

**ORAL HEALTH STATUS AND HYGIENE PRACTICES AMONG VISUALLY
IMPAIRED CHILDREN ATTENDING THIKA PRIMARY SCHOOL FOR
THE BLIND IN KIAMBU COUNTY, KENYA**

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DECLARATION

I Maureen Macharia declare that this thesis is my original work and that it has not been presented for any award in any institution of higher learning.

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DEDICATION

This thesis is dedicated to my mother Njeri. A pillar and role model to me, my family and to umpteen others.

To the children at Thika Primary School for the blind with whom a special bond was created, may you fly high in life and success be with you always.

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ACRONYMS & ABBREVIATIONS

CBM:	Christoffel Blinden Mission Committee
CP:	Cerebral Palsy
CPI:	Community Periodontal Index
CSHNS:	Children with Special Health Needs
DMFT:	Decayed Missing Filled Teeth
FDI:	Federation Dentaire Internationale
GI:	Gingival Index
IADR:	International Association for Dental Research
KNH:	Kenyatta National Hospital
KNH-UoN ERC:	Kenyatta National Hospital and UoN Ethics and Research
MOH:	Ministry of Health
NACOSTI:	National Commission for Science Technology and Innovation
OH:	Oral Health
PI:	Principal Investigator
SPSS:	Statistical Package for Social Sciences
UAE:	United Arab Emirates
UK:	United Kingdom
UoN:	University of Nairobi
USA:	United States of America
VI:	Visual Impairment
WHO:	World Health Organization

DEFINITION OF TERMS

Educational visual impairment – This is a loss in visual acuity and visual field with interference in school performance hence requiring special education.

Children with visual impairment – These are the students who fall under the category I and II of educational categorization of visually challenged students, who use Braille as their mode of learning.

Category I educational visual impairment- Students who fall under this category are totally blind with no perception of light and are educated using Braille.

Category II educational visual impairment-Students who fall under this category have perception of light and some useful vision but not sufficient to read print hence are educated using Braille.

Braille – This is a writing system that comprises of raised dots that the visually impaired utilise to read with the use of their fingers.

Dental caries – This is an infectious microbial disease affecting teeth and resulting in the demineralisation and destruction of the inorganic component.

Gingivitis – This is inflammation of the gums, often accompanied by tenderness and bleeding.

Low vision optical device – These are devices that provide significantly increased magnification powers and prescription strengths.

Oral Hygiene practices – These are the oral health care products, tools and daily oral health habits utilised in the maintenance of oral hygiene.

Oral health status – This is a state of being free from gingivitis, dental plaque and dental caries.

Visual acuity – This is the ability to see objects clearly and to distinguish details at a specific distance, e.g. from the classroom blackboard.

Visual field - This is the area that the students can see right, left, up and down while gazing straight ahead.

ABSTRACT

Background: Worldwide studies have reported poor oral health among visually impaired individuals. This has been attributed to several factors which include difficulty in attaining good oral hygiene, difficulty in evaluating effective plaque removal and also because demonstration of oral hygiene instructions via visual aids is not appropriate. Lack of parental supervision and the absence of manual-visual coordination have also been implicated. There is inadequate information available on dental health among Kenyan children who are visually impaired.

Study objective: To determine the oral health status and hygiene practices among visually impaired children attending Thika Primary School for the Blind in Kiambu County, Kenya.

Study population: One hundred and fifty-nine children in category I and II educational visual impairment, aged 10-19 years old attending Thika Primary School for the Blind.

Study design: This was a descriptive cross-sectional study.

Materials and methods: Participants were selected using proportionate stratified random sampling. Data collection methods constituted completion of a questionnaire and a clinical examination component. The questionnaire was administered in a face-to-face interview by the principal investigator and contained both open and close-ended questions to record the children's social demographic variables and oral hygiene practices.

Data was keyed into the computer database and analysed using Statistical Package for Social Sciences (SPSS) version 23.0 of Windows. The results have been presented in tables and figures and where appropriate univariate, bivariate and multivariate analysis performed and appropriate statistical inferences made.

Results: A total of 159 children participated in the study. There were 85 (53.5%) male participants and 74 (46.5%) female participants and the mean age was 13.91 ± 2.27 .

Ninety-four (59.1%) and 105(66%) of the participants perceived having good dental and gingival health status respectively. There was a statistically significant association on comparison (X^2) of gingival health perception with age of participants ($P=0.05$).

All participants used toothbrushes to clean their teeth with older children ($p= 0.004$) and female children ($p= 0.001$) more likely to replace their toothbrushes within three months when compared (X^2) to younger children and to male participants.

The mean plaque score was 0.95 ± 0.45 ($p=0.38$) depicting good oral hygiene with majority 116 (72.9%) of the children not reporting to experience challenges in practice of oral hygiene.

The overall prevalence of gingivitis was 88.1% ($n=140$) with a mean gingival score index of 0.28 ± 0.25 . On comparison (ANOVA) of gingival score index with age, there was a statistically significant association ($p=0.02$).

Dental caries prevalence was 42.1% ($n=67$) among in permanent dentition and 8.2% ($n=13$) in deciduous dentition. Age of participants influenced (ANOVA) dental caries prevalence among participants in deciduous dentition ($p=0.04$).

The overall DMFT/dmft was 0.99 ± 1.70 and 0.16 ± 0.63 respectively with decay (D,d) forming the highest component. In permanent dentition, mean DMFT was higher 1.13 ± 2.14 among female participants compared (t-test) to male 0.72 ± 1.15 participants. This difference was statistically significant ($p=0.05$). Visual impairment also had an influence on dental caries experience in deciduous dentition ($t=2.27$, $p=0.02$).

There was a statistically significant association when plaque score index was compared (spearman's correlation) with dmft index ($p=0.04$) and gingival score index ($p=0.001$). Null hypothesis was tested using Spearman's correlation for association between oral hygiene practices and oral health status. Oral hygiene practices did not influence oral hygiene status and dental caries status. However, an association was shown between frequency of toothbrush replacement and gingival index score ($p=0.003$).

Conclusion: Majority of the children attending Thika Primary School for the Blind have adequate oral hygiene practices. All used conventional toothbrushes with majority using toothpaste and brushing 2-3 times daily.

All participants were found to have good oral hygiene (plaque score= 0.95 ± 0.45) and mild gingivitis (gingival score = 0.28 ± 0.25) with low dental caries experience (dmft= 0.16 ± 0.63 ; DMFT= 0.99 ± 1.70). Only 27.1% of the participants reported experiencing challenges in practice of oral hygiene measures.

Category of visual impairment had an influence on dental caries experience among participants in deciduous dentition, being more among Category I visually impaired participants. Plaque score index increased with age of participants and influenced both the gingival score index and dmft score index. Gingival score index increased with age of participants but had no influence on dmft/DMFT score index. Dental caries experience in permanent dentition was influenced by gender and was more among female participants. Overall, oral hygiene practices did not influence oral hygiene and dental caries status. However, there was an association between frequency of toothbrush replacement and gingival score index.

Recommendations: There is need to reinforce oral hygiene practices among visually impaired children with emphasis towards frequency of toothbrush replacement within 3 months so as to achieve maximum benefits in maintenance of oral hygiene. There is need to introduce modalities for preventive measures and early diagnosis of dental caries, more so among children in deciduous dentition with Category I visual impairment. Further studies with more dose components of oral hygiene practices such as duration of brushing in each session and number of strokes used during tooth brushing are recommended to better assess the relationship between oral hygiene practices and oral hygiene status.

CHAPTER ONE

INTRODUCTION

1.1. Background of the study

Visual impairment is a sensory impairment, which varies from total blindness to slight limitations of shape, distance, colour and size. The total number of people who living with visual impairment worldwide are 253 million with 217 million having moderate to severe vision impairment while 36 million are blind(1). An estimated nineteen million children are visually impaired with 1.4 million suffering irreversible blindness requiring access to vision rehabilitation services to optimise function and reduce disability. Majority (75%) of the children who have irreversible blindness live in the poorest regions in Africa and Asia. According to Kenya National Bureau of Statistics report (2009) and the Kenya National Survey for Persons with Disabilities (2008), visual impairment was reported as the most common sensory impairment at 24.9% and 30% respectively and as the second most prevalent disability after physical disability (2).

1.1.1. Oral health and visual impairment

Good oral health constitutes a key aspect of general health and plays an essential role in impacting the quality of life, in the general wellbeing of an individual and in their overall health(3). However, maintenance of good oral health and dental care is particularly challenging in people with special health needs and has been reported to be poor in comparison to the general population (4).

A positive association has been reported between poor oral health and visual impairment (5–9). In particular, a high caries burden has been reported among visually impaired children (5). The visual impairedness has been attributed to several factors which include difficulty in attaining good oral hygiene due to inability to visually assess gingival bleeding during brushing, difficulty in evaluating if dental plaque has been effectively removed compounded by the fact that demonstration of oral hygiene instructions via visual aids is not appropriate (6).

Other factors suggested include lack of parental supervision and the absence of manual-visual coordination among visually impaired children (6). Also, conventional methods of teaching oral hygiene involve the use of disclosing agents to visualise plaque and brush the teeth to remove it, and re-disclosing periodically to monitor oral hygiene status (10). Unfortunately, these measures are not beneficial to visually impaired individuals who depend more on hearing and feeling to learn.

Despite the difficulty in removing bacterial plaque being key in the development of dental caries, studies have been inconclusive on the relationship between oral hygiene practices and oral health status among visually impaired children. There are also insufficient reports on the oral health status of visually impaired children in sub-Saharan countries. There is, therefore, need to understand oral health status and oral hygiene practices among visually impaired children in the country and to obtain baseline data that shall be useful in the formulation of oral health programs targeting this group.

1.2. Problem Statement

Visually impaired children are reported to suffer suboptimal levels of oral health status with majority exhibiting moderate to severe gingivitis and a high dental caries prevalence (6). Studies on oral health status in children with visual impairment suggest that these suboptimal levels could be multifactorial with some of the proposed reasons being; lack of parental supervision, inability to visualise dental plaque and gingival bleeding, reduced the concern of appearance by the child and absence of manual- visual coordination. However, other oral health behavioural factors that may be in practice such as poor oral hygiene practices may be a contributing factor (6).

Previous studies have been inconclusive on the relationship between oral hygiene practices and gingival health status and dental caries status among visually impaired children. This study sought to bridge this gap by investigating and reporting on oral health status and oral hygiene practices among visually impaired children attending Thika Primary School for the Blind.

1.3. Justification of the Study

Very few studies on the oral health of children with special health needs and more so visual impairment have been conducted in Kenya. Therefore, the research was justified for several reasons. First, the study will serve to build on knowledge and literature regarding visually impaired children of African descent in an emerging economy. Secondly, findings from the proposed study shall provide baseline data on oral health status and oral hygiene practices among visually impaired children attending Thika Primary School for the Blind. The findings shall be useful to relevant health planners in the formulation of oral health programs targeting visually impaired children with the aim of promoting and providing continuous and sustainable oral health care.

1.4. Objectives of the Study

1.4.1. Broad Objective

To determine the oral health status and oral hygiene practices among visually impaired children attending Thika Primary School for the Blind in Kiambu County, Kenya.

1.4.2. Specific Objectives

- i. To determine the prevalence of dental caries among visually impaired children attending Thika Primary School for the Blind.
- ii. To assess the prevalence of gingivitis among visually impaired children and attending Thika Primary School for the Blind.
- iii. To evaluate oral hygiene status among visually impaired children attending Thika Primary School for the Blind.
- iv. To investigate the oral hygiene practices among visually impaired children attending Thika Primary School for the Blind.
- v. To determine the association between oral hygiene practices and oral health status among visually impaired children attending Thika Primary School for the Blind.

1.5. Null Hypothesis

There is no association between oral hygiene practises and oral health status among children attending Thika Primary School for the Blind.

1.6. Alternative Hypothesis

There is a relationship between oral hygiene practices and oral health status among visually impaired children attending Thika Primary School for the Blind.

1.7. Conceptual Framework

Fig 1.1 summarizes the conceptual framework on which the study is based. Factors that influence oral health status can be categorized into oral hygiene practices of an individual, social demographics characteristics and visual health status. A review of literature noted a positive correlation between oral hygiene practices and oral health status (8,11). However, other studies have not reported a statistically significant relationship between the two variables (12,13). Studies demonstrating age differences and oral health status have been inconsistent(7,10). Similarly studies have not been consistent in showing an association between visual impairment and oral hygiene status with some reported a positive association (5,14) with others reporting no association (10,13). This study evaluates oral hygiene practices and oral health status among visually impaired children with an aim of determining an association between the two variables.

Independent Variables

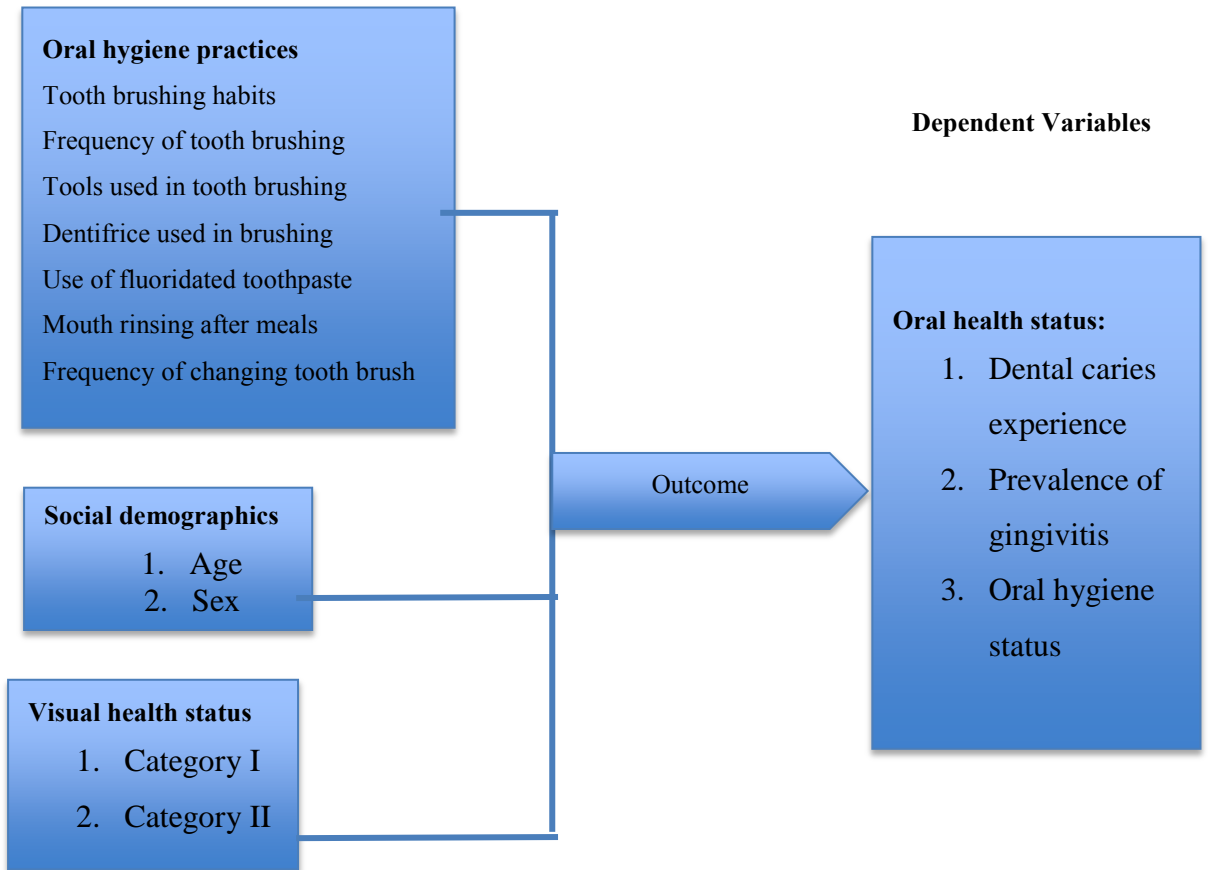


Figure 1.1: Effects of oral hygiene practices, social demographic characteristics and visual health status on oral health status.

Table 1.1: Variables of the study

VARIABLE	MEASUREMENT
Independent Variables	
Oral hygiene practices	Frequency of brushing, tooth-brushing devices, dentifrices used in brushing, frequency of changing toothbrush, use of fluoridated toothpaste, mouth rinsing with water after meals.
Dependent Variables	
a. Dental caries prevalence	decayed/Decayed, missing/Missing and filled/Filled teeth (dmft /DMFT Index)
b. Gingivitis	Presence or absence of gingival bleeding (Community Periodontal Index Modified)
c. Oral hygiene status	Presence or absence of plaque (Silness and Loe)
Socio-demographic Variables	
a. Age of child	Number of years
b. Gender of child	Male or female
Visual health status	
Visual impairment	Use of braille at school as the mode of learning. (Educational Visual impairment category 1 and II)

1.8. Scope of the Study

This study was on oral health status and oral hygiene practices among visually impaired children. Oral hygiene status, gingival health status and dental caries status were determined and oral hygiene practices investigated.

Focus was on visually impaired children who fell under the category I and II of educational visual impairment necessitating use braille as the mode of learning.

1.9. Limitations of the Study

Data was collected using the questionnaire obtained from the children without interviewing their caregivers.

CHAPTER TWO

LITERATURE REVIEW

2.1 Visual Impairment

2.1.1 Definition of Visual Impairment

Individuals with visual impairment have varying degrees of vision. Some use auditory and tactile channels for information acquisition while others use vision but only to supplement information acquired via other channels. Another group include persons who mainly use eyes to acquire input but supplement this with input from auditory, tactile and other senses (15). Legal blindness is a term used in some countries (e.g. USA) to refer to individuals whose primary channel of information acquisition is via tactile and auditory senses. Using the Snellen chart, a legally blind person has a visual acuity of 20/200 or less in the better-corrected eye. This means that a person with 20/200 visual acuity would have to stand a distance of 200 feet to see what a person with normal vision would see at 20 feet. A field of vision of 20 or less indicates ability to see objects within a range of at most 20 degrees while a normal eye sees objects within a range of about 160 to 170 degrees (16).

Educational visual impairment has been defined as loss in visual acuity and field with interference in child's performance in education environment requiring special education (17). While accurate measurements of visual acuity and visual field serve to determine eligibility for certain entitlements for legally blind in some countries, classifications based on the extent to which students with visual impairment use their vision and other channels for learning are more useful to providers of educational services. These classifications refer to students as totally blind when they can receive no useful information through the sense of vision and must use tactile and auditory senses for all learning.

However, functionally blind students learn primarily through the auditory and tactile senses though they may be able to use their limited vision to supplement information received from other senses and perform certain tasks such as mobility in the classroom. Students with low vision on the contrary use visual information with tactile and auditory input.

2.1.2 Categorization of Visual Impairment

The Low Vision Project – Kenya, a project established in 1994 and operated by a German based Christoffel Blinden Mission (CBM) to support the education of visually impaired children was formed with an aim of assisting children with low vision access education through optimal use of sight (18). This project detected two forms of education needs among visually impaired children; those who can use print as their educational medium and those who need to use Braille. The groups have been divided further into five categories. The first four categories are based on the working definition of the World Health Organization (WHO) and the fifth is based on the need to create a category for children attending special schools and programs who are not visually impaired but are mono eyed or wear heavy power glasses. Category I students with visual impairment under the Low Vision Project of Kenya are totally blind and are educated in Braille and category II have some useful vision but not sufficient to read print hence are also educated in Braille. Category III students are described as having low vision and are educated with aid of optical low vision devices to read print. Categories IV are described as students with low vision who have close to normal or normal vision and can read print using special techniques and methods without optical low vision devices. Categories V are students who are not considered in the low vision category because their sight is 6/18. These students do not need special education services if their sight is constant. These categories have been in use in Kenya since 1995 and are very useful in explaining children's educational needs(18). These five categories are used to determine the appropriate placement and services for students with visual impairments in Kenya.

Vision can also be affected in other ways apart from visual acuity and visual field impairment. The ability to merge two images into one (binocular vision) and ability of the eye to move (ocular motility) can influence the child's vision. Other forms of visual impairment include far-focus/near-focus, nystagmus (rapid and involuntary eye movement, strabismus (inability to direct the eyes to the same object) and amblyopia (lazy eye) resulting in reduced or vision loss in the weaker eye (19).

2.1.3 Aetiology of Visual Impairment

There are different causes of visual impairment in children with variation in regional distribution. These causes are largely influenced by socioeconomic advancement and accessibility to primary eye health services. In high-income countries, the predominant causes of blindness are lesions of the higher visual pathway and of the optic nerve. Retinopathy of prematurity is a significant cause of visual impairment in middle income countries while Corneal scarring from measles, Vitamin A deficiency, harmful traditional remedies and ophthalmia neonatorum are the main causes of visual impairment in low income countries. Hereditary retinal dystrophies, cataract and congenital abnormalities are other important causes in all countries. A study on blind pupils in Malawi, Uganda and Kenya aimed at determining causes of blindness or severe visual impairment reported visual loss due to corneal pathology attributed to measles infection and vitamin A deficiency at 35.2%, 14.8% was due to diseases of the retina and 13.5% due to cataract (20). In Khartoum Sudan, a study conducted among children > 16 years in five camps for internally displaced persons reported prevalence of blindness at 1.4 per 1000 children. The highest cause of blindness was corneal opacities due to vitamin A deficiency followed by amblyopia (21). Sadly, underlying causal factors of blindness in almost half of the blind children could have been prevented or the eye condition treated in order to preserve vision or treat the eye condition. (22).

2.1.4 Global Aetiology of Visual Impairment

Worldwide, an estimated 253 million people live with visual impairment (1). Out of these, 217 million have moderate to severe vision impairment while 36 million are blind. Among those who are blind or have moderate to severe vision impairment, 81% are aged 50 years and above. (1). Globally, chronic eye diseases are the main cause of vision loss with un-operated cataract and uncorrected refractive errors being the top two causes of vision impairment. Un-operated cataract remains the leading cause of blindness in low and middle-income countries with 80% of all vision impairment reported to being preventable or curable (23).

This could be attributed to the weak health systems in developing countries as well as a scarce workforce. An estimated 19 million children are vision impaired and of these, 12 million children have vision impairment due to refractive errors and around 1.4 million have irreversible blindness requiring access to vision rehabilitation services to optimize functioning and reduce disability (23).

“Vision 2020- the right to sight” is a global initiative aimed at eliminating avoidable blindness by the year 2020 by prioritizing childhood blindness (24). Childhood blindness is given precedence despite accounting for 1.4m of the total 45m blind people worldwide. This is prompted by the fact that blind children have a long time of blindness into the future and this could affect their general outlook in life including their education, employment and earning. Different strategies to combat childhood blindness need to be instituted and should be region specific. They should include control of Vitamin A deficiency, measles immunization and provision of tertiary level eye care facilities for specialized management (24).

2.1.5 Epidemiology of Visual Impairment in Developing Countries

In low-income countries with high under 5 mortality rates, prevalence of childhood blindness may be as high as 1.5 per 1000 children (25). This high prevalence combined with poor management of resources may result in huge negative impacts. Some of these impacts include longevity, with up to 60% of blind children dying within year one of loss of sight (26). In comparison, high-income countries with low under 5 mortality rates, the prevalence is around 0.3 per 1000 children (25)

A study conducted in Kenya by Barasa to investigate the prevalence and pattern of visual impairment and blindness among primary school pupils reported a prevalence of 4.77% while that of blindness was 0.13%. Girls contributed 35.14% of cases of visual impairment while boys contributed 64.86%. The age most affected was 11-15 years (59.46%) and the study reported that there was a higher chance of developing visual impairment with increasing age (27).

2.2 Oral Health Status

2.2.1 Dental Caries

2.2.1.1 Aetiology and Risk Factors of Dental Caries

Dental caries is also known as dental decay. It has been documented as the most common disease affecting human beings worldwide (28). Dental caries is a multifactorial disease caused by interaction of environmental factors and those of the host and the agent. It forms via a complex interaction between acid producing bacteria, fermentable carbohydrates and many host factors such as saliva and teeth, over a period of time (29).

Dental caries develops on both crowns and roots of teeth and can arise as an aggressive tooth decay that affects the primary teeth of infants and toddlers in early childhood. Risk factors for dental caries include inappropriate brushing methods, poor oral hygiene, insufficient fluoride exposure, inadequate salivary flow, poverty, high numbers of cariogenic bacteria and inappropriate infant feeding habits. Prevention and treatment of dental caries should focus on management of caries process for individual patients over time, with a minimally invasive approach (29).

The pathogenesis of dental caries entails bacteria in dental plaque (biofilm) metabolizing sugars to acid which then cause destruction and dissolution of dental enamel and dentin (30). It is caused by multiple microorganisms with mutans streptococcus, *Lactobacillus acidophilus* and *actinomyces viscosus* being the main pathogens which initiate and propagate development of dental caries (28). However, the most important microorganisms are the mutans streptococci with *streptococcus sorbinus* and *streptococcus mutans* being of the highest significance (31)

Consumption of sugars and other fermentable carbohydrates result in reduced dental PH caused by organic acids. This leads to increased calcium hydroxide solubility in the dental hard tissue and tooth surface calcium demineralization (32). Caries development therefore can be controlled via removal of plaque, reducing acidogenic potential of plaque, reducing sugar consumption, increase of tooth's resistance to plaque and forming a barrier between plaque and enamel by coating the tooth surface.

Currently, three approaches are of practical importance; fissure sealants, sugar control and fluoride. Therefore, since dental caries is a preventable disease, countries, communities and individuals should institute measures and strategies to curb the disease initiation and progression (33)

Dental caries in most countries increased in proportion with sugar importation being at its highest in 1950s and 1960s. With wide fluoride use however, severity of dental caries has reduced. Despite this, the disease still has great significance socially, economically and medically (30). This can be attributed to the high costs involved in dental caries treatment as well as the poor quality of life associated with dental caries.

2.2.2 Dental Caries among Children with Special Health Care (CSHCS) and Visually Impaired Children

More than 52% of children in the world are at risk for untreated oral disease and children with special healthcare needs (CSHNS) are prevalent in this “at risk” group (34,35). Multiple studies have reported a general association between visual impairment and dental caries (5,9,21,36), with high DMFT/dmft scores reported among visually impaired school children. This was reported in Riyadh, Saudi Arabia among 11-12 year olds where mean DMFT score was reported as 3.89 among 6-7 year olds, with a mean dmft of 6.58 (37). This study aimed at assessing the oral health of visually impaired children and of the 150 subjects examined, a high dental caries prevalence of 56 (37.3%) was reported.

In another study carried out in Istanbul, Turkey on caries experience and oral hygiene status among 7-16 year old school going children, a 16 item questionnaire was administered in addition to a clinical tooth examination (36). In comparison to the previous study only 26.40 % of the children were caries free. The high caries prevalence would have been because 3.3% of these students were mildly retarded and 2.8% of them had a developmental disability.

In a south Indian study investigating oral health status among visually impaired children, a modified WHO oral health assessment form was used to assess oral hygiene status, caries experience and gingival status.

It was reported that visually impaired children had suboptimal oral health levels with most of the children having a high caries prevalence (6). Similarly, a study carried out in Khartoum Sudan on oral health of visually impaired children reported that caries experience is high in children with visual impairment. It reported that this population had extensive dental treatment needs and an extremely deficient dental care index (5). The reason suggested for this finding was that dental care was not a priority in the school and the children were not receiving oral health education from their teachers and caregivers.

2.3 Gingivitis

2.3.1 Definition and Aetiology

Gingivitis is the inflammation of the gingiva and is the second most common oral health disease after dental caries to affect both adults and children (38). It results from accumulation of bacterial plaque along cervical margins of teeth leading to gingival inflammation with no signs of clinical attachment loss or bone loss. The rate and degree at which plaque forms in children is dependent on their tooth brushing frequency, ability to brush adequately, diet and presence of dental caries. All these factors contribute to the disease severity (39).

Gingivitis is also very common in young children and can be as a result of underlying conditions or infections like diabetes, *Borellia Vincentii* or Herpes simplex infections, leukemia, radiotherapy or malnutrition (40,41). Conditions such as these affect gingival health and present with an exaggerated inflammatory response to plaque. However, with improved oral hygiene and removal of bacterial deposits, the gingival condition usually responds positively (40).

2.3.1.1 Prevalence of Gingivitis in Developing Countries

Poor oral hygiene and gingival inflammation have been reported to be prevalent in developing countries (42). The prevalence rate among 6-11 year olds in developing countries has been reported at 73% with the prevalence rates rising to between 50-99% towards adolescence (43).

A cross sectional study done in Yemen, a developing nation, among 5-12 year olds on the prevalence of gingivitis reported a plaque index mean score of 0.35 for the 5 year olds with a prevalence rate of 27% compared to 78.6% among 12 year olds.

In a study to evaluate the gingival condition among school going children in Sharjah, UAE, 405 school children were examined and dental plaque and gingival condition scored using Silness and Loe and Loe and Silness criteria respectively (38). Moderate to severe gingivitis at 20% was reported with females being more likely to have the disease (38) .

Locally, prevalence of gingivitis has been reported in different studies as high. The Kenya National Oral Health Survey (2015) reported gingival bleeding in three out of four children (75.7%) among 5 to 15 year old children (44). Children aged 5 years had the highest (99.6%) prevalence of gingival bleeding. However, there were no major differences between the males and females. The survey also reported a lower prevalence of gingival bleeding (70.2%) among rural children compared to the peri-urban children. In an earlier study by Musera on dental caries, gingivitis, oral health knowledge and practices among 10-12-year old children in urban and rural children which, a high gingivitis prevalence was reported at 99.2% for urban and 98.4% for rural children (45).

A different local study by Owino et al among 12-year-old children reported the prevalence of gingivitis as 77.7%.(46). In this study, presence of disease was determined by a CPI score of one, which depicted bleeding gums. The study reported that the high prevalence rate of gingivitis was consistent with similar age groups in other parts of the world (46).

2.3.1.2 Gingivitis among Children with Special Healthcare Needs (CSHNS) and Visually Impaired Children

Oral health status of the physically and mentally impaired has been shown as generally poor in comparison to that of the general population because the treatment afforded to them is minimal (4). In a study carried out in Singapore on dental health of disabled children, 322 children aged 6-18 years were assessed.

The children had various disabilities; -intellectual, musculoskeletal, hearing and visual. Differences in the prevalence and severity of the dental conditions among children in the various disability groups were not significant. However, in comparison with non-handicapped school children aged 6- 18 years, higher levels of oral disease were noted among the disabled children(4) .

In a similar study on oral health status of handicapped primary school pupils in Dar es Salaam Tanzania, pupils aged 1- 22 years were examined. Majority (71%) were deaf followed by blind (17.8%) and mentally retarded (8.7%). Six (1.9%) pupils were both deaf and blind while one (0.3%) pupil was blind and mentally retarded.

Among the study participants, 73.5% had bleeding gums with the blind having the highest mean bleeding index ($p < 0.001$) and 82.8% of the pupils having calculus with the highest mean score mainly among the blind ($p = 0.008$) (47). Worldwide studies have also reported poor oral health among visually impaired individuals with higher levels of gingivitis noted, compared to their non-visually impaired peers (6,48).

In a comparative study carried out in Iraq on oral health status and treatment needs among blind children and non-visually impaired children, 58 blind and 58 non visually impaired children aged 6-15 years were examined (48). Silness and Loe plaque index (49) was applied for assessment of dental plaque adjacent to gingival margin of six index teeth (Ramfjord) (50) while Loe and Silness gingival index (51) was applied for gingival health evaluation.

Dental calculus was assessed according to calculus index component of the simplified oral hygiene index of Greene and Vermillion (52). This study reported poor oral health and extensive gingivitis among blind schoolchildren. This was associated with the fact that blind people are not able to recognize early oral disease and maybe unable to take immediate action unless informed of the situation.

In different studies in India, high levels of gingivitis have been reported. In a study carried on new insights into improving oral health of visually impaired children, 150 subjects from an academy for the blind run by a non-governmental organization were examined. Of the subjects examined, 107 (71.3%) were affected by gingivitis (9). Similarly, a study in South India on oral health status of the visually impaired children reported moderate to severe levels of gingivitis among visually impaired children (6).

A study carried out in Brazil on the relationship between periodontal status and degree of visual impairment in institutionalized individuals reported that periodontal condition is not related to level of visual impairment.

However, individuals with acquired visual impairment were reported to have worse indicators of periodontal health compared with those with congenital VI (53). This may be explained by the fact that those with congenital visual impairment may have refined their tactile feel in comparison to those with acquired visual impairment.

2.4 Oral Hygiene Status

2.4.1 Oral Hygiene Status among Children with Special Healthcare Needs (Cshns) and Visually Impaired Children

A correlation has been documented between poor oral hygiene and visual impairment with the general consensus being that CSHNS children have poor oral hygiene (7,12,35,54). In a local study where 449 CSHNS were examined, 100% of the examined sites were found to have plaque (54). However, after treatment during an intervention program, there was marked reduction in the number of sites with plaque, showing that it is possible to institute cheap and effective oral health programs in schools(54).

A study in Turkey to determine dental caries experience and oral hygiene status reported that great challenges exist in maintenance of oral hygiene among visually impaired children (36). This study was conducted at one of the largest schools for the visually impaired children among 178 students aged 7-16 years. A total 3.3% of these students were mildly retarded and 2.8% had a developmental disability. A 16-item questionnaire was employed in addition to clinical tooth examination.

The questionnaire was developed to record the students' general health, impairment, socioeconomic profile and education level of parents, oral health knowledge, source of information about oral health and oral hygiene habits. Greene and Vermillion Simplified Oral Hygiene Index (OHI-S) was used to assess oral hygiene status and only 2.2% of the students were reported to have good oral hygiene.

In a study carried out in Chennai, India on prevalence of oral health status in visually impaired children, 228 children were examined consisting of 128 visually impaired and 100 non visually impaired school going children. The children aged 6- 15 years were selected from two schools of similar socioeconomic strata. The finding of this study reported poor oral hygiene status among visually impaired children when compared to the non-visually impaired children. This was attributed to inability to see and remove plaque, lack of development of self-help skills and stay in hostel thus leading to lack of supervision while brushing.

This finding was in agreement with Schembri et al who reported that difficulty of the visually impaired individuals to see and remove plaque play a key role in lack of proper oral hygiene and has been implicated as the primary factor influencing the prevalence of periodontal disease among blind subjects (55).

On the contrary, other studies have failed to show an association between visual impairment and poor oral hygiene (3,10). In a study carried out in India on oral health knowledge, practice, oral hygiene status and dental caries prevalence among 8-13 years old visually impaired children in Bangalore, a total of 85 children from a residential blind school were examined (10). The Principal Investigator (PI) carried out a routine dental checkup followed by a verbal interrogation of the questionnaire.

DMFT index and def index were scored in each patient and Greene and Vermillion index used to score the oral hygiene status of the patient. 91.76% of the children had good oral hygiene whereas 5.88% had fair oral hygiene with only 2.35% having poor oral hygiene. Among these, 92% of boys and 91% of girls had good oral hygiene status and 6% girls, 6% boys had fair oral hygiene with just 2% boys and 3% girls having a poor oral hygiene status.

This finding was as a result of the study population having better knowledge regarding dental health care. Similar findings were reported in a study carried out in Chennai India to assess the prevalence of dental caries, oral hygiene knowledge, status and practices among visually impaired individuals (3).

This was a cross sectional study among 404 visually impaired individuals in which four schools were randomly selected. Oral hygiene status were found to be relatively fair with 42% of the individuals reported to have fair oral hygiene, 33% had good hygiene while only 25% had poor oral hygiene. This was associated with the fact that the sample population had better knowledge regarding oral health as they were informed about the importance of oral health by their teachers through simple oral health education (3).

2.5 Oral Hygiene Practices

2.5.1 Constituents of Oral Hygiene Practices

Oral hygiene practices constitute tooth brushing habits, frequency of tooth brushing, tools used in tooth brushing, dentifrice used in tooth brushing, use of fluoride containing toothpaste, mouth rinsing after meals and frequency of changing toothbrushes. Oral hygiene measures aim to modify oral flora so as to promote a healthy periodontium and dental tissues. Tooth brushing and flossing are the most commonly used approaches although wooden sticks and interdental brushes offer advantages in periodontally involved dentitions. Tooth brushing should begin once the teeth begin to erupt with assisted brushing advised until 8 years when child have achieved manual dexterity.

Chewing sugar free gums act as saliva stimulants hence can be applied as a caries preventive measure. Chemotherapeutic supplementation of mechanical measures using mouth rinses, gels and dentifrices can also act to improve oral hygiene. However, oral health approaches should be tailor made to suit lifestyles and abilities of children and adolescents in order to encourage them make decisions to improve their personal oral hygiene and oral health (56).

2.5.2 Visual Impairment and Oral Hygiene Practices

Visually impaired children rely heavily upon simple information and verbal instructions for their day to day activities (57). Oral hygiene is one such routine task that they must fulfill (5). Few studies have shown oral health problems to occur equally among visually impaired children and their sighted peers (58,59). This could be as a result of paucity in general dental knowledge and lack of regular dental visits across both groups (60). However, there are studies which have shown a correlation between poor oral health and visual impairment (7,36).

This was echoed in a study in India to compare dental caries and oral hygiene status among blind school children and their sighted peers, where the prevalence of dental caries among visually impaired children was 60% while that of sighted children was 31.5% (61). Similarly, another Indian study on comparison of oral hygiene status and dental caries experience among institutionalized visually impaired children and those with hearing impairment reported that the oral hygiene status among the hearing impaired was better than in those with visual impairment (62). Imperial data has therefore suggested that visual impairment must be causing a hindrance in bacterial plaque removal from tooth surfaces (57). Other challenges experienced by the visually impaired may include using inappropriate tooth brushing strokes that could cause damage to oral structures (57).

This could further cause gingival inflammation and damage to periodontium and result in calculus and accumulation of debris (57). Another reported difficulty is in the application of toothpaste on the toothbrush (57). To address these challenges, tactile aids in addition to verbal instructions have been advocated as they play a pivotal role in overcoming the compromised abilities faced by visually impaired individuals. (63). Poor oral hygiene status has been associated with poor oral hygiene practices among visually impairment students. In a study among 50 visually impaired volunteers in Iraq, poor oral hygiene was reported among 60% of the students with only 22% having fair oral hygiene and 8% exhibiting good oral hygiene (7). This was explained by the fact that most of the students relied upon themselves for their oral hygiene measures.

This study therefore suggested close monitoring by caregivers of this group when performing oral hygiene practices. Further studies with a larger sample size and a comparative group of non-visually impaired peers were however recommended.

On the contrary, other studies do not show a significant association between dental caries and oral hygiene practices among visually impaired children.

A study carried out in Bangalore, India on oral health knowledge, practice, oral hygiene status and dental caries prevalence where a total of 85 children were asked verbal questions on frequency of brushing, cleaning tools, use of dentifrice, frequency of dental visits and knowledge on role of sugar in producing dental decay, no significant relationship between dental caries and oral hygiene practices was reported (10). In this study, all the children were also screened and DMFT and def scores recorded and oral hygiene status assessed by Green and Vermillion index (10). Similarly, a study in Aligarh, India, among 80 visually impaired students between 10-35 years based in a residential school, reported no significant relationship between dental caries and oral hygiene practices (12).

In a local study aimed at obtaining data on oral hygiene status, oral hygiene practices and periodontal health of primary school children in Nairobi, 513 children from 6 randomly selected public primary schools within the city were examined (64). 262 were aged 6-8 years while 251 were aged 13-15 years. Despite most children reporting brushing, 55% in the older age groups and 75% in the younger age group had visible plaque on the index tooth surfaces (64).

This study therefore recommended oral health education among children in Nairobi following the results indicating poor oral hygiene practices and status. In a more recent local study on dental caries, gingivitis, oral health knowledge and practices among 10-12 year urban and rural children, Musera reported that 77.1% of children brush their teeth once or twice daily (45). This study reported that fewer rural children brushed their teeth (72%) as compared to urban ones (95%). In general, the study found that females had better oral hygiene practices than males with 96% of urban children using toothpaste while only 35% of rural children used toothpaste.

2.6 Summary

There are approximately two hundred and fifty-three million people living with visual impairment worldwide. Of these, 217 million individuals have moderate to severe vision impairment while 36 million are blind. An estimated nineteen million children are visually impaired with around 1.4 million having irreversible blindness. 75% of the children who have irreversible blindness live in the poorest regions in Africa and Asia(24). In high-income countries with low under-five mortality rates, the prevalence of visual impairment has been reported as 0.3 per 1000 children while in low-income countries with a high under-five mortality rate the prevalence has been reported as 1.5 in 1000 children (65).

Oral health status of individuals with special health needs has been reported as generally poor in comparison to that of the general population (8). Maintenance of good oral health and dental care has mainly been reported as challenging in this group (66). A correlation has been documented between poor oral hygiene and visual impairment with the general consensus being that CSHNS children have poor oral hygiene (11–13,54). However, other studies have failed to show an association between visual impairment and poor oral hygiene (5). This finding were associated with better knowledge by the study population regarding dental health (3) and also because of simple oral health education by the teachers (10).

Comprehensive studies have reported higher levels of gingivitis and poor oral hygiene among visually impaired individuals when compared to their non-visually impaired peers (10). This has been associated with the fact that blind people are not able to recognize early oral disease and maybe unable to take immediate action unless informed of the situation and also due to difficulty in vision which may negatively influence removal plaque (55).

Multiple studies have also reported a general association between visual impairment and dental caries (5,9,21,36), with high DMFT/dmft scores reported among visually impaired school children. On the contrary, several studies have failed to show a significant association between dental caries and oral hygiene practices among visually impaired children (8, 51).

Some surveys have reported a positive association between oral hygiene practices and oral health status (8,9) while other studies have not published a significant relationship between the two variables (12).

CHAPTER THREE

MATERIALS AND METHODS

3.1 Design of the Study

This was a descriptive cross-sectional study.

3.2 Study Area

This study was conducted in Kiambu County, Kenya, which is located in the central highlands of Kenya at an elevation of 1,631 meters (5,351ft). The county covers an area of 2,543.42 square kilometres and is also a leading innovative commercial hub that shares its borders with six other counties: Nairobi and Kajiado to the south, Machakos to the East, Murang'a to the North and North East, Nyandarua to the Northwest and Nakuru to the West.

Kiambu County has 1225 primary schools of which 876 are public, and 349 are private. These schools run both the day and boarding system for boys and girls. The specific study site was Thika Primary School for the Blind. The selection of the study area was made through purposeful sampling, as the school was integrated catering for visually impaired children in Kenya hence offered a national outlook comprising of pupils from across the country.

It is located in Thika, a significant town in Kiambu County lying 40 kilometres from Nairobi. Thika primary school for the blind is an institutionalized public facility, which is administered by the Ministry of Education and caters for both boys and girls. At the time of the study, the school population was 209 children ranging between 4 and 21 years old with varying categories of visual impairment, which included category, I and II. Kenya is comprised of 47 counties. However, for purposes of this study, the counties were stratified into 10 regions according to their geographical units as shown in (Table 3.1).

Table 3.1: Stratification of regions by counties

REGION		COUNTIES
Region 1	Coast	Taita Taveta, Kwale, Mombasa, Lamu, Tana River, Kilifi
Region 2	North Eastern	Garissa, Wajir, Mandera
Region 3	Upper Eastern	Kitui, Isiolo, Marsabit, Meru, Tharaka-Nithi, Embu
Region 4	Lower Eastern	Machakos Makueni, Kitui
Region 5	Central	Nyeri, Kirinyaga, Murang'a, Nyandarua, Kiambu
Region 6	Upper Rift valley	Turkana, Baringo, Elgeyo Marakwet, Uasin Gishu, West Pokot, Trans Nzoia, Laikipia, Samburu,
Region 7	Lower Rift valley	Kajiado, Nakuru, Nandi, Narok, Bomet, Kericho
Region 8	Western	Vihiga, Kakamega, Busia, Bungoma
Region 9	Nyanza	Homabay, Migori, Kisumu, Siaya, Kisii, Nyamira
Region 10	Nairobi	Nairobi

Borrowed and modified from Statoids- Kenya Counties (67)

3.3 Study Population

The study population comprised of visually impaired children in category I and II of educational visual impairment, aged 10-19 years old and attending Thika Primary School for the Blind.

3.4 Sample Size Determination

The study sample size was determined by the formula proposed by Fisher et al. (68). Assuming the children with dental caries to be 50% and considering a 95% confidence level and 5% degree of accuracy, the sample size was determined as follows (69).

$$n = \frac{z^2 p(1-p)}{e^2}$$

Where;

z = standard normal deviate for α at 95% confidence, $Z_{1-\alpha/2} = 1.96$

p = Estimated Prevalence of visual impairment in study population – set to 0.5, assuming maximum variability

e = precision (0.05)

$$n = \frac{1.96^2 \times 0.5(1-0.5)}{0.05^2}$$

$$n = 384.16 \approx 385$$

Data obtained from study area indicates that the total number of children meeting inclusion criteria i.e. the sampling frame was 205. Since the sampling frame was less than 10,000, the finite population correction was used to estimate the correct sample size:

$$n_f = \frac{n}{1 + n/N}$$

n_f = desired sample

n = calculated sample size

N = t estimated population size

$$n_f = \frac{385}{1 + 385/209}$$

$$n_f = 137.8 \approx 138$$

Addition of 10% to account for attrition, the sample size increased to **152**.

3.5 Sampling Procedure

Recruitment of the participants was done by the Principal Investigator (PI) using proportionate stratified random sampling. The study population was stratified into two ages groups. Age group one consisted of children 10-12 years old (mixed dentition) while age group 2 consisted of adolescents aged 13-19 years (permanent dentition).

Those aged 10-12 years were 64 in number, accounting for 30.6% of the population, while those aged 13-19 years were 145 in number accounting for 69.4% of the population.

Given the sample size of 152, 30.6%, i.e. 47 individuals were drawn from the 10-12 years stratum and 69.4%, i.e. 106 individuals were drawn from the 13-19 years stratum. In each stratum, an alphabetical listing of names was obtained and numbered serially. Random numbers generated by the computer were used to select the requisite number of individuals in each stratum until the sample size was reached. The individuals whose names corresponded to the selected numbers were recruited into the study.

3.5.1 Inclusion Criteria

- 1) Visually impaired children in educational category I and II attending Thika Primary School for the Blind.
- 2) Children aged 10-19 years old attending Thika Primary School for the Blind.
- 3) Children whose parents/guardian consented to the study.
- 4) Children who assented to the research.

3.5.2 Exclusion Criteria

Presence of physically or mentally debilitating conditions such as Cerebral Palsy (CP) or syndromes such as Down's syndrome, which may have impacted on the oral health status and skill to carry out oral hygiene practices. The children were screened during the recruitment exercise.

3.6 Data Collection Methods

Data was collected using a questionnaire administered to the children by the principal investigator (PI) in a face-to-face interview and a clinical examination component of each of the study participants.

3.6.1 Questionnaire

A modified questionnaire adopted from the Simplified Oral Health Questionnaire for Children WHO (2013) was used (Appendices 5 and 6). It contained both open and close-ended questions and was used to record the participants' social demographic variables and individual oral hygiene practices.

The questionnaire was pre-tested on children aged between 10-19 years at the University of Nairobi Dental Hospital. The aim was to check the suitability, simplicity and ease of understanding as well as to estimate the time taken to complete the questionnaire.

3.6.2 Clinical Examination

The clinical findings were recorded in a modified clinical assessment examination form adopted from the Oral Health Assessment Form for Children (WHO 2013) (Appendix 7). The PI determined oral hygiene status, gingival health status and dental caries status of the study participants and the findings recorded by a trained assistant.

The dental examination was done inside a classroom near a window using natural light, with the child seated upright on an office chair. FDI tooth notation system was used for teeth identification. Clean and sterile instruments, which consisted of rubber gloves, mouth mirrors, community periodontal probes, paper hand towels, gauze and containers (one for used and the other for disinfecting used instruments) plus disinfecting solution were used.

For every participant, the oral hygiene status was assessed first and the findings recorded using plaque index scoring criteria described by Silness and Løe in 1964 (70). The procedure entailed visual examination for accumulation of soft deposits on the free gingival margins, the gingival pockets and the tooth surfaces of index teeth. Following that, the PI assessed the gingival health and the findings recorded using the Community Periodontal Index (CPI) Modified (71).

Gingiva of all teeth present was examined by carefully and gently inserting a WHO CPI probe between the gingiva and the tooth. This was followed by full extent exploration of the sulcus by allowing the examination to follow the anatomical contour of the surface of the root to determine the presence or absence of bleeding.

Subsequently, the PI used visual and tactile examination to determine the presence of dental caries. Individual teeth were isolated and dried using sterile gauze and the investigation followed an organised pattern from one tooth to the adjacent tooth in each quadrant. The CPI probe was used to confirm visual evidence of caries on the tooth surface(s). Following a systemic approach, each tooth was recorded as decayed/Decayed, missing/Missing or filled/Filled due to caries; (dmft /DMFT) (71).

3.7 Reliability and Validity

An experienced Paediatric dentist calibrated the PI on plaque score index, presence of gingival score index and on diagnosis of dental caries. Calibration was carried out on children aged between 10-19 years at Lady Northey Dental Hospital. The inter-examiner consistency was then calculated and the mean Cohen Kappa statistic values were; Plaque Score= 0.85, Gingival Index= 0.88, dmft = 0.90 and DMFT= 0.89.

During data collection, every 10th child was re-examined by the PI for the purpose of determining intra-examiner consistency.

The mean Cohen Kappa statistic values obtained were; Plaque Score= 0.95, Gingival Index= 1.00, dmft = 0.87 and DMFT= 0.82. A data clerk who aided in data recording was trained and pretested by the PI on proper data recording of the findings made during the examination to ensure that there were minimal errors in the record.

3.8 Data Analysis and Presentation

The data was entered into a computer database and analysed using Statistical Package for Social Sciences (SPSS) version 23.0 of Windows. The results were presented in tables and figures. Where appropriate, univariate, bivariate and multivariate analysis was carried out and appropriate statistical inferences made. Independent samples t-tests was used to compare means from the various indices in the study, by multiple categories, e.g. sex etc. Pearson's Chi-square will be used to assess bivariate relationships between the dependent, independent and socio-demographic variables and visual health component in the study.

3.9 Ethical Consideration

1. Ethical clearance to carry out the research was obtained from Kenyatta National Hospital and UoN Ethics and Research Committee (KNH-UoN ERC).
2. Permission to conduct the study was sought and received from the National Commission for Science Technology and Innovation (NACOSTI), Thika County Director of Education and Thika Primary School for the Blind authorities.
3. Participation in the study was voluntary. Written consent was obtained from the parents or guardians of the study participants and assent from the children and adolescents before commencement of the study.
4. Patient confidentiality was ensured by allocation of identification numbers which were written on each page of the questionnaire. Therefore, no names were included in the questionnaire.
5. Children in need of treatment were referred to Thika level 5 Hospital following an arrangement that had been made with the hospital management previously.
6. Oral health education was given to the children on the day of data collection.
7. Information obtained was used solely for the purpose of this study.
8. Dissemination of the study findings will be done through conferences, workshops and scientific publications. The PI will target several stakeholders who are concerned with oral health care of children, such as fellow oral health providers, Ministry of Health, Ministry of Education and further, Kenya Society for the Blind

CHAPTER FOUR

RESULTS

The study results are presented in four sections. Presented in section 4.1 are overall results. Presented in section 4.2 are variations of oral hygiene practices by demographic characteristics and visual impairment. Presented in section 4.3 are variations of oral health status by demographic characteristics and visual impairment while in section 4.4, the association between oral hygiene practices and oral health status is tested.

4.1 Overall Results

4.1.1 Visual Impairment and Demographic Characteristics of Participants

4.1.1.1 Categorization of Participants by Visual Impairment

A total of 159 children participated in the study and were stratified into Category I (total blindness having no perception of light and educated using Braille) and II (perception of light and some useful vision but not sufficient to read print hence educated using Braille) of educational visual impairment. There were 69 (43.4%) children in Category I and 90 (56.6%) in Category II. Among the participants, a higher 86 (54.1%) number of participants had congenital visual impairment compared to acquired visual impairment 73 (45.9%).

4.1.1.2 Socio-Demographic Characteristics

The study participants were further stratified by gender, age and geographical units of origin.

4.1.1.2.1 Distribution of Participants by Gender and Age

Out of 159 participants, 85 (53.5%) were male while 74 (46.5%) were female. The participants were thereafter divided into 3 age categories: 10-12 years , 13-15 years and 16- 19 years. The overall mean age was 13.9 ± 2.3 with a male and female participant's mean age of $14.1 + 2.5$ and $13.7 +_2.1$ respectively.

In the 10-12 years age category, male and female participants were equal 24 (50%) in number. In 13-15 years age category, there were more female 34 (50.7%) than male participants 33 (49.3%) while among children 16-19 years old, male participants were

more 28(63.6%) compared to the female participants 16 (36.4%)

Children 13-15 years old were the highest 67(42.1%) in number with a mean age of 13.9±0.8 years. Those 10-12 years old were 48 (30.2%) with a mean age of 11.3±0.8 years while children 16-19 years old were 44(27.7%) with a mean age of 16.8 ±0.9 years.

There was no statistically significant difference between gender and age ($F= 1.27$, $df= 2$, $p= 0.29$ (Table 4.1).

Table 4.1: Distribution of participants by gender and age

Characteristics		N=159	Mean age
Overall		n=159(100%)	M±SD
Gender	Male	85(53.5%)	14.1±2.5
	Female	74(46.5%)	13.7±2.1
Age	10-12yrs	48(30.2%)	11.3±0.8
	13-15yrs	67(42.1%)	13.9±0.8
	16-19yrs	44(27.7%)	16.8±0.9

4.1.1.2.2 Distribution of Participants by Geographical Units

Region 5 (Nyeri, Kirinyaga, Murang'a, Nyandarua, Kiambu) had the largest 54 (32.7%) representation while region 1 (Taita Taveta, Kwale, Mombasa, Lamu, Tana River, Kilifi) and 2 (Garissa, Wajir, Mandera) had the least 1 (0.6%) representation. Two (1.26%) participants originated from Tanzania (Fig 4.1). The composition of the various regions is shown in table 3.1.

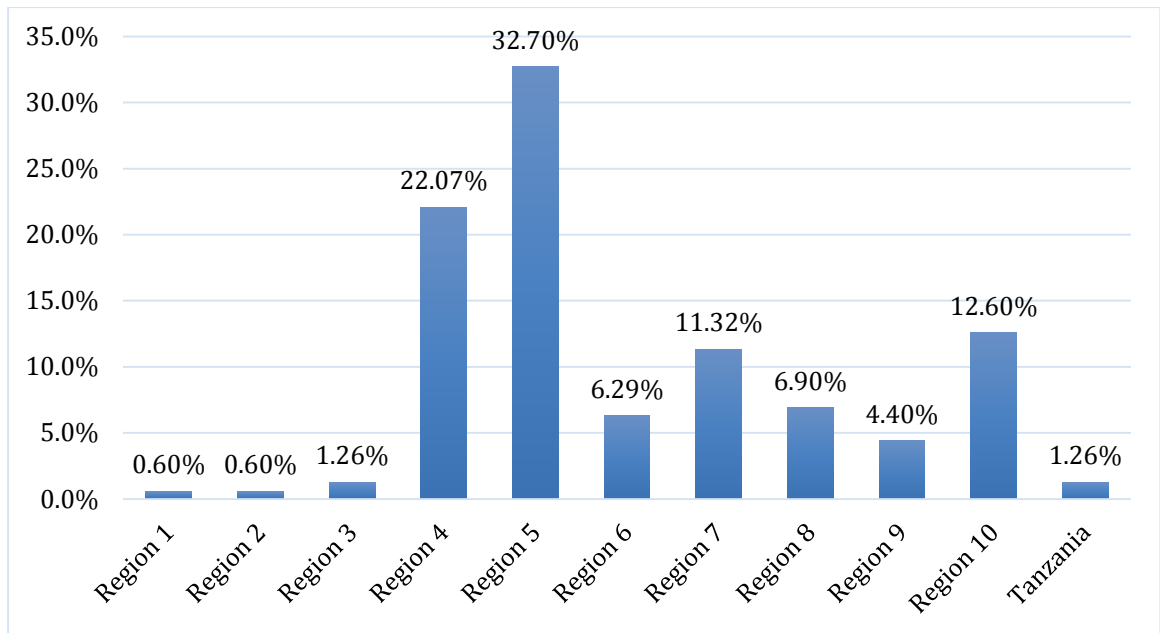


Figure 4.1: Distribution of participants by geographical units

4.1.2 Perception of Dental and Gingival Health

4.1.2.1 Perception of Dental Health

Ninety-four (59.1%) and 23 (14.5%) participants described their dental health status as good and very good respectively. The others described it as average 16 (10.1%), poor 13 (8.2%) and excellent 9 (5.7%) respectively. No participants perceived themselves as having very poor dental health (Table 4.2).

4.1.2.1.1. Perception of Dental Health by Gender

Among male participants, 50 (58.8%) and 12 (14.1%) children perceived themselves as having good and very good dental health respectively. The other participants perceived having poor 9 (10.6%), average 8 (9.4%) and excellent 5 (5.9%) dental health respectively.

Among the female participants, 44 (59.5%) and 11 (14.9%) children perceived themselves as having good and very good dental health respectively. Others perceived themselves as having average 8 (10.8%), excellent 4 (5.4%) and poor 4 (5.4%) dental health. There was no statistically significant association between perception of dental health and gender of participants ($\chi^2=2.71$ $df= 5$ $p=0.74$) (Table 4.2).

4.1.2.1.2 Perception of Dental Health by Age

No participant in the 10-12 years age group perceived themselves as having excellent dental health. However, 33 (68.8%) participants described having good dental health. The rest perceived themselves as having very good 6 (12.5%), very poor 6 (12.5%) and average 1 (2.15%) dental health. Among respondents aged 13-15 years, 39 (58.2%) and 11 (16.4%) perceived themselves as having good and average dental health respectively.

The rest perceived having very good 9 (13.4%), poor 4 (6.0%) and excellent 3 (4.5%) dental health. Among children 16- 19 years, 22 (50.0%) and 8 (18.2%) perceived themselves as having good and very good dental health respectively. The others perceived having excellent 6 (13.6%), average 4 (9.1%) and poor 3 (6.8%) dental health. There was no statistically significant association between perception of dental health and age of participants ($\chi^2= 2.35$ df=1, $p= 0.13$) (Table 4.2).

Table 4.2: Perception of dental health by gender and age among the participants

Characteristic	Excellent	Very good	Good	Average	Poor	Very poor	Don't know	Total	X ²	df	p
Dental health											
Overall n (%)	9 (5.7%)	23 (14.5%)	94 (59.1%)	16 (10.1)	13 (8.2%)	0 (0.0%)	4 (2.5%)	159	2.71	5	0.74
Gender											
Male	5 (5.9%)	12 (14.1%)	50 (58.8%)	8 (9.4%)	9 (10.6%)	0 (0.0%)	1 (1.2%)				
Female	4 (5.4%)	11 (14.9%)	44 (59.5%)	8 (10.8%)	4 (5.4 %)	0 (0.0%)	3 (4.1%)				
Age											
10-12	0 (0.0%)	6 (12.5%)	33 (68.8%)	1 (2.1%)	6 (12.5%)	0 (0.0%)	2 (4.2%)	2.35	1	0.13	
13-15	3 (4.5%)	9 (13.4%)	39 (58.2%)	11 (16.4%)	4 (6.0%)	0 (0.0%)	1 (1.5%)				
16-19	6 (13.6%)	8 (18.2%)	22 (50.0%)	4 (9.1%)	3 (6.8%)	0 (0.0%)	1 (2.3%)				

4.1.2.1.3 Perception of Dental Health by Category of Visual Impairment

Among category I visually impaired children, the highest 41(59.4%) number of participants perceived themselves as having good dental health. Others described having good 12 (17.4%), average 6(8.7%), excellent 4 (5.8%) and poor 4 (5.8%) dental health respectively. Among category II visually impaired children, the highest 53(58.9%) number of participants perceived themselves as having good dental health. The rest described having very good 11(12.2%), average10 (11.1%), poor 9(10%) and excellent 5 (5.6%) dental health respectively. There was a no statistically significant association between category of visual impairment and perceived dental health by the participants ($t=0.78$ $df= 157$ $p=0.43$). (Table 4.3)

Table 4.3: Category of visual impairment by perception of dental health, gender and age among the participants

Factors	Categories	Category of visual impairment		t	df	p
		Category I	Category II			
Perception of dental health status	Excellent	4 (5.8%)	5 (5.6%)	0.78	157	0.43
	Very good	12 (17.4%)	11 (12.2%)			
	Good	41 (59.4%)	53 (58.9%)			
	Average	6 (8.7%)	10 (11.1%)			
	Poor	4 (5.8%)	9 (10.0%)			
	Don't know	2 (2.9%)	2 (2.2%)			

4.1.2.2 Perception of Gingival Health

More than half 105(66%) of the participants perceived themselves as having good gingival health. The rest perceived having very good 24 (15.1%), poor 11 (6.9%), excellent 7 (4.4%) and very poor 1(0.6%) gingival health respectively (Table 4.4).

4.1.2.2.1 Perception of Gingival Health by Gender

Most 56 (65.9%) male participants perceived themselves as having good gingival health. The rest described having very good 12 (14.1%), poor 8 (9.4%), excellent 4 (4.7%) and average 8 (9.4%) gingival health respectively.

No male participants perceived themselves as having very poor gingival health status. Among female participants, 49 (66.2%) and 12 (16.2%) perceived themselves as having good and very good gingival health. The rest perceived having average 4 (5.4%), excellent 3 (4.1%), poor 3 (4.1%) and very poor 1 (1.4%) gingival health respectively. There was no statistically significant association between perception of gingival health and gender of participants ($\chi^2= 3.47$, $df=6$, $p= 0.75$ (Table 4.4).

4.1.2.2.2 Perception of Gingival Health by Age

Children 10-12 years old did not perceive themselves as having excellent gingival health. However, 34 (70.8%) and 7 (14.6%) of the children perceived having good and very good gingival health respectively. The rest perceived having poor 4 (8.3%) and average 1 (2.1%) gingival health respectively. Among participants aged 13-15 years, 45 (67.2%) and 9 (13.4%) perceived themselves as having good and very good gingival health respectively. The rest perceived having average 7 (10.4%), poor 4 (6.0%) and excellent 2 (3.0%) gingival health respectively. Among participants 16- 19 years, 26 (59.1%) and 8 (18.2%) perceived themselves as having good and very good gingival health respectively. The rest perceived having excellent 5 (11.4%), poor 3 (6.8%) and very poor 1 (2.3%) gingival health respectively. There was a statistically significant association between perception of gingival health and age of participants. ($\chi^2= 3.841$, $df=1$, $p= 0.05$) (Table 4.4).

Table 4.4: Perception of gingival health by gender and age among participants

Characteristic	Excellent	Very good	Good	Average	Poor	Very poor	Don't know	Total	X ²	df	p
Overall n (%)	7 (4.4%)	24 (15.1%)	105 (66%)	8 (5%)	11 (6.9%)	1 (0.6%)	3 (1.9%)	159	3.47	6	0.75
Gender											
Male	4 (4.7%)	12 (14.1%)	56 (65.9%)	4 (4.7%)	8 (9.4%)	0 (0.0%)	1 (1.2%)				
Female	3 (4.1%)	12 (16.2%)	49 (66.2%)	4 (5.4%)	3 (4.1%)	1 (1.4%)	2 (2.7%)				
Age											
10-12	0 (0.0%)	7 (14.6%)	34 (70.8%)	1 (2.1%)	4 (8.3%)	0 (0.0%)	2 (4.2%)		3.84	1	0.05
13-15	2 (3.0%)	9 (13.4%)	45 (67.2%)	7 (10.4%)	4 (6.0%)	0 (0.0%)	0 (0.0%)				
16-19	5 (11.4%)	8 (18.2%)	26 (59.1%)	0 (0.0%)	3 (6.8%)	1 (2.3%)	1 (2.3%)				

4.1.2.2.3 Perceived Gingival Health by Category of Visual Impairment

Among category I visually impaired children, 46 (66.7%) perceived themselves as having good gingival health. The rest perceived having very good 13 (18.8%), poor 5 (7.2%), excellent 3(4.3%) and average 1(1.4%) gingival health respectively.

Among category II visually impaired children, 59 (65.6%) perceived themselves as having good gingival health. The rest perceived having very good 11 (12.2%), average 7(7.8%), poor 6 (6.7%) and very poor 1 (1.1%) gingival health respectively.

There was a no statistically significant association between category of visual impairment and perceived gingival health by the participants ($t=1.87$ $df= 157$ $p=0.26$) (Table 4.5).

Table 4.5: Category of visual impairment by perceived gingival health status

Factors	Categories	Category of visual impairment		t	df	p
		Category I	Category II			
Perceived gingival health status	Excellent	3 (4.3%)	4 (4.4%)	1.87	157	0.26
	Very good	13(18.8%)	11 (12.2%)			
	Good	46 (66.7%)	59 (65.6%)			
	Average	1 (1.4%)	7 (7.8%)			
	Poor	5 (7.2%)	6 (6.7%)			
	Very poor	0 (0.0%)	1 (1.1%)			
	Don't know	1 (1.4%)	2 (2.2%)			

4.1.3 Participant's Experience of Toothache

In the 12 months period prior to the study, 17 (10.7%) participants had experienced toothache occasionally, 14 (8.8%) rarely and 9 (5.7%) often. However, majority 119 (74.8%) had not experienced toothache (Table 4.6).

4.1.3.1 Participant's Experience of Toothache by Gender

Among male participants, majority 65 (76.5%) had not experienced a toothache over a twelve-month period prior to the study. However, 9 (10.6%) had experienced toothache rarely, 7 (8.2%) occasionally and 4 (4.7%) often.

Among female participants 10 (13.5%) had experienced toothache occasionally, 5 (6.8%) often and 5 (6.8%) rarely with 54 (73.0%) not having experienced toothache. There was no statistically significant association between participant's experience of toothache and gender of ($\chi^2 = 2.04$ df=3, $p = 0.56$) (Table 4.6).

4.1.3.2 Participant's Experience of Toothache by Age

Among children 10-12 years old, 6 (12.5%) had experienced toothache occasionally, 4 (8.3%) rarely and 2 (4.2%) often while majority 36 (75.0%) had never experienced a toothache.

Among participants 13-15 years old, 7 (10.4%) had experienced toothache often, 6 (9.0%) rarely, 5 (7.5%) occasionally while majority 49 (73.1%) had never experienced a toothache. With participants 16-19 years old, 6 (13.6%) and 4 (9.1%) had experienced toothache occasionally and rarely respectively. However, majority 34 (77.3%) of the participants had never experienced a toothache. There was no statistically significant association between participant's experience of toothache and age ($\chi^2 = 0.23$ df=1, $p = 0.63$) (Table 4.6).

Table 4.6: Toothache experience by gender and age

Characteristic	Often	Occasionally	Rarely	Never	I don't know	Total	X ²	df	p
Overall	9(5.7%)	17 (10.7%)	14 (8.8%)	119 (74.8%)	0 (0.0%)	159 (100%)	2.04	3	0.56
Gender									
Male	4 (4.7%)	7 (8.2%)	9 (10.6%)	65 (76.5%)	0 (0.0%)				
Female	5 (6.8%)	10 (13.5%)	5 (6.8%)	54 (73.0%)	0 (0.0%)				
Age							0.23	1	0.63
10-12	2 (4.2%)	6 (12.5%)	4 (8.3%)	36 (75.0%)	0 (0.0%)				
13-15	7 (10.4%)	5 (7.5%)	6 (9.0%)	49 (73.1%)	0 (0.0%)				
16-19	0 (0.0%)	6 (13.6%)	4 (9.1%)	34 (77.3%)	0 (0.0%)				

4.1.3.3 Participant's Experience of Toothache by Category of Visual Impairment

Over the past 12 months prior to the study, 3(4.3%) category I visually impaired participants reported having had a toothache often, 5(7.2%) had suffered occasional toothache, 6(8.7%) rare toothache while the highest 55(79.7%) number had not suffered a toothache (Table 4.7)

Among category II visually impaired participants, 6 (6.7%) reported having suffered toothache often, 12 (13.3%) had suffered occasional toothache, 8 (8.9%) rare toothache while 64 (71.1%) had not suffered toothache.

Participant's experience of toothache did not have a statically significant relationship with category of visual impairment ($x^2= 2.11$, $df= 3$ $p= 0.54$) (Table 4.7)

Table 4.7: Toothache experience by category of visual impairment

Characteristics	Categories	Category of visual impairment		X ²	df	p
		Category I	Category II			
Toothache experience	Often	3 (4.3%)	6 (6.7%)	2.11	3	0.54
	Occasionally	5 (7.2%)	12 (13.3%)			
	Rarely	6 (8.7%)	8 (8.9%)			
	Never	55 (79.7%)	64 (71.1%)			

4.2 Oral Hygiene Practices

4.2.1 Frequency of Tooth Brushing

All 159 (100%) participants in the study brushed their teeth. Majority 107 (67.3%) of them brushed two or more times daily while the rest 52(32.7%) brushed less than two times daily (Table 4.8).

4.2.1.1 Frequency of Tooth Brushing by Gender

Male participants who brushed their teeth two or more time daily were 55 (64.7%) while those who brushed less than two times daily were 30 (35.3%). Among female participants, majority 52 (70.3%) brushed their teeth two or more times daily while 22 (29.8%) brushed less than two times daily. There was no statistically significant association between frequency of tooth brushing and gender of participants ($x^2= 0.66$, $df= 2$ $p= 0.72$) (Table 4.8).

4.2.1.2 Frequency of Tooth Brushing by Age

Among participants 10-12 years old, 29 (60.4%) brushed their teeth two or more times daily while 19 (39.6%) brushed less two times daily. In the 13-15 years age group, 47 (70.1%) brushed two or more times daily while 20(29.9%) brushed less than two times daily. Among participants 16- 19 years, 31 (70.5%) brushed their teeth two or more times daily while 13 (29.5%) brushed less than two times daily. There was no statistically significant association between frequency of tooth brushing and age of participants ($x^2= 0.28$ $df=1$, $p= 0.59$) (Table 4.8).

Table 4.8: Frequency of tooth brushing by gender and age

Characteristic		Less than 2 times daily	2 or more times a day	Total	X ²	df	p
Overall		52(32.7%)	107(67.3%)	159(100%)			
Gender	Male	30 (35.3%)	55 (64.7%)		0.66	2	0.72
	Female	22 (29.8%)	52 (70.3%)				
Age	10-12	19 (39.6%)	29 (60.4%)		0.28	1	0.59
	13-15	20 (29.9%)	47 (70.1%)				
	16-19	13 (29.5%)	31 (70.5%)				

4.2.1.3 Frequency of Tooth Brushing by Category of Visual Impairment

Among category I visually impaired participants, 49 (71.0%) brushed their teeth two or more times a day while 20 (27.9%) brushed less than twice daily. Category II visually impaired participants who brushed their teeth two or more times daily were 58 (64.4%) while 32 (35.6%) brushed less than twice daily.

There was a no statistically significant relationship between frequency of tooth brushing and category of visual impairment ($\chi^2=5.67$ df= 2, $p=0.06$) (Table 4.9).

Table 4.9: Frequency of tooth brushing by category of visual impairment

	Categories	Category of visual impairment		X ²	df	p
		Category I	Category II			
Frequency of tooth brushing	2 or more times a day	49 (71.0%)	58 (64.4%)	5.67	2	0.06
	Less than twice daily	20(27.9%)	32(35.6%)			
Adjunct toothbrush devices	Wooden tooth picks	39(39%)	61(61%)	2.26	2	0.34
	Plastic toothpicks	1(50%)	1(50%)			
	Dental Floss	6(75%)	2(25%)			
	Charcoal	2(22.2%)	7(77.8%)			
	Chew sticks	23(57.5%)	17(42.5%)			
Frequency of toothbrush replacement	Less than three months	6 (8.7%)	7 (7.8%)	1.74	3	0.62
	3 months	31 (44.9%)	35 (38.9%)			
	After 3 months	27 (39.1%)	36 (40.0%)			
	Not sure	5 (7.2%)	12 (13.3%)			
Frequency of flossing	Daily	0 (0.0%)	1 (1.1%)	1.32	2	0.51
	Seldom	5 (7.2%)	12 (13.3)			
	I do not floss	64 (92.8%)	85 (94.4%)			
Use of fluoride toothpaste	Yes	2 (2.9%)	2 (2.2%)	0.07	2	0.96
	No	3 (4.3%)	4 (4.4%)			
	Don't know	64 (92.8%)	84 (93.3%)			
Mouth rinsing after meals	Yes	61 (89.7%)	76 (84.4%)	1.01	2	0.60
	No	4 (5.9%)	7 (7.8%)			
	Seldom	3 (4.4%)	7 (7.8%)			

4.2.2 Tooth brushing Devices

All 159 (100%) participants used toothbrushes. However, other adjunct devices used included; wooden toothpicks 100 (62.9%), plastic toothpicks 2(1.3%), chew sticks/mswaki 40 (25.2%), charcoal 9 (5.6%) and thread (dental floss) 8 (5%) (Table 4.10).

4.2.2.1 Tooth Brushing Devices by Gender

Over half 100 (62.9%) of the participants used wooden toothpicks with more 60 (60%) female to male 40 (40%) participants. Male participants did not use plastic toothpicks while among the female participants only 2 (100%) employed their use. Male participants who used dental floss were 5 (62.5%) while female participants were 3 (37.5%). Four (44.4%) male participants used charcoal with 5 (55.6%) female participants using charcoal. Male participants who used chew stick/mswaki were 19 (47.5%) while female participants were 21 (52.5%). There was no statistically significant association between gender and use of adjunct tooth brushing devices (Table 4.10).

4.2.2.2 Tooth Brushing Devices by Age

Older children 16-19 years old used wooden toothpicks more 47 (47%) compared to children 10-12 years old 20 (26%) and 13-15 years old 27 (27%). One (50%) participant in the 13-15 years age group and another 1 (50%) aged 16-19 years used plastic toothpicks. None of the participants in the 10-12 years age group used plastic toothpicks. Only 1 (12.5%) participant used dental floss in the 10-12 years age category, 2 (25.0%) in the 13-15 years age category and 5 (62.5%) in the 16-19-age category. Those who used charcoal among the different age groups were 2 (22.2%) in the 10-12 years age category, 4 (44.4%) in the 13-15 years age category and 3 (33.3%) in the 16-19 years age category. Participants who used dental floss among the different age groups were 1 (12,5%) in the 10-12 years age category, 2 (25%) in the 13-15 years age category and 5(62.5%) in the 16-19 years age category. Participants in the age category of 10-12 years who used Chew stick/Mswaki were 10 (25.0%), those 13-15 years were 18 (45.0%) and those 16-19 years were 12 (30.0%). There was no statistically significant association between age and use of adjunct tooth brushing devices (Table 4.10).

Table 4.10: Use of adjunct tooth brushing devices by gender and age

Characteristics		Adjunct Devices				
		Wooden Toothpick	Plastic toothpicks	Dental floss	Charcoal	Chew stick/mswaki
Overall	n (%)	100	2	8	9	40
	159(100%)	(62.9%)	(1.3%)	(5.0%)	(5.6%)	(25.2%)
Gender	Male	40	0	5	4	19
		(40.0%)	(0%)	(62.5%)	(44.4%)	(47.5%)
	Female	60	2	3	5	21
		(60.0%)	(100%)	(37.5%)	(55.6%)	(52.5%)
Age	10-12	20	0	1	2	10
		(26.0%)	(0%)	(12.5%)	(22.2%)	(25.0%)
	13-15	27	1	2	4	18
		(27%)	(50.0%)	(25%)	(44.4%)	(45.0%)
	16-19	47	1	5	3	12
		(47%)	(50.0%)	(62.5%)	(33.3%)	(30.0%)
X² (df)		0.11 (1)	0.49 (1)	3.02 (1)	1.02 (1)	0.12 (1)
p-value		0.74	0.48	0.08	0.31	0.74

4.2.2.3 Tooth Brushing Devices by Category of Visual Impairment

Use of wooden toothpicks was highest 61(61%) among category II visually impaired participants compared to category I 39(39%). Use of plastic toothpicks was equal 1(50%) among participants in category I and category II. Use of chew sticks was higher 23(57.5%) in category I compared to 17(42.5%) in category II. More 6(75%) participants in category I reported use of dental floss compared to category II 2(25%). Charcoal use was higher 7(77.8%) among category II participants compared to category I 2(22.2%). There was no statistically significant association between use of adjunct tooth brushing devices and category of visual impairment ($\chi^2=2.26$, $df=2$, $p=0.34$) (Table 4.9).

4.2.3 Frequency of Toothbrush Replacement

Sixty-six (41.5%) participants replaced their toothbrushes at 3 months, 63 (39.6%) after 3 months, while 13 (8.2%) replaced in less than 3 months. However, 17 (10.7%) participants were unsure at what duration they replace their toothbrushes (Table 4.11).

4.2.3.1 Frequency of Toothbrush Replacement by Gender

Male participants who replaced their toothbrush in less than three months were 4 (4.7%), those who replaced at three months 37 (43.5%) and those who replaced after three months 39 (45.9%). Among female participants, 9 (12.2%) replaced their toothbrushes in less than three months, 29 (39.2%) at three months and 24 (50.0%) after 3 months. There was a statistically significant association between frequency of toothbrush replacement and gender ($X^2 = 8.63$, $df= 3$ $p= 0.04$) suggesting female participants were more likely to change toothbrushes within three months compared to male participants (Table 4.11).

4.2.3.2 Frequency of Toothbrush Replacement by Age

There were no participants aged 10-12 years who replaced their toothbrushes in less than 3 months. However, in the 13-15 and 16-19 years age categories, 7 (10.4%) and 6 (13.6%) participants replaced toothbrushes in less than three months respectively. Participants aged 10-12 years who replaced toothbrushes at 3 months were 14 (29.2%), those 13-15 years 31 (46.3%) and those 16-19 years old 21 (47.7%). Participants aged 10-12 years who replaced toothbrushes after three months were 24 (50.0%), those 13-15 years 23 (34.3%) and those 16-19 years 16 (36.4%). There was a statistically significant association between frequency of toothbrush replacement and age of participants ($X^2= 15.4$ $df= 1$ $p= 0.001$) (Table 4.11).

Table 4.11: Frequency of toothbrush replacement by gender and age

		Less than 3 months	3months	After 3 months	Not sure	Total	X^2	df	p
Characteristics									
Overall		13 (8.2%)	66 (41.5%)	63 (39.6%)	17 (10.7%)	159 (100%)			
Gender	Male	4 (4.7%)	37 (43.5%)	39 (45.9%)	5 (5.9%)	85 (53.5%)	8.62	3	0.04
	Female	9 (12.2%)	29 (39.2%)	24 (32.4%)	12 (16.2%)	74 (46.5%)			
Age	10-12	0 (0.0%)	14 (29.2%)	24 (50.0%)	10 (20.8%)	48 (30.2%)	15.4	1	0.001
	13-15	7 (10.4%)	31 (46.3%)	23 (34.3%)	6 (9.0%)	67 (42.1%)			
	16-19	6 (13.6%)	21 (47.7%)	16 (36.4%)	1 (2.3%)	44 (27.7%)			

4.2.3.3 Frequency of Toothbrush Replacement by Category of Visual Impairment

Among category I respondents, 6 (8.7%) replaced their toothbrushes in less than 3 months, 31 (44.9%) at 3 months and 27 (39.1%) after 3 months. Among category II participants, 7(7.8%) replaced their toothbrushes in less than three months, 35 (38.9%) replaced their toothbrush at 3 months and 36 (40.0%) replaced after three months. Five (7.2%) and 12(13.3%) respondents in Category I and II respectively were not sure when they replaced their toothbrushes.

There was no significant association between frequency of toothbrush replacement and category of visual impairment ($\chi^2= 1.744$, $df= 3$ $p= 0.62$) (Table 4.9)

4.2.4 Use of Fluoridated Toothpaste

Majority 158 (99.4%) of the participants used toothpaste with only 1 (0.6%) participant reporting to not using toothpaste. Seven (4.4%%) children reported to not use fluoridated toothpaste while majority 148(93.1%) of the children reported to not being aware on whether the toothpaste they used contained fluoride. Only 4(2.5%) participants were aware the toothpaste they used contained fluoride (Table 4.12).

4.2.4.1 Use of Fluoridated Toothpaste by Gender

Male participants who used fluoridated toothpaste were 2 (2.4%), those who did not 4 (4.7%) while those who were not aware whether the toothpaste they used contained fluoride were 79 (92.9%). Female respondents who used fluoridated toothpaste were 2 (2.7%), those who did not 3 (4.1%) and those who were not aware whether the toothpaste they used contained fluoride were 69 (93.2%). There was no statistically significance association between use of fluoridated toothpaste and gender of participants ($X^2= 0.06$, $df= 2$ $p= 0.97$) (Table 4.12).

4.2.4.2 Use of Fluoridated Toothpaste by Age

Among the 10-12 years age category, 1 (2.1%), respondent used fluoridated toothpaste, 1 (2.1%) did not while 46 (95.8%) were not aware whether the toothpaste they used contained fluoride. Among participants aged 13-15 years, 1 (1.5%) used fluoridated toothpaste, 5 (7.5%) did not and 61 (91.0%) did not know whether the toothpaste they used contained fluoride.

In the 16-19 years age category, 2 (4.5%) used fluoridated toothpaste, 1 (2.3%) did not while 41 (93.2%) were not aware whether the toothpaste they used contained fluoride or not. Use of fluoridated toothpaste did not have a statically significant association with age of participants ($\chi^2 = 0.45$, $df = 1$ $p = 0.50$) (Table 4.12).

Table 4.12: Use of fluoridated toothpaste by gender and age

Characteristics	Yes	No	Don't know	Total	χ^2	df	P	
Overall	4(2.5)	7(4.4%)	148(93.1%)	159(100%)				
Gender	Male	2(2.4%)	4(4.7%)	79(92.9%)	85 (53.5%)	0.06	2	.97
	Female	2(2.7%)	3(4.1%)	69(93.2%)	74 (46.5%)			
Age	10-12	1(2.1%)	1(2.1%)	46(95.8%)	48 (30.2%)	0.45	1	0.50
	13-15	1(1.5%)	5(7.5%)	61(91.0%)	67 (42.1%)			
	16-19	2(4.5%)	1(2.3%)	41(93.2%)	44 (27.7%)			

4.2.4.3 Use of Fluoridated Toothpaste by Category of Visual Impairment

Among Category I participants, 2(2.9%) were aware that the toothpaste they used contained fluoride while 3(4.3%) reported to use toothpaste that did not contain fluoride. Among category II participants, 2(2.2%) were aware of their use of fluoridated toothpaste while 4(4.4%) reported to use toothpaste that did not contain fluoride. Comparing the two categories, more 84 (93.3%) Category II participants did not know if the toothpaste they used contained fluoride in comparison to Category I 64(92.8%) Use of fluoridated toothpaste had no statistically significant association with the category of visual impairment ($\chi^2 = 0.07$, $df = 2$ $p = 0.96$) (Table 4.9).

4.2.5 Mouth Rinsing after Meals

Majority 137(86.7%) of the participants rinsed their mouth with water after meals while 10(6.3%) rinsed seldom and 11 (7.0%) did not rinse at all (Table 4.13).

4.2.5.1 Mouth Rinsing After Meals by Gender

Majority 72 (84.7%) of the male participants rinsed their mouth with water after meals. Those who seldom rinsed were 6 (8.2%) while those who did not rinse at all were 7 (8.2%).

Among female respondents, majority 65 (89.0%) rinsed their mouth after meals, 4 (5.5%) seldom rinsed and 4 (5.5%) did not rinse at all. There was no statistically significant association between mouth rinsing after meals and gender of participants ($X^2= 0.06$, $df= 2$ $p= 0.72$) (Table 4.13).

4.2.5.2 Mouth Rinsing after Meals by Age

Participants aged 10-12 years who rinsed their mouth after meals were 45 (93.8%), 1 (2.1%) seldom rinsed and 2 (30.4%) did not rinse at all. Among participants aged 13-15 years, 57 (85.1%) rinsed after meals, 6 (9.0%) seldom rinsed and 4 (42.4%) did not rinse at all. In the 16-19-age category, majority 35 (81.4%) of the participants rinsed after meals, 4 (9.3%) seldom rinsed and 4 (27.2%) did not rinse. Mouth rinsing after meals did not have a statistically significant association with age of participants ($x^2= 2.45$ $df= 1$ $p= 0.12$) (Table 4.13)

Table 4.13: Mouth rinsing after meals by gender and age

Characteristic		Yes n(%)	No n(%)	Seldom n(%)	Total n(%)	X^2	df	p
Overall		137(86.7%)	11(%)	10(6.3%)	159(100%)			
Gender	Male	72(84.7%)	7 (8.2%)	6 (7.1%)	137(53.)	0.66	2	0.71
	Female	65(89.0%)	4 (5.5%)	4 (5.5%)	7 (46.2%)			
Age	10-12	45(93.8%)	1 (2.1%)	2 (30.4%)	48(30.4)			
	13-15	57(85.1%)	6 (9.0%)	4 (42.4%)	67(42.4)			
	16-19	35(81.4%)	4 (9.3%)	4 (27.2%)	43(27.2)			

4.2.5.3 Mouth Rinsing After Meals by Category of Visual Impairment

Among Category I participants, majority 61 (89.7%) rinsed their mouth after meals, 3(4.4%) rinsed seldom, and 4 (5.9%) did not rinse at all. Among the category II participants, majority 76 (84.4%) rinsed after meals, 7(7.8%) seldom rinsed while 7(7.8%) did not rinse at all. There was no statistically significance association between mouth rinsing and category of visual of impairment ($x^2= 1.01$, $df= 2$, $p= 0.60$) (Table 4.9).

4.2.6 Challenges Experienced in Practice of Oral Hygiene

Majority 116 (72.9%) of the children did not report experiencing challenges in practice of oral hygiene with only 43 (27.1%) participants reporting challenges.

Thirteen (28%) of the participants needed someone to check if their teeth were clean after brushing, 10 (23.3%) needed assistance by the house mother in application of toothpaste to the toothbrush, 7(16.2%) experienced pain when brushing, 4(9.3%) experienced bleeding gums, 3(7.0%) had challenges applying toothpaste on the toothbrush and 2(4.6%) needed both the assistance of the dormitory mother in application of toothpaste as well as having someone check if their teeth were clean after brushing.

One child (2.3%) experienced bleeding gums and needed someone to check if their teeth were clean after brushing, another experienced bleeding gums and needed assistance by the dormitory mother in toothpaste application, another experienced challenges cleaning their teeth properly, another had a challenge locating their toothbrush and toothpaste, another was not sure when their teeth were clean on brushing while another experienced pain while brushing, bleeding gums and need for assistance by the dormitory mother in toothpaste application (Table 4.14).

Table 4.14: Challenges experienced during tooth brushing

Challenges	n=43 (%)
Applying toothpaste on toothbrush	3 (7.0%)
Bleeding gums	4 (9.3%)
Bleeding gums and need for someone to confirm if teeth are clean after brushing	1 (2.3%)
Bleeding gums, need for dormitory mother to help in toothpaste application	1 (2.3%)
Cleaning the teeth properly	1 (2.3%)
Locating the toothpaste and toothbrush	1 (2.3%)
Need for dormitory mother to help in toothpaste application	10 (23.3%)
Need for dormitory mother to help in toothpaste application, need for someone to confirm if teeth are clean after brushing	2 (4.6%)
Need for someone to confirm if teeth are clean after brushing	13(30.2%)
Not sure when teeth are clean	1 (2.3%)
Pain when brushing	7 (16.2%)
Pain when brushing, bleeding gums and need for dormitory mother to help in toothpaste application	1 (2.3%)

4.2.6.1 Challenges Experienced In Practice of Oral Hygiene by Category of Visual Impairment

Among participants in Category I visual impairment, 10 (76.9%) needed someone to confirm if their teeth were clean after brushing and 4(40%) had a need for the housemother to help in application of toothpaste onto the toothbrush. Further, 1(100%) had difficulty applying toothpaste on the toothbrush, 1(100%) had bleeding gums and had a need for someone to confirm if their teeth were clean after brushing, 1(100%) had difficulty locating their toothpaste and toothbrush, 1(100%) had a need for the housemother to help in toothpaste application and a need for someone to confirm if their teeth were clean after brushing and 1(100%) experienced pain when brushing.

Among participants in category II, 6 (8.6%) experienced pain when brushing while another 6 (60%) had a need for the housemother to help in toothpaste application. Four (100%) had bleeding gums, 3 (23.1%) had a need for someone to confirm if teeth were clean after brushing and 2 (66.6%) had difficulty applying toothpaste on the toothbrush. Further, 1 (100%) had bleeding gums and had a need for someone to confirm if their teeth were are clean after brushing, 1 (100%) had a challenge cleaning their teeth properly, 1 (50%) had a need for the housemother to help in toothpaste application as well as need for someone to confirm if their teeth were clean after brushing, 1 (100%) was not sure when teeth were clean while 1 (100%) experienced pain when brushing, bleeding gums and had a need for house mother to help in toothpaste application. There was no statistical significance between challenges and categories of visual of impairment. ($X^2= 14.77$, $df= 12$, $p= 0.25$) (Table 14.5).

Table 4.15: Challenges in practice of oral hygiene by category of visual impairment

	Category of visual impairment		Total	X ²	df	p
	Category I n= 19 (%)	Category II n=24 (%)	n= 43 (%)			
Difficulty applying toothpaste on toothbrush	1 (33.3%)	2 (66.6%)	3(100%)			
Bleeding gums	0 (0.0%)	4 (100%)	4(100%)			
Bleeding gums and need for someone to confirm if teeth are clean after brushing	1 (100%)	0 (0.0%)	1 (100%)			
Bleeding gums, Need for housemother to help in toothpaste application	0 (0.0%)	1 (100%)	1(100%)			
Cleaning the teeth properly	0 (0.0%)	1 (100%)	1(100%)			
Difficulty locating toothpaste and toothbrush	1 (100%)	0 (0.0%)	1(100%)	14.77	12	0.25
Need for housemother to help in toothpaste application	4 (40.0%)	6(60.0%)	10(100%)			
Need for housemother to help in toothpaste application, Need for someone to confirm if teeth are clean after brushing	1 (50%)	1 (50%)	2 (100%)			
Need for someone to confirm if teeth are clean after brushing	10(76.9%)	3(23.1%)	13(100%)			
Not sure when teeth are clean	0 (0.0%)	1 (100%)	1(100%)			
Pain when brushing	1 (12.3%)	6 (8.6%)	7 (100%)			
Pain when brushing, bleeding gums and need for house mother to help in toothpaste application	0 (0.0%)	1 (100%)	1 (100%)			

4.3 Oral Health Status

4.3.1 Oral Hygiene Status

All 159(100%) children who participated in the study were found to have varying amounts of plaque deposits with a plaque score of 0.95 ± 0.45 (Table 4.16).

4.3.1.1 Oral Hygiene Status by Gender and Age

Female participants had a lower 0.88 ± 0.44 plaque score compared to their male 1.02 ± 0.45 counterparts. However, plaque score index had no statistically significant association with gender of participants ($t = 1.88, p = 0.07$) (Table 4.16).

Plaque score was higher 0.99 ± 0.47 among children 13-15 year old followed closely 0.99 ± 0.42 by those 16-19 years old. Children 10-12 years old had the least 0.87 ± 0.44 mean plaque score. However, the difference in plaque score among the age categories was not statistically significant (ANOVA= 1.20, p= 0.30) (Table 4.16)

Table 4.16: Distribution of participants by plaque score, gender and age

Characteristics	n = 159 (%)	Plaque score
		(M \pm SD)
Overall	n = 159 (100)	0.95 \pm 0.45
Gender		
Male	85 (53.5%)	1.02 \pm 0.45
Female	74 (46.5%)	0.88 \pm 0.44
T-Test t = 1.88, df = 88, p = 0.07 ANOVA = 1.20, df = 2, 87, p = 0.30		
Age		
10-12 yrs	48 (30.2%)	0.87 \pm 0.44
13-15 yrs	67 (42.1%)	0.99 \pm 0.47
16-19 yrs	44 (27.7%)	0.99 \pm 0.42

4.3.1.2 Oral Hygiene Status by Category of Visual Impairment

The mean plaque score index among Category I participants was higher 0.99 ± 0.43 compared to Category II 0.92 ± 0.45 . However, there was no significant statistical difference in plaque index score between the categories of visual impairment. (t=0.87, p=0.38) (Table 4.17)

Table 4.17: Category of visual impairment by plaque index, gingival index and dmft/DMFT index

	Category of visual impairment			t	P
	Category I	Category II			
Plaque score	0.99 \pm 0.43	0.92 \pm 0.45		0.87	0.38
Gingival score	0.27 \pm 0.24	0.28 \pm 0.25		0.31	0.75
dmft	0.29 \pm 0.24	0.25 \pm 0.80		2.27	0.02
DMFT	0.85 \pm 1.32	0.03 \pm 0.17		0.89	0.37

4.3.2 Gingival Health Status

The overall prevalence of gingivitis was 88.1% (n=140) (Table 4.5) and the mean gingival score index was 0.28 ± 0.25 (Table 4.18).

4.3.2.1 Gingival Health Status by Gender and Age

Prevalence of gingivitis was higher 90.6% (n=77) among male participants compared to female 85.1% (n=63) participants. Prevalence of gingivitis was least 39 (81.3%) among children 10-12 years old. It increased 41 (93.2%) among 13-15 years olds and was highest 60 (89.6%) among children 16-19 years old. There was no association between prevalence of gingivitis and age of participants $F=1.90$, $df=2$, $p=1.68$ (Table 4.18).

Gingival score index among male participants was higher 0.30 ± 0.25 than in female 0.25 ± 0.24 participants. However, there was no statistically significant association between gingival score index and gender of participants ($t= 1.39$, $p= 0.17$) (Table 4.19).

Children 10-12 years old had the least 0.20 ± 0.21 gingival score index followed by children 13-15 years old with a gingival score index of 0.29 ± 0.14 while children 16-19 years old had the highest 0.34 ± 0.28 gingival score index. Gingival score index had a statistically significant association with age of participants ($ANOVA=4.06$, $p=0.02$) (Table 4.19).

Table 4.18: Distribution of participants by presence of gingivitis, gender and age

Characteristic		Gingivitis		
		Yes n(%)	No n(%)	Total n(%)
Overall		140(88.1%)	19(11.9%)	159(100%)
Gender	Male	77(90.6%)	8(9.4%)	85(100%)
	Female	63(85.1%)	11(14.9%)	74(100%)
Age	10-12	39(81.25)	9 (18.75)	48(100%)
	13-15	60(89.5)	7(10.5)	67(100%)
	16-19	41(93.2%)	3(6.8%)	44(100%)

Table 4.19: Distribution of participants by gingival score index, gender and age

Characteristic	GI			
	M+SD	F	t	p
Overall	0.28±0.25			
Gender	Male	0.30±0.25	1.39	0.17
	Female	0.25±0.24		
Age	10-12 years	0.20±0.21	4.06	0.02
	13-15 years	0.29±0.14		
	16-19 years	0.34±0.28		

GI= Gingival Score Index

4.3.2.2 Gingival Health Status by Category of Visual Impairment

Among participants in Category I visual impairment, 59 (85.5%) had gingivitis while among participants in category II, 81 (90.0%) had gingivitis.

The mean gingival score index among Category II respondents was higher 0.28 ± 0.25 compared to the Category I respondents 0.27 ± 0.24 . However, there was no significant statistical difference in gingival index score between categories of visual impairment. ($t=0.31$ $p=0.75$) (Table 4.17).

4.3.3 Dental Caries Status

The overall prevalence of dental caries was 44.7%. It was higher 42.1% ($n=67$) among participants in permanent dentition (Table 4.20) compared to those in deciduous dentition 8.2% ($n=13$) (Table 4.21).

No missing teeth due to dental caries were reported among participants with deciduous dentition, while 3 (1.9%) participants were reported to have missing teeth among participants with permanent dentition. No teeth were reported as filled in both dentitions.

The average dmft was 0.16 ± 0.63 with the missing and filled component reported as zero (Table 4.22). Mean DMFT was 0.99 ± 1.70 ; decay component was the highest 0.97 ± 1.70 , missing component was 0.02 ± 1.70 and the filled teeth component was zero (Table 4.23).

4.3.3.1 Dental Caries Status by Gender and Age

In deciduous dentition, dental caries prevalence was slightly higher 4.4% (n=7) among male children compared to the female children 3.8% (n=6). In the different age categories, children 10-12 years had the highest 7.4% (n=9) dental caries prevalence followed by children 13-15 years old 0.8% (n=4) while dental caries was absent among 16-19 years olds. Dental caries prevalence in deciduous dentition had a statistically significant association with age (ANOVA=3.37, p=0.04) (Table 4.20)

In the permanent dentition, dental caries prevalence was also slightly higher 21.9% (n=35) among male participants compared to female 20.2% (n=31) participants. Among the different age categories, prevalence of dental caries was highest 17.6% (n= 28) among 10-12 year olds followed by children 13-15 years old with a prevalence of 13.82% (n=22) and lastly 16-19 year olds with a prevalence of 10.68% (17). There was no statistically significant association between dental caries prevalence in permanent dentition and age (p=0.07) (Table 4.20)

Table 4.20: Distribution of participants by presence of dental caries in deciduous dentition by gender and age

Characteristic	Dental caries		
	Yes n(%)	No n(%)	Total n(%)
Overall	13(8.2%)	146(91.8%)	159(100%)
Gender	Male	7(4.4%)	78(95.6%)
	Female	6(3.8%)	68(96.2%)
Age	10-12	9(7.4%)	39 (92.6%)
	13-15	4 (0.8%)	63(99.2%)
	16-19	0(0%)	44(100%)

Table 4.21: Distribution of participants by presence of dental caries in permanent dentition by gender and age

Characteristic		Dental caries		
		Yes n(%)	No n(%)	Total n(%)
Overall		67(42.1%)	92(57.9%)	159(100%)
Gender	Male	35(21.9%)	50(78.1%)	85(100%)
	Female	31(20.2%)	43(79.8%)	74(100%)
Age	10-12	28(17.6%)	20(82.4%)	48(100%)
	13-15	22(13.82%)	45(86.2%)	67(100%)
	16-19	17(10.68%)	27(89.32%)	44(100%)

In deciduous dentition, mean dmft was higher 0.20 ± 0.78 among male participants than among female 0.10 ± 0.39 participants. However, the difference in dmft index between genders was not statistically significant ($t= 0.91$, $p=0.36$). Among the different age categories, dmft decreased with increase of age as noted among children 16-19 years old who had a dmft of zero. Children 10-12 years old recorded the highest 0.33 ± 0.81 dmft followed by children 13-15 years old who had a dmft of 0.13 ± 0.67 . Difference in mean dmft among different age categories was statistically significant. (ANOVA= 3.37, $p=0.04$) (Table 4.22).

In permanent dentition, mean DMFT was higher 1.13 ± 2.14 among female participants compared to male 0.75 ± 1.15 participants. The difference in DMFT index between genders was statistically significant ($t= 1.93$, $p=0.05$). The DMFT decreased with extremities in age with children 10-12 years and 16-19 years old recording a DMFT of 0.97 ± 1.79 and 0.95 ± 1.26 respectively while children 13-15 years old recorded the highest 1.03 ± 1.89 DMFT. The difference in the mean DMFT among different age categories was not statistically significant (ANOVA=3.37, $p=0.004$) (Table 4.23).

Table 4.22: Dental caries experience by gender and age in deciduous dentition

		Mean decay	Mean missing	Mean filled	dmft	t	F	p
OVERALL		0.16±0.63	0.00	0.00	0.16±0.63	-	-	
Gender	Male	0.20±0.78	0.00±0.00	0.00	0.20±0.78			
	Female	0.10±0.39	0.00±0.00	0.00	0.10±0.39	0.91	-	0.36
Age	10-12	0.33±0.81	0.00±0.00	0.00±0.00	0.33±0.81			
	13-15	0.13±0.67	0.00±0.00	0.00±0.00	0.13±0.67	-	3.37	0.04
	16-19	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00			

Table 4.23: Dental caries experience by gender and age in permanent dentition

		Mean Decay	Mean missing	Mean filled	DMFT	t	F	p
		M+SD	M+SD	M+SD	M+SD			
OVERALL		0.97±1.70	0.02±1.70	0.00	0.99±1.70	-	-	-
Gender	Male	0.72±1.15	0.02±0.15	0.00	0.75±1.15			
	Female	1.26±2.15	0.01±0.12	0.00	1.13±2.14	1.93	-	0.05
Age	10-12	0.94±1.80	0.04±0.2	0.00±0.00	0.97±1.79			
	13-15	1.03±1.89	0.00±0.00	0.00±0.00	1.03±1.89		0.28	0.97
	16-19	0.93±1.26	0.02±0.15	0.00±0.00	0.95±1.26			

4.3.3.2 Dental Caries Status by Category of Visual Impairment

Among participants in deciduous dentition, children in Category II had a higher 12(13.3%) prevalence of dental caries compared to children in Category I 1(1.4%). Similarly among participants in permanent dentition, children in Category II had a higher 40(44.4%) prevalence of dental caries than children in Category I 27 (42%). Children in deciduous dentition with Category I visual impairment had a higher 0.29 ± 0.24 mean dmft compared to children in Category II 0.25 ± 0.80 . There was no report of missing teeth due to dental caries or filled teeth in the deciduous dentition.

The difference in the mean dmft between categories of visual impairment was statistically significant ($t=2.27$, $p=0.02$). Children in permanent dentition with category I visual impairment had a mean DMFT of 0.85 ± 1.32 while those in Category II had a mean DMFT of 0.03 ± 0.17 . The difference in the mean DMFT between visual impairment categories was not statistically significant ($t=0.89$, $p=0.37$) (Table 4.17)

4.4 Association between Oral Hygiene Practices and Oral Health Status

Plaque score index had a statistically significant association (Spearman's correlation= 0.52 , $p=0.01$) with gingival score index indicating that poor oral hygiene contributed to an increase in gingival score index.

Plaque score index had a statistically significant association with dmft index (Spearman's correlation= 0.14 , $p=0.04$) suggesting that poor oral hygiene contributed to a higher dmft score. Categories of visual impairment had a statistically significant association with mean dmft ($t= 2.27$, $p= 0.02$) depicting a higher disease burden among participants with deciduous dentition and in Category I of visual impairment.

Null hypothesis was tested using Spearman's correlation for association between oral hygiene practices and oral health status (Table 4.24). There was no association between oral hygiene practices, oral hygiene status and dental caries status. However, an association was reported between frequency of toothbrush replacement and gingival index score ($p=0.003$). Therefore, the null hypothesis that there was no association between oral hygiene practices and oral health status was accepted.

Table 4.24: Association between oral hygiene practices and oral health status

Oral hygiene practices	Plaque index		Gingival index		dmft		DMFT	
	r	p	r	p	r	p	r	P
Perceived health of teeth	-0.04	0.64	-0.14	0.09	0.12	0.14	0.00	0.94
Perceived health of gums	0.02	0.78	-0.03	0.72	0.04	0.65	-0.11	0.19
Toothache last twelve months	-0.12	0.88	0.10	0.19	0.03	0.68	-0.13	0.11
Frequency of teeth cleaning	-0.02	0.34	0.06	0.42	-0.03	0.68	0.01	0.91
Replacement of toothbrush	-0.52	0.52	0.24	0.003	0.14	0.08	-0.10	0.21
Frequency of flossing	-0.30	0.71	0.003*	0.98	-0.12	0.13	0.07	0.37
Use of toothbrush	0.02	0.34	0.07	0.36	0.02	0.07	0.02	0.42
Use of adjunct tooth brushing devices	0.04	0.52	0.01	0.32	0.13	0.32	0.05	0.56
Toothpaste use	-0.14	0.09	0.07	0.36	0.02	0.77	-0.07	0.41
Use of fluoridated toothpaste	-0.87	0.28	0.02	0.77	0.81	0.31	0.05	0.52
Rinsing after meals	0.82	0.30	0.13	0.10	-0.05	0.55	0.10	0.22

CHAPTER FIVE

DISCUSSION

5.1 Categories of Visual Impairment

Participants were grouped into Category I and II educational visual impairment. Category I was composed of participants who suffered total blindness having no perception of light and were educated using Braille. Category II participants had perception of light and some useful vision but not sufficient to read print hence were also educated using Braille. There was a higher (56.3%) number of participants in category II than in category I (43.7%) visual impairment. Among the study participants, an association was reported between category of visual impairment and age with more of the younger children falling in category II and older children in category I. This could have been occasioned by the natural course of disease, which may worsen over time if left unattended. In addition, a higher (54.1%) number of participants had congenital visual impairment compared to those with acquired visual impairment (44.7%).

5.2 Demographic Characteristics

The male: female ratio of the participants was 1.4:1.1 which is almost equal participation between the genders. The mean participant's age was 13.9 ± 2.3 years. The recommended school age for primary school children in Kenya is 6-14 years (72). A large (61.3%) number of the participants fell within this age category. However, 38.7% fell above the recommended age. Time used to seek medical and surgical intervention to address the illness that may have resulted to visual impairment may have been attributed to the delay in attaining education as per the prescribed time lines. More so, learning challenges especially when children attended schools for sighted peers which lacked equipment for specialized learning may have also played a role.

One third of the participants were from the central region (Nyeri, Kirinyaga, Murang'a, Nyandarua, Kiambu) of the country while one fourth were from the Lower Eastern region (Machakos Makueni, Kitui). This may have been attributed to the geographic proximity of these regions to the study area.

The least (0.60%) representation was from the Coastal region (Taita Taveta, Kwale, Mombasa, Lamu, Tana River, Kilifi) and North Eastern region (Garissa, Wajir, Mandera) (0.60%). The physical distance between the study area and these regions may have similarly occasioned this.

5.3 Oral Hygiene Practices

More than half of the study participants regarded their oral health status as good. It is possible that these participants had not experienced any dental problems previously hence had a positive perception regarding their oral health. This answer was also justified as most of the participants in this study had good oral hygiene, mild gingivitis and low dental caries experience.

Majority (74.8%) of the participants had not experienced toothache 12-months preceding the study. Contrary to these findings, a study among visually impaired children in Chennai, India reported that 49% of the participants had reported suffering from tooth sensitivity (8). In a different study in Malaysia, 58.3% of the participants reported having suffered from tooth sensitivity and 43.6% from inflamed and painful gums(14).

All the participants in this study claimed that they brushed their teeth using a toothbrush with majority 107 (67.3%) brushing their teeth two or more times daily. This may have explained the low plaque score obtained in this study. These results are similar to a Malaysian study in which all participants brushed their teeth daily with most brushing twice or more daily (73). However, the results are in contrast to a different study among visually impaired individuals where only 12% brushed more than twice daily (7). Good tooth brushing habits reported in the current study may have been attributed to the institutionalized nature of the school which may have provided standardized enforcement of oral hygiene measures.

Study participants applied use of adjunct devices in cleaning of teeth. Wooden toothpicks had the highest (62.9%) application of all the devices. It is however important to note that commercial wooden toothpicks were not available in the school and the participants reported they used wooden sticks obtained from trees within the school compound. These results contrasted a study carried out in Malaysia among visually impaired adolescents where tooth pick use was low (14.9%) (58).

Use of other devices was also employed in cleaning teeth. These included use of plastic toothpicks, dental floss, charcoal and chewstick/mswaki. Mostly, these were used during the school holidays, due to easier accessibility at home. Dental flossing was reported to be very low (5%) in this study. However, flossing is uncommon even in the normal population because of the alien culture of dental flossing and scarcity and prohibitive cost of dental floss (74). To overcome this, Esa et al suggested education on dental flossing is key as tooth brushing alone has limited effect in removing plaque interdentally (75) .

It has been reported that 3 month-old toothbrushes are as effective as new toothbrushes in plaque removal (58). In this study, almost half (49.7%) of the participants replaced their toothbrushes in 3 months or less. This is however indicative that the other half of the participants were not changing toothbrushes at the stipulated duration and hence were not deriving maximum benefit from them in maintenance of oral hygiene. Socioeconomic factors as well as lack of knowledge on ideal oral hygiene practices may have contributed to this.

All participants with exception of one reported to use of toothpaste. However, majority (93.1%) of the participants did not know if the toothpaste they used contained fluoride. In light of the fact that most of the toothpastes available commercially in Kenya are likely to be fluoridated, it was deduced that most of the children were benefitting from the protective benefit conferred by fluoride against dental caries. This may have been evidenced by the low caries experience among participants as brushing twice daily with fluoridated toothpaste has been shown to reduce dental caries risk (76) .

5.4 Oral Health Status

Mean plaque score was 0.95 ± 0.45 depicting good oral hygiene as prescribed by Silness and L oe (1964). Good oral hygiene could have been attributed to the frequency of tooth brushing with majority (67.3%) of the participants reporting to brush two or more times daily. Findings of the current study on presence of good oral hygiene among study participants was also comparable to results obtained in a study in Bangalore, India, among 8-13 years old visually impaired children where good (91.76%) oral hygiene was reported (10). However, the study results greatly differed with several other studies, which have reported fair to poor oral hygiene among visually impaired children. A study in Sudan among 11-13 year old visually impaired children, reported fair (43%) to good (35.4%) oral hygiene (5). In a different study in Sulaimani city, Iraq, 60% of visually impaired children and adults aged 7-29 years had poor oral hygiene (7). In a study among 16-25 year old students in a school for the blind in India, poor (55.5%) oral hygiene was reported (12).

Good oral hygiene reported in the current study could have been attributed to the fact that the study was carried out in residential institution where standard oral hygiene measures are enforced. Despite the children having a high (88.1%) prevalence of gingivitis, the mean gingival score was low indicative of mild gingival disease. The high prevalence of gingivitis reported in the current study is comparable to other studies among visually impaired children, which have generally reported high levels of gingivitis. A study in Iraq among visually impaired children 6-15 years old reported extensive gingivitis (90%) (77). A different study in India by Nandini reported a gingivitis prevalence of (71%) (9).

Overall prevalence of dental caries was 42.1% in the permanent dentition and 8.2% in the deciduous dentition. This difference may have been occasioned by a smaller number of deciduous teeth compared to the permanent teeth among the study participants. This varied greatly with a study in Khartoum State, Sudan among 11-13 year old visually impaired children where the prevalence of dental caries in the permanent dentition was 19.6% and 23.9% in deciduous dentition (5).

5.5 Influence of Visual Impairment on Oral Hygiene and Oral Health Status

Generally, visual impairment did influence any of the oral hygiene practices. Similarly, visual impairment did not influence oral hygiene status ($p=0.38$). This deferred with a study carried out in Malaysia where visually impaired individuals with better vision had higher plaque levels (14).

In the same light, there was no statistically significant association reported between categories of visual impairment and gingival score index ($p=0.38$). This result was indicative that the level of visual impairment did not influence gingival health status. A study carried out in Brazil reported that periodontal health was not influenced by the level of visual impairment, which is in line with the findings of the current study. However, it is important to note that the study in Brazil was carried out in an adult population (53).

A statistically significant association was reported between dental caries experience in deciduous teeth and category of visual impairment ($p=0.02$) indicating that participants who had Category I visual impairment had a high disease burden compared to participants in Category II. This was in contrast to a study by Tagelsir where children with partial visual impairment were reported to have a higher likelihood in diagnosis of dental caries compared to children with complete visual impairment. The results also differed with studies by Prashanth et al and Bekiroglu et al who reported no association between dental caries and levels of visual impairment (10,13). Findings of the current study supported an assumption that children with Category I visual impairment were less independent in self-care skills than children in Category II hence this may have contributed to a higher disease experience.

5.6 Influence of Demographic Characteristics on Oral Hygiene and Oral Health Status

An association was reported between perception of gingival health and age ($p=0.001$) indicating that younger children perceived better gingival health compared to the older children. This could have been necessitated by the fact that older children especially teenagers are more critical on appearance and well-being hence may have been more critical in the assessment of their gingival health compared to the younger children.

Gender was shown to influence frequency of toothbrush replacement ($p=0.04$) with more female participants replacing toothbrushes in less than 3 months. An association was also reported between frequency of toothbrush replacement and age ($p=0.04$), with older children more likely to change toothbrushes in less than three months compared to younger children. The level of psychological development could have resulted to the older children having a better understanding of the need for toothbrush replacement at 3 months.

Plaque score was higher among male (53.5%) compared to female (46.5%) participants and also increased with age. This could have been attributed to the fact that older children have less supervision by caregivers when performing oral hygiene practices. However, there was no association between oral hygiene status with both gender ($p=0.07$) and age ($p=0.30$). Lack of association between oral hygiene status with gender and age was in line with other studies carried out among visually impaired children in previously in Iraq and Saudi Arabia (7,78).

Gingival score index was influenced by age of participants ($p=0.02$) indicating that gingivitis increased with the age. This validates the finding mentioned above that plaque score increased with age indicating that the increase plaque score influenced gingival health. Increase of gingival score with age could have been manifest that older children were not adhering to oral hygiene measures as prescribed by their caregivers.

A slightly higher (21.9%) prevalence of dental caries was reported among female participants in permanent dentition compared their male counterparts ($p=0.05$) indicating a higher dental caries burden among female children. A significant association was reported between dental caries experience in deciduous dentition and age ($p=0.04$) indicating a high disease burden among children in deciduous dentition. These results differ with a study carried out in India where no association was reported between dental caries experience in deciduous dentition and age (10). In the same study, no association was shown between DMFT and age. These results were consistent with the current study where no association was reported between DMFT and age. However, these results varied with a study carried out in Iraq where DMFT scores increased with age (7). This was attributed to the cumulative and irreversibility of the disease.

5.7 Challenges in Practice of Oral Hygiene

Majority of the participants did not experience challenges in practice of oral hygiene practices. However, challenges such as the need to call someone to confirm if teeth were clean after brushing and need to have the dormitory mother help in application of toothpaste were reported.

This results were partly similar to those reported among a Malaysian visually impaired population where difficulties encountered in placing toothpaste onto the tooth brush and poor brushing were reported (73). The results also contrasted a different study carried in Iraq where majority (22%) of the participants reported a need to have assistance from their mothers when brushing their teeth (7) .

5.8 Association between Oral Hygiene Practices and Oral Health Status

Plaque index score was shown to influence gingival index score ($p=0.001$). This could explain why children in the 16-19 years age category who had the highest (0.99 ± 0.42) plaque score values registered the highest (0.34 ± 0.28) gingival index scores. These results are however is in contrast with a study by Shokhan et al, which reported no significant relationship between plaque index and gingival index (7).

Plaque index score was also reported to influence dmft ($p=0.04$) indicating that poor oral hygiene contributed to a high dmft score. This was comparable to a study by Prashanth et al where a high association was reported between oral hygiene status and dental caries (10).

Oral hygiene practices were compared to oral health status and a statistically significant association was shown between frequency of toothbrush replacement and gingival score index ($p=0.003$) emphasizing the need for replacement of toothbrushes at a 3-month duration. However, the other components of oral hygiene practices such as frequency of tooth brushing and use of toothpaste did not have a statistically significant influence on oral health status.

Therefore, the null hypothesis that there was no association between oral hygiene practices and oral health status was accepted. In contrast, a study carried out in Iraq reported that poor oral hygiene practices such as frequency of tooth brushing had an influence on oral hygiene status among visually impaired students (7). Results similar to this study were reported in Aligarh and Bangalore, India, where oral hygiene practices did not have a statistically significant influence oral hygiene status (10,12).

5.9 Limitations to the Study

The study was carried out among institutionalized children hence the results cannot be generalized.

The study participants were not representative of visually impaired children in Kenya as majority originated from counties in close proximity to the study area.

5.10 Conclusion

Majority of the children attending Thika Primary School for the Blind had adequate oral hygiene practices. All used conventional toothbrushes with majority using toothpaste and brushing 2-3 times daily with only 27.1% of the participants reporting to experience challenges in practice of oral hygiene measures.

All participants were found to have good oral hygiene (plaque score= 0.95 ± 0.45) and mild gingivitis (gingival score = 0.28 ± 0.25) with low dental caries experience (dmft= 0.16 ± 0.63 ; DMFT= 0.99 ± 1.70).

Category of visual impairment had an influence on dental caries experience among participants in deciduous dentition; being more among Category I visually impaired participants.

Category of visual impairment had no influence on oral hygiene practices, gingival health status and dental caries experience among participants in permanent dentition.

With exception of frequency of toothbrush replacement, demographic characteristics did not influence oral hygiene practices. Female and older (16-19 years) participants replaced their toothbrushes within a 3-month period compared their male and younger (10-15 years) counterparts who replaced toothbrushes after 3 months.

Plaque score index increased with age of participants and influenced both the gingival score index and dmft score index.

Gingival score index increased with age of participants but had no influence on dmft/DMFT score index.

Dental caries experience in permanent dentition was influenced by gender and was more among female participants.

Overall, oral hygiene practices did not influence oral hygiene and dental caries status. However, there was an association between frequency of toothbrush replacement and gingival score index.

5.11 Recommendations

There is need to reinforce oral hygiene practices among visually impaired children with emphasis towards frequency of toothbrush replacement within 3 months so as to achieve maximum benefits in maintenance of oral hygiene.

There is need to introduce modalities for preventive measures and early diagnosis of dental caries, more so among children in deciduous dentition with Category I visual impairment.

Further studies with more dose components of oral hygiene practices such as duration of brushing in each session and number of strokes used during tooth brushing are recommended to better assess the relationship between oral hygiene practices and oral hygiene status.

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APPENDICES

APPENDIX 1: CONSENT FORM

PROJECT TITLE: ORAL HEALTH STATUS AND HYGIENE PRACTICES AMONG ADOLESCENTS ATTENDING THIKA PRIMARY SCHOOL FOR THE BLIND, KIAMBU COUNTY, KENYA

Dear Parent/Guardian of.....

I am Dr. Maureen Macharia currently pursuing a Masters degree in Pediatric Dentistry at the University of Nairobi, Kenya.

Purpose of the Study: In partial fulfillment of my degree, I am working on a dissertation entitled: Oral health status and hygiene practices among children and adolescents attending Thika primary school for the blind, Kiambu County, Kenya

This study will provide baseline information on gum disease, dental caries, oral hygiene practices and challenges experienced in oral hygiene practices among visually impaired children and adolescents. Gum disease and dental caries are considered to be the commonest oral diseases affecting adolescents worldwide.

Procedure: Your child shall undergo an interview followed by a dental examination. This will be carried out by myself. The examination will involve an assessment of the oral health status by checking for presence or absence of plaque and calculus, gum disease and tooth decay.

Risks: There are no risks in this study since no invasive procedures shall be performed on your child.

Benefits:

1. Your child will obtain free oral health education on the day of data collection.
2. The results of this study shall assist in sensitizing you and other Kenyans on the oral health status and challenges faced in maintaining oral hygiene practices among visually impaired children and adolescents if there are any.

3. The results shall also be used to advice relevant health planners in formulation of oral health programs targeting visually impaired adolescents with the aim of promoting and providing continuous and sustainable oral health care.

Assent process: Your child will not be forced to participate in the study if they are unwilling or unable to.

Cost and referral: Children and adolescents with dental problems and in need of elective and emergency care will be referred to Thika level 5 hospital. I will make personal arrangements with the hospital for smooth referral of the study participants. The students will however bear the cost of treatment. Further, a referral system will be set up for future consultation and treatment of the study participants at the hospital.

Confidentiality: All the information that obtained from your child shall be confidential to protect their privacy. This shall be done by giving codes to their questionnaire and examination form thereby avoiding using their name when gathering information. The information shall only be accessed by authorized professionals involved in the study but they will not recognize your child's identity. There is no identity of any participant that shall be disclosed in any public conferences, reports or publications.

Participation

I.....

parent/guardian of

..... do hereby freely consent/do not consent to my child participation in the said study.

Signature/Thumb Print: Signature of investigator.....

Date: Date.....

For further information or inquiries please contact: -

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APPENDIX 2: CONSENT FORM (KISWAHILI)

FOMU LA KUKUBALI- MAELEZO YA KUTAFUTA IDHINI KUTOKA KWA WATOTO WATAKAOSHIRIKI KATIKA UTAFITI.

KICHWA CHA MRADI: HALI YA AFYA NA MASUALA YA USAFI WA MENO NA UFIZI MIONGONI MWA VIJANA WANAOSOMA KATIKA SHULE YA MSINGI YA WASIO-ONA THIKA KATIKA KAUNTI YA KIAMBU, NCHINI KENYA.

Kwa mzazi au mlezi wa

Mimi, Daktari Maureen Macharia, mwanafunzi wa shahada ya uzamili wa masuala ya meno ya watoto katika chuo kikuu cha Nairobi.

Sababu kuu ya utafiti: Katika hali ya kutaka kutimiza mahitaji ya shahada yangu, ninafanya kazi katika tasnifu inayohusu: Hali ya afya ya mdomo na masuala ya usafi miongoni mwa vijana wanaohudhuria masomo katika shule ya msingi ya wasiokuwa na uwezo wa kuona ya Thika katika kaunti ya Kiambu nchini Kenya.

Utafiti huu utaweza kutoa msingi wa habari kuhusu ugonjwa wa ufizi na meno kuoza sawa na usafi wa meno miongoni mwa vijana wenye matatizo ya kuona. Ugonjwa wa ufizi na meno kuoza unachukuliwa kuwa ugonjwa wa mdomo unawaathiri sana vijana kote ulimwenguni.

Utaratibu: Nitahoji mtoto wako na kisha kukagua meno yake. Uchunguzi utahusisha tathmini ya hali ya afya ya mdomo kwa kuangalia kuwepo au kutokuwepo kwa ugonjwa wa ufizi na meno kuoza.

Hakuna matibabu yatakayopewa wanafunzi japo wale ambao watapatikana na matatizo na wanahitaji usaidizi wa dharura wataweza kuelekezwa katika hospitali ya Thika level 5.

Hatari: Hakuna hatari katika utafiti huu kwa sababu utaratibu wa upasuaji hautafanywa kwa mtoto wako.

Manufaa: Matokeo ya utafiti huu yatasaidia katika kukuhamasisha wewe na wakenya

wengine kuhusu hali ya afya ya mdomoni na changamoto zinazokumba shughuli za kudumisha usafi wa midomo miongoni mwa vijana wenye matatizo ya kuona kama ipo. Licha ya hayo matokeo haya yatasaidia katika kutoa ushauri kwa wapangaji husika wa shughuli za matibabu katika kuweka mikakati ya afya ya midomo inayolenga vijana wenye matatizo ya kuona kwa lengo la kuendeleza na kutoa huduma zinazoendelea na endelevu katika utunzi wa afya ya midomo.

Siri: Habari yote itakayochukuliwa kutoka kwa mtoto wako itakuwa siri ili kuingia hali yao yasiri. Jambo hili litawezekana kwa kutoa nambari maalumu katika rekodi zao za matibabu na vijikaratasi vya maswali hivyo basi kuepuka kutumia majina yao habari inapokusanywa kutoka kwao. Habari itakaguliwa na wataalamu walohusika katika uchunguzi na wale ambao wameruhusiwa kufanya hivyo lakini hawawezi kutambua jina la mtoto wako. Hakuna kitambulisho cha mshiriki yeyote ambacho kitatolewa katika mikutano ya umma, ripoti au chapa.

Hifadhi ya nakala ya habari utakayotoa: Habari yote nitakayokusanya kutoka kwa mtoto wako zitahifadhiwa kwa siri na kutumiwa katika utafiti huu. Majina ya watoto binafsi watakaoshiriki hayataandikwa mahali popote wakati wowote. Nakala zote za habari kuhusu mtoto wako zitafungiwa katika makabati maalum wakati wote wa utafiti huu. Tutasistiza usiri huu katika kusimamia habari tutakazopewa ili kuzuia kujulikana kwa watakaoshiriki katika utafiti huu. Hakuna majina yatakayotumika katika vikao vya sayansi kwa umma na ripoti zitakazochapishwa katika majarida haya.

Idhini yako na sahihi: Nimesoma maelezo yaliyoko hapa juu na nimekubali kwa hiari yangu kuwa mtoto wangu ashiriki katika utafiti huu;

Mimi mzazi wanakubali / nakosa kukubali mtoto wangu kuhusishwa katika huu utafiti.

Sahihi/Alama ya kidole: Sahihi ya mtafiti.....

Tarehe: Tarehe.....

Kwa maswali zaidi tafadhali wasiliana na: -

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Msimamizi mkuu:

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Mwenyekiti, Kenyatta Hospital/University of Nairobi Ethics and Research Committee
uonknh_erc@uonbi.ac.ke

Tel: 00202 726300-9

APPENDIX 3: MINOR ASSENT DOCUMENT

PROJECT TITLE: ORAL HEALTH STATUS AND HYGIENE PRACTICES AMONG VISUALLY IMPAIRED CHILDREN AND ADOLESCENTS ATTENDING THIKA PRIMARY SCHOOL FOR THE BLIND IN KIAMBU COUNTY, KENYA

Investigator: Dr Maureen Wanjiru Macharia

I am doing a research study about the health status of the oral cavity and the tooth brushing practices among visually impaired children and adolescents attending Thika Primary School for the blind in Kiambu County, Kenya.

Permission has been granted to undertake this study by the Kenyatta National Hospital-University of Nairobi Ethics and Research Committee (KNH-UoN ERC Protocol No. P693/11/2017). This research study will help to understand the oral health status and oral hygiene practices among visually impaired children and adolescents as well as provide baseline data that will be useful in making of oral health programs targeting this group. At least 152 children will be participating in this research study with you.

If you decide that you want to be part of this study, a dental examination will be performed on you inside a classroom near a window using natural light as you seat upright on an office chair. Clean and sterile instruments will be used in your mouth to check for dental cavities, gum disease and food particles on your teeth. This procedure will take about 15 minutes. There is something about this study you should know. This is that there will be discomfort when probing the gum to assess its health. Not everyone who takes part in this study will benefit. A benefit means that something good happens to you. Some of these benefits might be a free dental checkup and referral for emergency and non-emergency dental treatment. If you do not want to be in this research study, I will tell you what other kinds of treatments there are for you. When I am are finished with this study, I will write a report about what was learned. This report will not include your name or that you were in the study.

You do not have to be in this study if you do not want to be. If you decide to stop after we begin, that's okay too. Your parents know about the study too.

If you decide you want to be in this study, please place your thumb stamp.

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

(Thumb stamp)

(Date)

APPENDIX 4: MINOR ASENT FORM (KISWAHILI)

STAKABADHI YA KUTIA SAHIHI YA MTOTO

KICHWA CHA MRADI: HALI YA AFYA NA MASUALA YA USAFI WA MENO NA UFIZI MIONGONI MWA WATOTO NA VIJANA WANAOSOMA KATIKA SHULE YA MSINGI YA WASIOONA THIKA KATIKA KAUNTI YA KIAMBU, NCHINI KENYA.

Mtafiti: Daktari Maureen Wanjiru Macharia

Ninafanya utafiti wa hali ya afya ya mdomo na shughuli za kuyasugua meno miongoni mwa watoto na vijana wenye matatizo ya kuona wanaosoma katika shule ya Thika ya watoto wasioona.

Nimepewa ruhusa ya kufanya utafiti huu na hospitali kuu ya kitaifa ya Kenyatta – kamati ya maadili na utafiti ya chuo kikuu cha Nairobi (KNH – UON ERC protocol No P693/11/2017)

Utafiti huu utasaidia kuelewa hali ya afya ya midomo na shughuli za usafishaji wa midomo miongoni mwa watoto na vijana wenye matatizo ya kuona. Vilevile, itatoa msingi wa data ambayo itakuwa muhimu katika kutengeneza ratiba ya usafi wa midomo inayolenga kundi hili. Angalau watoto 152 watahiriki katika utafiti huu na wewe.

Ukiamua kuwa mmoja wa washiriki katika utafiti huu, utafanyiwa ukaguzi wa meno ndani ya darasa karibu na dirisha kutumia mwangaza wa jua huku ukikaa wima katika kiti cha ofisi. Vifaa vilivyotibiwa vitatumika katika mdomo wako kuuangalia ugonjwa wa meno, ugonjwa wa ufizi na masalio ya chakula kwenye meno yako. Utaratibu huu utachukua muda wa dakika 15. Kuna kitu muhimu kuhusu utafiti huu unapaswa kujua, kutakuwa na ukosefu wa utulivu tutakapokuwa tukichunguza ufizi ili kutambua hali ya afya.

Sio kwamba kila mtu anayehusika katika utafiti huu atafaidi. Faida inamaanisha kitu kizuri kitakufanyikia. Baadhi ya faida hizi zaweza kuwa kuangaliwa meno na kuelekezwa kwa huduma za dharura na pia huduma sizizo za dharura za matibabu ya meno.

Iwapo hutaki kuhusika kaatika utafiti huu, nitakuelezea njia zingine za matibabu ambazo zinaweza kukusaidia.

Sio lazima uwe katika utafiti huu ikiwa hutaki. Vilevile, ukiamua kutoendela baada ya kuanza pia ni sawa.

Wazazi wako wanafahamu kuhusu uchunguzi huu pia.

Mimi _____ningependa niwe katika utafiti

Sahihi\kidole gumba

(Tarehe)

APPENDIX 5: QUESTIONNAIRE

DEMOGRAPHIC DATA AND ORAL HYGIENE PRACTICES AMONG VISUALLY IMPAIRED CHILDREN AND ADOLESCENTS

[Simplified Oral Health Questionnaire for Children (Modified WHO, 2013)]

Date _____

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

General information:

Identification number

--	--	--	--	--

Sex

Boy

Girl

Age (years)

D.O.B _____

1. County of origin _____

a) Category of visual impairment

Category I

Category II

b) For how long have you been visually impaired? _____

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

	Teeth	Gums
Excellent	<input type="checkbox"/>	<input type="checkbox"/>
Very good	<input type="checkbox"/>	<input type="checkbox"/>
Good	<input type="checkbox"/>	<input type="checkbox"/>
Average	<input type="checkbox"/>	<input type="checkbox"/>
Poor	<input type="checkbox"/>	<input type="checkbox"/>
Very poor	<input type="checkbox"/>	<input type="checkbox"/>
Don't know	<input type="checkbox"/>	<input type="checkbox"/>

5. How often during the last 12 months did you have toothache or feel discomfort due to your teeth?

Often	<input type="checkbox"/>
Occasionally	<input type="checkbox"/>
Rarely	<input type="checkbox"/>
Never	<input type="checkbox"/>
Don't know	<input type="checkbox"/>

6. How often do you clean your teeth?

Never.....

Several times a month (2-3 times)

Once a week

Several times a week (2-6 times).....

Once a day

2 or more times a day

7. Do you use any of the following to clean your teeth or gums?

	Yes	No
	<input type="checkbox"/>	<input type="checkbox"/>
Toothbrush	<input type="checkbox"/>	<input type="checkbox"/>
Wooden toothpicks.....	<input type="checkbox"/>	<input type="checkbox"/>
Plastic toothpicks	<input type="checkbox"/>	<input type="checkbox"/>
Thread (dental floss).....	<input type="checkbox"/>	<input type="checkbox"/>
Charcoal	<input type="checkbox"/>	<input type="checkbox"/>
Chew stick/mswaki	<input type="checkbox"/>	<input type="checkbox"/>

Other

Please specify _____

APPENDIX 6: QUESTIONNAIRE (KISWAHILI)

UHOJAJI - MASUALA YA USAFI WA MENO NA UFIZI MIONGONI MWA WATOTO NA VIJANA WANAOSOMA KATIKA SHULE YA MSINGI YA WASIO-ONA THIKA KAUNTI YA KIAMBU, NCHINI KENYA.

Fomu la Uhojaji la Watoto [Kutoka Kikundi cha Afya Ulumwenguni (2013)]

Tarehe _____

Kwanza, ningependa kukuliza mwasali ya kibinafsi na maswali kuhusu meno yako.

Habari za jumla.

Namari ya kujitambulisha.

--	--	--	--	--

Jinsia.

Mvulana.

Msichana.

Umri.

Tarehe

ya

kuzaliwa.

_____a

asili.

1. Kategoria ya tatizo la kuona.

Kategoria I

Kategoria II

2. Umekuwa na matatizo ya macho kwa muda gani? _____

3. Unaweza kuelezea kuhusu afya ya meno na fizi kwa njia gani?

	Meno.	Fizi.
Bora	<input type="checkbox"/>	<input type="checkbox"/>
Vyema zaidi	<input type="checkbox"/>	<input type="checkbox"/>
Vyema	<input type="checkbox"/>	<input type="checkbox"/>
Wastani	<input type="checkbox"/>	<input type="checkbox"/>
Mbaya	<input type="checkbox"/>	<input type="checkbox"/>
Mbaya zaidi	<input type="checkbox"/>	<input type="checkbox"/>
Sijui	<input type="checkbox"/>	<input type="checkbox"/>

6. Ni mara ngapi kwa miezi kumi na miwili iliyopita umekuwa na jino linalokuuma au kuhisi kutokutulia kwa meno yako?

	<input type="checkbox"/>
Kila mara	<input type="checkbox"/>
Mara moja	<input type="checkbox"/>
Si raise	<input type="checkbox"/>
Seaway	<input type="checkbox"/>
Sijui	<input type="checkbox"/>

7. Ni mara ngapi wewe usafishaji meno yako?

Hakuna.....	<input type="checkbox"/>
Mara kasha Kwa miezi	<input type="checkbox"/>
Mara moja kwa wiki	<input type="checkbox"/>
Mara kneeing Kwa wiki.....	<input type="checkbox"/>
Mara moja kwa siku	<input type="checkbox"/>
Mara mobile au zaidi Kwa siku	<input type="checkbox"/>

8. Je, umewahikutumia nini kwa vifuatavyo kuyasafisha meno au fizi zako?

	Yes	No
Mswaki	<input type="checkbox"/>	<input type="checkbox"/>
Vijiti vya kichokonoo.....	<input type="checkbox"/>	<input type="checkbox"/>
Vichokonoo vya plastiki	<input type="checkbox"/>	<input type="checkbox"/>
Uzi.....	<input type="checkbox"/>	<input type="checkbox"/>
Makaa	<input type="checkbox"/>	<input type="checkbox"/>
Makaa	<input type="checkbox"/>	<input type="checkbox"/>
Nyingine	<input type="checkbox"/>	<input type="checkbox"/>

Kamanyingine,

tafadhali

bainisha

9. Ikiwa waitumia mswaki wako, ni mara ngapi waibadilisha? Chini ya miezi mitatu

Miezi mitatu

Baada ya miezi mitatu

Sina uhakika

10. Ikiwa unayaflosi meno, huwa unayaflosi kwa muda gani?

Sijawai

Kila Siku	<input type="text"/>	Mara kwa mara	<input type="text"/>	<input type="text"/>
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Ndio La

11.a) Je, wewe hutumia dawa ya meno kuyasafisha meno yako?

b) Je, unatumia dawa ya meno iliyo na floridi?

La

Ndio

Sijui

12. Je, huwa unayasuuza meno yako baada ya mlo? Ndio

Mara kwa mara

La

13. Je, unakumbana na changamoto gani kudumisha usafi wa meno?

APPENDIX 7: CLINICAL EXAMINATION FORM

(Modified from WHO Oral Health Assessment Form for Children, 2013)

Serial No.....

Leave blank													Year	Month	Day			
Identification No. (1)□□□□(4)(5)													□□□□□□ (10)(11)			□□□□		
General information: Sex 1=M, 2=F □□ (18) 19)						Date of birth □□□□□□ (24)						Age in years (25) □□ (26)						
Category of visual impairment.....													Category I □			Category II □		
County of origin													□ (33)					
Dentition status																		
		55	54	53	52	51	41	42	43	44	45				Primary teeth	Permanent teeth 0= Sound 1= Caries 2= Filled w/caries 3= Filled, no caries 4= Missing due to Caries 5= Missing for another reason 6= Fissure sealant 7= Fixed dental prosthesis/crown, abutment, veneer, implant 8= Unerupted 9= Not recorded		
17	16	15	14	13	12	11	21	22	23	24	25	26	27	A				
														B				
														C				
														D				
														E				
														—				
		55	54	53	52	51	61	62	63	64	65			F				
														G				
47	46	45	44	43	42	41	31	32	33	34	35	36	37	—				
														—				
Periodontal status																		
		55	54	53	52	51	41	42	43	44	45							
17	16	15	14	13	12	11	21	22	23	24	25	26	27					
		55	54	53	52	51	61	62	63	64	65							
47	46	45	44	43	42	41	31	32	33	34	35	36	37					
Gingival bleeding Scores																		
(0) Absence of condition								(1) Presence of condition										
(9) Tooth excluded								(X) Tooth not present										

Oral Hygiene Status: Plaque Index (Silness-Löe, 1964)

54 (M)	54 (B)	54 (D)	54 (P)	52 (M)	52 (B)	52 (D)	52 (P)	64 (M)	64 (B)	64 (D)	64 (P)
84 (M)	84 (B)	84 (D)	84 (L)	72 (M)	72 (B)	72 (D)	72 (L)	75 (M)	75 (B)	75 (D)	75 (L)

KEY: Criteria for classifying debris

Scores	Criteria
0	No plaque is seen
1	A film of plaque adhering to the free gingival margin and adjacent area of the tooth
2	Moderate accumulation of the soft deposits within the gingival pocket or the tooth and gingival margin, which can be seen with naked eye.
3 — 9	Abundance of soft matter within the gingival pocket and or on the tooth and gingival margin.
	Missing due to caries/exfoliated

NEED FOR IMMEDIATE CARE AND REFERRAL

1. Life threatening condition Present Absent

2. Pain or infection Present Absent

3. Other condition seen (specify)

4. Referral Yes No