DENTAL CARIES, GINGIVITIS AND TREATMENT NEEDS AMONG CHILDREN RESIDING IN FOUR CHARITABLE INSTITUTIONS IN NAIROBI CITY COUNTY
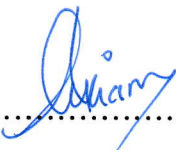
MARIAM ABDUL BAKHRANI

REG. NO. V60/37862/2020

A RESEARCH DISSERTATION SUBMITTED IN PARTIAL FULFILMENT FOR THE MASTER OF DENTAL SURGERY DEGREE IN PAEDIATRIC DENTISTRY (MDS PAEDIATRIC DENTISTRY) AT THE UNIVERSITY OF NAIROBI

2023

DECLARATION

I, Dr. Mariam Abdul Bakhrani, declare that this dissertation is my own work and has not been submitted for any award in any other institution.

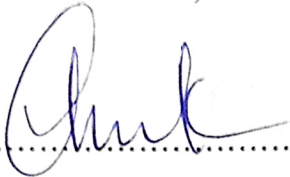Signature: ....   **Date:** ...13|11|2023........

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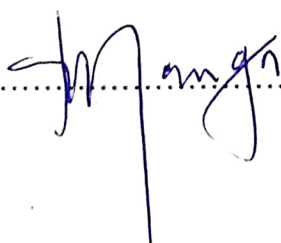
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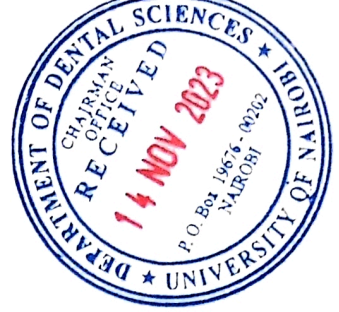
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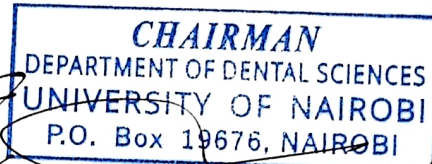
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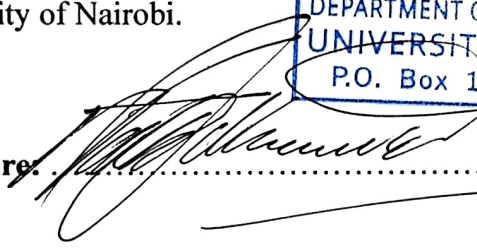
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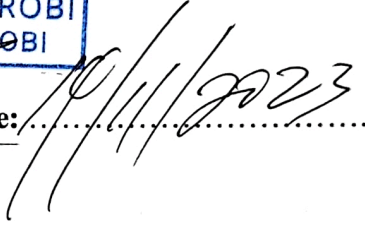
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DEDICATION

To my husband, MohamedImran,

my pillar of strength.

To my children, Aqsa and Iqra,

the wind beneath my wings.

To my parents,

my guiding light.

ACKNOWLEDGEMENT

I wish to express my sincere gratitude to:

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LIST OF ABBREVIATIONS

ANOVA   -   One-way Analysis of Variance

CCIs   -   Charitable Children's Institutions

dmft   -   decayed, missing, filled teeth

DMFT   -   Decayed, Missing and Filled Teeth

ECC   -   Early Childhood Caries

FDI   -   Federation Dentaire Internationale

KNH   -   Kenyatta National Hospital

KNOHS   -   Kenya National Oral Health Survey

$\overline{X}$ -   Mean

NCCS   -   National Council of Children's Services

PI   -   Principal Investigator

SPSS   -   Statistical Package for Social Sciences

TNs   -   Treatment Needs

UN   -   United Nations

UNCRC   -   United Nations Convention on the Rights of the Child

UoN   -   University of Nairobi

WHO   -   World Health Organization

DEFINITION OF TERMINOLOGIES

Age of Participant   Child's age as at their last birthday.

Caregiver   Person in charge of the child's major care activities at the CCI. Also served as a main informant for the 6 to 8 years old participants.

Dental Caries   A biofilm mediated, sugar driven, multifactorial, dynamic disease that results in phasic demineralization and remineralization of dental hard tissues.

Gingivitis   Inflammation of the gums, often accompanied by tenderness and bleeding.

Oral Health   A state of being free from chronic mouth and facial pain, oral and throat cancer, oral sores, birth defects, periodontal disease, tooth decay and tooth loss and other diseases and disorders that affect the oral cavity.

Oral Hygiene Practices   These are the oral health habits utilized in maintenance of oral hygiene. This includes oral health care products and tools.

Orphan   A child who has lost one or both parents through death.

Registered CCI   An NCCS-approved home or institution that has been established to manage a programme for the care, protection and rehabilitation of children.

Vulnerable Child   A vulnerable child is one who cannot live with his/her or parents and family due to hostile conditions that subject the child to a constrained development. Like orphans, this child has in a way "lost" their primary caregiver.

ABSTRACT

Background: Global epidemiological studies have reported that the oral health status of institutionalized children is worse than that of their counterparts in the general population. This has been attributed to poor oral hygiene and limited access to preventive or therapeutic dental services. Furthermore, there is inadequate information on the dental health of Kenyan children residing in Charitable Children Institutions (CCIs).

Objectives: The main objective of the study was to determine the prevalence of dental caries, gingivitis and treatment needs of children residing in CCIs in Dagoretti and Westlands Sub-Counties of Nairobi City County in Kenya.

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

Material and methods: The study population comprised of 170 participants aged 6 to 15 years and who had continuously resided in the selected CCIs for a period of at least three months. Data was collected for the study using the WHO (2013) simplified oral health questionnaire for children, administered by the Principal Investigator (PI), who also carried out the clinical oral examinations of the participants. The questionnaire gathered information on the participants' socio-demographic profile, oral hygiene practices, and dietary practices. The oral hygiene status, including the presence of plaque, gingival health, dental caries status, and treatment needs, were recorded using a modified version of the WHO (2013) oral health assessment form for children. A trained and pre-tested assistant recorded the clinical findings.

Data analysis and presentation: The data was analyzed using SPSS version 25 for Microsoft Windows. The descriptive statistics applied to the continuous data were summarized as range, mean ± standard deviation while categorical data in percentage. The inferential statistics applied for comparison of the continuous variables were t-test and one-way analysis of variance (ANOVA). Categorical variables were compared by Chi-square ($\chi 2$) and Fishers exact test. All statistical tests and hypothesis testing were determined at 95% Confidence Interval (CI) and $p < 0.05$ was considered statistically significant. Data was presented in form of statements, tables, graphs and pie charts.

Results: Among the 170 study participants, 86 (50.6%) were male and 84 (49.4%) were female. The mean age of the study participants was 10.7±2.9 SD. While all the participants reported using a conventional toothbrush and toothpaste, 140 (82.4%) reported to brushing their teeth once a day, 14 (8.2%) brushed twice daily, 15 (8.8%) brushed several times a week and one participant (0.6%) reported to brushing once a week. These findings indicated poor oral hygiene amongst the participants, as reflected by a mean plaque score of 2.1±0.4 SD. A high prevalence of gingivitis was also observed, affecting 99.4% of the participants, with a mean gingival index of 1.4±0.3 SD. The prevalence of dental caries was 75.9%, and the mean values for dmft/DMFT were 0.96 (±1.76 SD) and 1.15 (±1.49 SD) respectively. Based on the assessment of the periodontal treatment needs, majority of the study participants, 140 (82.4%), required scaling and oral prophylaxis and 30 (17.6%) required improvement of personal oral hygiene. Regarding dental caries, most of the participants, 99 (76.7%),

required restorations as part of their treatment whilst 19 (14.7%) required pulp therapy, and 7 (5.65) required extractions.

Conclusion: The study participants had poor oral hygiene status in spite of the majority of the study participants (82.4%) claiming to brush at least once daily using a conventional toothpaste and toothbrush. There was a high prevalence of gingivitis and dental caries in the study participants at 99.4% and 75.9% respectively. The children also had many unmet dental treatment needs with majority requiring scaling and polishing, and restorations.

Recommendation: Treatment intervention programs, such as oral health education and outreach programmes with mobile dental clinics can be undertaken through the Health Department of the respective county governments, to address the treatment needs of institutionalized children. A wider multi-centre study is necessary to determine the burden of oral diseases in institutionalized children. The baseline data from the study may help in formulation of oral health care protocol in order to provide preventive and curative oral health services for institutionalized children.

CHAPTER ONE: INTRODUCTION AND LITERATURE REVIEW

1.1. INTRODUCTION

Oral health is an important aspect of children's overall health, it has been described as a state of being free from constant mouth and facial pain, oral and throat cancer, oral sores, birth defects such as cleft lip and palate, periodontal disease, tooth decay, and tooth loss, as well as other diseases and conditions affecting the oral cavity[1]. Oral diseases are estimated to affect nearly 3.5 billion people worldwide, with over 530 million of them being children[2]. According to WHO, these diseases are the fourth-costliest to treat, with people with higher socioeconomic status seeking care more often than those with fewer resources[2]. As urbanization increases so does the frequency of oral diseases which can be attributed to changes in dietary habits and lifestyle choices. Furthermore, urbanization has led to disproportionate distribution of oral health care providers, where majority of them are concentrated in urban areas, resulting in insufficient oral health care facilities for the most vulnerable[3].

Dental caries and periodontal diseases are two most important global oral health burdens[4]. The distribution and severity of these two diseases varies by age group in region and country for both high income and low-middle income countries[5,6], with the disadvantaged children, regardless of race, ethnicity, culture, or nation, bearing the brunt of the load[6]. Among early studies conducted in Kenya, Ng'ang'a and Valderhaug[7] reported dental caries prevalence of 46% (DMFT of 1.7) among 6 to 8 year olds and a prevalence of 50% (a mean DMFT of 1.8) in 13 to 15 years old children. In another study by Matalanga *et al*[8], among 3 to 12 years old children, a

dental caries prevalence of 89.4% (dmft of 5.47) in the deciduous dentition and 29% (DMFT of 0.79) in the permanent dentition was reported. The variation in dental caries prevalence observed between the studies conducted by Ng'ang'a and Valderhaug[7], and Matalanga et al[8] can be attributed to the distinct study areas. Ng'ang'a and Valderhaug[7] conducted their research in a school setting while the study by Matalanga et al[8] was hospital-based, thus an increased prevalence of dental caries reported due to selection bias in the latter's study. Interestingly, Opondo et al[9] studied the impact of dental caries on the oral health related quality of life on 452 children residing in slums within Nairobi and found that children with DMFTs of 4 and higher were four times more likely to experience negative oral impacts on their everyday lives.

Oh et al[10] have reported that the most prevalent periodontal disease in children and adolescents is plaque-induced chronic gingivitis. This disease in the form of marginal gingivitis can begin in early childhood and worsens in frequency and severity through puberty stage. A more severe form of periodontal disease, aggressive periodontitis affects individuals during puberty leading to premature tooth loss and is reported to affect about 2% of the youth[4].

Evaluation of oral health status plays a crucial role in the planning of oral health services. This typically involves an assessment of the oral diseases in the targeted regions and a determination of their treatment needs which includes a road map for determining where intervention is required, the cost implications, and allocation of resources towards the prevention and treatment of the oral diseases[11]. These results will also assist the oral health provider in decision making on treatment needs and

planning for oral health services for a given community[5,12,13]. Additionally, this helps the provider to identify the most common oral health problem, determine its economic implications, and allocate resources efficiently toward disease prevention and intervention for the community. Children, in particular, are a vulnerable population whose health must be prioritized in order for them to grow and have fulfilled lives, regardless of their socioeconomic background[11,12].

Research has demonstrated that institutionalized children are underprivileged as they lack the supportive and stimulating environment required for normal growth and development[14,15]. Globally, it is estimated that there are around 2.7 million children who reside in institutional care, with 286,000 in Eastern and Southern Africa[16,17]. In Kenya, CCIs have emerged as a source of alternative care centers for the lack of suitable support mechanisms for family-based care, such as foster care[18]. The CCIs offer accommodation and provide orphaned and vulnerable children with a family-like environment. However, it is widely acknowledged that institutionalization has adverse effects on the developmental outcomes and the well-being of children, that results in a significant difference in the oral health-related quality of life between institutionalized children and their counterparts living with their parents[14,18]. A high prevalence of dental caries and gingivitis was observed in institutionalized children in a comparative study between institutionalized and non-institutionalized children in India[19]. The authors attributed this to personalized care and support that the non-institutionalized children receive from their parents[19]. Due to challenges such as under-staffing, time, and financial constraints, institutions are sometimes only able to offer basic care for children rather than addressing the children's individual needs for

healthy and complete development. Untreated oral diseases can lead to pain, eating difficulties and overall health problems. Therefore, recognizing these issues is essential to providing optimum oral health to these disadvantaged children.

1.2. LITERATURE REVIEW

1.2.1. Charitable Children's Institutions

Children residing in institutional care face unique challenges related to their physical and mental well-being, as well as their social and emotional development[14]. To address these issues, there are global policies that guide the provision of care for children in institutional settings. One of the most significant global policies on children in institutions is the United Nations Convention on the Rights of the Child (UNCRC)[20]. It emphasizes that every child has the right to a safe and nurturing family environment, and that institutional care should only be used as a last resort.

The Kenyan government has adapted policies to guide the provision of care for children in institutional settings. The Children's Act of 2001 provides for the protection and care of children, including those in institutions and other forms of alternative care[21]. The Government through the Ministry of Gender, Children and Social Development has developed national standards for the operation of children's homes and institutions, which aim to ensure that these facilities provide safe, supportive, and nurturing environments for children[22]. However, there have been concerns raised about the quality of care provided in some institutions in Kenya, with reports of abuse, neglect, and poor living conditions[23,24].

1.2.2. Dental caries

1.2.2.1. Aetiology of dental caries

Dental caries is a multifactorial, dynamic disease of the dental hard tissues resulting in an imbalance of demineralization and remineralization of dental hard tissues[25]. A complex ecosystem formed by four factors – bacterial agents concentrated in plaque, susceptible tooth surface, dietary habits concentrated mainly in refined sugars, and time – contribute to the initiation and progression of the disease[26]. Children who have a history of consuming cariogenic carbohydrates for extended periods of time will have a greater incidence of dental caries[27]. Fermentable carbohydrates, also known as 'free sugars' are found in confectioneries, cakes, biscuits and sweetened beverages. These carbohydrates are readily metabolized by bacteria in the mouth to produce organic acids, which gradually dissolve the dental hard tissues[28,29]. Dental caries is further attributed to inadequate oral hygiene, poor brushing techniques, insufficient exposure to fluoride, poor salivary flow, poor nutritional and dietary habits[26,28]. Risk factors for dental caries vary between higher and lower socioeconomic classes and the greatest burden lies with disadvantaged and poor populations[30].

The pathogenesis of dental caries involves bacteria in dental plaque forming a biofilm, within which sugars are metabolized to acid, causing the degradation and breakdown of enamel and dentin[29]. Multiple microorganisms are involved in the pathogenesis of dental caries; they include *Streptococcus mutans*, *Bifidobacteria*, *Lactobacillus acidophilus* and *Actinomyces viscosus*[31]. However, the most important causative agents are *Streptococcus mutans* and *Lactobacilli*[31,32].

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In its early stages, dental caries presents as a white spot lesion and is usually asymptomatic. However, as the disease progresses, it leads to tooth decay, causing pain, infections, abscesses, and potentially even sepsis. Fortunately, dental caries can be prevented through several approaches, including mechanical plaque removal through tooth brushing and flossing, fluoride administration, and sugar restriction in the diet[32]. The resultant effect being improved oral hygiene and reduced risk of developing dental caries.

1.2.2.2. Epidemiology of dental caries among children in general population

According to the World Health Organization (WHO), dental caries is the most common non-communicable disease and of a major public health concern[29]. It also ranks first for permanent tooth decay (2.3 billion people) and 12th for deciduous teeth in the 2015 Global Burden of Disease Study, making it the most common disease that was examined (560 million children)[29]. A report between the Federation Dentaire Internationale (FDI) and the WHO indicates that this disease is more common in low- and middle-income countries than in most high-income countries. Reasons for this difference include exposure to fluoridated water and/or fluoride supplements, including regular use of fluoride toothpaste; the provision of preventive oral health services; the increased dental awareness through organized oral health education programmes; and availability of dental resources in the developed countries[33]. Dental caries is also the most common oral diseases among children, and these individuals are prone to the disease throughout their lives[27,34]. The frequency of occurrence of dental caries varies by population, with the most vulnerable being the underprivileged[27,34]. In most countries dental caries increased in proportion when

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sugar importation was at its highest in the 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[35]. 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[30].

The Kenya National Oral Health Survey (KNOHS)[35] conducted in 2015 indicated that children between the ages of 5 and 15 years old were reported to have dental caries prevalence of 23.9% with an overall DMFT/dmft of 0.8. A small proportion (3.4%) of the children had teeth missing due to caries while 0.5% had filled teeth. The prevalence of dental caries was higher among the 5 year old (46.3%) when compared to the other age groups. Females recorded a higher dmft/DMFT of 1.38 compared to 0.82 recorded for males. The dental caries experience was highest (dmft/DMFT 0.86) among the peri urban children and lowest (dmft/DMFT 0.65) among the urban children whereas the rural children had a dmft/DMFT of 0.76.

Among other studies carried out in Kenya, Njoroge *et al*[36] in 2010 reported a high prevalence of dental caries (59.5%) among 3 to 5 year old school children in Kiambu District in Kenya. This finding compared well with the KNOHS[35] which had reported a high prevalence of dental caries among the five year old children. The report further highlighted the importance of implementing preventive strategies to address oral health diseases during early childhood. In contrast, Sumbi *et al*[37] in 2014 reported a lower caries prevalence of 18.1% in 12 year old school children, in Njiru District of Nairobi. The study speculated that the lower prevalence may be due to factors such as

good oral hygiene practices and high literacy of the parents. On the other hand, Macharia *et al*[38] conducted a study in 2019 among visually impaired children attending Thika primary school aged 10 to 19 years in Kenya. A higher prevalence of dental caries in the permanent dentition (42.1%) was noted compared to the deciduous dentition (8.2%). The difference in the prevalence of dental caries among the permanent and deciduous teeth was attributed to the fact that there was a smaller number of deciduous teeth compared to the permanent teeth.

A hospital-based study carried out by Kagasi *et al*[39] in 2015 among 3 to 5 year old children attending Gertrude's children's hospital in Nairobi, Kenya reported a dental caries prevalence of 39.5%. The study further revealed that cariogenic foods were significantly associated with dental caries. Musera *et al*[40] on the other hand reported an exceptionally high prevalence of dental caries amongst rural and urban children in 2003, with the rural children having a substantially higher overall prevalence of 74.8% compared to 49.2% in the urban children. Increased sugar consumption and changes in dietary habits have been linked to an increase in the prevalence of dental caries as appreciated above.

Macigo *et al*[41] in their longitudinal retrospective study on Kenyan children aged 3 to 15 years between the years 1969 and 2009, found that the dmft increased from 1.5 in the 1980s to nearly 3 after 2000, and a DMFT of 0.2 to 0.92 over the same period. Manji[42] reported a DMFT of 0.2 in 1984 in study based on Nairobi primary school children, whereas Frencken *et al*[43] reported a DMFT of 0.51 in 1986 among urban children residing in Nairobi and Dar-es-Salaam. This DMFT value rose to 0.92 after

the year 2000, according to Owino *et al*[44] in a school-based study in Kitale. For both the deciduous and permanent dentition, the overall trend was a rise in caries experience over time.

1.2.2.3. Epidemiology of dental caries among institutionalized children

Several studies conducted in Asia highlight the high prevalence of dental caries amongst institutionalized children. In an Indian orphanage, Sharma *et al*[45] in 2014 reported that dental caries affected 61.5% and 73.5% of the 5 year old males and females, respectively, as well as 18.2% and 19% of the 12 year old males and females respectively. Their findings also revealed untreated caries and absence of restorations, which correlated to poverty, illiteracy, lack of awareness and oral health services. Another similar study by Shah *et al*[46] in Kashmir, in 2016 reported caries prevalence of 50.9% in the deciduous dentition and 69.1% in permanent dentition, indicating a moderate to high caries level in these children. Alsayeh *et al*[47] in 2020 reported a 96.6% prevalence of dental caries with a DMFT of 8.40±4.19, among 6 to 18 year old children in Saudi Arabia. The DMFT of female participants in this study was higher (9.42±3.20) than that of male participants (8.04±4.44). These findings revealed that the absence of parental care can lead to detrimental effects on the oral health of a child.

In the African region, Ojukwu *et al*[48] in 2019 from Nigeria found a low prevalence of dental caries (22.4%) in five Nigerian orphanages and a mean dmft/DMFT score of 0.21 ± 0.41 and 0.14 ± 0.35 respectively. However, despite the low prevalence of dental caries, a considerable number of decayed teeth were left untreated, indicating a substantial need for restorative dental care among these children. Abedassar *et al*[49]

conducted a study in Uganda in 2020, which involved children aged 6-12 years residing in support centers. The study revealed that these children had a mean DMFT and dmft of 1.73±1.84 and 4.13±3.80 respectively, which indicates that the oral health of these study participants is inadequate.

According to a local research conducted by Edalia *et al*[50] in 2009 among 52 children aged 10 to 12 year old, residing in two children's home in Nairobi, 85% of them associated dental caries with consumption of sugary foods, while only 2% linked it to eating hard foods. The study further reported a mean DMFT of 1.15 and suggested that the institutionalized children may have had better oral health outcomes due to their favourable attitude towards oral care and improved oral hygiene practices, despite their high sugar intake.

1.2.3. Gingivitis

1.2.3.1. Aetiology of gingivitis

Gingivitis is described as the inflammation confined to the margins of the gingiva, with dental plaque as the primary local cause[51]. Dental plaque is an oral biofilm consisting of bacteria, saliva, and food residues. The bacteria mostly implicated in gingivitis, *Actinomyces species*, *Capnocytophaga species*, *Leptotrichia species*, and *Selenomonas*[52,53], are found within the dental plaque. Gingivitis develops when bacterial plaque builds up on the cervical margin of the teeth, causing gingival inflammation with no evidence of bone loss or clinical attachment loss[51]. In children, gingivitis is stated to be less severe than in adults; this may be due to variations in

bacterial plaque composition, gingival morphology, and the predominance of lymphocytic infiltrate in gingival tissues in children[54].

Dental plaque formation in children is influenced by their tooth brushing habits including the frequency, ability to brush effectively, diet, and the existence of dental cavities[55]. All of these factors contribute to the severity of gingivitis. The gingival condition normally improves with increased oral hygiene practices and the elimination of bacterial deposits.

1.2.3.2. Epidemiology of gingivitis among children in general population

Children and adolescents are universally exposed to a wide variety of gingival inflammation of varying severity. However, little emphasis has been placed on early identification, which is critical for a successful treatment[56,57]. According to a review article by Pari A *et al*[57] in 2014, the prevalence of gingivitis in children aged 6 to 11 has been estimated to be around 73% in high income countries. The prevalence rates tend to increase with age, and during adolescence, it ranges between 50 to 99%. Similarly, poor oral hygiene and gingival inflammation have also been reported to be prevalent in low-middle income countries[47]. A cross sectional study done in 2013 by Al-Haddad *et al*[58] on the prevalence of gingivitis among 5 to 12 year olds in Yemen, revealed that the 5 year olds had a lower prevalence rate (27%) compared to the 12 year olds (78.6%). Additionally, in a study conducted by Kane *et al*[59] in 2018, the prevalence of gingivitis among Malian children aged 3 to 14 years was 87.5%.

The KNOHS[35] conducted in 2015 reported gingival bleeding in three out of four children (75.7%) aged 5 to 15 years. Children aged 5 years had the greatest rate of gingival bleeding (99.6%). However, there were no significant differences between males and females. The study also found that rural children had a lower prevalence of gingival bleeding (70.2%) compared to peri-urban children (80.0%). Similarly, Musera et al[40], among 10 to 12 year old children in urban (Nairobi) and rural (Meru South District) children found a high gingivitis prevalence of 99.2% and 98.4% respectively. Interestingly, the teeth brushing habits of the children did not tie in with their gingival health as 94.7% of the urban and 72.4% of the rural children reported that they brushed their teeth.

A separate local research conducted by Owino et al[44] in 2010 among 12 year old primary school children in Kitale, reported a prevalence of gingivitis of 77.7%. Similarly, Fujawa et al[60] in 2014 reported a prevalence of 75.1% among 3 to 18 year old children and adolescents in a school based study in Kithoka and Matalanga et al[8] in 2009 found gingivitis to be prevalent in 95% among 3 to 12 year old in a hospital based study in Nairobi. Masiga and Holt[61] in 1993, on the other hand, reported gingivitis in 37% of nursery school children aged 3-5-years in Nairobi, which was significantly lower than the previously reported findings. Their population consisted of younger children and this can be explained by the fact that the prevalence of gingival inflammation increases with age, particularly in older children.

1.2.3.3. Epidemiology of gingivitis in institutionalized children

Among studies carried out in Asia; in India, Thetakala *et al*[62] carried out a comparative study in 2017 among children aged 6 to 15 years old residing in an orphanage and children living with their parents and found the prevalence of gingival bleeding at 79.5% and 71.4% respectively. They concluded that there was a dire need for oral health programs to be implemented in these institutions. In contrast, Kavayashree and Girish Babu[63] carried out a cross-sectional study in 2019 among children in an orphanage and reported the gingival health status of the children to be fairly good as 45%, 39%, and 16% of children had normal, mild, and moderate gingival score, respectively. Their findings were attributed to good oral hygiene practices among the children. In China, Gu *et al*[64] in 2014 investigated gingival bleeding and the presence of calculus in 317 institutionalized children between the ages of 4 and 17 years and reported that gingival bleeding and calculus was prevalent in 78.2% and 67.7% of the children respectively. Their findings revealed a poor oral health status among the orphans, and that preventive and therapeutic oral health interventions had been underutilized.

In Africa, a study carried out by Onigbinde *et al*[65] in 2017 to assess the periodontal status of children and adolescents between the ages of 6 and 17 years in orphanages in Nigeria reported a high prevalence of periodontal disease (63.7%), with a high percentage of calculus (60.4%). In the same report, more girls than boys had poor oral hygiene, which the authors speculated may have been a direct consequence of pubertal changes in the girls who mature earlier. A study by Rao *et al*[66] in 2008 on institutionalized street children in Tanzania, reported that 87% of the participants had

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a periodontal condition, 36% of them presented with bleeding gums, 37% had calculus and 14% had periodontal pockets of 4 to 5mm. The study reported that there was a pressing need to address the oral health needs of institutionalized children, and that educating the caregivers on oral health disease prevention may improve the children's oral health.

In Kenya, there is paucity of information on the prevalence of gingivitis among children residing in CCIs. However, various studies have been done among children in varied populations as discussed above. Among children in institutions, Theuri *et al*[67] conducted research in 2021 on 12 to 17 year olds in the juvenile system, and discovered that all the study participants had gingivitis due to inadequate oral hygiene practices.

1.2.4. Oral hygiene practices

1.2.4.1. Oral hygiene practices among children in general population

Oral hygiene practices constitute tooth brushing habits, frequency of tooth brushing, the use of fluoride-containing toothpaste, mouth rinsing after meals and frequency of changing toothbrushes. These practices aim to disrupt and alter the oral flora in order to encourage a healthy periodontium and dental tissues. While tooth brushing and flossing are the most widely used methods, wooden sticks and interdental brushes are beneficial too. It is recommended that tooth brushing should begin as soon as the first tooth appears[11], with assisted brushing recommended until the child reaches the age of 8 years, when the child has attained manual dexterity[38]. It is further recommended

to have teeth brushed twice a day for adequate plaque control, improved gingival health and prevention of dental caries[68,69].

Among some of the school-based studies carried out in Kenya, Okemwa *et al*[70] in 2010 reported that 48% of the children in the rural area of Uasin Gishu brushed their teeth twice daily, 59.1% reported using a chewing stick instead of the commercial toothbrush while use of toothpaste was reported by 38.9% of the children. The authors recommended the implementation of oral health education programs to improve oral hygiene practices of the children. Additionally, according to Kibosia *et al*[71] in 2006, the usage of toothbrushes was reported by 78% of pre-primary school children in urban areas and 35.9% in rural areas. Similarly, toothpaste usage was reported by 87.9% of urban pre-primary school children and 50% of rural pre-primary school children. The study found a significant association between dmft and tooth brushing habits and concluded that oral hygiene practices do affect the oral health status of the children.

1.2.4.2. Oral hygiene practices in institutionalized children

A study by Bansal *et al*[72] in 2015 on the oral hygiene practices among 4 to 26 year olds residing in orphanages in India, reported that although 65.9% of the study participants used a toothbrush to brush their teeth at least once a day, 55% of them did not clean their tongue. The authors concluded that in such institutions, oral health education and care programs ought to be established in order to have a positive impact on childrens' oral health behaviour and prevent future deterioration in their dental health.

Koyuncuoglu *et al*[73] in 2016 assessed the oral health status and oral hygiene practices of 55 female participants between the ages of 12 to 18 years residing in Government-operated Protection Institution in Turkey. They found that 78.2% of the females knew that dental caries could be prevented with brushing of the teeth. 50.9% of the girls used mouth washes and 20% of them used a dental floss. They further recommended that oral hygiene activities should be closely monitored to maintain the quality of oral health, because correct practice stems from proper information, which should be supported by effective application of that knowledge.

A separate study by Kahabuka and Mbawalla[74] in 2006 examined the oral health knowledge and practices of former street children of ages 7 to 16 years old in Dar-es-Salaam. At the time of the study, they found that 92% of the children brush their teeth regularly, compared to only 74% when they were living on the streets. When the children were living on the streets, nearly half of them did not use toothpaste; however, only 8% of them do not use toothpaste in the institution. This was interpreted, by the authors, to mean that access to a safe environment, guidance, and motivation can lead to improvements in oral hygiene practices.

A previously mentioned study by Edalia *et al*[50] further reported that 82% children brushed their teeth after every meal, while 10% did so twice a day and 8% brushed once a day, indicating a good understanding of oral hygiene practices. However, the researcher notes that the children's responses may have been influenced by what they thought the researcher wanted to hear.

1.2.5. Dental treatment needs

1.2.5.1. Dental treatment needs among children in general population

The term dental treatment needs refer to a population's demand for oral healthcare. Bradshaw[75] broadly described four categories of needs which include:

1. Normative need – a professional-defined need.

2. Felt need – this need equates want.

3. Expressed need/demand – when a felt need is converted into action by seeking help.

4. Comparative need – need that is determined by comparing the care received by people who have similar characteristics.

The treatment needs in this study describe the normative needs for oral health care among the study group, and they include the treatment needs of dental caries and gingivitis. Treatment needs were determined using the WHO's criteria for oral diseases surveys, in which each participant's dental treatment requirements were identified and recorded using specific codes for each need.

A local research by Chepkwony *et al*[76] in 2015 on the treatment needs of children visiting a childrens' dental clinic in Nairobi, reported that majority of the participants (87.5%) required restorations, 62.5% required pulp therapy and stainless steel crowns, 60.3% needed extractions and 44% required management of gingivitis either through oral prophylaxis and or scaling. Owino *et al*[44] in 2010 reported that the primary treatment need of the 12 year old children in Kitale was at least one surface restoration with 46.9% requiring this treatment, 38.7% required scaling and oral prophylaxis,

7.5% of the children required endodontic therapy while only 5.1% needed tooth extraction.

The observed differences in treatment needs between the studies conducted by Chepkwony *et al*[76] and Owino *et al*[44] can be attributed to the distinct settings in which the research was carried out. Chepkwony *et al*[76] conducted their study in a dental hospital, where children sought dental treatment, while Owino *et al's*[44] research was conducted in a school-based setting. These contrasting contexts highlight the importance of accurate disease diagnosis, as it serves as a basis for planning effective preventive and curative oral therapies tailored to the specific treatment needs of individuals.

1.2.5.2. Dental treatment needs for institutionalized children

There have been varied studies on the dental treatment needs among institutionalized children. Khare *et al*[77] conducted a cross-sectional study in 2012 on 883 children from 13 orphanages in India. The study revealed that 26.2% needed one surface restoration, 19% required pulp therapy, 18.3% needed 2 or more surface restored, 11.1% required dental extraction, 5.2% needed other dental interventions, 1.8% required preventive or caries arresting treatment, 0.9% of them needed fissure sealant applications. Unmet requirements for decayed teeth were shown to be high in the above study, implying very low accessibility and affordability of oral health care.

Similarly, Shanthi *et al*[78] conducted a study in 2017 on 253 children from different orphanages in Malaysia and found that a considerable proportion of the children

needed dental interventions. 22.9% of these children needed preventive and or caries arresting intervention, 19.4% required two surfaces restoration, 16.6% required fissure sealant application, 13% needed one surface restoration, 9.1% needed pulp therapy, 6.3% required orthodontic treatment, and 3.2% required tooth extraction. According to these findings, the authors concluded that there is an urgent need to implement prevention strategies for children who are living in challenging situations.

A study by Alsayeh *et al*[47] in 2020 on the dentition status and treatment needs among 238 orphans in Saudi Arabia, found that 51.3% of the children required at least one surface restored, 49.6% needed fissure sealant applications, 13.1% required two or more surfaces restored and 8.1% required dental extraction. Furthermore, 7.6% needed preventive caries arresting treatment, 2.5% required crown work, 0.4% needed veneer or laminate, 0.2% required pulp therapy. They concluded that orphaned children made insufficient use of preventative and therapeutic oral health resources.

In a cross-sectional study done among children and adolescents residing in a Ugandan orphanage, Rubin *et al*[79] reported in 2016 that although 64% of the children in deciduous dentition did not require dental treatment, 98% of those in permanent dentition needed dental treatment. This finding was attributed to a high sugar intake and poor brushing habits in the older children[79].

In Kenya, Theuri *et al*[67] conducted a study in 2021 on 152 children between the ages of 10 to 12 years old that were incarcerated in juvenile prisons. The research findings indicated that 43.1% of the children required dental restorations for one tooth surface,

while 18.4% required restoration for two tooth surfaces. Additionally, 16.4% of the children required pulp therapy, 14.5% could benefit from fluoride varnish, and 6.6% needed teeth extractions. The study also found that the majority of the participants (68.4%) required professional cleaning in the form of oral prophylaxis (31.6%) and scaling and polishing (36.8%). These high dental treatment needs were attributed to inadequate comprehensive oral healthcare and a lack of attention to long-term needs.

1.3. PROBLEM STATEMENT

Dental caries and gingivitis are the most prevalent oral health concerns affecting society and the greatest impact of these oral diseases is seen in the underprivileged and socially marginalized populations[1]. Globally, institutionalized children are reported to suffer suboptimal levels of oral health status with majority exhibiting a high dental caries prevalence[45,47] and moderate to severe gingivitis[66]. Studies show that these suboptimal levels could be multifactorial with some of the reasons being lack of parental care, lack of awareness, lack of oral health services, poverty and illiteracy[45]. However, there is limited information on the oral health status and treatment needs among institutionalized children, more so in children residing in CCIs in Kenya. This study seeks to investigate and report on the prevalence of oral diseases in these children, as well as their treatment needs.

1.4. JUSTIFICATION OF THE STUDY

Oral health studies carried out on Kenyan children have indicated that dental caries and gingivitis are the most common oral health problem. The prevalence of these oral

diseases in the general children population is reported to be high with dental caries prevalence ranging from 23.9% to 74%[35,40] and gingivitis prevalence ranging from 70.2% to 99.6%[35]. Among studies carried out in children residing in CCIs, majority of them have been done in other developing countries. There is therefore a paucity of information on oral health status of children residing in CCIs in Kenya, and thus the need to carry out this study.

According to literature, institutionalized children lack parental support which can negatively impact their oral health[19]. The current study results will not only provide a baseline information for dental caries and gingivitis prevalence but also enhance comprehension of the common oral disease pattern and treatment requirements in institutionalized populations. Additionally, the study findings may aid authorities in formulating effective oral health policies aimed at children in CCIs. This information may also be used to implement control and prevention measures for oral diseases in institutionalized children, as well as build a base to conduct additional research on other oral conditions affecting this population. Moreover, the study will contribute to the existing body of knowledge on the oral health of institutionalized children.

1.5. OBJECTIVES OF THE STUDY

1.5.1. Broad objectives

To determine the prevalence and experience of dental caries, gingivitis and treatment needs among children residing in four charitable institutions in Nairobi City County.

1.5.2. Specific objectives

1. To determine the oral hygiene status and practices among children in CCIs in Westlands and Dagoretti sub-counties.

2. To ascertain the prevalence of gingivitis among children in CCIs in Westlands and Dagoretti sub-counties.

3. To establish the dental caries prevalence and experience among children in CCIs in Westlands and Dagoretti sub-counties.

4. To determine the childrens' treatment needs for dental caries and gingivitis.

1.6. CONCEPTUAL FRAMEWORK

Independent Variables

Oral Hygiene Practices
Frequency of brushing,
tooth-brushing devices,
dentifrices used in
brushing, use of
fluoridated toothpaste.

Outcome →

Dependent Variables

Dental Caries Prevalence
and Experience
- DMFT (Decayed,
  Missing, Filled Teeth)
- dmft (decayed, missing,
  filled teeth)

Gingivitis

- Gingival index scoring
  criteria (Loe and Silness,
  1967)

Oral Hygiene Status

- Plaque index scoring
  criteria (Silness and Loe,
  1964)

Socio-demographic
Variables

Age of Child
Number of years

Gender of Child
Male or Female

1.7. STUDY VARIABLES

Variables	Measurement
Independent Variables	
Oral hygiene practices	Frequency of brushing, tooth-brushing devices, dentifrices used in brushing, use of fluoridated toothpaste.
Dependent Variables	
Dental Caries Prevalence and Experience	DMFT (Decayed, Missing, Filled Teeth) dmft (decayed, missing, filled teeth)
Gingivitis	Gingival index scoring criteria (Löe and Silness, 1967)[80]
Oral Hygiene Status	Plaque index scoring criteria (Silness and Löe, 1964)[80]
Socio-demographic Variables	
Age of child	Number of years
Gender of child	Male or Female

CHAPTER TWO: MATERIALS AND METHODS

2.1. STUDY DESIGN

This was a descriptive cross-sectional study design. An observational research method used to examine the relationship of a disease with other variables of interest in a particular population at a single point in time or over a short period of time. One measures all the factors simultaneously i.e., exposure, outcome and confounders. The outcome measure that is obtained is prevalence.

2.2. STUDY AREA

The study was conducted in two Sub-counties, Dagoretti sub-county and Westlands sub-county within Nairobi City County. Nairobi City County is the smallest in size and most populous of the 47 counties in Kenya. It is both the capital and the largest city in Kenya. It occupies an area of $696km^2$ with a population of more than 4 million occupants (population Census 2019). Nairobi City County is divided into 17 Administrative Sub-Counties, which are Westlands, Dagoretti, Langata, Kibra, Roysambu, Kasarani, Ruaraka, Embakasi South, Embakasi North, Embakasi Central, Embakasi East, Embakasi West, Makadara, Kamukunji, Starehe and Mathare. The study was derived from 4 CCIs in the Dagoretti and Westlands Sub-counties.

2.3. STUDY POPULATION

The study participants comprised of children and adolescents aged 6 to 15 years residing in the four CCIs in Westlands and Dagoretti sub-county. This age bracket was

considered to include the children in early mixed dentition, mid-mixed to late mixed dentition and those that have transitioned to permanent dentition.

2.4. SAMPLE SIZE DETERMINATION

The sample size was determined using Fisher's formula and computed as follows[81]:

$$n = \frac{\left(Z_{1-\frac{\alpha}{2}}\right)^2 p(1-p)}{d^2}$$

Where:

n = sample size

Z = value from the standard normal distribution for 95% confidence level = 1.96

p = estimated prevalence of dental caries = 0.24 (KNOHS, 2015)[35]

d = allowable error (absolute) = 0.05

Therefore:

$$n = \frac{(1.96)^2 0.24(1-0.24)}{0.05^2}$$

$$n = 280$$

However, since the sample size derived was for a study population > 10000 and the desired sample size was for a study population < 10000, the sample size was corrected for a study population < 10000 using the formula[81]:

$$n = \frac{n_0}{1 + \frac{(n_0 - 1)}{N}}$$

Where:

n = desired sample size for a study population < 10000

n_0 = sample size derived for a study population > 10000

N = estimated size of the study population (children population) = 350

Therefore:

$$n = \frac{n_0}{1 + \frac{(n_0 - 1)}{N}}$$

$$n = \frac{350}{1 + \frac{(280 - 1)}{350}}$$

$$n = 155$$

The sample size was further increased by 10% to 170 from 155 to account for attrition.

2.5.   SAMPLING METHOD

A pilot study was carried out to identify the registered CCIs which sheltered orphaned and vulnerable children in the age bracket of 6 to 15 years. The study yielded the following findings: there are 66 registered CCIs in Nairobi City County, out of which

Dagoretti sub-county has six and Westlands sub-county has three registered CCIs. Other CCIs include those who shelter children who are HIV positive, street children, pregnant adolescent girls, refugee children, orphaned and vulnerable children aged 3 to 6, orphaned infants, children with special needs, orphaned and vulnerable children with physical disability and children under rehabilitation from the juvenile system. Thus, these CCIs were omitted from the sampling due to the confounding factors.

The selection of the two sub-counties (Dagoretti and Westlands) for the study was based on purposive sampling. This method was chosen because these areas have a substantial number of orphaned and vulnerable children aged between 6 and 15 years. Simple random sampling was carried out to select two CCIs from each sub-county.

In each CCI, stratified random sampling was used to select the children. The strata were age groups 6 to 8 (early mixed dentition), 9 to 12 (mid mixed to late mixed dentition) and 13 to 15 (permanent dentition). In each stratum, an alphabetical listing of names was obtained and numbered serially. Random numbers were generated by the computer to select the requisite number of individuals in each stratum until the sample size was reached. The children whose names corresponded to the selected numbers were enrolled into the study. CCI 1 and 3 were from Dagoretti sub-county with 51 (30%) and 34 (20%) study participants enrolled respectively. CCI 2 and 4 were from Westlands sub-county with 52 (30.6%) and 33 (19.4%) study participants respectively.

2.5.1. Inclusion criteria

1. Children aged between 6 and 15 years.

2. Children in CCIs where the administrative authority gave consent.

3. Children who assented to the study.

4. Children who had resided in the CCI for a period not less than 3 months.

2.5.2. Exclusion criteria

1. Children with any underlying medical condition.

2.6. DATA COLLECTION TOOLS AND TECHNIQUES

2.6.1. Questionnaire

A modified questionnaire adopted from WHO simplified oral health questionnaire for
children (2013) (Appendix 3), which included both open and closed ended questions.
The PI used the questionnaire in a face-to-face interview with the caregiver at each
CCI to collect data on the childrens' social demographic variables and dietary
practices. The responses for the oral hygiene practices for the children in the age
bracket of 6-8 years was given by the caregiver as a proxy to the children, whereas the
participants aged 9 and above provided their own response. The questionnaire was
pre-tested on caregivers of children of a similar age at the University of Nairobi Dental
Hospital. The aim of the pre-test was to check the suitability, simplicity and ease of
understanding as well as to estimate the time taken to complete the questionnaire.

2.6.2. Clinical examination procedure

The PI conducted a clinical examination to determine the oral health status of the study participants. The data gathered was recorded on a modified WHO (2013) clinical assessment form for children (Appendix 3). The PI carried out the examination of the oral hygiene status, gingival health status, dental caries status of the children while the findings were recorded by a trained and pretested assistant using the forms. The oral examination was conducted under natural light at each respective CCIs, with the child seated upright on an office chair. FDI tooth notation was used for teeth identification. Clean and sterile instruments were used which consisted of latex gloves, mouth mirrors, community periodontal index (CPI) probes, sickle shaped dental explorer. The aseptic technique was observed closely.

For every participant, the oral hygiene status was assessed first by determining the presence and intensity of plaque present on the index teeth (16, 12, 24, 36, 32 and 44) as per Silness and Löe[80]. This was achieved through visual examination and gently walking the CPI probe on the buccal and lingual surfaces of the index teeth. The PI then assessed the gingival health by carefully inserting the CPI probe between the gingiva and the tooth. This was followed by full extent exploration of the sulcus by allowing the probe to follow the anatomical contour of the surface of the root to determine the presence or absence of bleeding. Both the buccal/labial and palatal/lingual aspects of the index teeth were examined and the findings were recorded using the gingival index scoring criteria as described by Löe and Silness[80]. The related treatment needs for oral hygiene and gingival health status were recorded using a modified Periodontal Treatment Needs Index.

In determination of dental caries, the PI used visual and tactile examination to examine all the teeth starting from the first quadrant, second quadrant, third quadrant and finishing with the fourth quadrant. Individual teeth were dried using sterile gauze and the examination followed an orderly manner from one tooth to the adjacent tooth in each quadrant. The sickle shaped dental explorer was used to confirm visual evidence of caries on the tooth surface(s). Following a systemic approach, each tooth was recorded as decayed, missing or filled (dmft) or Decayed Missing or Filled (DMFT) for deciduous and permanent teeth respectively. The related dental treatment needs for each participant was noted and recorded using a modified dental treatment needs index.

2.6.3. Reliability and validity

The Principal Investigator (PI) was calibrated for the clinical examination by an experienced paediatric dentist on diagnosis of dental caries and determination of the presence of plaque and gingivitis. The calibration was carried out on children and adolescents of a similar age during the pre-testing exercise at the University of Nairobi Dental Hospital. A Cohen's Kappa coefficient was used to determine the inter-examiner reliability and the scores of 0.90 were achieved for plaque scores, 0.95 for gingivitis, 1.0 for dmft/DMFT, 0.97 for dental caries treatment needs and 1.0 for treatment needs related to gingivitis in the participants. This showed good consistency and minimal variability.

The intra-examiner consistency of the PI was done by re-examining every tenth child during the data collection period. The Cohen Kappa Scores were calculated and the

mean values were: 0.88 for plaque scores, 0.96 for gingivitis, 0.97 for dmft/DMFT, 0.97 for dental treatment needs, and 1.0 for treatment needs related to gingivitis in the participants.

A research assistant who aided in data recording was trained and pretested by the PI. Training included an overview of the study, data recording into the questionnaires and assistance with disinfection and sterilization of instruments and infection control.

2.6.4. Quality assurance

1. The data collection forms were checked by the PI for completeness and accuracy prior to data entry.
2. Once data entry had been done into the computer, 15% of the questionnaires were sampled for double entry.
3. Additionally, the dataset was checked for any logical or typographical errors.

2.6.5. Security of data

All information collected was coded and password protected whereas filled questionnaires were arranged in folders and kept in lockable drawers for confidentiality. Only the principal investigator (PI) had access to the information.

2.6.6. Minimization of errors and biases

All examinations were carried out by the Principal Investigator (PI) and the findings recorded in the recording schedules by the trained and pretested assistant.

2.7. DATA ANALYSIS AND PRESENTATION

Data was entered into a computer database and analyzed using Statistical Package for Social Sciences (SPSS) version 25 for Microsoft Windows. The descriptive statistics applied to the continuous data were summarized as range, mean ± standard deviation while categorical data in percentage. Continuous variables were compared by t-test and one-way analysis of variance (ANOVA) and the significance of mean difference between the groups was done by Tukey's post hoc test after ascertaining the normality and homogeneity of variances by Shapiro-Wilk test and Levene's test, respectively. Categorical variables were compared by Chi-square ($\chi2$) and Fishers exact test. All statistical tests and hypothesis testing were determined at 95% Confidence Interval (CI) and $p < 0.05$ was considered statistically significant. Data was presented in form of statements, tables, graphs and pie charts.

2.8. ETHICAL CONSIDERATION

Approval for the study was sought from Kenyatta National Hospital and University of Nairobi Ethical and Research Committee (KNH-UoN ERC), reference number: P858/11/2021. A license to conduct the study was also obtained from the National Commission for Science Technology and Innovation (NACOSTI), reference number:

102503. Further permission was granted from the Ministry of Public Service, Gender, Senior Citizen Affairs and Special Programmes in Nairobi City County, reference number: CS/10/10/14 (84).

Participation in the study was voluntary and written consent was obtained from the administrative authority of the CCIs. An informed oral assent was obtained from the selected participants prior to commencement of the study. Confidentiality of the participants was ensured by allocation of identification numbers on the forms. No names were included in the questionnaire. In addition, numbers 1 to 4 were assigned to the selected CCIs to provide additional safeguarding measures for the anonymity of the children.

Oral health education was given to all the children and caregivers on the day of data collection. Children in need of dental treatment were referred to the nearest dental facilities for management or to the University of Nairobi Dental School Hospital. No monetary gifts were given to the participants or the institutions.

The information obtained was used for the purposes of the study alone. Dissemination of the study findings will be done through conferences, workshops and scientific publications to target stakeholders such as oral health providers, the Ministry of Health, the Ministry of Education and the Ministry of Public Service, Gender, Senior Citizen Affairs and Special Programmes.

CHAPTER THREE: RESULTS

3.1. SOCIO-DEMOGRAPHIC CHARACTERISITICS

An equal number of participants were drawn from the sub-counties of Dagoretti and Westlands of Nairobi City County and the results discussed collectively. Out of the 170 participants in the study, 86 (50.6%) were males and 84 (49.4%) were females. The age of the study participants ranged between 6 – 15 years with a mean age of 10.7 (SD of 2.9 years). The participants were thereafter, stratified into three age groups: 6 – 8 years ($n = 56$, 32.9%), 9 – 12 years ($n = 54$, 31.8%) and 13 – 15 years ($n = 60$, 35.3%), with gender distribution as shown in Figure 1. The 6 to 8 year old were used to study the early mixed dentition, 9 to 12 for mid-mixed to late mixed dentition and 13 to 15 were used to study children in early permanent dentition.
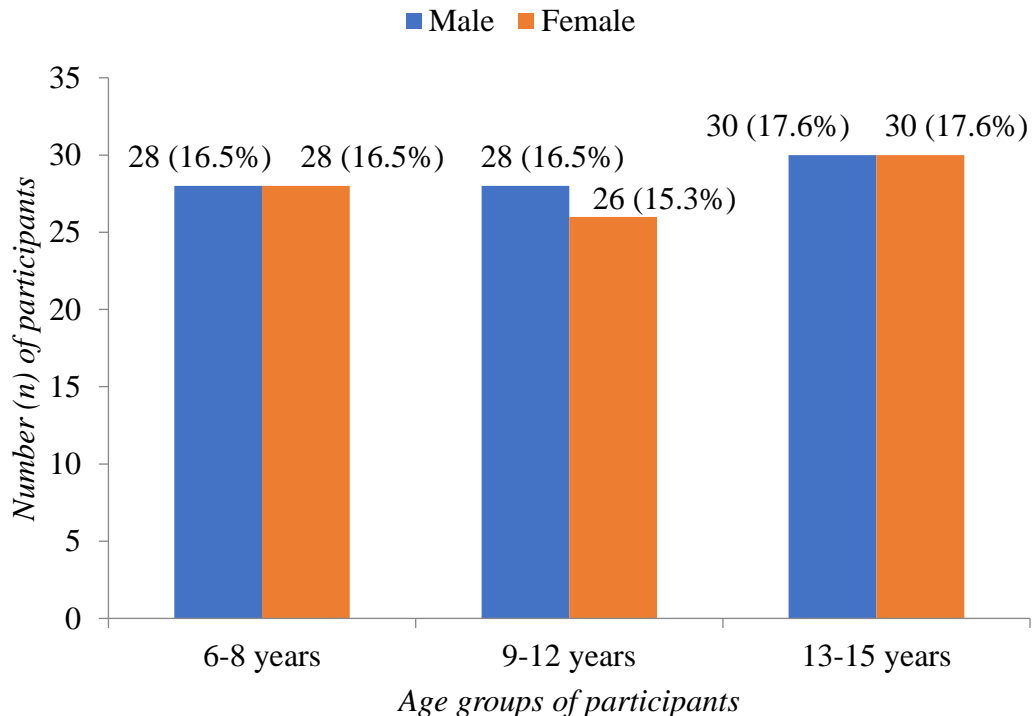
Figure 1. *Distribution of participants by age groups and gender (n=170)*

3.2. SNACKING PATTERNS

The participants' daily food consumption commonly included sugary foods such as cakes and pastries (49.4%) and tea with sugar (49.4%) followed by fresh fruit (19.4%). Soft drinks, jam/honey, chewing gum containing sugar, sweets/chocolates and milk with sugar were however consumed occasionally. The snacking patterns were considered collectively and a summary of the consumed sugary foods/drinks is as shown in Table 1.

Table 1: *A summary of the distribution of the frequency of sugary food and drinks consumed by the study participants. (n = 170).*

Food/Drink	Frequently n(%)	Occasionally n(%)	Never n(%)	Total n(%)
Fresh fruit	33(19.4)	137(80.6)	0	170(100)
Biscuits, Cookies, Cakes, Sweet buns, Bread etc.	84(49.4)	86(50.6)	0	170(100)
Soft drinks	0	118(69.4)	52(30.6)	170(100)
Jam/Honey	0	67(39.4)	103(60.6)	170(100)
Chewing gum containing sugar	0	118(69.4)	52(30.6)	170(100)
Sweets/Chocolates	0	170(100)	0	170(100)
Milk with sugar	0	34(20.0)	136(80.0)	170(100)
Tea with sugar	84(49.4)	86(50.6)	0	170(100)

Frequently; Several times a day/every day.

Occasionally; Several times a week/Once a week/Several times a month.

3.3. ORAL HYGIENE PRACTICES

Although, all the study participants brushed their teeth using a conventional toothbrush and toothpaste,140 (82.4%) reported to brushing their teeth once a day, 15 (8.8%)

brushed several times a week while 14 (8.2%) brushed twice or more times a day and one participant (0.6%) reported to brush once a week as shown in Figure 2.

As reported by the caregivers, the study participants from 2 CCIs (n = 85, 50.0%) used fluoridated toothpaste, while for the study participants in the other 2 CCIs (n = 85, 50.0%) the caregivers did not know if the toothpaste was fluoridated or not. None of the study participants were supervised on brushing.
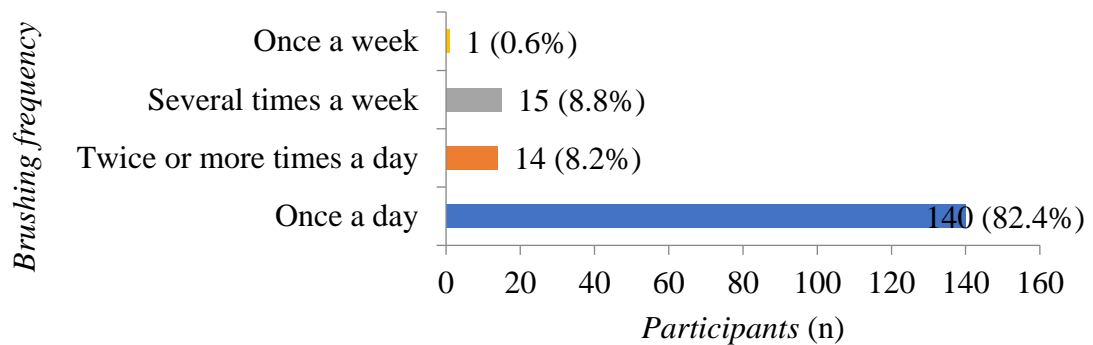
Figure 2. Brushing frequency among participants (n = 170).

3.3.1. Oral hygiene practices by age

Table 2 below summarizes the study participants' oral hygiene practices by the age groups.

Table 2: *Comparison of the study participants' oral hygiene practices by age groups (n = 170).*

Oral hygiene practice		n(%)	Age group (years)			Statistical test (95% CI)
			6 - 8	9 - 12	13 - 15	
Tooth brushing	Several times a week	16(9.4)	0	6(3.5)	10(5.9)	*Fisher's = 2.138 p = 0.726*
	Once a day	140(82.4)	56(33)	42(24.7)	42(24.7)	
	2 or more times a day	14(8.2)	0	6(3.5)	8(4.7)	
Fluoridated toothpaste	Yes	85(50.0)	28(16.5)	27(15.9)	30(17.6)	*$X^2 = 0.001$ p = 0.999*
	Don't know	85(50.0)	28(16.5)	27(15.9)	30(17.6)	

3.4. ORAL HYGIENE STATUS

Oral hygiene status was evaluated using plaque scores as described by Silness and Löe[80]. The plaque scores of the study participants ranged from 1.0 to 2.8 with a mean of 2.1 ($\pm$ 0.4 *SD*) which is indicative of poor oral hygiene. This data is presented in Table 3.

Table 3: *Summary of study participants' plaque scores (n = 170).*

Plaque category	Frequency (n)	Percentage (%)
Excellent (0)	0	0
Good (0.1 – 0.9)	0	0
Fair (1.0 – 1.9)	60	35.3
Poor (2.0 – 3.0)	110	64.7

3.4.1. Oral hygiene status by age groups

The oral hygiene status of the study participants was further compared by age groups. ANOVA test elicited a statistically significant difference in the plaque scores in the three age groups [ANOVA ($F(2, 167) = 7.532$, $p < .001$)]. A Tukey post hoc test revealed that the plaque scores were statistically significantly lower in 6 – 8 years group (2.01 ± 0.39, $p < .001$) and 9 – 12 years group (2.06 ± 0.37, $p = 0.013$) compared to 13 – 15 years group (2.26 ± 0.37, $p < .001$). There was no statistically significant difference between the 6 – 8 years and 9 – 12 years groups ($p = 0.720$). Table 4 below shows the study participants' oral hygiene status by their age group.

Table 4: *Comparison of the study participants' oral hygiene status by age groups (n = 170).*

Oral hygiene status	n(%)	Age group (years)			Statistical test (95% CI)
		6 - 8	9 - 12	13 - 15	
Fair	60 (35.3)	28 (16.5)	21 (12.4)	11 (6.5)	$X^2 = 13.166$, df = 2
Poor	110 (64.7)	28 (16.5)	33 (19.4)	49 (28.8)	$p = 0.001$
Total	170 (100)	56 (32.9)	54 (31.8)	60 (35.3)	

3.4.2. Oral hygiene status in relation with oral hygiene practices

There was a statistically significant difference in plaque scores among the tooth brushing frequency groups as determined by one-way ANOVA ($F(2, 167) = 14.080$, $p < .001$). A Tukey post hoc test revealed that the plaque scores were significantly higher in study participants who brushed several times a week (2.41 ± 0.27, $p < .001$) and once a day (2.13 ± 0.35, $p < .001$) compared to brushing twice or more times a

day (1.60 $\pm$ 0.44, $p < .001$). The oral hygiene status of all the participants in relation to their oral hygiene practices is provided in Table 5.

Table 5: Comparison of the study participants' oral hygiene status by oral hygiene practices (n = 170).

Oral hygiene practice		n%	Plaque score		Statistical test (95% CI)
			$\overline{X}$	SD	
Tooth brushing	Several times a week	16 (9.4)	2.41	0.27	*F = 20.723*, df = 2, 167 p < .001*
	Once a day	140 (82.4)	2.13	0.35	
	2 or more times a day	14 (8.2)	1.60	0.44	

3.5. GINGIVITIS

The prevalence of gingivitis among the study participants was 99.4% (n = 151, 88.8%) with majority having moderate gingivitis as illustrated in Figure 3 below. There was no significant difference in the prevalence of gingivitis among males and females. However, the males exhibited a slightly higher prevalence (50.6%) compared to the females (48.8%). The gingival index, according to Löe and Silness[80], ranged from 0 to 2.1 with a mean of 1.4 ($\pm$ 0.3 *SD*).
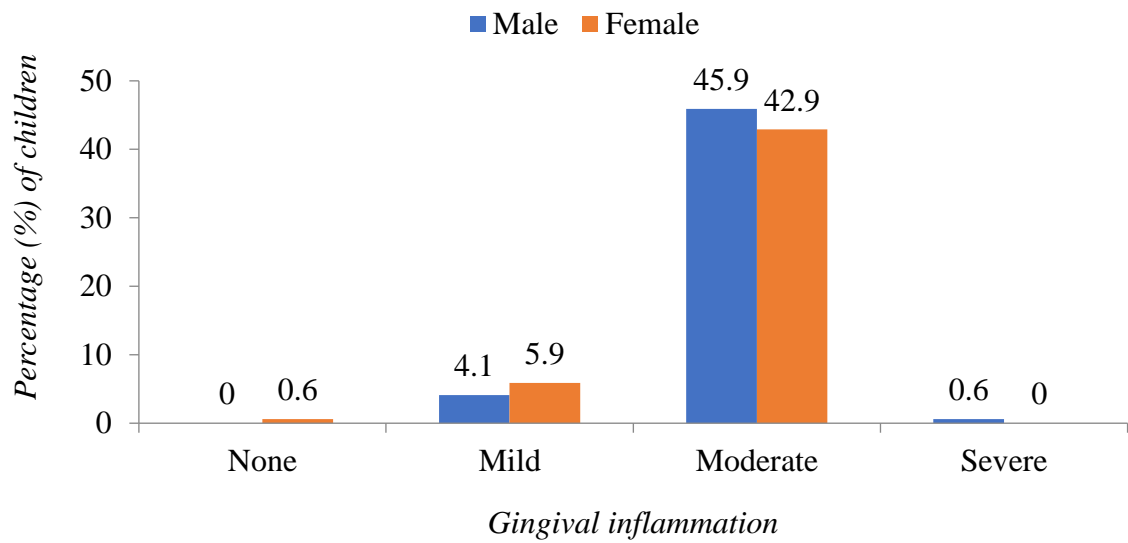
Figure 3. *Prevalence of gingivitis by gender (n = 170).*

3.5.1. Gingivitis by age and gender

There was a statistically significant difference in gingival index in the three age groups as determined by one-way ANOVA ($F(2, 167) = 3.189$, $p = .044$). A Tukey post hoc test revealed that the gingival index was significantly lower in $6 – 8$ years group (1.37 ± 0.21, $p = 0.050$) compared to $9 – 12$ years (1.48 ± 0.24, $p < .050$) and $13 – 15$ year old (1.46 ± 0.26, $p < .050$) as shown in Table 6 below.

Table 6*: Comparison of the study participants' gingival index by age and gender (n = 170).*

Characteristics		n(%)	Gingival index		Statistical test
			$\overline{X}$	SD	(95%) CI
Age group	6 – 8 years	56 (32.9)	1.37	0.21	*F = 3.189*, df = 2, 167 p = 0.044*
	9 – 12 years	54 (31.8)	1.48	0.24	
	13 – 15 years	60 (35.3)	1.46	0.26	
Gender	Male	86 (50.6)	1.45	0.23	*t = 0.545, df = 168 p = 0.587*
	Female	84 (49.4)	1.43	0.25	

3.5.2. Gingivitis and oral hygiene practices

The brushing frequency in relation to the occurrence of gingivitis is as shown in Table 7. The results report that there was a significant difference in gingival index with tooth brushing frequency as determined by one-way ANOVA ($F(2, 167) = 26.051, p < .001$). A Tukey post hoc test revealed that the gingival index was significantly lower in study participants who brushed twice or more times a day (1.11 ± 0.19, p < .001) and once a day (1.44 ± 0.22, p < .001) compared to brushing several times a week (1.68 ± 0.19, p < .001).

Table 7: *Comparison of study participants' gingival index by oral hygiene practice (n = 170).*

Oral hygiene practice		n%	Gingival index		Statistical test
			$\overline{X}$	SD	(95% CI)
Tooth brushing	Several times a week	16 (9.4)	1.68	0.19	*F = 26.051*,*
	Once a day	140 (82.4)	1.44	0.22	*df = 2, 167*
	2 or more times a day	14 (8.2)	1.11	0.19	*p < .001*

3.5.3. Gingivitis and oral hygiene status

The study participants with high plaque scores had statistically significantly higher gingival index (1.50 ± 0.22) compared to study participants with low plaque scores (1.31 ± 0.23), $t(168) = 5.257, p < .001$. The association between the occurrence of gingivitis and oral hygiene status of the participants is as exhibited in Table 8.

Table 8*: Comparison of study participants' gingival index by oral hygiene status (n = 170).*

Oral hygiene status	n%	Gingival index		Statistical test (95% CI)
		$\overline{\text{X}}$	SD	
Fair	60 (35.3)	1.31	0.23	*t = 5.257*,*
Poor	110 (64.7)	1.50	0.22	*df = 168, p < .001*

3.6. DENTAL CARIES

3.6.1. Dental caries prevalence and experience

The overall prevalence of dental caries was 75.9%. The males had a higher prevalence (41.2%) compared to the females (34.7%). Chi-Square test showed a significant difference in dental caries between the males and females; rate ratio 95% CI; 0.73 – 1.79, p = 0.049. Among the age groups, the 13 to 15 year olds had a slightly lower prevalence of dental caries (24.1%) compared to the 6 to 8 year old (25.9%) and 9 to 12 year olds (25.9%) as shown in Figure 4 below. Chi-Square test showed a non-significant difference in dental caries prevalence among the age groups; rate ratio 95% CI; 0.51 – 1.67, p = 0.780.
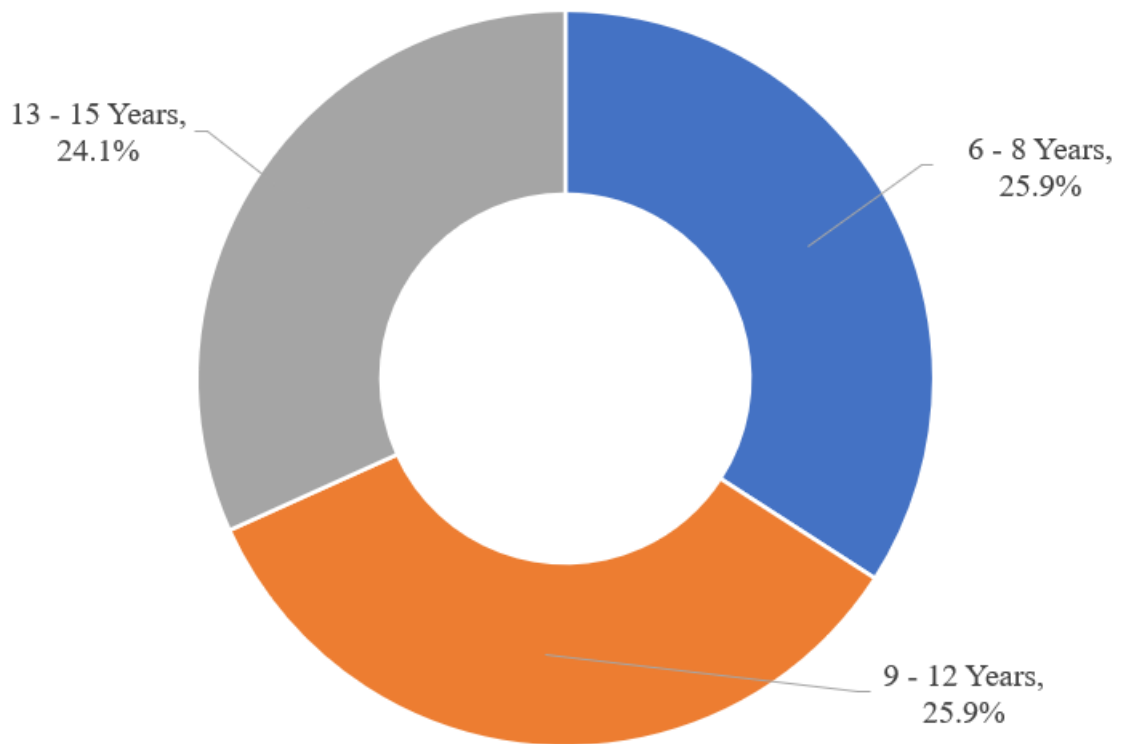
Figure 4. *Distribution of dental caries by age groups (n = 170)*

Decayed teeth accounted for the highest component of the dmft and DMFT indices in both dentitions as demonstrated in Table 9.

Table 9: *Distribution of decayed, missing and filled teeth per dentition*

	DMFT components	n = 3408	%
	D	188	5.5
	M	4	0.12
	F	3	0.09
Category			
	dmft components	n = 920	%
	d	151	16.4
	m	13	1.4
	f	0	0

3.6.2. Dental caries experience in deciduous dentition

The mean dmft was 0.96 ($\pm$1.76 SD). The component of decayed teeth was 0.89 ($\pm$1.59 SD) and missing teeth was 0.08 ($\pm$0.38 SD). There were no filled teeth in the deciduous dentition. Table 10 shows the distribution of dmft with the age and gender in the deciduous dentition.

Table 10: Comparison of study participants' dental caries experience (dmft) for deciduous dentition by age and gender (n = 170).

Characteristics		n(%)	dmft		Statistical test
			$\overline{X}$	SD	(95%) CI
Age group	6 – 8 years	56 (32.9)	2.43	2.30	*F = 44.841*, df = 2, 167*
	9 – 12 years	54 (31.8)	0.44	0.90	
	13 – 15 years	60 (35.3)	0.07	0.31	*p < .001*
Gender	Male	86 (50.6)	0.95	1.59	*t = 0.084, df = 168*
	Female	84 (49.4)	0.98	1.93	*p = 0.933*

3.6.3. Dental caries experience in permanent dentition

The mean DMFT was 1.15 ($\pm$1.49 SD). The mean decayed teeth among the participants was 1.11 ($\pm$1.44 SD) while the mean missing teeth was 0.02 ($\pm$0.15 SD). There were three filled teeth with a mean of 0.02 ($\pm$0.13 SD) in the permanent dentition. Table 11 shows the distribution of DMFT with the age and gender in the permanent dentition.

Table 11: *Comparison of study participants' dental caries experience (DMFT) for permanent dentition by age and (n = 170).*

Characteristics		n(%)	DMFT		Statistical test
			$\overline{\text{X}}$	SD	(95%) CI
Age group	6 – 8 years	56 (32.9)	0.13	0.38	*F = 25.502*, df = 2, 167*
	9 – 12 years	54 (31.8)	1.57	1.57	*p < .001*
	13 – 15 years	60 (35.3)	1.72	1.59	
Gender	Male	86 (50.6)	1.28	1.58	*t = 1.170, df = 168*
	Female	84 (49.4)	1.01	1.38	*p = 0.244*

3.6.4. Pattern of tooth decay in permanent teeth

In the maxillary arch, 16 and 26 were the teeth with the highest caries prevalence of 19.4% and 15.9% respectively as illustrated in Figure 5 below.
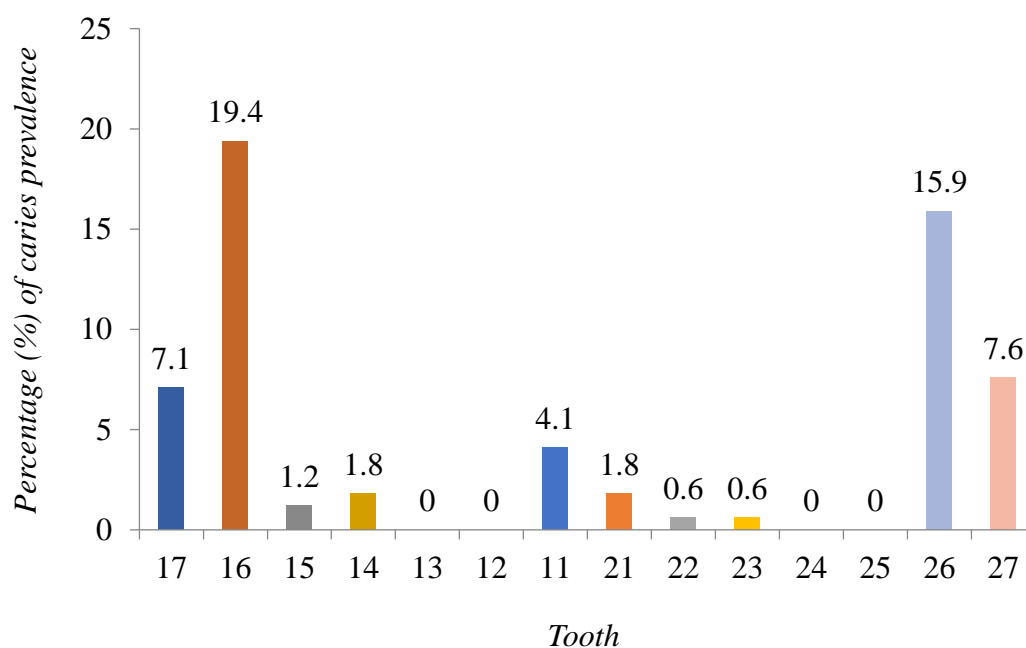
Figure 5. *Pattern of tooth decay in the maxillary arch for permanent tooth (n = 1701).*

In the mandibular arch, 36 and 46 were the teeth with the highest caries prevalence of 23.0% and 18.8% respectively as shown in Figure 6 below.
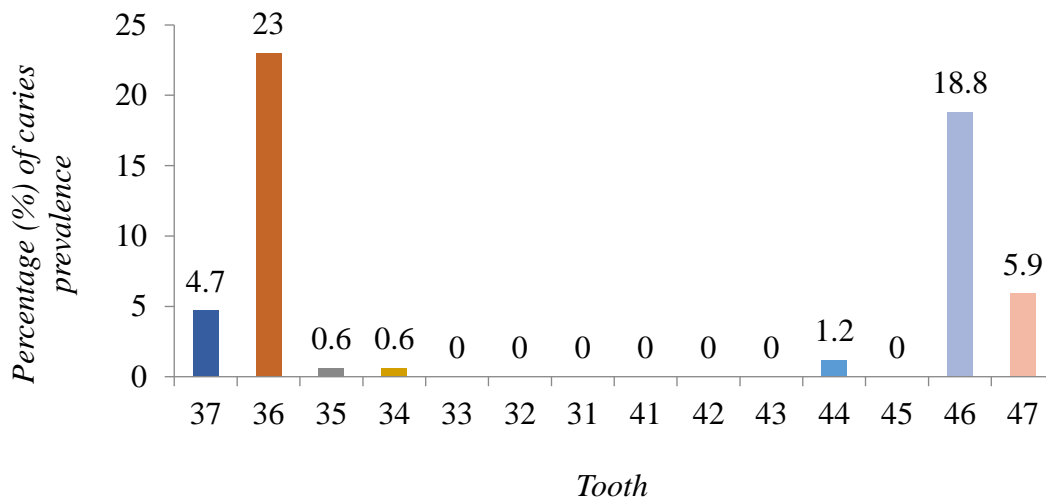
Figure 6. Pattern of tooth decay in the mandibular arch for permanent tooth (n = 1707).

3.6.5. Pattern of tooth decay in the deciduous dentition

In the maxillary arch, 55 and 65 were the teeth with the highest caries prevalence of 2.4% and 4.7% respectively as shown in Figure 7 below.
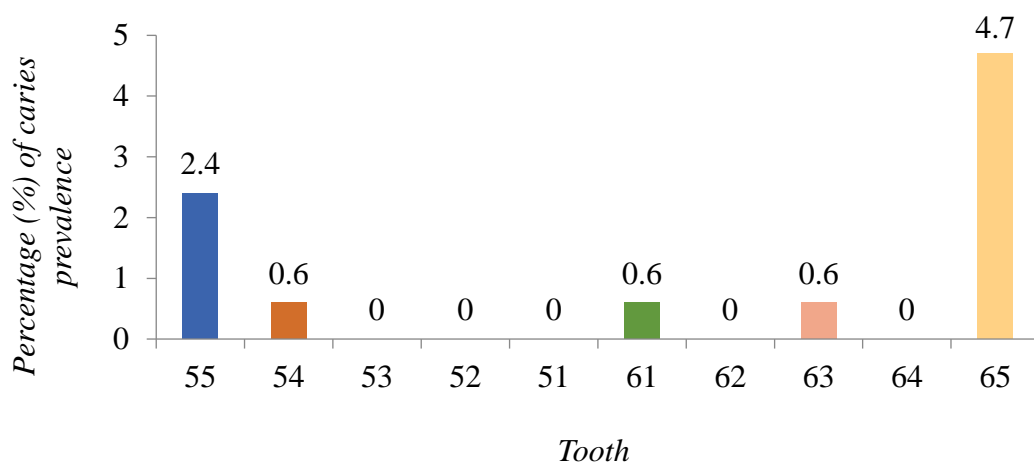
Figure 7. Pattern of tooth decay in the maxillary arch for deciduous tooth (n = 468).

In the mandibular arch, 75 and 85 were the teeth with the highest caries prevalence of 4.1% and 3.5% respectively as illustrated in Figure 8 below.
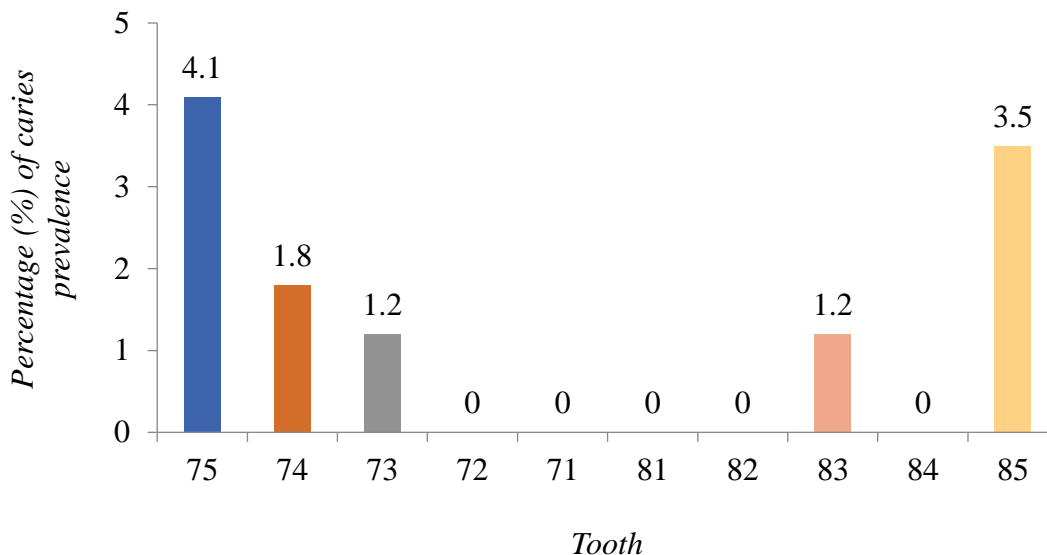
Figure 8. Pattern of tooth decay in the mandibular arch for deciduous tooth (n = 452).

3.6.6. Dental caries and oral hygiene practices

There were statistically significant differences in dental caries prevalence and experience among the study participants in relation to different brushing frequencies ($F = 4.548$, $df = 3, 166$, $p = 0.004$) and the use of fluoridated toothpaste ($t = 2.040$, $df = 168$, $p = 0.043$). A comprehensive association of this data is shown in Table 12.

Table 12: *Comparison of study participants' dental caries experience (dmft/DMFT) by oral hygiene practice (n = 170).*

Oral hygiene practice		n(%)	Dental caries		Statistical test (95% CI)
			$\overline{X}$	SD	
Tooth brushing	Once a week	1 (0.6)	5.00	.	*F = 4.548*, df = 3, 166 p = 0.004*
	Several times a week	15 (8.8)	2.47	1.64	
	Once a day	140 (82.4)	2.21	1.97	
	2 or more times a day	14 (8.2)	0.50	0.76	
Fluoridated toothpaste	Yes	85 (50.0)	1.81	1.94	*t = 2.040*, df = 168 p = 0.043*
	Don't know	85 (50.0)	2.41	1.90	

3.6.7. Dental caries experience and oral hygiene status

The study participants with poor oral hygiene status had significantly higher dmft/DMFT (1.47 ± 2.05 and 1.34 ± 1.57 respectively) compared to study participants with fair oral hygiene status (0.69 ± 1.52 and 0.80 ± 1.27 respectively). Table 13 and 14 illustrate the study participants dmft/DMFT indices by their oral hygiene status respectively.

Table 13: *Comparison of the study participants' dental caries experience (dmft) by oral hygiene status (n = 170).*

Oral hygiene status	n%	dmft		Statistical test (95% CI)
		$\overline{X}$	SD	
Fair	60 (35.3)	0.69	1.52	*t = 2.567*, df = 168, p = 0.006*
Poor	110 (64.7)	1.47	2.05	

Table 14: *Comparison of the study participants' dental caries experience (DMFT) by oral hygiene status (n = 170).*

Oral hygiene status	n%	DMFT		Statistical test (95% CI)
		$\overline{X}$	SD	
Fair	60 (35.3)	0.80	1.27	*t = 2.270*, df = 168,*
Poor	110 (64.7)	1.34	1.57	*p = 0.024*

Chi-Square test was used to determine the association between oral health status and presence of dental caries among the study participants. Poor oral hygiene was found to be significantly associated with a high occurrence of dental caries, $X^2(1) = 4.553$, $p = 0.033$.

3.7. TREATMENT NEEDS

3.7.1. Treatment needs for gingivitis

The study participants needed intervention for gingivitis where 140 (82.4%) required professional cleaning and 30 (17.6%) required improvement of personal oral hygiene. This is illustrated in Figure 9 below.
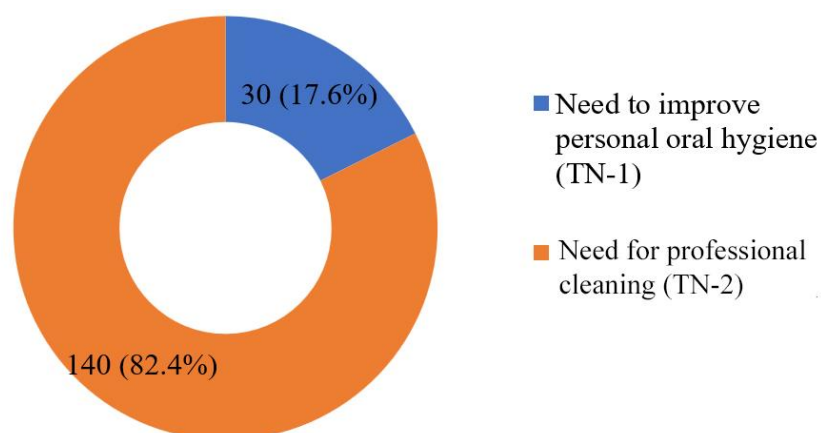
Figure 9. *Distribution of the study participants' treatment needs for periodontal disease (n = 170).*

3.7.2. Treatment needs for dental caries

Amongst the participants who needed treatment for dental caries ($n = 129$, 75.9%), majority required restorations (76.7%). The treatment needs for dental caries are illustrated in Table 15.

Table 15: Distribution of the study participants' dental caries treatment needs by gender (n = 129).

Treatment needs	n(%)	Gender	
		Male n(%)	Female n(%)
Extraction	7 (5.4)	5 (3.9)	2 (1.5)
Restoration	99 (76.7)	51 (39.5)	48 (37.2)
Stainless steel crown	3 (2.3)	3 (2.3)	0
Pulp therapy for posterior teeth	15 (11.6)	10 (7.7)	5 (3.9)
Pulp therapy for anterior teeth	4 (3.1)	1 (0.8)	3 (2.3)
Radiograph required before treatment plan	1 (0.8)	0	1 (0.8)
Total	129 (100)	70 (54.0)	59 (46.0)

CHAPTER FOUR: DISCUSSION, CONCLUSION AND RECOMMENDATION

4.1 DISCUSSION

The placement of children in Charitable Children's Institutions (CCIs) in Kenya is a multifaceted issue influenced by various social, economic, and cultural factors. Common reasons for children being placed in these institutions include loss of parental care, poverty, abandonment, neglect, and abuse. Additionally, conflicts, displacement, and natural disasters have contributed to the rising number of children residing in CCIs.

It is widely recognized that institutionalization has a detrimental impact on children's developmental outcomes and well-being, resulting in considerable differences in their oral health. The present study evaluated the prevalence of dental caries, gingivitis, and treatment needs among children living in four CCIs located in Dagoretti and Westlands sub-counties within Nairobi City County.

4.1.1   Socio-demographic characteristics

Out of the 170 participants recruited, 86 (50.6%) were males and 84 (49.4%) were females. The age range of the children was 6 to 15 years with a mean age of 10.7 ± 2.9, and this age bracket was considered to include the children in early mixed dentition, mid-mixed to late mixed dentition and those that have transitioned to permanent dentition. This age distribution is similar to a study in Jaipur City, India in

2014 which was conducted among 180 orphanage children (85 males and 95 females) between the ages of 5 to 15 years old[45].

The fact that all the participants had stayed in their institutions for more than three months at the time of the research indicates that they were settled in their environment and likely to be familiar with the routines and activities of the CCIs. However, the children had different duration of stay at the CCIs, which may have had varied impact on their overall oral health. Nevertheless, it was difficult to ascertain their exact duration of stay.

4.1.2   Oral hygiene practices

The prevention of oral diseases involves good oral hygiene, which can be achieved by the reduction or elimination of dental plaque from the tooth surfaces. The most effective method of achieving this is through mechanical means, such as tooth brushing. All the study participants used conventional toothbrushes and toothpaste to brush their teeth, however, the majority of the participants (82.4%) brushed their teeth once a day, and only 14 (8.2%) children brushed two or more times a day. Similarly, in a study done on institutionalized children in Tanzania, 92% of them brushed their teeth daily[74]. In contrast, Okemwa *et al*[70] reported that 48% of the children in rural area of Uasin Gishu brushed their teeth twice daily. He further stated that only 38.9% of the children used toothpaste. Despite reporting a high frequency of toothpaste and toothbrush use, a high percentage of gingivitis (99.4%) and dental caries (75.9%) was found in these children. This may be attributed to improper brushing technique and lack of individual supervision.

Research has shown that using fluoride toothpaste regularly can significantly lower the incidence and severity of dental caries[82]. For the prevention, arrest, and treatment of dental caries, toothpaste with a fluoride concentration of between 1,000 and 1,500 ppm is effective[83]. However, as much as all the participants in this study reported using a toothpaste, only half of them used fluoridated toothpaste and the other half did not know if the toothpaste had fluoride or not. This is in contrast to the Kenya National Oral Health Survey where although the use of toothpaste was high among the respondents (82.7%), 72.3% of them used fluoridated toothpaste and 5.4% used non-fluoridated toothpaste[35]. Nevertheless, most of the commercially available kinds of toothpaste in Kenya are fluoridated and, likely the meaning of fluoridated toothpaste may not have been understood.

The current study population was found to have a high consumption of sugar, particularly in the form of cakes, pastries and sugar in tea. The significance of diet in the development of dental caries is critical, with frequent and prolonged consumption of sucrose, glucose, and fructose having been linked to a high prevalence of dental caries in children. Tea with sugar was the most frequently consumed beverage, and this is at par with a previous Kenyan hospital-based study where 93.7% of the children consumed tea with sugar[76]. Sugar consumption may have been elevated due to ease in its availability and accessibility[70]. The increased consumption of sugar may also be attributed to an increase in its donation from benefactors. The findings of this study suggest that the high sugar intake among the children in this population is a major risk

factor for dental caries, and that there is a need for intervention to reduce sugar consumption and promote oral hygiene practices.

The WHO recommends limiting the intake of free sugars to less than 10% of total energy intake and preferably to less than 5% for additional health benefits[29]. The high consumption of cakes and pastries seen in this study is concerning, as they are typically high in sugar and low in nutrients, and a contributory factor to the prevalence of dental caries in this population. Previous studies have shown that regular consumption of sweet snacks and desserts is associated with an increased risk of dental caries[84]. Moreover, the high consumption of tea with sugar is likewise concerning, as sugar-sweetened beverages have also been associated with dental caries[85]. Additionally, this study also found occasional consumption of fresh fruit and milk, which is a cause for concern. Fruits are a nutrient-dense food that provide essential vitamins and minerals[86] and milk is an important source of calcium and other nutrients that are essential for maintaining healthy teeth and bones.

4.1.3   Oral hygiene status

Oral hygiene status is usually determined by the level of plaque deposits on the teeth surfaces. The plaque score of the participants in the present study had a mean of 2.1 ($\pm$ 0.4 SD) which is indicative of poor oral hygiene status. Furthermore, 64.7% of the study participants had poor oral hygiene status which contrasts with a study by Ojahanon *et al* in Nigeria where 73.7% of the institutionalized study participants between the ages of 6 to 17 years old had fair oral hygiene[87]. However, Al-Jobair *et al*

observed worse oral hygiene in Saudi Arabian orphan children[88]. This finding was attributed to ineffective brushing techniques and lack of close supervision, which can also be the case for the present study participants. In this study, the plaque score appeared to increase with increasing age and this can be attributed to inadequate oral hygiene practices in the older children. An increased prevalence of gingivitis is attributed to poor oral hygiene and further associated with teeth eruption and hormonal changes at puberty[87].

4.1.4 Gingivitis

Good oral hygiene practices help reduce the plaque scores which in turn help reduce the inflammation on the gingiva. In the present study, the prevalence of gingivitis was 99.4%. This finding is in accordance with Rao *et al*[66] and Theuri *et al*[67], who reported a significantly higher prevalence of gingivitis among institutionalized children at 87% and 100% respectively. Poor oral hygiene and lack of individualized care could have contributed to the poor gingival health in the present study population. The KNOHS[35] carried out among children aged 5 to 15 years in the general population reported a prevalence of 75.7%. This demonstrates that institutionalized children have a higher incidence of gingivitis in comparison to non-institutionalized children.

The gingival index for the male participants was slightly higher (1.45 ± 0.23SD) than in the females (1.43 ± 0.25 SD). This is similar to studies conducted to elicit gender differences between the oral hygiene of females and males[89,90] which demonstrate that the oral health behaviour of females is generally better; females are believed to be

more keen on personal grooming and cleanliness in comparison to their male counterparts. Moreover, there was an increase in the gingival index with an increase in age noted in the present study, which may be a result of poor oral hygiene practices among the older children. Where all the 6 – 8 year olds brushed once a day, some of the older children reported to brushing occasionally which can be attributed to the increase in the gingival index among the older age group. Additionally, hormonal changes that occur during puberty have an effect on the gingival tissues, resulting in an increase in inflammation of the gingiva[91].

In the present study, children who brushed their teeth twice a day had significantly lower plaque scores and thus a low gingival index (1.11 ± 0.19 SD). FDI recommends the ideal frequency of toothbrushing to be at least twice daily and this has been associated with better oral hygiene, which significantly improves the odds of developing mild plaque deposits and subsequently mild gingivitis compared to severe plaque and gingivitis associated with brushing once a day or less[82,92].

4.1.5   Dental caries

The prevalence of dental caries in the current study participants was 75.9%. This is fairly high in comparison to the national prevalence reported as 23.9% according to the KNOHS[35]. This shows that the prevalence of dental caries among children in CCIs is higher in comparison to the national average for the same population.

Despite the high prevalence, the number in severity of the teeth affected was low as evidenced by the dmft/DMFT of 0.96 (± 1.76 SD) and 1.15 (± 1.49 SD) respectively. The average intake of cariogenic foods such as cakes and pastries at 49.4% may have led to an increased prevalence, however, daily tooth brushing among 90.6% of the study participants could be associated with the lower caries experience. In comparison, Abedassar et al[49] reported a high dmft/DMFT at 4.13 (± 3.80 SD) and 1.73 (± 1.84 SD) among children in support centers in Uganda citing poor eating habits. In contrast, Ojukwu et al[48] recorded a much lower prevalence of dental caries with a mean dmft/DMFT of 0.21 (± 0.41 SD) and 0.14 (± 0.35 SD) respectively sighting a non-cariogenic diet[48]. Dietary intake of fermentable carbohydrates, which serve as a substrate for bacterial action, has long been known to play a part in the onset and progression of dental caries[26]. Eliminating these fermentable carbohydrates, which are found in confectionaries and sweetened drinks, would result in lower prevalence of dental caries.

The teeth in the permanent dentition most affected by dental caries were the 16, 26, 36, and 46. This is attributed to the fact that permanent molars are the first to erupt at around 6 years of age, making them the longest-standing teeth in the mouth. In the deciduous dentition, teeth 55, 65, 75, and 85 had the most decay. The deciduous second molars and first permanent molars have a complex occlusal anatomy of pits and fissures which serve as plaque retentive areas, making them more susceptible to dental caries. Moreover, when children under the age of eight brush their teeth without assistance, it is highly likely that they are unable to have the toothbrush reach their

most posterior teeth due to poor manual dexterity thus further increasing their risk to plaque retention and subsequently dental caries.

The prevalence of dental caries was higher among the males (41.2%) compared to the females (34.7%). The above findings are at par with a study to assess gender differences in caries experience among males and females[93], where it was observed that males had a greater burden of dental caries while the females had fewer teeth with active dental caries and more dental restorations. Interestingly, the KNOHS observed that females recorded a higher dmft/DMFT of 1.38 compared to 0.82 recorded for males[35]. The oral health behavior of females is generally better as evidenced by the gingival index (1.43 ± 0.25 SD) and thus a lower prevalence of dental caries. Moreover, the study revealed that the 13 to 15 year old age group had a slightly lower prevalence rate (24.1%) of dental caries when compared to younger age groups, which aligns with the findings of Macharia *et al*[38]. This data is significant because it helps identify age groups that could be more vulnerable to dental caries, especially among children aged 6 to 12 years. Furthermore, during this stage, children's permanent teeth are emerging, making it harder for them to maintain proper oral hygiene.

Inadequate tooth brushing and poor oral hygiene status was associated with high scores of dental caries. The children with poor oral hygiene practices had poor oral hygiene status and thus a high occurrence of dental caries. This study thus signifies the importance of adequate oral hygiene practices to reduce the incidence of dental caries which can otherwise lead to pain and discomfort.

4.1.6   Dental treatment needs

The treatment needs for gingivitis in this study showed that the majority of the participants (82.4%) required professional cleaning which involves full mouth scaling and oral prophylaxis. This is in contrast to a local study by Chepkwony *et al*[76] who reported that fewer children required dental treatment for gingivitis. This difference can be attributed to the distinct study areas. Chepkwony *et al's*[76] study was in a hospital-based setting which signifies that the study participants had their dental treatment needs addressed, unlike the children in the CCIs.

Furthermore, it was observed that the majority of the participants required restorative treatment. This is in line with the dmft/DMFT score that showed that the number of decayed teeth was relatively high, highlighting unmet dental needs amongst institutionalized children. This further supports previously reported studies of unmet dental needs in institutionalized children where factors such as poor access to dental facilities, poor preventive care or an aversion to dental treatment were recorded as barriers to seeking treatment[47,77]. Additionally, only one participant needed radiographs to determine their treatment need according to the index used which is applicable in community settings. It is highly probable that when these children seek treatment in a hospital based setting, majority of the study participants with dental caries would require radiographic evaluation prior to receiving definitive treatment[94].

Moreover, the oral health seeking behavior of the study participants was investigated and it was found that only 25.9% of them had visited a dentist before. This signifies that the study participants have high unmet treatment needs indicating a lack of

emphasis on dental treatment when considering the overall wellbeing of these children living in institutions.

4.2 LIMITATIONS

1. The study was carried out among institutionalized children from only four CCIs, thus the results cannot be generalized across all CCIs

2. Diagnosis of dental caries, gingivitis and oral hygiene status was solely based on clinical examination. Since no radiographic investigation for dental caries was used in this study, there is a probability of underestimation of dental caries as reported by Lesan[95].

4.3 CONCLUSION

In spite of the majority of this study participants (82.4%) claiming to brush at least once daily using a conventional toothpaste and toothbrush, their oral health status was poor, perhaps due to their poor oral hygiene and consumption of sugary foods. The mean plaque score of the study participants was 2.1 (+-0.4) indicative of poor oral hygiene. The prevalence of gingivitis was high at 99.4% (mean score of 1.4), and the prevalence of dental caries was also high at 75.9%, with dmft/DMFT of 0.96 and 1.15 respectively. In terms of treatment needs, the children had many unmet dental needs with majority (82.4%) requiring scaling and polishing, and restorations (76.7%).

4.4 RECOMMENDATIONS

Given that health functions have been devolved in Kenya to County Government, treatment intervention programs, such as oral health education and outreach programmes with mobile dental clinics need to be undertaken through the Health Department of the respective county governments, to address the treatment needs of institutionalized children.

There is a need to reduce the consumption of cariogenic foods and drinks and improve on the dietary habits of the children residing in CCIs to lower the prevalence of dental caries and gingivitis. Additionally, it is of utmost importance to reinforce the practice of supervised brushing amongst the younger children and place significant emphasis on the importance of twice daily brushing so as to gain maximum benefits in maintenance of oral hygiene.

A wider multi-centre study is necessary to determine the burden of oral diseases among institutionalized children. Additionally, baseline data from the above study may help in formulation of oral health care protocol in order to provide preventive and curative oral health services for institutionalized children.

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APPENDICES

Appendix 1A: Study Participant Informed Consent Form 1A – English

Date: ....

Participant code: ....

Project Title:

DENTAL CARIES, GINGIVITIS AND TREATMENT NEEDS AMONG CHILDREN IN CHARITABLE INSTITUTIONS IN NAIROBI CITY COUNTY.

Objective of the study

The objective of the study is to determine the prevalence of dental caries, gingivitis and treatment needs among children in charitable institutions in Nairobi City County.

Procedure to be followed

You shall be interviewed on the child's dietary and oral hygiene practices. Each child will be examined by trained and qualified health professionals. At the end of the study, you shall be informed of the results. The results will also be communicated to the community and sponsors, and both in local and international scientific conferences.

Risks

There are no risks anticipated in this study since no invasive procedures will be performed on your child. However, in the event of a child exhibiting psychological symptoms such as dental anxiety and fear, the child will be counselled and reassured by the PI before commencing the clinical examination.

Benefits

The children and the caregivers shall obtain free oral health education for the child, on the day of data collection. The results of this study will assist in determining the prevalence of dental caries and gingivitis among the children residing in the Children Charitable Institutions in Dagoretti sub-county and Westlands sub-county within Nairobi County. This will help in allocation of available resources on the same based

on the treatment needs of these children. The results shall also be used to advice relevant health planners in formulation of oral health programs targeting institutionalized children, with the aim of promoting and providing continuous and sustainable oral health care.

Assent process

No child will be forced to participate in the study if they are unwilling or unable to.

Confidentiality

All the information that will be obtained from the children will be confidential to protect their privacy. This will be done by giving codes hence avoiding the use of their name. The identity of any participant will not be disclosed in any public conferences, reports or publications.

Right to withdrawal

You may withdraw the child from participating at any time without suffering any consequences.

Period of study

The study will be conducted in September 2022 and the participants will be interviewed and examined only once during the period of the study.

Role of Ethics Research Committee

The role of the Kenyatta National Hospital/University of Nairobi Ethics and Research Review Committee (KNH/UON-ERRC) is to review biomedical research in order to help safeguard the dignity, rights, safety and well-being of all actual or potential research participants. A cardinal principle of research involving human participants is "respect for dignity of persons". The goals of research, while important, should never be permitted to over-ride the health, well-being and care of research participants. KHN/UON-ERRC shall takes into consideration the principles of justice. Justice requires that the benefits and burdens of research be distributed fairly among all groups

and classes in society, taking into account age, gender, socio-economic status, culture, and ethnic consideration.

Your co-operation will be highly appreciated.

Yours sincerely,

Dr Mariam Abdul Bakhrani, 0707 700852 (Principal Investigator)

Prof. Arthur Kemoli, 0722 436481 (Lead supervisor)

Kenyatta National Hospital/University of Nairobi - Ethics, research and standards committee.

Email: uonknh_erc@uonbi.ac.ke

Tel: 726300-9

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P.O. Box 20723-00202 Nairobi.

Appendix 1B: Study Participant Informed Consent Form 1B – Swahili

<u>Fomu ya Idhini ya Mshiriki wa Utafiti</u>

Tarehe: ....

Nambari ya mshiriki: ....

Jina la mradi

UFAHAMU WA UFINYAZO WA JINO, UKOLEZO WA UFIZI NA HITAJI LA MATIBABU KATI YA WATOTO KATIKA TAASISI ZA KUJALI KATIKA KAUNTI YA JIJI LA NAIROBI.

Lengo la utafiti

Lengo la utafiti huu ni kutambua kiwango cha ufinyanzi wa meno, ukolezo wa ufizi na mahitaji ya matibabu miongoni mwa watoto katika taasisi za kujali katika Kaunti ya Jiji la Nairobi.

Utaratibu wa kufuatwa

Utahojiwa kuhusu mazoea ya lishe na afya ya mdomo ya mtoto. Kila mtoto atachunguzwa na wataalamu wa afya waliofunzwa na wenye sifa. Mwisho wa utafiti, utaarifiwa matokeo. Matokeo pia yatawasilishwa kwa jamii na wafadhili, na pia katika mikutano ya kisayansi ya ndani na ya kimataifa.

Hatari

Hakuna hatari zinazotarajiwa katika utafiti huu kwa kuwa hakuna taratibu za uvamizi zitakazofanywa kwa mtoto wako. Hata hivyo, katika tukio la mtoto kuonyesha dalili za kisaikolojia kama vile wasiwasi wa meno na hofu, mtoto atashauriwa na PI kabla ya kuanza uchunguzi wa kimatibabu.

Faida

Utafiti huu unalenga kubainisha aina ya hali ambazo watoto wanakuwa nazo katika Taasisi za Msaada kwa Watoto katika Kaunti Ndogo 2, Kaunti Ndogo ya Dagoretti na Kaunti Ndogo ya Westlands ndani ya Kaunti ya Nairobi.

Hii itasaidia katika ugawaji wa rasilimali zilizopo sawa kulingana na mahitaji ya matibabu ya watoto hawa. Tutatumia matokeo kuwashauri watunga sera na wataalamu wa huduma za afya juu ya afua bora katika utoaji wa huduma ya afya ya kinywa.

Kwa kuongezea, utafiti huo unatumika kama utimilifu wa sehemu ya hitaji la Shahada ya Uzamili ya Upasuaji wa Meno katika Madaktari wa Meno ya Watoto.

Usiri

Taarifa zote zitakazopatikana kutoka kwa watoto zitakuwa siri ili kulinda usiri wao. Hii itafanywa kwa kutoa misimbo hivyo basi kuepuka matumizi ya majina yao. Utambulisho wa mshiriki yeyote hautafichuliwa katika mikutano, ripoti au machapisho yoyote ya umma.

Kipindi cha masomo

Utafiti utafanywa Septemba 2022 na washiriki watahojiwa na kuchunguzwa mara moja tu katika kipindi cha utafiti.

Jukumu la Kamati ya Utafiti wa Maadili

Jukumu la Kamati ya Mapitio ya Maadili na Utafiti ya Hospitali ya Kenyatta/Chuo Kikuu cha Nairobi (KNH/UON-ERRC) ni kukagua utafiti wa matibabu ili kusaidia kulinda hadhi, haki, usalama na ustawi wa washiriki wote halisi au wanaotarajiwa. . Kanuni kuu ya utafiti unaohusisha washiriki wa kibinadamu ni "heshima ya utu wa watu". Malengo ya utafiti, ingawa ni muhimu, hayapaswi kamwe kuruhusiwa kuendesha zaidi afya, ustawi na utunzaji wa washiriki wa utafiti. KHN/UON-ERRC itazingatia kanuni za haki. Haki inahitaji kwamba manufaa na mizigo ya utafiti isambazwe kwa usawa miongoni mwa makundi na tabaka zote katika jamii, kwa kuzingatia umri, jinsia, hali ya kijamii na kiuchumi, utamaduni na uzingatiaji wa kikabila.

Ushirikiano wako utathaminiwa sana.

Wako mtiifu,

Dr Mariam Abdul Bakhrani, 0707 700852 (Mpelelezi Mkuu)

Prof. Arthur Kemoli, 0722 436481 (Msimamizi Kiongozi)

Hospitali ya Kitaifa ya Kenyatta/Chuo Kikuu cha Nairobi - Kamati ya Maadili, utafiti na viwango.

Barua pepe: uonknh_erc@uonbi.ac.ke

Simu: 726300-9

Faksi: 725272

P.O. Box 20723-00202 Nairobi.

Appendix 1C: Consent Form (Administrative Authority)

<u>**English**</u>

...., ID No.: ....

whose role is…………………………………….…………… in the Administrative

Authority of .... I understand the aims

and the content of the study. I Agree/Disagree to let the child and I participate in the

study. I understand that this study is totally voluntary, and the child can decide to

withdraw from the study without any victimization.

Signature of the Administrative Authority*:* ....

Date: …………………….

Signature of the Principal Investigator: ....

Date: ……………………..

<u>**Swahili**</u>

...., Nambari ya Kitambulisho:................

ambaye jukumu lake ni……………………………………………… Mamlaka ya

Utawala ya ……………………………………....................... Ninaelewa malengo na

maudhui ya utafiti. Ninakubali/Sikubaliani kuruhusu mimi na mtoto kushiriki katika

utafiti. Ninaelewa kuwa utafiti huu ni wa hiari kabisa, na mtoto anaweza kuamua

kujiondoa kwenye utafiti bila dhuluma yoyote.

Saini ya Mamlaka ya Utawala: ....

Tarehe: …………………….

Saini ya Mpelelezi Mkuu: ....

Tarehe: …………………

Appendix 2A: Minor Assent Form (English)

PROJECT TITLE: DENTAL CARIES, GINGIVITIS AND TREATMENT NEEDS AMONG CHILDREN IN CHARITABLE INSTITUTIONS IN NAIROBI CITY COUNTY.

Investigator: Mariam Abdul Bakhrani

I am doing a research study about the health status of the oral cavity and treatment needs among children in charitable institutions in Nairobi. Permission will be sought to undertake this study from the Kenyatta National Hospital - University of Nairobi Ethics and Research Committee (KNH-UoN ERC).

Purpose of the study: This research study will help to understand the oral health status and oral hygiene practices among children in charitable institutions as well as provide baseline data that will be useful in making of oral health programs targeting this group. At least 170 children will be participating in this research study with you.

Procedure: 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.

Risk: There will be some discomfort when probing the gums and teeth to assess their health.

Benefits: Some of these benefits might be a free dental check-up 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 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.

Right to withdrawal: 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 acceptable too. Your caregiver knows about the study too.

Appendix 2B: Minor Assent Form (Swahili)

JINA LA MRADI: UFAHAMU WA UFINYAZO WA JINO, UKOLEZO WA UFIZI NA HITAJI LA MATIBABU KATI YA WATOTO KATIKA TAASISI ZA KUJALI KATIKA KAUNTI YA JIJI LA NAIROBI.

Mtafiti: Mariam Abdul Bakhrani

Ninafanya utafiti kuhusu hali ya afya ya kinywa na mahitaji ya matibabu kati ya watoto katika taasisi za hisani huko Nairobi. Ruhusa itatafutwa kutekeleza utafiti huu kutoka kwa Kamati ya Utafiti na Maadili ya Hospitali ya Kitaifa ya Kenyatta- Chuo Kikuu cha Nairobi (KNH-UoN ERC).

Kusudi la utafiti: Utafiti huu utasaidia kuelewa hali ya afya ya mdomo na mazoea ya usafi wa mdomo kati ya watoto katika taasisi za hisani na pia kutoa data ya msingi ambayo itakuwa muhimu katika kutengeneza mipango ya afya ya mdomo inayolenga kundi hili. Angalau watoto 170 watashiriki katika utafiti huu pamoja nawe.

Utaratibu: Ikiwa utaamua kwamba unataka kuwa sehemu ya utafiti huu, uchunguzi wa meno utafanywa kwako ndani ya darasa karibu na dirisha kwa kutumia mwanga wa asili unapokaa wima kwenye kiti cha ofisi. Vyombo safi na visafi vitatumika kinywani mwako kuangalia kwa cavities za meno, ugonjwa wa fizi na chembe za chakula kwenye meno yako. Utaratibu huu utachukua takriban dakika 15.

Hatari: Kutakuwa na baadhi ya usumbufu wakati wa kupima fizi na meno ili kutathmini afya yao.

Faida: Baadhi ya faida hizi zinaweza kuwa uchunguzi wa bure wa meno na rufaa kwa matibabu ya dharura na yasiyo ya dharura. Ikiwa hutaki kuwa katika utafiti huu, nitakuambia aina nyingine za matibabu zilizopo kwako. Nikimaliza utafiti huu, nitaandika ripoti juu ya yale yaliyojifunza. Ripoti hii haitajumuisha jina lako au kwamba ulikuwa katika utafiti.

Haki ya kuondoa: Huna lazima uwe katika utafiti huu ikiwa hutaki kuwa. Ikiwa utaamua kuacha baada ya kuanza, hiyo ni sawa pia. Mlezi wako anajua juu ya utafiti pia.

Appendix 3A: Questionnaire (English) (WHO 2013 Criteria And Indices)

Participants' No. (Code): …………………

Section A: Socio-Demographic Data

1. Date of birth   : ……………………… (DD/MM/YY)

2. Age in years   : ……………………......

3. Gender   (1) Male   (2) Female

4. Constituency {Geographical location}:

    1. Dagoretti Sub County   2. Westlands Sub County

    3. Other (Specify) …………………………

5. How long have you stayed in this institution?.........................

6. What is the highest level of school completed by the caregiver?
    a) No formal schooling
    b) Less than primary school
    c) Primary school completed
    d) Secondary school completed
    e) College/University completed
    f) No female adult in household
    g) I don't know

Section B: Oral Hygiene and Dietary Practices

7. Dietary Habits:

How often does the child eat or drink any of the following foods, even in small quantities?

	Several times in a day	Every day	Several times a week	Once a week	Several times a month	Never
	6	5	4	3	2	1
Fresh fruit						
Biscuits, Cookies, cakes, sweet buns, bread etc.						

Soda, Ribena, Afya or other soft drinks						
Jam/Honey						
Chewing gum containing sugar						
Sweets/Chocolates						
Milk with sugar						
Tea with sugar						

8. Brushing Habits

Does the child brush his/her teeth after meals?
 a) Never

 b) Several times a month (2-3 times)

 c) Once a week

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

 e) Once a day

 f) 2 or more times a day

Does the child use any of the following to clean his/her teeth or gums?
Yes (1)   No (2)
 a) Tooth brush

 b) Chewing Stick/Miswak

 c) Wooden toothpicks

 d) Thread (dental floss)

 e) Charcoal

 f) Other ....

Does the child use toothpaste to clean teeth?   1. Yes   2. No

Does the child use fluoridated toothpaste?   1. Yes   2. No   3. Don't know

Who brushes the child's teeth?
1.Child   2. Caregiver   3. Child assisted by caregiver

9. Dental Visits

How often has the child visited a dentist during the last 12 months? {One answer only}

a) Once

b) Twice

c) Three times

d) Four times

e) More than four times

f) Never received dental care/visited a dentist

g) Never visited dentist in the last 12 months

If the child has never visited a dentist go to Question 11

10. What was the reason of the last visit to the dentist?

a) Pain or trouble with teeth, gums or mouth

b) Treatment/follow-up treatment

c) Routine check-up of teeth/treatment

d) Can't remember/ don't know

11. Oral Health Education

Where do you obtain information of oral diseases, its prevention and treatment options?

a) Mass media

b) Dental clinics

c) Friends

d) Others (Specify)............................

Modified WHO Oral Health Assessment Form (2013)
Section C: Clinical Assessment

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

F	55/16		52/12		64/24	
L	55/16		52/12		64/24	
L	84/44		72/32		75/36	
F	84/44		72/32		75/36	

Score criteria:

1. No plaque detected

2. A film of plaque adhering to the free gingival margin and adjacent area of the tooth, which can only be seen by applying a probe on to the tooth surface.

3. Moderate accumulation of soft deposits within the gingival margin which can be seen with the naked eye.

4. Abundance of soft matter within the gingival pocket and /or the tooth and gingival margin.

Interpretation:

0:	Excellent
0.1 to 0.9:	Good
1.0 to 1.9:	Fair
2.0 to 3.0:	Poor

Gingivitis (Gingival Index, Loe & Silness,1967)

F	55/16		52/12		64/24	
L	55/16		52/12		64/24	
L	84/44		72/32		75/36	
F	84/44		72/32		75/36	

Score criteria:

0. Normal gingiva, no inflammation

1. Mild inflammation, no bleeding on probing

2. Moderate inflammation, bleeding on probing

3. Severe inflammation, spontaneous bleeding

Interpretation:

Mild gingivitis (0.1-1)

Moderate gingivitis (1.1-2)

Severe gingivitis (2.1-3)

Treatment Needs for periodontal disease

Treatment Needs (TN)	Status
TN-0	A recording of code 0 or code Y(missing) all six sextants will indicate that there is no treatment need
TN-1	Need to improve personal oral hygiene
TN-2	A code of 2 or 3 will indicate the need for professional cleaning and removal of plaque retentive factors/Prompt treatment

Dental Caries Assessment (Modified WHO 2013 Oral Assessment Form)
Dentition status and Treatment need

	17	16	55/15	54/14	53/13	52/12	51/11	61/21	62/22	63/23	64/24	65/25	26	27
Status														
Treatment need														

	37	36	75/35	74/34	73/33	72/32	71/31	81/41	82/42	83/43	84/44	85/45	46	47
Status														
Treatment need														

Status

0 = Sound

1 = Caries

2 = Filled & Decayed

3 = Filled no caries

4 = Missing due to caries

5 = Missing for another reason

6 = Fissure sealant

7= Fix dental prosthesis/crown, abutment, veneer

8 = Unerupted

9 = Not recorded

Treatment Need (TN)

None	= 0
Extraction	= 1
Filling	= 2
Stainless Steel Crown	= 3
Pulp Therapy and SSC	= 7
Crown/Veneers	= 5
Need for other care	= 6
Pulp therapy for anterior teeth	= 8
Radiograph required before treatment plan	= 9

dmft/DMFT =

Other Findings / Special Comments:

……………………………………………………………………………………………

……………………………………………………………………………………………

……………………………………………………………………………………………

……………………………………………………………………………………………

Appendix 3B: Questionnaire (Swahili) (WHO 2013 Criteria And Indices)

Nambari ya Mshiriki (Kodi): …………………

Sehemu A: Data ya Kijamii na Idadi ya Watu

1. Tarehe ya kuzaliwa : ………………………… (DD/MM/YY)

2. Umri katika miaka : ……………………

3. Jinsia: (1) Mwanaume   (2) Mwanamke

4. Eneo bunge {Eneo la kijiografia}:

      1. Kaunti Ndogo ya Dagoretti   2. Kaunti Ndogo ya Westlands

      3. Nyingine (Bainisha) …………………………

5. Umekaa kwa muda gani katika taasisi hii?........................

6. Je, ni kiwango gani cha juu cha shule kilichokamilishwa na mlezi?

    a) Hakuna shule rasmi

    b) Chini ya shule ya msingi

    c) Shule ya msingi iliyokamilika

    d) Shule ya sekondari imekamilika

    e) Chuo/Chuo kikuu kimekamilika

    f) Hakuna mtu mzima wa kike katika kaya

    g) Sijui

Sehemu B: Usafi wa Kinywa na Mazoezi ya Chakula

7. Tabia za Chakula:

Je, ni mara ngapi mtoto hula au kunywa mojawapo ya vyakula vifuatavyo, hata kwa kiasi kidogo?

	Mara kadhaa kwa siku	Kila siku	Mara kadhaa kwa wiki	Mara moja kwa wiki	Marak kadhaa kwa mwezi	Kamwe
	6	5	4	3	2	1
Matunda safi						
Bikuti, keki, mkate tamu, mkate, etc.						
Soda, Ribena, Afya au vinywaje vingine						

Jam/Asali					
Gum ya kutafuna yenye sukari					
Peremende/Chokoleti					
Maziwa na sukari					
Chai na sukari					

8. Mazoea ya kupiga miswaki:

Je, mtoto hupiga mswaki baada ya kula?

   a) Kamwe

   b) Mara kadhaa kwa mwezi (mara 2-3)

   c) Mara moja kwa wiki

   d) Mara kadhaa kwa wiki (mara 2-6)

   e) Mara moja kwa siku

   f) Mara 2 au zaidi kwa siku

Je, mtoto hutumia mojawapo ya yafuatayo kusafisha meno au fizi zake?
Ndiyo (1) Hapana (2)

   a) Mswaki wa meno

   b) Fimbo ya kutafuna/Miswak

   c) Vijiti vya meno vya mbao

   d) Uzi (uzi wa meno)

   e) Mkaa

   f) Nyingine ....

Je, mtoto hutumia dawa ya meno kusafisha meno?   1. Ndiyo   2. Hapana

Je, mtoto hutumia dawa ya meno yenye floridi? 1. Ndiyo   2. Hapana   3. Sijui

Nani hupiga mswaki meno ya mtoto?
1.Mtoto   2. Mlezi   3. Mtoto anayesaidiwa na mlezi

9. Ziara za meno

Ni mara ngapi mtoto amemtembelea daktari wa meno katika miezi 12 iliyopita?

{Jibu moja tu}

a) Mara moja
b) Mara mbili
c) Mara tatu
d) Mara nne
e) Zaidi ya mara nne
f) Sijawahi kupata huduma ya meno/kumtembelea daktari wa meno
g) Sijawahi kumtembelea daktari wa meno katika kipindi cha miezi 12 iliyopita

Ikiwa mtoto hajawahi kumtembelea daktari wa meno nenda kwa Swali la 11

10. Ni nini sababu ya ziara ya mwisho kwa daktari wa meno?
a) Maumivu au shida na meno, fizi au mdomo
b) Matibabu/ufuatiliaji wa matibabu
c) Uchunguzi wa mara kwa mara wa meno/matibabu
d) Siwezi kukumbuka/ sijui

11. Elimu ya Afya ya Kinywa:

Unapata wapi habari za magonjwa ya kinywa, njia za kuzuia na matibabu yake?

a) Vyombo vya habari
b) Kliniki za meno
c) Marafiki
d) Nyingine (Taja)...........................

Fomu ya Tathmini ya Afya ya Kinywa ya WHO Iliyobadilishwa (2013)

Sehemu C: Tathmini ya Kliniki

Hali ya Usafi wa Kinywa: Kielezo cha Plaque (Silness-Löe, 1964)

F	55/16		52/12		64/24	
L	55/16		52/12		64/24	
L	84/44		72/32		75/36	
F	84/44		72/32		75/36	

Vigezo vya alama:

1. Hakuna plaque iliyogunduliwa
2. Filamu ya plaque inayoambatana na ukingo wa bure wa ufizi na eneo la karibu la jino, ambalo linaweza kuonekana tu kwa kutumia probe kwenye uso wa jino.
3. Mkusanyiko wa wastani wa amana laini ndani ya ukingo wa ufizi ambayo inaweza kuonekana kwa macho.
4. Wingi wa vitu laini ndani ya mfuko wa ufizi na / au ukingo wa jino na ufizi.

Ufafanuzi:

0:	Bora
0.1 to 0.9:	Vyema
1.0 to 1.9:	Wastani
2.0 to 3.0:	Mbaya

Gingiva (Kielezo cha Gingiva, Loe & Silness,1967)

F	55/16		52/12		64/24	
L	55/16		52/12		64/24	
L	84/44		72/32		75/36	
F	84/44		72/32		75/36	

Vigezo vya alama:
1. Ufizi ya kawaida, hakuma kuvimba
2. Kuvimba kidogo, kutokwa na damu wakati wa uchunguzi
3. Kuvmba kwa wastani, kutokwa na damu wakati wa uchunguzi
4. Kuvimba sana, kutokwa na damu kwa hiari

<u>Ufafanuzi:</u>

Ufizi pole (0.1-1)

Ufizi wastani (1.1-2)

Ufizi kali (2.1-3)

Matibabu Mahitaji ya ugonjwa wa ufizi

Matibabu Mahitaji (TN)	Hali
TN-0	Rekodi ya geresho 0 au misimbo Y (haipo) yote sita ya ngono itaonyesha kuwa hakuna haja ya matibabu
TN-1	Inahitajika kuboresha usafi wa kibinafsi wa mdomo
TN-2	Nambari ya 2 au 3 itaonyesha hitaji la kusafisha kitaalamu na kuondolewa kwa sababu za kuhifadhi plaque/ Matibabu ya haraka.

Tathmini Ya Afya Na Masuala Ya Usafi Wa Meno (Fomu Iliyorekebishwa ya WHO 2013 ya Tathmini ya Kinywa))
Hali ya Meno na Matibabu Mahitaji

	17	16	55/15	54/14	53/13	52/12	51/11	61/21	62/22	63/23	64/24	65/25	26	27
Hali														
Matibabu Mahitaji														

	3 7	3 6	75/3 5	74/3 4	73/3 3	72/3 2	71/3 1	81/4 1	82/4 2	83/4 3	84/4 4	85/4 5	4 6	4 7
Hali														
Matibabu Mahitaji														

Hali

 0 = Sound

1 = Caries

2 = Filled & Decayed

3 = Filled no caries

4 = Missing due to caries

5 = Missing for another reason

6 = Fissure sealant

7= Fix dental prosthesis/crown, abutment, veneer

8 = Unerupted

9 = Not recorded

Matibabu Mahitaji (TN)

None = 0

Extraction = 1

Filling = 2

Stainless Steel Crown = 3

Pulp Therapy and SSC = 7

Crown/Veneers = 5

Need for other care = 6

Pulp therapy for anterior teeth = 8

Radiograph required before treatment plan = 9

dmft/DMFT =

Matokeo Mengine / Maoni Maalum:

……………………………………………………………………………………

……………………………………………………………………………………

……………………………………………………………………………………

……………………………………………………………………………………

Appendix 4: Dental Treatment Recommendation Letter

To: ………(Name of the CCI)……………
Date: …………..………
Dear …………………………….………,

An oral health survey was carried out at the aforementioned CCI and the following children were noted to have dental problems as indicated. It is therefore recommended that they receive dental treatment at the nearest dental treatment facility.

Any assistance accorded to them will be appreciated.

Children's names and their respective dental problem:
……………………………………………………………………….…………………
……………………………………………………….…………………………….………
…………………………………………………………….………………………………
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……………………………………………………………………………………………
……………………………………………………………………………………………
………………………………………………………………….…………………………

Thank you.

Your faithfully,

Dr. Mariam Abdul Bakhrani.
MDS Paediatric Dentistry,
Department of Dental Sciences.
School of Health Sciences, University of Nairobi.

Appendix 5: KNH-ERC Approval

UNIVERSITY OF NAIROBI
FACULTY OF HEALTH SCIENCES
P O BOX 19676 Code 00202
Telegrams: varsity
Tel:(254-020) 2726300 Ext 44355

KNH-UON ERC
Email: uonknh_erc@uonbi.ac.ke
Website: http://www.erc.uonbi.ac.ke
Facebook: https://www.facebook.com/uonknh.erc
Twitter: @UONKNH_ERC https://twitter.com/UONKNH_ERC

KENYATTA NATIONAL HOSPITAL
P O BOX 20723 Code 00202
Tel: 726300-9
Fax: 725272
Telegrams: MEDSUP, Nairobi

Ref: KNH-ERC/A/68

24th February, 2022

Dr. Mariam Abdul Bakhrani
Reg. No. V60/37862/2020
Dept. of Dental Sciences
Faculty of Health Sciences
University of Nairobi

Dear Dr. Bakhrani,

RESEARCH PROPOSAL: PREVALENCE OF DENTAL CARIES, GINGIVITIS AND TREATMENT NEEDS IN CHILDREN RESIDING IN CHARITABLE INSTITUTIONS IN NAIROBI   (P858/11/2021)

This is to inform you that KNH-UoN ERC has reviewed and approved your above research proposal. Your application approval number is **P858/11/2021.** The approval period is 24th February 2022 – 23rd February 2023.

This approval is subject to compliance with the following requirements;

i.   Only approved documents including (informed consents, study instruments, MTA) will be used.
ii.   All changes including (amendments, deviations, and violations) are submitted for review and approval by KNH-UoN ERC.
iii. Death and life threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to KNH-UoN ERC 72 hours of notification.
iv.   Any changes, anticipated or otherwise that may increase the risks or affected safety or welfare of study participants and others or affect the integrity of the research must be reported to KNH-UoN ERC within 72 hours.
v.   Clearance for export of biological specimens must be obtained from relevant institutions.
vi.   Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. Attach a comprehensive progress report to support the renewal.
vii. Submission of an executive summary report within 90 days upon completion of the study to KNH-UoN ERC.

Protect to discover

Prior to commencing your study, you will be expected to obtain a research license from National Commission for Science, Technology and Innovation (NACOSTI) https://research-portal.nacosti.go.ke and also obtain other clearances needed.

Yours sincerely,

DR. BEATRICE K.M. AMUGUNE
SECRETARY, KNH-UoN ERC

c.c.   The Dean, Faculty of Health Sciences, UoN
       The Senior Director, CS, KNH
       The Chairperson, KNH- UoN ERC
       The Assistant Director, Health Information, KNH
       The Chair, Dept. of Dental Sciences, UoN
       Supervisors: Prof. Arthur Kemoli, Paediatric Dentistry and Orthodontics Unit, UoN
                    Prof. Mary A. Masiga, Paediatric Dentistry and Orthodontics Unit, UoN
                    Dr. Marjorie Muasya, Paediatric Dentistry and Orthodontics Unit, UoN

Protect to discover

Appendix 6: NACOSTI Research License

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: **102503**

Date of Issue: **16/March/2022**

RESEARCH LICENSE

This is to Certify that Dr.. Mariam Abdul Bakhrani of University of Nairobi, has been licensed to conduct research in Nairobi on the topic: **PREVALENCE OF DENTAL CARIES, GINGIVITIS AND TREATMENT NEEDS IN CHILDREN RESIDING IN CHARITABLE INSTITUTIONS IN NAIROBI for the period ending : 16/March/2023.**

License No: **NACOSTI/P/22/16341**

102503

Applicant Identification Number

Director General
NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Verification QR Code

NOTE: This is a computer generated License. To verify the authenticity of this document,
Scan the QR Code using QR scanner application.

Appendix 7: Approval From Ministry of Public Service, Gender, Senior Citizen Affairs and Special Programmes

MINISTRY OF PUBLIC SERVICE, GENDER, SENIOR CITIZEN AFFAIRS AND SPECIAL PROGRAMMES
STATE DEPARTMENT FOR SOCIAL PROTECTION, SENIOR CITIZENS AFFAIRS AND SPECIAL PROGRAMMES
DIRECTORATE OF CHILDREN'S SERVICES

Tel: +254(0)2228411
Fax: +254(0)2248827
Email: dcs@socialprotection.go.ke
When replying please quote

SOCIAL SECURITY HSE, BISHOPS RD
P. O. BOX 46205-00100
NAIROBI
KENYA

Ref. CS/10/10/14 (84)   Date: 23th March 2022

Dr. Miriam Abdul Bakhrani
University of Nairobi

Dear Madam,

RE: APPROVAL TO CONDUCT RESEARCH

Reference is made to your letter dated **23rd March, 2022** requesting approval to conduct research on *"The Prevalence of Dental Caries, Gingivitis and Treatment needs in Children residing in Charitable Children institutions in westlands and Dagoretti Sub Counties"*.

The Directorate of Children Services (DCS) has taken note of the approval from the National Commission for Science, Technology and Innovation. Since the study population involves children, please observe **child safeguarding principles** as you undertake the study.

The Directorate has no objection to the study and the approval is hereby granted.

By a copy of this letter, the County Coordinator Children's Services – Nairobi sub county children's Officers, Dagoretti and Westlands are requested to give the necessary support to Dr. Miriam in carrying out the study.

Yours Sincerely,

SHEM NYAKUTU
SECRETARY CHILDREN'S SERVICES

Cc.
1. County Coordinator, Children's Services - Nairobi
2. Sub County Children's Officer, Dagoretti
3. Sub County Children's Officer, Westlands
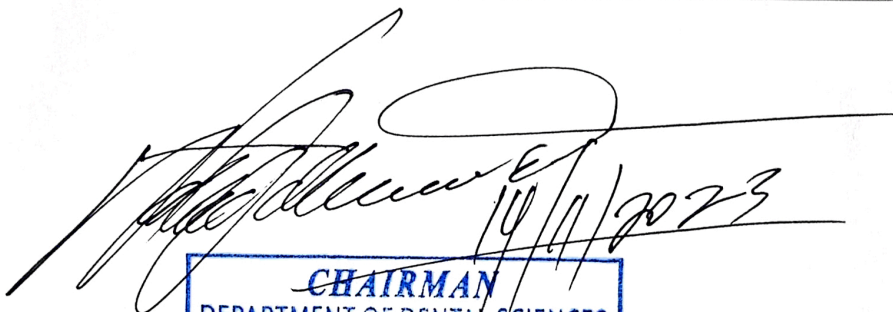
Appendix 8: Plagiarism Report

DENTAL CARIES, GINGIVITIS AND TREATMENT NEEDS AMONG CHILDREN IN CHARITABLE INSTITUTIONS IN NAIROBI

CHAIRMAN
DEPARTMENT OF DENTAL SCIENCES
UNIVERSITY OF NAIROBI
P.O. Box 19676, NAIROBI

14/11/2023