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THE ORAL HEALTH STATUS AND ORAL HEALTH BEHAVIOR OF SCHOOL CHILDREN IN ASSIN NORTH MUNICIPAL AREA

BY

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DECLARATION

I, Jonathan Karikari Mensah, hereby declare that this study is my own original work, and that this dissertation has not been presented elsewhere for another degree. Also, all the sources that I have used or quoted have been indicated and duly acknowledged by means of complete references.

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DEDICATION

This dissertation is dedicated to first of all to the Almighty God for given me life, protection and wisdom, and also to my lovely and supportive wife Elizabeth Ohenewaa Appiagyei, my little daughter Emerald Awurama Mensima, as well as my mum, Mrs Agnes Mensah and dad Mr James Mensah, and all my siblings for their loving support.

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ABSTRACT

Objective: To determine the prevalence of oral diseases among school going children and how their oral health behaviors relate with their oral health status.

Method: Descriptive cross-sectional study design was used. Purposive and cluster sampling were used to select 279 school children from upper Primary and Junior High School in nine (9) basic schools in Assin North Municipal Area. Data were collected from the 279 students using the WHO Oral Health Questionnaire for Children and clinical examination done using the WHO Oral Health Assessment Form for Children.

Results: The participants were made up of 124(44.44%) males and 155(55.56%) females with their ages ranging between 9 and 19 years and a mean age of 14 years (13.99 ± 2.22). The prevalence of oral diseases among schoolchildren in Assin North Municipal Area was gum disease (31.54%), dental caries (6.09%) tooth fracture (2.16%) and enamel hypoplasia (1.44%).

All the participants used toothbrushes and only 11.11% use other items like charcoal, chewing stick and toothpicks in addition to the toothbrushes to clean their teeth. Although most of the children (98%) uses tooth paste, only a few (11.83%) knew that their toothpaste contained fluoride. Most of the children brush once a day (65.59%). 91.04% of the children eat fresh fruits weekly or daily. Most also ate biscuits (89.61%), chew gum containing sugar (89.61%), soft drinks (74.19%) tea with sugar (73.83%), sweets/candy (70.61%), and milk with sugar (63.8%). Diets like coffee with sugar (44.45%) and jam/honey (43.01%) were eaten less often.

No causal relationship between the oral health behaviors and oral diseases such as dental caries and gum diseases were observed.

Conclusion: This study showed that school children in the Assin North municipal area practiced good oral health behaviors and practices. Health education programmes that emphasize good oral health practices need to be adopted by the institutions in order to maintain good oral health of the children.

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LIST OF ACRONYMS

CHPS	Community Health Planning and Services
DMFT	Decayed Missing Filled Teeth
FDI	World Dental Federation
GES	Ghana Education Service
GHS	Ghana Health Service
JHS	Junior High School
MOH	Ministry of Health
MHMT	Municipal Health Management Team
MMDA	Metropolitan/Municipal District Assembles
PTA	Parents and Teachers Association
WHO	World Health Organization

DEFINITION OF TERMS

Avulsion: Complete displacement of the whole tooth from its socket in alveolar bone due to trauma

Demineralization: The opposite process of mineralization, a process to reduce the content of mineral substances in tissue or organism or of tooth.

Dentin: The Second layer of tooth structure. It is yellowish tissue and makes up the bulk of all teeth. It is harder than bone but softer than enamel.

Dentition: The development of teeth and their arrangement in the mouth. In particular, it is the characteristic arrangement, kind and number of teeth present at a given age.

Enamel: Semi-clear, hard, outermost layer of teeth.

Permanent teeth: They are the second set of teeth that replaces the primary teeth in the mouth. They are also known as adult teeth.

Pits and Fissures: Grooves or deep cavities found on surfaces of premolar and molar teeth

Pulp: Innermost part/layer of a tooth. It contains of nerves, blood vessels and connective tissue.

Plaque: Biofilm bacteria that grows on the surfaces of teeth. It is usually white or pale yellow "slime layer", commonly found between the teeth and along the cervical margins.

Remineralization: The process in which certain minerals are returned to the molecular structure of the tooth.

CHAPTER ONE

INTRODUCTION

1.1 Background

According to the World Health Organization (WHO) oral health is defined as "a state of being free from mouth and facial pain, oral and throat cancer, oral infection and sores, periodontal (gum) disease, tooth decay, tooth loss, and other diseases and disorders that limit an individual's capacity in biting, chewing, smiling, speaking, and psychosocial wellbeing". It further added that "Oral health is a human right, an integral part of general health and essential for overall wellbeing and quality of life" (WHO, 2005: 3; Weil, 2016: 7). This widely recognised definition acknowledges oral health as integral part of general health, and thus a basic human right as stated in the UN universal declaration of human rights adopted by all nations (FDI World Dental Federation, 2014).

A healthy mouth goes hand in hand with a healthy body. On the contrary, oral diseases can have damaging effects on physical and emotional and mental wellbeing. This is because a lot of general or systemic diseases show their signs in the mouth where as poor oral health and long standing serious oral diseases can have their effects spreading to other parts of the body (WHO, 2012). According to the WHO, the seven commonest oral disease burden for Africa are tooth decay and cavities (dental caries); gingival/gum (periodontal) diseases; cancers or oral region; noma(cancrum oris); oral manifestations(signs) of HIV and AIDS; oro-facial injuries from accidents and violence; and cleft of lip and palate(WHO, 2016).

A study by International Collaborative Global Burden of Disease (1990-2010), reported that untreated (or chronic) dental caries was the topmost common condition among 291 health illnesses studied. The same research revealed that worldwide, between 60 - 90% of schoolchildren have dental caries and about 15-20% of people are suffering from severe gum

(periodontal) diseases. Periodontal diseases constitute the leading cause for tooth loss (FDI World Dental Federation, 2014).

Dental caries is one of the most predominant chronic illnesses of people globally. People are vulnerable to this ailment throughout their lifetime, and everyone can be affected (T. Sonis, 2015). After eating, bacteria in the mouth feeds on the debris or sugar on the surfaces of teeth and convert it to acid. The acid dissolves the hard tissues of the teeth and results in cavity or caries formation. Cavities that are left untreated can result in discomfort, pain, swelling of the face and other serious health conditions that may lead to hospitalization or even death (WHO, 2012). The key aetiological factors that influence the development of tooth decay caries include (1) tooth surface that can easily accumulate plaque and bacteria, (2)presence of acid-producing bacteria, (3) continuous or constant supply of dietary fermentable carbohydrates(sugars), (4) Inadequate flow of saliva or buffering capacity and (5) low exposure of tooth surfaces to dietary or topical fluoride (T. Sonis, 2015). Bacterias such as *Streptococcus. mutans* and *lactobacilli* are responsible for dental caries formation, with help from *Streptococcus salivarius* and *Streptococcus sanguis.* These organisms breakdown sucrose(a form of sugar) to form acidic by-products which destroys enamel surfaces (Mohan, 2010).

Gum (Periodontal) disease also known as gingivitis begins as chronic inflammation of the gum which may be painful or painless and usually associated with bleeding from the gums, especially during brushing. It may develop to periodontitis, which is more severe and destroys tissues that supports the tooth like gum and periodontal fibres and bones leading eventually to loss of tooth (FDI , 2015).The primary cause of gingivitis and periodontitis is bacterial plaque, specifically gram-negative bacteria such as *Porphyromonas gingivalis* and *Aggregatibacter actinomycetemcomitan.* The toxins from these bacteria may directly cause tissue destruction leading to tooth mobility and tooth loss (T. Sonis, 2015). Oral/dental

diseases are often hidden and not visible, and many people accept it as part of life and consequence of old age. Research findings suggest that these conditions can be prevented or brought to a minimum with simple and practical measures at every point in life. This can be achieved at the individual and community levels (FDI, 2015).

In most developed countries, prevalence of oral diseases especially dental caries has been declining over the past 20 years, though it is still higher compared with Africa. This decline came about due to the improvement in public health practices, such as the use of fluoridated agents, oral health education as well as improving ones' living conditions, ways of life and improvement oral hygiene practices (Petersen, Bourgeois, Bratthall, & Ogawa, 2005).

The situation was somehow different in less industrialised nations. The rate of dental diseases was low until recent years; however, the trend has changed such that the prevalence and incidence rates are on the rise. This can be attributed to urbanization of most African countries with associated dietary modification towards increasing consumption of sugars and yet lack of access to dental facilities (Ahmed, Åstrøm, Skaug, & Petersen, 2007).

Adults and children tend to miss work and school respectively due to effect of dental diseases. Additionally, oral diseases such as dental caries (decay), periodontal (gum) disease, and oral cancers share common socio-behavioural risk factors with noncommunicable diseases (NCDs), such as diabetes, heart disease, chronic respiratory disease and cancer. Reducing such common risk factors like high intake of sugar, tobacco use, and lack of physical activity/exercise will help to decrease the prevalence of a number chronic or noncommunicable diseases (Petersen *et al*, 2005).Therefore it is necessary to conduct more studies on the burden of oral diseases on the young ones in order to improve their oral health as well as general health and well-being.

1.2 Problem Statement

Diseases of the mouth such as dental caries and gum diseases are global problems affecting all age groups and people of all socio-economic demographic classes. In most developed countries dental caries affect 60–90% of schoolchildren and the vast majority of adults (FDI World Dental Federation, 2014). From the WHO oral health database, in 2013, 200 million incident cases of tooth pain due to permanent caries and about 2.4 billion asymptomatic permanent caries worldwide were recorded (Vernazza *et al.*, 2015). In 2015, dental caries was among the top eight chronic diseases affecting more than 10% of the world's population. The FDI annual report in 2010 revealed that oral diseases towered above all other condition worldwide. About 2.4 billion people suffered from untreated caries in permanent dentition whereas untreated caries in primary dentition affected 621 million globally. This made caries in permanent dentition the topmost illness whilst untreated caries in deciduous teeth occupied 10th position. Severe periodontitis was the 6th most prevalent condition worldwide (FDI World Dental Federation, 2014).

In Africa, the prevalence of dental caries was found to be 55.1% among 18 years old and 74.4% in 34 years old (Siddiqui *et al*., 2013). However Ghana recorded low prevalence rate for oral conditions such as dental caries than other African states (WHO, 2016). In Ghana, it is estimated that about 96% of people between the ages of 35-40 years are suffer from periodontal diseases. The statistics further show that 40% children around the age of 12 years had either carious teeth, missing teeth, stained teeth or bad breath (Appiah, 2017). A cross-sectional study by Korle-Bu Teaching Hospital among 1040 school children aged 9-15 years in Accra, showed that 17.4% had dental caries, about 60.0% of the respondents had plaque, 64% had supragingival calculus and 50% had bleeding gums (Ndanu *et al,* 2015). A similar study among 377 school children in Ho municipality (Beni, 2009) revealed a mean Decay Missing Filled Teeth (DMFT) score of 0.24(+/-0.75) with caries component of 92.3% and

79.6% calculus/bleeding gums. Quist (2016) reported that the prevalence of dental caries among patients attending the dental unit of Tema General Hospital was 81.3%, and 92.3% of these patients had complete destruction of the tooth. The study also showed that the burden of oral diseases is much higher among people of low socioeconomic status than those of moderate to higher socioeconomic status.

The situation in the Assin North Municipality is not different. From the St Francis Xavier hospital records, 2878 cases of various forms of oral diseases were seen in 2016. About 70% of these cases were dental caries related conditions (GHS, 2016). In the Assin North Municipality no study has been done on the prevalence of oral diseases. Much study has not been undertaken to establish frequency of occurrence of the disease among basic school children in the Municipality.

This study therefore sought to ascertain the prevalence of the disease among children less than 15 years in the Municipality and identify the factors associated with the disease in order to provide a baseline data for planning interventions for the control of the disease in the district.

1.3 Conceptual Framework for Risk Factors in Oral Diseases

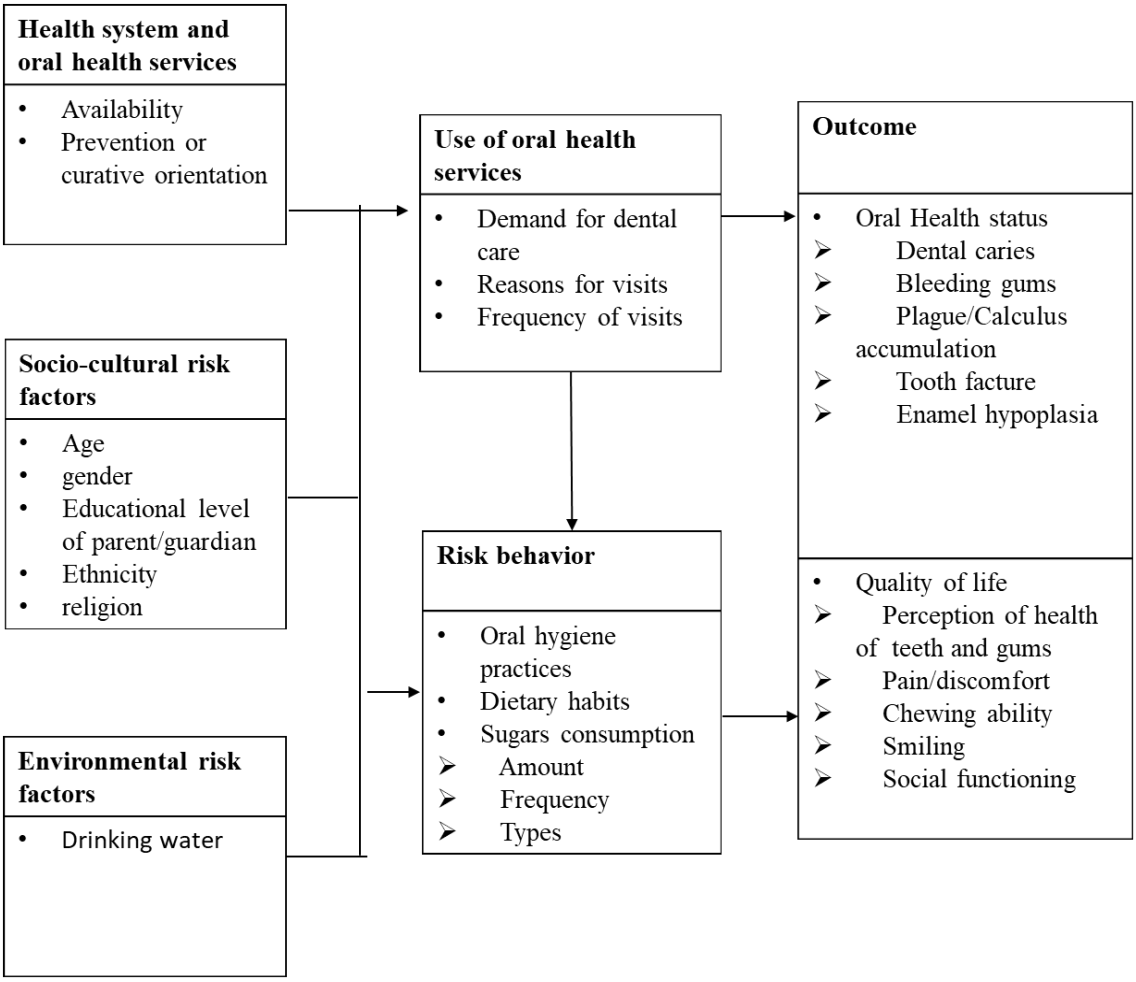

Figure 1.1: Conceptual Framework

Risk Factor Model for Analysis of Oral Diseases. This was adapted from the WHO model for promoting oral health (Pe, Dent, Epidemiol, & Munksgaard, 2005)

Good oral health is influenced by several contextual factors. The factors of interest in this study have been shown in the conceptual framework (Figure 1.1). The framework attempts to explain the various factors influencing prevalence of oral diseases among school children in Assin North Municipality. The proposed framework on risk factors in oral diseases is categorized into: Health systems and oral health services, socio-cultural risk factors, and environmental risk factors.

Understanding the interplay of these factors is crucial to developing strategic policy interventions aimed at improving oral health among children in the municipality.

Availability of oral health facilities will make it easier for individuals to access dental care and this will contribute to improved oral health. On the other hand, lack of dental clinics results in poor access to oral health care which will lead to poor oral health outcomes. Those who do not visit these facilities may not get the chance to be treated and educated on good oral hygiene practices such as method of brushing, number of times of brushing, type of toothbrush to be used. All these factors will determine one's ability to develop or prevent dental caries and that may further worsen their conditions.

Socio-cultural factors such as level of education, occupation (or occupation of parents or guardians), ethnicity, lifestyles, and environmental factors like sanitation and hygiene all influence one's oral health behavioural practices. People on high academic pedestal or income level usually access dental facilities and afford more expensive treatments than those of lower socio-economic class (FDI World Dental Federation, 2014).

Some socio-cultural factors such as ethnicity and religion have certain myths and perceptions that prevent people from accessing dental services. For example, in some cultures, it is perceived tooth extraction in a pregnant woman will affect the unborn child, and also extraction can cause swelling of the head and even death. Some of these beliefs tend to affect an individual's attitude and use of dental care services, and that in turn may also influence his or her self-care practices and eventually the ability to develop caries or not.

1.4 Justification

In Ghana as well as the Assin North Municipal Health Directorate, there is limited information on the extent of oral disease in the population, especially, in the semi-urban and rural areas. The study will therefore provide information on the level of disease burden in

such an area. There is therefore an urgent need for accurate data on the occurrence of oral disease and the associated factors causing oral diseases in the district for effective planning of educational programmes to create awareness about the disease while working towards prevention and early treatment of these diseases as proposed by the World Health Organization.

The research will provide the basis for further studies on oral diseases in the Municipal Area.

1.5 Research questions

1. What is the prevalence of oral diseases in school children in Assin North Municipality?

2. How do school children in Assin North Municipality take care of their oral health?

3. What are the effects of socio-behavioral factors on oral hygiene status and dental caries experience?

1.6 Objectives of the study

1.6.1 General Objective:

To determine the oral health status and oral health related behaviors of school children in Assin North Municipality.

1.6.2 Specific Objectives:

1. To determine the prevalence of oral diseases in school children in Assin North Municipality?

2. To assess the oral health self-care practices among school children in Assin North Municipality?

3. To assess the effect of socio-behavioral factors on oral hygiene status and dental caries experience.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

The understanding of oral health can be derived from the yardstick provided by the WHO's definition. It explains oral health as being free from diseases or disorders of oro-facial region such as oral and/or pharyngeal tumors, oral infections and ulcers, periodontal diseases, dental caries, loss of tooth/teeth and other conditions. It means that good oral health enables a person to perform physiological functions like biting, chewing, smiling, and speaking without any difficulty and have a general and psychosocial wellbeing (WHO, 2012). This further suggest that one with good oral health is free of birth deformities such as cleft lip and palate, and other diseases and disorders that affect the oral cavity, and craniofacial structures, collectively known as the craniofacial complex (The National Institute of Dental and Craniofacial Research, 2014).

In 2016, WHO listed seven commonest oral diseases burden for Africa. Among them are tooth cavities (dental caries); gum (periodontal) disease (WHO, 2016). This review seeks to explore the prevalence these two most common diseases that affect oral health and other conditions such as fractured teeth, enamel hypoplasia among school children as well as oral hygiene status and socio-behavioural factors that impact on their oral health.

2.2 Prevalence of Oral Diseases among School Children

2.2.1 Dental Caries

Dental caries, also known as tooth decay is a very prevalent condition among humans affecting them throughout all stages of life. Globally, a lot of studies have been conducted to determine the prevalence of dental caries among school going children. One of such studies in India on the dental problems of school children revealed that about 58.89% of the children

were found to be having dental problems. Overall prevalence of deposits was 41.4%, 26.72% for gum diseases and 22.22% for cavities. The prevalence of dental caries in the age groups was found to be 44.4% in 11-13 years, 58.82% in 14-15 years and 67.79% in 16 and above (Hussaini, Bendigiri, & Swati, 2016). A similar study in Europe among Portuguese children established that the prevalence of dental caries was moderate among children between 6-12 years and high among children below the 6 years (Veiga, Pereira, & Amaral, 2015).

It is important to emphasize that knowledge of the Decay Missing Filled Teeth (DMFT) index which provides basis for measuring the level of dental caries prevalence need to be defined.

The "DMFT index, can define four levels of dental caries prevalence severity: Very low prevalence: 0,1 to 1,1; Low prevalence: 1,2 to 2,6; Moderated prevalence: 2,7 to 4,4; High prevalence: 4,5 to 6,5;Very high prevalence: >6,5." (Veiga *et al*., 2015:998). WHO (2004) adds that it is helpful for researchers delving into the epidemiological studies in oral health understand and apply the DMFT index in assessing the oral health status of population under investigation. Petersen (2009) outlined the roadmap of the world map on dental caries. He identified and grouped countries using the DMFT index. Some of the African countries which fall under the 'very low' criteria were Ghana, Togo, Benin, Liberia and Nigeria. Those within the bracket of the 'low' criteria were Cote d'Ivoire, Senegal and Niger. The 'moderate' criteria housed countries including Chad and Madagascar whereas Peru the only South American country was found within the 'high' criteria. This information provides a clear overview what a researcher could assume during an empirical investigation into the prevalence of dental caries.

Applying the concept to a study in one African country, it was revealed that the prevalence of caries was 13.9%, with a mean DMFT of 0.14 which indicated a very low severity among

children at age 12 in Nigerian schools (Adeokoya *et al*, 2006). The findings of the study revealed that decayed component represented 77.2% of the DMFT, while missing and filled teeth accounted for 7% and 15.8% respectively. More than 85% of the children examined were caries free and the likelihood of having caries experience, DMFT >0 related statistically with the type of school and regular eating of sweets.

The high prevalence of caries among Ghanaian school children is similar to the above findings as some studies show. For example, a study by Ndanu *et al*, 2015, reported that the overall prevalence of caries was 17.4%. About 19% was found to be in the public schools whiles 15% showed up in the private schools. The statistics revealed that female students had 19.3% whereas their male counterpart recorded 15.1% in both private and public schools. Another study by Beni (2009), revealed a DMFT of 0.24 (+/-0.75) with a decay component of 92.3 per cent and the caries free prevalence was 87.5 per cent. These studies confirm that the prevalence of dental caries in Ghana is very low according to the DMFT index.

2.2.2 Periodontal (Gum) Disease

Periodontal diseases are part of infectious conditions that cause inflammation of the gingiva and periodontal tissues leading to the progressive loss of alveolar bone and probable tooth loss. Periodontal disease is the second most common oral disease and severe periodontal disease which may result in tooth loss is found in over 20% of most adult population worldwide (Peterson *et al*, 2005). One study on oral diseases in India reported overall prevalence of deposits, gum disease and cavities of 41.4%, 26.72% and 22.22% respectively among school children. In Ghana, very high prevalence of gum disease is reported to be among the population including children. For example, a website reported that 96% of Ghanaian adults have gum diseases (Appiah, 2017). Other studies (Ndanu *et al*., 2015) also reported that about 60.0% of school children had accumulation of deposits and 64.4% of

them had supra-gingival calculus. The study by Beni (2009), reported a very high prevalence of a total of 79.6% of school children in Ho municipality with calculus/bleeding gums.

2.2.3 Tooth Fracture/ Dental Trauma

A study conducted in Nigeria on fracture of anterior teeth due to trauma among 12-year-old school pupils, reported that more males 86 (10.8%) had various degrees of anterior teeth trauma compared to 71 girls (8.9%) i.e. Male: Female ratio was 1.2:1(Agbelusi & Jeboda,2005). In that study the overall prevalence of fractured teeth reported about 9.8%. Class II fractures (about 52%) was the most frequent fractures and there were more upper teeth fractures than lower teeth and with a difference which was statistically significant $p < .01$, and the upper central incisors were the teeth most frequently fractured in both sexes.

A study conducted in Jordan reported that the prevalence rate of dental trauma among school children was 13.8% (Hamdan & Rajab, 2003). It was further noted that there is a statistically significant difference in the prevalence rate between boys (17.1%) and girls (10.6%). The maxillary central incisors were the most affected (79.2%). Enamel-dentin fracture was the commonest type of fracture with 40.6% prevalence. The relationship between dental trauma and socio- economic factors was statistically significant.

Another study conducted in the Wa municipality in Ghana by Abu- Sakyi, reported that 7.6% of the subjects had fractured incisors. Those requiring treatment constituted 3.2% of the study subjects. None of the 19 respondents who had fractured tooth had not been treated and ten (10) of them had no visible sign of a complication (Abu-Sakyi, 2005). The study by Beni (2009) in Ho Municipality also showed that 16 school children (4.2%) had fractured anterior teeth. Also, there were more males (2.7%) than females (1.6%) with fractured tooth, though not statistically significant with a p-value=0.302. None of the 16 children with fractured teeth had undergone any form of treatment. However, 86.7% of those with fractured teeth had no

visible problem or complication. Only 13.3% had problems or complications due to fractured teeth.

2.2.4 Enamel Fluorosis/Hypoplasia

Petersen *et al.* (2005: 665) argue that "dental fluorosis develops during the formation of teeth in young children". "Drinking-water with" fluoride content above "1.5 ppm (parts per million) can give rise to enamel defects and discolouration of teeth leading to endemic fluorosis in the population". They advanced their argument that "dental fluorosis can differ in intensity from mild to severe". Examples of some countries that have high prevalence of fluorosis included "East Africa, the Great Rift Valley area, and in some parts of India and north Thailand", where "the groundwater has very high levels of fluoride". They further noted that "in such areas, dental fluorosis may be found in most of the people". The condition is not limited to developing countries as the researchers established that "fluorosis of the teeth can also occur in individuals in developed countries due to widespread use of certain forms of fluorides for prevention of dental caries, although the degree of fluorosis is mostly very mild when compared to that in countries where fluorosis is endemic" (Petersen *et al.*, 2005: 665).

A study done among 12-year old in Iran in 2001 on assessment of DMFT and enamel hypoplasia reported the prevalence of enamel hypoplasia to be 32.7% (Daneshkazemi & Davari, 2005). Work done on the burden of intrinsic tooth discoloration/stains among children between the ages of 11 to 16year old in Nigeria showed a prevalence of 7.3% of enamel hypoplasia (Koleoso *et al,* 2004).

According to the report from Beni (2009), 20 of the subjects constituting 5.3% had enamel hypoplasia with 70% being females and 30% males. Also 60% were found in urban regions compared to 40% in the rural regions. These differences were not statistically significant, p=0.198 for sex and p=0.074 for locality.

2.3 Oral Health Behaviour

2.3.1 Dietary Habits and Oral Health

There is an association between dietary habits and oral health: balanced diet correlates well with a state of good oral health, which will result in healthy periodontal and dental tissues, quality and amount of saliva produced. On the other hand, a poor nutritional intake leads to oral diseases (Scardina & Messina, 2012). Healthy Diet can help in the prevention of caries. Very low prevalence of dental caries are reported in agricultural communities with traditional way of living and low intake of sugars (Scardina & Messina, 2012). Similarly, periodontal disease progress more quickly among the malnourished populations. Many research works have revealed that there is an association between oral health and diet intake. For example, according to a survey conducted in Taiwan, the DMFT index of children who like to eat and/ or drink sugar-containing foods or drinks are significantly higher than children who dislike eating sweets and/or do not drink sugary drinks (Cheng, Huang, Wu, Chen, & Yeh, 2014).

Furthermore, other studies have revealed that at low levels of sugar intake, dental caries is usually low, but when sugar intake is about 15 to 35 kg per year, dental caries increases with increasing sugar intake (Karjalainen, 2007).

In Ghana a study conducted showed that snacking frequency was high among children of both public and private school groups but this was not statistically significant(Ndanu et al., 2015).

2.3.2 Fluoride and Dental Caries

Another way to describe the association between sugar intake and dental health is to include the effect of fluoride. Studies show that individuals with good oral hygiene and regular

fluoride exposure tolerate higher sugar intake levels before caries occurs than their counterparts without regular use of fluorides (Joshi, Sujan, Joshi, Parekh, & Dave, 2013).

2.3.3 Teeth Cleansing/Oral Hygiene Practices

Adequate practice of oral hygiene which includes regular toothbrushing with fluoridated toothpaste and flossing, as well as regular patronage of dental facilities have great impact in the prevention of various oral diseases (Menezes et al., 2010). A study conducted among school children in Brazil found out that most of the participants cleaned their teeth (approx.80%) with toothpaste (98%), a toothbrush (93%) and dental floss/thread (approx. 26%). All the participants (150) used toothbrush and performed three or more daily brushings (56%) and the majority (56%) perceived their teeth to be in good and healthy condition. Another study on oral hygiene practices among school children in Iran showed that school 272 children (71.2%) start brushing their teeth after the age of 2 years, and that about 24.2% brushed their teeth lower than once daily.

In Ghana, a study by Beni (2009) revealed majority of the subjects i.e. 59.9% reported having good oral cleaning practice (brushing their teeth twice a day). About 55.3% females had good oral cleaning practice as compared to the 44.7% males. There was a relationship between the variables with a p-value of 0.014. The difference in frequency of cleaning teeth among urban and rural schools was insignificant statistically.

In that Ghana study, there were 82.2% of the children who claimed to use the toothbrush and 92.3% reported using toothpaste which contained fluoride. This was similar to the results obtained by Ndanu *et al*. (2015) which reported that almost all of the pupils (96.6%) brushed every morning. Others indicated brushing at night before going to bed. This practice was found to be common among privately-owned school pupils than the government school pupils. Although private school children had more knowledge on floss than public school

children, the use was relatively more among public school children than private school children. The school children also reported using tooth pick after eating.

2.4 Socio- economic factors

Several studies have revealed a close relationship between socio-economic, socio-demographic variables and the prevalence of oral diseases. For example, a study revealed that the frequency of brushing among the children was associated with the number of children in the family and the employment status of mothers. In addition, the age at which tooth brushing had been started was significantly associated with the educational level of fathers. Furthermore, decayed primary teeth was associated with children's age, number of the children in the family, and their mothers' education (Shaghaghian & Zeraatkar, 2017).

2.5 Summary

The studies that have been reviewed so far show that oral diseases such as dental caries, periodontal disease, trauma, enamel fluorosis are very prevalent globally as well as in Ghana. Poor oral health can also have a negative impact on general health and vice-versa. Similar studies have been done in Ghana to determine the impact of oral health practices and other factors on the prevalence of dental caries and other oral diseases among school children. However, not much research has been conducted in the Assin North Municipality on this topic. Therefore, this research will identify factors causing oral diseases and provide possible ways to correct them.

CHAPTER THREE

METHODS

3.1 Design

A cross sectional study was conducted to measure the prevalence of oral diseases and to describe the oral health behaviours of school children.

3.2 Study Area

The Assin North Municipality is in the central region of Ghana and forms part of the 20 Metropolitan/Municipal District Assembles (MMDA's) in the Region. The municipality lies midway between Kumasi and Cape Coast on the Kumasi-Cape Coast highway. The total land area of the municipality is about 1,150 sq.km and contains about 500 settlements including Assin Foso (the Municipal Capital) and other suburban communities such as Assin Nyankumasi, Assin Akonfudi, Assin Bereku, Assin Praso and Assin Kushea.

Figure 3.1: Map of Assin North Municipal Area

3.2.1 Population Size

According to the 2010 Population and Housing Census the population of Assin North Municipality is estimated to be about 16100 making up 7.3 % of the total population in the region. Males form 49.7% and females form 50.3% of the population in Assin north Municipal area. About 63% of the population are rural dwellers. The male to female sex ratio is 100 females to 103.8. The youthful population (population< 15 years) in the municipality account for 44.5% of the population giving a population pyramid with a broad base and a tapering apex of small number of elderly ones (population aged ≥ 60 years).

3.2.2 Household Characteristics

There are 157,749 Households in Assin North, 65 percent of which is found in the rural communities. About 49 percent of the Households consist of Nuclear families.

3.2.3 Education and Literacy

Twenty (20) % of the population 11 years and older have no formal schooling, that is, cannot read and write in any language. Apart from English, Ghanaian language and French, no

person in Assin North is literate in any other language. About half of the people attending school now in Assin North are at the primary level. There is a very low attendance of vocational/technical/commercial (0.4%) schools in Assin North as well as tertiary which is one percent.

3.2.4 Religious Affiliation

The majority (53.1%) of the population of the municipality are Christians, followed by Moslems (36.1%). Also, a small percentage of the population either belong to others religion (0.2%) or do not associate with any religion (6.4%).

3.2.5 School Attendance

Of the 35,379 persons aged 3 years and older in the Municipality, 3,417 representing 9.7% are in the Nursery, 16.8% in Kindergarten, 49.1% in primary and 16.6% in Junior high School (JHS). Senior High School (SHS) has about 6.4 %. Tertiary has a proportion of 0.9 %.

3.2.6 Health Facilities

The Assin North Municipal has only one (1) Hospital, one (1) Polyclinic, six (6) Health Centres, four (4) Rural Clinics, nineteen (10) CHPS (Community Health Planning and Services) compound and one (1) Maternity Home, and about 5 private health facilities. There is also only one dental clinic in the Municipality. These facilities provide health care service to a population of 95,480 comprising 47,302 (49.6%) male and 48,178 (50.4%) female with a total land surface area of 5,108sq km. One Nurse is expected to provide health care to 4,781 Patients.

3.2.7 Occupation

Over half of the population (59.4%) are employed in skilled agriculture, fishing work and forestry. Others are engaged in sales and services (11.7%), craft and related trade (13.9%), and managers, technicians, and professionals (6.8%).

3.3 Study Variables

Dependent variables

Decayed teeth, missing teeth, filled teeth, periodontal diseases, oral hygiene status, dental trauma, tooth erosion.

Independent variables

Age, Gender, Ethnic group, Religion, Occupation of guardian, travel distance, and behavioural factors like teeth brushing, flossing, dietary habits and dental visits.

Table 3.1: Dependent and Independent Variables

Independent **Socio-demographic Factors**	**Independent** **Oral Health Behaviours**	**Dependent** **Oral Health Status**
Age,	Brushing	Decayed teeth
Gender,	Dental visit	Bleeding gums
Ethnic group	Dietary habits	calculus
Religion		Dental trauma
Educational Level of Parent or Guardian		Enamel hypoplasia

3.4 Study Population

The study population was school going children in selected Primary and Junior High Schools in Assin North Municipality.

3.4.1 Inclusion and Exclusion Criteria

Only pupils who are in upper primary or Junior High schools in the Assin North Municipality during the study period were included in the study. This was to ensure that those selected to partake in the research could understand and provide objective responses to the questionnaires.

However, students who were absent from school during the data collection period were excluded from the study.

3.5 Sampling

3.5.1 Sample size

In all 284 pupils were interviewed using the WHO oral health questionnaires for children. The pupils were also examined for their oral health status with the WHO oral health assessment form for children.

3.5.2 Sample Size Determination

The sample size of the study was determined by adopting a sample size calculation formula developed by Cochran (1963:75) for a cross sectional study for infinite population.

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

Where:

n = sample size,

Z = Z statistic for a level of confidence: 1.96

P = expected prevalence or proportion: 0.174

d = precision: 5% margin of error (d=0.05)

The expected prevalence was deduced from a study done by Ndanu et al (2015) that reported prevalence of dental caries of 17.4 % among 9-15-year olds Ghanaian school children. Considering these assumptions, the actual sample size for the study was calculated using the formula:

$$n = \frac{1.96^2 x 0.174(1 - 0.174)}{0.05^2} = 220.85$$

n=221

Accounting for 10% non-response rate, the total sample was estimated to be 243 (221 + 22). The 10% non-response rate was projected because some respondents may not be willing to participate, or there may be errors in some of the answered questionnaires. Based on this an estimated minimum sample size of 243 pupils in selected schools was targeted.

3.5.3 Sampling Procedure

A two-stage sampling technique was used. In the first stage, 17 Basic and Junior High Schools were purposively selected from the list of schools that was obtained from the Assin North Municipal Educational Directorate because these schools had about 70% of the total student population in the municipality. Letters were written to the Parents and Teachers Association (PTA) of these schools through their headteachers informing them about the intention and purpose of the study and also free dental screening of the entire student population. Each school was expected to respond to the letter within 4 weeks after receipt of the letter. By the end of the four weeks, nine (9) out of the 17 schools responded and therefore were purposively selected for the study.

In the second stage, simple random sampling was used to select one (1) class from the upper primary to JHS by balloting. Once a class had been selected, all children in the classroom

who agreed to partake in the study were interviewed, examined and the data collected using the Questionnaire and the examination form.

3.6 Pre-testing

The questionnaire and instruments were pretested on ten (20) respondents in a school in Assin Foso which was not part of the final study. This allowed the assistants to familiarize themselves with the questionnaires and the actual work that was about to take place. The results obtained from the pre-test were used to make the necessary changes or modifications required on the survey forms.

3.7 Data Collection Techniques and Tools

Collection of data was done by the primary investigator and trained research assistants. The participants were interviewed and examined one after another. This was done using structured questionnaires, after which oral examination was done for each participant to ascertain their oral health status. The survey tools used were adopted from the WHO Oral Health Questionnaire for Children (WHO, 2013) and the WHO Oral Health Assessment Form for Children (WHO, 2013b), for their oral examination. The questionnaire examined variables like participants perception on health of their teeth and gums, their frequency of dental pains or discomfort within the past 12 months, their frequency of dental visits and the reason for visiting a dental facility. The questionnaire also explored participants oral hygiene practices such use of toothbrushes, floss, chewing stick and their frequency of brushing. It also looked into the socio-demographic characteristics such as age, sex, ethnicity, and educational level of parents/guardians. The WHO Oral Health Assessment Form explored variables such as dentition, periodontal status, bleeding gums, enamel fluorosis and dental trauma. Research assistants were selected and trained to administer the questionnaires. The assistants guided the children throughout the questionnaire explaining the questions to them in both English and local (Twi) languages. Items like toothbrush, tooth paste, chewing stick,

charcoal etc. were shown to the pupils to help them understand the questions. Oral examination was done by a dental surgeon and a physician assistant after registering and interviewing the children. Children were examined under sunlight, using plain mouth mirrors and single periodontal probes. The participants were examined individually and in isolation to ensure privacy. To ensure that Standard cross-infection control was observed, the instruments were sterilized with chemicals. Standard cross-infection control was observed through cold sterilization of instruments with the chemical PeraSafe® and use of one pair of disposable hand gloves per participant.

3.8 Data Storage and Usage

Completed questionnaires were kept securely in a locked cabinet which was only assessable by the Principal Investigator. Questionnaires were anonymised with ID numbers so that pupils would not be identified by their questionnaires. Soft Copies of information of the data were placed on an external hard drive, pen drive, and the PI's personal computer and password protected. Data files were password protected.

3.9 Quality Control Measures

Selected Research Assistants were trained on the study protocol, questionnaire, informed consent process and other study procedures. The completed questionnaires were checked for accuracy, consistency and completeness.

3.10 Data Processing and Analysis Plan

All completed data were checked for accuracy and consistency before data entry. Data were double entered and validated using MS excel 2016. Data were cleaned and recoded to make analysis easier using STATA 15.0 software. STATA 15.0 was then used to analyze and generate descriptive statistics using frequencies and 2x2 cross tabulations. Univariate

analyses of categorical variables were also expressed in frequencies, proportions and percentages. Pearson Chi Square analysis was done for all the factors.

3.11 Ethical Considerations

The following ethical issues were observed.

3.11.1 Ethical Approval

Ghana Health Service Research Ethics Review Committee granted Ethical approval before the study was conducted (GHS-ERC120/12/17).

Permission was also sought from the Assin North Municipal Education Directorate, as well as the Parent and Teachers Association (PTA) through the head teachers and teachers of the selected schools.

In each of the selected classes, students were made aware that consent had already been sought from the PTA and their teachers and therefore all in the class were expected to be part of the study. However, each one had the right to opt out if they were not comfortable with the study after the procedure had been duly explained to them. Those above 18 years of age were allowed to consent themselves. No child was coerced to take part in the study. The children were made to know that participation was purely voluntary, and that they have the right to refuse or withdraw from the study at any time without it affecting their ability to access dental health care at the facility in the future. Refusing to opt was an indication of having assented to partake in the study.

3.11.2 Privacy/Confidentiality/Anonymity

The study was conducted in a manner that ensured the privacy of the respondents. In reporting data, codes, instead of names, were used to ensure confidentiality of information that was collected from participants. The results of the study were circulated in a way that information about participants could not be linked to any particular individual.

CHAPTER FOUR

RESULTS

4.1 Socio-Demographic Characteristics of Participants

As shown in table 4.1, a total of 279 school going pupils of the Assin North Municipal area participated in the study. They were randomly selected from nine (9) basic schools (specifically upper primary and JHS) in the municipality. They were made up of 124(44.44%) males and 155(55.56%) females. Their ages ranged between 9 and 19 years with the mean age of 14 years (13.99 ± 2.22) and a modal age of 14 years. The majority of the respondents were Akans making about 76.34%. Other ethnic groups represented are Ewes (12.54%) Ga/Dangme (3.94%) and others such as Nzema, Gonja, Frafra, Sisasla.

About 90% of the respondents were Christians and the remaining 10% are Muslims. No other religious group represented in the study. Majority of the parents/guardians of the respondents have had some form of formal education, that is about 57.71% of male parents have schooled up to high school level and 20.79% had completed university/college. For the female parents/guardians, about 59.86% had schooled up to high school level, and 14.34% completed college/university. About 3.23% of male parents have no formal education whiles 6.45% of mothers of the respondents have no formal education.

Table 4.1: Background Characteristics of Participants

Variable	Response	Total=279	%
Sex			
	Male	124	44.44
	Female	155	55.56
Age in years			
	12 and below	70	25.09
	13 to 16	172	61.65
	17 and above	37	13.26
Ethnicity			
	Akan	213	76.34
	Ewe	35	12.54
	Ga/Dangme	11	3.94
	Others	20	7.16
Religion			
	Christian	251	89.96
	Muslim	28	10.04
Educ. Level of Father			
	No formal schooling	9	3.23
	High school or less	161	57.71
	College/university completed	58	20.79
	don't know	51	18.28
Educ. Level of Mother			
	no formal schooling	18	6.45
	high school or less	167	59.86
	college/university completed	40	14.34
	don't know	54	19.35

From table 4.2, it can be seen that most of the participant perceived their oral health to be in good condition, but they were more confident about the health of their teeth than the health of their gums as 83.51% (233) respondent perceive the health of their teeth to be good as compared to 78.49% (219) who perceived the health of their gums.

Few of the participants indicated that they experienced pain or discomfort in relation to their teeth and gums as only 16(5.73%) experience pain often. About 151(54.12%) of the participants never or rarely experience dental pain and 96(34.41%) said they experience pain occasionally.

Those who did not visit the dentist within that last twelve months and those who had never visited the dentist before are about 77.42%. Twenty-eight (28) participants visited the dentist within the past year due to pains or discomfort in relation to their gums or teeth, as follow-ups to treatment or for routine check-ups. 6 of the respondents visited the dentist but cannot remember the reason for which they visited.

Table 4.2: State of Oral Health and Experiences with Pain and Discomfort

State/Experience	Response	Total =279	%
Perception of Health of Teeth			
	Good	233	83.51
	Average	10	3.58
	Poor	10	3.58
	Don't know	26	9.32
Perception of Health of Gums			
	Good	219	78.49
	Average	22	7.89
	Poor	6	2.15
	Don't know	32	11.47
Frequency of Toothache or Discomfort			
	often	16	5.73
	occasionally	96	34.41
	rarely	57	20.43
	never	94	33.69
	don't know	16	5.73
Frequency of Dental Visits			
	once	12	4.3
	2 or more times	17	6.09
	I had no visit to dentist	89	31.9
	never received dental care	127	45.52
	don't know/don't remember	34	12.19
Reason for Dental Visit			
	no visit	251	89.96
	Pain or trouble with teeth, gums or mouth	12	4.3
	Treatment/follow-up treatment	6	2.15
	Routine check-up of teeth/treatment	4	1.43
	I don't know/don't remember	6	2.15

Table 4.3: Problems Experienced Due to State of Teeth and Mouth

Problem	Yes (number out of 279)	% (out 100% of respondents)
I am not satisfied with appearance of teeth	120	43.1
I often avoid smiling and laughing because of my teeth	22	7.89
Other children make fun of my teeth	23	8.24
Toothache or discomfort caused by my teeth forced me to miss classes at school or miss school for few days	33	11.83
I have difficulty biting hard foods	57	20.43
I have difficulty in chewing	53	19

Even though the majority of the participants perceive their oral health to be in good condition, a high number of them, about (120) 43.10%, were not satisfied with the appearance of their teeth and even 22 (7.89%) students avoid smiling and laughing because of the appearance of their teeth (Table 4.3). About 8.24% (23) indicated that other children make fun of them because of their teeth. 33(11.83%) of the pupils miss school due to dental pain, and about 40% (110) others have difficulty biting hard food and chewing.

4.2 Prevalence of Oral Disease Among School Children

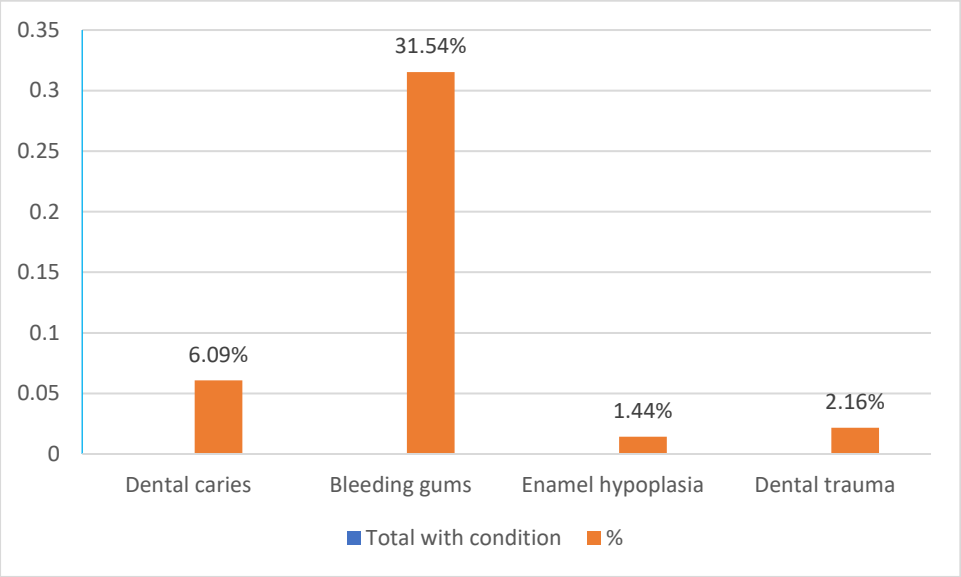

Figure 4.1: Prevalence of Oral Diseases among School Children

The bar chart above shows that 31.54% of the pupils have bleeding gums (or gum disease) making it the most prevalence of oral condition among the pupils. This is followed by dental caries affecting 6.08%. The other conditions like dental trauma and enamel hypoplasia are of low prevalence making 2.16% and 1.44% respectively (Figure 4.1).

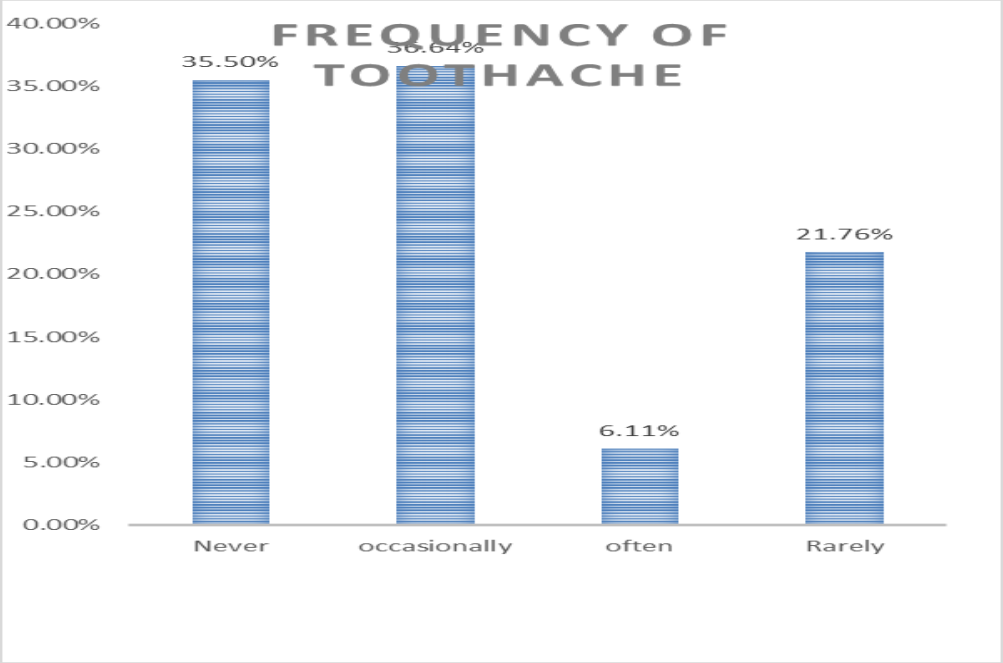

Figure 4.2: Frequency of Toothache

4.3 Oral Health Behaviors and Oral Hygiene Practices Among School Children

All the participants use toothbrush to clean their teeth. However about 11.11% of them use tooth brush and other materials like charcoal, tooth pick, chewing stick etc. to clean their teeth, whereas as 88.89% use toothbrush alone (Table 4.8).

Table 4.4: Oral Hygiene Practices/Behaviour

Practice/Behavior	Response	Frequency	%
Item for Brushing			
	toothbrush alone	248	88.89
	toothbrush+other item(s)	31	11.11
Use of Fluoride			
	Yes	33	11.83
	No	35	12.54
	Don't know	211	75.63

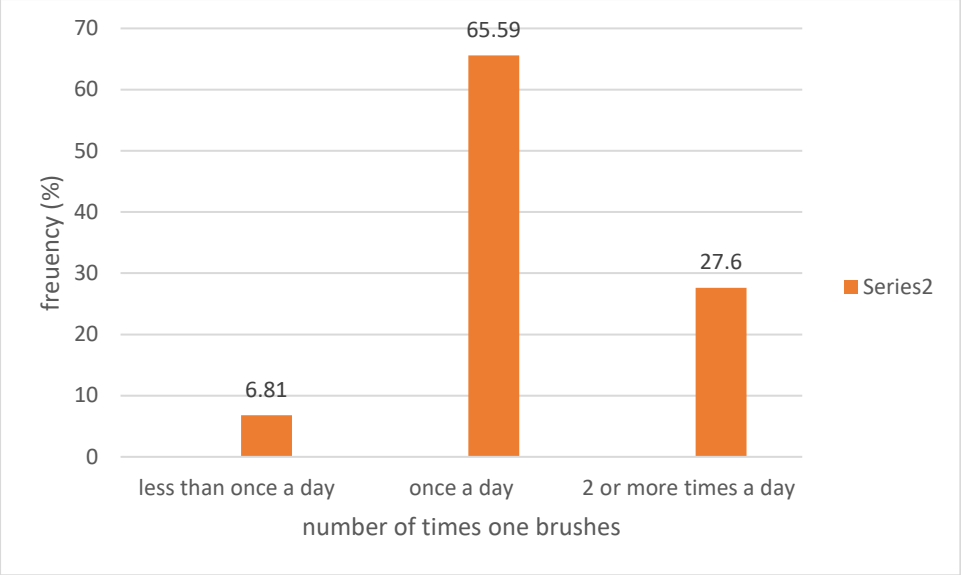

Figure 4.3: Frequency of Brushing

From Figure 4.3, most of the children brush once a day (65.59%), 27.6% brush 2 or more times a day and 6.81% brush less than once a day. However, from the data, there was no association between the frequency of brushing and the experience of dental caries among the school children (p-value = 0.163).

Only 5 of the children indicated that they did not use toothpaste to clean their teeth. Over 98% of the pupils use toothpaste, but there was no association between individuals' use of toothpaste and their experience of caries. Although, most of the children use tooth paste, only a few (11.83%) know that their toothpaste contains fluoride, the majority (82.08%) did not know whether the paste they use contained fluoride or not.

4.4 Effects of Socio-Demographic Factors and Oral Health Practices on Oral Health Status of School Children

Table 4.5: Relationship between Socio-Demographic Factors and Dental Caries Experience

Variables		Caries Experience			
	Total	No	Yes	pearson chi2	P-value
Sex				0.6139	0.433
male	124	118(95.16)	6(4.84)		
female	155	144(92.90)	11(7.1)		
Age(years)					0.621
12 or less	70	65(23.3)	5(1.75)	ψ	
13 to 16	172	163(58.42)	9(3.23)		
17 and above	37	34(12.19)	3(1.08)		
Ethnic Group					0.515
Akan	213	200(71.68)	13(4.66)	ψ	
Ewe	35	34(12.19)	1(0.36)		
Ga/Dangme	11	10(3.58)	1(0.36)		
Others	20	18(6.45)	2(0.72)		

Father's Educational Level				ψ	0.639
no formal schooling	9	8(2.87)	1(0.36)		
high school or less	161	152(54.48)	9(3.23)		
college/university co	58	55(19.71)	3(1.08)		
dont know	51	47(16.85)	4(1.43)		
Mother's Educational Level				ψ	0.122
no formal schooling	18	15(5.38)	3(1.08)		
high school or less	167	159(56.99)	8(2.87)		
college/university	40	36(12.90)	4(1.43)		
dont know	54	52(18.64)	2(0.72)		

Ψ-fischer exact test

Table 4.6: Relationship between Caries Experience and Oral Hygiene Practice

		caries experience		
Variable	Total	Yes	No	p-value
Frequency of Cleaning				0.163
less than once a day	19(6.81)	0(0)	19(6.81)	
once a day	183(65.59)	15(5.38)	168(60.22)	
2 or more times a day	77(27.6)	2(0.72)	75(26.88)	
Items for Brushing				0.704
toothbrush alone	248(88.89)	16(5.73)	232(83.15)	
toothbrush+other item	31(11.11)	1(0.36)	30(10.75)	
Use of Toothpaste				1

yes	274(98.21)	17(6.09)	257(92.11)	
no	5(1.79)	0(0)	5(1.79)	
Use of Fluoride				0.222
yes	33(11.83)	0(0)	33(11.83)	
no	35(12.54)	1(0.36)	34(12.19)	
dont know	211(75.63)	16(5.73)	195(69.89)	

Table 4.7: Relationship Between Eating Habit and Dental Caries

Fresh Fruits				0.241
never or occasionally	25(8.96)	2(0.72)	23(8.24)	
once or more times a week	132(47.31)	5(1.79)	127(45.52)	
everyday	122(43.73)	10(3.58)	112(40.14)	
Biscuits				0.469
never or occasionally	29(10.39)	1(0.36)	28(10.04)	
once or more times a week	101(36.2)	4(1.43)	97(34.77)	
everyday	149(53.41)	12(4.3)	137(49.61)	
Soft Drinks				0.467
never or occasionally	72(25.81)	3(1.08)	69(24.73)	
once or more times a week	131(46.95)	7(2.51)	124(44.44)	
everyday	76(27.24)	7(2.51)	69(24.73)	
Jam/Honey				1
never or occasionally	159(56.99)	10(3.58)	149(53.41)	
once or more times a week	68(24.37)	4(1.43)	64(22.94)	
everyday	52(18.64)	3(1.08)	49(17.56)	
Chewing Gums				0.815
never or occasionally	71(25.45)	4(1.43)	67(24.01)	
once or more times a week	113(40.5)	6(2.15)	107(38.35)	
everyday	95(34.05)	7(2.51)	88(31.54)	
Sweets/Candy				0.44
never or occasionally	82(29.39)	7(2.51)	75(26.88)	
once or more times a week	114(40.86)	5(1.79)	109(39.07)	

everyday	83(29.75)	5(1.79)	78(27.96)	
Milk				0.385
never or occasionally	101(36.2)	4(1.43)	97(34.77)	
once or more times a week	112(40.14)	7(2.51)	105(37.63)	
everyday	66(23.66)	6(2.15)	60(21.51)	
Tea				0.485
never or occasionally	73(26.16)	3(1.08)	70(25.09)	
once or more times a week	111(39.78)	6(2.15)	105(37.63)	
everyday	95(34.05)	8(2.87)	87(31.18)	
Coffee				0.839
never or occasionally	155(55.56)	11(3.94)	144(51.61)	
once or more times a week	65(23.3)	3(1.08)	62(22.22)	
everyday	59(21.15)	3(1.08)	56(20.07)	

Table 4.8: Relationship between Oral Hygiene Practice and Bleeding Gums and Calculus

	Bleeding Gums			
Frequency of Cleaning	**Total**	**Absence**	**Presence**	**P-Value**
less than once a day	19(6.81)	10(3.58)	9(3.23)	0.241
once a day	183(65.59)	131(46.95)	52(18.64)	
2 or more times a day	77(27.6)	55(19.71)	22(7.89)	

Frequency of Cleaning	**Calculus**			**0.93**
	Total	**No**	**Yes**	
less than once a day	19(6.81)	13(4.66)	6(2.15)	
once a day	183(65.59)	130(46.59)	53(19.00)	
2 or more times a day	77(27.6)	54(19.35)	23(8.24)	

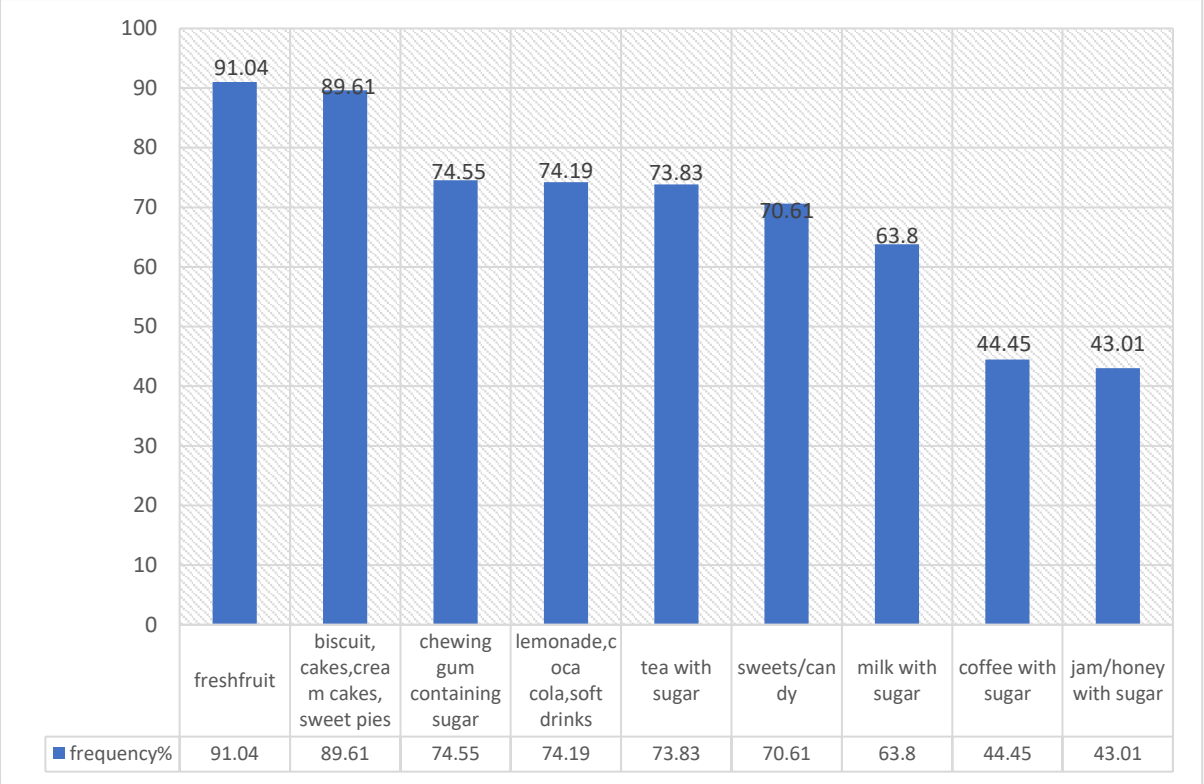

Figure 4.4: Frequencies of Dietary Consumption

For the dietary habit (Figure 4.4), foods that were eating more often by the participants weekly or daily are about fresh fruits (91.04%), biscuits (89.61%), chewing gum containing sugar (89.61%), soft drinks (74.19%) tea with sugar (73.83%), sweets/candy (70.61%), and milk with sugar (63.8%), coffee with sugar (44.45%) and jam/honey (43.01%).

However, there was no association between their dietary habits and caries experience.

Chi square analysis of socio-demographic factors, and behavioral factors showed no association between these factor and dental caries or periodontal diseases as all the p-values are greater than 0.05. (Tables 4.5, 4.6, 4.7, and 4.8).

CHAPTER FIVE

DISCUSSION

5.1 Prevalence of Oral Diseases and Oral Health Status of School Children

The findings of the study on the prevalence of oral diseases among school children in Assin North Municipal area revealed that gum disease had the highest percentage (31.54%) among the four variables which were studied. This was seen in the section on data presentation in table 2. In a study by Beni (2009), also revealed that gum disease was the highest percentage (87.5%) among the variables that were studied. Although this study had a lower percentage in terms of gum disease compared to what Beni presented, the trend seems to be the same. In that, gum disease in those two studies had higher percentages in the sample. Beni (2009), stated one possible reason for the cause(s) for this trend. The finding of his study indicated that the poor state of oral hygiene led to gum disease.

It was also noticed that periodontal disease had a higher prevalence (31.54%) than dental caries (6.09%) among the respondents who were studied. This finding is consistent with other studies (Hussaini *et al.*, 2016; Ndanu *et al*, 2015; Beni, 2009) that reported incidence of high prevalence of periodontal diseases compared to dental caries. This might be that although poor oral hygiene can lead to both gum disease and dental caries, the progression in gum disease is much faster than dental caries. Dental caries can take several months or years to develop (Sonis, 2015). For that reason, it could explain the difference in the variation in the percentages.

The prevalence of dental caries (6.09%) and gum disease (31.54%) obtained from this study, although lower compared with other studies, however is not significantly different from results obtained from oral health screening done by the dental team of St. Francis Xavier hospital on school children in that same area. From that programme 5.66% (129) and 28.98%

(660) out of 2,278 of the school children had dental caries and gum diseases respectively (St Francis Xavier hospital records, 2018).

The prevalence of dental caries (6.09%) in particular obtained in this study was lower compared with the prevalence reported in other studies among school children in other parts of the country such as 17.4% (Ndanu *et al*, 2015), 12.5% (Beni,2009), 26.7% (Onuoha, 2002) and 13.9% (Adeokoya *et al*, 2006). Although, the empirical data does not provide any clue beyond what is being discussed here, it might be suggestive that geographical location and environmental factors contribute to the reason. For instance, a study by Donaldson *et al.* (2008) suggested that socio-economic status of an individual can have adverse effect on his or her oral health status. The researcher further argued a well-established relationship between socio-economic status and oral health (Donaldson *et al., 2*008). Furthermore, a comparative study in Russia and Norway confirms the above claim that high prevalence of dental caries among Russian school children compared to Norwegian school children was as a result of the attitude of Russian parents toward regular dental visits (Koposova *et al.*, 2013). It can therefore be argued that geographic location, indicating where one lives, with its socio-behavioral factors can influence their caries experience.

Aside dental caries and gum diseases, another finding from the study was the low prevalence rate (2.16%) of fractured teeth compared to other studies. Findings from other studies (Beni, 2009; Agbelusi and Jeboda, 2005) indicated that the prevalence rate of school children studied were 4.2% and 10% respectively. This might be due respondents' low engagement in violent sporting activities. Diaz *et al*, (2010) argued in their study to establish that violent activities such as accidental falls, striking teeth against objects and accidents from bike riding can cause various injurious to the teeth (Díaz *et al*. (2010). These ludic activities might be lower in the remote agricultural communities where research participants lived.

The study further observed the prevalence of enamel hypoplasia to be 1.44%. This figure falls below what other studies have reported. For instance, a research conducted by Koleoso *et al*, (2004) revealed that respondents had 7.3% prevalence of enamel hypoplasia among school going children in Nigeria. This low prevalence could be explained by the normal levels of fluoride in drinking water. As Petersen *et al*. (2005) argued, in areas where the amount fluoride in groundwater is above normal levels, dental fluorosis may be found in most of the people.

From the above discussion, it has been noted that respondents had low prevalence of dental caries, gum diseases, fractured teeth and dental fluorosis. This finding perhaps explains why most of the participants perceive their oral health to be in good condition. The data reveals that 83.51% and 78% respectively perceived their health of teeth and gums to be in good condition, whereas a few (5.73%) of the participant indicated that they experience pain or discomfort in relation to their teeth and gums

According to the World Health Organization (WHO) and other studies, the criteria for prevalence of oral illnesses like dental caries range from low, medium and high on the scale (WHO, 2003; Veiga *et al.*, 2015). The DMFT index identifies four levels of dental caries prevalence ranging from very low to high in severity. The finding from this study on the prevalence of dental caries (DMFT 0.12) indicated and confirms that the study area (Assin Foso) which is in Ghana is within the very low prevalence of dental caries zone (DMFT < 1.2). It thus supports and shows similarity to what WHO (2004) reported.

From the analyses and the discussion of the findings, it might be safe to conclude that respondents have a low prevalence of the three variables (dental caries, enamel hypoplasia and gum disease) studied.

However, presence of active oral diseases such as active caries, bleeding gums, fractured and or discolored teeth could have impact on quality of life. This might lead to experience of pain, discomfort, perception of poor oral health based on respondents self-assessment , dislike of appearance of teeth, avoidance of laughing or smiling, or being unable to chew, as reported in other studies (Masood et al, 2017 ; Peterson et al., 2005). In the current study, though the prevalence of oral diseases studied among the participants were low, a significant number of the participants, 43.10%, were not satisfied with the appearance of their teeth. Whereas 7.89% students claim to avoiding smiling and laughing because of the appearance of their teeth. Furthermore, 11.83% of the pupils missed school due to dental pain, and 40% had difficulty biting hard food and chewing. This suggests that improving the oral health of the children could help improve their general well-being, social interactions and overall quality of life (Allen & Camisa, 2015).

5.2 The Oral Health Behavior and Practices among School Children

The oral health behaviors in this study focused on practices such as teeth brushing and the kind of food respondents eat could positively or negatively affect their oral health.

The data revealed that all participants used toothbrushes to clean their teeth. A section of the sample (11.11%) indicated however, that they use other items like charcoal, chewing stick, toothpicks and dental floss in addition to toothbrushes for cleaning. This finding is not out of the ordinary since other empirical study (Kwamin *et al,* 2012) have suggested that respondents use similar items to clean their teeth. The above study further claimed that laboratory studies and clinical trials have shown that certain plants used for cleaning the teeth contain therapeutic agents and strategies for prevention and treatment of aggressive forms of periodontitis.(Kwamin *et al.*, 2012). Unknown to the research participants, some of their cultural oral health behaviors and practices have been scientifically approved and documented.

With respect to the frequency of brushing, it was realized that just a quarter of the participants brush two or more times a day, more than half of the children brush once a day whereas few of the respondents (6.81%) brush less than once a day. That is, even though the latter brush their teeth, it can be suggested that the frequency is low within the week. This practice of irregularity in brushing the teeth is not limited to the study area alone. Other studies confirm similar brushing irregularities in other countries such as China and Portugal (Zhu *et al.*, 2003; Veiga *et al*., 2015). A comparative study by Koposova *et al.* (2013), also adds that Russians have brushing habits which were found to be less regular and dental fear more pronounced compared to Norwegian participants. These findings suggest that irregularities in brushing are a global concern. It also does suggest that many are not brushing their teeth two or more times a day, which is considered as the fundamental principle of good oral hygiene (Veiga *et al*., 2015). This finding suggests that these respondents are less aware of the benefits and implications regarding proper oral hygiene.

It is of a concern to realize that the majority of the respondents did not know the component of a recommended tooth paste. Only a few (11.38 %) indicated knowledge of the presence of fluoride in tooth paste, even though all the participants revealed usage of tooth paste. Is it lack of proper oral health education in the schools, community or a nationwide problem? The data does not reveal more than it is discussed here.

In operationalizing eating habits, the researcher focused on the consumption and frequency of sugar-containing foods. Most of the research participants showed that they regularly eat sugar-containing foods such as biscuits, chewing gum, soft drinks, tea with sugar, sweets/candy, and milk with sugar. This eating habit is not different from what other studies have reported. For instance, a research by Ndanu *et al*., (2015) revealed that school children consumed snacks very often and this usually occurs when at school than home. The sugar-containing foods often consumed included fruit drinks, sweets, biscuits and cakes.

Additionally, Beni (2009) noted that the majority of school children consumed either fruits/gum or ice cream/toffees respectively on a daily basis.

Other studies have also shown that these sugar-containing foods increase the risk of developing dental caries (Sculean, 2017; Lord & Fricke, 2015; Ndanu *et al*, 2015; Cheng *et al.*, 2014; Beni, 2009; Karjalainen, 2007). Dental caries however is shown to be on a decline in the global north (Western world) even though such countries had a high prevalence of dental caries whereas the disease is documented to be on the increase in the global south (developing world) although it was almost non-existence (WHO, 2013; Petersen, 2009). What might possibly account for the change? Are developing countries wrongly copying and embracing every life-style that seems to come from the west? Could it also be that individuals associate with western style of living and therefore impress their peers? As Erving Goffman (1956) dramaturgical perspective postulates, individual's day-to-day lives can be understood as resembling performers in action on a theater stage. This unseen force determines how people behave. It could be that such school children who eat high sugar-containing food would want to impress their peers who might be economically incapable to afford such foods. The answers are beyond what this study has provided.

Amine et al. (2003) argued that consumption of starchy diets and fresh fruits have a strong relationship with low prevalence of dental caries (decay). This claim is well supported by Beni (2009). The researcher noted that the protective factors of fresh fruits cancelled out the cariogenic effect of the ice cream/toffee eaten by the respondents. He further argued that this cancellation led to low prevalence of dental caries among the research participants. The above studies are in line with the findings of this particular research which showed that most (91.04 %) of the children eat healthy diets like fruits daily.

5.3 Relationship between Socio-demographic and Oral Hygiene Practices and Oral Diseases.

Socio-demographic variables such as age, sex, religion, ethnicity and parents' level of education showed no causal association with dental caries. This finding does not support what other studies have established. For example, Quist (2016) argued that socio-demographic variables positively correlate with the experience of dental caries. Other studies confirm similar relationship (Cheng *et al.* 2014; Scardina & Messina, 2012).

It was noted from the above discussion and the ongoing analyses that fresh fruits have protective properties that have the ability to cancel out the negative effect of sugar-containing foods that cause dental caries. This revelation might explain the reason for no causal relation among the variables tested in this study. Other unknown variables could also have accounted for this finding. It therefore leaves the door open for further studies to be conducted on the subject.

Even though there is no relationship established among the demographic variables and dental caries, the differences in proportions (males 4.84% and females 7.1%,) of sex of respondents in relation to dental caries support the findings of studies by Quist (2016) and Cheng et al, (2014). The finding confirms that females usually have higher prevalence of dental caries than their male counterparts. This could be attributed to the desire by females for cariogenic foods such as pie, sweets/candies and biscuits (Karjalainen, 2007). Other behavioral practices such as frequency of brushing, use of toothpaste, and dietary habits yielded differences in proportions within the categories of variables tested, but these findings were not statistically significant.

Limitations of the Study

The researcher could not investigate all the factors that contribute to dental caries and periodontal disease. For example, morphology of tooth, immunity and other variables. These factors, along with oral hygiene practices, sugar consumption and attitude toward dental services could have provided us with more thorough data regarding oral diseases.

The researcher also could not use dental probes and radiographs that have the ability to detect hidden carious lesions. This could have resulted in underestimation of the prevalence of dental caries.

CHAPTER SIX

CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

The prevalence of oral diseases such as dental caries, gingivitis, fractured teeth and dental fluorosis among school going children is low in the study area.

There were irregularities in the frequency of brushing and low awareness of presence of fluoride in toothpaste.

Although respondents ate high sugar-containing foods, fresh fruits which have been shown to contain protective agents cancelled out the negative effects of the cariogenic foods.

Finally, the findings showed no associations between the demographic variables and dental caries of respondents.

6.2 Recommendations

On the basis of the above conclusions, the following recommendations are made:

1. There is the need to involve the media, the Parent and Teachers Association (PTA), and other stakeholders in educating parents/guardians on the need to help their children to improve their oral health status and reduce the intake of high-sugar containing foods.
2. Since it has become a global concern regarding the irregularities in the frequency in brushing, there should be collaboration between the Municipal Health Management Team (MHMT), the St. Francis Xavier Hospital and Ghana Education Service (GES) to properly educate and improve the awareness level of the benefits of good oral hygiene.

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APPENDICES

APPENDIX A: PARENTAL CONSENT

Title: The Oral Health Status and Oral Health Behavior of School Children in Assin North Municipality

Principal Investigator: Jonathan Mensah

Address: School of Public Heath, University of Ghana, Legon.

General Information about Research

As part of the requirements for the award of the Master of Public Health Degree, I am conducting a research on the oral health status and oral health behavior of school children in Assin north municipality.

Procedure

All children selected will be interview by means of questionnaire and the mouth will be checked for the presence of tooth decay or gum disease. Your child has been selected to take part in this research.

Possible Risks and Discomforts

This research will not will not bring any discomfort to your child. However, data collectors will ask your child some questions and will look into your child mouth. No extraction will be done.

Possible Benefits

The study will help the Municipal Health Directorate to identify the burden of the oral diseases in the municipality and plan to prevent it. All children who will be identified with the disease will also be referred to St Francis Xavier Hospital for treatment. Also, all the

school children will be educated on how they can prevent practice and maintain good oral hygiene

Confidentiality

We will protect information about your child to the best of our ability. Your child will not be named in any report, publication or dissemination of the research findings. All the information obtained from this study will be kept confidential and used for the purpose indicated for this study alone.

Compensation

You or your child will not be paid or compensated for participating in the study.

Additional Cost

If a child is identified with the dental caries or gum disease, the parent(s) will bear the cost of treatment if the child is insured under the National Health insurance Scheme.

Voluntary Participation and Right to Leave the Research

Participation in this research is voluntary and your child can withdraw without any penalty to him or her.

Whom to contact:

For any question regarding the Research, you may contact

Hannah Frimpong

Administrative Secretary, Ghana Health Service Ethics Review Committee

Telephone Number: 050-704-1223.

Email: *ghserc@gmail.com* **Contacts for Additional Information**

VOLUNTEER AGREEMENT

The above document describing the benefits, risks and procedures for the research *he oral health status and oral health behavior of school children in Assin north municipality* has been read and explained to me. I have been given an opportunity to ask any questions about the research and they were answered to my satisfaction. I agree that my child should participate as a volunteer.

_____ _____

Date Name and signature or mark of parent or guardian

If volunteers cannot read the form themselves, a witness must sign here:

I was present while the benefits, risks and procedures were read to the child's parent or guardian. All questions were answered and the child's parent has agreed that his or her child should take part in the research.

_____ _____

Date Name and signature of witness

I certify that the nature and purpose, the potential benefits, and possible risks associated with participating in this research have been explained to the above individual.

_____ _____

Date Name Signature of Person Who Obtained Consent

APPENDIX B: CONSENT FORM-FOR 18 YEARS AND ABOVE

Introduction

I am Jonathan Mensah, a student of the School of Public Health, University of Ghana. As part of the requirements for the award of the Master of Public Health Degree, I am conducting a research on *The Oral Health Status and Oral Health Behavior of School Children in Assin North Municipality*

Procedure:

We will conduct an interview after you have been attended to by the Doctor and record the diagnosis in your folder. A structured questionnaire will be used for the interview. No x-rays will be taken or any invasive procedure will be done, thus, no physical harm. There will be no financial compensation for participation.

Freedom to Participate:

Your participation is completely voluntary and you may refuse to participate. You may ask me to stop the interview if it makes you feel uncomfortable, or you may also decline to answer any questions if you are uncomfortable with it.

Risks and Benefits:

You may feel uneasy with some of the questions that we will be asking you and the examination that will be done. However, they will be helpful to us and to the providers of healthcare in Ghana if you could answer all the questions and partake in the examination. The information you provide will contribute to the efforts aimed at mitigating the effects of dental caries on children.

Privacy, Anonymity and Confidentiality:

Your name will not appear. The information you provide for the interview will be used only for the purpose of the study and you will be assured of its confidentiality.

Voluntary Participation and Right to Leave the Research

You can stop participating at any time if you feel uncomfortable. No one will be angry with you if you do not want to participate.

Contacts for Additional Information

You may ask me any questions about this study. You can call me at any time *0245411125.* Please talk about this study with your parents before you decide whether or not to participate. I will also ask permission from your parents before you are enrolled into the study. Even if your parents say "yes" you can still decide not to participate.

Your rights as a Participant

This research has been reviewed and approved by the Ghana Health Service Ethics Review Committee. If you have any questions about your rights as a research participant you can contact: Hannah Frimpong

Administrative Secretary, Ghana Health Service Ethics Review Committee

Telephone Number: 050-704-1223.

Email: *ghserc@gmail.com*

VOLUNTARY AGREEMENT

By making a mark or thumb printing below, it means that you understand and know the issues concerning this research study. If you do not want to participate in this study, please do not sign this assent form. You and your parents will be given a copy of this form after you have signed it.

This assent form which describes the benefits, risks and procedures for the research titled *he oral health status and oral health behavior of school children in Assin north municipality* has been read and or explained to me. I have been given an opportunity to ask questions about the research and they have been answered to my satisfaction. I agree to participate.

Child's Name……

Child's Mark/Thumbprint……

Date: ……...

Researcher's Signature…….....

Researcher's Name…….....

Date: …….

APPENDIX C -REFFERAL FORM

NAME: ……...

AGE: …….

SEX: …….

DATE: ……...

CONDITION: ……...

The above-named person with the identified condition was detected through an oral health screening exercise held in the Assin North Municipality. He/she is being referred to you for expert management

QUESTIONNAIRE

ORAL HEALTH QUETIONAIRE FOR CHILDREN, 2013

Annex 8

Oral Health Questionnaire for Children

First, we would like you to answer some questions concerning yourself and your teeth

	Identification number	Sex	Location
1.	☐☐☐☐ (1–4)	Boy ☐ 1 Girl ☐ 2	Urban ☐ 1 Periurban ☐ 2 Rural ☐ 3

2. **How old are you today?** _____ (Years)

3. **How would you describe the health of your teeth and gums?**

(Read each item)

	Teeth	Gums
Excellent	☐ 1	☐ 1
Very good	☐ 2	☐ 2
Good	☐ 3	☐ 3
Average	☐ 4	☐ 4
Poor	☐ 5	☐ 5
Very poor	☐ 6	☐ 6
Don't know	☐ 9	☐ 9

4. **How often during the past 12 months did you have toothache or feel discomfort due to your teeth?**

Often	☐ 1
Occasionally	☐ 2
Rarely	☐ 3
Never	☐ 4
Don't know	☐ 9

Now please answer some questions about the care of your teeth

5. **How often did you go to the dentist during the past 12 months?**
(Put a tick/cross in one only)

- Once ..... ☐ 1
- Twice ..... ☐ 2
- Three times ..... ☐ 3
- Four times ..... ☐ 4
- More than four times ..... ☐ 5
- I had no visit to dentist during the past 12 months ..... ☐ 6
- I have never received dental care/visited a dentist ..... ☐ 7
- I don't know/don't remember ..... ☐ 9

If you did not see a dentist during the last 12 months, go on to question 7

6. **What was the reason for your last visit to the dentist?**
(Put a tick/cross in one box only)

- Pain or trouble with teeth, gums or mouth ..... ☐ 1
- Treatment/follow-up treatment ..... ☐ 2
- Routine check-up of teeth/treatment ..... ☐ 3
- I don't know/don't remember ..... ☐ 9

7. **How often do you clean your teeth?**
(Put a tick/cross in one box only)

- Never ..... ☐ 1
- Several times a month (2–3 times) ..... ☐ 2
- Once a week ..... ☐ 3
- Several times a week (2–6 times) ..... ☐ 4
- Once a day ..... ☐ 5
- 2 or more times a day ..... ☐ 6

8. **Do you use any of the following to clean your teeth or gums?**
(Read each item)

	Yes 1	No 2
Toothbrush	☐	☐
Wooden toothpicks	☐	☐
Plastic toothpicks	☐	☐
Thread (dental floss)	☐	☐
Charcoal	☐	☐
Chewstick/miswak	☐	☐
Other	☐	☐

Please specify_____

9.

		Yes	No
a)	**Do you use toothpaste to clean your teeth**	☐ 1	☐ 2
b)	**Do you use toothpaste that contains fluoride?**	☐ 1	☐ 2

Don't know..... ☐ 9

10. **Because of the state of your teeth and mouth, have you experienced any of the following problems during the past year?**

		Yes 1	No 2	Don't know 0
(a)	I am not satisfied with the appearance of my teeth	☐	☐	☐
(b)	I often avoid smiling and laughing because of my teeth	☐	☐	☐
(c)	Other children make fun of my teeth	☐	☐	☐
(d)	Toothache or discomfort caused by my teeth forced me to miss classes at school or miss school for whole days	☐	☐	☐
(e)	I have difficulty biting hard foods	☐	☐	☐
(f)	I have difficulty in chewing	☐	☐	☐

11. **How often do you eat or drink any of the following foods, even in small quantities?**
(Read each item)

	Several times a day	Every day	Several times a week	Once a week	Several times a month	Never
	6	5	4	3	2	1
Fresh fruit	☐	☐	☐	☐	☐	☐
Biscuits, cakes, cream cakes, sweet pies, buns etc.	☐	☐	☐	☐	☐	☐
Lemonade, Coca Cola or other soft drinks	☐	☐	☐	☐	☐	☐
Jam/honey	☐	☐	☐	☐	☐	☐
Chewing gum containing sugar	☐	☐	☐	☐	☐	☐
Sweets/candy	☐	☐	☐	☐	☐	☐
Milk with sugar	☐	☐	☐	☐	☐	☐
Tea with sugar	☐	☐	☐	☐	☐	☐
Coffee with sugar	☐	☐	☐	☐	☐	☐

(Insert country-specific items)

12. **How often do you use any of the following types of tobacco?**
(Read each item)

	Every day	Several times a week	Once a week	Several times a month	Seldom	Never
	6	5	4	3	2	1
Cigarettes, pipe or cigars	☐	☐	☐	☐	☐	☐
Chewing tobacco or snuff	☐	☐	☐	☐	☐	☐

13. **What level of education has your father completed (or your stepfather, guardian or other male adult living with you)?**

No formal schooling	☐ 1
Less than primary school	☐ 2
Primary school completed	☐ 3
Secondary school completed	☐ 4
High school completed	☐ 5
College/university completed	☐ 6
No male adult in household	☐ 7
Don't know	☐ 9

14. **What level of education has your mother completed?**

No formal schooling	☐ 1
Less than primary school	☐ 2
Primary school completed	☐ 3
Secondary school completed	☐ 4
High school completed	☐ 5
College/university completed	☐ 6
No female adult in household	☐ 7
Don't know	☐ 9

(Insert country-specific categories)

That completes our questionnaire

Thank you very much for your cooperation!

Year	Month	Day	Interviewer	District	Country

ORAL HEALTH ASSESSMENT FORM FOR CHILDREN

World Health Organization

Oral Health Assessment Form for Children, 2013

Annex 2

Leave blank (1)(4) | Year (5) | Month | Day (10) | Identification No. (11)(14) | Orig/Dupl (15) | Examiner (16)(17)

General information: Sex 1=M, 2=F (18) | Date of birth (19)(24) | Age in years (25)(26)

(Name)

Ethnic group (27)(28) **Other group** (29)(30) **Years in school** (31)(32) **Occupation** (33)

Community (geographical location) (34)(35) **Location** Urban (1) Periurban (2) Rural (3) (36)

Other data (37)(38) **Other data** (39)(40)

Other data (41)(42) **Extra-oral examination** (43)(44)

Dentition status

		17	16	55 15	54 14	53 13	52 12	51 11	61 21	62 22	63 23	64 24	65 25	26	27	
Crown	(45)															(58)
Crown	(59)															(72)
		47	46	85 45	84 44	83 43	82 42	81 41	71 31	72 32	73 33	74 34	75 35	36	37	

Periodontal status

		17	16	55 15	54 14	53 13	52 12	51 11	61 21	62 22	63 23	64 24	65 25	26	27	
	(73)															(86)
	(87)															(100)
		47	46	85 45	84 44	83 43	82 42	81 41	71 31	72 32	73 33	74 34	75 35	36	37	

Gingival bleeding

Primary teeth	Permanent teeth
	Status
A	0 = Sound
B	1 = Caries
C	2 = Filled w/caries
D	3 = Filled, no caries
E	4 = Missing due to caries
—	5 = Missing for any another reason
F	6 = Fissure sealant
G	7 = Fixed dental prosthesis/crown, abutment, veneer
—	8 = Unerupted
—	9 = Not recorded

Enamel fluorosis (101)

Status

0 = Normal 3 = Mild
9 = Not recorded (unerupted tooth)

Dental erosion

Severity (102)

0 = No sign of erosion
1= Enamel lesion
2 = Dentinal lesion
3 = Pulp involvement

No. of teeth (103)(104)

Dental trauma

Status (105)

0 = No sign of injury
1 = Treated injury
2 = Enamel fracture only
3 = Enamel and dentine fracture
4 = Pulp involvement
5 = Missing tooth due to trauma
6 = Other damage
9 = Excluded tooth

No. of teeth (106)(107)

Oral mucosal lesions

Condition (108)(109)(110)

0 = No abnormal condition
1 = Ulceration (aphthous, herpetic, traumatic)
2 = Acute necrotizing ulcerative gingivitis (ANUG)
3 = Candidiasis
4 = Abscess
8 = Other condition
9 = Not recorded

Location (111)(112)(113)

0 = Vermillion border
1 = Commissures
2 = Lips
3 = Sulci
4 = Buccal mucosa
5 = Floor of mouth
6 = Tongue
7 = Hard and/or soft palate
8 = Alveolar ridges/gingiva
9 = Not recorded

Intervention urgency (114)

0 = No treatment needed

1 = Preventive or routine treatment needed

2 = Prompt treatment (including scaling) needed

3 = Immediate (urgent) treatment needed due to pain or infection of dental and/or oral origin

4 = Referred for comprehensive evaluation or medical/dental treatment (systemic condition)

ETHICAL APPROVAL

GHANA HEALTH SERVICE ETHICS REVIEW COMMITTEE

In case of reply the number and date of this Letter should be quoted.

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MyRef. GHS/RDD/ERC/Admin/App 18/253
Your Ref. No.

16th May, 2018

Mensah Jonathan Karikari
University of Ghana
School of Public Health
Legon, Accra

The Ghana Health Service Ethics Review Committee has reviewed and given approval for the implementation of your Study Protocol.

GHS-ERC Number	**GHS-ERC120/12/17**
Project Title	The Oral Health Status and Oral Health Behaviour of School Children in Assin North Municipality
Approval Date	16th May,2018
Expiry Date	15th May, 2019
GHS-ERC Decision	**Approved**

This approval requires the following from the Principal Investigator

- Submission of yearly progress report of the study to the Ethics Review Committee (ERC)
- Renewal of ethical approval if the study lasts for more than 12 months,
- Reporting of all serious adverse events related to this study to the ERC within three days verbally and seven days in writing.
- Submission of a final report **after completion** of the study
- Informing ERC if study cannot be implemented or is discontinued and reasons why
- Informing the ERC and your sponsor (where applicable) before any publication of the research findings.

Please note that any modification of the study without ERC approval of the amendment is invalid.

The ERC may observe or cause to be observed procedures and records of the study during and after implementation.

Kindly quote the protocol identification number in all future correspondence in relation to this approved protocol

SIGNED.....
DR. CYNTHIA BANNERMAN
(GHS-ERC CHAIRPERSON)

Cc: The Director, Research & Development Division, Ghana Health Service, Accra