EFFECTS OF ORAL HYGIENE PRACTICES ON ORAL HYGIENE STATUS AMONG ADULT INHABITANTS OF RURAL COMMUNITIES IN IDO LOCAL GOVERNMENT OF OYO STATE, NIGERIA.

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SUPERVISOR ATTESTATION

We hereby attest that we supervised the project titled **"Effects of Oral Hygiene Practices on Oral Hygiene Status among adult inhabitants of rural communities in Ido Local Government, Oyo State, Nigeria"** carried out by Dr Nasiru W. Olukemi ..

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Declaration

I hereby declare that I carried out this study and it is original unless otherwise acknowledged. The study has not been presented at any scientific meeting or any examining body or submitted elsewhere for publication either in part or as a whole.

Nasiru Wosilat Olukemi BDS (Ibadan)

DEDICATION

Almighty God, YOU know where YOU found me and where YOU are taking me to. This work is dedicated to YOU, my constant HELPER.

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List of Abbreviation

WHO	World Health Organization
CPITN	Community Periodontal Index for Treatment Needs
OHI-S	Oral Hygiene Index-Simplified
FDI	International Dental Federation
MMWR	Morbidity and Mortality Weekly Report
PG	Prostaglandin
ILs	Interleukins

Abstract

The effects of oral hygiene practices on oral hygiene status among adult rural community dwellers in Ido Local Government Area of Oyo State, Nigeria were investigated in this cross sectional study.

Material and methods: A representative sample of two hundred and fifty participants (143 males and 107 females) between the ages of 18 and 67 years with mean age of 41.60 ± 13.43 years, were selected among adults from 5 rural communities in Ido Local Government Area of Oyo State.Data were collected through clinical examinations and the use of interviewer – administered questionnaire. Frequencies and percentages of relevant variables were reported. Chi square test was used to test association between categorical variables at 5% level of significance.

Results: One hundred and thirty nine participants (55.6% had fair practices, 108 (43.2%) had poor practices and only 3(1.2% had good practices. The results demonstrated a low prevalence (19.6%) of twice daily tooth cleaning frequency, 16% cleaning period practice and 20.8% cleaning duration. Only 22% of the study participants use medium tooth brush texture, 26% changes their toothbrush every three months, (30%) use vertical stroke tooth brushing technique, (4.4%) use dental floss, (4.4%) use mouth wash and (8.8%) visit the dental clinic regularly.

There is a strong statistically significant association between the choice of cleaning aids and age ($p<0.05$). All (100%) participants within the age groups 18 -24 years used toothbrush and toothpaste as compared to only 15.2% among the age groups 55 -64 years. Poor oral hygiene was recorded among 54.8% of participants, 31.2% had fair oral hygiene while only 14% of the study participants had good oral hygiene.

Poor oral hygiene was also depends on the level of education, however, the widowed (92.3%) were shown to present with the poorest oral hygiene. Likewise, oral hygiene practices were strongly significantly associated with age, gender, marital status, level of education and occupation ($p< 0.05$). The results also showed that subjects (78.7%) with poor oral hygiene practices have the poorest oral hygiene.

There was a strong relationship between cleaning aids and oral hygiene status. All (100%) participants who used toothbrush and toothpaste had good oral hygiene as compared to 54% of chewing stick users who had poor oral hygiene. The level of oral hygiene status was shown to increase with increase in the level of good oral hygiene practices.

There was an increase in poor oral hygiene with increase age, males (68.5%) have poorer oral hygiene than the females (36.4%), and the poorest oral hygiene were found among the farmers (80.9%).

Conclusion / Recommendation: This study highlights the poor oral hygiene status of the majority of adult's inhabitants of rural communities in Ido local Government. It also expresses the relationship between poor oral hygiene practices and poor oral hygiene status. Also, it expresses the influence of age, marital status, educational status and occupation on the two.

It is recommended that more community oriented oral health promotion programmes, emphasizing the practice of good oral hygiene should be conducted in this local government area to improve oral health of the inhabitants.

CHAPTER ONE

1.0 Introduction

A good quality of life is possible if adults maintain their oral health and become free of oral diseases because oral health is an essential aspect of general health throughout life. It can be defined as, a standard of health of the oral and related tissues which enables an individual to eat, speak and socialize without active disease, discomfort or embarrassment and which contributes to general well being (Kay,1997). It includes healthy teeth and the surrounding gingival tissues, periodontal ligaments and the alveolar bones. However, the oral cavity is associated with the development of healthy personality, perception and the overall experiences of pleasure.

The World Health Organization described oral diseases as a global health problem in both industrialized and developing countries (WHO 2004). This is attributed to several aetiological factors such as unemployment, traditional and cultural beliefs, lack of oral health awareness, habits such as smoking and tobacco chewing, low level of education and most importantly poor oral hygiene (Laing *et al.*, 2008). Oral hygiene is part of oral health practices which involve the different ways of keeping the mouth clean and healthy by brushing and flossing to prevent oral diseases. Oral hygiene can also be referred to as the general mouth cleanliness using various methods of cleaning to make it hygienic (Muhammad & Lawal, 2010). It determines oral health status, therefore a good oral hygiene practice and maintenance of good oral hygiene status can prevent occurrence of many oral diseases.

In the past, oral health had often been associated with the mouth only but only in the last decade has the possible effect of oral health on the general health and mortality of elderly people attracted much attention. An association between dental health practices and dentition mortality have been reported in several studies; Hamalainen *et al.*, 2003, Morita *et al.*, 2006, Osterberg *et al.*, 2007, Osterberg *et al.*, 2008. It was found that failure of tooth brushing at night before bed, using dental floss everyday and visiting the dentist were significant risk factors for longevity (Paganini, 2011) . Never brushing at night increased risk by 20-35% compared with brushing every day. Never flossing increased risk by 30% compared with flossing every day and failure in visiting the dentist within 12 months increased risk by 30-50% compared with visiting a dentist two or more times annually (Paganini, 2011). Recent studies by Dominique *et al.*, 2007, American Academy of Periodontology ; 2008, and Chockaling *et al.*, 2009 have shown that the advanced stage of periodontitis has been linked with medical health problems such as heart disease and stroke. Some researchers (Moreu *et al.*,2005; Elter ;2002; Dominique *et al.*, 2004) also reported that periodontitis can cause

premature birth, low birth weight, pancreatic cancer, high blood sugar and even bacterial pneumonia.

Although some oral diseases are not life threatening, their psycho-social impact can affect the quality of life significantly (WHO 2005, Sheiham; 2007, Lopez; 2009). They can affect the most basic human needs including the ability to eat, drink, swallow and maintain proper nutrition. As people age, many lose their teeth thereby resulting to reduced mastication capacity and can influence food selection, nutritional status and general health.

Some authors like Albandar, 2002 and , 2005 have found out that oral diseases in children and adolescent restrict activities in school, at work and home causing millions of school and work hours to be lost each year worldwide.

Studies carried out by Sofola *et al.*, [2002]; Akpata [2004] and Owotade *et al.*, [2005] reported that the prevalence of oral diseases such as caries, periodontal disease, halitosis, gingivitis, cancrum oris, tooth loss and oral cancers are increasing in rural and urban communities in Nigeria and most of these diseases are caused by poor oral hygiene. Likewise, studies by Morenke *et al.*, 2007; Goyal *et al.*, 2007 and Dhar *et al.*, 2007 had shown that dental caries and periodontal diseases are due to poor oral hygiene practices.

A study conducted by Taiwo *et al.*, 2004 in Ibadan South East Local Government Area of Oyo State in Nigeria showed a high prevalence of poor oral hygiene among the elderly while Bamigboye *et al.*, 2005 reported a high prevalence of poor oral hygiene among the inhabitants of Idikan, a semi-urban community in Ibadan.

Researchers such as Sudhal; 2005, Khan; 2008 and Peterson; 2008 in their studies reported high prevalence of oral diseases among an Indian population, while on the contrary, a study by Muwazi; 2005; 2007 in Uganda reported a generally low prevalence of oral diseases among the inhabitants of both rural and urban communities, though caries experience was significantly higher in some urban districts when compared to rural districts in both children and adults.

Maintaining good oral hygiene practices, which is the cheapest form of preventive oral health measure, will help to prevent these diseases and their psycho-social complications (Spencer; 2003. A study in Sweden to monitor the incidences of oral diseases [tooth loss, caries and attachment loss] during a 30-year period [1972-2002] in a group of adults who maintained a carefully managed plaque controlled, reported that the incidence of oral diseases was very low since a high standard of oral hygiene was maintained. (Axelson *et al.*, 2004)

Oral health practices involve skills, habits and lifestyle - Kassak [2001]; Bokhari [2006]. Different studies by Kassak (2001), Penner *et al.*, 2004, Bokhari (2006) carried out in

different parts of the world have shown that, our ways of life, habit and lifestyle have assumed major importance in the etiology of both medical and oral diseases . Good oral hygiene practices should therefore aim at maintaining oral hygiene and preventing oral disease.

1.1 Problem Statement

Poor oral hygiene results in oral diseases which impact on the general health of the individual. Okolo et al.,2006 have noted that oral hygiene is about the cheapest form of preventive health measure, although cheap, it is surprisingly one of the most ignored in practice especially in the under privileged rural communities and this has resulted into high level of oral diseases. (Okolo *et al.*, 2006). A study in Ibadan demonstrated poor oral hygiene and high prevalence of periodontal disease among the elderly (Taiwo *et al.*, 2004.)

Also, various studies (Al-Otaibi *et al.*, 2003; Ibiyemi *et al.*, 2010; Azodo and Amenaghawon, 2013) have demonstrated poor oral hygiene among rural communities and Bamigboye and Akande, 2005 reported a high prevalence of poor oral hygiene among the inhabitants of Idikan, a semi-urban community in Ibadan. The author has observed an increase in the number of adults' rural dwellers reporting for emergency dental care in Idikan (Akande, 2005).This has therefore raised the need to look into the oral hygiene practices of rural communities of the peripheries of Ibadan. The choice of cleaning materials and the failure to use them effectively could be a predisposing factor to poor oral hygiene which could result in oral disease. There is little reported data on Oral hygiene practices in rural communities in Nigeria.

1.2 Justification

Part of the essential package of oral health care in Nigeria include prevention of oral diseases through provision of oral health education in rural communities and the general public. Delivery of oral health education has been part of the Community Dentistry curriculum in the University College Hospital Ibadan since establishment. However, the oral health education addressed the level of awareness of oral hygiene practices and oral diseases in general. It has been observed during oral health education programme in some rural communities in Ibadan that, "people from rural communities present with poor oral hygiene" though, it was noted that these people had no access to dental services. Search into the literature showed paucity of data relating oral hygiene practices in Nigeria to location especially the rural communities particularly in Oyo State. There is no published information on the oral hygiene practices and

their effect on the oral hygiene status of adult inhabitants of the rural communities in Oyo State. This study will provide the much needed information required to facilitate the oral health education and preventive programme in Oyo State.

1.3 Research questions

This study was able to provide information to the following:

1) The various oral hygiene practices adopted by adults of the rural communities in Ido Local Government.
2) The relationship between socio demographic characteristics (age, sex, educational status and occupation) of adults' rural dwellers in Ido Local government and their oral hygiene practices.
3) The oral hygiene status of the study participants.
4) The relationship between oral hygiene practices and oral hygiene status of the study participants.
5) The relationship between socio demographic characteristics (age, sex, educational status and occupation) and oral hygiene status of adults' rural dwellers in Ido Local government.

1.4 Aim

To determine how the oral hygiene practices affect oral hygiene status among adults living in the rural communities of Ido Local Government Ibadan Nigeria.

1.5 Objectives

- To determine the various oral hygiene practices among the study subjects.
- To determine oral hygiene status of study subjects.
- To determine the relationship of socio-demographic characteristics to oral hygiene practices
- To determine the relationship between socio-demographic characteristics and oral hygiene status of the study subjects.
- To determine the relationship between various oral hygiene practices and oral hygiene status in this community.

1.6 Research hypothesis

The following hypothesis will be tested:-

1) There is no significant difference between oral hygiene practices and oral hygiene status among the adult rural inhabitants in Ido Local Government
2) Socio demographic factors do not have a significant effect on oral hygiene practices and oral hygiene status of the study participants.

CHAPTER TWO

LITERATURE REVIEW

2.1 Historical Background of Oral hygiene Practices

The oral cavity in the life of a man is the most valuable possession follwed by his health. Without a healthy mouth, life is deprived much if not all of its usefulness, joy and pleasures. Generally, human well being may be halted due to dangers of unhealthy mouth. Furthermore, if the mouth is not in a good state of health, one cannot enjoy eating what one desires. A man with poor oral hygiene does not suffer pains and discomfort alone, he will also be unable to supply his body system with its needs. He may also require one or more persons to carry out his responsibility and someone to spend time, money and energy caring for him. Till date, there is no chemical that can make someone permanently plaque free, the only way to achieve good oral hygiene is by removing plaque "a soft tenacious material found on tooth surfaces that is not readily removed by rinsing with water" (Dawes; 1963). The unhindered deposition of plaque occurs on all surfaces of the teeth and is recognizable clinically within 24 hours (Claydon 2003).

Primitive man removed plaque and maintained oral hygiene with the use of charcoal, ashes, broken bottle powder, cotton wool, finger, rinsing with water and the use of chewing stick. Oral hygiene practiced by the Samarians of 3000 BC and elaborately decorated gold toothpicks found in the excavations at Ur in Mesopotamia, suggest an interest in cleanliness of the mouth (Gurudath, 2012).The Babylonians and Assyrians massaged a clay tablet combined with various herbal medications on the gingiva to treat periodontal disease (Gurudath, 2012) The Chinese about 5000 years ago used the chewing stick as a toothpick and toothbrush to clean teeth and massage the gingiva using urine as mouth rinse, they believe that urine rinse may aid in the prevention of tooth decay (Gurudath, 2012).

In Africa, the premature loss of teeth resulting from poor oral hygiene was regarded as a natural phenomenon especially to the adults and the elderly before the advent of the Western man. (Aderinokun, 1998) However, different native ways were used to take care of the teeth such as the use of chewing stick and various forms of astringents powder. In the early 1800,s, the Europeans started colonizing Africa and brought with them Western medicine which was introduced to the African man through colonial hospitals but dental care was not introduced until very late. In western industrialized countries significant improvements in oral health status have occurred as a result of effective work on oral hygiene, frequent tooth brushing

with the use of fluoride containing toothpaste,the use of dental floss,the use of mouth rinses together with changing living conditions and lifestyles (Varenne *et al.*, 2006). Although the improvements have not been the same in developing countries (Varenne *et al.*, 2006), there has been progress in the trends of solving the problems of poor oral hygiene from the early civilization days to the twenty first century (Varenne *et al.*, 2006).

2.2 Oral hygiene practice

Oral hygiene is the level of oral cleanliness of an individual, and is assessed based on the accumulation of soft and hard deposits on the surfaces of teeth, which are the aetiological factors of periodontal diseases (Gurudath., 2012) .The simplified oral hygiene index developed by Greene and Vermillion (1964) is a simple, standard and acceptable method of assessing oral hygiene. Assessment of oral hygiene of individuals reasonably reflects their gingival and periodontal health, as the soft and hard deposits on the tooth are implicated in gingivitis, periodontitis, dental caries and halitosis. The newer studies linking periodontal disease with systemic problems have necessitated the need to assess oral hygiene of various categories of individuals in an attempt to provide preventive and interventional oral healthcare in order to halt the linked systemic health problems and, ultimately, improve the quality of life

The practice of keeping the mouth clean and healthy to prevent oral diseases is called oral hygiene practices (Gurudath, 2012). Meanwhile, the attributes of good oral health practice according to Health Education Authority, (1989), Rilley *et al.*, (1995), Luciene, (2009) and Tomar and Cohen, (2010) includes: regular cleaning of the mouth at least twice daily, (after every breakfast and last thing at night), periodic visit to the dentist for routine check up and professional oral hygiene measures and adequate use of fluoride in any form and consumption of a balanced diet low in refined carbohydrates.

2.3 Types of Oral Hygiene Practices

A variety of oral hygiene measures have been used by different populations and cultures around the world since history. The oral hygiene practices in a certain population depend on various factors, such as cultural background, religious norms, educational levels and socio economic status (Asadi S and Asadi Z, 1997). Nowadays, cleaning teeth with manufactured toothbrushes is common in most developed countries, whereas in many third world countries toothbrushes are still uncommon (Al-Otaibi *et al*, 2003). Instead, chewing sticks, made from local material such as trees and shrubs are commonly used (Hardie and Ahmed, 1995). In

Saudi Arabia today there are large variations in oral hygiene habits, related mainly to age and socio economic levels (Al-Otaibi *et al*, 2003). The chewing stick, or miswak, is commonly used as a traditional and spiritual custom (Guile *et al.*, 1996; Almas *et al.*, 2000; Al-Otaibi *et al.*, 2003) and is carefully selected for certain characteristics such as size, hardness, and taste. The plant most commonly used for miswak manufacture is Salvadora Persica and this type is called Arak. In Africa, it has been reported that traditional chewing sticks were widely used by adults for tooth cleaning although toothbrush were only used by few especially in the rural communities (Benoit *et al.*,2006; Ojo *et al.*,2007, Bankole *et al.*,2012). In Nigeria it has been reported that majority of the urban dwellers use toothbrush and toothpaste Umesi-Koleoso and Ayanbadejo,2007 while reports from rural communities showed that the use of chewing stick is the most popular method of tooth cleaning (Faaziusl *et al.*, 2007, Ibiyemi *et al.*, 2010, Azodo and Amenaghawon, 2013).

The maintenance of optimal oral hygiene is dependent on the efficacy of oral self-care, which includes mechanical plaque control (with the use of tooth cleaning aids such as (tooth brush, traditional use of chewing stick, dental floss, interdental cleaning aids and periodic visit to the dentist for professional scaling), Chemical plaque control (with the use of mouth rinses), maintaining the natural balance of the resident oral microbiota, using probiotic and prebiotic regulation and lately the use of cleansing diets such as sugarless-chewing gum and carrots are also other plaque controlling methods. The choice of plaque control method however depend on the oral hygiene practice of an individual or a community. (Luciene , 2009,Tomar and Cohen, 2010)

2.3.1 The use chewing sticks

Chewing sticks are commonly used as oral hygiene tools in various parts of the world and it has been in use from time memorial (Al Sadhan and Almas, 1999) and is still in use today in many developing countries including Nigeria. (Faaziusl *et al.*, 2007). The choice of stick depends largely on religious or cultural purposes, traditions as well as ease availability, low cost and simplicity in use. The chewing stick is an affordable oral hygiene device and additional benefits are derived from its function as jaw exerciser as well as reflex induction of saliva secretion which is beneficial to the oral hygiene (Khalid and Taha, 1995).

The lower incidence of dental caries amongst users of chewing sticks compared to non-users has been attributed to the superior mechanical cleansing action on the teeth and to the antimicrobial properties of some of these sticks (Fatemeh,2010) The efficacy and usefulness of chewing sticks in comparison to the toothbrush and toothpaste in dental hygiene has been documented (Al-Otaibi., 2004). The World Health Organization has recommended and

encouraged the use of chewing stick as an effective and alternate tool for oral hygiene in areas where their use is customary (WHO,1997). This recommendation is also consistent with the principles of the primary Health Care Approach that focus on prevention, community participation and the use of appropriate technology (Al-lafi *et al.*, 1995). The promotion of good oral health by chewing stick is mainly attributed to mechanical cleansing efficacy, including the mechanical effects of its fibres. Also, the release of beneficial chemicals such as trimethyleamine, salvadorine, mustard oil, vitamin C, resins, flavodine, saponins, sterol and fluoride might all play an important role (Hardie and Ahmed.,1995).

Origin / Sources of chewing sticks

The chewing stick has its origin in antiquity and its use has been documented since ancient times. It was used by the Babylonians some 7000 years ago. Al-Sadhan and Almas., 1999) It was also used by the Arabs of the Pre-Islamic era to make teeth white and shiny (Khoory, 1983). In the early Islamic period, chewing stick (Miswak) was associated with a cultured elegant lifestyle. Muslims follow the example of their prophet, who was a fervent supporter of the Miswak (Chewing sticks), declaring it to be "cleansing for the mouth and a pleasure for Allah" (Yarde and Robinson., 1996, Sadhara., 1999). The use of wood stick for brushing teeth continues to be an important tool in many African and Asian communities. It has different names in different societies for instance; miswak, siwak or arak is used in the Middle East and India, miswaki, in Tanzania, mefaka in Ethiopia and datun in India and Pakistan (Almas, Al-Lafi ., 1995).

The conventional meaning of miswak is stick used to clean teeth and gums. The most commonly used chewing sticks are those having a good flavor, texture and a recognized effect on the teeth and supporting tissue. Freshly cut specimens are always desirable because they are more easily chewed into a brush. The plants used are very carefully selected for such properties as foaminess, hardness or bitterness and certain species are more popular than others. A great number of these plant species have related medicinal properties that may be antibacterial (Almas and Al-Lafi;1995). Chewing sticks are obtained from the roots, twigs or stems of various plants. According to Sole *et al.*, 1995, chewing sticks obtained from a variety of selected plants are used as traditional mechanical oral hygiene by up to 80 – 90% of Nigerians. Some of the chewing stick plants commonly used in Africa include:

Table 1: Examples of chewing stick plants used in Africa

Scientific Names	Family Names	Local Names
Masularia acuminate	Rubiaceae	Pako ijebu
Zanthoxylum zanthxyloides	Rutaceae	Orin ata
Terminalia glycosides	Combretaceae	Orin idi
Alchornea laxiflora	Euphorbiaceae	Pepe
Anogeissus leocarpus	Combretaceae	Ayin
Azadirachta indica	Meliaceae	Dongoyaro
Psidium guajava	Mytacea	Guava
Vernonia amygdalina	Asteraceae	Ewuro
Mangifera indica	Anacardiaceae	Mangoro
Jatropha mutifida	Euphobiaceae	Ogege

Adapted from, Taiwo, *et al.*, 2012.

Properties of chewing sticks

Properties of chewing sticks include the following depending on the type of chewing stick (Alali and Lafi; 2003, Daronti *et al.*, 2000 & Kubota *et al.*, 1988.

- Mechanical effects (massage of the gingival)
- Release of beneficial chemicals
- Stimulation of saliva resulting in a cleansing effect
- Plaque inhibiting effect
- Astringent effect on the mucosa membrane, reducing clinically detectable gingivitis
- Some chewing sticks contain resin which form a layer over the enamel protecting it against caries formation.
- Some chewing sticks contain alkaloids which exert a bactericidal effect in the oral cavity
- Some chewing sticks possess essential volatile oils which give aroma and exert antiseptic effect
- Some have a mild bitter taste stimulating salivary flow and has both cleansing and antiseptic effect
- Chewing stick contain vitamin C which is an antioxidant

- Some of them contain sodium bicarbonate which have a mild abrasive effect
- Some of them have a high concentration of flouride, inhibiting calculus formation and results in removal of stains from the teeth.
- Some of them also contain calcium which facilitates remineralization of the tooth (Alali and Lafi; 2003, Daronti *et al.*, 2000, Kubota *et al.*, 1988.

Effectiveness of Chewing sticks on Oral Hygiene

In Africa, particularly Nigeria, many people use chewing stick especially in the rural communities for oral hygiene tools based on its effects on gingivitis, its taste (bitter, sour and peppery) and cultural belief of a community to a particular chewing stick plant. The antimicrobial activities of some chewing sticks have been investigated and most of these chewing sticks have been shown to have significant antimicrobial activities against the oral microbial flora in varying degrees (Sote and Wilson;1995, Akande *et al.*, 1998, Darout, 2002, Al-Lafi T, Ababneh H;1995, Otaibil,2004, Owoseni and Ogunnusi; 2006, Ojo *et al.*, 2007. A recent study by Fatemeh, 2010 to determine the efficiency of miswak in preventing dental caries showed that miswak effectively prevent dental caries. The capability of some chewing sticks to confer a protective effect against dental caries has been link to its fluoride content (Taiwo *et al.*,2012).

Likewise the cleaning efficiency of chewing stick as compared to tooth brush has been investigated by some authors (Aderinokun, 1999, Otaibil, 2004, Darout and Albandar, 2000, Batwa, 2006). It can be concluded that chewing stick was as effective as toothbrush for reducing plaque on teeth surfaces. A study conducted by Darout *et al.*,2000 in Sudan to assess and compare the periodontal status of adult Sudanese habitual chewing stick users and toothbrush users, reported that, the periodontal status of chewing stick users in the Sudanese population is better than that of toothbrush users while in the contrary, Aderinokun in her study to compare the effect of two common Nigerian chewing sticks on gingival health and oral hygiene reported that , there was no significant difference in oral hygiene status between those using toothbrush and those using chewing sticks.

Apart from the use of chewing stick in maintaining good oral hygiene, some oral conditions are also treatable with plants in traditional oral health practices e.g. toothache, gingivitis, angular stomatitis, mouth ulcers, tonsillitis and black tongue.Puranwasi (2006). The use of chewing stick in cultures, religions and social purposes cannot be undermined. A study by Bukar *et al* (2004) on traditional Oral health practices among Kanuri women of Borno State,

Nigeria, reported that, traditional oral health practices particularly the use of chewing stick constitute important part of the life style .

2.3.2 The use of toothbrush

Ancient Roman participants engaged special slaves to clean their teeth as part of religious ritual. Gurudath, 2012. The toothbrush seems to have its origins in the chewing sticks of Babylonia as early as 3500 BC. Over the years the toothpick evolved into a chew stick, which was the size of a pencil. Records from China around 1600 BC show that one end was chewed until it became brush like; the other end was pointed and used as a toothpick. The twigs used for this purpose were from aromatic trees and therefore freshened the mouth, as well as cleaned it. The first toothbrush was conceptualized and invented in China in 1000 AD. It had an ivory handle and bristle made from horse's mane (Kumar and Jayanth V; 2011). The first modern idea of a toothbrush is believed to have been invented in China (Kumar and Jayanth;2011). However, many other people used different forms of toothbrushes. Ancient Indian medicine has used the neem tree and its products to create toothbrushes and similar products for millennia. In the Muslim world, the miswak, or siwak, made from a twig or root with antiseptic properties is widely used (Al-Sadhan and Almas, 1999). The first bristled toothbrush also originates from China at around the same time and was brought back to Europe by traders. It was made from hairs from the neck of the Siberian wild boar, which were fixed to a bamboo or bone handle. The handles were carved out of cattle bones and the bristles were made from wild boar or horsehair (Gurudath, 2012). Over the past few decades, there have been improvements on the basic design and the materials used in the manufacturing of tooth brush. The nylon bristle was introduced in 1938 and there have been subsequent improvements to these bristle fibres. The old style brush with a large and hard bristles has been replaced by a soft brush with a small head, with consequent benefits to oral hygiene. Other tooth brush innovations have given us slanted and rotating bristles, the electric tooth brush and a cleaning device that squarts jet of water on the teeth (Warren, 2007).

Prevalence of tooth brush users

Generally, the use of toothbrush and toothpaste is recommended by several authors (Dentino 1996, Gianco 2002, Gordon 2007,) and its use is more effective than other cleaning aids for the removal of plaque. Toothbrush is used throughout the world and particularly among the urban communities. A study by Addo-yobo,(1991) to inquire into oral cleaning practices and to determine levels of oral cleanliness among 12year old Ghanaians urban and rural school children, reported a high prevalence of toothbrush users. Also Koleoso (2007) in his study to

determine the oral hygiene practices among adolescents in Lagos Nigeria reported that, the use of toothbrush and toothpaste appears to have an increased prevalence than other cleaning aids. Azodo (2013) in his study to investigate the oral hygiene status and practices among rural dwellers in delta and Edo state Nigeria reported that 86.4% used toothbrush, Ibiyemi *et al*, 2010 reported a prevalence of 54.8 while Azodo and Odai (2011) also reported a prevalence of 54.4% user. Although, Ogunbodede and Fajemilehin, in osun state reported a prevalence of 6% tooth brush users in their study among the elderly, Taiwo *et al.*, 2004 reported that the elderly in South East local government area in Ibadan used the chewing stick more frequently than the toothbrush. The increase in the use of tooth brush over the years may be due to low and affordable cost.

Choice of tooth brushes

There are multitudes of different shapes, textures, sizes and patterns of toothbrushes available to the public. Although toothbrushes have been in use for many centuries, their general design has not varies much as we still lack concrete information about the relative merits of various types of toothbrush, and the practicable significant of variation in hardness , and of bristle or nylon filaments. There is no clear evidence about the superiority of any particular design of toothbrush nor has any difference in cleaning efficiency between nylon and natural bristle toothbrushes been documented (Green, 1966).There are brushes with tufted ends, design particularly for the lingual surfaces of the lower anterior teeth, also, there are straight brushes with all bristles of equal length. Since few people will use more than one brush at one brushing session, the straight brush is the one most generally recommended (Dunning 1979) Presently, no definite superiority has been shown for either natural or synthetic bristles tooth brushes, the method and toothbrush of choice depends upon the patients oral health, manual dexterity,personal preference, and his ability to desire to learn and follow prescribed techniques (Dental therapeutic, 1992). However, the recommended specifications for good oral hygiene in adults and in children involves a number of considerations, including effectiveness, cleaning ability, ease of use and likely compliance. Therefore an ideal toothbrush should effectively and safely remove plaque and deliver agents in the dentifrice to the tooth surface. It should be easy to use, ergonomic and patient-friendly and be able to remove plaque from all surfaces of the tooth, including interstitially. For children, the toothbrush can incorporate design features that help motivate them to brush.

Components of toothbrushes

The most important part of a toothbrush is its bristle or filament. Artificial filaments made of nylon are the most common type of tooth brush bristle used today., they are superior to

natural bristles in homogenicity of the material, uniformity of size, elasticity, resistance to fracture and the repelling of water and food debris (Park,Matis and Christen, 1985).

Texture of toothbrush

For the users, the most important characteristics of a toothbrush is its texture, that is, the designated hardness or softness of the brush itself. At present, the accepted texture descriptions are extra hard, hard, medium, soft and extra soft. Chong & Beech ,(1983) indicated in their review of toothbrushes in Australia that for any given brush head design, the texture is basically controlled by two factors: the tufting materials and the dimensions of the individual monofilaments or bristles. Hard and extra hard tooth brushes can cause considerable damage to oral tissues.

Effectiveness of toothbrushes

No one specific type of toothbrush has been found to be consistently more effective than another. Differences in oral hygiene conditions and the manual dexterity of individuals may lead to varying requirement for tooth brushes. The effectiveness of manual versus powered toothbrushes in relation to plaque removal have been investigated and it was shown that there was no evidence of a statistically significant difference between powered and manual brushes (Robinson; 2004, Davies; 2006).

Several studies Aaron & Patricia; 2007, Sharma & Walter, 2010, Aruna *et al*, 2011 have been conducted on the effectiveness of toothbrushes on plaque removal and it has been shown that, the effectiveness of a toothbrush in controlling plaque on the tooth depends on the following:

- Type of toothbrush – manual versus powered;
- Frequency of tooth brushing and frequency of changing toothbrush;
- Technique of tooth brushing;
- Duration of tooth brushing and manual dexterity of the individual.

Aaron and Patricia,2007 in their study to evaluate the plaque removal efficacy of an advanced rotating-oscillating power toothbrush versus a sonic toothbrush reported that the powered tooth brush was significantly more effective in single-use plaque removal than Sonic toothbrush. Also a study by Sharma and Walters,2010 to evaluate the plaque removal efficacy of five manual tooth brushes reported that all the five manual tooth brushes showed highly effective plaque reduction for whole mouth and gingival margin. James et al 1998 in their study to compare the efficacy of sonic toothbrush with traditional manual toothbrush reported that the sonic tooth brush was found to be significantly superior to the manual brush, plaque reduction was found to be 38% with the sonic brush and 6% with the manual brush. In

Comparison to chewing sticks, it has been reported that manual toothbrush and chewing sticks were both effective in the removal of plaque, but manual toothbrush was more effective than chewing stick (Norton & Addy; 1989, Aruna *et al.*, 2011).

Frequency of tooth brushing

Study of the literature gives no clear evidence as to the optimal time-point of tooth brushing. Some investigators have recommended brushing as frequently as five times a day, whereas other suggests a frequency as low as once a day. The brushing habit of individual differs widely, particularly regard to the amount of time spent, the total number of stokes used and brushing pressure. Tooth brushing without damaging either the hard and soft tissue is more important than the frequency and the techniques used (Park *et al,* 1985).

Some authors Van der Weijden, 1991, Ashley, 2001, Attin & Hornecker, 2005, Andrew; 2009 have investigated the effects of brushing frequency and time in relation to plaque removal and had reported that an increase in the frequency of toothbrushing with increased brushing time results in decrease in gingival inflammation and visible plaque.At the extremes, brushing for 180 seconds removed 55% more plaque than brushing for 30 seconds. Brushing for 120 seconds removed 26% more plaque than brushing for 45 seconds. However, in order to eliminate food impaction and to shorten the duration of sucrose impact by tooth cleaning after meals, tooth brushing twice daily are most likely to accomplish this prime goal and is recommended by many dentists in order to improve plaque control.

Tooth brushing Techniques

Several tooth brushing techniques have been proposed, such as Charters, Stillman, vertical and horizontal scrubbing, the Roll technique and the Bass technique. Stillman [1932]; Leonard [1939]; Bass [1954] and Wilkman [1992]. No one technique has been shown to be consistently more effective than another. Although, the scrubbing technique is the most popular method of brushing and there are findings that a scrubbing techniques is more effective than the Roll technique in adults (Frandsen *et al.*, 1970). The scrubbing method was found to clean in two minutes and clean better than the other techniques (Frandsen *et al.*, 1970). It may be concluded that tooth brushing methods are subjects to much variation. Many techniques are based on empiricism, clinical experience and personal preference. To be effective, any brushing techniques should be simple, easily learned and require minimal reinforcement and dexterity. It must remove the plaque from the gingival sulcus and the interproximal areas, where periodontal disease and caries most commonly occur and importantly, not cause injury to the periodontal tissues, such as by abrasion or gingival recession (Haffajee, 2001).

2.3.3 The use of Toothpaste

Plaque reduction can be achieved by the mechanical activity of toothpaste slurry in combination with a toothbrush and/or by using chemotherapeutic agents to reduce the volume of plaque. Toothpaste is a paste or gel used with a toothbrush as an accessory to clean and maintain the aesthetics and health of teeth. Toothpaste is used to promote oral hygiene and it serves as an abrasive that aids in removing the dental plaque and food debris from the teeth, assists in suppressing halitosis and delivers active ingredients (fluoride) to help prevent dental caries (ADA, 2010). An ideal dentifrice should help prevent plaque formation, disrupt plaque and optimize plaque removal (Haffajee, 2001). It should also contain agents that help protect the dentition and periodontal tissues; these include agents that prevent demineralization and aid remineralization; prevent and reduce periodontal inflammation and disease; help prevent oral ulcerations, irritations and other oral conditions; and prevent or reduce halitosis (Haffajee, 2001). In addition, the toothbrush and dentifrice should be effective without damaging the tooth surface or gingivae. Finally, in our esthetically conscious society, toothpaste that improves esthetics by whitening the teeth through stain removal, or that gives the appearance of whiter teeth, is desirable (Haffajee, 2001)

Contents of toothpaste

Toothpastes contain active ingredients or additives that perform specific functions. These additives are abrasives, fluorides, desensitizing agents. anti plaque agents, and anti tartar or anti calculus ingredients (Ciancio, 1995).Toothpastes also contain detergents, humectants, thickeners, preservatives, flavouring agents, sweeteners, and coloring agents (Sheen *et al.*, 2001, David, 2004)

i) **Abrasives**: The abrasives components of toothpaste perform the primary functions of removing plaque and stain from teeth (Sheen *et al.*, 2001)

ii) **Fluoride:**Common fluorides in toothpastes include stannous fluoride, sodium monophosphate fluoride and sodium fluoride. Fluoride's primary action is to be incor porated into the tooth substrate (enamel and dentin) making the tooth more resistant to acid attack by cariogenic bacteria. Fluoride is also bactericidal and has additional anti plaque effects (White *et al.* 2008, Yeung,2008)

Fluoride Toxicity

Although water flouridation has been praised as one of the top medical achievements of the 20th century (CDC, 1999) fluoride-containing toothpaste can be acutely toxic if swallowed in large amounts. The risk of using fluoride is low enough that the use of 'full-strength' toothpaste (1350-1500ppm fluoride) is advised for all ages (although smaller volumes are used for young children, a 'smear' of toothpaste until three years old) major concern of dental flourosis is for children under 12 months ingesting excessive fluoride through toothpaste. Several non-fluoride toothpastes are available.

iii) **Desensitizing agents**: are active ingredients, usually potassium nitrate, which reduce dentin hypersensitivity through a depolarizing effect on the odontoblastic processes in the dentinal tubules. The nerve endings of the odontoblastic processes then repolarize and have a reduced pain sensing ability (Silverman *et al*,1996; Swift, 2004). Also, desensitizing effects of arginine bicarbonate/ calcium carbonate complex and stabilized stannous fluoride have been demonstrated to provide a dentin desensitizing effect (Davies *et al.*, 2004; Mariotti, 2009)

iv) **Antiplaque agents**: reduce plaque growth. This can have a positive effect in reducing plaque growth on teeth, reducing gingivitis, and potentially reducing caries. (Wade & Addy, 1992). Some antiplaque agents include papain, and sanguinaria extract. Triclosan has been accepted by the FDA as an antiplaque-antigingivitis therapeutic additive to toothpastes (Davies *et al.*, 2004; Gunsolly, 2006).

v) **Antitartar ingredients:** that reduce calculus build-up on teeth include tetrapotassium pyrophosphate, tetrasodium pyrophosphate, disodium pyrophosphate, papain and citroxaine. (Allen & Nunez,1985)

vi) **Remineralizing agents:** have recently been added to toothpastes. These remineralizing agents are based upon amorphous calcium phosphate. This soluble calcium and phosphate are described as enhancing remineralization, preventing dental caries, reducing enamel and/or dentin erosion, and reducing dentin hypersensitivity. The mode of action that has been hypothesized for these agents is that the calcium and phosphate in soluble form allows it to bind to enamel and dentin and to dental plaque. While there are laboratory studies demonstrating these effects, there is little clinical evidence to support these claims (Davies *et al.*, 2004)

vii) **Detergents:** are responsible for the foaming action of toothpastes. Sodium lauryl sulfate (SLS), the most widely used detergent in toothpastes, has been reported to cause adverse effects on oral soft tissues. SLS in toothpastes significantly increased the incidence of desquamation of the oral mucosa compared with toothpastes containing the detergent cocoamidopropyl-betaine (CAPB). Patients with a history of recurrent apthous ulcers should use toothpastes that are SLS-free (Chahine *et al.*, 1997).

viii) **Humectants:** provide for toothpaste texture and help the toothpaste maintain its moisture. Some common humectants in toothpastes are glycerine, sorbitol and water. Xylitol is also a humectant.

ix) **Thickeners:** are added to toothpaste to provide body to the toothpaste. Some thickeners are carrageenan and xanthan gum.

x) **Preservatives:** prevent growth of microbes in the toothpaste. Some common preservatives used in toothpastes are methyl paraben and sodiumbenzoate.

xi) **Flavoring agents:** are added to improve the taste of toothpastes. They can range from minty flavors to fruity flavors.

xii) **Herbal agents:** such as aloe vera, sodium carrageen, an Echinacea, goldenseal and bee propolis have been added to toothpastes. Currently there are no controlled, long-term studies that demonstrate the efficacy of these agents (Davies *et al.*, 2004)

xiii) **Sweeteners:** also improve the taste of toothpaste. Most toothpaste sweeteners are artificial and are not able to be used by cariogenic bacteria.

xiv) **Coloring agents:** are added to provide toothpastes with a pleasing appearance.

2.3.4 Interdental Cleaning Devices

It is worth noting that reviews on mechanical plaque control consider manual tooth brushing, electric tooth brushing and interdental cleaning with the adjunctive use of floss or other interdental devises to remove plaque interdentally (where a toothbrush cannot reach or only partially reaches) are recommended for oral hygiene (Axelson *et al.*, 1993). In terms of risk analysis, for the development of periodontal disease and caries, the interproximal tooth surfaces are more susceptible to periodontal diseases. Indeed, the importance of interproximal plaque control, and its effectiveness at reducing inflammation, is well documented (Lang 1973., Lang 1995). It is appreciated that the toothbrush alone is capable of removing up to 1 mm of sub gingival plaque, but is ineffective in the interproximal region. Hence, the

developments of a variety of mechanical and electrical devices have been approved, with the aim of enabling the user to achieve higher standards of interdental cleaning. Frandsen (1986), in his seminar article on oral hygiene practices, stated that no interdental cleaning agent showed greater efficacy than any other in relation to plaque control and maintaining gingiva health. He further suggested that cleaning devices should be recommended according to individual dexterity, preference and interdental anatomy (Frandsen (1986). The American Dental Association thereby recommends using either floss or an interdental cleaner daily (American Dental Association). Interdental cleaning is associated with lack of compliance and has been reported to have relatively poor efficacy with a number of methods used (Hygiene Town Survey, 2005). A wide variety of interdental cleaning devices are available for removing soft debris from between the teeth. The most common types are interdental brushes, picks, wood sticks and irrigators (Schmid; 1976 and Kinane; 1998)

2.3.4.1 Dental floss

Dental floss is the most widely recommended tool for removing plaque from proximal tooth surfaces and flossing in combination with tooth brushing have been shown to prevent periodontal disease, halitosis and dental caries effectively (Giermo *et al.*, 1969, Berchier *et al.*, 2008).) Regular flossing has also been linked to reduction in the incidence of heart disease and increased life expectancy (WHO, 2009).

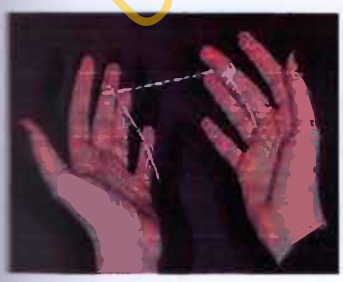
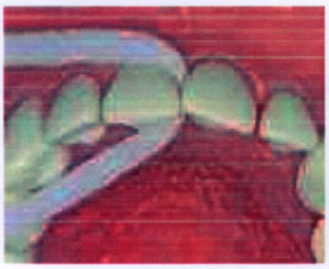
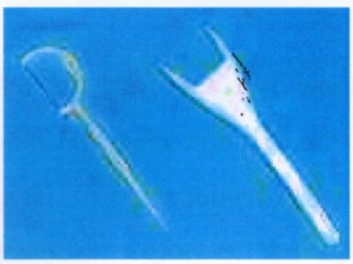
History of Dental Floss

The first form of dental floss was invented in 1815by Levi Spear Parmly who recommended that people should clean their teeth with silk floss (Sanouduos *et al.*, 1999). Dental floss was still unavailable to the consumer until the Codman and Shurtleft Company started producing human-usable unwaxed silk floss in 1882. In 1898, the Johnson and Johnson corporation received the first patent for dental floss. Other early brands included Red Cross, Salter Sill Co. and Brunswick. The adoption of floss was poor before World War 2, It was around this time, however, that Dr. Charles C. Bass developed nylon floss. Nylon floss was found to be better than silk because of its greater abrasion resistance and elasticity. In response to environmental concerns, dental floss made from bio degradable materials is now available. Dental floss is available as a multifilament bundle of thin or thick nylon that is twisted or non- twisted, bonded or non- bonded, waxed or unwaxed (Giermo *et al;* 1969).

Effectiveness of dental floss

Dental floss is known to be difficult for patients to use, which can result in inadequate plaque removal even with compliance. Some studies have been conducted to determine the effectiveness of interdental aids as adjuncts for interproximal plaque removal of which negligible efficacy have been found with the use of dental floss and the investigators thereby concluded that dental professionals should determine for individual patients whether recommending floss is useful and if patients can floss adequately (Sjögren *et al.,* 2004, Berchier *et al.,* 2008). Clinical research have demonstrated no significant differences in the ability of the various types of floss to remove dental plaque, they all work equally well. However, the factors influencing the choice of dental floss includes the tightness of tooth contacts, roughness of proximal surfaces, and the patient's manual dexterity (Cater-Hanzon 1996). Optimal plaque removal is attained only when an effective technique of dental flossing is used regularly and thoroughly at least every 2 or 3 days, brief episodes of flossing at shorter interval have been reported to have little or no effect on interdental plaque removal (Cater-Hanzon 1996). However an effective technique involves:

Gently moving floss through the contact area between the teeth with a back and forth action, ensuring that the floss does not suddenly slip through in an uncontrolled fashion and traumatize the top of the gum. The floss is then shaped into a C- configuration so that it 'hugs' one proximal tooth surface and is then moved from the contact area to a position under the edge of the gum where it cannot penetrate any further and then back again to the contact area. This up and down wiping action should be repeated several times and then the tooth surface on the other side of the interdental space cleaned in the same way. Flossing can be a difficult exercise to master initially; therefore coaching and motivation are required (Berchier et al., 2008).

Types of dental floss

2.3.4.2 Interdental brushes

Concave root surfaces and furcations that are often present in periodontal patients who have experienced significant attachment loss and recession are not thoroughly cleaned with dental floss alone. The use of interdental brushes have been shown to remove more interdental plaque than brushing alone, resulting in improvements in plaque scores, bleeding on probing scores and probing pocket depth (Berchier *et al.*, 2008, Slot *at al.*,2008). A comparison study of dental floss and interdental brushes in removing interproximal plaque reported a higher efficiency for interdental brushes (Lewis 2004).

Types of interdental brushes

2.3.4.3 Wood sticks

Wood sticks are interdental triangular cleaning devise which are made of soft wood to prevent injury to the gingival. Unlike floss, wood sticks can be used on the concave surfaces of the tooth root. Some are hand held, while others are designed to be mounted in handle, which helps gain access to the interdental areas in the posterior region of the mouth. (Axelsson,2004). The wood can store fluoride crystals both on the surface and in the porosities. These crystals readily dissolve when the wood stick is moistened with saliva

Axelsson, 2004).Wood sticks have the advantage that they are easy to use and can be used throughout the day without the need for special facilities. Wood sticks may be used in primary preventions, even in cases of poor dexterity, including posterior areas. To use wood sticks, there must be sufficient interdental space available and in these cases, wood sticks are an excellent substitute to dental floss, although long term use may cause a permanent loss of the papilla (Axelsson 2004). Evidence from clinical controlled trials shows that wood sticks did not only reduce the level of visible interdental plaque but also help to improve interdental gingival inflammation and bleedings (Hoenderdos *et al.*,2008, Tucker, 2009)

2.3.5 Chemotherapeutic agents or mouth rinses.

A number of chemotherapeutic agents to inhibit bacterial plaque formation, and thus prevent or resolve gingivitis, have been studied (Bowsher *et al.*, 1999). Of these agents, those in common use are chlorhexidine, Listerine and triclosan. Chlorhexidine is one of the most effective antimicrobial mouthwashes because it is broad spectrum and acts not only against gram-negative bacteria, but also against yeasts and gram-positive bacteria (Deriso *et al* 1996). It is particularly suitable for the inhibition of plaque formation as it has substantivity, the ability to maintain effective concentrations for prolonged periods of time, by way of binding to soft and hard tissue (Houston *et al* 2002). However, with long-term use, unpleasant side-effects, such as disturbance of taste, discoloration of teeth and composite restorations have been discovered (Koeman *et al* 2006).

Researchers like Sekino *et al* (2004);Eggimann *et al* (2003); Fourier e*t al.*, (2005) have conducted studies on other mouth rinses such as essential oil mouth rinse, Listerine, hydrogen peroxide mouth rinse, although disturbance in taste and mucosa abnormality have been found with hydrogen peroxide use Tombes *et al.*, (1993). Physiological salt solution [normal saline] and tap water have also been used as mouth rinses (Anaissie *et al.*, 2002, Trautmann *et al.*, 2001, Grap *et al.*, 2004).

2.3.6 Sugarless chewing gum

Chewing gum is a habit practiced regularly by a relatively high proportion of individuals in many countries including Nigeria, and its use has increased within the last decade. In 1999, available data suggested that some 374 billion pieces of chewing gum were sold worldwide, (Imfeid *et al.*, 1999).Besides the obvious pleasant taste imparted by flavors and sweetening agents in chewing gum, the practice has the potential to benefit oral and dental health (Hanham & Addy, 2001) . The introduction of sugar-free or sorbitol-containing chewing

gums renewed interest in this aspect of diet, and caries reduction with sugarless and sugar phosphate products was reported by Finn and Gimision (Finn and Gimision, 1967) . In the last decade, sugar-free chewing gum has been claimed to provide oral health benefits, including caries reduction and plaque control (Imfeld, 1999). The caries preventive effects of these products have been well documented in many experimental and clinical investigations.(Barne et al.,2005). The mechanical cleaning effects of chewing gum have also been studied, but the results on the antiplaque efficacy, particularly at the smooth (buccal and lingual) surfaces of the teeth, have been equivocal (Imfeld, 1999, Hanham & Addy, 2001). Indirect effect of chewing gums to oral health could be through salivary flow stimulation and mechanical tooth cleaning (Hanham & Addy, 2001). Supragingival plaque is exposed to saliva and to the natural self-cleansing mechanisms existing in the oral cavity. Studies have shown that daily chewing-gum has beneficial effects. It increases salivary flow, raises the pH of plaque and saliva, (Dawe, 1992) reduces oral malodour. Kahtani, 1999 and is effective for stain removal (Ozcan, 2003). Very few studies have examined the antiplaque effect of sugar-free chewing-gum and the results of these studies were variable. Some studies showed the antiplaque effect of chewing-gum,(Barne *et al.*, 2003, Takahashi *et al.*, 1996, Holgerson *et al.*, 2007) but other studies suggested that chewing sugar-free gum can reduce occlusal plaque but has no plaque inhibitory effect on interdental surfaces (Hanham & Addy, 2001, Pizzo *et al.*, 2007) . Imfeld stated that chewing-gum can result in some reduction of debris, but little or no reduction of plaque (Imfeld, 1999).

2.3.7 Carrot Fruits

Carrots are one of the most widely used and enjoyed vegetables in the world, partly because they grow relatively easy, and very versatile in a number of dishes and cultural cuisines Carrots are scientifically classified as Daucus carota and it is categorized as a root vegetable. Carrot is a popular fruit eaten regularly especially in Nigeria, the chewing of carrot fruits like any other fibers have been observed to clean teeth surfaces effectively, though there is sparse documentation. The masticatory forces on food are believed to create frictional forces that are physically able to prevent the accumulation of, and can assist in the removal of plaque from the occlusal and incisal areas of the teeth although these same forces are less effective interproximally and at the gingival margin.

Ingestion of high-fiber food might be anticipated to reduce plaque accumulation, but it has no significant preventive effect as documented by Lindhe and Wichen, 1969. In their study to investigate the effects of chewing fibrous food on the gingivae, eighteen male dental students 20–24 years of age, were studied using the Gingival Index system (GI) of Löe and Silness

(1963), the Plaque Index system (PII) of Silness and Löe (1964) and gingival exudates measurements according to Egelberg (1964). The participants were told not to use any active oral hygiene measures for a period of eighteen days. During this time, nine of the students were given three raw carrots three times a day. These were carefully chewed for two to three minutes under supervision. After the eighteen days of observation, it was reported that, the regular chewing of raw carrots had no influence on the degree of plaque formation or tooth cleansing effect, as the difference between the Plaque Index scores of the experimental and the control groups were statistically significant.

This investigation also demonstrated that, when all active tooth cleansing was discontinued, healthy gingivae developed chronic inflammation, and pre- existing gingivitis gradually became aggravated. Thus the Gingival Index scores and exudates measurements clearly indicated a gradual deterioration of the gingivae of all the subjects throughout the eighteen days of experiment. The increases in the GI-values and in the gingival exudation were of the same magnitude in both the experimental and the control groups. Thus it was concluded that the chewing of fibrous food had no influence on the rate of deterioration of the gingivae when no tooth-cleansing was practiced.

2.3.8 The use of Flouride

Fluoride is a natural element that is considered a beneficial nutrient at optimal levels and is important to the integrity of bone and teeth (National Academy of Science, 1997). About 99% of the fluoride in the body is in the hard tissues (Levy, 2003).

When consumed in optimal amounts in water and food and used topically in fluoridated dentifrices, oral rinses, gels, foams, and professionally applied office treatments, fluoride increases tooth mineralization, helps reduce dental enamel demineralization and promote dental enamel remineralization, and helps reduce dentin hypersensitivity. The use of fluorides for the prevention of dental caries is recognized as the most effective dental public health measure in existence (Dept of Health & Human services, 2000, Center for Disease control,2012). Fluoride is beneficial to all age groups. Recent statistics show that adults are just as likely to experience new dental caries as children Griffin *et al.*, 2004, Gooch, 2005). Fluoride is important for bone health as well, through its role in mineralization.

Mechanisms of Fluoride Action on Teeth

Fluoride functions to enhance tooth mineralization and remineralization, decrease and reverse tooth demineralization, and inhibit the metabolism of the acid-producing bacteria responsible for dental caries (Wynn, 2002) .Fluoride incorporated into the developing enamel of teeth pre-eruptively results in a crystalline tooth structure that has increased resistance to caries. However, recent research has found that the primary action of fluoride occurs topically after tooth eruption with consistent application, and the benefits continue throughout life (MMWR Recommendation, (2001), Wynn,(2002). The maximum caries prevention benefit is achieved when both systemic and topical sources of fluoride are utilized (Singh & Spencer, 2004).

Sources, indications, and efficacy of fluoride

Fluoride can be obtained from fluoridated drinking water; foods and beverages made with fluoridated water; other beverage sources, such as tea; and from oral health products, such as fluoride oral rinses, fluoride containing dentifrices, topically applied gels and foams, and dietary fluoride supplement(Chu *et al.*, 2010).

Fluoride safety

Fluoride research of more than 65years has shown that fluoride is safe and effective at the levels used for water fluoridation (0.7 to 1.2 mg/L). However, naturally fluoridated areas at a level 2mg/L can put children 8 years old and younger at increased risk for dental fluorosis, and consumption of water with a fluoride content of 4 mg/l over a life time can increase risk for bone fractures (Center for Disease Control, 2012). Fluorosis is hypo mineralization of tooth enamel that results from excessive fluoride ingestion before tooth eruption in children during enamel development (Centre for Disease Control, (2012), Beltran,(2012). Clinically, the appearance of fluorosis can range from hardly noticeable white spots to severe pitting and discoloration of teeth, depending on the dose, duration ,and timing of fluoride intake. To prevent fluoride toxicity, children must be prevented from using excessive fluoride, swallowing of toothpaste and the use of fluoride containing toothpaste of not more than a pea-sized amount is recommended for tooth brushing. Children under six years of age should be supervised while brushing while children under the age of three years should have their teeth brushed by adult using children formulated toothpaste.

2.4 Effects of poor oral hygiene practices.

Failure to brush the teeth has been reported to cause some oral disease ranging from simple plaque accumulation to tooth loss.

2.4.1 Dental Plaque Accumulation

Research has shown that lack of good oral hygiene is associated with accumulation of plaque which can result to several oral diseases. Ashley (2008).

Dental Plaque

Dental plaque is the community of microorganisms found on a tooth surface as a biofilm, embedded in a matrix of polymers of host and bacterial origin (Socransky, 2002; Marsh, 2004). Reddy, (2008) had also described bacterial plaque as an adherent intercellular matrix consisting primarily of proliferating micro-organisms. It is soft deposits that form the biofilm adhering to the tooth surface or other hard surfaces in the oral cavity including removable and fixed restorations.

Plaque is natural and contributes to the normal development of the physiology and defenses of the host (Marsh, 2000, Wilks, 2007). Plaque bacteria generally have a harmonious relationship with the host; they use endogenous nutrients (e.g. salivary proteins and glycoproteins, such as mucin) for their growth, from which there is little acid production, and their presence helps exclude exogenous microorganisms (colonization resistance). It is differentiated from materia alba and calculus. Materia alba refers to soft accumulations of bacteria and tissue cells that lack the organized structure of dental plaque and are easily displaced with a water spray.

Calculus is a hard deposit that forms by mineralisation of dental plaque and is generally covered by a layer of unmineralised plaque.Structurally, bacterial plaque is considered to be a biofilm. Biofilms are defined as matrix-enclosed bacterial populations adherent to each other and or to the surface or interfaces. It contains areas of high and low bacterial biomass interlaced with aqueous channel of different sizes which are the nutrient channels for bacterial colonization. The intercellular matrix forms a hydrated gel in which bacteria can survive and proliferate.Hence, biofilm adheres firmly to the tooth surface and is resistant to mechanical removal as well as antibiotics (Hall –Stoodley *et al.*, 2004).

Classifiction of bacterial dental plaque

The dental plaque is differentiated into two categories by Pavel Godoroja and Olga Dulghieru 2004, namely: supra- and sub-gingival plaque.Supra-gingival plaque is most commonly found at gingival third of the crown of the tooth, Inter-proximal areas, pits and fissures and also on other surfaces with irregularities. The supragingival plaque is divided into the, coronal plaque, which is in contact with only the tooth surface and the marginal plaque, which is associated with the tooth surface at the gingival margin. Marginal plaque is important in the development of gingivitis (Wilks, 2007).

Sub-gingival plaque below the dento-gingival junction is usually divided into:Tooth adherent zone, Epithelial adherent zone , Non adherent zone (Pavel Godoroja and Olga Dulghieru 2004) Subgingival plaque is usually located beneath the gingival margin in the periodontal pocket or gingival sulcus. It can be detected by running a probe around the gingival margin. Morphological studies show that it can be subdivided into the tooth-associated subgingival plaque and tissue associated subgingival plaque (Drescher *et al.*, 2010). Tooth associated plaque is important in root caries and calculus formation while tissue associated subgingival plaque is important in the soft tissue destruction that characterizes different forms of periodontitis (Drescher *et al.*, 2010).

Plaque detection

Identification of the supra-gingival dental plaque is difficult for both patient and dentist,because of the color similarity between the tooth surface and dental plaque. Plaque identification may be done either by screening the plaque directly from the tooth surface (Loe,1967), changing its color with a disclosing solution (Gillings,1977), or by using the ability of natural teeth to fluoresce under blue light (Lang,1972). Disclosing dyes work by changing the color of dental plaque so that it contrasts with the white tooth surface. Dental plaque has the ability to retain a large number of dye substances which can be used for disclosing purposes. This property is related to interaction, because of the polarity difference between the components of the plaque and the dyes (Gallagher et al.,1977). The particles are bound to the surface by electrostatic interaction (proteins) and hydrogen bonds (polysaccharides). Over the years, different staining agents have been used. The first chemical reported to stain plaque was iodine (Skinner,1914) but, over the time, a variety of dyes have been used, such as: fuchsine , erythrosine, merbromin ,methylene blue ,brilliant blue ,crystal violet,gentian violet ,fluorescein (Reyes Silveyra,2011; Wolf HF, Hassell

,2006; Tan ,1981). As the plaque accumulates, reaching certain thickness, it becomes clinically visible. A probe can be used in detecting plaque.

Composition of Dental Plaque

Dental plaque is made up primarily of micro-organisms. Approximately 70-80% of plaque is micro-organisms. One gram of plaque (wet weight) contains approximately $2x10^{11}$ bacteria. Over 500 microbial species have been isolated from plaque. Other than bacteria, mycoplasma, fungi, protozoa and viruses can also be found in the plaque. It also contains the host cells such as leucocytes, epithelial cells and macrophages. The intercellular matrix, derived from saliva, gingival crevicular fluid and bacterial products, is made up of organic and inorganic components. The organic components are proteins, polysaccharides, glycoprotein and lipids material. Glycoprotein from saliva are an important component of the pellicle that initially coats a clean tooth surface and are also incorporated into the developing plaque biofilm (Hall-Stoodley *et al.*, 2004)

Polysaccharides produced by bacteria, of which dextran is the predominant form, contribute to the organic portion of the matrix. The inorganic components include calcium, phosphorus and a trace amount of magnesium, potassium, fluoride and sodium. The source of inorganic constituents of supragingival plaque is primarily saliva while that of the subgingival plaque is from the gingival crevicular fluid (Ximenez *et al.*, 2000). Studies have distinguished the bacteria from subgingival and supragingiva plaque and found that supragingival plaque contains species of Streptococcus, species of Actinomyces, Capnocytophaga, Veillonella parvula, Leptotrichia buccalis, species of Selenomonas and Rothia dentocariosa while in contrast, Fusobacterium species, Peptostreptococcus species, Eubacterium species, Campylobacter rectus, Porphyromonas gingivalis and a number of Prevotella species were found to be the predominant in subgingival plaque (Cao *et al.*, 1990,Zee *et al.*, 1996, Ximenez *et al.*, 2000).

Plaque formation

There are distinct stages in plaque formation:

- Acquired pellicle formation when molecules derived mainly from saliva are absorbed onto the tooth surface.
- Reversible adhesion, which involves weak, long-range, physiochemical interactions between the microbial cell surface (adhesins) and complementary receptors present in the acquired pellicle; these interactions are stronger and operate over a relatively short distance (Hall-Stoodley *et al.*, 2004).

Co adhesion, in which secondary colonizers adhere via cell surface adhesions to receptors on already, attached bacteria leading to an increase in microbial diversity within the developing biofilm. Many of the secondary colonizers have fastidious growth requirements (Kolenbrander, 2006,Kuramitsu *et al.*, 2007) .

The attached cells multiply, leading to an increase in biomass and synthetic exopolymers to form the biofilm matrix. Numerous biochemical and molecular interaction take place among the constituent species. The metabolic of these microorganism leads to the development of gradient within the biofilm; for example, aerobic and facultatively anaerobic bacteria consume oxygen and produce carbon dioxide and hydrogen, making the condition suitable for the growth of obligate anaerobes. These processes lead to the establishment of a mature biofilm. Of clinical relevance is that biofilm such as dental plaque are less susceptible to antimicrobial agents when compared with the same cells growing in conventional liquid culture. The structure of the plaque biofilm can restrict the penetration of antimicrobial agents because of the presence of charged exopolymers in the matrix, while bacteria growing on a surface divide only slowly and display novel properties, one consequence of which is a reduced sensitivity to inhibitors (Gilbert *et al.*, 2002).

Role of plaque in the etiology of oral diseases

A number of hypothesis have emerged of over the years in an attempt to explain how bacteria plaque cause periodontal disaese

The specific plaque hypothesis Loesche, (1976) proposed that specific microorganisms were responsible for the development of periodontal disease i.e it is the quality of the bacteria rather than the quantity. The evidency are the linking of Aggregatibacter actiomycetemcomitans (Aa), .Porphyromonas gingivalis.

The non-specific plaque hypothesis Thilade (1986) proposed that periodontal disease results from shear mass of organisms present and once this exceeds a certain threshold, disease will occurs.

The environmental plaque hypothesis. Haffajee (2008) proposed that the entire subgingival microbial environment is the key to disease development. To develop periodontitis a subsceptible host and a suficiently high number of pathogenic species must emerge within the subgingival biofilm.

The Role of the Host Response.

The host reponse to microbial plaque is designed to be protective but the balance is a delicate one where under-activity or indeed over-activity of specific aspects of the response can lead

to tissue destruction. There are 2 main components of the host response to plaque. Natural/ Innate immunity and the acquire immunity (Arnett & Viney (2007).

Role of plaque in the etiology of periodontal disease.

The concept that plaque causes gingivitis is a fact, proven by a series of studies Seymour, (1983), Othman *et al.*, (1995) but whether plaque causes periodontitis is a different debate. Without plaque bacteria, inflammatory periodontitis would not occur, but in the presence of plaque bacteria, periodontitis often does not occur if there is no enabling circumstances. Whether periodontitis develops in an individual depends upon a myriad of complex issues collectively called "risk factors" which could be systemic (subject base that upsets the host-microbial balance) or local (intra-oral factors that could influence plaque accumulation). Unlike gingivitis which develops in the majority, if not all, humans, periodontitis is multi-factorial and cannot be regarded as a pure infection like HIV disease or TB. It is poly microbial and there are many "host factors" (natural/innate immunity and acquired / specific immunity) involved some of which are genetically determined while some are environmentally determined (Arnett & Viney, 2007).The present opinion on the aetiopathogenesis of periodontal disease is that majority of the tissue destruction is as a result of the stimulation of the host factors. It had been recognised that though the bacteria initiate the periodontal inflammation, the host response to these pathogens is equally, if not more important in mediating connective tissue breakdown, including bone loss. It has become clear that the host-derived enzymes such as the matrix metalloproteinases (MMPs), as well as changes in osteoclast activity driven by cytokines and prostanoids, cause most of the tissue destruction in the periodontium (Arnett & Viney 2007). Thus, plaque bacteria initiate the disease and bacterial antigens that cross the junctional epithelium drive the inflammatory process. Therefore, bacteria are essential for periodontitis to occur, but they are insufficient to cause disease alone. For periodontitis to occur, a susceptible host is also required. The majority of periodontal breakdown (bone loss and attachment loss) is caused by host-derived destructive enzymes (MMPs) and inflammatory mediators (PGs and ILs) that are released during the cascade of destructive events that occur as part of the inflammatory response. Paradoxically, the inflammatory response, which is essentially protective in design, is responsible for much of the breakdown of the soft and hard periodontal tissues (Arnett & Viney 2007).

The role of plaque in the etiology of dental caries

Two main schools of thought exist on the role of plaque in the etiology of caries and periodontal disease. The "Specific Plaque Hypothesis "proposed that out of the diverse

collection of organisms comprising the plaque microflora, only a few species are involved in disease activity (Loesche, 1986) In contrast, the Non Specific Plaque Hypothesis" considered that disease is the outcome of the overall activity of the total plaque micro flora (Theilade, 1996). More recently, another hypothesis has been proposed (the Ëcological Plaque Hypothesis") that reconciles the key elements of the earlier two hypothesis (Marsh, 2003), Dental caries is a consequence of an imbalance in the micro flora because of the enrichment within the microbial community of these oral pathogen caused by frequent condition of low pH. Potentially, cariogenic bacteria are found naturally in dental plaque, but these organism are only weakly competitive at neutral Ph and present as a small proportion of the total plaque community. In this situation, with a conventional diet, the level of such potentially cariogenic bacterial appear clinically insignificant and the process of demineralization and remineralization are in equilibrium. If the frequency of fermentable carbohydrate intake increases, longer interval of low ph persist leading to enamel demineralization (Bradshaw & Marsh, 2002).Low pH favors the proliferation of acid tolerating (acidogenic) bacteria including (mutans streptococci and lactobacilli) which encourage tooth demineralization. Greater numbers of bacteria in plaque results in acid being produced at faster rates, thereby enhancing demineralization further. The key element of the ecologic plaque hypothesis is that disease can be prevented not only by targeting the causative pathogens directly eg (using antimicrobial or anti adhesive strategy), but also by interfering with the selection pressures responsible for their enrichment (Marsh, 2003).

2.4.2 Periodontal diseases

Failure to remove plaque by regular and proper oral hygiene measures has been shown to result in several diseases e.g. caries, halitosis, oral cancer, gingivitis and more importantly periodontal disease (Laing, 2008).

The Periodontium consist of the gingiva and alveoli bone. Periodontal membrane and cementum which are also constituents are often involved in the pathological changes that may affect one or all the components. The changes may be inflammatory, degenerative or neoplastic in nature. Periodontal disease is a term which includes all pathological conditions of the periodontium. It is however commonly used in reference to those inflammatory diseases which are plaque induced and which affect the marginal periodontium i.e. gingivitis and periodontitis (Carranza 1990).

Gingivitis is the inflammation of the gingiva without the involvement of the underlying tooth supporting structures. It is usually a response to irritation from bacterial plaque (Manson & Elley 2000).

Periodontitis is an inflammatory (Feng & Weinberg) lesion of the tooth supporting tissues which often follow an apical extension of gingivitis with associated alveolar bone loss and formation of periodontal pocket. It eventually leads to mobility and tooth loss in some cases (Arowojolu *et al.*, 2001)

Aetiology of periodontal Diseases

Bacteria plaque is considered the primary etiological factor for periodontal diseases and other factors considered as secondary (Carranza 1990, Gienco 1996). The cause and effect relationship between plaque and gingival inflammations had been confirmed by the possibility of inducing experimental gingivitis in man (Seymour, 1983).

Abstinence from oral hygiene measure has led to rapid accumulation of bacterial plaque and Inflammation of the gingival within 10-21days. This inflammation resolves within 7days of resuming oral hygiene measures (Seymour, 1983)

The conversion of bleeding gum to non bleeding gum with oral hygiene intervention alone has been reported and this provide a strong evidence for the role of poor oral hygiene in the etiology of gingivitis (Othman,1995, Newman *et al.*, 2006)

The secondary factors can be classified as local which predisposes to bacterial plaque accumulation or systemic which is said to alter the gingival response to the plaque. The local factors includes: crowding of teeth; malposition of teeth; high frenal attachment; faulty restoration margins; mouth breathing.

The Systemic factors include: medications e.g. nifedipine (antihypertensive drug; Phenytoin – anticonvulsant drugs; stress; Diabetic mellitus; Immunosuppression; Hormonal changes such as puberty and pregnancy (Manson and Eley, 2000; Kinane *et al.*, 2006)

The current concept on the etiology of periodontitis considered three groups of factors as determinants for active periodontitis in a subject. These include:

i) A susceptible host – Susceptibility of the host is partly hereditary as in the association between periodontitis susceptibility and increased interleukin -1 (IL-1) production. It can however be influenced by environmental factors such as stress and diabetes mellitus (Mathews, 2000)

ii) The presence of pathogenic species: the next essential factor for disease initiation and progression is the presence of one or more pathogens in sufficient numbers. Criteria by which periodontal microorganism may be judged to be potential pathogens includes the following (Newman *et al.*, 2006)

a) Must be associated with the disease, as evident by increase in the number of organisms at diseased sites.

b) Must be eliminated or decreased in sites that demonstrate clinical resolution of disease with treatment.

c) Must demonstrate a host response, in the form of an alteration in the host cellular or humoral response.

d) Must be capable of causing disease in experimental animal models.

e) Must demonstrate virulence factors responsible for enabling the microorganism to cause destruction of the periodontal tissues.

Some of the microorganism that have been associated with periodontal diseases include *Actinobacillus actinomycetemcomitans (Aa), Tannerella forsythia (T.forsythia) and Porphyromonas gingivalis(P. gingivalis), Prevotella nigrescens, Peptostreptococcus micros, Campylobacter rectus, Fusobacterium nucleatum* and various species of *spirochetes* Socransky *et al.*, (1998); Tanner *et al.*, (1998).

Socransky *et al.*, (1998) also reported an increase in number of the red complex bacteria, which include *T. forsythia, P.gingivalis and Treponema denticulate,* with increasing pocket depth. The red complex and individual species within the group were also associated with bleeding on probing as reported by the study. The role of "beneficial species" of the host is less obvious in the progression of disease. Such bacteria can affect disease in different ways:

a) by passively occupying a niche that may otherwise be colonized by pathogens
b) By actively limiting a pathogen's ability to adhere to appropriate tissue surfaces.
c) By adversely affecting the vitality or growth of a pathogen
d) By affecting the ability of a pathogen to produce virulence factors or
e) By degrading virulence factors produced by the pathogens.

A well documented example of such a beneficial action is the production of hydrogen peroxide by *Streptococcus sanguis,* which either directly or by host-enzyme amplification can kill *Actinobacillus actinomycetemcomitans.* Other bacteria that have been associated with health include *Streptococcus mitis, Veillonella parvula, Actinomyces viscosus and Rothia dentocariosa* (Roberts and Daveau, 2002; Newman *et al.*, 2006).

2.4.3 Dental Caries

Dental caries is a highly prevalent chronic sugar dependent infectious disease affecting calcified tissue of the tooth and causing demineralization of the inorganic portion with subsequent destruction of the organic substance Mignogna and Fedele, (2006). It is a slow

process and clinically, visible destruction of the enamel takes up to 4 years to develop Mignogna and Fedele, (2006).

Dental caries was defined as a progressive, irreversible bacterial damage to the teeth in the mouth. It is a multifactorial disease and results from a combination of four principal factors: Host and teeth factors, microorganism in dental plaque principally streptococcus mutants and substrate principally sucrose Fejerskov (2003). These factors interact to produce a variety of dental diseases at varying rates and intensities. The factors contributing to these variations could either be cultural, genetic, or environmental in nature.Other factors including poor dietary and oral hygiene habits as well as social class have been reportedly related to caries occurrence Gibson and Williams, (1999); Harris *et al.*, (2004); Oliveira *et al.*, (2008); Sayegh et al., (2002); Sowole *et al.*, (2007). It is further reported that those in the lower social classes tend to have higher caries occurrence (Gibson and Williams, (1999); Sayegh *et al.*, (2002). In one study, brushing at least twice daily was associated with reduced caries occurrence although this had less impact in the lower social classes (Gibson and Williams, (1999). In contrast, another study reported that oral hygiene had no association with caries occurrence (King *et al.*, (2003). A study among Nigerian children identified the child's age, gender and frequency of sugar consumption as possible risk factors for developing caries (Folayan *et al.*, (2007). While oral hygiene was identified as a possible predisposing factor for caries occurrence, tooth-brushing alone is generally agreed as insufficient for caries prevention and positive results are often attributed to the use of fluoride containing toothpastes (Winter *et al.*, (1990).

2.4.4 Bad breath / Halitosis

Halitosis is used to describe any disagreeable odor in the breath. Halitosis frequently causes embarrassment, may affect interpersonal social communication Bosy, (1997) and has also become an important market for the pharmacological and cosmetic industries with millions of Naira spent annually on medications Bosy, (1997). The true prevalence of halitosis is unknown and some reports are difficult to evaluate unless they specify the classification, terminology and methodology used Nadanovsky *et al.*, (2007). Currently available epidemiological data are difficult to evaluate as they are mainly based on subjective self-estimation of malodor, which is well known to be limited by inaccuracy and low sensitivity. However, the available evidence suggests that halitosis is common and can affect people of all ages Liu *et al.*, (2006). The prevalence of persistent oral malodor in a recent Brazilian study was reported to be 15%, was nearly three times higher in men than in women (regardless of age) and the risk was slightly more than three times higher in people over 20

years of age compared with those aged 20 years or under, controlling for gender Nadanovsky *et al.*, (2007). The large majority of studies report that about 30% of people have halitosis Liu *et al.*, (2006), Outhouse *et al.*, (2006).

Oral malodor is common on awakening (morning breath), and is transient and rarely of any special significance Outhouse, (2006), Yaegaki K, Coil, (2000), Scully and Rosenberg, (2003), probably resulting from increased microbial metabolic activity during sleep that is aggravated by a physiological reduction in salivary flow, lack of nocturnal physiologic oral cleansing (e.g. movement of the facial and oral muscles) and variable oral hygiene procedures prior to sleep. Starvation can lead to a similar malodor Outhouse, (2006). These forms of oral malodor can be readily rectified by eating, oral cleansing and rinsing the mouth with fresh water Faveri, (2006). Tongue cleansing using a scraper may help but was found to be unable to prevent morning oral malodor in the absence of tooth cleaning in periodontally healthy individuals Haas *et al.*, (2007). Malodor at other times may be the consequence of lifestyle. Halitosis as a result of the ingestion of certain food and drinks, such as spices, garlic, onion, cabbage, cauliflower and radish, or of habits such as smoking tobacco or drinking alcohol, is usually transient, often caused by sulfur-containing volatile agents and is considered to arise both from intra-oral (food debris) and extra-oral (respiratory) origins Suarez *et al.*, (1999). Prevention of infective processes, improvement of oral hygiene (including the use of topical antimicrobial products, mouthwashes or toothpastes) and sometimes the use of antimicrobial therapy, if necessary, can usually manage this type of halitosis.

2.5. Factors that affect oral hygiene practices in rural communities

A lot of oral diseases known to plaque individuals and communities today are so speak "opportunistic" We become vulnerable through our behavior or attributes toward common healthy measures. Oral hygiene practices either in a rural or urban communities could be affected by certain factors, such as cultures and beliefs, education, socioeconomic status, occupation, religion and gender Okolo *et al.*, (2006).

Beliefs: People within communities hold certain beliefs which guide their behavior. The cultural beliefs in a rural community may differ from those people in urban setting. Some of these beliefs and practices affect oral health in a positive and a negative way. Aderinokun (2000). In Yoruba communities in Nigeria, care of the oral cavity is said to begin as soon as a child is born. A variety of locally available materials are used for this purpose e.g. Alum (Aluminum Sulphate) mixed with lapalapa (sap), Hydrogen peroxide applied with cotton wool are used. Other materials commonly used include salt on cotton wool, sand, broken

bottle powder and ashes Aderinokun (2000). In Yoruba land, it is believed that chewing sticks are not to be used at night. It is thought that anyone cleaning the teeth at night will lose his mother prematurely. This will have a negative influence on oral hygiene. Aderinokun (2000)

Religion: There has been a relationship between religion and oral health practices. The practice of good oral hygiene among Somalis has been related to the practices of Islamic faith. Chewing stick was used by the Arabs of the pre-Islamic era to make their teeth white and shiny .Muslims follow the example of their prophet, who was a fervent supporter of the miswak, declaring it to be "cleaning for the mouth and pleasure for Allah" Carranza (2000)

Education: A study conducted by Bukar *et al* (2004) reported a strong association between the choice of tooth cleaning aids and level of education. The users of toothbrush, toothpaste, Interdental brushes and mouth rinses are common among the educated ones and among people with high socioeconomic status Bukar *et al* (2004).

Cultures: A study by Bukar (2004) on the traditional oral health practices among Kanuri women of Borno state Nigeria reported that, traditional oral health practices constitute important part of their cultural lifestyle. It was observed that more than half of the studied population stained their teeth with the flower Nicotinia tobaccums to keep their teeth strong Bukar *et al.*, (2004)

Occupation: It has been observed that chewing stick users are common among the farmers, because they have easy access to plants Azodo *et al.*, (2013)

Gender: Surveys of adolescents and young adults In Africa have shown that more females than males engage in daily tooth cleaning Bamigboye & Akande, (2007).

Age: The adults especially in the rural communities are less concerned with their oral health than the younger age groups. The differences in oral health attitude and behaviors of the adults are attributed to the influence of different social and cultural life experiences. The old elderly especially grew up at a time when dentistry was primitive and dental treatment was considered a luxury for many who only sort it when they were in pain. Restoration of the tooth was not popular and extraction was often the choice of treatment. People associated procedure in dentistry with pain. For many reason, many elderly especially the older elderly in the developing countries in particular are edentulous and have a negative perception of dentistry. These perceptions still exist among the young generation. This has led to high dental morbidity among our elderly, Taiwo *et al.*, (2004).

Medical and Physical condition of the elderly: Health problems involving physical and mental conditions directly or indirectly affect the oral health of the elderly. Specific

conditions such as severe chronic arthritis, any neurological disturbance of motor functions (stroke, Parkinson's disease, neuromuscular diseases) have some bearing on the ability to maintain a reasonable standard of oral hygiene and oral health Kelsey & Lamster, (2008). Disease conditions such as diabetic, malnutrition, cardiac conditions, blood dyscrasia directly affect the oral health of the elderly". Mental conditions involving changes in affection, Cognitive function and motor neuron function indirectly affect oral health of the elderly. It prevents elderly from seeking care especially those who are house bound. Certain health conditions may compromise good quality care e.g. involuntary movement as a result of Parkinson diseases. Musculoskeletal and cardiovascular problems prevent treatment of the patients in the supine position. They encourage the progress of gum diseases in the elderly (Patrica Coleman, 2002, Kelsey and Lamster (2008)

2.6. Effect of some oral hygiene practices on oral health

Teeth discolorations: Chewing stick could be effective in removing plaque. One of the chewing sticks commonly used in Yoruba land is "Orin Ayan" though has some beneficial effect especially on the gums, but it colors the teeth and mucosa yellowish after long use, thereafter causing stains of the teeth.

Poor oral hygiene: In Yoruba land, the belief that chewing sticks are not to be used at night may lead to poor oral hygiene, because the frequency of cleaning with chewing stick may be low.

Tooth wear: Tooth brushes although widely used but the use of hard bristle tooth brush have been shown to worn away tooth enamel by intense scrubbing, thereby results to hypersensitivity, gum recession and promotes dental caries.(Danser 1998)

Oral ulcers and xerostomia: Sap leaf extract is commonly use in some rural communities for cleaning the mouth especially for people with oral candidiasis, undiluted sap extract have been noted to cause oral ulcers, dry mouth ,green discoloration of the teeth and ultimately inability to eat.

CHAPTER THREE

METHODOLOGY

3.1 Study Design

The study was a cross-sectional study in which adult inhabitants of the rural communities in Ido Local Government Oyo State were interviewed and examined to investigate the relationship between their oral hygiene status and their oral hygiene practices.

3.2 Study location:

The study was carried out in rural communities in Ido Local Government area of Oyo State Nigeria. Ido Local Government was created in 1989 with it's headquarter located at Ido. It was carved out of the former Akinyele West Local Government during the second republic. It shares boundaries with Oluyole, Ibarapa East, Akinyele, Afijio, Ibadan North, Ibadan south west and Ibadan North West Local Governments in Oyo State and Odeda Local Government in Ogun state. Yoruba tribe mainly inhabit the communities within this local government, although, there are a handful of other ethnic groups such as Igbo, Hausa, Fulani and Igede. It consist of ten wards, forty two villages and eleven major towns with their major occupation being farming. The total population of Ido Local Government according to year 2006 population census is 103,261. There are 75 primary schools, 9 secondary schools, 6 maternity centres, 20 primary health centers and 30 private hospitals in the Local Government.

3.3 Study population:

The study participants consisted of adults aged 18 – 60 years from the five randomly selected rural communities in Ido Local Government who fulfilled the inclusion criteria and who consented to participate in the study.

3.4 Sample size determination: (Araoye, 2004)

The Sample size for this study was statistically calculated from the Leslie and Kish formula., for cross sectional study to be 200 based on the prevalence of poor oral hygiene in this environment (Taiwo *et al* 2004).

$$n = \frac{Z\alpha^2 Pq}{d^2}$$

Where n = minimum desired sample size.

α=standard normal deviation corresponding to 5% level of significance [1.96]

P=prevalence of poor oral hygiene in a Ibadan, Nigeria according to Taiwo *et al.*, 2004 given as 87.7%.

q= I-P

d=level of precision, usually set at 0.05

Therefore $n = Z\alpha^2 pq / d2$

$$\frac{[1.96)^2 (0.87) (1-0.87))}{0.05^2} = 173.79$$

10% non – response rate adjustment was done using the formula $n \times 100/100-10$

$= 174 \times 100/90$

$= 193$

The total sample size was estimated at 200.

Two hundred and fifty (250) adults , aged 18- 65 years participated in the study.

3.5 Sampling techniques

A 4- stage (Multi-stage) sampling technique was used for this study.

Ido Local Government Area was selected from the 5 urban and 6 rural Local Government Areas in Ibadan land. It is the largest of the rural Local Government Areas and the Community Dentistry Outreach Department of University of Ibadan in collaboration with University College Hospital have been going to this local government for oral health education. Also the Ophthalmology Outreach Department of the University College Hospital (UCH), Ibadan is located within this Local Government Area. The participants benefitted from emergency treatment using the primary health care centre of the Ophthalmology Outreach Department.

1st stage: The list of all the ten wards in the Local Government Area was obtained from the Local Government Headquarters secretariat, where it was grouped into 3 rural, 3 urban and 4 semi-urban wards. One ward was randomly selected by the use of balotting paper from the three rural wards (ward 6)

2nd stage: The list of all the towns and villages and the population of adults within the selected ward was obtained from the selected rural ward were obtained from the political ward house located at Ido town. (This consists of 11 towns and 42 villages). Two towns and three villages representing 10% of all the towns and villages within the selected ward were picked randomly by balloting. The towns are Ido and Akufo, while the villages are odebode, Tapola and Eleyele Oko. Visits were paid to the heads and "Baales" of the villages and towns where we educated them about the study and got the number of houses in each town and village.

3rd stage: Systematic sampling from a list of sampling frame of all the housing units was done and every 2nd house was chosen.

4th stage: Every adult within the age range 18 – 67 years in the house was selected for the study.

Inclusion Criteria

- Adults aged 18 – 60 years from the selected communities.
- Adults with full or partial dentition
- Adults who consent to participate in the study

Exclusion Criteria

- Adults with special needs especially those who were mentally challenged and those who drink alcohol to stupor
- Uncooperative adult who did not allow intraoral examination.
- Adults who did not consent to participate in the study.

3.6 Ethical considerations

Confidentiality

All information gathered from the participants was kept confidential. Each participant was accorded a unique identification code on the data collection form; the subjects' names were not included in the questionnaire.

Translation of protocol

The questionnaire was translated to Yoruba which is the dominant language spoken in the study area and translated back to English. This was pre-tested among a small cluster of adults to ensure that the questions are explicit in construct and intent. All informed consent was also translated to Yoruba language for easy understanding by the participants.

Beneficence to participants

- All those who participated in the study benefited from oral health education on how to achieve good oral hygiene..
- Those with dental problems were referred for dental treatment.
- Souvenirs: a medium size fluoride containing toothpaste and a medium bristle tooth brush with a water bowl was given to each participant.

Non-maleficence to participants.

The aim and objectives and extent of the study were carefully explained to the participants and they were assured that there are no ill effects or added discomfort to them as a result of their involvement in the study. The protocol of the study involved dental examination with appropriate sterile instruments and procedure for each examination was

done without any invasive procedure. They were asked to participate willingly by signing an informed consent form (Appendix).

Voluntariness

Those eligible were assured of their right to decline participation or withdraw at any time in the course of the study without any loss of benefit. They were also assured that after the start of the interview, if they felt they do not want to continue, they were under no obligation for the interviewer to continue.

Ethical approval

- Ethical approval was obtained from the joint University of Ibadan/University College Hospital Ethical Review Committee (Appendix)
- Approval letter was obtained from the chairman Ido Local Government.
- Verbal approval was obtained from the Head of chiefs in each community.

3.7 Instrument of measurement

Instrument of measurement for this study consisted of an interviewer-administered questionnaire.The questionnaire was divided into three sections:

Section A assessed the socio-demographic information like age, gender, level of education, marital status and occupation of the study participants.

Section B of about twenty (20) questions, sought information on oral hygiene practices of participants, including tooth cleaning aids, frequency of tooth cleaning, pattern of dental visit etc.

Section C was a checklist extracted from the modified WHO Oral assessments form where the intra oral examination reports such as Teeth Present, Plaque Score, Calculus Score and the Simplified Oral Hygiene Index Scores were recorded.

3.8 Criteria for scoring of oral hygiene practices

Oral hygiene practice was determined as a triple outcome indicating good, fair and poor oral hygiene practice. What constitutes good oral hygiene practice as documented in the literature include regular, daily and conscious cleaning of the teeth (Health Education Authority 1989). Twice cleaning of the teeth daily is regarded as the minimum frequency acceptable for a preventive oral health practice (Health Education Authority 1989). Regular attendance at the dental clinic at least twice every year (Health Education Authority 1989). Eating a balanced diet rich in vitamins and minerals and low in refined carbohydrates are attributes of good oral health practice.

A total of twenty correct practice questions were asked to assess the oral hygiene practices of the study participants. One mark each was awarded to each correct answer and a total of 20 scores was considered as maximum and zero as the minimum score.

The total scores was then categorized as

0-6 (Poor oral hygiene practices)

7- 13 (Fair oral hygiene practices)

14 – 20 (Good oral hygiene practices)

3.9 Oral examinations, indices and criteria for scoring

Oral examination included:-

- Charting the teeth present using two digits number according to the International Dental Federation (FDI) system. The first digit specified the quadrant of the mouth and the second digit, the actual tooth.
- Determination of the Oral hygiene status using Simplified Oral Hygiene Index (OHI-S) of Greene and Vermillion (1964). This involved a partial recording with six index teeth as shown below.

16, 11	26
46	31, 36

11 = upper right central incisor

16 = Upper right first molar

26 = Upper left first molar

31 = Lower left central incisor

36 =Lower left first molar

46 = Lower right first molar.

A modification by Green and Vermillion was also use in the selection of the index teeth in subjects who had lost any of the index teeth, the second molar and the lateral incisors were examined.

The buccal surfaces of the selected upper molars and the lingual surfaces of the selected lower molars were inspected and scored while the labial surfaces of the upper right and the lower left central incisors were also inspected and scored.

OHI-S has two components – the Debris index and the Calculus index.

Oral debris was recognized as the soft foreign material loosely attached to the teeth. The surface area covered by the debris was estimated by running the side of the CPI probe along the tooth surface to be examined. The occlusal or incisal extent of the debris was noted and scores for each tooth as shown below.

Debris index

Score	Criteria
0	No debris or stain present
1	Soft debris covering up to one-third of the tooth surface
2	Soft debris covering one-third to two-thirds of the tooth surface
3	Soft debris covering more than two-thirds of the tooth surface

Calculus was recognized as hard calcified deposits found on the tooth surface and the color ranged from white to yellowish brown in supragingival calculus and light brown to greenish black in sub gingival calculus. A CPI probe was used to estimate the surface area covered by supragingival calculus and to probe the sub gingival calculus. Each tooth was scored according to the criteria shown below.

Calculus index

Score	Criteria
0	No calculus present
1	Supragingival calculus covering not more than one-third of the exposed tooth surface
2	Supragingival calculus covering more than one-third but not more than two-thirds of the exposed tooth surface or the presence of individual flecks of sub gingival calculus around the cervical portion of the tooth or both
3	Supragingival calculus covering more than two-thirds of the exposed tooth surface or a continuous heavy band of sub gingival calculus around the cervical portion of the tooth or both

For each individual, the debris and the calculus scores were totaled and divided by the number of surfaces scored. The average individual debris and calculus scores were calculated to obtain the simplified oral hygiene index (OHI-S).

The clinical levels of oral hygiene as associated with group OHI-S were as follows:

Good	:	0.0	-	1.2
Fair	:	1.3	-	3.0
Poor	:	3.1	-	6.0

3.10 Pre –test of instrument

A pre-test was conducted on twenty subjects a month prior to the commencement of data collection. It was tested among a small cluster of adults in another community but of similar characteristics as the study location. An average of 10 minutes was spent to administer and examine each subject. The research assistants were involved in the pre- testing of the questionnaires in order to create opportunity for them to acquire practical interviewing skills. This was analyzed for instrument validity. From the result of the pre-test, ambiguous questions were reframed or where necessary removed.

3.11 Validity

To reduce observation/evaluation bias, examiners were trained and calibrated on the interpretation and use of diagnostic criteria. Training was conducted for four hired research assistants who were final year dental students and Dental House Officers to ensure they have adequate understanding of the instrument prior to the commencement of data collection. The training was focused on the objectives and importance of the study, how to secure respondents informed consent, interviewing skills and how to review questionnaires to ensure completeness. The instrument was pre-tested among few adults of similar characteristics to the study population to ensure that the instrument measured all the parameters it was supposed to measure.

3.12 Reliability

The responses from the pre tested were further scrutinized, and there was resetting of items for questions that were not properly responded to. The questionnaires were also translated to Yoruba language and back to English based on the response from the pre-test.

This was to make the instrument reliable and be able to elicit the same information throughout the study. The reliability of the instrument was confirmed after the process of validation. The corrected version of the questionnaire was administered to 20 subjects in another rural community.

3.13 Data collection.

Phase 1- Cross – sectional survey

This stage involved the actual preparation for the study, which included an extensive literature search, consultations with supervisors and development of the research protocol. Ethical clearance and approval were sought from the UI/UCH institutional Review Committee. A letter of introduction was obtained from the Faculty of Dentistry which was taken to Ido Local Government Headquarters and permission to carry out this study was obtained from the Local government chairman. All permission and identification letters were thereby shown to the selected communities' leaders for identification after which meetings were held with them and the purpose of study was explained, questions, answered and their consent and assistance sought.

3.14 Actual survey/ Data collection method

Data were collected over a period of 3-weeks with the help of research assistants using the instruments of measurement as described above. Oral examination of each participant was carried out independently by the researcher and one other examiner with the aids of sterile dental mirrors, sterile Community Periodontal Index Probe, and gloves under natural light while two research assistants administered the questionnaire. The subjects were examined sitting upright on a chair in front of a house provided by the Baales. Only one participant was allowed for examination at a time to ensure privacy.

3.15 Data management and analysis

Data collected were checked each day to make sure that the questionnaires were properly filled. A coding guide was developed to facilitate data entry. Each questionnaire was coded and entered into a computer facilitated by the developed coding guide. Data entering and analysis was done using SPSS version 16.0 statistical package. Finally, information obtained was summarized and presented in tables and charts. Summary statistics (frequency percentages and cross tabulations) were generated. Test of significance was done with Chi square test and $P<0.05$ was considered to be statistically significant.

3.16 Limitation of the study

1) Refusal of oral examination was a major challenge as some of the subjects declined opening their mouth for oral examination after they had succeeded in filling the questionnaires. This was overcome by addition of the attrition rate during sample size calculation.

2) Illiteracy: The study population is in the rural communities where majority of the study participants were farmers, the level of illiteracy is very high, therefore they were not able to

read the consent letter and the questionnaires in English language, this problem was overcome by translating the inform consent into local language (Yoruba) and the questionnaires were interviewer administered in local language.

3). Sometimes the participants gave false answers especially on the use of cleaning aids. For example, some participants still claimed the use of toothbrush and toothpaste despite their visible poor oral hygiene during oral examination.

CHAPTER FOUR

RESULTS

4.1 Socio-demographic Characteristics of the study participants

Table 4:1 shows the frequency distribution of the study participants according to their socio-demographic characteristics. The age range of the subjects was 18 – 67 years with the mean age of 41.60 (SD± 13.43) years. The study comprised 143(57.2%) males and 107 (42.8%) females with 65(26%) and 63(25%) within the aged group 35-44 and 45- 64 respectively. The majority 190(76.0%) were Yoruba while others 60(24%) were Ibo, and Hausa. The majority 166(66.4%) were married while only 42(16.8%) were single. Ninety seven, (38.8%) were illiterate and 80 (32.0%) had primary school education. One hundred and ten (44%) and 76 (30.4%) were farmers and traders respectively.

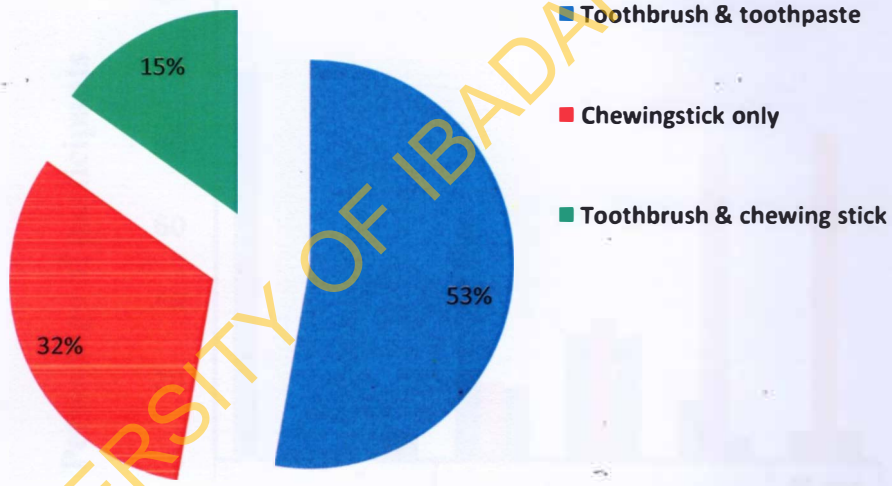
TABLE 2: DISTRIBUTION OF SOCIO DEMOGRAPHIC CHARACTERISTICS OF STUDY PARTICIPANTS

Social demographic Variables	Frequency (%)	Social demographic	Varieables Frequency (%)
Age (Years)		**Marital Status**	
15-24	28(11.2)	Married	166(66.4)
25-34	48(19.2)	Single	42(16.8)
35-44	65(26.0)	Separated	9(3.6)
45-54	63(25.2)	Divorce	7(2.8)
55-64	33(13.2)	Others	26(10.4)
65 above	13(5.2)	Total	250(100)
Total	250(100)		
Gender		**Ethnic Group**	
Male	143(57.2)	Yoruba	190(76.0)
Female	107(42.8)	Others	60(24.0)
Total	250(100)	Total	250(100)
Occupation		**Educational Status**	
Farmer	110(44)	Illiterate	97(38.8)
Trader	76(30.4)	Primary School	80(32.0)
Student	34(13.6)	Secondary School	47(18.8)
Artisan	21(8.4)	Tertiary Education	26(10.4)
Civil Servant	9(3.6)	Total	250(100%)
Total	250(100)		

4.2 Cleaning aids used by the study participants

The frequency distribution of cleaning aids used by the study participants is as in (Table 2) The majority 132 (52.8%) used toothbrush and toothpaste to clean their teeth,80 (32.0) used chewing sticks only while 38 (15.2%) used chewing sticks alternate with tooth brush and tooth paste.

FIG 1: CLEANING AIDS USED BY THE STUDY PARTICIPANTS

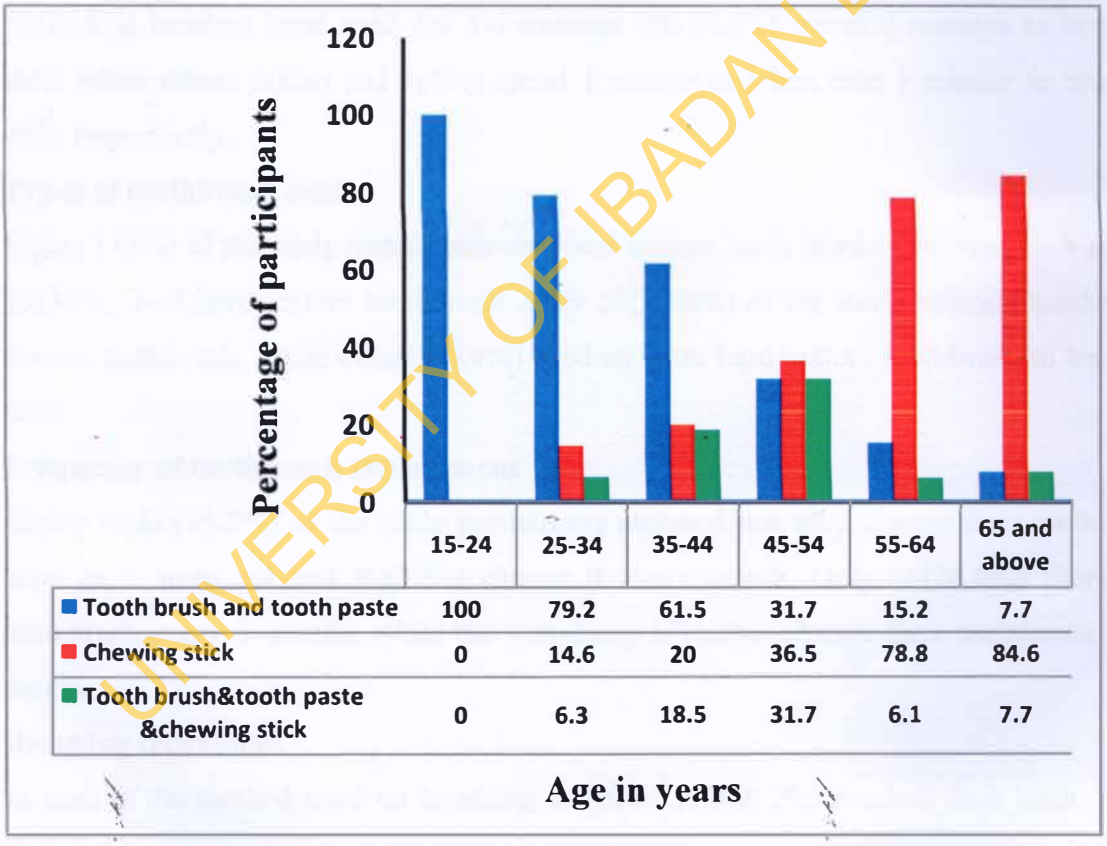


Key note: More than half of the participants use toothbrush and toothpaste.

4. 3. Cleaning aids and age of the study participants

The result of this study shows that the use of toothbrush and toothpaste increases with decrease age, 28(100%) of participants between the age group 18 – 24 years used toothbrush and toothpaste when compared to only 5(15.2%) among the age ranged 55 -64years. Likewise, none 0(0%) of the participants within the aged range 18 -24years cleaned their teeth with chewing stick when compared to 26(78.8%0 of the aged range 55 -64years.It was shown from the result that 20(31.7%) of the aged range 45 – 54 years combine or alternate toothbrush and tooth paste with chewing stick as compared to 0(0%) of the aged range 15 -24years and only 2(6.1%) of the aged range 55 -64years. There is strong statistical significant difference between cleaning aids and age (p=0.005). (Fig 2)

FIG 2: AGE AND CLEANING AIDS OF STUDY PARTICIPANT



	15-24	25-34	35-44	45-54	55-64	65 and above
Tooth brush and tooth paste	100	79.2	61.5	31.7	15.2	7.7
Chewing stick	0	14.6	20	36.5	78.8	84.6
Tooth brush&tooth paste &chewing stick	0	6.3	18.5	31.7	6.1	7.7

Key note: The use of toothbrush and toothpaste decreased with increased age.

4.4 Oral hygiene practices by the study participants

Frequency of tooth cleaning

Majority 194(77.6%) of the participant in this study brushed their teeth once daily, only 49(19.6%) brushed twice daily and the others 6(2.4%) brushed more than twice daily while only 1(4%) do not brush every day.

Times of the day tooth cleaning is done

Majority 190(76%) of the subjects in this study brushed their teeth in the morning before breakfast, while 40(16%) brushed before breakfast and at night before going to bed. Others 3(1.2%) and 17(6.8%) brushed their teeth all times after meal and when they feel dissatisfied with their mouth respectively.

Duration of tooth cleaning

More than half 139(55.6%) of the study participants had no specific duration at which they brushed, they brushed their teeth until they feel the satisfaction of cleanliness. Only 52(20.8%) brushed their teeth for 3-4 minutes, 49(19.6%) spend 2 minutes to brush their teeth while others 2(8%) and 1(4%) spend 1 minute and less than 1 minute to brush their teeth respectively.

Types of toothbrush used

Eighty (32%) of the study participants used soft texture tooth brushes to brush their teeth and 75(30%) used hard texture toothbrush. Only 55(22.0%) of the study subjects used medium texture toothbrush, while others 10(4%) used an extra hard texture toothbrush to brush their teeth.

Frequency of toothbrush replacement

Eighty eight (35.2%) of the study participants reported that they change their toothbrush as soon as it worn out and 80(32%) change it every month. Only 65(26.0%) change their toothbrush every 3 months while the remaining 17(6.8%) change their toothbrush every 6 month.

Brushing techniques

In term of the method used for brushing, majority 173(69.2%) brushed their teeth using the horizontal technique of tooth brushing, only 75(30%) uses the vertical stroke technique while the remaining 2(8%) brushed their teeth by rolling the toothbrush round their teeth (circular motion technique).

The use of dental floss

Majority 239(95.6%) of the study participant have never use dental floss as an interdental cleaning aids while only 11(4.4%) reported that they have used dental floss.

TABLE 3: ORAL HYGIENE PRACTICES OF THE STUDY PARTICIPANTS

Variables	Frequency (%)
Do you drink alcohol?	
Yes	112(44.8)
★No	138(55.2)
Total	250(100)
Do you smoke Cigarette	
Yes	76(30.4)
★No	174(69.6)
Total	250(100)
Do you Snuff Tobacco	
Yes	42(16.8)
★No	208(83.2)
Total	250(100)
Do you chew tobacco	
Yes	4(1.6)
★No	246(98.4)
Total	250(100)
Do you chew kolanut	
Yes	161(64.4)
★No	89(35.6)
Total	250(100)
Cleaning aids	
★Toothbrush and tooth paste	132(52.8)
★Chewing stick	80(32.0)
★Chewing stick + tooth brush and paste	38(15.2)
Total	250(100)
Frequency of tooth cleaning	
Not every day	1(0.4)
Once Daily	194(77.6)
★Twice	49(19.6)
More than twice	6(2.4)
Total	250(100)
Times of the day tooth cleaning is done	
Morning before breakfast	190(76.0)
★Before breakfast and at night before bed	40(16.0)
All times after meal	3(1.2)
When I feel dissatisfied with my mouth	17(6.8)
Total	250(100)

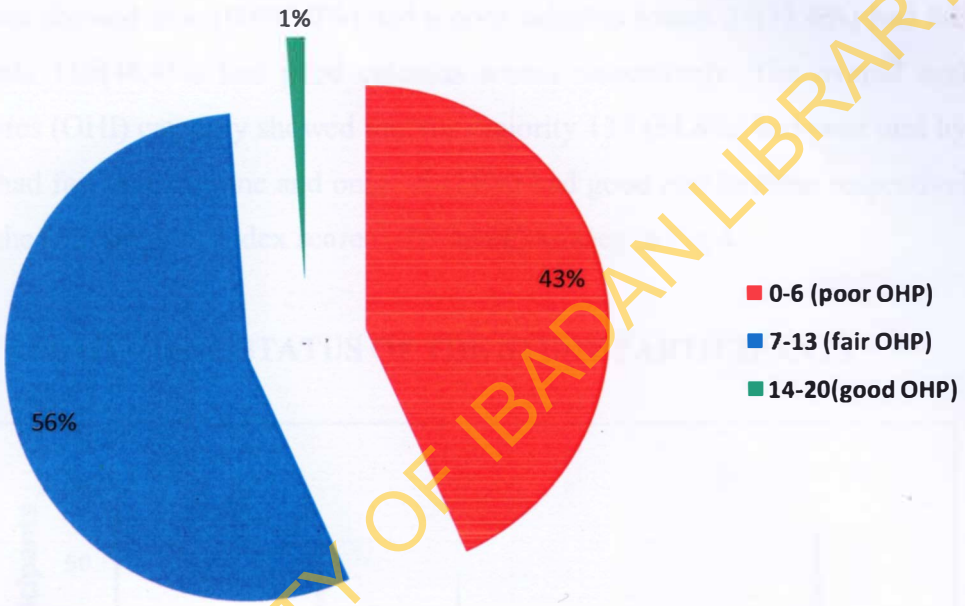
Variables	Frequency (%)
Duration of tooth cleaning	
Less than 1 minute	1(0.4)
1 minute	2(8.0)
2 minutes	49(19.6)
★3-5 minutes	52(20.8)
As soon as I feel satisfied	139(55.6)
Total	250(100)
Why do you prefer tooth brush	
Don't use tooth brush	80(32.0)
It is less expensive	32(12.8)
It is less stressful	16(6.4)
It is more stressful	74(29.6)
Recommended by dentist	48(19.2)
Total	250(100.0)
Type of toothbrush used	
Don't use tootbrush	80(32.0)
Soft	55(22.0)
★Medium	30(12.0)
Hard	75(30.0)
Very Hard	10(4.0)
Total	250(100)
Frequency of toothbrush replacement	
Don't use toothbrush	80(32.0)
Every month	65(26.0)
★Every 3 months	17(6.8)
As soon as it worn out	88(35.2)
Total	250(100)
Brushing Techniques	
By rolling round the teeth	2(0.8)
Back and forth movement (Horizontal)	173(69.2)
★Up and down (vertical)	75(30.0)
Total	250(100)
Why do you prefer chewing stick	
Do not use chewing stick	132(52.8)
It is less expensive	26(10.4)
It is less stressful	1(0.4)
It is more effective	91(36.4)
Total	250(100)

Variables	Frequency (%)	Variables	Frequency (%)
What type of chewing stick do you use		**Pattern of dental visit**	
Not applicable	132(52.8)	Never	207(82.8)
Pako ijebu	15(6.0)	★Every 6 months	2(0.8)
Pako ayan	75(30.0)	Once in a year	32(12.8)
Pako ata	28(11.2)	Every 2-5 years	9(3.6)
Total	250(100.0)	Total	250(100.0)
Do you clean your tongue while brushing			
★Yes	226(90.4)		
No	24(9.6)		
Total	250(100)		
How often do you eat cleansing fruit			
Not often	151(60.4)		
Often	95(38.0)		
★Very often	4(1.6)		
Total	250(100)		
Do you pick your teeth after a meal			
★Yes	206(82.4)		
No	44(17.6)		
Total	250(100)		
If yes what do you use			
Don't pick	44(17.6)		
Tooth pick	147(58.8)		
Broom stick	56(22.4)		
Match stick	3(1.2)		
Total	250(100.0)		
Do you use interdental cleaning aids			
★Yes	11(4.4)		
No	239(95.6)		
Total	250(100.0)		
How often do you use mouth wash			
Never	198(79.2)		
Not Often	50(20.0)		
★Often	2(0.8)		
Total	250(100)		

4.5 Oral hygiene practices score of the study participants

The results of the study shows practice score range of 2 – 15 points with the mean score of 7.11 (SD± 2.48). The result of oral hygiene practice score categorization in this study further shows that 108(43.2%) had poor oral hygiene practices, 139(55.6%) had fair oral hygiene practices while only 3(1.2%) had good oral hygiene practices. (Fig 3).

Fig 3: ORAL HYGIENE PRACTICE SCORES BY THE STUDY PARTICIPANTS



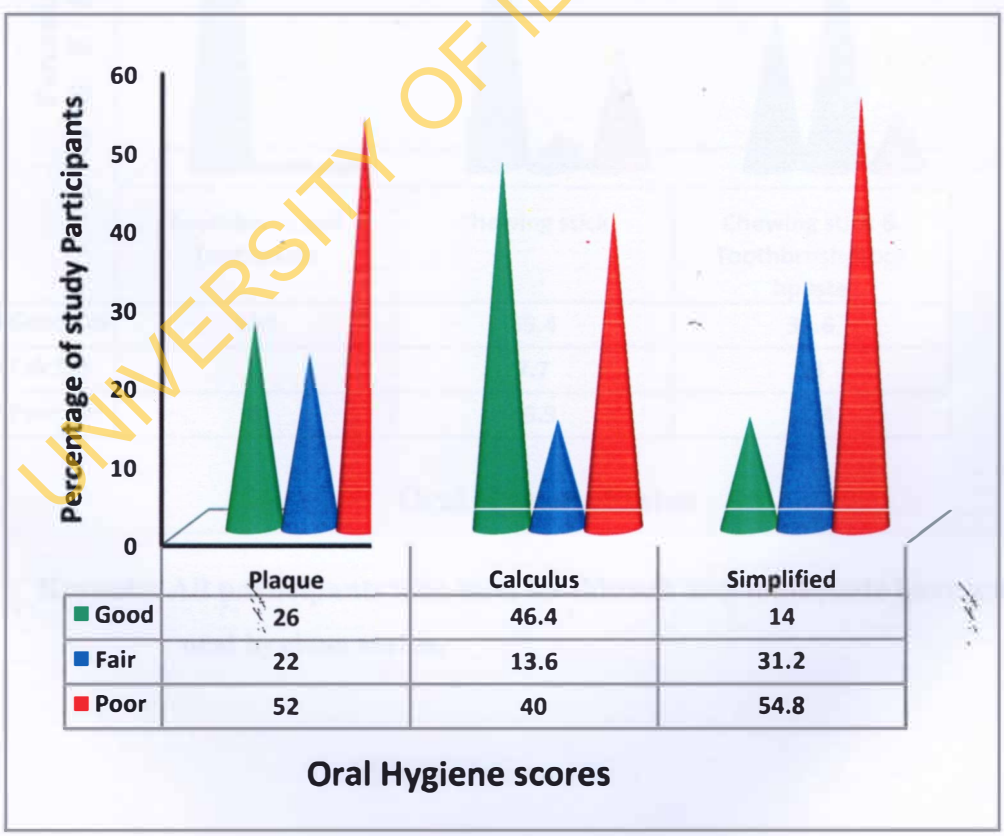
Key note: Only 1% of participants had good oral hygiene practices.

4.6 Oral hygiene status of the study participants

All the 250 subjects were examined for oral hygiene status out of which all of them had the index teeth or modification of the index teeth used for scoring. The frequency distribution of the oral hygiene status of the study subjects shows the OHI range of the subjects was 0.8 – 6 with the mean score of 3,87 (SD± 1.98) (fig ii). It was shown that 94(37.6%) of the study participants had an OHI score of 6 which means they have the maximum score of poor oral hygiene whereas only one subject had a score of less than 1. (Fig 4).

One hundred and thirty (52%) had poor plaque index score, 55(22%) had a fair plaque index score while the remaining 65(26%) had good plaque index score respectively. The calculus index score showed that 100(40.0%) had a poor calculus scores 34(13.6%) had fair calculus score while 116(46.4%) had good calculus scores respectively. The overall oral hygiene index scores (OHI) category showed that the majority 137 (54.8%) had poor oral hygiene, 78 (31.2%) had fair oral hygiene and only 35 (14%) had good oral hygiene respectively. (Table 4.3) and the Oral hygiene index score (OHI-score) as seen in Fig 4.

Fig 4: ORAL HYGIENE STATUS OF THE STUDY PARTICIPANTS

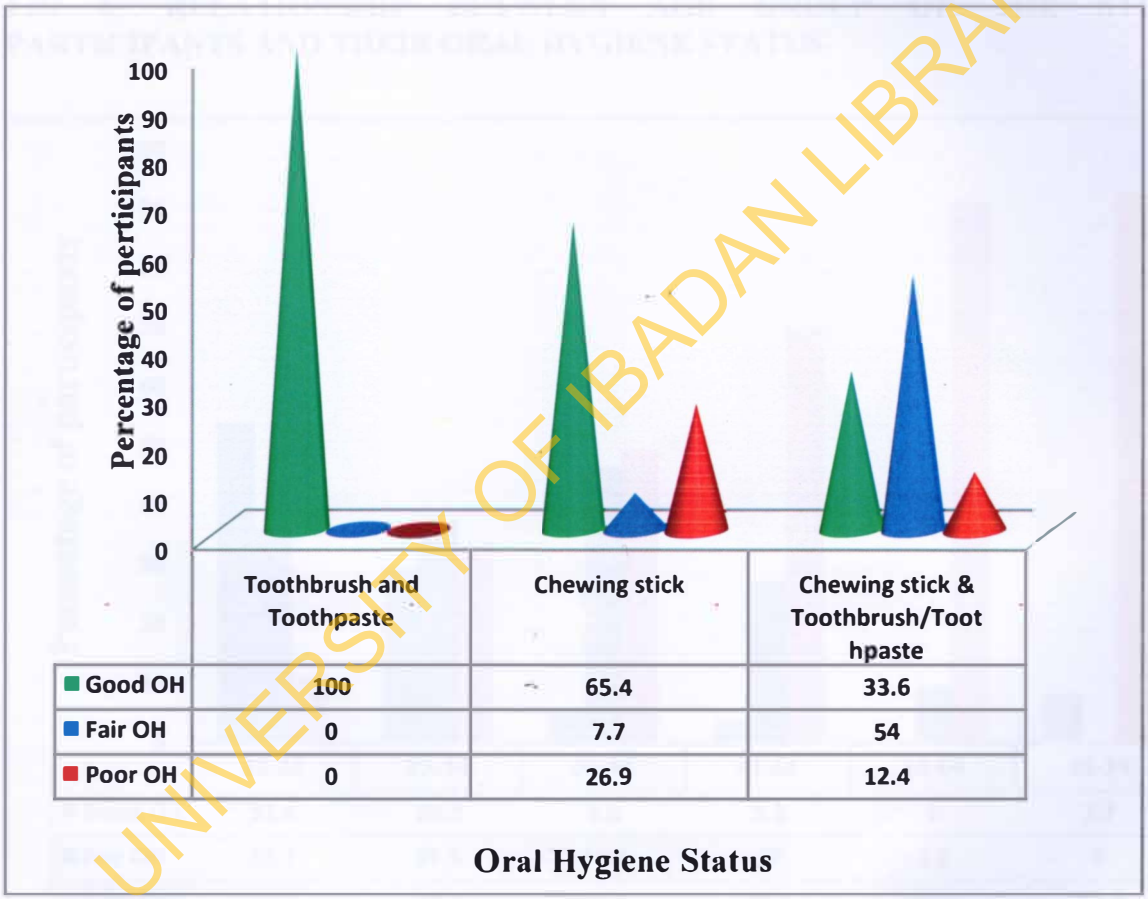


Keynote: More than half of the participants had poor oral hygiene status.

4.7: Cleaning aids and Oral hygiene status of the Study participants.

The result of the relationship between the cleaning aids use by the study participants and their oral hygiene status is as shown in (Table 16). Thirty five (100.0%) of those who use toothbrush and tooth paste have good oral hygiene status, while majority 74(54.0%) of those who use chewing stick only have poor oral hygiene and 21 (26.9%) of those who combine toothbrush / toothpaste with chewing stick have fair oral hygiene status respectively (Figure

FIG 5: RELATIONSHIP BETWEEN CLEANING AIDS AND ORAL HYGIENE STATUS

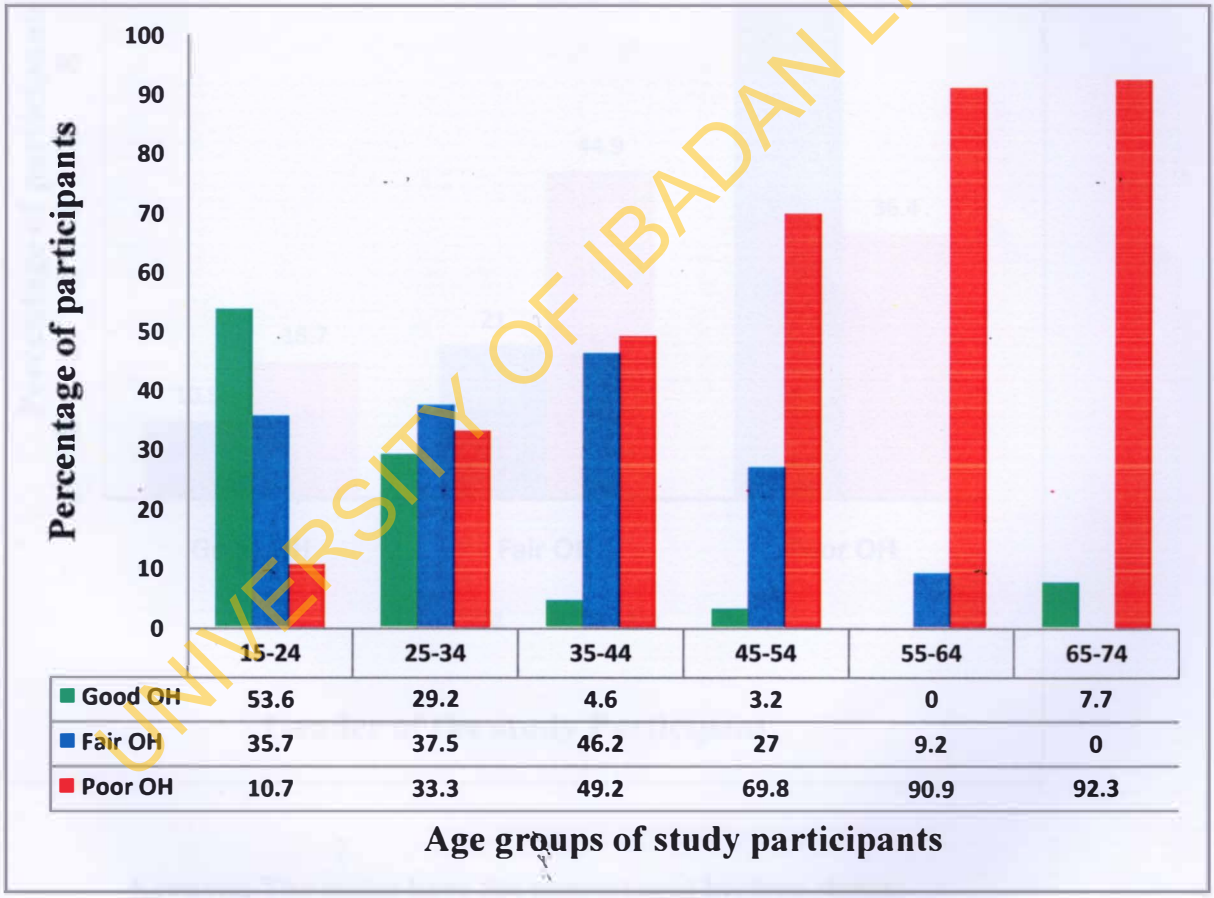


Keynote: All participants who used toothbrush and toothpaste have good oral hygiene status.

4.8 Age group and oral hygiene status of the study participants

Relationship between age group and the Simplified Oral hygiene index score of study participants shows that the age group 65 and above had the poorest oral hygiene (92.3%) followed by age group 55 -65 (90.9%) and age group 45 54years (69.8%) respectively. The result shows an increase in poor oral hygiene with increase age. Oral hygiene was fair among subjects between ages 35 – 44 years (46.2%) and 25 -34 (37.5%) respectively. No age category was shown to have good oral hygiene except age range 15 – 24years where 53.6% had good oral hygiene. However, the relationship between age and oral hygiene status, showed there was statistical significant difference. ($p<0.05$) (fig.6)

FIG 6: RELATIONSHIP BETWEEN AGE GROUP OF THE STUDY PARTICIPANTS AND THEIR ORAL HYGIENE STATUS



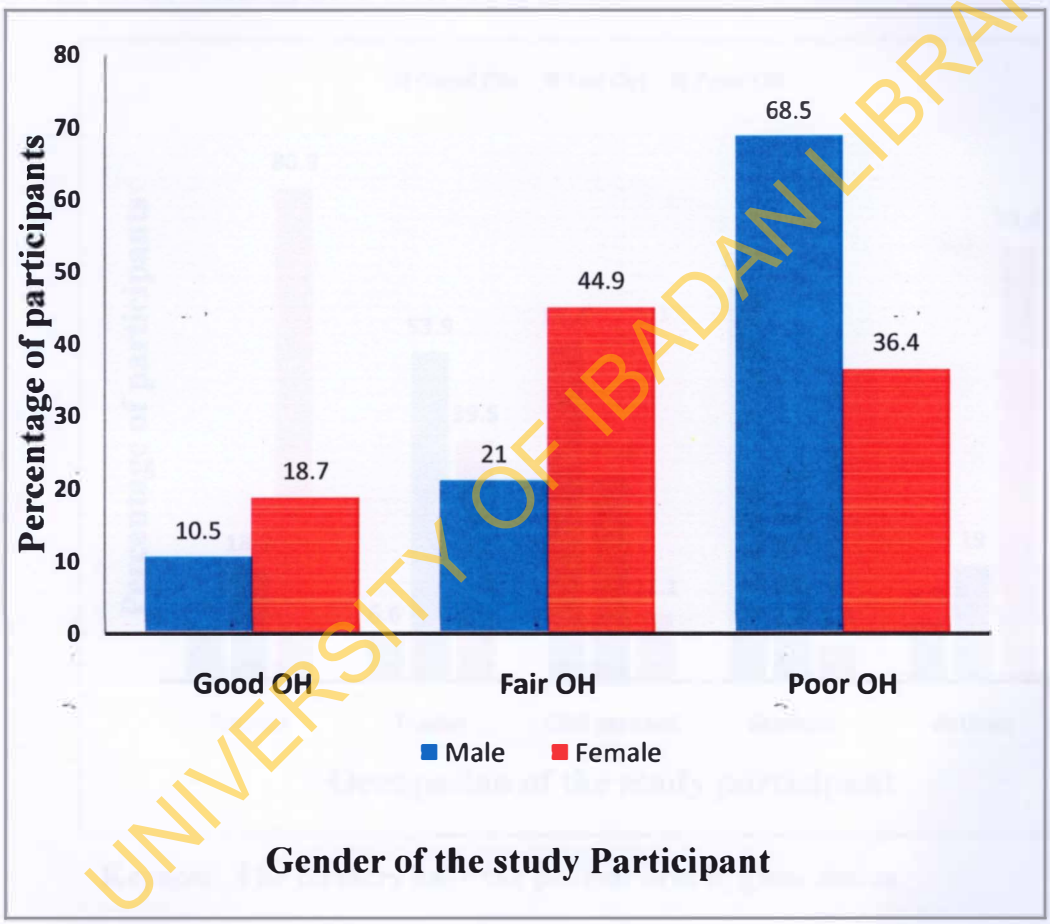
	15-24	25-34	35-44	45-54	55-64	65-74
Good OH	53.6	29.2	4.6	3.2	0	7.7
Fair OH	35.7	37.5	46.2	27	9.2	0
Poor OH	10.7	33.3	49.2	69.8	90.9	92.3

Keynote: The older adults have the poorest oral hygiene status

4.9 Relationships between gender and oral hygiene status of the study participants.

The study comprised 143(57.2%) males and 107 (42.8%) females, the results of oral hygiene and gender shows that male 98(68.5%) had poorer oral hygiene than female 39(36.4%). Fairer and good oral hygiene 48(44.9%) and 20(18.7%) were also found among the females compare to the male 30(21.0%) and 15 (10.5%) respectively. This result shows a statistical significant difference. P>0.05. (Table 5)

FIG 7: RELATIONSHIP BETWEEN GENDER AND ORAL HYGIENE STATUS OF THE STUDY PARTICIPANTS

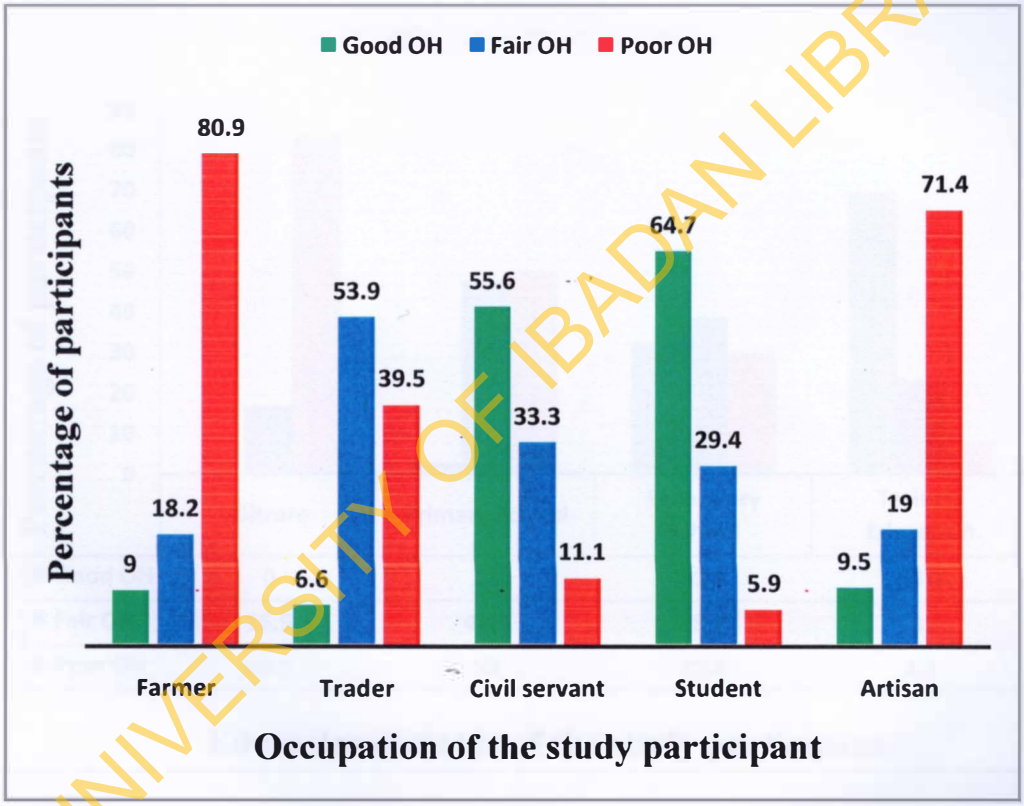


Keynote: The males have the poorest oral hygiene status.

4.10 Relationships between Occupation and oral hygiene status of the study participants.

The relationship between occupation and the oral hygiene status, showed there was statistical significant difference ($p<0.05$).The farmers 89(80.9%) had the poorest oral hygiene status, followed by the artisans 15(71.4%) and the traders 30(39.5%) respectively. Fair oral hygiene was found among the traders and civil servants 41(53.9%) and 3 (33.3%). However, only the students 5(55.6%) have good oral hygiene.

FIG 8: RELATIONSHIP BETWEEN OCCUPATION AND ORAL HYGIENE STATUS OF THE STUDY PARTICIPANTS

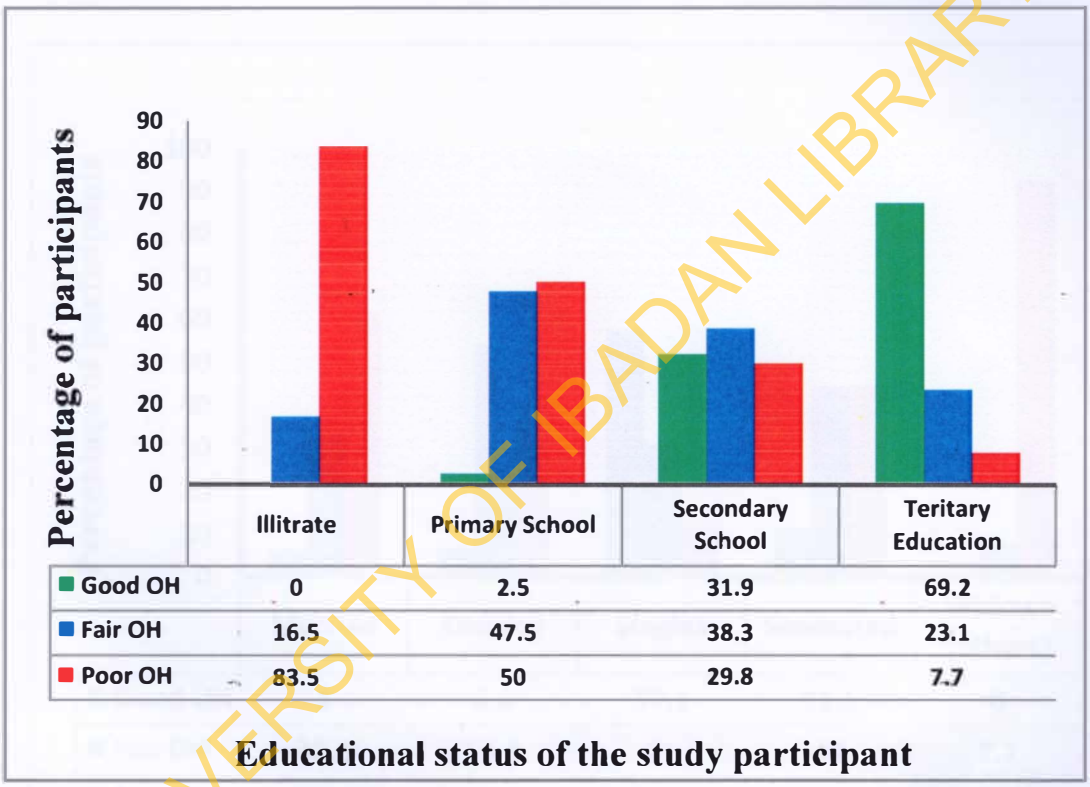


Keynote: The farmers have the poorest oral hygiene status

4.11 Relationships between Educational status and oral hygiene status of the study participants.

The study participants who had no formal education (illiterate) 81(83.5%) had the poorest oral hygiene status, followed by those with primary school education 40(50%) and secondary school education 14(29.8%) respectively .Fair oral hygiene was found among the secondary school education 38(47.5%). However, only subjects with tertiary education had good oral hygiene status 18 (69.2% .This difference was statistically significant $p< 0.05$).

FIG 9: RELATIONSHIP BETWEEN EDUCATIONAL STATUS AND ORAL HYGIENE STATUS OF THE STUDY PARTICIPANTS

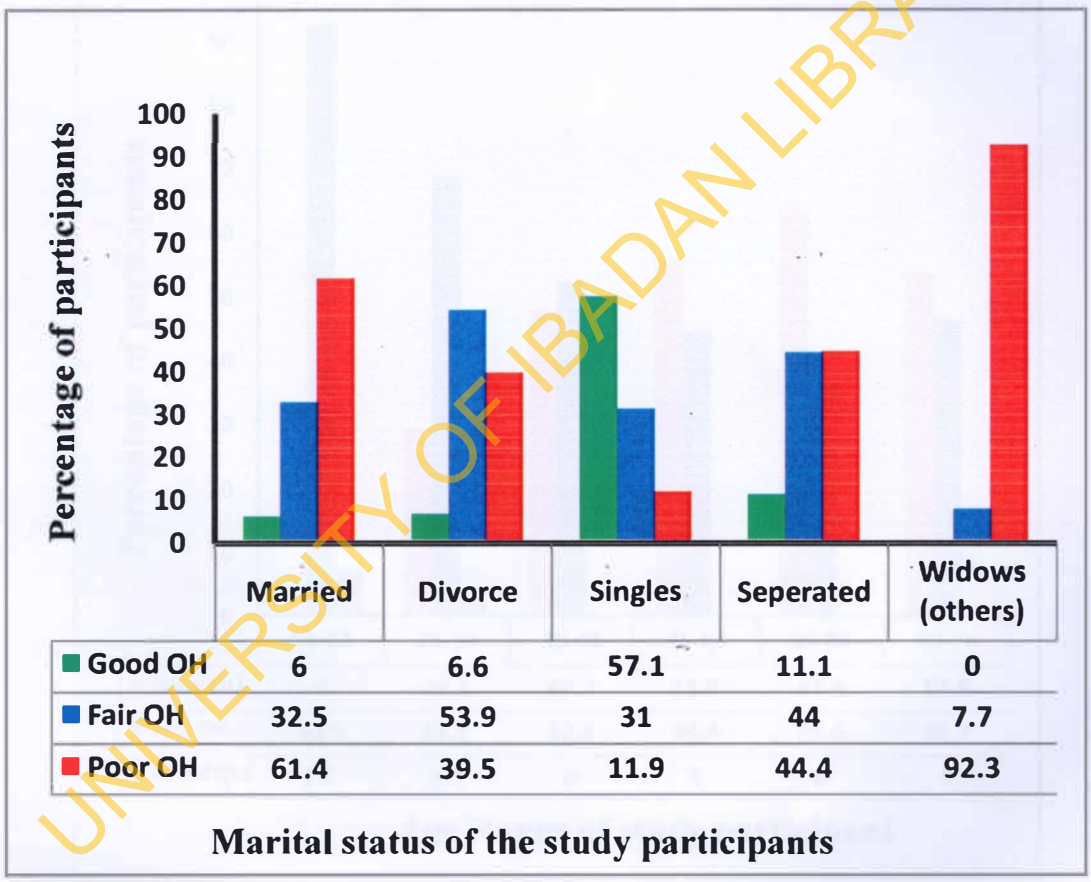


Keynote: Majority of the illitrates have poor oral hygiene status.

4.12 Relationships between marital status and oral hygiene status of the study Participants.

The result of the relationship between marital status and oral hygiene status of the study participants in this study shows that those participants who are widow (others) 24(92.3%) had the poorest oral hygiene followed by the married 102 (61.4%). Fair oral hygiene was found among the divorce 5(71.4%). Only the singles 24 (57.1%) have good oral hygiene. There is statistical significant difference between marital status and oral hygiene status ($p > 0.005$).

FIG 10: RELATIONSHIP BETWEEN MARITAL STATUS AND ORAL HYGIENE STATUS OF THE STUDY PARTICIPANTS

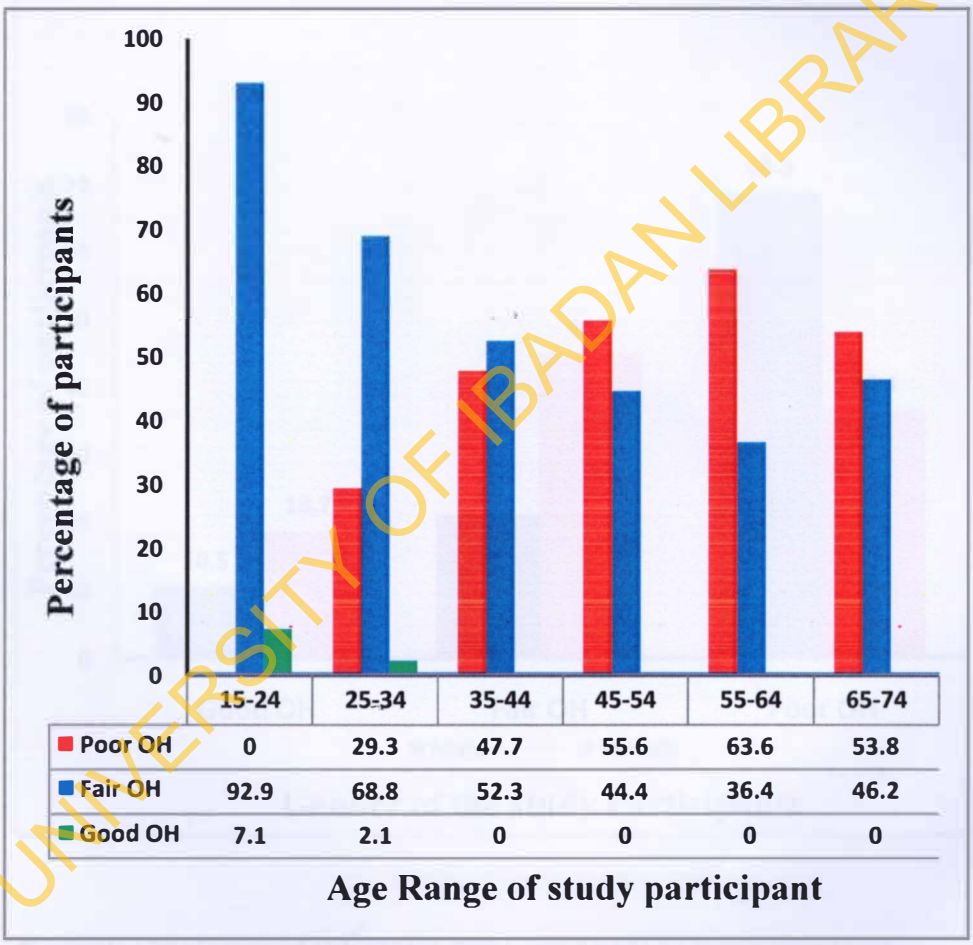


Keynote: The widows and widowers have the poorest oral hygiene status.

4.13 Relationship between the age range of the study participants and their oral hygiene practices.

The study shows that age range 55-64 (63.6%) had the poorest oral hygiene practice score and it was shown that the increase in age range, the poorer the practice. Also, oral hygiene practices were found to be fairest among the age range 15 -24 years and decreases with increase age. None of the age range was found to practice a good oral hygiene.

FIG 11: RELATIONSHIP BETWEEN AGE RANGE OF THE STUDY PARTICIPANTS AND THEIR ORAL HYGIENE PRACTICES



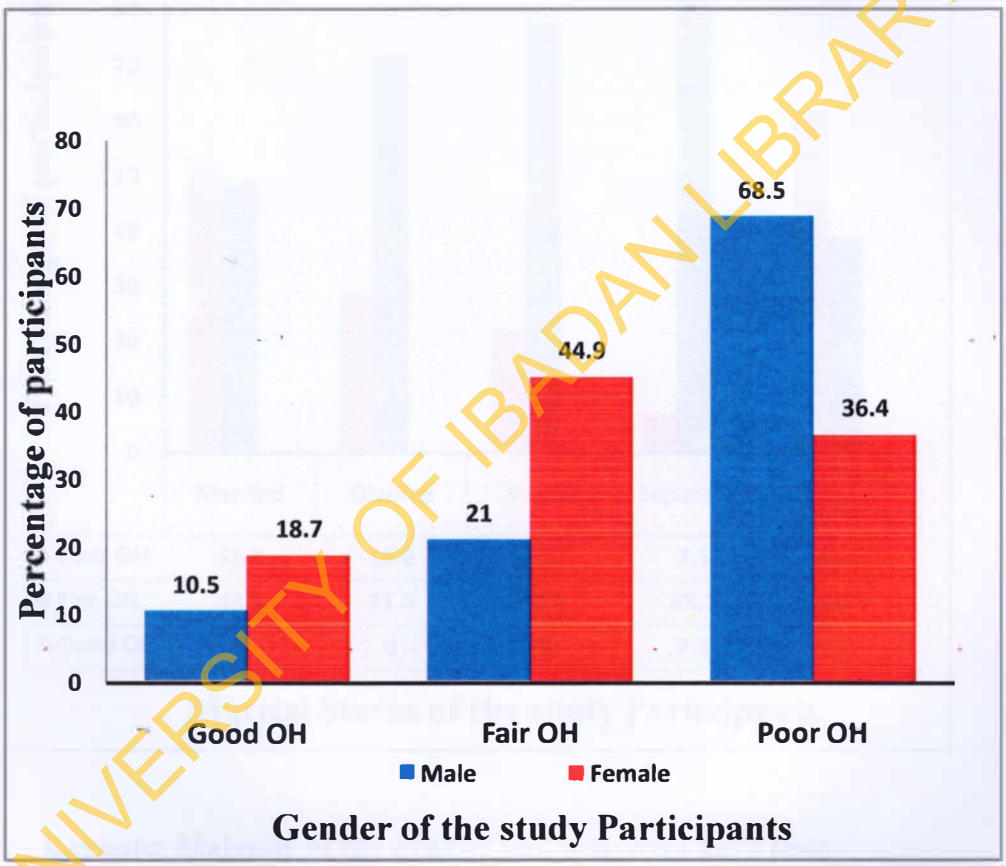
	15-24	25-34	35-44	45-54	55-64	65-74
Poor OH	0	29.3	47.7	55.6	63.6	53.8
Fair OH	92.9	68.8	52.3	44.4	36.4	46.2
Good OH	7.1	2.1	0	0	0	0

Keynote: Only a few young adults among the study participants have good practice of oral hygiene.

4.14 Relationship between Gender and oral hygiene practices of study participants.

The result of this study shows a statistically significant difference (p>0.05) between gender and oral hygiene practices. Male 92(64.3%) had poorer oral hygiene than the female counter pacts 16(15.0%) Although fairer practices were also found among the male 89(83.2%). No gender was shown to have a good oral hygiene practices.

FIGURE 12: RELATIONSHIP BETWEEN GENDER AND ORAL HYGIENE PRACTICES OF THE STUDY PARTICIPANTS

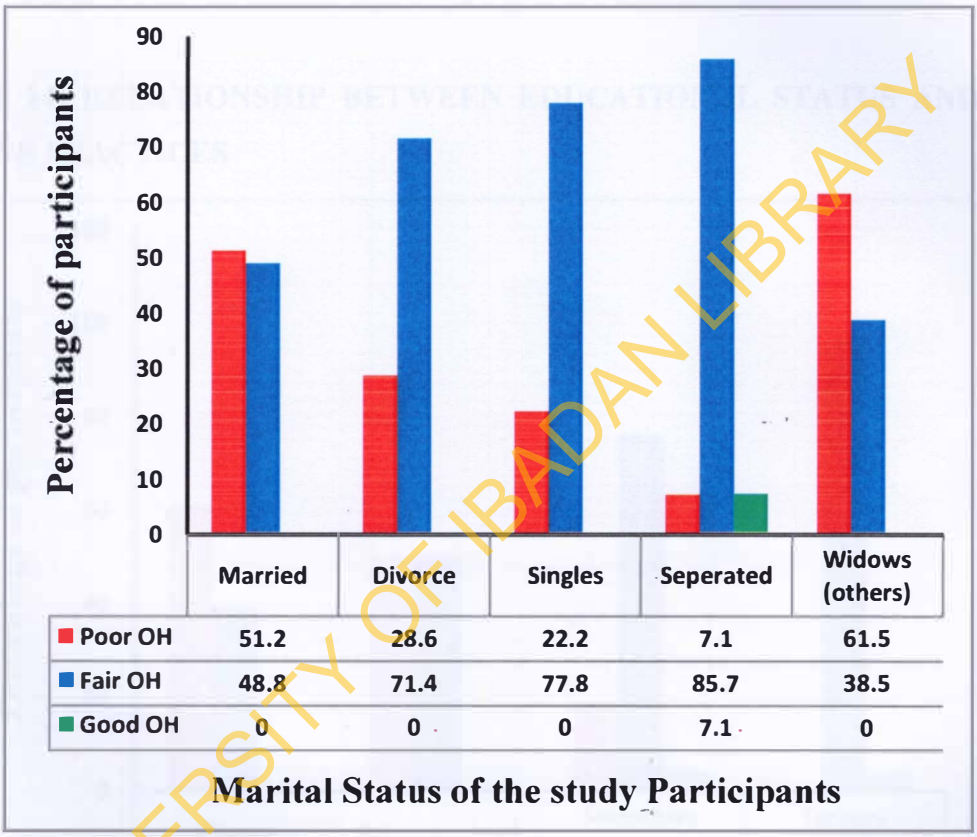


Keynote: Majority of the males have poor oral hygiene practices

4.15 Relationship between marital status and oral hygiene practices

The relationship between marital status and oral hygiene status in this study shows that the widows and widowers 16 (61.5%) have the poorest oral hygiene practices. The singles were found to have the fairest practices while none of the marital status seems to have a good oral hygiene practices. The difference is statistically significant p>0.005.

FIG 13: RELATIONSHIP BETWEEN MARITAL STATUS AND ORAL HYGIENE PRACTICE

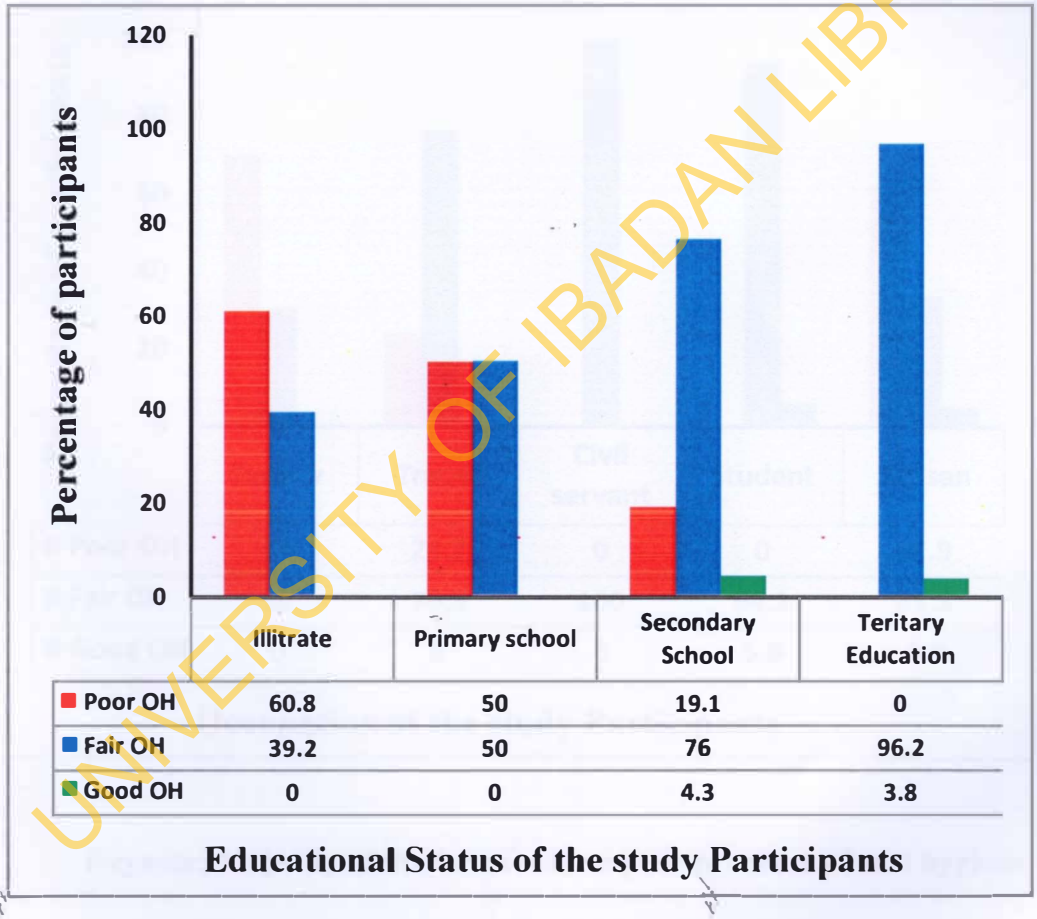


Keynote: Majority of the widows and widowers have poor practices of oral hygiene

4.16 Relationship between educational status and oral hygiene practices

The study shows a statistically significant difference between educational status and oral hygiene practices. P>0.005. The poorest practice of oral hygiene was found among the illiterate 59(60.8%). The lesser the educational status, the poorer the oral hygiene practices. It was also shown that subjects who had tertiary education 25(96.2%) had the fairest oral hygiene practices. Although, none of the study participants was shown to have a good oral hygiene practices.

FIGURE 14: RELATIONSHIP BETWEEN EDUCATIONAL STATUS AND ORAL HYGIENE PRACTICES

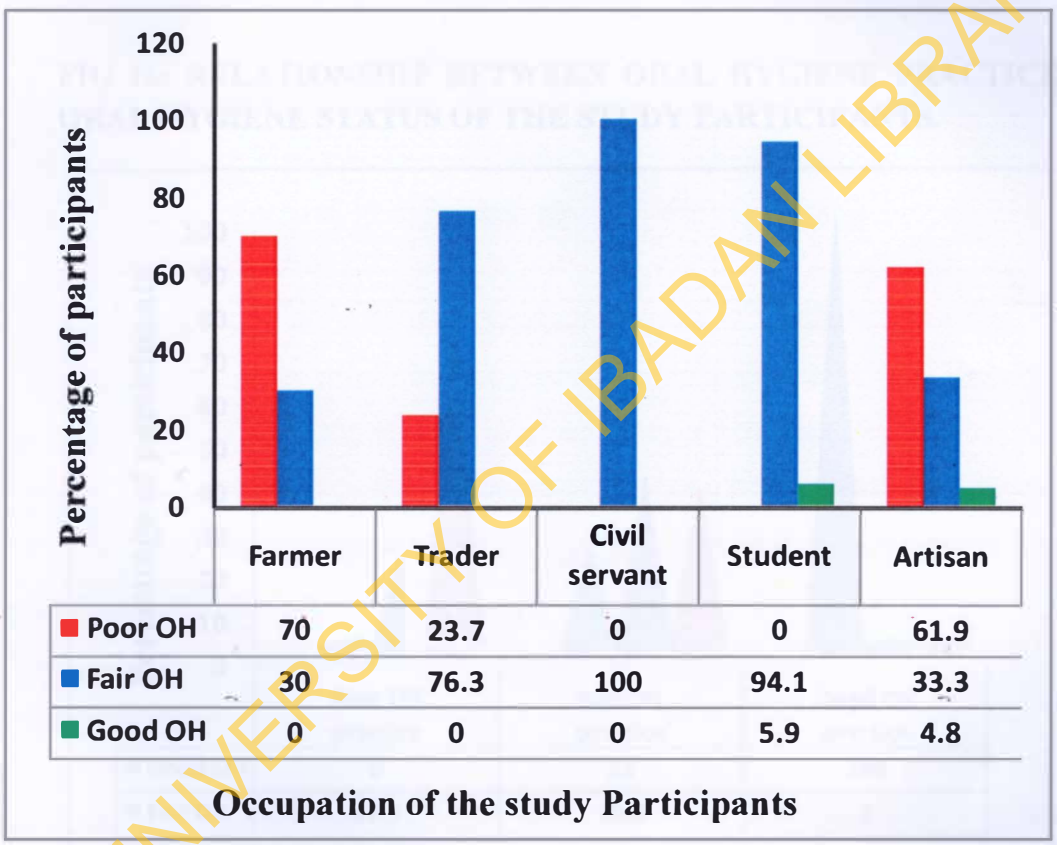


Keynote: Majority of the illtrates have poor practices of oral hygiene

4.17 Relationship between occupation and oral hygiene practices

The results of occupation and oral hygiene practices of the study participants shows a statistically significant difference between oral hygiene practices and occupation p>0.005. It was shown that the farmers 77(70.0%) have the poorest practices of oral hygiene, the civil servants 9(100%) have the fairest practices followed by the students 32(94.1%). No occupational category was found to have a good practice.

FIG 15: RELATIONSHIP BETWEEN OCCUPATION AND ORAL HYGIENE PRACTICES

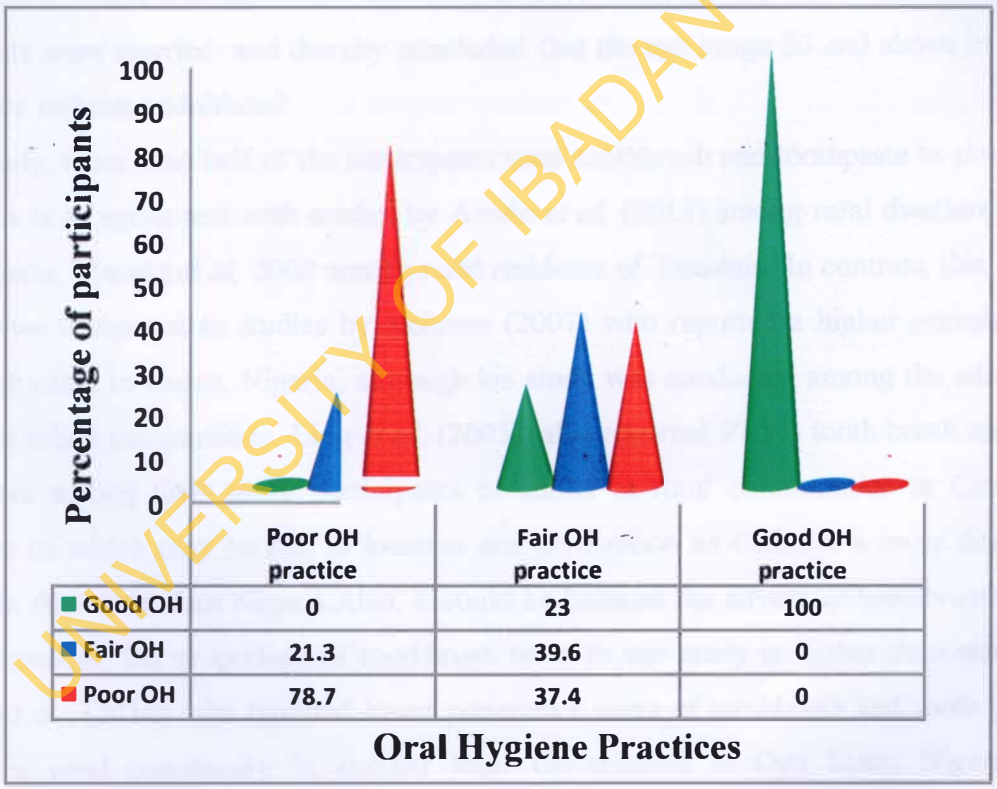


Keynote: Majority of the farmers have poor practices of oral hygiene

4.18 Relationship between oral hygiene practices and oral hygiene status of the study participants.

The relationship between oral hygiene practices and oral hygiene status of the study participants shows that subjects with poor practices 85(78.7%) have the poorest oral hygiene status. Those with fair practices 55(39.6%) have fair oral hygiene status; also all subjects with good practices have good oral hygiene status. The trend shows that, the better the oral hygiene practices, the better the oral hygiene status of the subjects. Therefore there is statistically significant difference between the practice of oral hygiene and oral hygiene status. P> 0.005.

FIG 16: RELATIONSHIP BETWEEN ORAL HYGIENE PRACTICES AND ORAL HYGIENE STATUS OF THE STUDY PARTICIPANTS.



	Poor OH practice	Fair OH practice	Good OH practice
Good OH	0	23	100
Fair OH	21.3	39.6	0
Poor OH	78.7	37.4	0

Keynote: All participants who practiced good oral hygiene have good oral hygiene status.

CHAPTER FIVE

DISCUSSION

Most of the participants in this study were within the age group 35-44 years; with Yoruba tribe majorly inhabit the study location. Most of them were married and almost half were farmers. Eighty percent of the study participants had primary school education. The level of education and occupation in this study is expected of a rural community where there is lack of infrastructure like electricity, good transportation and communication system. The result is in agreement with Ajibefun study in 2002 who reported that most rural dwellers in Nigeria are either full time farmers or combining farming with other vocations like hunting and petty trading. Ajibefun et al., 2002 in their study also reported that majority of the rural dwellers in their study had no formal education. Also in this study, more than half of the participants were married, which is in agreement with Olujide,2006 who reported that 67.2% of his study participants were married and thereby concluded that the age range 20 and above in a rural community indicates adulthood.

In this study, more than half of the participants used toothbrush and toothpaste to clean their teeth. This is in agreement with studies by Azodo *et al,* (2013) among rural dwellers in Edo state, Nigeria, Masalu *et al,* 2009 among rural residents of Tanzania. In contrast, this finding is low when compared to studies by Koleoso (2007) who reported a higher prevalence of toothbrush users in Lagos, Nigeria, although his study was conducted among the adolescent and in the urban communities. Ling *et al,* (2005), also reported 97.5% tooth brush and tooth paste users among their study participants of adults in rural communities in China, the difference of which may be due to location and civilization as China is a more developed country in the world than Nigeria.Also, it could be because the advent of toothbrush was in China. However, the proportion of toothbrush users in our study is higher than studies by Ibiyemi *et al.,* (2010) who reported lower prevalence users of toothbrush and tooth paste in Igboora, a rural community in another local Government in Oyo State, Nigeria. The difference in these findings may be due to the fact that, Igboora dwellers has higher prevalence of oral health education opportunity which were taken for granted and are not utilizing as compared to our study location which only received oral health education shortly before the collection of data in this study and are eager for more knowledge. The prevalence of tooth brush and tooth paste users in this study is also high when compared to Taiwo *et al,* (2004) and Fajemilehin and Ogunbodede, (2002), although their studies were conducted among the elderly while this study was conducted among the adults.

These reports also contrasted with previous reports among adults rural dwellers in Nigeria with very low prevalence of toothbrush use Sofola *et al.*, (2003). Some authors Benoit *et al.*, (2006), Faaziusl *et al.*, (2007) also reported lower prevalence of tooth brush and tooth paste users among rural adult in Burkina Faso, the difference of which may be due to the fact that, although the two are developing nations but the social status of Nigerians are higher than Bukina Fasos. The trends and changes in accessibility and availability of information, governance, and economic situations in the different study site over time may have resulted in high use of toothbrush and toothpaste. The fashionable nature of tooth brushing may have accelerated its acceptance among rural dwellers. Likewise, the availability of small sachets of toothpastes at low cost in the Nigerian rural market, which makes it relatively affordable and meet the needs of the population, had increased its use in almost every home. The use of toothbrush and toothpaste among 52.8% of rural dwellers in this study indicate an improvement on the oral hygiene awareness on the use of tooth brush and toothpaste and possibly have been influence by the previous oral health education that has been given by the Community Dentistry Outreach Unit before the collection of data for this study.The reasons for the use of toothbrush and toothpaste in this study, ranged from its effectiveness, its reccomendation in the hospitals and affordable cost as reported in this study.

The use of chewing sticks was reported among few participants in this study and it is in agreement with Azodo *et al.*, 2013, Joyce *et al.*, (2009). Lower proportion of chewing sticks users were reported in this study while compared with Taiwo *et al.*, (2004); Charlotte F N, (2005), Benoit *et al.*,(2006), Faaziusl *et al.*, (2007), Ibiyemi *et al.*, (2010); Azodo and Amenaghawon, (2013).The effectiveness of chewing stick and its low cost had prompted some of the participants in this study to engage in its use as their cleaning aids.The chewing stick according to some of the participants in this study is cheaper and at times free as people break branches of tree to make local chewing stick, and their use require no skill at all, unlike toothbrush.

Frandsen, 1986 during the state of science press review on mechanical oral hygiene practices, concluded that findings from previous workshops, which had identified a brushing frequency of two times a day was substantiated. Also the American Dental Association recommended two times daily tooth brushing for all dentists (American Dental Association, 2013). Likewise, twice daily cleaning of the teeth was regarded as the minimum frequency acceptable for a preventive oral health practices (Health Education Authority, 1989).

Although brushing once in a day was the commonly used method of cleaning in this study, the percentage of subjects who brushed their teeth twice daily was 19.6% which is in

agreement with Lawal *et al*, (2013) in their study among rural dwellers of Idikan community in Ibadan, Oyo State, Nigeria who reported that, only 26.2% of their study participants brushed their teeth twice daily. Findings from Nitika *et al.*, 2012 are also similar to this study. However, this result is low when compared to Taiwo *et al.*, (2004), Bamgboye and Akande (2007) and Ibiyemi *et al.*, (2010). Also very low when compared to reports by Dilip CL, (2005) Jiang et al.,(2005) Zhu L, *et al.*, (2005) and Al-Shammari *et al.*, (2007). However, Koleoso (2007), Bukar *et al.*, (2012) and Azodo, (2013) reported lower prevalence of study participants who brushed their teeth twice daily in Lagos Nigeria.

Reports from this study show that only few of the participants brushed in the morning after breakfast and last thing at night before bed. This result is low when compared to Bamigboye and Akande, (2007) who reported higher percentage among their study participants who brushed in the morning and at night, although Bamgboye and Akande study was conducted among the secondary school students. The result of this study showing the minority of the participants brushing only in the morning is a sign of a health related rather than a health directed behaviour. This could be attributed to difficulty in behavioural and attitudinal change.

Report has concluded that tooth brushing duration is an important variable in plague removal efficacy, therefore 2-5 minutes have been recommended as the idea for manual brushing (Ashley, 2001; Terezhalmy *et.al*, 2005). In this study, more than half of the participants reported that they clean their teeth until they are satisfied with the cleanliness while very few brushed their teeth within the speculated 2-5 minutes. This result is in contrast with the recommended duration of tooth brushing, and in contrast to Singh and Tuli, (2013) who reported higher percentage of participants who brushed their teeth over a period of 2-5 minutes in their study. Although, their study was conducted in an urban area while this study was conducted in rural communities.

Prior to 2003, it was shown that no one method of tooth brushing was superior to the other, but recent studies compared 3 minutes brushing with all methods of tooth brushing and found the modified bass techniques (vertical mini stroke brushing technique) as being superior to others in removing plague Poyato-Ferrera, (2003).It is noteworthy that 69.2% of our study participants brushed their teeth using the traditional horizontal method, which will jeopardize the tooth structure and the vertical mini stroke technique was only used by 30% of the participants.

This finding is similar to Ibiyemi *et al.*, (2010) who reported 48.1% vertical stroke and 71.9% of horizontal tooth brushing techniques among their study participants in Igboora, a rural

community in Nigeria. Also, in agreement with this study are Zhu *et al.*, (2005), who reported 60% of their study participant, adopting the horizontal method of tooth brushing. However, a lower percentage of participants who brushed their teeth by adopting the vertical mini stroke technique were reported in a study by Lawal *et al.*, (2013) in Idikan a rural community in Ibadan. The difference in this finding could be due to ignorance and non challant attitude to oral health Education displaying by the people of Idikan Community.

In the time past, the use of soft texture toothbrush was the order of the day, but recently, as observed in dental practice especially in Nigeria, medium texture tooth brush is recommended especially for adults. Suprisinly, results from this study still showed that, the use of medium texture tooth brush was only found among 22% of the study participants while most of them still adopting the use of soft texture toothbrush as reported bu Zhu et al ., (2005). This may be due to low level of awareness on how to differentiate and identify the various types of tooth brush texture, also the lack of awareness on the type and the idea toothbrush for tooth brushing. This finding may also be due to difficulty in behavioural change. This result is in contrast to Nitika et al., (2012) and Singh and Tuli (2013) who reported a higher proportion of users of medium toothbrush among their study participant. The difference could be due to study site, as their study was conducted in an urban area and among the civilized

In this study, only 26% of the participants change their toothbrushes every 3 months as similarly reported by Nitika *et al.*, (2012) and Lawal *et al.*, 2013. This result is a deviation from the idea as reccomended by the American Dental Association (ADA), who stated that toothbrush be replaced every 3 months, as toothbrushes are less effective after 3 months and as they become worn out (Warren *et.al*, (2002), ADA (2013). This finding may be due to the believe in some rural communities that, toothbrushes are not to be changed until they are worn out. However, the result is low when compared to a study by Singh and Tuli, 2013.The difference could also be due to difference in the level of oral health awareness

There is generally a failure in the use of dental floss as only 4.4% of the study participants use dental floss, this is similar to a study by Nitika *et al.*, (2012) where none of their study participants use dental floss. This report also agrees with previous studies by Jamjoom, (2001) and Benoit *et al.*, (2006). However, a higher proportion of those who use dental floss have been reported by Hamilton and Coulby, (1991) in India, Lorna *et al*, (2011) and Singh and Tuli, (2013) in China. The difference could be due to location and higher level of civilization by the Chinesse. Dental floss, to many of the rural dwellers, is for the rich and some of them even claimed they have not set their eye on dental floss in their lifetime. This

could be due to inadequate oral health education in our rural communities. The fact that majority of the study participants had never use mouth washes, call for an urgent need to increase the delivering of oral health education and motivation in this community and in the general public, to use mouth wash as part of efficient method for oral health care.Majority of participants in this study do not eat cleansing fruits often, this finding is similar to finding of a study by Taiwo *et al.*, (2004) who reported that higer proportion of participants among their elderly study population do not eat fresh fruit. The failure of eating cleansing fruits found in this study may be a contributing factor to their poor oral hygiene status. However, in constrast, Lindhe and Wihen, (1969) in their study to investigate the effcts of chewing fibrous food on the gingivae reported that irregular chewing of raw carrots had no influence on the degree of plaque formation. The result of their investigation also demonstrated that, when all active tooth cleansing was discontinued, healthy gingivae was found to develop chronic inflammation and pre- existing gingivitis gradually became aggravated.

The increase in proportion of those who clean their tongue while brushing among the participants in this study indicate a good complaince with the basic method of maintaing oral hygiene and it is a clear indication that, there is effcetiveness in the oral health education delivering in this community. The finding in this study is higher than Nitika *et al*, (2012) who reported that only 20% of their study participants cleaned their tongue while brushing.The participant's low attendance to dental services could be explained by many reasons, such as acess to oral health services, socioeconomic factors and attitudes to oral health Adeleke and Danfillo, (2005). This could also be due to the fact that dental treatment are expensive and may be non-affordable for some people especially the rural dwellers Petersen, (2008). Also the tradition and belief of some rural dwellers is that, dental visit is a luxury, unless one is in pain, therefore low priority. The result of this study is in agreement with Benoit, (2006), Al-Omrri *et al*., (2006), Umesi-Koleose, and Ayanbadejo (2011), and Azodo, (2013). Some daily habits which can be associated risk factors to oral health and predipose people to poor oral hygiene are tobacco smoking, chewing, snuffing and alcohol consumption.This study showed that 44.8% drink alcohol, and another 30.4% smoke cigarrette. This result is in agreement with Zhu *et al.*, 2005 who reported that 40% of their study patricipants smoke cigarette and drink alcohol respectively. Tobacco smoking or chewing have been found to be associated with extrinsic tooth discoloration. The result from this study showed that more than half of the study participants had fair oral hygiene practices and 43.2% had poor oral hygiene practices. Only 1.2% have good oral hygiene practises, These findings could be explained by the low prevalence (19.6%) of participants who engage in twice daily tooth cleaning , low

prevalence (16%) in the time of the day cleaning is done, low prevalence (20.8%) in the duration of tooth cleaning, low prevalence (22%) in the idea type of toothbrush used for cleaning, low prevalence (26%) in the frequency of toothbrush change, low prevalence in the frequency of an idea tooth brushing technique, use of dental floss (4.4%), the use of mouth wash (4.4%) and the low prevalence (8.8%) in the pattern of dental visit reported by the participant in this study. The report of this study is in agreement with Lorna *et al.*, (2011), who reported low level of oral health practises among their study subjects. The report is also in agreement with Azodo *et al.*, (2013).

In this study, the use of cleaning aids has been shown to strongly associated with age. All participants within the age range 18 – 24 years were reported to use toothbrush and toothpaste while only very few was reported among the age ranged 55 – 64years. Likewise, no participant among the age group 18 -24 years was engage in the use of chewing stick as compared with majority of the older age group. The use of the idea cleaning aids was shown to decreased with increase age. This difference may be due to the fact that older adult have developed their own oral hygiene habit which may be difficult to change.

In this study, more than half of the participants had poor oral hygiene status, which may be attributed to the high prevalence of poor oral hygiene practices, in term of daily cleaning frequency, duration of tooth brushing, the use of dental floss, tooth brushing technique, etc as reported by the participants. The proportion of participants with poor oral hygiene as obtained in this study is higher as compared to Azodo and Osarobo, 2013 who reported that 33.1% of their study participants among rural dwellers in Edo State had poor oral hygiene. However, it is lower than Taiwo *et al.*, 2004, who reported a prevalence of 87.6% among the elderly subjects studied.

The cleaning aids used by our study participants have been shown to have strong association with their poor oral hygiene status. The explanation for these findings may be due to inappropriate use of cleaning aids by the study participants as evident from the result of this study that majority of subjects, who used chewing stick, were shown to have the poorest oral hygiene status. Chewing sticks have been reported as the cleaning aids used by most adults especially in rural communities where most of them have access to plants and it has been reported that, the cleaning efficiency of chewing stick was as effective as toothbrush Otaibil, (2004), Batwa, (2006)

However, Taiwo *et al.*, 2004 reported that the elderly in South East Local Government Area in Ibadan used chewing stick more frequently than toothbrush, but it is of great interest to

note that many of the participants cleaned their teeth using chewing stick and still present with poor oral hygiene with gross accumulation of plaque and calculus, because a very high percentage did not brush their teeth with the tuft of the chewed sticks Taiwo *et al.*, (2004).

The reported low proportion of the participants with fair and good oral hygiene status could be an indication of low prevalence in the frequency of daily cleaning demostrated by the study participants. This is a possible explanation for the recorded high plaque, calculus and oral hygiene scores.The high calculus score in this study has also been reported by Savage, *et al.*, (1999) in Lagos Okeigbemen, *et al.*, (2004) in Benin City. Likewise, Khamrco, (1999) and Coelho *et al.*, (2008) also reported a high calculus score in Brazil.

Oral hygiene status was significantly associated with age, gender, and educational status. Occupation and marital status were also found to be strongly associated with oral hygiene status. The young adult had better oral hygiene status as compared with older adults. Likewise, majority of the older adult had the poorest oral hygiene status. The report in this study shows an increase in poor oral hygiene status with increase in age. This finding is in support of a report by Wojciech *et al.*, (2012) who reported that people aged 65 and above have been observed to neglect their oral hygiene and oral care (Wojciech *et al.*, 2012). The young adult exhibited more tendencies to have good oral hygiene status because, this is the age at which individual are more conscious of their appearance and are careful and meticulous in taking care of their oral hygiene. The report of poor oral hygiene as increasing with increase age may be due to the fact that, the older adult have developed their own oral hygiene habit which may be difficult to change.

In this study, female participants had better oral hygiene status than male participants. This is similar to findings of previous studies in South West Nigeria Agbelusi and Jeboda (2006), Bamgboye & Akande, (2007), Umoh & Azodo, (2013).This may be explained by the fact that females exhibit better health practices and attach more importance to their health as quantified by the fairer oral hygiene practices demonstrated by 83.2% of female in this study. The demostration of poorer oral hygiene among the widows as compared with the singles in this study, may be a reflection of poor attitude to oral health as similarly reported by Sara *et al.*, (2003) that poorer physical and mental health, likewise generally poor health behaviour was reported among the widows as compared to the married women Sara *et al.*, (2003). This apparently, elucidates the common Yoruba adage: "Obun riku oko tiro mo" which literally translates to mean "the widow has seized the death of her husband to engage in dirty habits". The depression suffered upon the death of husbands and wives make some widow's and widowere non challants in their oral hygiene habits.

Participants with higher educational status have better oral hygiene as compared with subjects with no formal education whom about 84% had poor oral hygiene. This could be attributed to knowledge which comes with education and influence oral health behaviour.

In term of occupational status, it was reported that 80.9% of the farmers had poor oral hygiene status. This may be explained by the fact that, majority of the farmers especially in the rural communities have access to plants, therefore they use chewing sticks as their cleaning aids as been supported by a study by Fajemilehin and Ogunbodede,(2002) who reported 94% of chewing stick users among their study participants in a rural community in Osun State Nigeria. The reason for the choice of chewing sticks sometimes may be availability, low cost and therapeutic reasons. The reason for poor oral hygiene in this group of study participants may also be attributed to improper use of chewing stick as Taiwo *et al.*, (2004) reported a very poor oral hygiene with gross plaque and calculus accumulation among the elderly in Ibadan South Local Government, despite the fact that majority (70.4%) of them clean their teeth using chewing stick. The reason for the poor oral hygiene was thereby attributed to the fact that," although 70% of the participants clean their teeth using the chewing stick but a very high percentage did not brush their teeth with the tuft of the chewed sticks". (Taiwo *et al.*, 2004).Another relevant reason for the high prevalence of poor oral hygiene among the farmers could be due to the tight schedule associated with farming.

CHAPTER SIX

CONCLUSION/ RECOMMENDATION

In conclusion, this study has provided data on the various types of oral hygiene practices and oral hygiene status among the adult rural dwellers of Ido Local Government Area in Oyo State, Nigeria. In this study, the various practices of oral hygiene (like, cleaning aids, frequency of daily tooth cleaning, tooth cleaning duration, the use of dental floss, pattern of dental visit and tooth brushing methods) have a relationship with oral hygiene status (OHIS).Poor practices were strongly associated with poor oral hygiene among the adults in these rural communities. Also, socioeconomic factors like age, gender, marital status, level of education and occupation have been found to be strongly associated with oral hygiene practices and status.

Therefore, the following recommendations are suggested:

- There is a need for more studies as regard this topic.
- There is an urgent need for establishing oral health services in the country in order to meet the basic dental care needs of people living in rural communities.
- Attempt should be made to expand to rural areas and communities through adequate training of primary oral health workers who are made available at various health posts.
- There is need to develop and implement community-oriented oral health promotion programs targeting oral health practices to control preventable oral diseases among rural dweller.
- The nation's health and social policy should be expanded to incorporate fully traditional methods of care. It will not be out of place to include all technologically appropriate orientation, concepts and behaviour in oral health education programmes.
- Government should invest more on research on traditional oral hygiene methods and technologies so as to boost its own primary health care services by a way of research break through on local technologically appropriate means of dental services.

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APPENDIX A

QUESTIONNAIRE TO ASSESS THE EFFECT ORAL HYGIENE PRACTICES AND ORAL HYGIENE STATUS OF ADULTS IN RURAL COMMUNITIES OF IDO LOCAL GOVERNMENT, OYO STATE.

SECTION A SOCIO DEMOGRAPHY FACTORS

1. Age in years ----------
2. Tribe (i) Yoruba (ii) Ibo (iii) Hausa (iv) others
3. Sex-------(i) Male (ii) Female
4. Occupation (i) farming (ii) trader (iii) Civil servant (iv) student (v) others
5. Educational Status (i) No education (ii) Less than Primary 6 (iii)Secondary School (iv) Lower diploma (v) Higher diploma (vi) University graduate (vii) Post graduate (viii) others (Specify)
6. Religion (i) Islam (ii) Christianity (iii) Others
7. Marital status(i) Married(ii)Divorce (iii) Separated(iv) single (v) others

SECTION B ORAL HYGIENE PRACTICES

Tick the option that applies to you for each item.

8. Do you drink alcohol Yes ☐ No ☐
9. Do you smoke Yes ☐ No ☐
10. Do you snuff tobacco Yes ☐ No ☐
11. Do you chew tobacco Yes ☐ No ☐
12. Do you chew kola nut or bitter kola Yes ☐ No ☐
13. What do you use to clean your teeth
    i. Toothbrush and toothpaste
    ii. Chewing stick only
    iii. Chewing stick, toothbrush and toothpaste
14. How often do you brush your teeth?
    i. Not every day
    ii. Once daily
    iii. Twice daily
    iv. More than twice
15. When do you brush your teeth?
    i. Morning before breakfast
    ii. Before breakfast and at night before bed
    iii. All times after a meal
    Iv. When I feel dissatisfy with my mouth.
16. How much time do you spend in cleaning your teeth?
    i. Less than 1 minute
    ii. 1 minute.
    iii. 2 minutes
    iv. Between 3 – 5 minutes
    v As soon as I feel satisfy with my mouth

If you use toothbrush, please answer the questions below and if you do not use toothbrush, please jump to question 21.

17. Why do you prefer it?
    i. It is less expensive.
    ii. It is less stressful.
    iii. It is very effective
    iv. It is the one recommended by the dentist.

18. What type of toothbrush do you use?
i. Soft ii. Medium (not too soft) iii. Hard (not too hard iv.Extra hard (too hard)

19. How often do you change your tooth brush?
i. Every month
ii. Every 3 months
iii. Every 6 months
iv. As soon as it worn out

20. How do you brush your teeth?
i. By rolling it round the teeth.
ii. By moving tooth brush back and forth.
iii. Up and down movement

If you use chewing sticks

21. Why do you prefer it?
i. It is less expensive
ii. It is less stressful.
iii. It is more effective
iv. It is the one we use in our community

22. What type of chewing stick do you use?
i. Pako ijebu
ii. Pako Ayan (orin ayan)
iii. Pako Ata.
iv. Pako Orogbo. (Gacinia kola)

23. Do you clean your tongue while brushing with your chosen cleaning aids?
Yes ☐ No ☐

24. How often do you eat cleansing fruits like carrot, cabbage e t c?
i. Not often
ii. Often
iii. Very often.

25. Do you pick your teeth after a meal
Yes ☐ No. ☐

26. If yes, what do you use?
i. Toothpick ii. Broomstick iii. Match sticks iv. Others

27. Do you use interdentally cleaning aids like, dental floss, dental tapes after your meal?
Yes ☐ No ☐

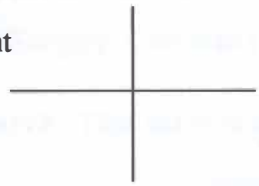
28. How often do you use mouth wash?

i. Never ii. Not often iii. Often iv. Very often

29. How often do you visit a dentist?

i. Never ii. Every 3 months ii.Every 6 months iv. Once in a year v. Every 2 -5 years

SECTION C Dental examination

30. Teeth present 

31. Oral Hygiene status (Simplified oral hygiene Index) of Greene & Vermilion (1964)

Plaque/Debris Index:-

16	11	26
46	31	36

Calculus Index:

16	11	26
46	31	36

Total OHI index = $\frac{\text{S = Plaque index + calculus}}{6}$

APPENDIX B

Informed Consent Form:

1RB approval number **UI/EC/13/0325**

This approval will elapse on: 15/01/2015

Title of Research: Effects of oral hygiene practices on oral hygiene status among adult inhabitants of rural communities in Ido Local Government Ibadan, Oyo State.

Name of Researcher: I am Dr. Nasiru Wosilat Olukemi, a postgraduate student at the Faculty of Dental Surgery, University of Ibadan.

Sponsor of research: This study is going to be sponsored by myself.

Purpose of Research: The purpose of this study is to find out how various oral hygiene processes affects the oral hygiene status of adults in rural communities.

Procedure of the Research: This research will involve administering questionnaires to the 200 selected subjects in some selected communities in a selected ward in Ido Local government .Oral examination of the subjects will also be done to know their oral hygiene status. The examination will be carried out with sterilized instruments and gloves which will cause no harm for the participants.

Expected duration of research and of participants' involvement: The study will take up to 2 weeks to complete but each participant will not participate for more than 15 minutes and in just a day and preferably during work free period.

Risk: There will be no added discomfort or risk to the participants as a result of their involvement in this study.

Cost to the participant: Your participation in this research will not cost you anything.

Benefits: You will benefit from oral health education on how to achieve and maintain good oral hygiene.

The mouth examination will be a benefit to you as you will know if you have any disease in your mouth and proper referral for treatment will be done.

Souvenirs: You will be given a medium size tube of fluoride containing tooth paste and a medium brittle tooth brush to demonstrate the ideal tooth brush and tooth paste.

Confidentiality: All information gathered from you will be kept confidential. You will be assigning a unique identification code on the data collection form and your name will not be included in the questionnaire.

Voluntariness: You will be giving the right to withdraw from the study at any time you wish without any loss of benefit.

Due Inducement: If the study is going to be carried out in a nearby town or village close to you, you will be compensated for the cost of transportation to and from the research site.

Researcher's statement

I have fully explained this research to _____ and have given sufficient information, including risk and benefits, to make an informed decision.

DATE_____ SIGNATURE_____

NAME_____

Statement of person giving consent:

I have read the description of the research and have had it translated into the language I understand. I have also talked it over with my family to my satisfaction. I understand that my participation is voluntary. I know enough about the purpose, methods, risk and benefits of the research study to judge that I want to take part in it. I understand that I may freely stop being part of this study at any time. I have received a copy of this consent form to keep for myself.

DATE_____ SIGNATURE_____

NAME_____

APPENDIX C

KIKOPA NINU IWADI

1RB approval number **UI/EC/13/0325**

This approval will elapse on: 15/01/2015

Akole Iwadi : Ipa ti Isowosetoju enu nko ninu imototo enu larin awon agbalagba olugbe agbegbe ijoba ibile ido ni Ipinle Oyo.

Oruko Oluwadi: Oruko mi ni Dokita Nasiru, Wosilat Olukemi. Mo je Dokita ti o n keko ijinle nipa itoju eyin ati enu lapapo ni ile iwosan nla ti Orita Mefa (UCH) ni ilu Ibadan.

Agbateru fun iwadi yi: Emi funra mi ni mo n se agbateru iwadi yi.

Erongba Iwadi yi: Idi ti mo fi gun le iwadi yi lati mo Ipa ti Isowosetoju enu nko ninu imototo enu larin awon agbalagba olugbe agbegbe ijoba ibile ido ni Ipinle Oyo.

Igbese **fun Iwadi yi**: Iwadi yi yoo ni se pelu pinpin awon iwe ibere fun awon akopa to to igba ni awon agbegbe ti a ti yan ni woodu kookan, ni ijoba Ibile Ido. A o se ayewo enu awon olukopa kookan, lati mo bi imototo enu won se ri. A o lo awon irin ise ati ibowo ti a ti se itoju won daadaa ti ko si ni ko ijamba baa won akopa.

Iye Asiko fun iwadi ati ti olukopa: Ise iwadi yi maa gba wa to bi ose meji. Sugbon akopa kookan ko ni lo ju iseju meedogun lo ni ojo kan pere, ni asiko ti ko si idiwo ise.

Ewu ti o wa nidi iwadi yii: A fe mu da yin loju pe ko si ewukewu ti o le de ba olukopa ninu iwadi yi.

Iye owo fun sisan: Ko si akopa, ti yoo san owo fun kikopa ninu iwadi yi.

Anfaani to wa ninu kikopa ninu iwadi yi: Olukopa yoo je anfani idanileko lori bi a se nse imototo enu.

Ayewo enu yoo fi han bi olukopa ba ni aarun Kankan ninu enu , ati pe a o dari won si ibi itoju to ye.

Ebun: A o fun Olukopa kookan ni ose ifoyin ati ohun elo ifoyin lati se afihan fun olukopa ni ona igbalode ti a fin lo won.

Asiri: Oluwadii yi maa ri wi pe ko si ohun ti enikan ba so tabi esi ayewo enikan to maa han si elomiran. Eto wa fun ki enikookan ni ami asiri fun ara re. Ko ni si oruko olukopa ninu awon iwe ayewo ti a ba lo.

Iyonda: Olukopa ni eto lati kopa tabi ki o ko lati ma kopa ninu ayewo naa.

Awon anfaani miran: A o san owo oko fun akopa kookan lati wa si ibudo iwadi,ati lati pada si ile won ti a ba se iwadi yi ni agbegbe ti o ba jinna die si ibudo iwadi.

Oro Oluwadi:

Mo ti se alaye lekunrere fun olukopa yi lori imo ti o ye ko ni ati ewu pelu anfaani to wa ninu iwadi ki olukopa naa le pinnu lati kopa ninu iwadi naa.

Oruko Oluwadi ---------- **Ami ifowosi** ----------

Deeti ----------

Oro lati odo eni ti o gba lati kopa:

Mo ti ka gbogbo alaye ti oluwadi yi ti se fun mi lori ise iwadi yi ni ede abinibi mi, ti o si ye mi yekeyeke. Mo si ti ba ebi mi jiroro lori re, mo si ti fara mo gbogbo alaye naa. Won tun mu da mi loju siwaju wipe kikopa mi je atokanwa. Oye si ye mi lori erongba ise yi, ona ti won fe gbe gba, ewu ati anfaani to wa nibe lati pinnu pe ki n kopa ninu iwadi naa. Nigbakugba ti o ba si wu mi, mo tun le yi ipinnu mi pada lori kikopa ninu iwadi naa. Nitori idi eyi, mo gba eda iwe yi lati mu pamo fun ara mi.

Oruko obi olukopa ---------- **Ami ifowosi** _____

Deeti _____

INSTITUTE FOR ADVANCED MEDICAL RESEARCH AND TRAINING (IAMRAT)
COLLEGE OF MEDICINE, UNIVERSITY OF IBADAN. IBADAN, NIGERIA.

Director: **Prof. A. Ogunniyi,** B.Sc(Hons), MBChB, FMCP, FWACP, FRCP (Edin), FRCP (Lond)

Tel: **08023038583, 08038094173**

E-mail: **aogunniyi@comui.edu.ng**

UI/UCH EC Registration Number: **NHREC/05/01/2008a**

NOTICE OF FULL APPROVAL AFTER FULL COMMITTEE REVIEW

Re: Effects of Oral Hygiene Practices on Oral Hygiene Status among Adult Inhabitants of Rural Communities in Ido Local Government, Ibadan, Oyo State

UI/UCH Ethics Committee assigned number: UI/EC/13/0325

Name of Principal Investigators: **Dr. W. O. Nasiru**

Address of Principal Investigators: Department of Periodontology & Community Dentistry, University College Hospital, Ibadan

Date of receipt of valid application: 17/09/2013

Date of meeting when final determination on ethical approval was made: **16/01/2014**

This is to inform you that the research described in the submitted protocol, the consent forms, and other participant information materials have been reviewed and *given full approval by the UI/UCH Ethics Committee.*

This approval dates from 16/01/2014 to 15/01/2015. If there is delay in starting the research, please inform the UI/UCH Ethics Committee so that the dates of approval can be adjusted accordingly. Note that no participant accrual or activity related to this research may be conducted outside of these dates. *All informed consent forms used in this study must carry the* UI/UCH EC *assigned number and duration of* UI/UCH EC *approval of the study.* It is expected that you submit your annual report as well as an annual request for the project renewal to the UI/UCH EC early in order to obtain renewal of your approval to avoid disruption of your research.

The National Code for Health Research Ethics requires you to comply with all institutional guidelines, rules and regulations and with the tenets of the Code including ensuring that all adverse events are reported promptly to the UI/UCH EC. *No changes are permitted in the research without prior approval by the* UI/UCH EC *except in circumstances outlined in the Code. The* UI/UCH EC *reserves the right to conduct compliance visit to your research site without previous notification.*

16 JAN 2014
APPROVED

Professor A. Ogunniyi
Director, IAMRAT
Chairman, UI/UCH Ethics Committee
E-mail: uiuchirc@yahoo.com

IDO LOCAL GOVERNMENT, IDO

OYO STATE, NIGERIA

Further Communication should be addressed
to the Chairman:
Ido Local Government quoting

P.M.B. 5179 IDO, IBADA
OYO STATE.

IDO LOCAL GOVERNMENT OYO STATE

Our Ref: I [illegible] Your Ref: _____ Date: 12th May, 2010

D. [illegible]
Dept. of [illegible]ntive Dentistry,
Faculty of Dentistry,
College of Medicine,
University of Ibadan,
Ibadan.

RE: [illegible] TO CARRY OUT A RESEARCH

Recall to your application on the above subject matter, approval is hereby [illegible] to carry out the research.

The department expects feed back after completion of the exercise for record purpose.

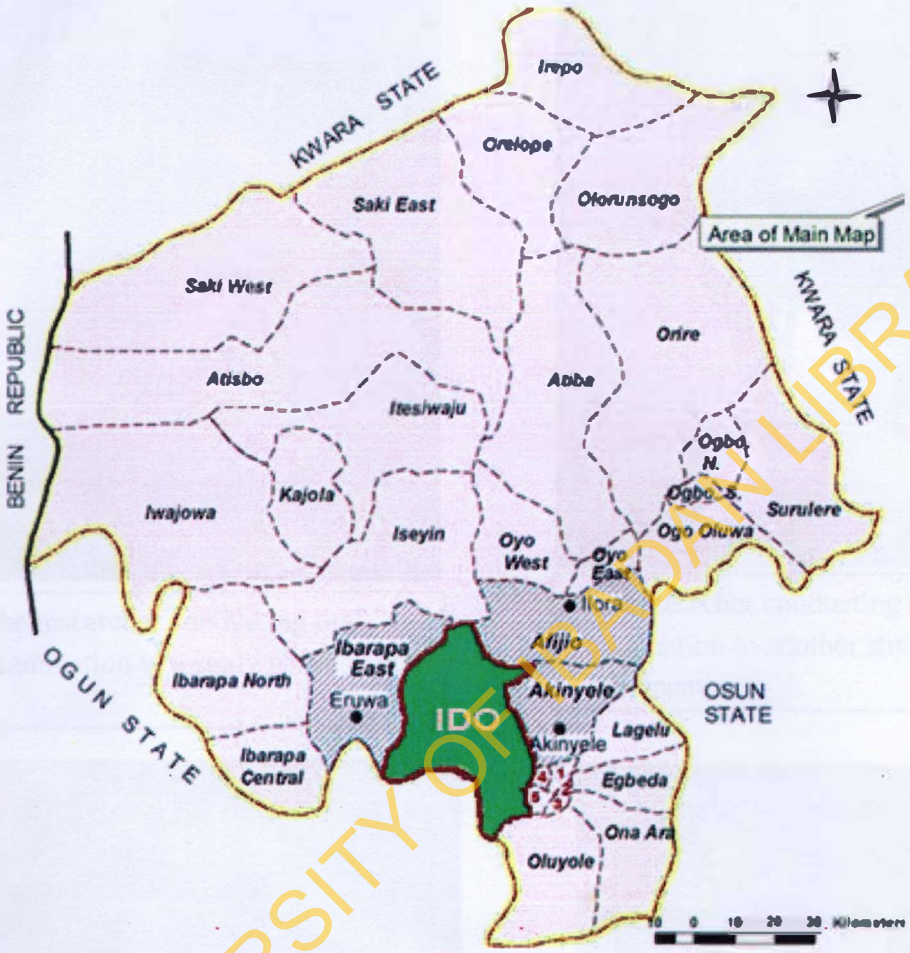
Best of luck.

DIRECTOR ENV. HEALTH SERVICES
IDO LOCAL GOVT.
IDO, IBADAN

Director Env. Health Services,
Ido Local Government,
Ido.

APPENDIX F

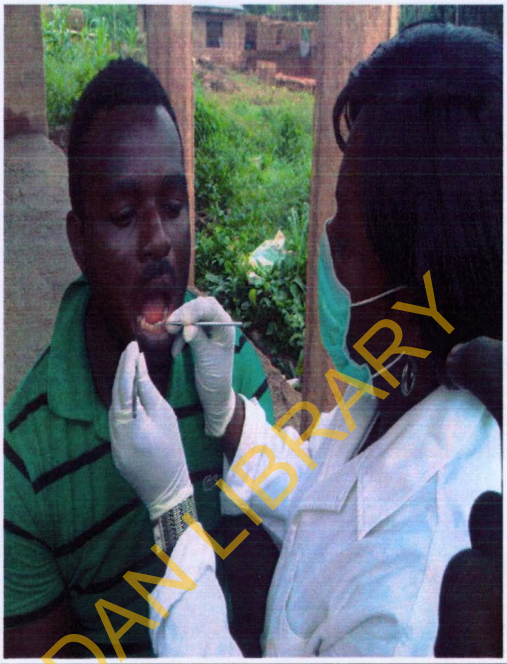
Map of Ido local Government



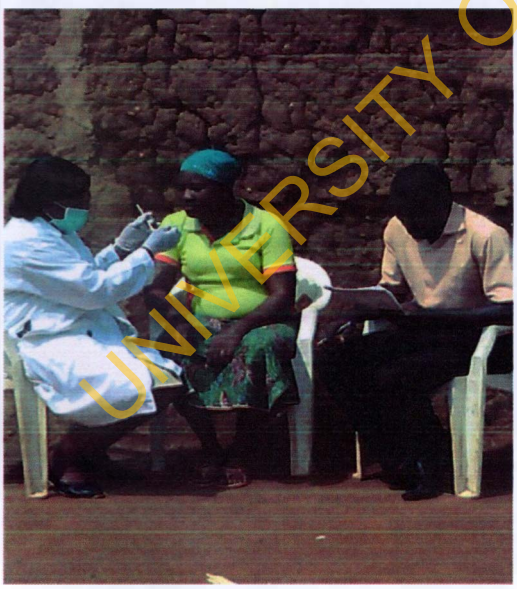
APPENDIX G

Overview of the study area

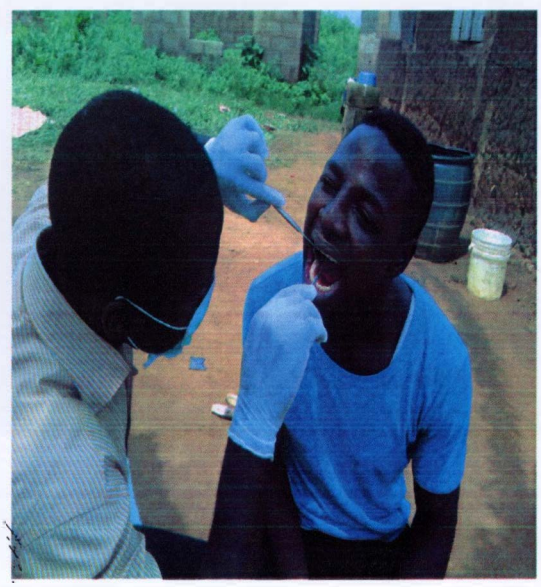
The researcher conducting oral examination to a study participant



The researcher conducting oral examination to another study participant



The researcher conducting oral examination to a study participant



One of the research assistance conducting oral examination to a study participant