DENTAL CARIES, GINGIVITIS AND NUTRITIONAL STATUS OF PRESCHOOL CHILDREN IN THIKA, KIAMBU COUNTY.

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A RESEARCH DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT FOR THE REQUIREMENTS OF A MASTER OF DENTAL SURGERY IN PAEDIATRIC DENTISTRY (MDS, PAEDIATRIC DENTISTRY) DEGREE AT THE UNIVERSITY OF NAIROBI, AUGUST 2017.

DECLARATION

I, Dr. Ogada Alphonce Owino declare that this is my original work and has not been submitted in any other institution as a dissertation.

Signature:…… Date: ……

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This research dissertation was submitted for examination with our approval as University of Nairobi supervisors.

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DEDICATION.

This work is dedicated to my sister, the late **Veronica Akinyi Ogada** (1980-2012).

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ACRONYMS

AAPD- American Academy of Pediatric Dentistry

BDS- Bachelor of Dental Surgery

dmft- decayed, missing, filled teeth (for deciduous dentition)

DMFT- Decayed, Missing, Filled Teeth (for permanent dentition)

ECC- Early Childhood Caries

GI- Gingival Index

HAZ- Height for Age Z score

KNH- Kenyatta National Hospital

MDS- Master of Dental Surgery

MSc- Master of Science.

PDWG- Paediatric Dentistry Working Group.

PS- Plaque score

SD- Standard deviation

UNICEF- United Nations Children's Fund

UoN- University of Nairobi

WAZ- Weight for Age Z score.

WHO- World Health Organization

WHZ- Weight for Height Z score

DEFINITION OF TERMS.

Preschool: A school for children who are younger than five years old (Cambridge dictionary)

Child: A person below the age of 18 years, unless the laws of a particular country set the legal age for adulthood younger (UNICEF)

Nutrition: Intake of food, considered in relation to the body's dietary need (WHO)

Nutritional status: The extent to which nutrients are available to meet metabolic needs (Mosby's medical dictionary)

Early childhood caries: Presence of any decayed, missing or filled tooth in a child under the age of 72 months (AAPD)

Gingivitis: Inflammation of the periodontal tissues without clinical attachment loss.

ABSTRACT.

Introduction:

WHO 1948 defined health as complete wellness state including physical, mental and social parameters. Nutritional status of children has a major role in their growth and development. This study sought to establish whether there is a relationship between certain nutritional parameters and oral diseases (caries and gingivitis) in preschool children.

Study objective: To determine the prevalence of dental caries and gingivitis in relation to nutritional status of children aged 36-59 months in Thika, Kiambu County.

Setting: Eight randomly selected preschools in Thika sub County, Kiambu County.

Study design: This was a cross sectional study of children aged 36-59 months in Kiambu County.

Results: 295 children were included in the study, giving a response rate of 77.6%. 142 (48.1%) were males while the remaining 153 (51.9%) were females. The ages ranged between 36-59 months with a mean age of 48.36 months (SD 7.06). The prevalence of gingivitis was 79.0% (n=233), 115 (49.4%) were males and 118 (50.6%) were females. The prevalence of dental caries was 62.7% (n=185), 100 (54.1%) were females while 85 (45.9%) were males. The dmft among the participants ranged from 0 to 18 with a mean of 3.19 (SD 3.96). There was a statistically significant relationship between frequency of tooth cleaning and use of tooth paste with dental caries prevalence among the participants. There was a statistically significant relationship between dental caries prevalence and at-will breastfeeding during the night. Children with low weight for age, low height for age and low weight for height accounted for 1.7%, 2.5% and 1.1% of the total population respectively. The relationship

between all nutritional parameters and the prevalence of dental caries and gingivitis was not significant.

Conclusion: There is no relationship between nutritional status, prevalence of dental caries and gingivitis among children aged 36-59 months.

Recommendations: There is need for education on oral hygiene and diet with emphasis on maternal breast feeding practices in order to reduce the prevalence of dental caries and gingivitis among children aged 36-59 moths. There is need for improvement on availability and accessibility to preventive and curative dental services in order to combat the dental diseases which are on the rise among children aged 36-59 months. Further research with larger sample size to gather more knowledge on the relationship between nutritional status and dental diseases in children is recommended.

CHAPTER 1.

1.0 INTRODUCTION AND LITERATURE REVIEW

According to WHO definition of 1948, health is described as the well-being of an individual both physically, mentally and socially. The WHO further states that health is not equal absence of disease. Improvement of oral health is one of the ways of ensuring a healthy population especially healthy children because dental caries and gingivitis are some of the commonest chronic diseases that children suffer from globally. Nutritional status of children has a major role in their growth and development. Children under the age of five years are vulnerable to disease and malnourishment.

Studies on nutritional status of children and its effects on the oral cavity have generated variable results. Some studies have failed to relate different nutritional parameters to the prevalence of dental caries in children while others have yielded results that suggest a relationship between nutritional status and prevalence of this oral condition (1-4). Obesity in children has been identified as a risk factor for gingivitis by some authors(5) while other authors have disputed this(6). However, studies on the relationship between obesity and periodontal disease in children of specific age groups are few and further studies regarding this relationship have been recommended(7). The current study was motivated by the gap in knowledge and variable results in the relationship between nutritional status and prevalence of dental caries and gingivitis. The study sought to establish whether there is a relationship between certain nutritional parameters and dental caries and/or gingivitis in children aged between 36-59 months.

1.1 LITERATURE REVIEW

1.1.1 Dental caries in children aged 36-59 months

"The disease of early childhood caries (ECC) is the presence of one or more decayed (cavitated or non cavitated), missing (due to caries) or filled tooth surface in any primary tooth in a child under the age of six years" (8). The cause of ECC is similar to the cause of all other types of dental caries however, the predisposing factors to ECC are still unclear and its etiology can be modified by child specific factors(9). Dental caries continues to increase in prevalence in both the developed and the developing world. This could be partly due to changes in dietary patterns in the developing countries in which children tend to be fed on diets rich in refined carbohydrates(10).

A study in Brazil reported the prevalence of dental caries among children aged five years and below to be 40%. The incidence of dental caries was found to be positively related to poverty and maternal illiteracy (11). In India, the prevalence of dental caries among preschool children aged between 3-5 years was reported to be 45.1% by Gupta et al. The caries prevalence increased with age and had a gender bias with boys being more affected (12).

The United States of America (USA) national center for health statistics (NCHS) approximated the prevalence of dental caries among preschool children aged 2-5 years to be 23% between 2011 and 2012.The prevalence is much lower than those reported from Brazil and India respectively, highlighting the role of economic development on dental caries prevalence among children (13). In Brisbane, Australia it was reported that 66.3% of preschool children were caries free with a mean dmft (decayed, missing and filled teeth) of 1.4 at the time. The survey was conducted among children aged 4-6 years(14). The larger age

group in this survey may partially explain the higher figures as compared to the USA, highlighting the effect of time on dental caries occurrence. However, these two industrialized nations have low prevalence of early childhood caries compared to the developing countries.

In Moshi, Tanzania, the prevalence of ECC among preschool children aged 3-5 years was reported by Rwakatema et al to be 30.1% and the mean dmft for this population was 0.95 with the d and m components constituting 0.87 and 0.08 respectively(15). The prevalence of dental caries among Kenyan preschool children has been reported by different authors. A study in Kiambaa of the former Kiambu district reported a prevalence of 59.9% with the d component of dmft division taking the bulk of more than 95%. The mean dmft from this study was 2.46 with the d, m and f components accounting for 2.3, 0.08 and 0.19 respectively. The prevalence of ECC was found to be increasing with age from 3 through to 5 years and there was also a gender bias in the prevalence with boys being more affected than girls (16). A study based in Nairobi, Kenya, prevalence of dental caries was reported to be 63.5% among children aged 3-5 years. The d component of dmft was high at 96% of total dmft (17). The mean dmft was 2.95. The caries prevalence in this group was higher than that reported by the Kiambaa based study. The difference in the set ups of the two Kenyan studies could explain the role of urbanization in dental caries occurrence. The Kiambu based study was conducted in a rural set up while the Nairobi based study was in an urban set up. There is generally higher prevalence of dental caries in Kenya compared to Tanzania as reported by these studies.

Early childhood caries interferes with children's development and performance in school. It causes poor health and in extreme cases can lead to death. ECC also exerts psychological

stress and financial pressure on parents of the affected children. ECC also exerts pressure on the healthcare systems through management of emergency cases (18). ECC can affect nutrition through interference with a child's masticatory function. ECC is a multifactorial disease whose prevention requires multiple approaches some of which include dietary modification through parental counselling, fluoride application either topically or systemically, behavior modification especially oral hygiene practices of the children and their parents and suppression of oral bacteria through mechanical and chemical cleaning methods (19).

1.1.2 Gingivitis in children aged 36-59 months

There are two main forms of inflammatory periodontal diseases and these are gingivitis and periodontitis. Gingivitis which is reported to be the commonest periodontal disease in children (20). Gingivitis in children needs to be diagnosed early and prevented because it may lead to periodontitis later in life (21). It is mainly caused by plaque accumulation. Poor oral hygiene and underdeveloped manual dexterity among preschool children are the main pre disposing factors to gingivitis in this age group (22).

A study conducted in Brazil reported gingivitis prevalence among 5 year olds to be 16.6%. From this study, male gender, poverty, dental cavity and crowding were noted as possible risk factors for gingivitis in children (23). Wafaa et al in Cairo, Egypt reported the prevalence of gingivitis among preschool children aged between 3-5 years to be 94.7% and 86.6% among malnourished and normal weighted children respectively. These results emphasize the role of nutritional status on oral health of preschool children (24). A Kenyan study reported gingivitis prevalence of 37% and 40% among children aged 3 and 5 years respectively (25). These

studies show variable prevalence in gingivitis among children in different parts of the world which further stresses the need for a study of preschool children of Kiambu County.

1.1.3 Nutritional status of children aged 36-59 months

Nutrition has been defined as an individual's food consumption compared to the body's dietary requirements (26). Malnutrition occurs due to inadequate or excessive dietary intake of essential nutrients (27). Under nutrition includes the states of wasting, stunting, underweight and micronutrient deficiencies. The major causes of under nutrition in infants and young children include inadequate breastfeeding and poor complementary feeding compounded by childhood illnesses (28). Malnutrition has multifactorial causation summarized by UNICEF as immediate, underlying and basic factors (29). Protein energy malnutrition (PEM) is an imbalance between protein and energy availability and the body's demand for them which can either be excess or inadequate with the latter causing wasting, stunting and underweight (30).

1.1.4 Epidemiology of malnutrition.

The level of stunting in children under 5 years has reduced significantly in the third world according to an analysis of nutritional status between years 1980 and 2000 however, malnutrition still remains a public health concern in the developing world (31).

Acute malnutrition was found to be high among hospitalized children according to a review (32). A study conducted in the European Union reported obesity to be prevalent among children with differences in the levels reported by different countries (33). This is consistent with a study in Mexico which reported overweight or obesity at 20% of all children studied. The Mexican study points out poverty as a risk factor for obesity and stunting combination in

young children (34). In India, underweight was reported to be the main malnutrition concern among children however, increasing urbanization has seen an upcoming shift towards overweight which may change the status quo in the foreseeable future especially in the urban areas (35).

Several studies have reported prevalence of malnutrition among children in Africa. A study in Limpopo province, South Africa reported levels of stunting, overweight and obesity at 48%, 22% and 24% respectively. Some of the children studied were both stunted and overweight (19%) (36). A study in Southern Ethiopia reported that the children examined for anthropometric measures of height for age, 50.3% were found to be stunted with boys being more affected than girls. Ethiopia was reported as having the highest prevalence of stunting in the whole world (37).

In Dagoreti division of Nairobi Kenya, a study revealed prevalence of stunting, underweight and wasting to be 24.5%, 14.9% and 9.7% respectively with boys being more stunted than girls(38). Another Kenyan study reported a prevalence of stunting, underweight and wasting to be 30%, 13% and 8% respectively in children aged between 0-24 months. From the same study, children aged between 25-59 months had a prevalence of 40%, 17% and 4% for stunting, underweight and wasting respectively. The malnutrition parameters increased with increasing ages which might suggest a sudden change in feeding practices or diet (39). These figures compare closely to Ethiopian, South African and Tanzanian studies and this might be a reflection of similarities in the factors that predispose children to under nutrition across the continent. The Kenya demographic and health survey of 2014 estimated the national levels of stunting, wasting and underweight in children under age of five years to be 26%, 11% and 4%

respectively. The level of stunting among children under five years in Kiambu County was estimated to be between 15-25% according to the survey. There is a decrease in levels of malnutrition among children in Kenya between 2008 and 2014 according to these figures(40)

1.1.5. Nutritional status and general health

Nutrition and infectious disease have a bidirectional relationship in which malnutrition has been established to weaken the immune system and thus predispose the affected individuals to infectious diseases. Infection on the other hand affects appetite, reduces food absorption and also increases wastage of food and this leads to malnutrition. The management of any of these conditions among children is dependent on the presence or absence of the other (41). Malnutrition is related to 50% of all infant deaths. Increased risk of death from malnutrition has been observed consistently in diseases such as diarrhea, acute respiratory diseases and malaria (42). Analysis of under nutrition as an underlying cause of child death reported that 52.5% of all deaths in young children are due to under nutrition. The study reported that under nutrition elevated the relative risks of death from all the childhood illnesses that were assessed (43). A study conducted in Kenya by Bejon et al reported that malnutrition accounts for more than half of childhood morbidity and mortality in the studied population (44).

1.1.6 Nutritional status and Oral health

1.1.6.1 Nutritional status and dental caries

A study in Germany by Qadri et al (45) reported that overweight and obese children acquired more carious lesions after a follow up of one and a half years. These findings are consistent with those from a Mexican study among children aged 4-5 years (46). According to the Mexican study, children at risk of overweight and the overweight children were found with

more carious lesions and thus higher dmft scores than the children of healthy weight. Childhood obesity has been associated with inadequate flow of saliva and increased dental caries among children according to another study by Modeer et al (47). These studies therefore indicate that childhood obesity might be a risk factor for dental caries.

A review of literature indicates that many studies have shown that there is a relationship between protein energy malnutrition and dental caries in the deciduous dentition. The cause of the relationship has been hypothesized to be enamel hypoplasia of the teeth caused by PEM thus subjecting the teeth to acid demineralization that leads to cavitation (48). A study by Ribeiro et al in Ceara, Brazil reported that undernourishment is a potential risk factor for early childhood caries (ECC). The caries experience among the studied children increased with age and the authors linked this phenomenon to effect of chronic under nutrition on the immune system of the children (49).

Contrary to these findings, a retrospective study of adolescents who had early childhood PEM (ECPEM) in Haiti reported an inverse relationship between ECPEM and dental caries in permanent dentition among the subjects. The dental caries experience reduced with severity of ECPEM according to this study (50). Similar results on the inverse relationship were reported in two primary schools in Dar es Salaam, Tanzania where a study reported malnutrition to be insignificantly predictive for development of dental caries (51).

1.1.6.2 Nutritional status and gingivitis

Studies on the relationship between nutritional parameters and gingivitis prevalence have generated different results. A study in Italy reported a positive relationship between obesity/overweight and gingivitis (52). A South African study reported that there was an

association between malnutrition and gingivitis. The study comprised of 49 children attending a facility based nutrition program(53). A Study based in Nigeria also reported that PEM is a predisposing factor to NOMA, which usually occurs as a sequel of acute necrotizing ulcerative gingivitis (ANUG). PEM is implicated above other known predisposing factors to NOMA (54)

1.2 STATEMENT OF THE PROBLEM

The prevalence of dental caries and gingivitis among preschool children in Kenya remains high due to changes in dietary patterns and lack of proper oral hygiene practices (16, 17, 25). These conditions if unmanaged can cause pain, suffering, loss of school and play time and financial loss to the parents due to absence from work and possible complications of the disease (18) . Management of these conditions require knowledge of the at-risk groups of children. Nutrition plays an important role in the general health of children and is related to various systemic illnesses and deaths. Malnutrition levels in Kenya is still a public health concern. In Kenya, there is scarce information on dental caries, gingivitis, in relation to nutritional status of children aged 36-59 months. This study aimed to determine this relationship in Kiambu County.

1.2.1 Study justification

High prevalence of dental caries in Kiambu County partly informed the choice to conduct the study of this nature. This study could contribute worldwide scientific knowledge in the field of pediatric dentistry. The results could be useful in informing policy concerning oral health and nutrition of preschool children. The results will form baseline data on the relationship

between dental caries, gingivitis and nutritional status of preschool children in Kenya and other parts of the world.

1.2.2 BROAD OBJECTIVE

To determine the dental caries experience and prevalence of gingivitis in relation to nutritional status of children aged 36-59 months in Kiambu County.

1.2.3 SPECIFIC OBJECTIVES

1. To determine the dental caries experience among children aged 36-59 months.

2. To determine the prevalence of gingivitis among children aged 36-59 months.

3. To determine the nutritional status of children aged 36-59 months in Kiambu County.

4. To determine the relationship between nutritional status and dental caries experience in children aged 36-59 months.

5. To determine the relationship between nutritional status and prevalence of gingivitis in children aged 36-59 months.

1.2.4 Null hypotheses

1. There is no relationship between nutritional status and dental caries experience in children aged 36-59 months.

2. There is no relationship between nutritional status and prevalence of gingivitis in children aged 36-59 months.

1.2.5 Study variables

1.2.5.1 Socio-demographic variables

1. Age of the child

2. Gender of the child.

3. Primary care giver of the child.

4. Employment status of the mother/caregiver.

1.2.5.2 Independent variable

Nutritional status.

1.2.5.3 Dependent variables

1. Dental caries

2. Gingivitis

CHAPTER 2

2.0 MATERIALS AND METHODS

2.1 Study area

The study was conducted in Kiambu County which is one of the forty seven counties in Kenya based on the new constitution of 2010. The County borders Murang'a County to the North and north-east, Machakos County to the East, Nairobi and Kajiado counties to the South, Nakuru County to the West and Nyandarua County to the North West. The population of this County is about 1.6 million people accounting for 4.2% of Kenya's total population. The main economic activities include farming, food processing, manufacturing, mining,

textile, motor vehicle assembly, wholesale and retail trade. As of 2007, Kiambu County had 1,135 primary schools and 373 secondary schools with an enrollment of 291, 765 pupils in primary schools(55). Kiambu County is divided into twelve sub counties with Thika town being one of them. Kiambu town is the administrative capital of Kiambu County. Thika town is located on A2 road 40 KM north east of Nairobi. It has a rapidly growing population which might be higher by the time of the current study. (56). Thika Sub County is sub divided into four wards namely Hospital, Gatuanyaga, Kamenu and Township. Thika sub County has more than 70 public and private early childhood education centers.

2.2 Study population

The study involved preschool children aged 36-59 months within Thika Sub County, Kiambu County.

2.3 Study design

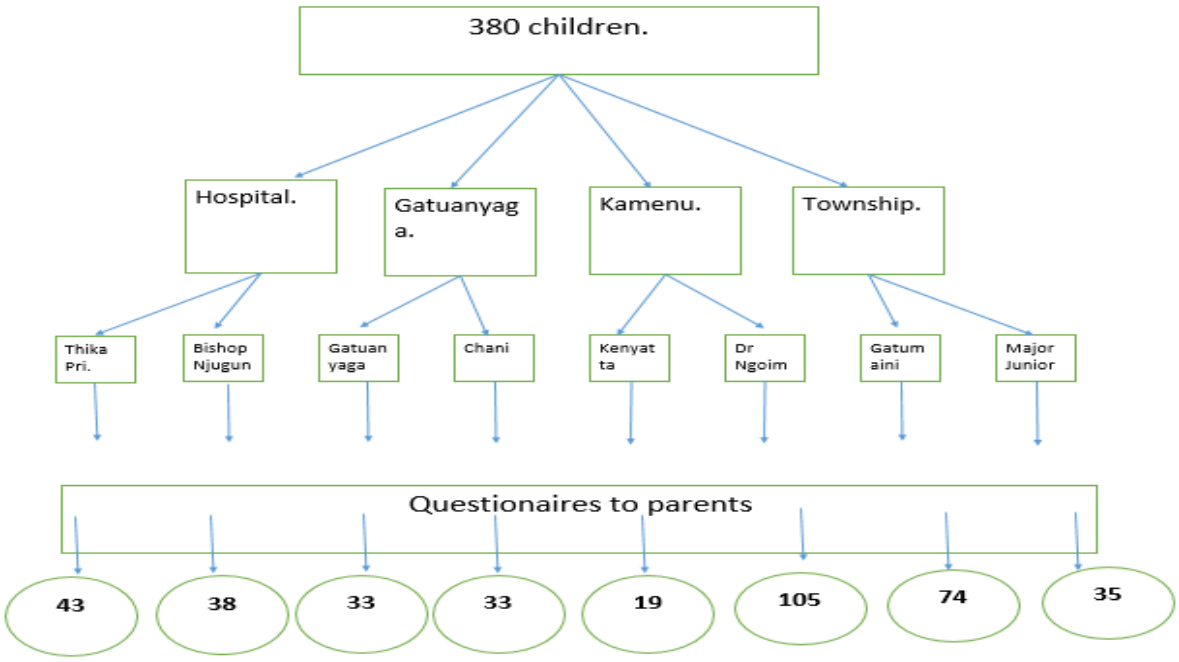
This was a descriptive cross sectional study.

2.4 Sampling method

Multistage stratified sampling of the preschools was done. In the first stage, Thika sub county was divided into four administrative units called wards; Hospital, Gatuanyaga, Kamenu and Township. In second stage, schools in each ward were stratified into private and public schools as per the list provided by the sub County early childhood development officer. In each strata, one preschool was randomly selected for the study. The total number of children from the eight preschools was determined. Proportionate sampling was then conducted to ensure fair distribution of the children among the schools. In each school, all children were

given oral hygiene instruction and provided with a tooth brush and a tooth paste. The study participants were then randomly selected from the school register by taking every n^{th} child until the desired number was reached. Questionnaires were sent out to the parents through the children however, it was noted that parental response was poor as the response rate was less than 50%. To counter the problem parents were approached directly by the principal investigator and requested if they could fill in the questionnaires. This method proved to have a higher response rate than the first method as parents were explained for the rationale behind filling in the questionnaires. The children with fully filled questionnaires and signed consent forms were included in the study. Figure 1 below illustrates the sampling procedure.

Figure 1: Sampling flowchart



2.5 Sample size determination

Formula: $n= \underline{(Z_{1-\alpha})^2 [P (1-p)]}$

$(d)^2$

n is the required sample size.

$Z_{1-\alpha}$ is the critical value associated with the level of significance.

p is the estimate of proportion.

d is the margin of error.

The prevalence of dental caries among children aged 3-5 years in Kiambu County was reported to be 59.9% (16)

P=0.599

$$n = \frac{1.96^2 \times 0.599(1-0.599)}{0.05 \times 0.05}$$

n= 344.

Adding 10% to cater for attrition as the study depended on parental consent and children's assent. The sample size for this study was 380 children aged 36-59 months.

2.6 Inclusion criteria

1. Children aged 36-59 months.

2. Children whose parents/guardians gave consent to participate in the study.

3. Children who assented to be examined for the study.

4. Children without chronic systemic conditions.

2.7 Exclusion criteria

1. Children whose ages could not be ascertained.

2. Children who had special health care needs.

3. Children whose parents/ guardians did not give consent for the study.

2.8 Instruments for data collection

2.8.1 Socio-demographic data

Semi-structured self-administered questionnaires together with an explanatory letter and a consent form were initially sent to the parents/ guardians of the study children through their children to obtain socio-demographic data. However the response was low and the principal investigator decided to approach the parents directly after making arrangements with the school administration. This gave a better response as more forms were returned by the parents.

2.8.2 Nutritional status

Nutritional status was assessed by taking the weight and height of the children. The height of the children was measured with a standard height board to the nearest 0.5cm while the individual was standing erect and bare foot. The weight was measured using a Salter scale to the nearest 0.1kg. Two readings were taken for height and weight and the average calculated. The age was taken in complete months from school records or as reported by the care giver. WHO methodology of measuring children was used (57)

2.8.3 Intraoral examination

Intra oral examination was done by the principal investigator under natural light using a sterile mouth mirror and a dental probe with participants seated on an ordinary chair next to a window. Data sheets were used to score for dental caries, plaque index and gingival index. Dental plague and gingivitis were recorded first before examining for dental caries which required the tooth to be wiped with gauze before examination.

2.8.3.1.1 Dental plaque and gingivitis

2.8.3.1.1 Oral hygiene status

Oral hygiene status was assessed using the plaque index of Silness and Loe (1964). According to Silness and Loe, a tooth is divided into four surfaces; lingual, buccal/ labial, mesial and distal. Each tooth surface was examined for presence of plaque accumulation. The scoring was done as follows.

0- No plaque detected.

1- 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.

2- Moderate accumulation of soft deposits within the gingival pocket or the tooth and gingival margin which can be seen with the naked eye.

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

The following index teeth were used for plaque scores: 55, 52, 64, 72, 75, and 84.

Calculation for a tooth: sum of scores from 4 areas of tooth divided by 4.

Calculation for an individual: total scores from all teeth examined divided by the number of teeth examined.

Scores of 0, 0.1-0.9, 1.0-1.9, 2.0-3.0 was indicative of excellent, good, fair and poor oral hygiene respectively.

2.8.3.1.2 Gingival index

Gingival index was scored using gingival index of Loe and Silness (1967) where probing using a periodontal probe was done on the lingual, buccal, distal and mesial sulci of index teeth.

Score Criteria

0 normal gingiva

1 mild inflammation, slight edema, no bleeding on probing.

2 moderate inflammation, bleeding on probing.

3 severe inflammation, marked edema, tendency to spontaneous bleeding.

The following index teeth were used for gingival index: 55, 52, 64, 72, 75, and 84.

Calculation of index for each tooth: sum of scores from 4 areas of tooth divided by 4.

Calculation for an individual: total scores from all teeth examined divided by the number of teeth examined.

2.8.3.2 Dental caries

Dental caries was determined using the world health organization criteria of 2013 (58). Each tooth was scored as sound, decayed, filled or missing; dmft. Prior to caries diagnosis, each tooth was dried with a piece of sterile gauze.

i) Caries was recorded as present when a pit/fissure or a smooth surface had an unmistakable cavity, undermined enamel or a detectably softened floor or wall. Teeth with temporary fillings or filled teeth with secondary caries were scored as decayed. Radiographs were not taken for dental caries assessment. In cases where the crown had been destroyed by the caries and only the roots were left, the caries was judged to have originated from the crown and such teeth were categorized as decayed.

ii) A missing tooth was only scored if there was history of loss due to dental caries. This score was only given if an individual was at an age when normal exfoliation could not be a sufficient explanation for the absence. Knowledge of tooth eruption patterns, the appearance of the alveolar ridge in an area of tooth space in question and caries status of other teeth in the mouth was used to provide clues in deciding whether a tooth is un-erupted or has been extracted.

iii) A filled tooth was only scored when one or more permanent restorations were present and there was no caries anywhere on the crown. A tooth that had been crowned because of previous decay was recorded in this category. The dentition was coded according to WHO recommended procedures.

2.9 Ethical considerations

Ethical approval was sought from the Ethics and Research committee of the University of Nairobi and Kenyatta National Hospital, Kenya. Permission to conduct the study was sought

from Kiambu County minister for education. The schools head teachers' permission was sought in the selected study schools. Informed consent was obtained from the parents/caregivers and children's assent obtained. Confidentiality was maintained and information obtained was only used for the purpose of the study and for the benefit of the community. Data collected was coded and input in a password protected computer. Patients who required emergency dental treatment were referred appropriately.

3.0 Data validity and reliability

The investigator was calibrated by the supervisors on scoring dmft, plaque score, gingival index, weight and height to ascertain inter-examiner reproducibility. A standardized examination and measurement procedure was used for all participants. A duplicate clinical examination was carried out on every 10^{th} child and Cohen's kappa index used to calculate intra-examiner reliability.

3.1 Data analysis and presentation

The data was coded, entered and analyzed using SPSS version 22 software. Nutritional data was analyzed using the WHO anthroPlus software (2007). Statistical tests were performed to establish the relationships between the different variables. Data is presented using tables and frequency tables.

CHAPTER 3

3.0: RESULTS

3.1: Socio- demographic characteristics

3.1.1: Children's socio-demographic characteristics

Out of the targeted three hundred and eighty children, a total of two hundred and ninety five had properly filled questionnaires and were included in the study and examined, giving a response rate of 77.6%. One hundred and forty two children were males which comprised 48.1% of the total while the remaining one hundred and fifty three (51.9%) were females. The ages of the study participants ranged between 36-59 months with a mean age of 48.36 months (SD 7.06).

Table 1: The study population.

Characteristic	Category	Frequency (n)	Percent (%)
Gender (Child)	Male	142	48.1
	Female	153	51.9
	Total	295	100

3.1.2: Caregiver socio demographic characteristics

A total of 295 caregivers consented to the study and filled in the questionnaires. The questionnaires sought to find out the caregivers' level of education and employment status which were considered confounding variables in this study. Slightly less than half of the caregivers had attained college/ university education (n= 129, 43.0%). Only two caregivers (n= 2, 0.7%) had no form of formal schooling. The rest of the caregivers attained education levels of between less than primary school to high school. The caregivers who had less than primary education, primary education, secondary school education and high school education accounted for 3.3% (n=10), 12.7% (n=38), 27.7% (n=83) and 12.0% (n=36) respectively. With regards to employment status, caregivers who were in self-employment accounted for 48.8% (n=144) about half of these being entrepreneurs (n=65, 47.4%). About a quarter of caregivers (27.1%, n=80) were in formal employment. A total of seventy one caregivers were unemployed (n=71, 24.1%). Among caregivers who revealed their gender, most (n=249, 84.4%) were female while the remaining (n=37, 12.5%) were male. Some caregivers (n=9,

3.1%) did not reveal their gender. Chart below shows caregiver by their gender, level of education and employment status.

Table 2: Care giver levels of education and employment status.

Characteristic	n	Percentage
Gender		
Male	37	12.9
Female	249	87.1
Undeclared	9	3.1
Education level.		
Less than primary schooling	12	4.1
Primary school completed	38	12.9
Secondary school completed	80	27.1
High school completed	36	12.2
College/ University	129	43.7
Employment status		
Self-employment	144	48.8
Formal employment	80	27.1
Unemployed	71	24.1

3.2: Dental caries prevalence among the children

The prevalence of dental caries was 62.7% (n=185). Among the children affected by dental caries, 100 (54.1%) were females while 85 (45.9%) were males. The dmft of the participants ranged from 0 to 18 with a mean of 3.19 (SD 3.96). The decay (d) component of the dmft accounted for 62.5% of the children. A total of 5.4% of the children had missing teeth while only 1.6% had filled teeth. More females (62.7%) had decayed teeth than males (56.8%).

Children aged between 36-47 months had higher prevalence of dental caries at 71.7% compared to children aged 48-59 months who had dental caries prevalence of 61.2%.

Table 3: Caries prevalence by age and gender of the children.

Characteristic	**Category**	**No caries n (%)**	**Decayed, missing or filled n (%)**	χ^2	**df**	***p-value at 95% CI***
Age	36-47 months.	28 (28.3)	71 (71.7)	3.058	1	0.080
	48-59 months.	66 (38.8)	104 (61.2)			
Gender	Male	57 (40.1)	85 (59.9)	0.953	1	0.329
	Female	53 (34.6)	100 (65.4)			

The pattern of dental caries per arch was determined. In the lower arch, the first and second deciduous molars were the most affected teeth in terms of dental caries experience. Most decayed teeth, filled teeth and teeth missing due to caries were the molars. Very few central incisors and canines had been affected by dental caries. The second molars were more affected than the first molars as shown in the table below.

Table 4: Pattern of dental caries experience in the mandible

Tooth	**Sound**		**Carious**		**Filled with no caries**		**Missing due to caries**	
	n	(%)	n	(%)	n	(%)	n	(%)
85	175	63.9%	97	35.4%	0	0.0%	2	0.7%
84	194	70.5%	77	28.1%	2	0.7%	2	0.7%
83	250	90.9%	24	8.7%	0	0.0%	1	0.4%

82	255	92.7%	20	7.3%	0	0.0%	0	0.0%
81	261	94.9%	12	4.7%	0	0.0%	1	0.4%
71	257	93.5%	16	6.1%	0	0.0%	1	0.4%
72	258	93.8%	17	6.2%	0	0.0%	0	0.0%
73	251	91.3%	23	8.4%	0	0.0%	1	0.3%
74	199	72.4%	76	27.6%	0	0.0%	0	0.0%
75	179	65.1%	91	33.1%	2	0.7%	3	1.1%

In the maxilla, a different pattern of dental caries experience was observed. The maxillary central incisors had the highest dental caries experience followed by second deciduous molars. The maxillary lateral incisors and first molars had near equal dental caries experiences. The central incisors were mainly decayed or missing due to caries as show in the table below.

Table 5: Pattern of dental caries experience in the maxilla

Tooth	Sound		Carious		Filled with no caries		Missing due to caries	
	n	%	n	%	n	%	n	%
55	209	76.3%	65	23.7%	0	0.0%	0	0.0%
54	223	81.1%	51	18.5%	0	0.0%	1	0.4%

53	263	95.6%	10	3.6%	1	0.4%	1	0.4%
52	230	83.6%	42	15.3%	1	0.4%	2	0.7%
51	186	67.6%	85	30.9%	0	0.0%	4	1.5%
61	186	67.6%	84	30.5%	1	0.1%	5	1.8%
62	221	80.4%	52	18.9%	0	0.0%	2	0.7%
63	260	94.5%	13	4.7%	1	0.4%	1	0.4%
64	222	80.7%	52	18.9%	0	0.0%	1	0.4%
65	203	73.8%	71	25.8%	0	0.0%	1	0.4%

Dental caries experience by tooth cleaning behavior of the children revealed variable results. The frequency of tooth cleaning and use of tooth paste during tooth cleaning had significant relationships with dental caries experience among the participants. Other tooth cleaning behaviors such as child supervision during brushing, frequency of supervision, use of tooth brush and use of fluoride did not have a statistically significant relationship with dental caries experience. Table 6 is an illustration of dental caries experience by tooth cleaning behavior among the study participants

Table 6: Caries experience by tooth cleaning behavior.

Characteristic	**Category**	**No caries experience** **n (%)**	**Decayed, missing or filled.** **n (%)**	χ^2	**df**	***p-value at 95% CI***
Tooth cleaning frequency	Never	3 (100)	0	12.194	5	***0.032***

	Several times a month(2-3 times)	6 (35.3)	11 (64.7)			
	Once a week	8 (35.3)	3 (27.3)			
	Several times a week(2-6 times)	17 (29.8)	40 (70.2)			
	Once a day	66 (37.9)	108 (62.1)			
	2 or more times a day	18 (40.0)	27 (60.0)			
Child supervised	No	12 (33.3)	24 (66.7)	0.395	1	*0.530*
	Yes	105 (38.7)	166 (61.3)			
Supervision Frequency	Never	10 (31.3)	22 (68.8)			
	Every day	67 (40.4)	99 (59.6)			
	Once a week	21 (42.9)	28 (57.1)	3.617	3	*0.306*
	Three times a week	15 (28.3)	38 (71.7)			
Toothbrush use	Not used	4 (57.1)	3 (42.9)	1.131	1	*0.287*
	Used	113 (37.4)	189 (62.6)			
Toothpaste use	Not used	8 (72.7)	3 (27.3)	5.944	1	***0.015***
	Used	106 (36.4)	185 (63.6)			
Fluoride use	No fluoride	6 (27.3)	16 (72.7)			
	Fluoride used	74 (37.6)	123 (62.4)	1.192	2	*0.551*
	Don't Know	25 (40.3)	37 (59.7)			

Table showing tooth cleaning frequency having statistically significant relationships with dental caries experience (x^2 =12.194, df=5, **p=0.032)** .Use of tooth paste also had a significant relationship with dental caries experience (x^2 =5.944, df=1, **p=0.015**). Caregiver education and employment status on the other hand conferred no significant differences in the dental caries experience among the children as illustrated.

Table 7: Dental caries experience by caregiver education and employment status.

Characteristic	**Category**	**No caries experience**	**Decayed, missing or filled**	**χ^2**	**df**	***p-value at 95% CI***

		n (%)	n (%)			
Level of Education (Mother/ Caregiver)	No formal schooling	1 (50.0)	1 (50.0)			
	Less than primary school	6 (60.0)	4 (40.0)			
	Primary school completed	13 (34.2)	25 (65.8)			
	Secondary school completed	27 (32.5)	56 (67.5)	7.457	6	*0.281*
	High school completed	10 (27.8)	26 (72.2)			
	College/University	55 (42.6)	74 (57.4)			
	I don't know	0	2 (100)			
Employment status	Unemployed	23 (31.5)	50 (68.5)			
	Self-employed	64 (44.4)	80 (55.6)	5.419	2	*0.067*
	Employed	26 (31.3)	57 (68.7)			

The dental caries experience in relation to dietary habits and breast/ bottle feeding habits of the children was also studied and the results revealed that there was a significant positive relationship between dental caries occurrence and at-will breastfeeding during the night (x^2 =6.642, df=2, **p=0.036**). The rest of the dietary habits studied had no significant relationship with dental caries experience. Table below shows the relationships between dental caries experience and breast/ bottle feeding habits of the children.

Table 8: Dental caries experience by breast/ bottle feeding habits.

Characteristic	**Category**	**No caries experience**	**Decayed, missing or filled.**	χ^2	**df**	***p-value at 95% CI***
		n (%)	**n (%)**			
Breastfeeding duration	Not applicable	3 (50.0)	3 (50.0)			
	4 months - 1 year	31 (48.4)	33 (51.6)	7.192	4	*0.126*
	1 - 1.5 years	18 (27.3)	48 (72.7)			

	1.5 - 2years	40 (33.9)	78 (66.1)			
	Over 2 years	13 (36.1)	23 (63.9)			
Bottle Feeding	No	67 (39.4)	103 (60.6)	0.208	1	*0.648*
	Yes	46 (36.8)	79 (63.2)			
Contents of Bottle	Milk	27 (36.0)	48 (64.0)			
	Water	1 (16.7)	5 (83.3)	0.986	2	*0.611*
	Milk and Water	5 (38.5)	8 (61.5)			
Child slept with bottle in mouth	No	113 (38.2)	183 (61.8)	0.087	1	*0.768*
	Yes	3 (33.3)	6 (66.7)			
Child breastfed at will at night	No	23 (56.1)	18 (43.9)			
	Yes	92 (35.2)	169 (64.8)	6.646	2	***0.036***
	Don't Know	1 (50.0)	1 (50.0)			

3.3: Plaque scores and gingivitis

3.3.1: Children's oral hygiene practices

One hundred and seventy four parents (56.7%) reported cleaning their children's teeth once daily while 57 (18.6%) cleaned their children's teeth 2-6 times a week. Forty five participants (14.7%) reported cleaning their children's teeth twice or more daily. Only 1% of the children reported that they never cleaned their teeth (n=3). With regards to supervision during teeth

cleaning, majority of the caregivers (n=271, 88.3%) supervised their children during teeth cleaning while 11.7% did not. About half (55.3%) of the caregivers who supervised their children during brushing did so daily. The rest of the caregivers supervised their children during teeth cleaning once weekly (16.3%) and thrice weekly (17.7%). Most children brushed their teeth using a toothbrush (97.7%) and a toothpaste ((96.4%). About two thirds of caregivers (n=197, 70.1%) reported the use of fluoridated toothpaste while 22.1% (n=62) of the caregivers did not know whether their children used fluoride containing dentifrice or not. Twenty two caregivers (7.8%) reported use of non-fluoridated dentifrice by their children.

3.3.2. Oral hygiene status of the children

Oral hygiene was evaluated using plaque scores. These ranged from 0 to 2.29 with a mean of 0.95 (SD 0.34) which is indicative of a good oral hygiene. Most children had good oral hygiene while a few had excellent and poor oral hygiene status respectively. Table 9 shows a summary of the oral hygiene status of the children.

Table 9: Oral hygiene status of the children.

Plaque Category	P.S	Frequency	Percentage
Excellent hygiene	0	2	0.7
Good hygiene	0.1-0.9	144	52.6
Fair hygiene	1-1.9	126	46.0
Poor hygiene	2-3	2	0.7

Female children had slightly higher plaque scores compared to males. The mean plaque scores were 0.97 (+/- 0.33) and 0.95(+/- 0.33) for females and males respectively. Chi square showed no significant difference in plaque scores among the children aged 36-47 months and those aged 48-59 months (x^2=1.173, df=1, p=0.279). Likewise, there was no significant difference in plaque scores between female and male children (x^2=1.108, df=1, p=0.298).

Table 10: Plaque occurrence by age and gender of the children.

Characteristic	**Category**	**No plaque n (%)**	**Plaque present. n (%)**	χ^2	**df**	***p-value at 95% CI***
Age group	36-47 months.	0	99 (100)	1.173	1	*0.279*
	48-59 months.	2 (1.2)	168 (98.8)			
Gender	Male	1 (0.7)	141 (99.3)	1.081	1	*0.298*
	Female	0	153 (100)			

There was no statistically significant differences in plaque scores among the children in relation to their tooth cleaning frequency (x^2 =1.539, df=5, p=0.909), supervision during tooth cleaning (x^2 =0.267, df=1, p=0.605), frequency of supervision (x^2 =1.625, df=3, p=0.654), use of tooth brush (x^2 =0.047, df=1, p=0.829) and use of tooth paste (x^2 =0.076, df=1, p=0.783). However, there was a significant negative relationship between plaque score and use of fluoridated tooth paste (x^2 =23.714, df=2**, p<0.001**).

Table 11: Plaque score and tooth cleaning behavior

Characteristic	Category	No plaque n (%)	Plaque present n (%)	χ^2	df	*p-value at 95% CI*
Cleaning (frequency)	Never	0	3 (100)	1.539	5	*0.909*
	Several times a month(2-3 times)	0	17 (100)			

	Once a week	0	11 (100)			
	Several times a week(2-6 times)	0	57 (100)			
	Once a day	2 (1.1)	172 (98.9)			
	2 or more times a day	0	45 (100)			
Child supervision	Unsupervised	0	36 (100)	0.267	1	*0.605*
	Supervised	2 (0.7)	269 (99.3)			
Supervision Frequency	Never	0	32 (100)	1.625	3	*0.654*
	Every day	2 (1.2)	164 (98.8)			
	Once a week	0	49 (100)			
	Three times a week	0	53 (100)			
Toothbrush use	No toothbrush	0	7 (100)	0.047	1	*0.829*
	Uses toothbrush	2 (0.7)	300 (99.3)			
Toothpaste use	No toothpaste	0	11 (100)	0.076	1	*0.783*
	Uses toothpaste	2 (0.7)	289 (99.3)			
Fluoride use	No fluoride	2 (9.1)	20 (90.9)	23.714	2	***<0.001***
	Uses fluoride	0	197 (100)			
	Don't Know	0	62 (100)			

The plaque scores of the children were compared to the socio-economic status of the caregivers. There was no significant differences in plaque scores among the children in relation to their caregivers' level of education and employment status (Table 12)

Table 12: Children's plaque score and caregivers' socio-economic status.

Characteristic	**Category**	**No plaque n (%)**	**Plaque present n (%)**	χ^2	**df**	***p-value at 95% CI***
Level of Education (Mother/ Caregiver)	No formal schooling	0	2 (100)	2.669	6	*0.849*
	Less than primary school	0	10 (100)			

	Primary school completed	0	38 (100)			
	Secondary school completed	0	83 (100)			
	High school completed	0	36 (100)			
	College/University	2 (1.6)	127 (98.4)			
	I don't know	0	2 (100)			
Employment status	Unemployed	0	73 (100)			
	Self-employed	0	144 (100)	5.264	2	*0.072*
	Employed	2 (2.4)	81 (97.6)			

3.3.2: Gingivitis among the children

The prevalence of gingivitis was 79.0% (n=233). Severity of gingivitis among the children varied between mild to moderate. About a quarter of the children examined had healthy gingivae. The frequencies of severity of gingivitis among the children is as presented in the table below.

Table 13: Severity of gingivitis among the children.

	Frequency	Percent
Healthy	66	24.8
Mild	176	66.2
Moderate	24	9.0
Severe	0	0

Among the children who had gingival inflammation, 115 (49.4%) were males while 118 (50.6%) were females. The mean gingival index of the children was 0.41 (+/- 0.39) with a range from 0 to 1.58. More than half of the participants (n=176, 66.2%) had mild gingivitis with only a few (n=24, 9%) having moderate gingival inflammation. Male children had higher mean gingival index of 0.43 compared to females who had mean gingival index of 0.38. Children in the 36-47 months age bracket were found with mean gingival index of 0.36 while those in 48-59 age bracket had mean gingival index of 0.45. The comparison of gingivitis prevalence between age groups 36-47 months and 48-59 months revealed no significant differences (x^2 = 2.817, df=1, p=0.093). The comparison between prevalence of gingivitis among male and female children revealed no significant differences (x^2 =0.662, df= 1, p=0.416) as shown in table 14.

Table 14: Gingivitis by age and gender of children, caregiver education and employment status.

Characteristic	**Category**	**Healthy gingivae n (%)**	**Gingivitis (mild to moderate) n (%)**	**χ^2**	**df**	***p-value at 95% CI***
Age	36-47 months	26 (26.3)	73 (73.7)	2.817	1	*0.093*
	48-59 months	30 (17.6)	140(82.4)			

Gender	Male	27 (19.0)	115(81.0)	0.662	1	*0.416*
	Female	35 (22.9)	118 (77.1)			
Caregiver level of education	No formal schooling	0	2 (100)			
	Less than primary school	2 (20.0)	8 (80.0)			
	Primary school completed	5 (13.2)	33 (86.8)			
	Secondary school completed	16 (19.3)	67 (80.7)	3.688	6	*0.719*
	High school completed	9 (25.0)	27 (75.0)			
	College/University	31 (24.0)	98 (76.0)			
	I don't know	0	2 (100)			
Employment status	Unemployed	11 (15.1)	62 (84.9)			
	Self-employed	37 (25.7)	107 (74.3)	3.890	2	*0.143*
	Employed	15 (18.1)	68 (81.9)			

The association of severity of gingivitis among the children in relation to their caregivers' education and employment status was not significant. The behavioral teeth cleaning parameters such as frequency of tooth brushing, supervision during tooth brushing, frequency of supervision during tooth brushing, use of tooth paste and use of fluoridated tooth paste were tested against presence of gingivitis and the results revealed no significant differences (Table 15)

Table 15: Gingivitis by tooth cleaning behavior.

Characteristic	**Category**	**Healthy gingivae n (%)**	**Mild to moderate gingivitis. n (%)**	χ^2	**df**	***p-value at 95% CI***
Teeth cleaning frequency	Never	0	3 (100)	2.917	5	*0.713*
	Several times a	2 (11.8)	15 (88.2)			

	month(2-3 times)					
	Once a week	3 (27.3)	8 (72.7)			
	Several times a week(2-6 times)	15 (26.3)	42 (73.7)			
	Once a day	36 (20.7)	138 (79.3)			
	2 or more times a day	9 (20.0)	36 (80.0)			
Child supervision	No	7 (19.4)	29 (80.6)	0.073	1	*0.787*
	Yes	58 (21.4)	213 (78.6)			
Supervision Frequency	Never	6 (18.8)	26 (81.3)			
	Every day	40 (24.1)	126 (75.9)			
	Once a week	9 (18.4)	40 (81.6)	1.737	3	*0.629*
	Three times a week	9 (17.0)	44 (83.0)			
Toothbrush use	No	0	7 (100)	1.945	1	*0.163*
	Yes	66 (21.9)	236 (78.1)			
Toothpaste use	No	2 (18.2)	9 (81.8)	0.075	1	*0.784*
	Yes	63 (21.6)	228 (78.4)			
Fluoride use	No	6 (27.3)	16 (72.7)			
	Yes	39 (19.8)	158 (80.2)	1.437	2	*0.488*
	Don't Know	16 (25.8)	46 (74.2)			

Spearman's rho test revealed a positive relationship between plaque score and severity of gingivitis in which the severity of gingivitis increased with the increase in the plaque scores among the children with **p<0.001** which was statistically significant (Table 16)

Table 16: Gingivitis severity by plaque scores (Spearman's rho) p<0.001

Correlations

		Gingivitis Severity (0 normal, 0.1-0.9 mild, 1.0-1.9 moderate, 2.0 to 3.0 severe)	Plaque categories

Spearman's rho	Gingivitis Severity (0 normal0.1-0.9 mild, 1.0-1.9 moderate, 2.0 to 3.0 severe)	Correlation Coefficient	1.000	.370**
		Sig. (2-tailed)	.	.000
		N	266	266
	Plaque categories	Correlation Coefficient	.370**	1.000
		Sig. (2-tailed)	.000	.
		N	266	274

**. Correlation is significant at the 0.01 level (2-tailed).

3.4: Nutritional status of the children

3.4.1: Food consumption habits

Majority of the children consumed tea with sugar on a daily basis (n=230, 75.2%). Slightly less than half of the children (n=125, 40.6%) consumed fresh fruits every day. Other sweetened foods/ snacks such as biscuits, cakes, sugared gum, sweets/ candy and milk with sugar were consumed at variable frequencies with consumption of milk with sugar having the highest number of children (n=40, 13.5%) consuming it daily followed by biscuits/ cake at 8.3% (n=25) daily consumers. Sixty four children (22.1%) breast fed for a period of between 4 months to 1 year while 22.8% (n=66) breast fed for 1 to 1.5 years duration. One hundred

and eighty eight children (40.7%) breast fed for a period of 1.5 to 2 years. Only 12.4% (n=36) of the children breastfed for more than 2 years. Six children (2.1%) were reported to have never breastfed. Most of the study participants (n=261, 85.9%) breastfed at will during the night. One hundred and twenty five children (42.4%) were reported to have bottle fed while 170 (57.6%) did not use the bottle. Most children (n=75, 79.8%) who used the bottle for feeding had milk as the main content in the bottle. Only nine children (3%) were reported to have slept with the bottle in the mouth.

Table 17: Food consumption habits of the children.

	n (%)					
	Never	Several times a day	Every day	Several times a week	Once a week	Several times a month
Fresh fruit	0	43 (14.0)	125 (40.6)	103 (33.4)	27 (8.8)	10 (3.2)
Biscuits & Cakes	30 (10.0)	39 (13.0)	25 (8.3)	55 (18.3)	63 (20.9)	89 (29.6)
Soft drinks	43 (14.3)	34 (11.3)	8 (2.7)	41 (13.7)	47 (15.7)	127 (42.3)
Sugared gum	56 (18.6)	43 (14.3)	17 (5.6)	69 (22.9)	32 (10.6)	84 (27.9)

Sweets/Candy	57 (19.6)	43 (14.8)	12 (4.1)	53 (18.2)	39 (13.4)	87 (29.9)
Milk with sugar	159 (53.5)	23 (7.7)	40 (13.5)	27 (9.1)	23 (7.7)	25 (8.4)
Tea with sugar	15 (4.9)	27 (8.8)	230 (75.2)	20 (6.5)	3 (1.0)	11 (3.6)

3.4.2: Nutrition assessment.

Nutritional analysis was done using the WHO child growth standards which categorizes anthropometric measurements in form of standard deviations about the mean (Z scores). The WHO recommended cut off value of <-2 and >+2 Z scores was used to determine the nutrition status and any child below -2 Z scores was considered to be malnourished. Four of the children were moderately underweight. Six children had low height for age while three children had low weight for height. There were no obese or severely malnourished children. The tables below are summaries of the gender and age distribution of malnutrition among the study participants.

Table 18a: Prevalence of malnutrition among the children

	WAZ (< -2SD) (weight for age)	HAZ (< -2SD) (Height for age)	WHZ (< -2SD) (Weight for height)
36-47 months	1.1%	3.3%	2.2%
48-59 months	2.0%	2.0%	0.7%
Total	1.7%	2.5%	1.1%

Table 18b: Prevalence of malnutrition among male children

	WAZ (< -2SD)	HAZ (< -2 SD)	WHZ (<-2 SD)
36-47 months	0% (n=0)	6.1% (n=2)	0% (n=0)
48-59 months	3.8% (n=3)	2.5% (n=2)	0% (n=0)

Table 18c: Prevalence of malnutrition among female children

	WAZ (< -2SD)	HAZ (< -2 SD)	WHZ (<-2 SD)
36-47 months	1.7% (n=1)	1.7% (n=1)	3.4% (n=2)
48-59 months	0% (n=0)	1.5% (n=1)	1.5% (n=1)

3.5: Nutritional status and its relationship to gingivitis.

Stunted children had a lower mean gingival index (0.22) compared to children of normal height who had a mean gingival index of 0.41. A comparison between two groups (stunted and normal height) of children was done. ANOVA test revealed that there was no significant difference between the means (F= 1.389, p=0.240). Nutritional status of children as far as height for age was concerned did not have a significant relationship with the gingival index of the children. Four children (n= 4) had low weight for age (underweight). The mean gingival index of the children who had low weight for age was 0.58 (SD 0.545) compared to that of children having normal weight for age who had a mean gingival index of 0.40 (SD 0.384). As

much as children with low weight for age had a higher gingival index than children with normal weight for age, the effect of weight for age on gingivitis was not statistically significant (F=0.856, p= 0.356). Three children were found to be wasted in the nutritional assessment analysis. The gingival index of the children who were wasted was 0.21 (n=3, SD 0.36). Children who had normal weight for height had a mean gingival index of 0.41 (n=272, SD 0.387). The difference in gingivitis among the two groups of children was not significant (F= 0.793, p= 0.374). With these findings therefore, the hypothesis that there is no relationship between nutritional status and prevalence of gingivitis in children aged 36-59 months is not rejected.

3.6: Nutritional status and its relationship to dental caries.

A comparison in dental caries experience among stunted and normal height children was done. Stunted children had a mean dmft of 3.67 while normal height had dmft mean of 3.18. Stunted children had a slightly higher dmft index. The difference between the two groups was not significant (F=0.089, p=0.766). Children who had low weight for age were found with higher dmft than children of normal weight for age. The dmft's of the two groups were 4.50 and 3.17 respectively. However, the difference in dmft between the two groups was not significant (F=0.443, p= 0.506). Children who had low weight for height had a mean dmft of

2.00 while the ones who had normal weight for height had a mean dmft of 3.20. The relationship between weight for height and dmft was not significant (F= 0.273, p=0.602). The hypothesis that there is no relationship between nutritional status and dental caries experience is therefore not rejected.

CHAPTER 4

DISCUSSION

This study set out to determine the prevalence of dental caries and gingivitis in relation to nutritional status of children aged 36-59 months attending preschools in Thika, Kiambu County. The target number of children was 380 whereby questionnaires were sent out to their parents/ guardians to fill in and return to school. The target number was however not achieved due to lack of cooperation from the parents. Many children returned poorly filled forms which were lacking in parental consents. The response rate was 77.6% which is within acceptable

rates for self-administered questionnaires. The behavior of the parents could be attributed to ignorance and suspicion towards research activities. Most caregivers who gave consents were females. This could be a reflection of active role of mothers in bringing up children in this population. The literacy level is high among caregivers, a reflection of typical semi urban Kenyan population.

The mean plaque score of the study participants was 0.95 which can be rated as good oral hygiene according to Silness and Loe 1964. Age or gender did not have a significant relationship with oral hygiene of the children according to the findings. This could be due to lack of significant improvement in the manual dexterity of these children from the age of 36 months through to age 59 months. Manual dexterity among boys and girls could be the same and this might explain why there was no gender differences in dental plaque. In the findings, the tooth cleaning frequency did not have a significant relationship with plaque accumulation. This finding highlights the role of technique of brushing coupled with manual dexterity among children as being more important in plaque removal than the frequency of teeth cleaning. There was a significant relationship between use of fluoridated dentifrice and plaque scores among the children. Fluoride ion has been reported to be inhibitory to carbohydrate metabolism by plaque bacteria which then reduces acid production. This inhibition has been hypothesized to involve different mechanisms among them being inhibition of glycolytic enzyme enolase and H/ATPase proton pump in plaque bacteria (59). However, mechanical plaque removal must be coupled with inhibitory action of fluoride to ensure plaque control.

The prevalence of gingivitis among the children studied was 79%. This is comparable to the report by Kenya national oral health survey of 2015 (60) which reported prevalence of

gingivitis among children aged 5, 12 and 15 years as 75.7%. In the same report, the prevalence of gingivitis among children aged 5 years was reported as 99.6%. The high prevalence of gingivitis among young children could be attributed to lack of manual dexterity for effective tooth cleaning. The prevalence of gingivitis in this study is also comparable to study by Waafa et al in Egypt who reported prevalence of gingivitis at 86.6% among preschool children (24). However, it is in contrast to Masiga et al who recorded the prevalence of gingivitis among 3 and 5 year old children in preschools in Nairobi Kenya at 37% and 40% respectively (25). The prevalence in this study is higher than that reported by Masiga et al and this could be attributed to changes in disease prevalence and trends as the study by Masiga and colleagues was done 20 years before this study. Male children recorded higher mean gingival index than the female children. The role of gender in oral hygiene maintenance came into limelight. According to a Brazilian study (23), male gender is cited as a risk factor for gingivitis among preschool children among other risk factors. This could be due to negligence of oral hygiene by the male children or the caregivers of the male children.

This study did not find any significant relationship between nutritional status and the prevalence of gingivitis among the study participants. However, children who were stunted had lower mean gingival index (0.22) than normal height children (0.41). Wasted children also had a lower mean gingival index (0.21) compared to children of normal weight for height (0.41). These findings are in contrast with reports from South Africa (53) and Nigeria (54) which reported an association between malnutrition and gingivitis. Conversely, underweight children had a higher mean gingival index (0.58) compared to normal weight children. The number of malnourished children in the present study was low thus making interpretation of results difficult.

Prevalence of dental caries among the study participants was 62.7% and the mean dmft was 3.19 (SD 3.96). This is comparable to prevalence reported by Njoroge et al (16) and Ngatia et al (17). Njoroge et al reported prevalence of early childhood caries to be 59.9% while Ngatia and colleagues reported prevalence of ECC at 63.3%. Similarities in diets and oral health behavior among the children in Nairobi and Thika which are neighboring towns could partly explain the similarities in ECC prevalence. Maternal oral health behavior and child weaning habits could also be attributed to these similarities in dental caries prevalence.

In the present study, more females were affected by dental caries compared to males. This finding is in agreement with the report by Kenya national oral health survey of 2015 (60). According to the report, female children had higher dmft mean index than male children. The finding in the present study is in contrast with what Njoroge and colleagues reported that there was gender bias in dental caries prevalence with boys being more affected than girls (16). In the present study, girls were more affected by dental caries and this could be due to snacking habits of girls who tend to consume more refined sugars. The decay (d) component of the dmft in the present study accounted for 62.7% while the missing and filled components accounted for 5.4% and 1.6% respectively. The Kenya national oral health survey also reported that tooth decay was the major contributor to dmft among the study participants (60). Wasunna et al in 2012 reported that the decay component was high in their study possibly due to lack of accessibility to preventive and curative dental services among the population. Poorly equipped government facilities and lack of technical knowhow among the available oral health care providers was blamed for the high frequency of missing teeth due to extraction and low frequency of filled teeth (61). The present study agrees with these hypotheses as some of the causes of high frequency of decayed teeth and low frequency of

filled teeth among the study participants. High prevalence of decayed teeth is also a reflection of unmet treatment needs among preschool children in this County and the country at large. Children aged 36-47 months had more decayed teeth than their older counterparts. This is in contrast with what Gupta et al (12) reported in India that caries prevalence increases with age of the preschool children. However, the Kenya National Oral Health survey reported similar findings as in the present study that younger children aged 5 years had the highest dmft compared to 12 and 15 year olds. Disease burden due to dental caries is heavier among the younger children and it is possible that manual dexterity and thus effectiveness of tooth cleaning increases with age of a child. Older children are also likely to have had their teeth extracted due to pain thus a lower decay prevalence with an increase in missing teeth prevalence. The trend in dental caries occurrence could be changing with young children being more affected than the older ones. Female gender had higher dental caries prevalence among preschool children in the present study.

The frequency of tooth cleaning had a significant, negative relationship with dental caries experience among participants in this study (x^2 =12.194, df=5, **p=0.032**). Likewise, there was a significant, negative relationship between use of toothpaste during teeth clean and dental caries occurrence (x^2 =5.994, df=1, **p=0.015**). These findings emphasize the role of mechanical and chemical plaque removal in dental caries prevention. The most frequently used dentifrice among the children contained fluoride. The role of fluoride ion in plaque metabolism is therefore emphasized by this finding. Fluoride ion has been reported to have an inhibitory effect on plaque bacteria metabolism. Breast feeding at night had a significant, positive relationship with dental caries experience (x^2 =6.646, df= 2, **p=0.036**). This finding is in tandem with reports by other authors (62, 63). The swallowing reflex is less active at night.

This leads to reduced oral clearance of the carbohydrates consumed at bed time. Because the pathophysiology of dental caries is dependent on time, more cavities tend to occur when high carbohydrate is consumed during the night. This partly explains the significant relationship between at-will breast feeding during the night and dental caries occurrence. There was no significant relationship between nutritional status and dental caries occurrence among the participants in this study. However, stunted children had higher dmft than children of normal height for age. Stunting is an indicator of chronic malnutrition mostly as a result of food insecurity within the family. These stunted children could be coming from families with food insecurity and probably poor nutritional choices which can lead to increased dmft. Chronic malnutrition can also lead to hypoplasia of the teeth and this can predispose teeth to dental caries. Underweight children also had higher dmft than children of normal weight. This could be due to poor dietary habits of these children who could be consuming a lot of refined sugars with little nutritional value but more cariogenic potential. The hypothesis that nutritional status had no relationship with dental caries experience was therefore not rejected as there was no statistical significance from ANOVA tables. However, number of malnourished children in this population was low and this could be because children in this age group received meals at school for mid-morning snacks and lunch. Children who were not in the school lunch program had food delivered from home by parents or guardians. The study was in an urban set up where feeding programs catered for most needs of malnourished children.

Study limitations

Use of self-administered questionnaires reduced the sample size expected. Dental caries assessment was only done clinically, there was no radiographic adjunct and this could have

led to misreporting on dental caries. Dietary assessment was subject to bias recall as it depended entirely on memory of the caregivers.

Conclusions

The following conclusions can be drawn from this study:

1. The prevalence of dental caries was high in this population at 62.7% with dmft of 3.19 (+/- 3.96). The d component accounted for 62.5% of the dmft. The female children and children of lower age group were the most affected by dental caries.

2. The prevalence of gingivitis was 79.0% with mean gingival index of 0.41 (+/- 0.39). Male children and children of higher age group had higher prevalence of gingivitis.

3. There was a statistically significant relationship between dental caries occurrence and tooth cleaning frequency among the children. Increased frequency of tooth brushing can be associated with reduced dental caries occurrence.

4. There was a statistically significant relationship between dental caries occurrence and use of toothpaste among the children.

5. At-will breastfeeding during the night had a statistically significant relationship with dental caries occurrence among the children.

6. There was no relationship between nutritional status and prevalence of gingivitis among the children

7. There was no relationship between nutritional status and dental caries experience among the children.

Recommendations

1. There is need for more education on oral hygiene maintenance and dietary habits. Emphasis should be on maternal breast feeding practices in order to reduce the prevalence of dental caries among children aged 36-59 months. This education can be incorporated in the maternal child health clinics and also through the preschool curriculum.

2. There is need for improvement on availability and accessibility to preventive and curative dental services in order to combat the dental diseases which are on the rise among children aged 36-59 months.

3. Oral health of preschool children should be included in the counties' health policy in order to avail preventive and curative services to this vulnerable age group.

4. Further studies on oral diseases and nutritional status among preschool children, with larger sample sizes is recommended.

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Appendix 1

CLINICAL EXAMINATION FORM.

Id No……. **Age. ……./……/……**

DD/MM/YY.

Gender: Male…… Female……

Anthropometry.

	First reading	**Second reading**	**Average.**

Weight in Kilograms.			
Height in Centimeters.			

Oral hygiene status.

Tooth/surface.	**55**	**52**	**64**	**75**	**72**	**84**
Facial.						
Lingual.						
Mesio-facial						
Disto-facial						
Total score.						

Score criteria.

0- No plaque detected.

1- 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.

2- Moderate accumulation of soft deposits within the gingival pocket or the tooth and gingival margin which can be seen with the naked eye.

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

Dental caries assessment.

55 54 53 52 51 61 62 63 64 65

85	**84**	**83**	**82**	**81**	**71**	**72**	**73**	**74**	**75.**

Tooth status.	**Code for deciduous tooth.**
Sound	A (1)
Carious	B (2)
Filled with caries.	C (3)
Filled with no caries	D (4)
Missing due to caries	E (5)
Fissure sealant	F (6)
Fixed dental prosthesis	G (7)

Gingivitis assessment.

Tooth/Surface.	**55**	**52**	**64**	**75**	**72**	**84**
Facial.						
Lingual.						
Mesio-facial.						
Disto-facial.						

Total score.						

Scoring criteria.

0 normal gingiva

1 mild inflammation, slight edema, no bleeding on probing.

2 moderate inflammation, bleeding on probing.

3 severe inflammation, marked edema, tendency to spontaneous bleeding.

(Adapted from WHO oral health assessment forms 2013.)

Appendix 2

QUESTIONS TO BE ANSWERED BY MOTHER/CAREGIVER

The information obtained will be confidential and only used for the purpose of this study.

Childs ID number ☐

Parent's/Care giver's Sex ☐ Age ☐

Geographical location.....

A.ORAL HYGIENE PRACTICES

1. How often does your child clean his/her teeth?

Never..... ☐

Several times a month (2–3 times)..... ☐

Once a week..... ☐

Several times a week (2–6 times)..... ☐

Once a day..... ☐

2 or more times a day..... ☐

2. Do you supervise your child when brushing? .....Yes ☐ No ☐

If yes, how often do you do that?

Every day..... ☐

Once a week..... ☐

3 Times a week..... ☐

3. What does your child use to clean his/her teeth?

	Yes	No
Toothbrush.....	☐	☐
Wooden toothpicks.....	☐	☐
Plastic toothpicks.....	☐	☐

Charcoal.....
Wooden Toothbrush..... ☐ ☐

Other..... ☐ ☐
Please specify_____

4. Does your child use toothpaste on his/her teeth? ..... YES ☐ NO ☐

b) Does the toothpaste contain fluoride? ..... YES ☐ NO ☐ Don't know ☐

C.DIETARY HABITS

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

	Never	Several Times	Every day	Several times/week	Once a week	Once times/month	Several
Fresh fruit.....	☐	☐	☐	☐	☐	☐	☐
Biscuits and cakes.....	☐	☐	☐	☐	☐	☐	☐
Lemonade, Coca Cola Or other soft drinks.....	☐	☐	☐	☐	☐	☐	☐
Chewing gum Containing sugar.....	☐	☐	☐	☐	☐	☐	☐
Sweets/candy.....	☐	☐	☐	☐	☐	☐	☐
Milk with sugar.....	☐	☐	☐	☐	☐	☐	☐
Tea with sugar.....	☐	☐	☐	☐	☐	☐	☐

2. How long did your child breast feed? .....Don't know ☐

3. Did your child bottle feed? .....
If yes what did you place in the bottle? .....

4. Did your child sleep with the bottle in the mouth? Yes ☐ No ☐

5. Did your child breast feed while sleeping during the night? Yes ☐ No ☐

D.MOTHER'S/CAREGIVERS LEVEL OF EDUCATION

No formal schooling..... ☐

Less than primary school..... ☐

Primary school completed..... ☐

Secondary school completed..... ☐

High school completed..... ☐

College/university completed..... ☐

I don't know..... ☐

E.MOTHER'S/GUARDIAN'S ECONOMIC STATUS

1. Unemployed ☐

2. Self-employed ☐

If self-employed, what do you do?.....

3. Employed YES ☐ NO ☐

If yes who is your employer? .....

F. IMMUNIZATION STATUS OF THE CHILD.

Did your child receive all immunizations as recommended by the ministry of health? Yes ☐ No ☐

(Adapted from WHO oral health questionnaires 2013.)

MASWALI YA KUJIBIWA NA MAMA AU MLEZI.

Taarifa zitakazopatikana zitakuwa siri na zitatumika kwa madhumuni ya utafiti huu.

Nambari ya kutambua mtoto.

☐

Mzazi / Mlezi Jinsia ☐ Umri ☐

Eneo la kijiografia .....

A.MAZOEA YA USIFISHAJI WA KINYWA.

1. Mtoto wako husafisha meno yake mara ngapi?

Kamwe ....

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

Mara moja kwa wiki ....

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

Mara moja kila siku ..... .

Mara mbili au zaidi kwa siku .....

2. Je, wewe husimamia mtoto wako wakati anasafisha meno yake? Ndiyo Hapana

Kama ndiyo, mara ngapi unaweza kufanya hivyo?

Kila siku ....

Mara moja kwa wiki .....

Mara tatu kwa wiki .....

3. Je mtoto wako hutumia nini kusafisha meno

Ndiyo Ndiyo. Hapana

Mswaki ....

Kichokoleo meno (wooden toothpicks)..... .

Kichokoleo meno (plastic tooth picks).....

Mkaa ....

Mswaki wa kijiti. .....

Nyingine..... ..... .

Tafadhali fafanua…….

4. Je, mtoto wako hutumia dawa ya meno kwa meno yake? Ndio Hapana

b) Je, dawa ya meno yenye floridi? ..... Ndio Hapana Sijui

C.TABIA ZA MALAZI

1. Mara ngapi mtoto wako hula au hunywa chochote cha vyakula zifuatazo, hata kwa kiasi kidogo.

	Kamwe	Mara Kadhaa.	Kila siku.	Mara kadhaa Kwa wiki.	Mara moja. Kwa wiki.	Mara Kadhaa kwa
mwezi						
Matunda						
Biskuti na keki .						
Lemonade, Coca Cola Au vinywaji vingine baridi .						
chewing gum						
Zenye sukari						
Peremende.						
Maziwa iliyo na sukari						
Chai iliyo na sukari						

2. Mtoto huyu alinyonya matiti kwa muda gani? .. . . Sijui

3. Je mtoto wako alilishwa kwa chupa? .....

Kama ndiyo,kinywaji kipi uliweka kwenye chupa? .....

4. Je mtoto wako alilala na chupa kinywani? Ndiyo ☐ Hapana ☐

5. Je, mtoto wako alinyonya matiti anapolala usiku? Ndiyo Hapana

D.KIWANGO CHA ELIMU CHA MAMA/ML ☐

Hakuna elimu rasmi ..... ☐

Chini ya shule ya msingi ..... ☐

Shule ya msingi kukamilika ..... ☐

Shule ya sekondari kukamilika ..... ☐

Shule ya high school kukamilika ..... ☐

Chuo kikuu kukamilika ..... ☐

Sijui ....

E.HALI YA KIUCHUMI CHA MAMA/MLEZI.

1. Asiye na kazi.

2. Kujiajiri

Kama kujiajiri, unafanya nini .....? .

3. Walioajiriwa Ndiyo ☐ Hapana ☐

Kama ndiyo, nani mwajiri wako? ....

F. HALI YA CHANJO YA MTOTO.

Je, mtoto wako alipokea chanjo zote kama ilivyopendekezwa na wizara ya afya?

☐ ☐

Ndiyo Hapana

(Imenukuliwa kutoka WHO maswali ya afya ya meno 2013.)

Appendix 3

CONSENT FORM.

The purpose of the study.

I, Dr. Alphonce Owino Ogada from the University of Nairobi would like to conduct a study to determine the pattern of occurrence of dental caries and gingivitis in relation to nutritional status of children aged 36-59 months in Thika, Kiambu County. This is in partial fulfillment for a degree of Master of Dental surgery in Pediatric Dentistry.

How you participate.

I have sent you some questions regarding you and your child. Please answer them as accurately as possible. The information will assist me to be able to understand the factors that lead to dental caries (cavities) and gingivitis (gum disease) in children. I will measure your child's weight using a weighing scale and measure your child's height using a standard height board. I will then examine the child's mouth using sterile (clean) instruments and record the observations.

Voluntary participation.

You and your child's participation in the study is voluntary and you can withdraw from this study at any stage/time without any threat or intimidation. There is no financial benefit to you or your child by participating in the study.

Risks of the study.

There is no risk anticipated in this study.

Benefits of the study.

Your child will get free dental checkup and oral hygiene instruction. If your child has decay or gum disease, you will be referred appropriately for treatment. This study will form a baseline for other studies, could help in formulation of policies on oral health and nutrition of preschool children and will also serve as partial fulfillment for degree of Masters of Dental surgery in Pediatric Dentistry.

Confidentiality.

The information given to me will be kept in strict confidence and cannot be released, revealed or published with your identity. If you are satisfied with my explanation and you are willing to allow your child to participate in this study, please sign the consent form.

Consent form.

I……of Thika Sub-County, having understood the nature of the study as explained in this letter from Dr. Alphonce Owino Ogada of the University of Nairobi, is willing to have my child participate in the study.

Name of mother /caregiver…….Signature……..Date……..

I confirm that I explained the nature of the study to caregiver through a letter and to the child in person.

Name and contacts of investigator:

Dr. Alphonce Owino Ogada,

School of Dental Sciences, University of Nairobi.

Cell: 0713542364.

Email: ogadaalphonce@gmail.com

Name and contact of lead supervisor:

Dr. Edith Ngatia,

School of Dental Sciences, University of Nairobi.

Cell: 0722447393.

Email: ngatiedith@uonbi.ac.ke

The secretariat,

KNH-UoN Research ethics and standards committee, P.O BOX 20723-00202, Nairobi.

FOMU YA IDHINI.

Madhumuni ya utafiti.

Mimi, Daktari Alphonce Owino Ogada, kutoka Chuo Kikuu cha Nairobi ningependa kufanya utafiti ili kujua tukio la kuoza kwa meno(caries) na ugonjwa wa fizi (gingivitis) kuhusiana na hali ya lishe ya watoto wenye umri wa miezi 36-59 katika Kaunti ya Kiambu. Hii ni kutimia nusu kwa kiwango cha shahada ya upasuaji wa meno (Master of dental surgery in Pediatric Dentistry).

Jinsi unaweza kushiriki.

Nimekuletea baadhi ya maswali kuhusu wewe na mtoto wako. Tafadhali uyajibu kwa usahihi kadri iwezekanavyo. Maelezo yatanisaidia kuwa na uwezo wa kuelewa mambo ambayo husababisha meno kuoza (mashimo) na ugonjwa wa fizi (gingivitis) kwa watoto. Nitapima uzito wa mtoto wako kwa kutumia kipima uzito na kupima urefu wa mtoto wako kwa kutumia kiwango cha urefu wa bodi. kisha nitachunguza kinywa cha mtoto wako kwa kutumia vyombo safi na kurekodi uchunguzi.

Ushiriki wa hiari.

Wewe na mtoto wako kushiriki katika utafiti ni kwa hiari na unaweza kuondoka kutoka utafiti huu katika hatua yoyote / saa bila tishio lolote au vitisho. Hakuna faida ya kifedha kwako au mtoto wako kwa kushiriki katika utafiti.

Hatari ya utafiti.

Hakuna hatari katika utafiti huu.

Faida.

Mtoto wako atapata kuangaliwa hali ya meno na mafunzo jinsi ya kulinda usafi wa meno. Kama mtoto wako ana uozo au ugonjwa wa fizi, utajulishwa ipasavyo kwa ajili ya matibabu. Utafiti huu utakuwa wa kuunda msingi kwa ajili ya masomo mengine, unaweza kusaidia katika uundaji wa sera za afya ya meno na lishe ya watoto ambao hawajaanza shule na pia

kutumika kama kutimia nusu kwa kiwango cha Master of Dental surgery in Pediatric Dentistry.

Usiri.

Maelezo ambayo nitapata kwako yatawekwa katika imani kali na hayawezi kuwa huru au kuchapishwa kwa utambulisho wako. Kama umeridhika na maelezo yangu na uko tayari kuruhusu mtoto wako kushiriki katika utafiti huu, tafadhali saini fomu za kuridhia.

Ridhaa fomu.

Mimi ..... wa Thika Sub-County, baada ya kuelezwa asili ya utafiti katika barua hii kutoka kwa Dr Alphonce Owino Ogada wa Chuo Kikuu cha Nairobi, niko tayari kushirikisha mtoto wangu katika utafiti.

Jina la mama /mlezi.....Signature.....Tarehe..... ..

Mimi nathibitisha kwamba nilieleza asili ya utafiti kwa mlezi kupitia barua na kwa mtoto ana kwa ana.

Jina la mchunguzi.

Dr. Alphonce Owino Ogada,

Chuo kikuu cha Nairobi.

Nambari ya simu: 0713542364.

email: ogadaalphonce@gmail.com

Jina la msimamizi:

Dr. Edith Ngatia,

Department of Pediatric dentistry,

School of Dental Sciences, University of Nairobi.

Cell: 0722447393.

Email: ngatiedith@uonbi.ac.ke

The secretariat,

KNH-UoN Research ethics and standards committee,

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KENYATTA NATIONAL HOSPITAL APPROVED 16 OCT 2015

Ref: KNH-ERC/A/427

16th October 2015

Dr. Aphonce Ovino Ogada
V80/7813/2014
Dept. of Paediatric Dentistry and Orthodontics
School of Dental Sciences
University of Nairobi

Dear Dr. Ogada

Research proposal: Dental caries, Gingivitis and Nutritional status of Preschool children in Kiambu county (P561/08/2015)

This is to inform you that the KNH/UoN-Ethics & Research Committee (KNH/UoN-ERC) has reviewed and **approved** your above proposal. The approval periods are 16th October 2015 – 15th October 2016.

This approval is subject to compliance with the following requirements:

a) Only approved documents (informed consents, study instruments, advertising materials etc) will be used.
b) All changes (amendments, deviations, violations etc) are submitted for review and approval by KNH/UoN ERC before implementation.
c) Death and life threatening problems and serious adverse events (SAEs) or unexpected adverse events whether related or unrelated to the study must be reported to the KNH/UoN ERC within 72 hours of notification.
d) Any changes, anticipated or otherwise that may increase the risks or affect 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.
e) 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*).
f) Clearance for export of biological specimens must be obtained from KNH/UoN-Ethics & Research Committee for each batch of shipment.
g) Submission of an *executive summary* report within 90 days upon completion of the study. This information will form part of the data base that will be consulted in future when processing related research studies so as to minimize chances of study duplication and/or plagiarism.

For more details consult the KNH/UoN ERC website http://www.erc.uonbi.ac.ke

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