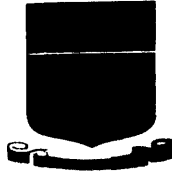


**SCHOOL OF PUBLIC HEALTH
COLLEGE OF HEALTH SCIENCE
UNIVERSITY OF GHANA**



**ASSESSMENT OF RISK FACTORS OF DENTAL CARIES AMONG URBAN
PRIMARY SCHOOL CHILDREN IN THE ADENTAN MUNICIPALITY**

BY

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(10600199)

**A DISSERTATION SUBMITTED TO THE UNIVERSITY OF GHANA
SCHOOL OF PUBLIC HEALTH IN PARTIAL FULFILMENT OF THE
REQUIREMENTS FOR THE AWARD MASTER OF PUBLIC HEALTH
DEGREE**


JULY, 2017

DECLARATION

I, Augustina Mensah Ephriam author of this dissertation, hereby declare that apart from special references which have duly been acknowledged, this study is my own original work and that it has not been submitted to any other body


STUDENT

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Date 10.10.2017
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DEDICATION

This work is dedicated to GOD Almighty, Mr E.K Appiah; my beloved husband and a constant companion; my children especially ADOMUNHYIRA KPEKPENA APPIAH, may your gentle soul rest in perfect peace. Thank you all for your encouragement and support throughout the period of study.



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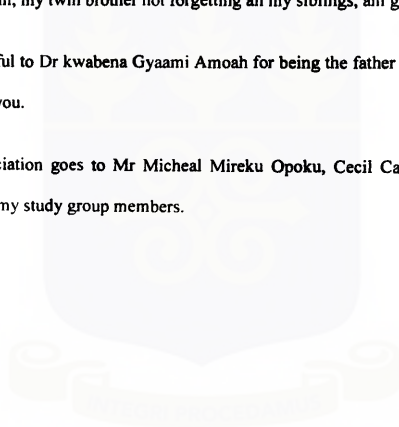


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LIST OF ABBREVIATION

WDF – World Dental Federation

DHF – Dental Health Foundation

WHO – World Health Organisation

MGCSP – Minister for Gender, Children and Social Protection

GNA – Ghana News Agency

DMFT – Decay, Missing and Filled Teeth

DMFs – Dental Missing and Filled surface

SHEP – School Health Education Programme

OHK – Oral Health Knowledge

OHP – Oral Health Practices

ANOVA – Analysis of Variance

SPSS – Statistical Package for Social Sciences

JHS – Junior High School

GSS – Ghana Statistical Service

PHC – Population and Housing Census

DSA – Dental Surgery Assistant

STATA – Statistics and Data

IRB - Institutional Review Board

SUMMARY

Background: Oral health is a key part of the general health of an individual and is crucial to quality of life. Several oral diseases can affect individuals' oral health and one of these diseases is dental caries. It occurs as a result of acids produced when sugars react with bacteria found in the plaque on the enamel of the tooth.

Objectives: To assess the risk factors of dental caries among urban primary school children.

Method: The study used a cross sectional design and 420 primary school children were sampled using simple random sampling technique in six school in Adentan Municipality. A face-to-face structured questionnaire was used and oral examination were conducted by two dentists. Gloves, dental probe, face mask, spatula, mouth mirror and a clinical dental forms were used during oral examination. Data analysed using independent t test and simple logistic regression.

Result: The findings suggest that, 1.43%, 63.81% and 34.76% of respondent had low, moderate and high levels of knowledge respectively. Level of knowledge was significantly associated with sex and school type. Averagely, females had 0.69 higher score than males and private school children had 2.03 higher. Level of oral health practices was significantly associated with school type. The odds of a child being diagnosed with dental carries was 1.51 times for a unit increase in diet and nutrition scores. Age and school types a statistical significance on diagnosis on dental caries while the sex of the school children was not.

Conclusion: An upsurge in consumption of sweet foods by primary school children increases the chances of caries; and age, type of school, oral health practices are contributing factors.

CHAPTER ONE

INTRODUCTION

Background

Oral health is a component of general health of an individual and is crucial to quality of life. According to Rao et al. (2005) oral health impacts an individual's general wellbeing and quality of life by positively influencing physical and mental wellbeing, appearance and interpersonal relationships. It includes; healthy gums, tongue, lips, salivary glands, linings of the mouth and throat, chewing muscles, as well as upper and lower jaws (World Dental Federation, 2014). However, there are several oral diseases that can affect individual and this may include; oral throat cancers, birth defects such as cleft lip and palate, oral sores, periodontal (gum) disease, dental caries and tooth loss.

According to the Dental Health Foundation (DHF, 2016), dental caries occurs as a result of acids produced when sugars, predominantly sucrose in foods or drinks react with bacteria present in the dental biofilm known as plaque of the tooth surface on the enamel surface. Thus, the acid produced leads to a loss of phosphate and calcium from the enamel in a process called demineralisation (DHF, 2016).

Dental caries affects many children in the general population, particularly in developing countries where the rate of the disease is increasing (Alsheneifi & Hughes, 2001). Dental caries has therefore been observed to be a common public health glitch in school children which is linked with poor dental visit habits, dietary and oral hygiene (Mulu, Demilie, Yimer, Meshesha, & Abera, 2014). It is known to have a complex aetiology which shows that caries occurs under conditions which are related to the

tooth itself, the oral environment and the present sugars in food and drinks (Chambers, 2012).

One of the leading causes of dental caries is consumption of sugar including food substance containing sugar (SIGN 83, 2005). There has been some evidence suggesting that the intake of sugar more than four times could lead to dental caries (World Health Organisation, 2004). Dental caries is mainly as a result of sugary food left-over in the mouth or on teeth. Sugary foods such as ice creams, toffies, fizzy drinks and among others are mostly consumed by children of school going age. These foods increase the risk of dental caries development but can be averted with appropriate oral health practices. In effect, appropriate oral health practices of school children depend on oral health knowledge of parents/guardian, teachers, other stakeholders including education on oral health practices and methods, of school children. Appropriate oral health practices also depend on level of education of the parents/guardian of these school children, socio-economic status and availability and access to quality oral health service centres.

With the increase in the rate of dental caries, one may assume that health policies which are link to oral health of children are being put in place to curb the menace. In some countries such as Scotland, Glasgow City in the year 1997-1998 and 2003-2004; a from-birth pilot programme was conducted to increase the oral health of Scottish children (Chambers, 2012). It included a drive towards healthy food and drinks policies within nurseries, free fluoride toothpaste, and the promotion of dental attendance (Chambers, 2012). This element can be recognised as risk factors of dental caries.

Problem Statement

In Ghana dental caries burden among children aged 12 years examined from two geographical regions was record as 22% (Addo-Yobo, Williams and Curzon, 1991). This finding also indicated that 32% of urban children were found to have dental caries while that 12% of rural children were found to have dental caries. This suggest that dental caries burden is higher in urban areas as compared to rural areas. Although some studies have found increasing level of the prevalence of dental caries (that is, 60-90% of school children in most developed countries) (Ahmed et al., 2007), till date, no specific study has been conducted in the Adentan Municipality on risk factors of dental caries among school children.

Moreover, increases in prevalence of dental caries suggest an increase in risk factors of dental caries. Thus, studies have suggested that poor nutrition, inappropriate diet intake and poor oral health practices due to lack or inadequate oral health knowledge have led to the increase in the incidence of dental caries (Ahmed et al., 2007). Ghazal (2013) categorised these risk factors to be demographic, dietary, behavioural as well as presence of *Streptococcus mutans*, existence of visible plaque and the use of fluoridated toothpaste.

In the Adentan municipality which have limited oral health centres, only parents/guardian with high socio-economic status and considerable level of oral health education are likely to visits these centres or travel afar to visit the dentist. Thus, parents/guardian with low socio-economic status may find it difficult to access and afford the services of a dentist. Some of these parents/guardian finds it difficult to afford the appropriate materials such tooth brush, fluoridated tooth paste and among others. Another challenge is that; free services or dental screening are rarely organised

for school children. Since there is currently no study on the prevalence of dental caries and its associated risk factors in the Adentan Municipality, it is difficult to compare current prevalence level with an acceptable level from literature.

In totality, Ghanaians in general are asserted to rarely go for check-up even for general health and will only visit the hospital or clinic when they are ill or in cases of emergencies. This has resulted in the Minister for Gender, Children and Social Protection (Nana Oye Lithur) to call on the general public to make regular visitation to health facilities for check-up (Ghana News Agency, 2016). This is however not different in the case of oral health where most of the limited dental health centres record low number of individuals coming for check-up. This therefore suggest that, parents/guardian hardly send their wards for regular dental check-ups; the result of which is dental caries and other oral diseases. Considering the high level of sugary food intake, lack or inadequate knowledge in oral health as well as poor oral health practices. It is therefore necessary to investigate the risk factors of dental caries among primary school children in the Adentan municipality.

General Objectives

The general objective of study is to assess the risk factors of dental caries among urban primary school children.

Specific Objectives

The specific objectives of this study are to:

1. Assess the oral health knowledge and oral health practices of primary school children.

2. Determine the relationship between diet/nutrition as a risk factor of dental caries among **primary school children**.
3. Investigate age and sex difference on prevalence of dental caries among primary school children in the **Adentan Municipality**.
4. Compare prevalence of dental caries among **public and private school children**.

Conceptual Framework

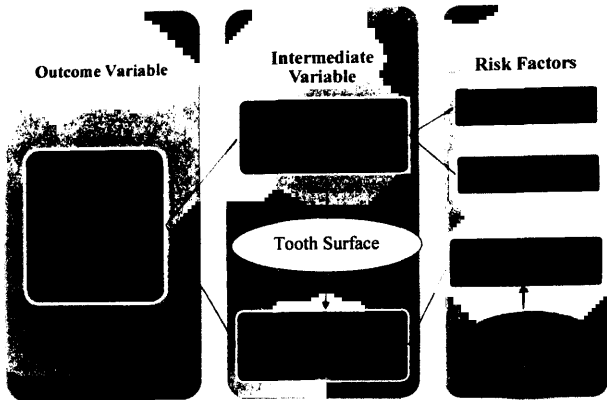


Figure 1: conceptual Framework

The figure 1 shows conceptualization of risk factors of dental caries. The frame work explains the impact of diet/nutrition and oral hygiene practices on the teeth as well as how these risk factors lead to dental caries. That is, good nutrition is necessary for strong and healthy teeth, yet bacterial act on left-over food particles in the mouth or teeth. Due to bodily changes and bacterial actions, it is crucial for appropriate oral health practices to be adopted. Inappropriate oral health practice such as lack of dental checkup, proper tooth cleaning methods among others leads interaction of left-over food on tooth surface and bacterial action. This causes phosphate and calcium loss from the enamel. Thus, a child who has access and frequently takes sugary food, does not brush the teeth regularly and does not get regular dental consultation and review is highly likely to have dental caries.

The findings by Ahmed et al. (2007) shows that; (1) an increased in sugar intake is linked with boys having mothers living in low socio-economic area, with low level education and brushing no less than once in a day; (2) positive oral health related practices were greater among female children with low level of dental caries; (3) the children preferred Western sweet snacks and frequently consumed sweet tea were prone to dental caries.

CHAPTER TWO

LITERATURE REVIEW

Introduction

This chapter reviewed the most appropriate prevalence, oral health knowledge and risk factors study vis-à-vis dental caries, which have been conducted in Ghana as well as elsewhere. The review of studies involves the aims of the studies, methods used, key findings of those studies, conclusions, some weaknesses and strengths of these studies; which was discussed and presented as follows:

ORAL HEALTH KNOWLEDGE

Oral Health Knowledge Definition

It has been asserted that there is limited knowledge about oral health among children from countries that are developing compared to counterparts from developed ones, even though such knowledge is a pointer to the effectiveness of the application of dental health awareness policies (Al-Omiri, Al-Wahadni, & Saeed, 2006)

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 (World Health Organisation, 2014). Oral health knowledge can be defined as the expertise and skills acquired on oral health by individuals through experience or education with the aim of living healthy (Sharda, & Shetty, 2008).

Oral Health Knowledge and Practices

Leghari (2012) investigated knowledge of the parents in Karachi, Pakistan regarding oral health of their children and its association with dental caries of their children. Three hundred and eighty (380) school children with age ranging from 12 – 15 years were sampled using a cross – sectional design. Knowledge of parents concerning oral health maintenance and the knowledge of their children was measured by a self-administered questionnaire. It's been found that the odds of girls developing carious lesions are higher than the odds of boys developing the lesions and this is statistically significant. The prevalence of the carious lesions has also been found to be higher in girls than boys (Gathecha, 2012). Also positive correlation between caries and age; as the increases in age from 12 years to 15 years result in the increase in caries. The findings in addition suggested that significant increase in father education; increases the odds of dental caries in school children. With parents who did not use fluoride containing toothpaste for their children, there is a higher odds of dental caries among children compared to those parents who used fluoride containing toothpaste.

Maderazo & delos Reyes (2014) investigated the source of dental health education process with the aim of determining the knowledge, attitude and oral health practices of public school children in Batangas city. In their study, 279 public school children were randomly selected from different grade levels from different schools. A questionnaire adopted from Peterson (2000) and Stenberg (2000) was used to assess the oral health knowledge of the participants. The findings suggest that the public school children have a high oral health knowledge. The findings also suggested a relationship between type of school and oral health knowledge, attitude and oral health practices.

Al-Darwish (2016), conducted a study with the aim of evaluating the oral health knowledge, practice and behaviour of school children in Qatar. A cross-sectional survey of which 2200 school children were sampled from 16 schools in different area. Oral health knowledge was assessed with a self-administered questionnaire. The result suggests that 25.8% of the school children were observed to have a high oral health knowledge and parent remained the most common source of information on dental health and wellbeing.

Al-Omiri, et al. (2006) has assessed oral health attitude, behaviour and knowledge of school children in North Jordan and also evaluated the factors that determine these variables. Five hundred and fifty-seven (557) school children of an average age of 13.5 years attending public schools were recruited. In their study, a questionnaire was employed to evaluate oral health based behaviour, perception and knowledge of school children as well as their dental treatment. Findings revealed that there were irregularities in oral hygiene habits of school children, whereas the role of parents in these habits of their children was also poor. Participants demonstrated higher awareness of caries compared to periodontal condition, yet showed a common irregularity in visiting of dentist. It was also observed that children had positive attitudes toward their dentists, yet it was observed that they feared dental treatment. The children acknowledged the significance of oral health in relation to their general well-being. Parents were not taking the initiative of ensuring that their children received consistent dental healthcare. The finding advocates the improvement of dental healthcare and oral health behaviour. The recommendation was that widespread oral health educational policy is required for both parents and their children to achieve this goal.

Okolo, et al. (2006) conducted a study aimed at reviewing the oral hygiene, nutritional and immunization status of children 1-7 years of age in a rural community in Nigeria. The study used a cross-sectional survey to sample 237, 168 and 321 children and their parents respectively in Nigeria, living in Illela, Gada and Gwadabawa. The authors also used the plaque/debris index score to examine oral hygiene status of the children. Their findings revealed poor oral hygiene, small measles immunization and malnutrition in the children. They therefore suggest that rapid and acceptable intervention programmes for instance systematic oral health, nutrition promotion and immunization policies are immediately needed in communities.

Petersen and Jurgensen (2013) performed a study on the promotion oral health of children through schools where they review the results from a World Health Organisation (WHO) global survey 2012. The authors employed a purposive sampling in 100 countries including Ghana and evaluated 108 school-based oral health projects in 61 countries. They found out that schools can provide an accommodating environment for the promotion of children's health. They also found out that while a number of well-known policies are being applied, a holistic health promoting actions is unused globally. The authors therefore suggested that the is the need to improving this situation through further research where greater emphasis is place on integrated health policies or a project-specific approaches.

Bruce, Addo, and Ndanu, (2002) performed a study to understand dental disease experience of Ghanaian children in a peri-urban community in Accra. They employed a cross-sectional study design and sampled 4-16-year-old school children. Their result of experience of dental caries ranged from low to very low, with a high Decay, Missing and Filled Teeth (DMFT) score of 1.11 (SE 0.07) in 7-9-year-olds and low

DMFT score of 0.30 (SE 0.06) in the 13-16-year-olds. However, they suggested that constant community preventive dental action requires to be put in place in both rural and urban areas to prevent and control both dental caries and periodontal diseases. They also recommend that these measures instituted will prevent future upsurges in the degree of dental caries as been experienced in some developing countries.

Abiola, et al. (2009) carried out a study to assess the prevalence of dental caries among Nigerian pre-school children. The authors utilised a cross-sectional method and simple random technique to sample 404 pre-school children. Children within the ages of 18 to 60 months were sampled. Mothers of the preschool children were also interviewed. The authors design a questionnaire which they used in sampling information from the study participants. Clinical examination was carried out but early stages of dental caries were excluded. The prevalence of dental caries was 10.9% and higher caries were found with children older than 3years as compared to those less than 3years. Also, the result also shows that, oral hygiene score was positively associated with caries prevalence. The conclusion was that, although less prevalence was recorded, age and oral hygiene score influence the occurrence of the caries observed.

Sudha, Bhasin and Aneundi (2005), undertook a study to ascertain the prevalence of dental caries among children within the ages of 5 to 13years. A survey was carried out among 524 school children in Manglore. Dental examination was conducted and calibration procedure were carried out prior to the study. Re-examination was performed and diet history for past 24hours were also recorded. The findings document a high prevalence of dental caries in 5 – 7years as juxtaposed to children within the 8 – 10years and 11 – 13years. The result also associated gender, ethnic

group, dietary pattern, socioeconomic status, sugar intake and oral hygiene habits to dental caries.

DENTAL CARIES

Definition of dental caries

According to Roberson (2002), “Dental caries is an infectious microbiologic disease of the teeth that results in localized dissolution and destruction of the calcified tissues.” The Dental Health Foundation (DHF, 2016), also define dental caries as disease of the teeth which occurs as a result of acids made when sugars, predominantly sucrose in foods or drinks react with bacteria present in the dental biofilm known as plaque of the tooth surface on the enamel surface.

Review of Related Studies on prevalence and Incidence of Dental Caries

Al-Darwish et al. (2014) carried out a study in early adolescent school children aimed at measuring the incidence of dental caries throughout Qatar. A total of 2113 children in Qatar were randomly sampled from 16 schools from different geographic areas. Their study documented 85% prevalence of dental caries whereas their incisors and canines on the mandibular were least affected. Additionally, the maxillary and mandibular molar teeth showed maximum incidence of dental caries. Also the prevalence of dental caries was affected by socio-demographic factors; significant differences were identified between male and female children. That is, more female children showed dental caries compared to males. Furthermore, children living in semi-urban areas exhibited more dental caries compare to urban areas.

Awooda, Saeed and Elbasir (2013) estimate dental caries prevalence of 3 – 5 year old children in Sudan. They found 342 Sudanese children within the ages 3-5 years were sampled with use of a multistage sampling technique. A clinical examination for caries were carry out using WHO criteria. A two-way ANOVA and chi-square test were utilized to analyse with a p-value < 0.05 considered to be significant. The findings suggested that 64.6% of the children sampled had caries. Socio-economic status, sex and level of education of the parents were found not to show a statistical significant relationship with caries, but age of children was significant. The authors concluded that prevalence of dental caries increased significantly with age.

Rajesh and Venkatesh (2016) studied the prevalence of dental caries with the aim of investigating factors associated with dental caries among school children in urban area in Bahir Dar city. Their study recruited 417 children from both public and private schools. The data was analysed using SPSS version 16.0. The findings documented a dental caries prevalence of 32.9%. The authors noted that the highest caries prevalence (49.7%) was found in the 6 to 10-year age group. The sex difference was that; females' prevalence level was 34% and 31.8%. in males. The authors concluded that there is the need for awareness creation amongst teachers, parents, and school children per dental caries and hygiene.

Al-Haddad, Ghouth and Hassan (2007) conducted a study aimed at determining the distribution of caries among 12 year-old school children. The authors used a multistage stratified sampling method to sample 400 children, consisting of equal numbers of males and females. All the study participants were chosen from five public schools and two private schools and clinical examinations were conducted by trained examiners under standardized conditions. The findings of the study suggested

that 49.5% of the school children had dental caries; among this were 51.5% males and 48.5% females. A higher prevalence was recorded by the authors in private schools (57%) as compared to public schools. It was therefore concluded that, dental caries is a significant health concern among school children hence the need for dental health education.

Akbari and Bendz (2010) performed a study to determine the prevalence of caries among primary school children. A survey was conducted and 754 primary school children within the ages of 5 – 15years were selected. A clinical examination was carried out on each child and findings show that 54.8% of the primary school children had caries. The sex difference observed was that; girls had a higher prevalence compared to boys. It was suggested that, there is the need for treatment since dental care is low.

Elfaki, et al. (2014) also assessed the prevalence of dental caries among primary school children. The authors sampled 192 girls from 3 different public schools using cross-sectional descriptive design. A high prevalence of dental caries was particularly found among the 10 – 11years age group. Frequency of sweet consumption per day among other factors were observed to contribute to high rate of dental caries. It was therefore suggested that evaluation of caries risk factors is important since it gives room for the improvement of diet, hygiene, including implementation of preventive measures.

Umer and Umer (2011) investigated the prevalence of dental caries among primary school children in an urban area. A cross-sectional observational design was used, 500 school children from classes one to five were sampled and examined. The result suggested that 72.4% of the study participants had dental caries. The authors revealed

that tooth brushing habits suggested a very significant role in reducing caries. The authors recommended that school based health programmes and service is necessary for the prevention of caries.

Garkoti, Singh, Rawat and Pandey (2015), assessed the prevalence and disease burden of dental caries in primary school children. A cross sectional study was used to randomly sample 385 school children from class one to four. These children were examined and sensitization of regarding their personal hygiene and their oral hygiene was carried out. The findings show that 58% of the participants were with dental caries and prevalence level declined with age. They therefore concluded on a high incidence of caries and the demand for precautionary measures to be carried out.

Risk Factors of Dental Caries

Risk factors of dental caries according Ghazal (2013) can be categorised as (1) demographic; age, gender, race/ethnicity and socioeconomic status, (2) dietary such as sugar consumption, bottle-feeding, and infants' formula, (3) behavioural such as tooth brushing; as well as presence of streptococcus mutans, existence of visible plaque and the use of fluoridated toothpaste.

Review of Related Studies on Risk Factors of Dental Caries

Harris, Nicoll, Adair and Pine (2004), shepherded a systematic review of literature on risk factors of caries among young children. The authors utilised an electronic searching to locate studies by the basis of key words, title and abstracts. Several literatures were reviewed whereas 106 risk factors which were significantly related to prevalence of caries were found. Their review revealed that early acquisition of Streptococcus Mutans by children most likely culminated in the development of

caries at an early age. The study also revealed the importance of dietary factor as a significantly related to childhood caries. In a longitudinal study by Ekman (1990) shows frequency of sugar containing products consumption was tested as one of the risk factors of dental caries, although not significant. Yet when Ekman's (1990) study was compared to Gibson and William's (1999) study, it was reveal that sugary foods is a risk factor of dental caries but can be reduce by frequent brushing of teeth. In their study, Harris, et al. (2004) stated that by definition, risk factor suggest exposure has occurred before the outcome.

Ahmed et al. (2007) examined 12-year-old schoolchildren from Baghdad the prevalence of dental caries as well as related risk factors including gender, socio-demographic factors, oral hygiene and sugar intake of dental caries. Based on WHO criteria, dental examinations and questionnaire surveys were performed on 392 children in 10 schools. Samples of water were collected and concentration of fluoride was assessed. The result shows a 62% of caries experience. Increased sugar consumption was linked to boys who their mothers living with little level education and brushing at least once in a day. It was also observed that positive practices oral hygiene was higher among girls. Most of the children preferred Western sweet snacks while sweet tea was frequently consumed. The content of fluoride in drinking water was very low for prevention caries.

Mulu, et al. (2014), examine dental caries and associated factors among primary school children. A cross sectional survey was carried out using a systematic random sampling method to sampled 147 primary children. The authors used a structured questionnaire to collect demographic information from children and/or their parents. Using experienced dentist, clinical dental information was taken using dental caries

criteria proposed by World Health Organization. Eighty-two (55.4%) of the 147 children were girls and the rest were boys. The result shows that most of the children (67.6%) cleaned their teeth using small stick of wood made of a special type of plant (traditional method). It was also found that the proportion of children having dental caries was 32 (21.8%) while primary tooth decay accounted for 24 (75%) of dental caries. The proportion of missed teeth was 7 (4.8%). Overall, toothache accounted for 40(27.2%) while dental plaque accounted for 99(67.3%) among the school children. Dental caries is a common health problem in school children and a public health concern. Therefore, preventive measures such as health education on oral hygiene, dietary habits and importance of dental visit are obligatory for children.

Popoola et al. (2013) carried out a study to assess the relationship between dental caries and socioeconomic status of children who were seen at paediatric dental clinic. Socio-demographic data for each child within period of one year was sampled and recorded. This was then followed by oral examination for each of children in the dental clinic in order to identify decayed, missing and filled deciduous, and permanent teeth. The authors observed that caries experience was directly associated with socioeconomic status of the parents of the sampled children. The highest caries prevalence was observed in high and middle socioeconomic classes. Compared to the study by (Akbari & Bendz, 2010), which also analysed potential correlations between amount of plaque, sugar consumption, besides oral hygiene practice and its impact on prevalence dental caries. The result suggested no significant relationship between amount of plaque and caries prevalence. Akbari and Bendz (2010) observed that sugar consumption was high and almost all the primary school children used one method or another in cleaning their tooth.

Another study in Ghana by Ndanu et al. (2015) aimed at assessing oral hygiene practices and caries prevalence among school children. The authors used a cross-section survey of 9 to 15-years school children. They randomly sample 1,040 private and public school children in Accra. They also assessed Oral hygiene and snacking habits by interview the school children using structured questionnaire. There were 547 children from 8 randomly selected private schools and 493 of them from 5 randomly selected public schools in Accra. In each school two torrents of classes were randomly selected by ballot and all children from primary classes 4 to Junior High School (JHS3) were screened. Dietary and snacking practices in addition to oral hygiene practices were examined by utilizing questionnaire. The dietary and snacking questionnaire was adapted from the ENDORSE Study questionnaire which examined the dietary and snacking behaviours of school children. Their result also suggests a higher rate (19.3%) in the females than the males (15.1%) from both private and public schools. They conclude that frequency of snacking was high in both groups however, did not account for the differences in caries prevalence observed (Ndanu et al., 2015).

Kaur, Maykanathan and Lyn (2015) assessed nutritional status, consumption of sugar, oral health behaviour and the related factors of caries among 7 to 11years old children. A total of 312 school children were sampled from two schools using a random and convenience sampling technique based on a cross-sectional design. A structured questionnaire was used by the authors to assessed frequency of sugar consumption, oral health behaviour and knowledge among others. A chi square test and multiple linear regressions analysis were performed using SPSS. The result shows that prevalence of caries was 44.6% and no association was found dental caries and weight distribution of the children. Age and dental hygiene practices were also observed to be

predicted of dental caries. The authors also found that younger children and poor oral hygiene practices were predisposing factors of caries. The authors therefore suggest oral health awareness or education to reduce the menace.

Shazly and Gabr (2016) investigated and identify the incidence of dental caries and the possible risk among primary school children. A case control method nested in cross sectional design was conducted and sample consisting of 651 males and 632 females were selected. These school children were selected through random sampling of 3 rural and 2 urban schools out of 44 rural and 22 urban areas. Questionnaires were the data collecting tool and general as well as local examination was also conducted. The findings were that the prevalence of dental caries was 62.8%. The study did not find significant difference in caries between males and females. Dental caries was also higher in children who consume dairy products and soft sugary drink on daily basis. The conclusion was that, there is the need for health education in order to create awareness among school children.

Another study by Sumbi (2011) aimed at determining the caries experience and risk factors for dental caries among twelve (12) years old primary school children in Kenya. A descriptive cross sectional design with a simple random technique was used to select 219 primary school children. Clinical examination was performed and questionnaire was administered. Caries was assessed using the DMFT index and recorded in WHO clinical examination form. The author carried out cross tabulation and chi square test were conducted on categorical variables. The findings show that all respondent were 12 years and the incidence of caries was 18.1%. The result shows that all the parents of the children have been to school and majority of fathers have attained tertiary education. According to the findings, most of the children have good

oral health practices. Also 42.5% of the children ate sweets several time a day while a few of them (38.2) take sweet at least ones a day. Sex was also statistically significantly related to frequency of eating sweet. The conclusion was the need to reduce cariogenic diet and preventive practices such as provision of health instructions and education is vital.

Leghari, Tanwir and Ali (2013) conducted a cross sectional study to determine the prevalence and risk factors of dental caries school children within the ages of 12 – 15years. A sample of 399 school children was selected from 14 schools. Clinical oral examination was done and structured questionnaire was used to assess knowledge of these children on oral health. Analyses were conducted by using chi square, independent sample t test, ANOVA, univariate and multivariable logistic regression analysis. The result shows that, dental caries increase with increasing age. Girls have higher score on decay compared to boys.

According to study by Sutthavong, et al. (2010) which was on risk factors of dental caries was to identify the prevalence and severity of dental caries as well as their risk factors in public schools. A cross sectional design was used and 158 children with age ranging from 2 – 12years were taking through a survey where oral examination was conducted. Questionnaires were used to sample some information from these children. The findings show that a comparatively high prevalence of dental caries was detected among children in suburban area in Thailand, specifically in early childhood. It was shown that having the parents overseeing their tooth brushing and having tooth brushing after breakfast may protect the dental caries for primary teeth. The authors concluded that public health interventions among this population are hereby urgently crucial for good oral health.

Fan, et al. (2016) performed a study to identify the risk factors of dental caries among preschool children in Beijing. A cross sectional survey design was employed and convenience sampling technique was utilized to sample 787 children with the ages 3 and 4 years. Oral health questionnaire was used and demographic data was also taken. Dental examination was also conducted and saliva sample was also taken. Using the SPSS, one-way ANOVA was carried out and means of the Dental Missing and Filled surface (DMFs) scores were also taken. The findings show that, the prevalence of caries was 49% and mutans streptococci in plaque as well as dental visit history shows a significant relationship with dental caries. It was suggested that there is the need for crucial screening of preschool children since they are at high risk of dental caries.

CHAPTER THREE

METHODOLOGY

Research Design

The study used a cross sectional design. This design was used as a result of the nature of the research which allows for the study to be conducted across different age group of primary school children. That is, the study involved primary school children in the Adentan municipality. The Municipality has some health centres and about 14 private health facilities. The study was a comparative study involving collection of information on the current dental health status of the prospective school children from both public and private schools. A preliminary data to identify the incidence of caries in the Adentan Municipality was conducted. The study took approximately eight months to complete. The quantitative approach whereby data collected were coded into figures. The study only involved primary school children from class one to six (1 – 6). Primary children with disability were excluded from the study. Also primary school children in peri-urban areas in the municipality were excluded from the study and children who are only present as at the time of data collection were sampled. The data were collected during school hours from Monday to Friday. Primary school children who were observed not to have caries serve as a control group for the assessment of risk factor of dental caries.

Study Area

Adentan Municipality is one of the ten districts in the Greater Accra Region of Ghana with its capital being Adenta East. The municipality has sixty-eight (68) public school and one hundred and thirty-four (134) private school; making a total of two hundred and two (202) schools. The study was conducted in six of these schools among which

were three private school and three public school. The six school were randomly selected and used in order to achieve uniformity between public and private school as well, this number was used due to the limited number of public schools in the municipality compared to the private schools. Also six schools were randomly selected in order to achieve the estimated sample size. These selected schools do not have any School Health Education Programme (SHEP). Since the study did not choose the school based on the presence or absence of SHEP, the study did not investigate whether the remaining schools have SHEP.

Study Variables

The study assessed the risk factor of dental caries among primary school children. Variables such as sex (male or female), age, school category (public or private school), oral health knowledge, oral health practices as well as diet/nutrition were assessed as determinants of dental caries. Diet/nutrition was measure as the level of sugar and fizzy drink taken by the primary school children from food. Variables such as sex, age, and school category constituted nominal data while, level of sugar and fizzy drink intake, oral health knowledge, oral health practices and dental findings (no caries, caries and other observations) constituted ordinal data.

- **Dependent variable** – Level of sugar and fizzy drink intake, oral health knowledge and oral health practices.
- **Independent variables** – Sex, age, and school category.

Each of the specific objectives was measured using the specific statistical test with the help of the STATA version 14. This was done by entering the data into the software and data was analysed.

Target Population

The study involved primary school children in urban areas in the Adentan Municipality. According to the Ghana Statistical Service, Population and Housing Census, there are 4,942 males and 5,134 female primary school pupils in the Adentan Municipality; making a total of 10, 076 pupils in the Municipality (Ghana Statistical Service, 2014).

Inclusion criteria

- The study only involved primary school children from class one to six (1 – 6).
- Children who are only present as at the time of data collection were sampled since data was collected during school hours from Monday to Friday

Exclusion criteria

- Primary children with disability were excluded from the study.
- Primary school children in peri-urban areas in the municipality were excluded from the study
- Primary school children below class 1 and above class 6 were not recruited as well as those below the age of 5years and above the age of 14years were not be sampled.

Preliminary Study

A preliminary study was conducted among two schools in the Adentan Municipality; one of which was a public school (Adentan Community School) and the other a private school (Golden Sunbeam School). Permission was obtained from the schools and one hundred and twenty-five primary school children were recruited using simple random sampling. The head of the schools, teachers and the pupils were debriefed and

confidentiality was assured. Sixty children were recruited from public school and sixty-five from the private school.

The oral assessment and examination of every child was conducted by two certified Dentists with the assistance of a Dental Surgery Assistant (DSA). This was done by seating each of the pupils on a chair using required instruments such as gloves, dental probe – which is used for the detection of caries, spatula, mouth mirror and a clinical dental form for recording. Primary school children below class 1 and above class 6 and those below 5years and above 14years were not assessed.

The preliminary findings revealed that, 45.6% (57) of the total primary school children sampled had dental caries. Among this, 23.1% (30) were public school children and 22.5% (27) were private school children.

Sample size

The current study appears to be the first study on dental caries among primary school children in the municipality. Although a Ghanaian study by Ndanu et al. (2015) found 17.4% overall prevalence level of caries among primary school children in Ghana; the current preliminary study in the Adentan Municipality shows that 45.6% of primary school children have dental caries. Hence the calculation of the sample size was based on the assumption that dental caries of primary school children in the Adentan Municipality will not be above 45.6%.

Assumption for Sample size calculation

The current study employed the formula proposed by Charan and Biswas (2013) in the calculation of the sample size.

$$\text{Thus } N = \frac{Z^2 p(1-p)}{d^2}$$

N = required sample size

Z = Confidence level of 95% = 1.96

p = Assumed proportion from preliminary study is 45.6% expressed in decimal = 0.456

d = Margin of error of 5% expressed in decimal = 0.05

Sample size calculation

$$N = \frac{1.96^2 \times 0.456(1-0.456)}{0.05^2} = n = \frac{0.95296}{0.0025} = 381.185$$

$N \cong 381$; since there is no 0.185 human beings.

Adding a 10% non-response rate; $\frac{10}{100} \times 381 = 38.1$

» $381 + 38 = 419$; hence the Sample size was estimated to 420 primary school children as participants of the study.

Sampling Technique

The study utilized the quantitative approach. A cluster sampling was used to sample public and private school children among each of the six classes from urban areas in the Adentan Municipality. This sampling technique was used because it gives each individual equal chance of being selected as well allows for group difference assessment and comparison. Six primary schools were randomly drawn from 202 primary schools in the Adentan Municipality; three each from private and public schools. Since six schools were recruited, a total of seventy (70) pupils from each school were sampled making a total of 420 pupils in all. This was done in the school premises with help of the class teachers.

Data Collection Method

Participants of the study were brief on the data collecting tool. Information on the demographic variable were collected first, followed by the dependent variable. For each class, the data collection will take 60minutes to complete.

Data Collection Technique

A face-to-face structured questionnaire was used to sample information from the school children. That is, a written questionnaire was self-administered to the pupils. Pupils who do not understand the items on the questionnaire received oral explanation of the item except items which aim at assessing oral health knowledge. That is, the questions were read out to pupils who were unable to read.

The oral examination of each primary school child recruited was conducted by certified Dentists with the assistance of DSAs. The oral examination was done by seating each of the primary school children on a chair and examining mouth after questionnaire has been administered, using required instruments such as gloves, dental probe, spatula, mouth mirror and a clinical dental form for recording.

Data Collection Tool

Structured questionnaire was used to collect data from the school children. Demographic data such as; sex, age, type of school and class were recorded. Level of sugar and fizzy drink intake, oral health knowledge and oral health practices were measured by adapting and using a questionnaire proposed by Al-Omiri, et al. (2006). The knowledge variable which has a yes and no answers was given a score of 1 and 2. Answers that depict good oral health knowledge received a score of 2 while those that do not received a score of 1. Knowledge variable with (a) – (d) answer were scores 0,

1 and 2 as low, moderate and high oral health knowledge respectively. The questionnaire was pre-tested during preliminary study and modification was made.

Also instruments such as gloves, dental probe, face mask, spatula, mouth mirror and a clinical dental form for recording were used during oral examination.

Data Analysis

The data collected were organized and entered into the STATA version 14. The data were analysed using the descriptive and inferential statistics. In this regard, a one sample t test was conducted to verify the level of knowledge the primary school children have on oral health as well their level of oral health practice. An independent t test was also conducted to compare dental health knowledge and practices among public and private school children. A simple logistic regression was done to predict the mean score of oral health practices based on school type. A simple logistic regression was done to predict the dental caries presence based on age categorized as either less than 10 years or 10 to 14 years.

Ethical Consideration

Approval was sought and obtained from the Institutional Review Board at the University of Ghana School of Public Health by the Principal Investigator for the recruitment of the primary school children. This entailed the submission of a proposal containing all the information regarding the purpose of the study, number and ages of Pupils, methods of managing and storing the data to be recorded, including any and all research-related files and paper documents.

Following this, permission was also sought from and **granted** by the schools chosen for the study. In addition, the informed consent documents were attached with the IRB request and assent forms for the children were provided.

CHAPTER FOUR

RESULT

Following the data collected on risk factors and prevalence of dental caries and analyses carried out, the findings are presented. Four hundred and twenty primary school children were sampled from six (6) schools in the Adentan municipality. The descriptive statistics are presented in table 1

Table 1: Descriptive Statistics of Sex and Age

Variable	Frequency (n)	Percentage (%)
Sex		
• Male	209	49.8
• Female	211	50.2
Age (Year)		
• 5	6	1.4
• 6	28	6.7
• 7	24	5.7
• 8	92	21.9
• 9	85	20.2
• 10	55	13.1
• 11	73	17.4
• 12	37	8.8
• 13	9	2.1
• 14	11	2.6
Mean Age (SD)	9.37	

As shown in Table, 1 the descriptive statistic of the sex and age of the primary school children sampled are presented. A fair distribution of male (49.8%) to female (50.2%) was observed among the primary school children. The ages of the children range from

5 to 14years with the modal age being 8years olds. The mean age however 9.37years as was indicated in Table 1 above.

Table 2: Descriptive Statistic of Type of School and Class

Variable	Frequency (n)	Percentage (%)
School Type		
• Public School	210	50.0
• Private School	210	50.0
Class Type		
• Class 1	21	5.0
• Class 2	43	10.2
• Class 3	55	13.1
• Class 4	122	29.0
• Class 5	78	18.6
• Class 6	101	24.0

Table 2 shows descriptive statistics of the type of school and class of the primary school children sampled. Equal percentage of public (50.0%) and private (50.0%) school children were sampled. There was uneven distribution across the various classes of the primary school children as indicated in Table 2.

Assessment of the Level of Oral Health Knowledge and Oral Health Practices

In order to ascertain the objectives of the current study, analyses of the data collected were carried out in order to achieve the objectives of the study.

Table 3 below shows that the level of knowledge of oral health is statistically significantly associated with sex and school type.

Table 3: Level of Oral Health Knowledge

Variables	Level of knowledge			P-value
	Low	Moderate	High	
Sex				*
Male	6(1.4)	140(33.3)	63(15.0)	
Female	0(0.0)	128(30.5)	83(19.8)	
Age in years (SD)	10.5 (1.64)	9.59 (2.01)	8.91 (1.71)	
School type				***
Public	3(0.7)	169(40.2)	38(9.0)	
Private	3(0.7)	99(23.6)	108(25.7)	

*significant at $p < 0.05$

***significant at $p < 0.001$

A multiple logistic regression was fitted to predict the level of oral health knowledge based on sex and school type. The odds of high level of oral health knowledge among private school children of the same sex was 4.92 times that among public school children of the same sex (AOR= 4.92; 95% CI: 3.14 – 7.71; $p < 0.001$). Females of the same school type have a 63% greater odds of having high level of oral health knowledge compared to males of the same school type (AOR= 1.63; 95% CI: 1.06 – 2.52; $p < 0.05$).

Table 4: Multiple logistic regression between level of knowledge and significant factors

Variables	High level of knowledge	
	AOR (95% CI)	P-value
Sex (Ref: Male)		
Female	4.92 (3.14 - 7.71)	< 0.001
School type (Ref: Public)		
Private	1.63 (1.06 - 2.52)	<0.05

Table 5 shows that oral health practices are significantly associated with school type. When a logistic regression model was fitted to determine the measure of association, it showed that, the odds of good oral health practices among private school children was 2.86 times greater compared to public school children (OR= 2.86; 95% CI: 1.86 – 4.38; $p < 0.001$).

Table 5: Levels of Oral health Practices

Variables	Levels of Oral health practices			
	Bad	Acceptable	Good	<i>P-value</i>
Sex				
• Male	3(0.7)	135(32.2)	71(16.9)	
• Female	3(0.7)	142(33.8)	66(15.7)	
Total	6(1.4)	277(66.0)	137(32.6)	
Age in years (SD)	10 (1.10)	9.57 (1.98)	8.93 (1.81)	
School type				***
• Public	0(0.0)	165(39.3)	45(10.7)	
• Private	6(1.4)	112(26.7)	92(21.9)	
Total	6(1.4)	277(66.0)	137(32.6)	

significant at $p < 0.05$* ***significant at $p < 0.001$**

The Pearson product-moment correlation that was run to assess relationship between oral health knowledge and oral health practices scores in 420 primary school children showed a mildly positive correlation [$r_{(418)} = 0.247$, $p < 0.001$], with oral health knowledge scores explaining 6.1% of variation in oral health practice scores.

Diet/Nutrition as a factor of Dental Caries

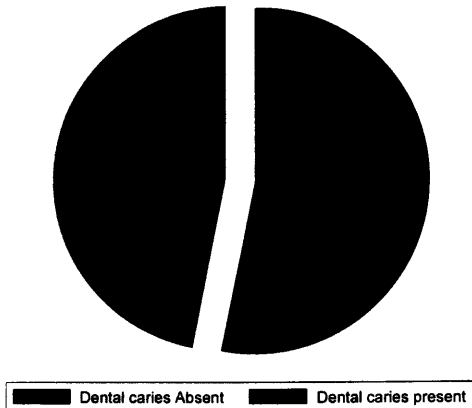


Figure 2: Prevalence of dental caries among primary school children in the Adentan Municipality

Independent sample *t*-test was used to assess the association of dental caries with diet/nutrition (measured as a numeric variable). There was a statistically significant difference between the mean diet/nutrition scores of those who had dental caries 5.49 (95% CI: 5.28 – 5.71) and that of those who did not have dental caries 4.74 (95% CI: 4.58 – 4.89); $t(418) = -5.76, p < 0.001$.

Age and Sex as Factors of Dental Caries

From Table 7 prevalence of dental caries is higher in primary school children within the ages of 5-9years (29.8%) compared to those within the ages of 10-14years (17.1%). Also dental caries prevalence is higher among females (25.5%) compared to males (21.4%).

Table 6: Age and Sex as Factors of Dental Caries

	Dental caries		<i>P-value</i> **
	Present	Absent	
Age			
5 – 9years	125(29.8)	110(26.2)	
10 – 14years	72(17.1)	113(26.9)	
Total	197(46.9)	223(53.1)	
Sex			
Male	90(21.4)	119(28.3)	
Female	107(25.5)	104(24.8)	
Total	197(46.9)	223(53.1)	

**significant at $p < 0.01$

The odds of children who are 10 to 14 years being diagnosed with dental caries was 46% less compared to children who are 5 to 9 years old [OR=0.56; 95% CI: 0.38 – 0.83; $p < 0.01$]. The odds of males being diagnosed with dental caries was 36% higher compared to females but this association was not statistically significant [OR=1.36; 95% CI: 0.93 – 2.00; $p = 0.118$].

Table 7: Multiple logistic regression between dental caries and significant factors

Variables	Dental caries	
	AOR (95% CI)	<i>P-value</i>
Age (Ref: 5 - 9 years)		
10 – 14	0.56 (0.38 - 0.83)	< 0.01
Sex (Ref: Male)		
Female	1.36 (0.93 - 2.00)	0.118

School type as a factor of dental caries

In a sample of 420 primary school children, 54.3% of those who attend private schools were diagnosed with dental caries while 39.5% of those who attend public school were diagnosed with dental caries. There was a statistically significant

association between dental caries and school type as shown in table table 8; [Pearson's chi square (1) = 9.19, $p < 0.001$].

Table 8: Bivariate analysis between dental caries and School type

	Dental caries		P-value
	Present	Absent	
School type			< 0.01
Public	83 (19.8)	127 (30.2)	
Private	114 (27.1)	96 (22.9)	

A simple logistic regression was done to predict the dental caries presence based on school type. The odds of children being diagnosed with dental carries given that they attend private school was 1.82 times as if they attend public school [OR=1.82; 95% CI: 1.23 – 2.68; $p < 0.01$].

CHAPTER FIVE

DISCUSSION

The current study aimed at investigating risk factors of dental caries among urban primary school children. As such, urban primary school children were recruited and information were sampled from them. The data collected were analysed and the result presented. The findings are summarized below.

The findings show a fair distribution of male (49.8%) to female (50.2%) among the primary school children with the ages ranging from 5 years to 14 years with the most observed age being 8 years olds and mean age being 9.37 year. Equal percentage of public (50.0%) and private (50.0%) school children were while there was uneven distribution across the various class.

The findings show 1.43%, 63.81% and 34.76% of respondent had low, moderate and high levels of knowledge respectively. Level of knowledge was significantly associated with sex and school type. Averagely, females had 0.69 higher score than males and averagely, private school children had 2.03 higher.

1.43%, 65.95% and 32.62% of the primary school children were practising bad, acceptable and good oral health habits respectively. Level of oral health practices was significantly associated with school type. Averagely, private school children had 0.61 higher scores on oral health practices than public school children

The odds of a child being diagnosed with dental caries was 1.51 times for a unit increase in diet and nutrition scores [OR=1.51; 95% CI: 1.30 – 1.75; $p < 0.001$]. The odds of children who are 10 to 14 years being diagnosed with dental caries was 46% less compared to children who are 5 to 9 years old [OR=0.56; 95% CI: 0.38 – 0.83;

$p < 0.01$]. The odds of males being diagnosed with dental carries was 36% higher compared to females but this association was not statistically significant [OR=1.36; 95% CI: 0.93 – 2.00; $p = 0.118$]. The odds of children who attend private schools being diagnosed with dental carries was 1.82 times compared to children who attend public schools [OR=1.82; 95% CI: 1.23 – 2.68; $p < 0.01$].

Discussion of Findings on Oral Health Knowledge

Oral health knowledge refers to the expertise and skills acquired on oral health by individuals through experience or education with the aim of living healthy (Sharda, & Shetty, 2008). Al-Omiri, et al. (2006) reveal that oral health knowledge among children from developing countries is limited. This is consistent with the current study which found that 65.2% of primary school children have low or moderate level of knowledge on oral health. That 63.8% of the primary school children had moderate level of knowledge suggests that oral health knowledge may have improved over the years in some developing countries. Comparing the time difference of Al-Omiri, et al. (2006) study to the current study; the findings suggest advancement of oral health knowledge of significant number of primary school children over years. However, it is necessary to state that the study by Al-Omiri, et al. (2006) was conducted among public school children and not both public and private. This further suggests that the type of school might have been the moderating factor resulting in the seeming increase in the level of knowledge between the current study and the study by Al-Omiri, et al. in 2006. In a similar study in Qatar Al-Darwish's (2016) found that result only 25.8% of the school children had high level of oral health knowledge and parent were the most common source of information on oral health. The difference between that study and the current one may be due the differences in geographical location, educational system as well as oral health policies in Qatar as compared to Ghana.

Although the current study did not investigate differences geographical location, educational system and oral health policies in both country, these factors may not be the same in these two countries and hence might be the reason the differences in Al-Darwish's (2016) study and the current study.

According to a study by Maderazo & delos-Reyes (2014), public school children have a high level oral health knowledge. This is at variance with the current findings. Although the findings of Maderazo & delos-Reyes (2014) were based on data from public school it also suggests a relationship between type of school and level of oral health knowledge.

Oral health Practices among Primary School Children

Oral health practices are an indication that the application of dental health education policies is efficient (Al-Omiri, Al-Wahadni, & Saeed, 2006). Al-Omiri, et al. (2006) found that oral hygiene habits, for instance tooth brushing, were irregular and parents' role in the oral hygiene habits of their children was limited. This is inconsistent with the current study which found that 98.6% of the pupils practice acceptable or good oral health habits. The current study however did not investigate parent's involvement in the oral hygiene habits of these children. The difference between the study by Al-Omiri, et al. (2006) and the current one may be due to the improvement of oral hygiene habits among children over the years.

There is also a discrepancy between the current study and the study by Okolo, et al. (2006), as the later suggested poor oral health practices among children while the former an improvement of oral health practices overtime. The improvement may be due to the oral health promotion programme by WHO of which a survey was conducted in 2012. Petersen and Jurgensen (2013) in their article found that schools

can provide an accommodating environment for the promotion of children's health. The authors also observed that while a number of well-known policies were being applied, a holistic health promotion approach was not being used. As such, the improvement observed in the current study on oral health practices among children may be as result of holistic oral health promotion measure. Also, a Ghanaian based study among peri-urban areas in Accra by Bruce, et al. (2002) suggested the need for a sustained community preventive dental action needs to be put in place in both rural and urban areas to prevent and control both dental caries and periodontal diseases. One these sustained community preventive dental action, is the need to improve good oral health practice among children of school going age.

Further, Umer and Umer (2011) found from their research that tooth brushing habits suggests a very significant role in reducing caries. This conforms to the present study which good oral health practices among children reduces the chance of dental caries. Ahmed et al. (2007) agrees with this by suggesting positive practices oral hygiene reduces risk of dental caries and oral health diseases. Also, according to Mulu, et al. (2014), dental caries is a common public health problem in school children associated with poor oral hygiene and dental visit. In effect, positive oral hygiene practices such as brushing twice daily, regular dental visits, the use of fluoridated tooth paste and among other reduces the risk of oral disease and dental caries.

Risk Factors of Dental Caries

According Ghazal (2013), risk factors of dental caries can be categorised as demographic such as age, gender, race/ethnicity and socioeconomic status; dietary such as sugar consumption, bottle-feeding, and infants' formula; behavioural such as tooth brushing; as well as presence of streptococcus mutans, presence of visible

plaque and the use of fluoridated toothpaste. The current study identified some of these factors as well as their differences.

Findings of the current study suggest a relationship between diet/nutrition and dental caries among primary school children. The Dental Health Foundation (DHF, 2016) referred to dental caries as a disease of the teeth which occurs as acid produce when sucrose in foods or drinks react with bacteria present in the dental biofilm. Diet and/or nutrition is essential for healthy living as well as oral health, and as such, diet can be seen as risk factor of dental caries. Evidence put forward Elfaki, et al. (2014), Ahmed et al. (2007), Akbari and Bendz (2010) and Mulu, et al. (2014) are consistent with this, in that, the frequency of consumption of sweet per day among other factors were observed to contribute to high rate of dental caries. Thus, higher consumption of sweet or sugary foods per day increase rate of dental caries. This suggests a positive relation between sugary diet and dental caries.

Shazly and Gabr (2016) also found Dental caries were also higher in children who consume dairy products and soft sugary drink on daily basis. This agrees with the present findings which show that the mean diet/nutrition score was higher among children with dental caries compared to those without dental caries. That is, high rate of consumption of sugary foods and fizzy drinks increase the chances of dental caries among children. Sumbi (2011) suggested this when the author found 42.5% of the children ate sweets several times a day while a few of them (38.2) take sweet at least ones a day. The incidence rate of caries was high as increase in the consumption of sugary foods predisposes these children to dental caries.

Age was found to be a predictor of dental caries, as the present study suggests that the odds of children who are 10 to 14 years being diagnosed with dental carries was 46%

less compared to children who are 5 to 9 years old. Kaur, et al. (2015) agrees with this by suggesting age and dental hygiene practices of school children are predictors of dental caries. That is, younger children and poor oral hygiene practices were predisposing factors of caries. Okolo, et al. (2006) found that, poor oral hygiene and malnutrition in children within the ages of 13 – 84 months (1.1 to 7years) increase the chances of caries. Bruce et al. (2002) also found high caries experience among 7 – 9year old children compared to 13 – 16year olds in peri-urban areas of Accra. There is therefore a consistency in this study as caries can be observed mostly among children within ages 5 and 9 years. This also means that, dental caries is relatively more prevalent during this age period since there is high consumption of sweets foods and fizzy drinks, and poor oral hygiene practices among other factors. Awooda, et al. (2013), found high dental caries rate among children within 3 and 5 years of age, and consequently concluded that prevalence of dental caries increased significantly with age. This conclusion is inconsistent with the current study. It must be noted that Awooda, et al. (2013) did not investigate caries prevalence among children who are 10years and above. The above evidence suggests that the incidence of dental caries among children increases with the ages 3 to 9 years and decreases among those aged 10 to 14 years. However, Rajesh and Venkatesh (2016) observed that highest caries prevalence was in the age group of 6–10 years while Elfaki, et al. (2014) also found caries prevalence to be high particularly among the age group 10 – 11years. Both studies suggest increase in caries prevalence within ages 10 and 11years. On the contrary, Garkoti, et al. (2015) found that the prevalence of dental caries declined with age. The observed differences in caries prevalence among the age groups may be due to differences in dietary habits. Different cultural, geographical and socio-

economic statuses have different influence dietary habits of children and for that matter the incidence of dental caries.

Higher prevalence of caries was observed among males as compared to females. The odds of males being diagnosed with dental caries was 36% higher compared to females although, this association was not statistically significant. This is consistent with the Al-Darwish et al. (2014) who also found out that female children showed higher prevalence of dental caries compared to their male counterpart. Rajesh and Venkatesh (2016), also observed similar sex difference in dental caries among primary school children; thus females' prevalence level was 34% and males was 31.8%. These observations which is noticeable in several studies implies that, females are more predisposed to sweet foods daily than male children. Akbari and Bendz (2010) also observed that prevalence of caries is higher among girls as compared boys.

The present study found statistically insignificant sex difference in relation to dental caries, yet Sumbi (2011) found out that sex was also statistically significantly related to frequency of eating sweet. Consequently, frequent eating of sweet per day was related to increase incidence of dental caries. As such, sex difference observed is related to that the high consumption of sugary food by female primary school children. Harris, et al. (2004), agrees with this by observing that by definition, risk factor suggest exposure has occurred before the outcome. Leghari, et al. (2013) also agrees that girls have higher incidence rate of dental caries compared to boys.

In Al-Haddad, Ghouth and Hassan (2007) study, higher prevalence was recorded by the authors in private schools (57%) as compared to public schools. This is consistent with the current study in which prevalence level was higher among private school

children as compared to public school children. This is probably because private school children, whose guardians are generally of a higher socio-economic status, are more exposed to sugary foods/sweets foods as compared to public school children.

Conclusion

This study assessed risk factors of dental caries among primary school children and found lack of oral health knowledge, appropriate oral hygiene practices, type of school, diet, age and sex as the risk factors of dental caries. Also, reduction in sweet food intake by primary school children especially female children will help in reducing the prevalence of dental caries. However, literature suggest that findings on age differences and dental caries is inconclusive as some findings suggest dental caries increase with age while others reveal decline in caries with increasing age.

Recommendation

Based on the findings it is necessary for parent and teachers to monitor consumption of sugary foods by their children; especially, female private school children within the ages of 5 – 9years.

Although most of the primary school children have some level of oral health knowledge, more work needs to be done on oral health awareness and to promoted oral health among primary school children.

Despite the fact that the study did not investigate into details the impact of the oral health knowledge of parent/guardian and teachers on dental caries, it was noticeable that dental health knowledge and behaviour of parent/guardian and teachers can go a long way to influence the prevalence of dental caries among primary school children. Hence, future researchers should consider investigating the impact of the oral health knowledge of parent/guardian and teachers on dental caries of their children.

Also, there is the need to foster sustainable school based preventive practices through public notice in order to promote good oral hygiene practices among children.

The study did not focus on other oral health related diseases, hence future researchers can investigate the relationship between dental caries, risk factors and other oral health related illness.

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APPENDICES

APPENDIX 1 : QUESTIONNAIRE ON ASSESSMENT OF ORAL HEALTH KNOWLEDGE AND PRACTICES

DATA COLLECTION TOOL

Section A: Demographic Information of Participants

- Gender a) Male b) Female
- Age []
- Class []
- School Type: Public [] Private []

Section B: Oral Health Knowledge

- Q1. Does sweets affect the teeth adversely? a) Yes b) No
- Q2. Does fizzy drinks affect the teeth adversely? a) Yes b) No
- Q3. Does brushing teeth prevents dental decay? a) Yes b) No
- Q4. Does using fluoride strengthens the teeth? a) Yes b) No
- Q5. Is it necessary to regularly visits to the dentist? a) Yes b) No
- Q6. Do you know who a dentist is? a) Yes b) No
- Q7. Do dentists always explain the dental problem and solve it? a) Yes b) No
- No

Q8. Do dentist examines and takes care of his or her patients? a) Yes b)

No

Q9. Does the dentist cares about only treatment not prevention? a) Yes b)

No

Q10. General body health is related to oral and dental diseases. a) Yes b)

No

Q11. Do you care about your teeth as much as your body? a) Yes b)

No

Q12. What does gum bleeding mean?

- a) Healthy gum.
- b) Gum recession.
- c) Inflamed gum.
- d) I do not know.

Q13. What does plaque mean?

- a) Soft debris on the teeth.
- b) Hard debris on the teeth.
- c) Staining of the teeth.
- d) I do not know.

Q14. What does dental plaque lead to?

- a) Inflammation of the gum.
- b) Dental caries.
- c) Staining of the teeth.
- d) I do not know.

Section B: Oral Health Practices and Diet

Q1. How often do you brush your teeth?

- a) Less than once per day.
- b) Twice per day.
- c) Once per day.
- d) More than twice per day.

Q2. What do you use for cleaning your teeth?

- a) Brush + toothpaste.
 - b) Mouthwash.
 - c) Dental floss.
 - d) Toothpicks.
 - e) Others
- (specify).....

Q3. When do you brush your teeth?

- a) Morning.
- b) Before going to bed.
- c) Noon (after lunch).
- d) Other times (specify).....

Q4. For how long do you brush your teeth?

- a) Less than one minute.
- b) Two minutes.
- c) One minute.
- d) More than two minutes.

Q5. My parents...

- a) Watch me while brushing my teeth.
- b) Only my mother watches me.
- c) Do not watch but advise me.
- d) Never cared.

Q6. How often do you visit your dentist?

- a) Regularly every 6-12 months.
- b) When I have dental pain.
- c) Occasionally.
- d) I never visited a dentist.

Q7. Last time I visited a dentist was:

- a) Six months ago.
- b) Last 1-2 years.
- c) Last 6-12 months.
- d) Last 2-5 years.
- e) More than 5 years.

Q8. How often do you take Sweets?

- a) Every day/ regularly.
- b) Only a few times a week.
- c) Occasionally.
- d) I do not like sweets

Q9. How often do you take fizzy drinks?

- a) Every day/ regularly.
- b) Only a few times.
- c) Occasionally.
- d) I do not like fizzy drinks

Q10. What did you eat yesterday?

MORNING	SNACK	AFTERNOON	SNACK	EVENING	SNACK

APPENDIX 2

CLINICAL DENTAL FINDINGS
 UPPER RIGHT QUADRANT UPPER LEFT QUADRANT
 LOWER RIGHT QUADRANT LOWER LEFT QUADRANT

PATIENT NUMBER: _____

DATE: _____

MISSING TOOTH
 PERIAPICAL PATHOSIS
 ROOT CANAL FILLED
 INCOMPLETE ROOT CANAL FILLING
 SINUS TRACT
 IMPACTED
 PARTIAL ERUPTION
 INTRUSION
 EXTRUSION
 FRACTURE
 CARRIES (Red)
 RESTORATION (Blue)
 GOLD CROWN
 GOLD CROWN ACRYLIC OR PORCELAIN FACING
 OVERHANG
 RESTORATION FOOD IMPACT
 DRIFTING
 POOR CONTACT
 ROTATION
 FURCATION
 I
 II
 III

16 17 18 19 20 21 22 23 24 25 26 27 28
 1
 2
 3

48 47 46 45 44 43 42 41 40 39 38
 1
 2
 3

16 17 18 19 20 21 22 23 24 25 26 27 28
 1
 2
 3

48 47 46 45 44 43 42 41 40 39 38
 1
 2
 3

UPPER RIGHT QUADRANT UPPER LEFT QUADRANT
 LOWER RIGHT QUADRANT LOWER LEFT QUADRANT

APPENDIX 3 : ASSENT FORM FOR MINOR (AGE 7 -12)

PROJECT TITLE: Assessment of Risk Factors of Dental Caries among Urban Primary School Children in the Adentan Municipality.

PRINCIPAL INVESTIGATOR: Augustina Mensah Ephriam

CONTACT DETAILS

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I am am doing a research about **risk factors of dental caries**. A research is a way to study more about people, animals or things. If you decide that you want to be part of this study, you will be asked to answer some question about what you know about oral health and practices.

There are some things about this research that you should know. You should know that, after you finish answering the question, doctors will look into your mouth to check if everything is okay with your teeth. This will not take long and it is not painful. The benefit of the research is that; if you take part, and there is anything wrong with your **teeth**, the doctors will give you a referral to the hospital so you can be treated. A benefit means that you can get something good.

When I finished with this research I will write something called a report about what I studied but your name will not be written in this report. If you do not want to be in this research, we will not do you anything; so is not by force okay. If you decide to stop after we begin, that's okay too. Your parents know about this research too.

If you decide you want to be in this study, please write your name and sign below.

I, _____, want to be in this research study.

(Sign your name here)

(Date)

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/619
Your Ref. No.

Ephriam Mensah Augustina
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-ERC: 117/02/17
Project Title	Assessment of Risk Factors of Dental Caries among Urban Primary School Children in the Adentan Municipality
Approval Date	23 rd June, 2017
Expiry Date	22 nd June, 2018
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