences in the utilization of oral health services and access to primary oral health care.<sup>(54,84)</sup>

#### 2.4.2 Trends in dental prevention:

After detecting the role of fluorides in caries prevention, fluoride was first added to piped water, starting in 1945 in Grand Rapids, Michigan, and from the early 1970s to toothpaste, leading to substantial caries decline (51). The use of fluoride toothpaste was the only clear and positive common denominator in the reports of 52 dental experts who were questioned about the impact of various possible caries preventive factors on the decline of caries in children and adolescents. In addition, improvement in dental health during the past 30 yrs has been related to improvements in social, economic and environmental factors (9). Due to the multi-factorial origin of caries, it seems that conclusive scientific evidence for the reasons behind caries decline will be hard to present.

Dental prevention measures were established at a time when caries was a common public health (86, 95). In the present era of low and stable occurrence, dental caries cannot be prevented totally, but it can be controlled. For dental prevention, several in-office measures with clinically proven effectiveness have been available: use of fluorides, sealing of fissures, use of xylitol and chlorhexidine, and professional tooth cleaning, scaling, and root planning (66). From among these, clinicians and dental administrators select the appropriate methods for each target population, leading, for example in Denmark, Iceland, Norway, and Sweden, to a wide variety of measures taken to

improve dental health, but resulting in similar caries declines (89). Another systematic review of reviews by Rozier (70) covering the period from 1980 to 2000 revealed good evidence for the effectiveness of fluoride gels and varnishes, chlorhexidine, and sealants as regards caries prevention in the permanent teeth of children and adolescents. In Sweden, a systematic review of caries-preventive methods extracted from the Medline database from 1966 to 2001 gave strong scientific evidence only for daily use of fluoride toothpaste in children and adolescents (72).

#### Since the 1990s, criticism has tended to be focused on

- Ineffective fluoride mouth rinsing programs are still being conducted in some schools (89),
- Dental health education interventions have no discernible effect on caries incidence, and introduce suggestions for improvement includes:
  - Re-confirmation of the purpose of caries prevention, and
  - A clear oral health policy, including prevention-based care (17).

Lately, the term "preservative dentistry" has gained in popularity, thus taking into account the modern management of caries as an infectious disease. Preservative dentistry tries to avoid or delay operative intervention as long as possible (26). Although new innovations, such as the use of xylitol and antibacterial chemotherapeutic agents, can improve oral hygiene, they also have their limitations. Despite the fact that its clinical efficacy is still under discussion (72), the use of xylitol to prevent caries saves dental resources (42).

#### 2-4-3 Situation analysis in Sudan:

Sudan, a large African country by size, has more than 500 ethnic groups with diversity in language and culture. Approximated 33.42 million is the total population with 37.6% living in urban areas. Children less than 15-years of age are estimated to be 41.3% of the total inhabitants [2].

Worldwide, dental caries with considerable variations in its occurrence between countries, regions within countries, areas within regions and within social and ethnic groups [23]. A few studies investigated the prevalence of dental caries in the Sudan in the past two decades. In 1986, DMFT values were found to be 2.9, 3.2 and 2.3 in 12-year-old urban and rural and 11-year-old semi urban children, respectively [38]. Two years later, another study found that the DMFT rose to 3.2 in the total sample examined [6]. In 1993, Raadal et al. found the mean dmft to be 1.68 in the preschool group and 2.77 in the school group. However, the mean DMFS was 2.08 in the preschool and 3.78 in the school group [67]. All the above investigations were conducted in Khartoum city.

#### 2-5 Oral health knowledge, attitude and behaviors:

Providing children with skills to improve knowledge, attitudes and behaviors to enable them to make healthy decisions, increases the likelihood of establishing healthy lifetime habits (WHO (98)). Several policy documents and authors have recommended that oral health promotion should take place in schools (21, 28, and 64). The WHO in particular provide very strong evidence for the need to make oral health promotion a part of the school curriculum.

Despite the WHO review and recommendations there continues to be a lack of oral health promotion delivered within the schools. In fact, oral health interventions have traditionally been based on informal conceptualizations lacking psychological models or theory (15), focusing on clinical outcomes such as plaque levels or gingival bleeding rather than attitudinal and behavioral outcomes (15, 91). Furthermore, there is no evidence to support the effectiveness of one type of intervention approach over another (91). In fact, Watt (90), Watt & Marinho (91) and WHO (97) consider the evidence base of oral health interventions and conclude that the design and evaluation quality are generally poor.

#### 2-6 Dental prevention

##### 2.6.1 Dental prevention approaches:

##### 2.6.1.1 A population strategy:

A population strategy in dental prevention envisions preventive measures for an entire target group or population and is feasible when the prevalence of dental diseases in the population is high. A population strategy attempts to control the causes of the incidence in

order to lower the mean level of risk factors in that population.

**2.6.1.2 A high-risk strategy:**

A high-risk strategy seeks to protect susceptible individuals, whereas a population strategy seeks to control the causes of incidence of diseases. This means that the individuals at high risk of dental diseases must first be identified in order to design preventive measures for them. Following the rapid decline in caries occurrence, a strong polarization in caries occurrence has been observed among child and youth populations (87). A high-risk strategy has been promoted in countries where caries is strongly polarized (73).

**2.6.1.3A combined population and high-risk strategy:**

Adoption of a high-risk strategy should not exclude the application of a population strategy and *vice versa*. In appropriate circumstances both strategies should be used together. In Sweden, preventive measures in public dental clinics were taken on the basis of a high-risk strategy by 49% of the clinics, while 50% of the clinics preferred a combination of high-risk and population strategy, which is in line with a suggestion that major shifts from a population strategy to a high-risk approach, should be implemented with Caution (32).

**2.6.2 Dental prevention in relation to scientific knowledge:**

Professional dental prevention should be based on scientific evidence and should reflect the actual needs of the patients. Some dental prevention measures consumed resources.

1995 and 1996, oral hygiene education was the most frequently provided method of dental prevention, followed by dietary advice and information on the use of fluorides (43).

**2.6.3 Costs and targeting of dental prevention:**

The decrease in the occurrence of dental diseases has been reflected as an increase of the costs per saved tooth or surface. The costs should be kept in mind because dental diseases are among the most expensive disease entities. The purpose of dental prevention is to produce health gains, not to save money, but the latter will also be achieved if the targeting is adequate. To avoid wasting resources, dental prevention needs careful consideration as to when, for whom and by which personnel are carried out.

Targeting in preventive dentistry means; controlling dental diseases in a cost-effective manner and concentrating the preventive resources on the patients who need them most. However, targeting seems to have been effective in "geographic pockets", i.e., in low socio-economic areas with high caries levels in a generally low-caries area. (71)

**2.6.4 Strategy Appraisal of dental prevention:**

The four most accepted measures for prevention of dental caries and its complications are: oral hygiene, dietary counseling, fluoride, and fissure sealant. The first two measures do not require much expenditure. They can be implemented in any place via an educational program which does not require significant financial and human resources. Good hygiene and diet can prevent periodontal disease and dental caries [81].

The most important means of maintaining oral hygiene is using a toothbrush. Tooth brushing at least twice daily with a small headed, medium hardness brush will help to reduce caries if fluoride toothpaste is used [22]. However, tooth brushing removes plaque only from smooth dental surfaces and not from the depths of contact areas, pits and fissures; more effective interdental removal requires regular flossing (some flosses also contain fluoride) [22].

Diet also plays an important role in preventing caries [94]. Sugars, particularly non-milk sugars, in items other than fresh fruits and vegetables, are the major dietary causes of caries [49].

Frequency of intake is more important than the amount because the risk is approximately the same for small or big portions of food [49, 75, and 94]. Because of the risk of erosion as well as of caries, frequent consumption of carbonated and cola type drinks should be discouraged. Water, milk, and sugar-free fruit juices are preferred options for children [49, 75].

Ideally, oral health programs should be carried out for the entire population. However, in case of limited time and resources children are the preferred target. First, it is easier to change their habits and to teach them to use oral hygiene measure. Second, once they get accustomed to these habits they will keep them throughout their lives.

Adults have mostly problems that require treatment rather than prevention. This does not decrease the importance of prevention for older people, but working with children can have more significant impact. Effective strategies to reduce risk by modifying the diet of children are not readily applicable to dental practice, nor are they typically effective. For example, the use of xylitol is particularly attractive because its action is not dependent upon reducing the amount of other sugars in the diet [47]. Xylitol-containing products have the potential to improve success in controlling the problem of rampant decay in the primary dentition [47].

A number of studies conducted among schoolchildren of various ages have shown that consumption of gum containing xylitol reduces the rates of dental decay in the treatment groups. Increasing use and higher doses lead to greater reductions. A major limitation in extending this approach is that chewing gum is not considered safe for very small children and is actively discouraged in school.

The socio-economic difficulties and limited public awareness of the importance of preventive dental care make it difficult to improve oral health, especially in rural areas. That most people do not visit a dentist for regular check-ups and even ignore mild toothache; they visit only when they have severe symptoms, e. g. unbearable pain [79].

Studies conducted showed that the knowledge level of children about the importance of oral health is poor [5,79], so there is a strong need to develop educational programs, which are easy to implement and of high effectiveness [68,91]. For example, a study implemented among 4-6-age children showed that a short (15 minutes), school-based oral hygiene educational intervention during a four week period may significantly influence children's oral health promotion (68).

**2.6.4.1 Fluoride:**

Water fluoridation was first introduced as a community based caries preventive measure in the mid-1940s. However the fluoridation of the public water since the 1970s and the massive use of fluoridated dentifrices from the 1980s are scientifically recognized as the main responsible factors for dental caries decline in the last decades [50].

In spite of this, a heterogeneous distribution of dental caries has been observed, in which high disease levels have been identified in a minority of individuals(3).

**Is Systemic Fluoride Supplementation for Dental Caries Prevention in Children Still Justifiable?**

Benefits and risks of fluoride with respect to possible over intake (due to multiple sources) resulting in dental fluorosis are evaluated.

It was assumed first that fluoride produced most of its cariostatic effects through pre-eruptive effects and ingestion in the early years of life was thus considered essential for a full range of fluoride benefits.

Fluoride dietary supplements are manufactured as tablets or drops, intended to be swallowed, as tablets for chewing or lozenges intended to be sucked slowly or to dissolve slowly in the mouth. Supplements contain a measured amount of fluoride, typically 0.25 mg, 0.5 mg, or 1.0 mg, usually as sodium fluoride, but sometimes as acidulated phosphate fluoride, potassium fluoride, or calcium fluoride.

**– Former recommended administration schedules for fluoride Supplements in several European countries (mg F/day) [1993].**

Child's age	0-1	1-2	2-3	3-4	4-5	5-6	6+
France	0.25	0.25	0.5	0.50	0.75	0.75	1.0
Switzerland	0.25	0.25	0.5	0.50	0.75	0.75	1.0
Germany	0.25	0.25	0.5	0.75	0.75	0.75	1.0

Scientific evidence (well conducted clinical trials) now favors the efficacy of fluoride's post eruptive effects in cario-stasis, especially when the supplements were used topically by chewing or slow dissolution in the mouth, which has led to a re-evaluation of the "systemic" benefits of fluoride (50).

**Supplements and risk of fluorosis:**

What has come to be called the "critical period" for the development of fluorosis is the late secretion-early maturation period of pre-eruptive dental enamel. While fluorosis can develop at any stage of pre-eruptive development under certain conditions, in this critical period the developing enamel is especially sensitive to ingested fluoride [14, 24].

There have been some reports, in which no association was found between supplement use and the development of fluorosis [39]. A number of studies also reported fluorosis among patients who ingested 0.5 mg or 1.0 mg of fluoride supplements daily from infancy [39].

In high concentrations, fluoride is toxic. Ingesting 3–5 mg/kg may cause symptoms to appear, while the estimated lethal dose is 5–10 g (32–64 mg/kg) in adults and 16 mg/kg in children (59). A toxic dose that may lead to adverse health effects is estimated at 3 to 5 mg/kg (58). Ingestion of fluoride can produce gastrointestinal discomfort at doses at least 15 to 20 times lower (0.2–0.3 mg/kg) than lethal doses (12).

U.S. government officials lowered its recommended levels to 0.7 milligrams of fluoride per liter of water -- the lower limit of the current recommended range of 0.7 to 1.2 milligrams (55).

**Excess fluoride consumption has been studied as a factor in the following:**

- A weakening of bones or skeletal fluorosis, adverse effects on the kidney and some studies suggest negative effects on the liver at chronic ingestion of 23 mg/day (55).

Little research has been done on possible liver damage<sup>(55)(292)</sup>

Chromosomal damage and interference with DNA repair.<sup>(55) 304</sup>

The evidence is clear that fluoride supplements, when ingested prior to tooth eruption, are a risk factor for dental fluorosis and preferable to start with fluoride supplementation (if necessary) at the age of three years. The amount of fluoride in early childhood, which would lead to fluorosis, was originally estimated to be 0.1 mg F/kg body weight/day. Since then this estimate has been revised downward, with 0.03 F/kg body weight/day; being the lowest suggested limit (24).

In some parts of Europe a similar situation may exist, where 0.4–0.6 mg F/day is being ingested by a child under 3 years of age, regardless of the source of fluoride, it is likely to be enough to cause fluorosis. Adding more from the supplements would only make the problem worse while adding no cariostatic benefits. When considering the risk/benefit ratio of fluoride supplements, total fluoride ingestion from all sources must be kept in mind. Enamel opacities seen in permanent teeth in young children represent the mildest form of the fluorosis. There is now evidence that the public may be more aware of very mild fluorosis than have previously been imagined [39 and 65].

**Newer recommended administration schedule for fluoride Supplements.**

**Ideal Daily Fluoride Dosages**

Ages	Fluoride Content of Drinking Water		
	0 ppm-0.3 ppm	0.3 ppm-0.6 ppm	>0.6 ppm
6 mo.-3 yrs.	0.25mg F	0	0
3-6 yrs	0.5 F	.25mg F	0
6-16 yrs.	1.0mg F	0.5mg F	0

It has been suggested that when fluoride tablets are swallowed, the fluoride returned via the plasma to the saliva may be sufficient to provide a "topical" benefit. Examination of work by Ekstrand and co-workers [24] shows that only a transient elevation of plasma fluoride occurs. This further supports the need to use fluoride supplements directly as a topical fluoride delivery mechanism if they are to be effective [93].

As a conclusion, the anti-caries effects of fluoride are primarily topical for children and for adults. The mechanisms of action of fluoride include the inhibition of demineralization on crystal surfaces, enhancement of re-mineralization on crystal surfaces, and inhibition of bacterial activity by inhibition of several key enzymes, especially those involved in glycolysis and in maintaining intracellular pH.<sup>(99)</sup>

Systemic benefits of fluoride are minimal. Therapeutic levels of fluoride can be achieved in drinking water and by topically applied fluoride products. If used, fluoride supplements should be employed as a topical delivery system by chewing or sucking tablets or lozenges for a maximum possible time before swallowing [57,93].

**2.6.4.2 DENTAL SEALANT PROGRAM:**

The Caries patterns are also changing. Eight out of every ten cavities that school children experience occur in the pits and fissures (chewing surfaces) of the teeth. Dental sealants are the most effective means of preventing pit and fissure cavities. Sealants are thin plastic coatings that provide a physical barrier to the bacteria. The United States Public Health Services' National Oral Health Objective for the Year 2010 is that at least 50% of school children will have protective sealants on the chewing surfaces<sup>(84)</sup>

**Income:** Income criteria for identifying the children to be served are considered because children from low income families are at higher risk of having dental disease and receive less dental treatment.

**Age:** The permanent teeth most likely to experience occlusal caries are the first and second permanent molars. First permanent molars erupt into the mouth at about age 6 years. Second permanent molars erupt into the mouth at about 12 to 13 years of age.

**Teeth:** The first and second molars are the targets for sealant programs in most countries (84).

**2.7 Dental indices and check-up intervals:**

**2.7.1 Usability of dental indices as administrative tools:**

Dental indices describing caries and periodontal diseases are used to assess treatment needs on the population level. The DMFT index was originally developed to describe the cumulative caries experience of the permanent teeth of children. The index consists of the number of decayed (DT), missing (MT) and filled (FT) teeth in permanent teeth, and for primary teeth the lower case (dmft) is used. Correspondingly, the DMFS/dmfs indices are defined by surface. DMFT and DMFS can be used so that DT refers to the number of teeth with caries lesions and DS the number of decayed surfaces. The DT+dt index indicates the sum of new dental lesions in permanent and in deciduous teeth. DMFT, DMFS, and DT have their weaknesses: e.g., the severity of the carious lesions is not fully described. In low-caries populations, the M component currently plays no role, because in adolescents there are practically no extractions due to caries (in some countries). Due to the substantial number of missing teeth, the M component for older adults is problematic because the reason for their extraction is not known.

For adults, the D component also presents problems. When two thirds of teeth in adults are treated for reasons other than caries, the filling therapy has weak impact on caries indices in an adult population (18). The main reason for the restorative treatment in 17 to 29 year-olds is primary caries, whereas in patients who are aged 30 or older, secondary caries and fractures of the tooth or restoration with no impact on indices dominate as reasons for restorations (27, 63).

**Calculating DMFT:** The teeth not counted are un-erupted teeth, congenitally missing teeth or supernumerary teeth, teeth removed for reasons other than dental caries, and primary teeth retained in the permanent dentition. Counting the third molars is optional; here in this study third molar was not scored. When a carious lesion(s) or both carious lesion(s) and a restoration are present, the tooth is listed as a D. When a tooth has been extracted due to caries, it is listed as an M. When a permanent or temporary filling is present, or when a filling is defective but not decayed, this is counted as an F. Teeth restored for reasons other than caries are not counted as an F.(5)

Inequalities in caries distribution were measured by the Gini coefficient in some studies. This index indicate perfect inequality with a

coefficient of 1 and perfect equality with a coefficient of 0. It has been used in a way to measure the association between exposure to a risk factor and disease prevalence (16). A higher Gini coefficient means that the risk of disease is more variable amongst the population.

**Limitations of DMF Index:** While DMF indices can provide powerful data and perspectives on dental caries, they can also present some limitations. For one, researchers have noted a significant amount of inter-observer bias and variability. Other criticisms include that the values do not provide any indication as to the number of teeth at risk or data that is useful in estimating treatment needs; that the indices give equal weight to missing, untreated decay, or well-restored teeth; that the indices do not account for teeth lost for reasons other than decay (such as periodontal disease); and that they do not account for sealed teeth since sealants and other cosmetic restorations did not exist in the 1930s when this method was devised (13).

For reasons discussed above, the "Significant Caries Index" (SiC Index) was introduced by Bratthall (13). The SiC index describes the mean DMFT for the third of the population with the highest DMFT scores (i.e., those in the group of subjects of the higher third of caries experience in the sample) and is suggested to be used to target dental prevention to those in need. The SiC index carries the same problems, being based on the use of the DMFT. SiC index was set as the outcome and those subjects with high or very high DMFT values were regarded as "SiC positive" while those with low DMFT or without caries were regarded as "SiC negative" (9, 52).

The CPITN index was designed for rapid and practical assessment of periodontal treatment needs in population surveys and for initial screening of patients receiving regular dental care (52).

**2.7.2 Dental indices in actual practice:** For caries risk assessment the evaluation of various clinical indices by an experienced clinician is adequate (69). Dental indices should be used in planning patient care but this was not the case as shown by a comparison of DMFT indices and the amount of time used for preventive care among children in many countries (89). In 1992, the DT+dt and DMFT indices also showed no association with dental prevention given to high-caries patients (85).

### 2.7.3 Dental indices and check-up intervals

The terms "check-up interval", "examination interval", and "recall interval" refers to the period between two consecutive dental examinations. The term "current recall interval" describes the period since the previous examination until the current examination, and the term "proposed recall interval" the period from completion of the current course of treatment until the next scheduled examination (88). The lengthening of check-up intervals would reduce treatment and examination times for low-caries children by 15% (46,88). Check-up intervals should be based on the individual needs of each patient".

However, no association was found between the length of the interval and the DMFT index scores for 12& 15-year-olds in Finland (44). According to a Finnish expert group, check-up intervals with no elevated caries risk could well be extended to 1.5 to 2 years.

### 2.8 Oral health resources:

The resources available in any country are limited. If land, capital, and manpower are used for one purpose they will not be available for another. Indeed the cost of using them for one purpose is the lost benefit from using them in the best alternative way. This idea of opportunity cost lies at the very heart of economic thinking. Choices have to be made in socio-economic planning between alternative uses of resources. For example, which use of resources would do most for the poor—more health services, more education services? During the 1980s a perception was created in many countries that dental caries had been eradicated. Health administrators were quick to redirect resources to other more urgent preventive programs. When it was realized 20 years later that dental caries had not disappeared, but was now one of the most disabling diseases in childhood, and even when resources are available, decision-makers should to consider essential cost-benefit and cost-effectiveness issues, with proper advice from researchers and practitioners in community dentistry (89).

### 2.9 Oral health manpower:

Without oral health manpower in the appropriate numbers and kinds we cannot hope to address the oral health problems of the population. Traditionally, dental associations have mostly concerned themselves with dentists and have defined dentists as the only independent practitioner that should be educated to address the population's oral health problems. It is not only a question of whether we have dentists or not, it is where they are located, what they are supposed to do, and whether the people who have dental disease will seek dental assistance at the right time. Simply increasing the number of dentists will not solve society's oral health problems. Those ten years after WWII many countries started to produce more dentists. A decade later there were perceived to be too many dentists and dental schools were closed or cut down. During the last 10 years schools have been reopened. So the issue clearly is beyond increasing or reducing the number of dentists; the answer lies in a combination of increased awareness of oral health issues among the general population, a better balance of oral health professionals, and a government commitment to look at public sector funding as necessary. The role of community dentistry caught in the cross fire between society's demands and expectations, because community dentists in research and practice will be expected to assist in building the models and creating the evidence on which the decisions will be made.

## Chapter three (MATERIAL AND METHODS)

### Study area & study population:

Sudan is the second largest African country by size, has more than 500 ethnic groups with diversity in language and culture. Gezira state is one of Republic of Sudan states; it has an estimated population of 3.575 million represented 10.7% of the approximated 33.42 million total populations of Sudan.

Gezira state has seven localities and Wadmedani city is the capital of it; education is officially funded by the government in governmental schools, with total number of primary schools 1977.

Wadmedani Elkobra is one of these localities; it has 158 governmental primary schools (58 boys, 59 girls, 41 mixed) and 59 private primary schools. Number of students in primary schools in Gezira state 694,223 while in Wadmedani Elkobra locality 70,753 students in governmental schools (35,554 boys, 35,199 girls) and 9691 in private schools (3,846 boys & 5,845 girls); distributed in five administrative units. Approximately number of students aged 12yrs in governmental schools and private schools is 8,649 (4,385 boys & 4,264 girls) and 2,420 respectively. 1717 students out of 8,649 in mixed schools (850 boys & 867 girls).

The majority of the primary school children in Wadmedani Elkobra locality are attending governmental schools (88%) while the remaining (12%) are attending private schools. This distribution justified the assumption that most 12-year-old children in Wadmedani Elkobra locality could be found in governmental or private schools.

### 3-1 Study Design and sampling:

It was a cross-sectional school based study; the proposal of which was approved by the Committee of the Faculty of Dentistry of Gezira University.

#### Sampling:

A school-based study was conducted using stratified random cluster sampling. Sampling was randomized and sample size was defined according to WHO criteria and consultation of statistic department Gezira University.

The sample size was calculated by the equation

$$Z \times p \times q$$

*d*

Where Z is the constant of critical value (1.96)

p is an estimated dental caries prevalence in previous studies ( 50%) and d is statistical precision ( 0.05)

The minimum sample size to satisfy these requirements was estimated

ed to be 400 children, but for more precision we duplicated the sample size to be 800 school children.

33 schools were selected randomly; five and six out of them were selected from mixed schools and private schools respectively. Students from each of these 33 schools were also randomly selected using a table of random numbers from the list of students provided by the Department of Education of Wadmedani Elkobra locality. The perfect number of selected schools and school children from each administrative unit was proportional to the population of children studying at each administrative unit in the locality. A two-stage probability proportional to size cluster sampling technique was used [9], taking into consideration school sector (private and governmental), the school density and the distribution of girls and boys.

800 children (400 boy and 400 girl) aged 12 yrs were included in the study after acceptance and permission from ministry of education and school managers of governmental and private schools (626 and 174 students respectively). Equal random sample distribution of male and female students was chosen as follow; governmental school students: 250 boys, 250 girls and 126 from mixed schools (63 boys and 63 girls); while private school students (87 boys and 87 girls). The study assessed DMFT, Self-perceived oral health, access to dental services and socio-demographic variables. Data collection was performed during Jan and Feb 2014.

### 3-2 Inclusion criteria

Children of both genders who meet the following criteria were enrolled in the study:

- Children aged 12 years.
- Consent sent to parents or representative (index 1).
- School administration approval, authorizing the participation of the child in the study.
- Available for taking part in the study.
- The child was accepting examination and the structured interviews carried out.

### Exclusion Criteria

Children under and above 12 yrs & all not fit the inclusion criteria.

The shade below shows the distribution of participants in the five administrative units of Wadmedani Elkobra locality.

locality * Gender Cross tabulation					
		Male	Female		%
locality	Medani Wasat	84	80	164	21%
	Medani Shamal	76	80	156	19%
	Medani Sharig	114	120	234	29%
	Hantoob	86	80	166	21%
	Shabarga	40	40	80	10%
Total		400	400	800	100%

### 3-3 Ethical consideration

Permission to conduct the study was obtained from the Ministry of Education in Wadmedani, the local administration authorities and from the school authorities on behalf of the children (index 2 & index 3).

Consent sent to child parents or representatives.

Children informed by the aims of the study and all children participating in this study enrolled in Oral Health education (instructions on how to perform effective oral hygiene for maintenance of the children's optimal oral health status).

Children who needed treatment were referred to the nearest dental care facility.

### 3-4 Tools of data collection

#### 3-4-1 Questionnaire (interview)

The questionnaires were constructed in English translated to Arabic and back translated for validation (index 4).

#### 3-4-2 Clinical examination methodology

The exam was done with the children seated on chairs under natural light.

All examinations were carried out by only one examiner (I.M) with assistant of another dentist (F.M).

The clinical examinations used for assessing decayed, missed or filled teeth (DMFT index).

Data was recorded on a standardized form (index 5)

**Instruments:** Materials used are disposable dental mirror, explorer probe and gloves.

**3-5: Statistical Analysis:** The DMFT Index is applied to the permanent dentition and is expressed as the total number of teeth that are decayed (D), missing (M), or filled (F) in an individual and scores per individual in this study range from 0 to 28. The status of each tooth was coded using visual-tactile method for analysis.

For the presentation of DMFT index, statistical description was performed to determine DMFT index means, the percentage of caries-free individuals according to gender and the mean participation of each part of this index (decayed, missing and filled teeth).

Percentages of caries-free children and DMFT were used to describe dental caries distribution among children. Significant Caries Index (56) (3) and Care Index (18) are adopted to assess the unequal distribution of dental caries and oral health care.

The Care Index was calculated using the DMFT (The component "F" (filled teeth) was divided by the total of DMFT and multiplied by 100).

Chi square and (phi and cramers) tests were used to study the association between DMFT and socioeconomic variables.

The Microsoft Office Excel 2003 for Windows was used for the entry of some data on oral health status and for creating the charts. All data were statistically processed using SPSS 15.0 for Windows (SPSS Inc., Chicago, IL, USA), with the help of statistician

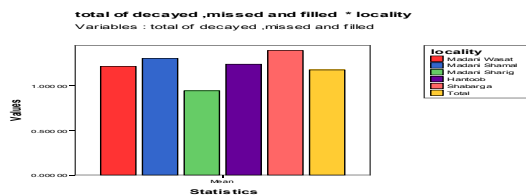
### CHAPTER Four: Results

All participants attended sixth or seventh grade in primary schools. According to data collected from the questionnaire, the most frequency of socioeconomic variables; owned home residence (73%), four or more number of rooms (41.12%), father graduate and postgraduate education (38.63%), farming and industrial father occupation (37.63%), mother primary school education (33.88%), house keeper mother occupation (76.38%), eight or more number of people in home (29.13%) and a car was not available in the family (66.88%).

Table 1 and figure 1 of this study showed DMFT index distribution and a mean of DMFT 1.17 (SD=1.26) among study population in Wadmedani Elkobra locality.

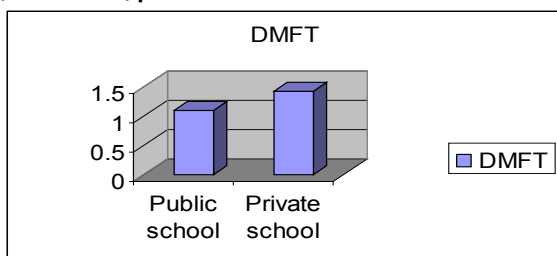
**Table 1: Mean DMFT distribution according to administrative units among school children in Wadmedani locality**

total of decayed ,missed and filled * locality			
locality	Mean	N	Std. Deviation
Medani Wasat	1.21	164	1.22
Medani Shamal	1.3	156	1.32
Medani Sharig	0.94	234	1.25
Hantoob	1.23	166	1.25
Shabarga	1.39	80	1.24
Total	1.17	800	1.26



**Figure1: Mean DMFT distribution according to administrative units among school children in Wadmedani locality**

**Figure 2 discussed that the private schools recorded significant higher DMFT compared to governmental schools (1.43 vs 1.10) p >0.001.**

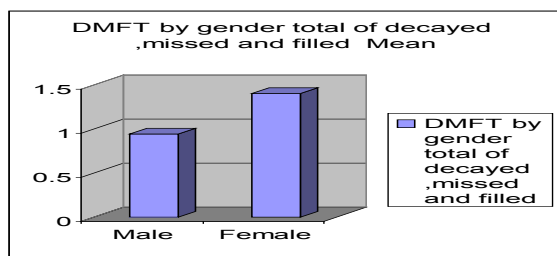


**Figure 2: Mean DMFT distribution in public and private schools**

Table 2 & figure 3 explained that, the girls mean DMFT was 1.4(SD=1.34), showed statistically higher prevalence using chi square (=17.321; p<0.001) than boys mean DMFT 0.94 (SD=1.13).

**Table2: DMFT in relation to gender**

DMFT by gender			
total of decayed ,missed and filled			
Gender	Mean	N	Std. Deviation
Male	0.9425	400	1.134642
Female	1.4025	400	1.343505
Total	1.1725	800	1.26382



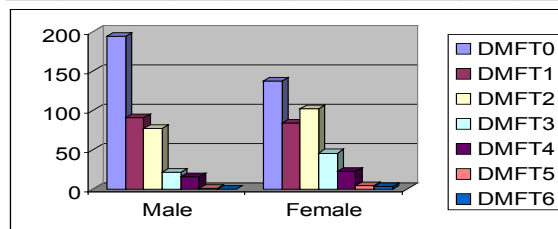
**Figure3: DMFT in relation to gender among study population**

Table 3 & figure 4 show that Caries free was 41.38 % ( n=331), for all participants and also show male compared to female, had high percentage of caries free (45.5% vs 34.25%) according to participants per gender.

It was found that public schools had a significantly higher proportion of students (266 out of 626) with no caries experience (DMFT = 0) than private schools (65 out of 174) (42.5% vs. 37.4%).

**Table 3: Caries free distribution among study population as related to gender**

Gender * DMFT Cross tabulation									
Count	DMFT						Total		
	DMFT0	DMFT1	DMFT2	DMFT3	DMFT4	DMFT5	DMFT6	DMFT0	DMFT10
Gender: Male	194	91	77	21	16	3	0	400	
Female	137	84	102	46	23	5	3	400	
Total	331	175	179	67	39	6	3	800	

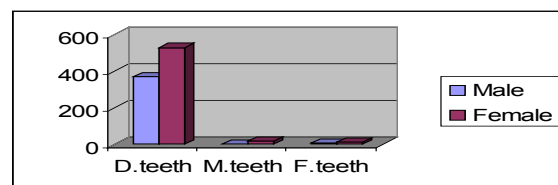


**Figure 4: Caries free distribution among study population as related to gender**

Table 4 & figure 5 discussed the percentage of decayed, missed and filled teeth and presented that the most prevalent component of DMFT was DT (96.27%) followed by MT (2.03%) and FT (1.7%) components. From the whole sample female compared to male, had high percentage of decayed teeth (58.8% vs 41.2% )and missed teeth(94.74% vs 5.26%). Care index (filled) was 1.7%, which represent very low value. Clinical examination recorded only two fillings in female gender, compared to zero in male gender in public schools, while ten fillings recorded in female gender, compared to four in male gender in private schools. These data also confirm female had higher percentage than male (75% vs 25%) in filling components.

**Table 4: the percentage of decayed, missed and filled teeth as related to gender**

Gender	D.teeth	M.teeth	F.teeth	Total
Male	372(41.2%)	1(5.26%)	4(25%)	377
Female	531(58.8%)	18(94.74%)	12(75%)	561
Total	903(96.27%)	19(2.03%)	16(1.7%)	938



**Figure 5: The decayed, missed and filled teeth as related to gender**

As shown in table 5, statistically significant difference found in decayed teeth between female and male (chi-square 27.95; p-value <0.001), while no significant difference found in missed and filled teeth between them (p-value=0.813 and 0.224 respectively).

**Table 5: Using chi-square to test DMFT component statistically in relation to gender**

DMFT	chi-square	df	p-value
D	27.95	6	<0.001
M	0.246	1	0.813
F	2.239	1	0.224

Table 6, shows that; the DT, MT and FT represented 98.1%, 1.6% and 0.3% which reflected the DMFT in governmental school attendees, compared to 91.2%, 3.2% and 5.6% respectively to the DMFT in private school attendees. However, the higher component of filling (F) from private schools (87.5%); while in governmental school (12.5%).



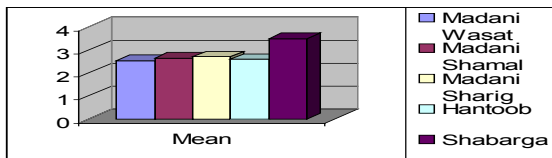
**Table 6: The number and percentage of decayed (D), missed (M) and filled (F) teeth in governmental and private schools**

	Public school	Private school	Total
D	677(98.1%)	226(91.2%)	903(96.3%)
M	11(1.6%)	8(3.2%)	19(2%)
F	2(0.3%)	14(5.6%)	16(1.7%)
Total	690(100%)	248(100%)	938(100%)

Table 7 figure 6 show that, the DMFT for the high caries-level individuals or the polarization group was determined considering a cut-off point of 2.00, with Sic index 2.66 (SD=0.89) among study population.

**Table7: Sic index among study population according to administrate units**

DMFT * locality			
DMFT			
locality	Mean	N	Std. Deviation
Medani Wasat	2.539683	63	0.799705527
Medani Shamal	2.645161	62	0.993367747
Medani Sharig	2.692308	65	0.917249232
Hantoob	2.584615	65	0.788438086
Shabarga	3.5	12	0.797724035
Total	2.655431	267	0.889156958



**Figure 6: Bar chart of Sic index among study population according to administrate units**

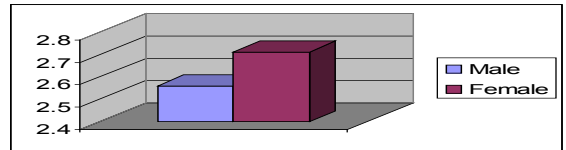
In table 8 and figure 7, the Sic index was 2.71 (SD=.94) for the girls and 2.56 (SD=0.75) for boys.

The value Of Sic index indicated that 75.59% of the disease was concentrated in one third of the sample (total DMFT of Sic index was 709 out of 938).

Furthermore, the Sic was 2.66 for the whole sample and 2.92 and 2.4 for private and public school attendees respectively.

**Table 8: The Sic index according to study population gender**

DMFT * Gender			
DMFT			
Gender	Mean	N	Std. Deviation
Male	2.56	100	0.795441558
Female	2.712575	167	0.938479907
Total	2.655431	267	0.889156958



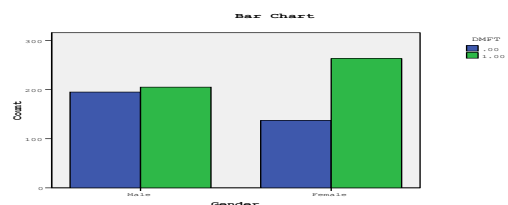
**Figure 7: The Sic index according to study population gender**

Using chi-square and (phi and cramer's) caries experience (DMFT > 0) was found to be statistically significantly and associated with gender, residence, home ownership, father education, mother education, mother occupation, number of people in the family and socioeconomic status.

**Table 9: show the association between DMFT and socio-economic variables using chi and phi**

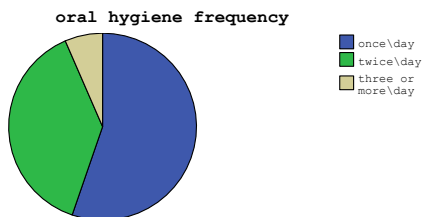
variable	chi-square	df(chi-square)	p value	phi and cramer'sV
gender	17.3	1	<0.001	0.47
residence	57.2	5	<0.001	0.27
home ownership	19.6	10	0.03	0.16
father education	37.6	15	<0.001	0.22
mother education	41.2	15	<0.001	0.23
mother occupation	31.6	20	0.04	0.2
number of people	52.7	15	<0.001	0.26
SES	21.4	12	0.05	0.16
father occupation	30.1	25	0.22	0.19
Number of rooms	11.7	18	0.8	0.12
car in the family	8.22	10	0.6	0.1
oral hygiene frequency	14.5	10	0.15	0.14

Figure 8 presented that, strong association was found to be between DMFT and gender and there was statistically higher mean DMFT in female than male gender



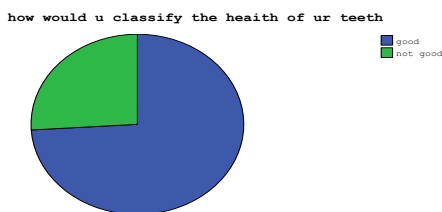
**Figure8: Explained the association between DMFT and gender**

All school children in this study (100%), chose regularly brushing of their teeth; as the method of maintaining good oral hygiene, with frequency once\day (55.25%), twice\day (38.25%) and three or more (6.5%), as shown in figure 9.



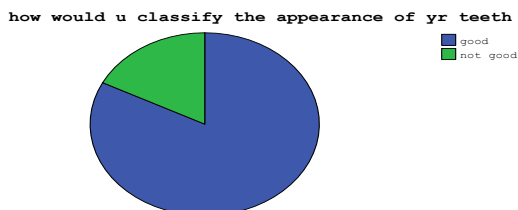
**Figure 9: Distribution of oral hygiene frequency among study population**

Figure 10 shows that the majority of the study school children believed that they were having good oral health (74%), while those not believed that (26%).



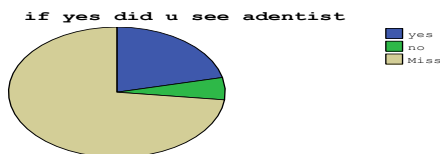
**Figure 10: Classification of students' teeth health**

Figure 11 reported that the higher percentage of students accepted the appearance of their teeth (82%), while those not accepted their teeth appearance (24%). Governmental school attendees reported 'good perception' and 'satisfaction' with oral health more than private school attendees (78.5% vs. 73%).



**Figure11: Classification of students' teeth appearance**

Figure 12 showing that, 73% of participants had no any dental problem during the last year, while 27% had a dental problem (79.2% of them went to a dentist).



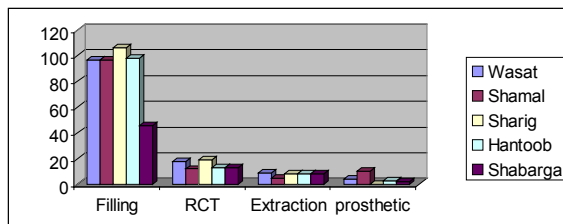
**Figure12: Frequencies of students had dental problem and those went to a dental clinic during last year**

Additional information collected from the clinical examinations; that 49% of school children in the sample had missed (not erupted) permanent teeth (n=392), 0.25% had missed permanent teeth due to trauma (n=2) and 30.12% of the children with retained deciduous teeth.

Table 10 and figure 13 discuss the status of treatment needed by participants as follow ;41.38% needed only preventive strategy, while 58.62% needed curative intervention, which distributed into filling, endodontic treatment, extraction and prosthetic management;

**Table10: status of treatment needed by participants**

treatment locality	Wasat	Shamal	Sharig	Hantooob	Shabar-ga	Total
Filling	97	97	106	98	46	444
RCT	18	12	19	13	13	75
Extraction	9	5	8	8	8	38
prosthetic	4	10	0	3	2	19
Total	128	124	133	122	69	576



**Figure13: bar chat showed treatment needed by participants in various administrate units**

Statistical significant difference was found to be between mean DMFT of rural and urban residence (1.07 vs 0.71).

Concerning home ownership, the mean DMFT of children lived in gifted or governmental house (1.06) was statistically significant higher than those lived in own (0.7) or rent house (0.68); p value =0.034.

The results show that appositive relationship between mean DMFT and father-mother education; graduate and postgraduate had the least mean DMFT, while illiterate had the highest mean DMFT(p value<0.001) for both father and mother education.

The proportion of children having fathers and mothers with high education was found to be significantly higher among private school attendees compared to children attending governmental schools: 66.7% vs. 26.9% and 40.6% vs. 13.6% respectively.

Children of officer women had significantly the least mean DMFT (0.66) compared to other occupations.

Mean DMFT is significantly increase with the increase in number of people in the family, that students in families with eight or more people had the highest mean DMFT (p value <0.001).

High socioeconomic status school children had statistically significant the highest mean DMFT followed by medium, while low SES had the least mean DMFT (p value=0.04).

The results of this study show no significant association between mean DMFT and father occupation, number of rooms, availability of a car and frequency of tooth brushing (p value 0.222; 0.86; 0.6; and 0.152 respectively).

Negligible difference was recorded, when comparing results of students from mixed public with non mixed public schools (p value 0.001); concerning all variables.

**CHAPTER FIVE**

**5-1: Discussion**

This study reported results that can be generalized to all 12-year-old school children residing in Wadmedani Elkobra locality. This locality was selected for its unique properties as it's the capital and the largest city in Gazira state. This age index enabled collation to previous studies about the Sudan and Gezira state, however, comparison of DMFT values was managed with care and acknowledging of the different criteria for inclusion and caries diagnosis.

Results in this study have concluded that the prevalence of dental caries was low (DMFT 1.17) compared with some studies. In 1966 the DMFT of 10 to 14-year-old children was reported to be 0.7 in Sudanese children generally and 1.5 in Khartoum province/state specifically and in 1986, Ibrahim et al reported DMFT values of 6 to 13-year-olds, in three areas within Khartoum province, classified by the authors to urban, semi-urban and rural, of 2.9, 3.2 and 2.3 respectively [38]. Two years later, this was followed by a reported rise of DMFT to 3.2, among a randomly selected sample of school children in Omdurman locality [6]. These authors expressed concern towards an "alarming rise" which suggested that we might find an even higher DMFT value. Ghandour in 1991 showed that in the rural sites examined in the Western, Eastern and Central states, the average DMFT scores were 0.0, 0.2 and 0.1 respectively. This could be considered low compared to those of the Northern state (DMFT=0.9), and especially when compared to Khartoum (DMFT=2.9). This variation was also reflected in the percentage of caries-free children (22% - 100%). Also Ghandour et al (2001) showed that the mean DMFT in Central states in young adults and older people was 2.3 and 3.2 respectively (2).

Study in Gazira state by Dr. Mojahid (2008), showed that, the mean DMFT index was estimated to be 7.56 in urban population, 5.72 in suburban population and 6.42 in the rural population. Considering that age of the population from 13 yrs old and above in previous study.

The DMFT value may have reduced as a result of better oral hygiene and improved dietary habits. Conversely, it may have been underestimated in the field due to the use of natural sunlight for examination and that questionable cases were recorded as negative for caries. A condition that applies to all studies using the DMFT tool is that the WHO criteria for dental caries diagnosis tend to underestimate the need for treatment by overlooking *small and proximal cavities*. In addition to the previous mentioned limitations of the DMFT index, the caries diagnosis methodology in the previously conducted studies was not clear enough to make an absolute comparison.

DMFT prevalence among the 12-year-olds of countries neighbouring the Sudan, reported after the year 2000, were obtained from the WHO Oral Health Country/Area Profile Programme. This study has shown that presently Wadmedani Elkobra locality stands above the lower border of DMFT values (Tanzania and Nigeria (Lagos) who reported a DMFT of 0.3 and 0.46 [96] among 12-year-old children in 2004 and 2003/04 respectively). Saudi Arabia, on the other hand, reported a DMFT of 5.9 in 2002 [96].

SIC was introduced to draw attention to those individuals with the highest caries scores since the caries distribution was observed to be generally skewed. The SIC of 2.66 for the total population is higher than 2 times the mean DMFT (1.17) of this study, same as what reported in other studies [56]. However, it was found to be well below the upper limit of SIC value of 3, which set by the WHO as a global average [93].

According to the published literature on dental caries in Sudan, the dental caries experience (proportion of individuals with DMFT > 0) is on the declining. Emslie reported in 1966 a caries experience of 57.4% among 10–14-year-old school children examined in Khartoum [24]. Baghdadly et al reported in 1979 a caries experience (DMFT > 0) among a randomly selected sample of 107 12-year-old Sudanese school children in Khartoum to be 51.4% [7]. Our study found that a representative 58.62% of the 12-year-olds in Wadmedani Elkobra locality were not caries free, which represent slightly a higher percentage. This may be attributed to that, if sic index used in previous studies, may have higher score recorded than our study. Also it may attributed to the changes of life style.

The average DMFT was higher among high SES, where more frequent visits to the dentist and they were more satisfied with their oral health. This attitude may reflect an influence from their parents who were probably more aware of oral health by

virtue of their higher education. Nevertheless, they still had a higher caries experience. Low SES school children, with their comparatively, did not experience caries as often. It has been reported that the diversity in caries prevalence is partly due to the variance in dietary habits, culture and oral hygiene of different communities and is thus associated with various socio-economic and biologic risk factors.

The Decay component contributed the most of the DMFT indicating that an unmet need for treatment. The care index of 1.7% suggested poor coverage of oral health services in Wadmedani Elkobralocality. Oral health services in Sudan are available to school children through governmental services via hospitals, primary health care centres and the oral school health programme and private specialized clinics for child care. The provision of services is mostly based on fee despite the health insurance system provided, thus some but all types of dental services becoming a burden for some of the population. Sudan has 1.7 dentists for every 100,000 individuals as of the year 2007, mostly concentrated in major cities, depriving many from professional treatment [2]. From the results of this study, the need for treatment is emphasized and a suggestion to launch oral health prevention programs via the television broadcast, oral health educators in hospitals and schools.

Results of this study revealed that all of the students cared to clean their teeth on a regular basis and this tallied with the clinical values of plaque accumulation. School children who had experience of dental clinic visits reported that they have good oral health more often than their counterparts that not visit dental clinic. This suggested that school children could have perceived good oral health as a pain-free mouth.

It may be concluded that in the present study SES among school children is directly associated with caries experience. Children with higher SES reported higher DMFT values. This because they may be able to purchase more sugary snacks. On the contrary, studies in Jordan and other countries have found that low SES is associated with a higher mean number of decayed and filled surfaces [31].

The skewed distribution of the caries experience in the study sample and the low DMFT, suggests the need for further studies. These should include more oral health related predictors to derive a more definitive conclusion.

## 5-2: Conclusion

All in all, the results indicate a low prevalence of dental caries among 12-year-old explained low DMFT (1.7), a need for treatment and highlight the impact of socioeconomic status as a risk indicator to the oral health status. This data may be of importance in the evaluation of the past and planning of future oral health prevention and treatment programmes targeting the high risk group.

## 5-3: Recommendations

**According to the findings of this study, it is recommended that:**

- 1- Establishing urgent organized preventive and curative programs for prevention and operative treatment for general population, especially children.
- 2- Motivation and using of audiovisual media as TV, radio, lectures and seminars, to educate and raise the awareness of students and their parents to maintain good oral hygiene and to understand the relationship between oral hygiene and dental diseases.
- 3- To build a concrete oral school health programs, hence periodic dental examination and utility of dental services can be obtained.

**Chapter SIX: 6.1 Appendix University Of Gezira Deanship of Graduate Studies And Scientific Research Questionnaire:**

Date:	Regist. Number:	Age:
Residence:	Urban	Rural

Number of rooms:	1	2	3	4 or more
Home ownership:	owned	rented	yielded	
Father education:	no schooling	primary	secondary	graduate/post
Father occupation:	no work	farming/industrial	office	
Mother education:	no schooling	primary	secondary	graduate/post
Mother occupation:	no work	farming/industrial	office	
N. of people in home:	2-3	4-5	6-7	> 8
A car in the family:	yes	no		
Economic status:	high ES	medium ES	low ES	
Oral hygiene habits:	brushing	flossing	others	
Frequencies of O.H:	once/day	twice/day	> twice	
How would U classify the health of Ur teeth:	good	not good		
How would U classify the appearance of Ur teeth:	good	not good		
Have you had dental problem during past year:	yes	no		
If yes did you see a dentist:	yes	no		
Dental history:				

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