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Comparison between pre-menopause and post-menopause women regarding periodontal health status in Sudan

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Abstract

Introduction

Little attention is given to oral health; national oral health guiding principles and strategies in several developing countries must be more evident**.**

Hormonal variations that occur before, during, and after menopause can influence the teeth and periodontium. These changes also affect the body's response to even minor injuries or sustain an equilibrium between beneficial and injurious bacteria in the mouth.

Various changes can occur in the oral cavity during the different hormonal phases of a woman's life. However, the most common postmenopausal oral features have been documented, and it is speculated that the decreasing oestrogen levels accompanying menopause may be a risk factor for developing periodontal disease.

Aim

The research aimed to determine whether oral health or oral health behaviour affects the periodontal disease status of women before menopause (pre-menopause) and after menopause (postmenopausal).

Methodology

Oral hygiene knowledge and behaviour data were collected through an interview with a structured questionnaire. A modified WHO assessment form (1997) was used for the clinical examination and periodontal health and treatment needs, and the CPITN index was used. The data was captured in Excel, and analysis was carried out using SPSS.

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Results

The most reported oral hygiene practice was using a toothbrush with toothpaste, with almost 100% of participants. Two-thirds of the women reported brushing their teeth twice daily, almost all brushing in the morning. Most of the pre-menopause women group described their gingiva health as good, while most of the post-menopause women group described their gingiva as poor. Although about 90% of the women visited a dentist, primarily for dental pain, 32% only saw the dentist less than 6 months ago.

The mean DMFT of the sample was 3.94 for the pre-menopause group and 6.30 for the post-menopause group. Although the periodontal health of the participating women was acceptable, bleeding on probing was higher among premenopausal than postmenopausal women. On the other hand, deep pockets appeared more frequently in post-menopause women.

Conclusion and recommendations

The oral health status of the pre-menopause women in this study was better than that of the post-menopause women. Therefore, the primary health care system recommends an integrated oral health education programme for postmenopausal women.

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Declaration

I, the undersigned, declare that the work contained in this dissertation is my original work and that it has not been previously in its entirety or part submitted at any university for a degree.

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…… 17/NOV/2022……

Duoaa Elmubarak Date

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Dedication

This thesis is dedicated to my beloved mother and father.

My husband, to whom I am deeply and forever indebted for his love, support and encouragement throughout my entire life.

My brothers, for their continuous encouragement and everlasting support given to me during the entire duration of my study period

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LIST OF ABBREVIATIONS

BMS	Burning Mouth Syndrome
CFU	Colony Forming Units
CPI	Community periodontal index
CPITN	Community periodontal index of treatment need
DMFT	Decayed, missing, filled and treatment need
FMH	Federal ministry of health
HRT	Hormonal Replacement Therapy
LOA	Loss of Attachment
OHI-S	Oral Hygiene Index-Simplified
PDL	Periodontal Ligaments
PHC	Primary health care
SES	Socioeconomic status
SMH	State ministry of health
SPSS	Social package of statistical analyses
USA	United States of America
WHA	World health assembly
WHO	World health organisation

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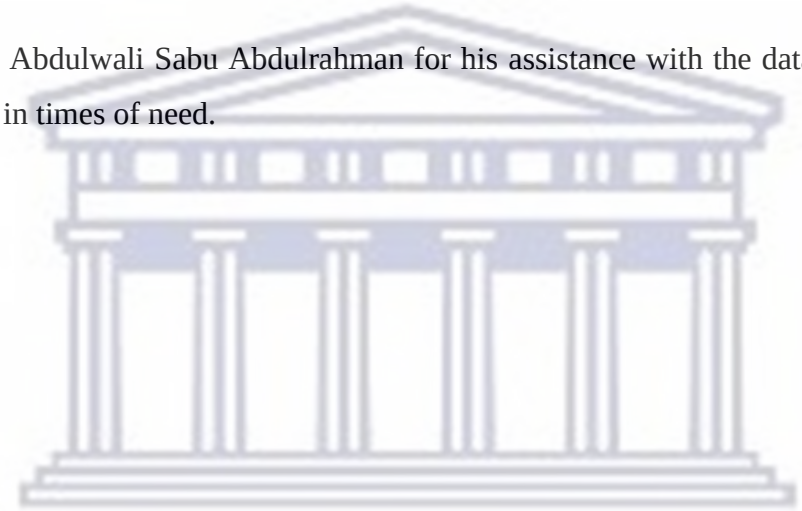

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Chapter 1: INTRODUCTION

In dentistry, there needs to be more focus on women's oral health. However, this area is specific to women, particularly in Sudan. Women are vital in promoting oral health and well-being, even though this function is unrecognised in the African region. The African region continues to experience a need for more solid and comparable data and an absence and delay in converting this data into planning information. Little attention is given to oral health; national oral health guiding principles and strategies in several developing countries are unclear **(**Etetafia & Azodo, 2019).

Hormonal variations that occur before, during and after menopause can influence the teeth and periodontium. These changes also affect the body's response to even minor injury or sustain an equilibrium between beneficial and injurious bacteria in the mouth. Various changes can occur in the oral cavity during the different hormonal phases of a woman's life. However, the most common postmenopausal oral features have been documented, and it is speculated that the decreasing estrogen levels accompanying menopause may be a risk factor for developing periodontal disease (Suri & Suri, 2014).

Osteoporosis, another complication of decreased oestrogen levels, can affect teeth and gingiva after menopause. The disorder causes brittle bones, scoliosis and resorption of the alveolar bones—the latter results in gingival recession and tooth loss (Loe & Silness, 1963). Periodontal disease has a spectrum of clinical signs, including tooth loss, pain, bleeding, and bad breath, and may impair the quality of life (Laine, 2002; Locker, 2000).

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Problem statement

Menopause itself is not responsible for specific oral diseases. Instead, poor oral health habits and hormonal alterations may initiate and aggravate oral changes seen during and after menopause. Mechanical cleansing, such as tooth and interdental brushing and flossing, is an effective means to remove pathogenic plaque that may harbour bacteria related to the formation of periodontal disease. Several factors influence oral health habits, including patient beliefs, perceptions of oral health care and mechanical techniques. Furthermore, regular visits to oral health care professionals are essential to maintaining optimal oral health and preventing oral diseases.

For this reason, the author investigated women's periodontal disease status and oral health behaviour before (pre-menopause) and after menopause (postmenopause) in Sudan. It was envisioned that the investigation would clarify the contribution of hormonal changes and oral health habits to developing periodontal disease among women in Sudan. Furthermore, it was hoped that the study would contribute toward knowledge about women's oral health.

Rationale

1. Menopause is accompanied by multifaceted physiological changes, some of which may unfavourably affect oral health.
2. Few studies have reported the association between periodontal disease and menopausal women in Sudan.
3. No investigations on the relationship between menopause, periodontal disease, and oral health behaviour have been conducted in Sudan.
4. No oral health programmes are currently concentrating on women, especially menopausal women.

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Chapter 2: LITERATURE REVIEW

2.1 Introduction

Menopause is a natural phenomenon. It occurs when a woman's menstrual cycle stops, and she can no longer bear children. Post-menopause is the period following menopause. Perimenopause (menopause transition) can begin eight to ten years before menopause and may last between a few months and approximately four years (North American Menopause Society, 2019). The literature below will cover the menopausal and post-menopause stages and the impacts on dental health in this particular group of women. The literature review will cover the normal anatomy for oral and vaginal mucosa, oral changes during menopause, decreased salivary flow in menopause, menopause and postmenopausal changes and their relation with periodontal diseases and oral and dental management during menopause.

2.2 Oral mucosa and vaginal mucosa

Thompson et al.(2001) stated that oral and vaginal mucosa are microscopically similar. Both epithelia have similar surface keratinisation patterns, lipid lamella distribution and appearance in the intercellular spaces. However, cholesterol esters and glycosylceramide esters are higher in the oral than vaginal epithelium.

Lactobacilli are abundant in the vaginal flora of healthy, premenopausal females. These organisms inhibit the overgrowth of facultative and obligate anaerobes and ensure healthy homeostasis in the vagina. Similarly, certain *lactobacilli* strains have shown promising results in inhibiting the growth of *S. mutans, P. gingivalis and P. intermedius*, protecting the oral cavity against disease (Hoffmann et al., 2014).

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2.3 Female sex hormone, microorganisms, and the oral biofilm

Sex hormone receptors are present in the oral mucosa and salivary glands. Oestrogen levels may influence the health of the periodontium. Imbalances of female hormones may directly affect the oral cavity (Suri & Suri, 2014).

Norderyd et al. (1993) conducted a study among 50 -to 64-year-old women. The authors concluded that gingival bleeding occurred less frequently in females who took estrogen supplementation than in age-matched controls. Thus, oestrogen changes the expression of inflammatory cytokines, modifies the periodontal tissue's response to lipopolysaccharides, and decreases bone damage (Shu et al., 2008).

The oral cavity temperature is approximately 37 ºC, is moist and has high concentrations of bacteria and abundant nutrients. Therefore, this is an optimal environment for microbial growth, and biofilms cover the teeth and oral mucosa. When the bacterial concentration reaches 109 CFU (colony-forming units) per mg, the biofilms are about 50-100 cells thick and thick microbial plaque will form on the teeth. Although the microbial colonies are stable throughout life, differences in diet, oral and general microorganisms (Hillman et al., 2017). Molecular pyrosequencing techniques have identified more than 700 oral microbial species from plaque and saliva. However, several isolated oral microbes remain unknown (Hillman et al., 2017).

Although it is possible to cultivate *Viridian streptococci, lactobacilli* comprise approximately 1% of the cultivable oral micro-flora. Oral *lactobacilli flora* differs from those located in the vagina. *L.casei, L.fer-mentum, L.rhamnosus, L. salivarius, L acidophilus L. plantarum* are the most typical *lactobacilli* species recovered saliva (Teanpaisan & Dahlén, 2006).

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Fungal infections of the mouth and vagina are similar, and Candida Albicans frequently cause candidiasis. Furthermore, there is a positive correlation between vaginal candidiasis and elevated estrogen levels (Cheng et al., 2006).

Probiotics benefit bacterial vaginosis and may assist with oral infections (Klinger et al., 1998; Falagas et al., 2007).

2.4 Saliva

The minor and major salivary glands (the parotid, submandibular and sublingual glands) secrete saliva. Saliva protects the oral cavity against insult and prevents dental caries. However, the amount of saliva needed to provide sufficient moisture to the oral surfaces varies between individuals. Reduced salivary flow can lead to microbial colonisation and affect oral health.

Some systemic diseases and drugs affect saliva secretions. Dryness of the mouth is also a common symptom of menopause.

2.5 Menopause

Menopause usually occurs between the ages of 45 and 55. However, some women, especially those with surgical intervention (such as removing the ovaries) or ovarian damage (such as chemotherapy), can experience menopause at a younger age. Early menopause occurs before the age of 45, and when menopause occurs at 40 years of age or younger, it is considered premature menopause (North American Menopause Society, 2019).

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2.5.1 Oral Changes During Menopause

Raviraj (2016) conducted a cross-sectional study to determine the effects of menopause on oral health. The investigation compared the oral features of menopausal women to those of age-matched men and assessed the progression and severity of oral changes in post-menopause women. One hundred postmenopausal women and 100 age-matched men participated in the study. Women who stopped menstruation for 12 months were included. Individuals with systemic diseases commonly contributing to oral problems, such as kidney, endocrine and neurological disorders and diabetes mellitus, were excluded. All participants completed a preformed questionnaire that was divided into two sections:

The first section examined the oral symptoms and included A. Burning mouth, B.Orofacial pain and dysphagia, C. History of dry mouth, and D.Altered taste perception.

The following denotes the distribution of the symptoms:

1. Orofacial pain (48% females and 26% males).
2. Dry mouth (56% females and 48% males).
3. Burning mouth (65% females and 59% males).
4. Dysphagia (42% females and 30% males).
5. Impaired taste perception (57% females and 48% males).
6.

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The distribution of clinical signs was as follows:

1. Xerostomia: 52% females and 48% males;
2. Ulceration: 16% of females and 26% of males;
3. Red and white lesions: 27% of females and 28% of males;
4. Halitosis: 98% of females and 99% of males and
5. Bald tongue: 33% of females and 36% of males.

There were high decayed, missing, filled and treatment score (DMFT) in 96% females and 97% males.

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The authors concluded that, apart from xerostomia and PDL, the oral findings were more prevalent in men than in postmenopausal women and appeared to progress with age.

2.5.2 Decreased salivary flow and menopause

Decreased saliva flow in menopausal females causes root caries, oral discomfort, alteration in taste, periodontal disease, and candidiasis (Lopez et al., 2010; Paganini-Hill et al., 2007). In addition, xerostomia and hyposalivation are common clinical symptoms in this group of individuals (Steinberg et al., 2000). Sjogren's syndrome is an autoimmune disease that occurs more commonly in menopausal women. Symptoms are treated with artificial saliva, frequent water sips, sugar-free gum or lozenges, sialogogues, and bethanechol (Portillo et al., 2002; Greenberg et al., 2008; Lopez et al., 2010). Mechanical cleaning using toothpaste /gel and fluoride varnish reduces plaque and prevents tooth and root caries (Mutneja et al., 2012).

To determine the effect of menopause on saliva and dental health, Rukmini et al., (2018), assessed the saliva flow rate, PH of whole stimulated saliva, oral hygiene status, tooth decay, gingival condition and the menstrual period after menopause. The investigation included healthy postmenopausal women selected from an outpatient Oral Radiology department at a Dental School and Hospital in Bengaluru, India. Eighty healthy women (forty postmenopausal and forty premenopausal women) were included in the study. The ages of the post-menopause women ranged from 41 to 60 years, and those in the control group from 21 to 31 years—the selection of both groups adhered to strict inclusion criteria. The authors reported that 50% of the postmenopausal women had a low salivary PH, and the saliva of all the women in the control group had a normal PH.

Furthermore, 82.5% (n=33) of women in the study group had poor oral hygiene than the control group. The mean DMFT score in the study group was (5.15 ± 2.94) and in the control group was (1.38 ± 1.56).

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The mean of the CPI score in the study group was (3.05 ± 0.55) and in the control group was (1.5 ± 1.00), and the mean of the LOA (Loss of Attachment) in the study group was (1.28 ± 0.45) and in the control group was (0.00 ± 0.00).

Furthermore, more than fifty–seven percent (n=23) of women in the study group complained of xerostomia, but none in the control group had similar experiences. The study group's salivary PH and flow rate were significantly lower than the control group (P<0.001). The authors concluded a significant decrease in salivary PH and flow rate in postmenopausal women, increasing OHI-S, DMFT, CPI, and LOA.

2.5.3 The effect of female hormones and hormone replacement therapy on salivary flow.

Sex hormone receptors are present in salivary gland tissue, and several sex hormones have been isolated in the saliva. Further, the salivary flow rates depend on an individual's estrogen levels. For example, postmenopausal women have lower salivary flow rates than women who menstruate due to the altered sympathetic output related to stress or alterations in interactions between the cranial nerves responsible for taste and pain sensation (Rukmini et al., 2018).

Studies suggest that salivary progesterone and cortisol levels are associated with xerostomia during menopause (Mirzaii-Dizgah et al., 2011; Dutt et al., 2013). Although saliva flow is higher in premenopausal women than in postmenopausal women (Streckfus et al., 1998; Meurman et al., 2009), there is no difference in salivary flow between women on hormone replacement therapy and those without.

The composition of saliva in women depends on estrogen, and hormonal replacement therapy improves the quantity and quality of salivary function in postmenopausal females (Leimola-Virtanen et al., 2000).

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A study conducted among 38 postmenopausal women using 17 beta-estradiol showed an inverse relationship between dry mouth severity and saliva flow.

All studies investigating the relationship between menopause and salivary flow have limited participants, and no controlled trials exist to establish the effect of hormonal replacement therapy on saliva secretion.

2.5.4 Oral discomfort and burning mouth sensation\syndrome and menopause

Menopausal females often experience oral discomfort. In a study conducted among 34 postmenopausal females with oral discomfort, 12 out of 22 treated with Hormonal Replacement Therapy (HRT) (oestriol) reported improved subjective and objective symptoms. The findings suggest that oestrogen deficiency may have caused discomfort. (Volpe et al., 1991; Meurman et al., 2009). Wardropa et al. (1989) reported that 33% of postmenopausal females suffer from oral discomfort. The authors also stated that postmenopausal women suffer more oral discomfort than premenopausal women (43%vs 6%). Moreover, it may accompany oral alteration, dysgeusia, dry mouth, dysphagia, and oro-facial/dental pain (Portillo et al., 2002; Lopez et al., 2010).

Postmenopausal women may also experience a burning mouth sensation called Burning Mouth Syndrome (BMS), a condition without apparent clinical pathology (Bergdahl et al., 1999). In burning mouth syndrome, the tongue, lips, vestibule and other mucosal sites may be affected by burning sensation chiefly in postmenopausal women. However, dentists do not screen for genital symptoms, and patients do not inform dentists about them (Meurman et al., 2009).

The affected individual may suffer symptoms that range from mild discomfort to intense pain.

The burning sensation may occur at different oral sites but is typically felt at the tip of the tongue (71%), lip (50%), lateral border of the tongue (46%) and palate (46%) (Miyamoto et al., 1998; Dahiya et al., 2013).

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Although the aetiology of BMS is unclear, the most recognised theory is that either a partial or total loss of the chorda tympani (facial) nerve function suppresses the trigeminal nerve. This would explain how the pain along the trigeminal nerve course occurs, all of which are regulated by inter-neurons of the central nervous system (Zakrzewska et al., 1999). Triggers for the disorder include candidiasis, lichen planus and viral infections (Merskey et al., 1986; Suri & Suri, 2014). BMS may also be associated with decreased oestrogen levels in postmenopausal females.

BMS prevalence increases with age and predominantly affects females between the fifth and seventh decades of life (Bergdahl et al., 1999).

The treatment of burning mouth syndrome in menopausal women is symptomatic. It includes HRT, low-dose topical/systemic centrally acting medication such as benzodiazepine, tricyclic, antidepressant, gabapentin, clonazepam, and psychological counselling (Portillo et al., 2002; Lopez et al., 2010; Mutneja et al., 2012; Dahiya et al., 2013).

2.6 Periodontal disease and menopause:

There are conflicting opinions about the relationship between periodontal disease and menopause. Most of the evidence suggests an insignificant association between the two. Even though endocrine change can affect bone density, it appears to have minimal influence on the periodontal status (Lopez-Marcos et al., 2005). However, the authors have stated that sex hormones have an inverse relationship with periodontal status. In contrast, other studies have shown that women have more tooth involvement than men of the same age.

Osteoporosis may be the leading cause of bone loss in the oral cavity, ultimately resulting in attachment loss(Meurman et al., 2009; Dutt et al., 2013; Suri & Suri, 2014).

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Calves et al. (2015) conducted a cross-sectional study to determine the relationship between menopause and periodontal disease in a Portuguese population. The study assessed the effects of menopause on the severity of periodontal disease and tooth loss by evaluating both oral and gynaecological factors. One hundred and two females were divided into a study (postmenopausal: n=68) and a healthy premenopausal control group (n=34). The results of the study showed that bacterial plaque was high in the control group ($p< 0.01$), and gingival recession was high in the study group (1.06 ± 0.81) compared to the control group (0.78 ± 0.70). The clinical attachment loss (Cal) in the study group was 4.31 ± 1.08 and 4.05 ± 1.28 in the control group. The DMFT score was 17.8 (6.9) in the study group compared to 16.7 (5.5) in the control group. Lastly, the periodontal disease scores were similar in the study and control groups (3.25 ± 1.70 and 3.25 ± 0.69, respectively). The women before and after menopause did not notice differences in gingival parameters and tooth loss. The study authors concluded that it is difficult to establish a relationship between menopause and dental disease because of its multi-factorial aetiology (Calves et al., 2015).

2.6.1 Periodontal changes in postmenopause:

Sex steroid hormones, directly and indirectly, affect cellular proliferation, discrimination, and growth in tissues, including keratinocytes and fibroblasts of the gingiva. Estrogen hormone is also responsible for variations in the blood vessels of target tissues in females. The changes stimulate blood flow in the endometrium during the estrogen plasma rise in the follicular phase—connective tissue changes resulting from menopause and the lack of ovarian steroids. Profound changes may occur in women's bodies and oral cavities during menopause.

In addition, a lack of ovarian sex steroids may contribute to the negative changes in the gingiva of postmenopausal females (Nidhi et al., 2014).

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Postmenopausal females may have a higher frequency of gingivostomatitis, which has the clinical appearance of pale gingival tissue, redness, and bleeding on probing and brushing. Additional symptoms include drying the oral tissues, discomfort, burning sensation, bad taste, a fissured mucobuccal fold and xerostomia (Guncu et al., 2005). In addition, postmenopausal females may experience increased bouts of periodontitis, dental caries, dysesthesia, and osteoporotic changes. These changes may complicate dental management and prevent or inhibit dental implant placement (Deepa & Jain, 2016).

The oral changes appearing after menopause could be attributed to the reduction in epithelial keratinisation, dryness of the mucosa, less attachment formation, poor wound healing, reduced bone mineral content in the jaws, increased periodontosis, and tooth loss due to the effects of osteoporosis (Friedlander et al., 2002; Deepa & Jain, 2016).

2.6.2 Hormonal replacement therapy and periodontal disease:

After menopause, *lactobacilli* in the vaginal flora decreases slowly, and *Escherichia coli* flourishes (Pabich et al., 2003). However, a study conducted by Devillard et al. (2004) concluded that hormone replacement therapy restores the *lactobacilli* associated with the protective effect against urogenital infections in the vagina. Moreover, hormone replacement therapy significantly increases the number of *lactobacilli* strains. Therefore, it alleviates the symptoms of vaginitis in postmenopausal females. Studies have shown that HRT improves subjective and objective symptoms in more than 50% of postmenopausal females.

In a study, Volpe et al. (1991) reported that oral discomfort in postmenopausal women was related to a decrease in steroid hormones in women and that estrogen replacement therapy may improve the symptoms in some of these women.

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Menopause affects the salivary flow rate, which changes the electrolyte levels in saliva. However, Sewon et al. (2000) reported that HRT with alendronate and calcium stimulates saliva flow rate in women with oral symptoms but has no effect on salivary parameters such as PH and the level of electrolytes in postmenopausal women using hormone replacement therapy HRT.

However, Tarkkila et al. (2008) found no difference in dental health or saliva flow in menopausal women with or without HRT. The authors stated that women who used HRT needed more dental restorations and requested more dental appointments than those who did not use the drug (Tarkkila et al., 2008).

Oral symptoms such as salivary changes, gingivitis, bleeding and changes in taste respond better to oestrogen than phytotherapy in postmenopausal females (Giuca et al., 2009). When using sterol as HRT, it was found that there was a significant increase in saliva flow and a decrease in complaints of dry mouth. In perimenopausal and postmenopausal women, proteins, immunoglobulins and salivary peroxidase are estrogen-dependent (Leimola-Virtanen, 2000).

Lopez-Marcos (2005) stated that HRT does not affect periodontal health; a further Japanese study showed estrogen enhances tooth retention by intensifying the periodontal attachment around the teeth without reducing oral bone porosity and raising the oral bone height. The relationship is strong between the duration of estrogen use and remaining teeth. Tarkkila et al. (2010) found that periodontal pathogens, *Porphyromonas gingivalis and Taannerlla forsythia*, decreased in number when using hormone replacement therapy (Tarkkila et al., 2010).

Women on HRT rapidly recover from periodontitis due to the effect of estrogen on interleukin levels. A famous study on postmenopausal women in the USA found that HRT users lost teeth 24% less than those not using HRT.

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German researchers found that the number of teeth in the mouth in women using HRT was higher than in men and women in the same age group (Meisel et al., 2008).

2.6.3 Oral health behaviour and periodontal disease:

One of the perfect ways to limit periodontal diseases is the improvement of oral hygiene measurements, which can be improved by tooth brushing, dental flossing, and interdental brushing (Han & Park, 2017).

Increasing toothy brushing frequency is an excellent way to prevent or limit periodontal diseases. Combining tooth brushing frequency with inter-proximal plaque removal and using proper tooth brushing techniques and ideal cleaning material is the gold standard to avoid periodontal diseases (Trivedi, 2016).

Low socioeconomic status and low education level can be associated with increased periodontal diseases, as tooth brushing and inter-dental flossing are not practised (Trivedi, 2016).

WHO introduced CPI (Community Periodontal Index) to measure periodontal diseases. It is reported that tooth brushing twice a day will decrease periodontal diseases by 50 % (Han & Park, 2017).

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2.7 Oral health and dental management during menopause :

Several researchers have published recommendations for oral health for postmenopausal women, but no clear guidelines have been established.

Apart from routine questions about medical conditions, investigators suggested that women attending menopausal clinics also be questioned about possible oral symptoms and, when present, be referred to an oral health professional (Suri & Suri, 2014).

The improvement and maintenance of oral health after menopause can be accomplished by regular intraoral examination of the oral mucous membranes, periodontium, and teeth and

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quantitative and qualitative evaluation of salivary flow. Specific tests such as radiographs, periodontal probing and sialometry would be beneficial when indicated. In addition, mechanical and chemical plaque control measurements should be addressed to decrease dental plaque. Problems relating to plaque control can be addressed using inter-proximal brushes, dental floss, brushing frequency and technique and chlorhexidine digluconate. These techniques decrease the aggregation of dental plaque, inhibit the progression of periodontal disease and reduce the rate of dental caries by eliminating *Streptococcus mutans* (Bullon et al., 2007). In addition, dental caries can be prevented by using toothpaste, varnishes or gels containing fluoride (Dutt et al., 2013).

All pre and postmenopausal women should undergo screening for oral mucosal lesions and good assessment for periodontal health and oral membranes.

Mechanical plaque control measures should be considered, such as inter-proximal brushing, dental flossing, and determining good tooth brushing techniques along with the mechanical measures, chemical plaque control is emphasised by using chlorhexidine mouthwash as a plaque-free oral cavity, which is the first step to improving periodontal health and decreasing caries incidence in pre and postmenopausal women. In addition, varnishes and oral gels are known to impact oral health positively (Bullon et al., 2007).

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Chapter 3: Aims and Objectives

3.1 AIM

To determine whether oral health or oral health behaviour affects the periodontal disease status of women before menopause (pre-menopause) and after menopause (postmenopausal) in Sudan

3.2 OBJECTIVES

1. To determine the periodontal status of pre and postmenopausal women at a tertiary dental hospital in Sudan.
2. To determine the oral health practices of pre and postmenopausal women at a tertiary dental hospital in Sudan.

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Chapter 4: Methodology

4.1 Introduction

This chapter presents the research design and methodology adopted in the study. It describes the research instrument's development and the data collection methods. The research method chosen was related to the study's aims and objectives.

4.2 Research Design

The study was a cross-sectional comparative study among the Sudanese population between 01/April/2022 and 31/July/2022.

4.3 Reference Population

Patients attending the clinic in a hospital set up at Bashaier Hospital. Participants shared the same demographic area with the same socioeconomic status.

4.4 Setting

The data recruitment and clinical collection were undertaken at Bashaier Hospital. This is the largest hospital in (Mayo) south of the capital, Khartoum city. Mayo neighbourhood is situated in the southern district of the capital, Khartoum, and is characterised by high population density, all sharing the same socioeconomic status.

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4.5 Sample Selection and Size

Seventy women were randomly selected from the different clinics of the hospital according to a particular age group (group 1: women 20-35 years old, 50 participants and group 2: 50-70 years old, 20 participants. Seventy questionnaires were administered to the participants: socio-demographic factors (age, education, and occupation), oral health behaviour (frequency of tooth brushing and flossing and dental visits), and oral health knowledge. Seventy modified WHO assessment forms (1997) were used for clinical evaluation.

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4.5.1 Inclusion Criteria

1. Women were free of mental or physical disease.
2. Women stopped menstruation for 12 consecutive months.
3. Two Age groups (20-35)- (50-70) years old.
4. Menopausal women.

4.5.2 Exclusion Criteria

Known history of chronic medical illness, hormonal disorders, HIV patients, and any systemic disease (kidney, endocrine and neurological disorders and diabetes) affecting the periodontal status.

4.6 Data collection

A questionnaire consisting of socio-demographic factors (age, education, and occupation), oral health behaviour (tooth brushing and flossing frequency and the frequency of dental visits), and oral health knowledge was administered to participants as per the WHO oral health survey form (Appendix 2). The survey form was translated into Arabic and was completed by the investigator or the participant. The WHO assessment form (2013) documents the clinical findings (Appendix 3). Only sterilised instruments (examination set) were used to examine the participants. Gloves and face masks were worn, and infection control measures were followed. The examination was held in the dental clinics of Bashayir Hospital. A dental assistant assisted in recording the clinical findings on the WHO assessment forms under direct supervision. The primary investigator examined all participants. No pilot study was conducted as a result of the Covid-19 pandemic.

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4.7 Validity and reliability

Only the investigator examined the participants involved in the study, ensuring standardisation of the data collection. Before commencing the study, the investigator was calibrated by a qualified periodontologist to ensure the quality of the measurements and minimise inter- and intra-observer variability.

4.8 Data analysis:

Data were categorised and coded, then entered into the computer. The data was captured in Excel and analysed using the statistical product and service solution (SPSS) version 26. After data analysis, raw data was stored in secured cabinets to protect participants' confidentiality.

4.9 Ethical Considerations:

The protocol was submitted to the Bio-Medical Research Ethics Committee of the University of Western Cape and the Ministry of Health in Sudan for ethical approval and permission to carry out the study. Informed consent (Appendix 1) was obtained from each participant before examinations were obtained. Strict confidentiality was emphasised and maintained at all times. No names or personal details were mentioned in the study's write-up. Anonymity was achieved by coding the questionnaire and was identified using serial numbers. The study was approved by the BMREC (BM21/7/7) (Appendix 4).

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CHAPTER 5: RESULTS

5.1 Introduction

The findings of the present study are presented in 6 sections: Association between menopause status and education with periodontal status, Association between menopause status and education with caries status, Oral hygiene habits and status, dental visits, dental visits history and Oral health status.

5.2 Association between menopause status and education with periodontal status

The results of Table 1 show that there was a significant association between menopause status and periodontal status (P = 0.002). The overall prevalence of periodontal was higher among post-menopause women (30%) than pre-menopause women (18%). In addition, the severity of periodontal disease was higher among post-menopause women (70%) than pre-menopause women (40%). Also, there was a significant association between educational level and periodontal status (P = 0.023). The prevalence of severe periodontal disease was much higher among those with non-formal education and only primary education (100%), followed by the secondary level (83.3%).

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Table 1: The association between menopause status and education with periodontal status

Menopause status	Absent F (%)	Present periodontal F (%)	Severe periodontal F (%)	χ^2 (DF)	P
Pre-menopause	21 (42.0)	9 (18.0)	20 (40.0)	12.01	0.002
Post-menopause	0 (0)	6 (30.0)	14 (70.0)	(2)	
Education				19.91	0.023
No formal	0 (0)	0 (0)	4 (100)	(12)	
In primary school	0 (0)	0 (0)	1 (100)		
Complete primary school	0 (0)	2 (33.3)	4 (66.7)		
Secondary school	0 (0)	1 (16.7)	5 (83.3)		
High school	1 (12.5)	1 (12.5)	6 (75.0)		
College/University	11 (36.7)	8 (26.7)	11 (36.7)		
Post degree	9 (60.0)	3 (20.0)	3 (20.0)		

F = frequency, DF = degree of freedom, χ^2 = Chi-square.

5.3 Oral hygiene habits and status

The results of Table 3 show that there was a significant association between menopause status and number of natural teeth (P = 0.018), removable dentures (P = 0.005), state of gingiva (P = 0.008), use of dental floss (P = 0.036), and days taken off work (P = 0.011). For the number of teeth, those in pre-menopause had a higher proportion of 20 or more teeth (76.2%) than those in post-menopause (23.8%).

Those in the postmenopausal group had a higher proportion of partial dentures (100%) than the premenopausal women (0%). In comparison, the premenopausal women wore more complete upper dentures (75.8%) than postmenopausal women (24.2%).

Considering the question about the state of teeth, 62.5% of the postmenopausal females described their teeth as deficient teeth, while 37.5% of premenopausal females described them as poor. None of the postmenopausal females described their teeth as excellent (0%).

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For the state of gingiva, 66.7% of the postmenopausal females described it as deficient gingiva. In comparison, 33.3 % of premenopausal females described it as poor, and none of the postmenopausal females reported excellent gingiva (0%). For dental floss use: None of the post-menopause patients use dental floss (0%). For days off work: the proportion of those taking off sometimes is higher among the post-menopause (83.3%) than in the pre-menopause (16.7%) groups, and the proportion of taken off work reasonably often is much higher among the premenopausal women (100%).

Table 2: The association between oral health practices and menopause status

Variables	Pre-menopause F (%)	Post-menopause F (%)	$\chi 2$ (DF)	P value
How many natural teeth do you have?			7.00 (1)	**0.018**
10 – 19	2 (28.6)	5 (71.4)		
20 or more	48 (76.2)	15 (23.8)		
Did your teeth or mouth cause any pain or discomfort?			1.33 (1)	0.248
Yes	33 (67.3)	16 (32.7)		
No	17 (81.0)	4 (19.0)		
Do you have any removable dentures?			10.61 (1)	**0.005**
Partial denture	0 (0)	4 (100)		
Full upper denture	50 (75.8)	16 (24.2)		
How would you describe the state of your teeth?			12.99 (4)	**0.005**
Excellent	8 (100)	0 (0)		
Very good	11 (84.6)	2 (15.4)		
Good	14 (70.0)	6 (30.0)		
Average	11 (84.6)	2 (15.4)		
Poor	6 (37.5)	10 (62.5)		
How would you describe the state of your gums?			14.11 (5)	**0.008**
Excellent	10 (100)	0 (0)		
Very good	6 (66.7)	3 (33.3)		
Good	15 (68.2)	7 (31.8)		
Average	13 (86.7)	2 (13.3)		
Poor	4 (33.3)	8 (66.7)		
Very poor	2 (100)	0 (0)		
How often do you clean your teeth?			0.40 (1)	0.528
Once a day	19 (76.0)	6 (24.0)		
Twice a day	31 (68.9)	14 (31.1)		
Do you use a toothbrush to clean your teeth?			2.54 (1)	0.286
Yes	50 (72.5)	19 (27.5)		
No	0 (0)	1 (100)		

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Do you use wooden toothpaste to clean your teeth? **Yes** **No**	 8 (72.7) 40 (70.2)	 3 (27.3) 17 (29.8)	0.03 (1)	0.589
Do you use plastic toothpaste to clean your teeth? **Yes** **No**	 3 (100) 45 (69.2)	 0 (0) 20 (30.8)	1.31 (1)	0.550
Do you use dental floss to clean your teeth? **Yes** **No**	 9 (100) 40 (66.7)	 0 (0) 20 (33.3)	4.22 (1)	**0.036**
Do you use charcoal to clean your teeth? **Yes** **No**	 6 (57.1) 44 (72.1)	 3 (42.9) 17 (27.9)	0.68 (1)	0.411
Do you use chews stick to clean your teeth? **Yes** **No**	 2 (66.7) 46 (70.8)	 1 (33.3) 19 (29.2)	0.02 (1)	0.655
Do you use toothpaste to clean your teeth? **Yes** **No**	 50 (71.4) 0 (0)	 20 (28.6) 0 (0)	-	-
Do you use toothpaste that contains fluoride? **Yes** **No**	 38 (77.6) 3 (42.9)	 11 (22.4) 4 (57.1)	4.02 (2)	0.120
How long is it since you last saw a dentist? **Less than 6 months** **6–12 months** **More than 1 year but less than 2 years** **2 years or more but less than 5 years** **5 years or more** **Never received dental care**	 23 (74.2) 7 (70.0) 3 (100) 8 (57.1) 5 (100) 4 (57.1)	 8 (25.8) 3 (30.0) 0 (0) 6 (42.9) 0 (0) 3 (42.9)	4.77 (5)	0.434
What was the reason of your last visit to the dentist? **Consultation/advise** **Pain or trouble with teeth, gums or mouth** **Treatment/ follow-up treatment** **Routine check-up/treatment** **Don't know/don't remember**	 1 (50.0) 27 (79.4) 11 (61.1) 10 (83.3) 1 (25.0)	 1 (50.0) 7 (20.6) 7 (38.9) 2 (16.7) 3 (75.0)	7.25 (4)	0.095
Difficulty in biting foods **Don't know** **No** **Sometime** **Very often**	 2 (100) 32 (74.4) 10 (62.5) 6 (66.7)	 0 (0) 11 (25.6) 6 (37.5) 3 (33.3)1	1.55 (3)	0.722
Difficulty chewing foods **Don't know** **No**	 2 (100) 36 (76.6)	 0 (0) 11 (23.4)	5.40 (4)	0.219

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Sometime **Fairly often** **Very often**	5 (50.0) 1 (33.3) 6 (75.0)	5 (50.0) 2 (66.7) 2 (25.0)		
Difficulty with speech/trouble pronouncing words **Don't know** **No** **Sometime** **Very often**	 2 (66.7) 42 (73.7) 3 (42.9) 3 (100)	 1 (33.3) 15 (26.3) 4 (57.1) 0 (0)	3.81 (3)	0.233
Dry mouth **Don't know** **No** **Sometime** **Fairly often** **Very often**	 2 (100) 43 (72.9) 3 (50.0) 0 (0) 2 (100)	 0 (0) 16 (27.1) 3 (50.0) 1 (100) 0 (0)	4.60 (4)	0.269
Felt embarrassed due to appearance of teeth **Don't know** **No** **Sometime** **Fairly often** **Very often**	 3 (100) 38 (74.5) 3 (42.9) 1 I100) 5 (71.4)	 0 (0) 13 (25.5) 4 (57.1) 0 (0) 2 (28.6)	4.18 (4)	0.445
Felt tense because of problems with teeth or mouth **Don't know** **No** **Sometime** **Fairly often** **Very often**	 3 (100) 39 (75.0) 3 (37.5) 1 (100) 4 (66.7)	 0 (0) 13 (25.0) 5 (62.5) 0 (0) 2 (33.3)	5.76 (4)	0.154
Have avoided smiling because of teeth **Don't know** **No** **Sometime** **Fairly often** **Very often**	 3 (100) 39 (72.2) 3 (37.5) 1 (100) 4 (100)	 0 (0) 15 (27.8) 5 (62.5) 0 (0) 0 (0)	6.32 (4)	0.116
Had sleep that is often interrupted **Don't know** **No** **Sometime** **Fairly often** **Very often**	 3 (100) 39 (73.6) 6 (60.0) 1 (100) 1 (33.3)	 0 (0) 14 (26.4) 4 (40.0) 0 (0) 2 (66.7)	4.13 (4)	0.337
Have taken days off work **Don't know** **No** **Sometime** **Fairly often**	 4 (100) 42 (73.7) 1 (16.7) 3 (100)	 0 (0) 15 (26.3) 5 (83.3) 0 (0)	9.40 (3)	**0.011**
Difficulty doing usual activities **Don't know** **No** **Sometime** **Fairly often**	 4 (100) 40 (72.7) 5 (50.0) 1 (100)	 0 (0) 15 (27.3) 5 (50.0) 0 (0)	3.78 (3)	0.249
Felt less tolerant of spouse or people			4.74 (4)	0.257

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who are close to you				
Don't know	4 (80.0)	1 (20.0)		
No	42 (72.4)	16 (27.6)		
Sometime	1 (25.0)	3 (75.0)		
Fairly often	1 (100)	0 (0)		
Very often	2 (100)	0 (0)		
Have reduced participation in social activities			4.68 (3)	0.143
Don't know	3 (75.0)	1 (25.0)		
No	44 (74.6)	15 (25.4)		
Sometime	2 (33.3)	4 (66.7)		
Very often	1 (100)	0 (0)		
Fresh fruit			4.03 (5)	0.540
Seldom	4 (66.7)	2 (33.3)		
Several times a month	6 (75.0)	2 (25.0)		
Once a week	5 (50.0)	5 (50.0)		
Several times a week	22 (75.9)	7 (24.1)		
Everyday	12 (80.0)	3 (20.0)		
Several times a day	1 (50.0)	1 (50.0)		
Biscuits, cakes, cream cakes			5.13 (5)	0.399
Seldom	12 (63.2)	7 (36.8)		
Several times a month	11 (78.6)	3 (21.4)		
Once a week	4 (50.0)	4 (50.0)		
Several times a week	16 (84.2)	3 (15.8)		
Everyday	5 (62.5)	3 (37.5)		
Several times a day	2 (100)	0 (0)		
Sweet pies, buns			8.15 (5)	0.114
Seldom	13 (50.0)	13 (50.0)		
Several times a month	13 (81.3)	3 (18.8)		
Once a week	5 (83.3)	1 (16.7)		
Several times a week	12 (85.7)	2 (14.3)		
Everyday	5 (83.3)	1 (16.7)		
Several times a day	2 (100)	0 (00		
Jam or honey			5.52 (5)	0.326
Seldom	20 (58.8)	14 (41.2)		
Several times a month	10 (90.9)	1 (9.1)		
Once a week	5 (83.3)	1 (16.7)		
Several times a week	8 (72.7)	3 (27.3)		
Everyday	4 (80.0)	1 (20.0)		
Several times a day	3 (100)	0 (0)		
Chewing gum containing sugar			5.92 (5)	0.289
Seldom	14 (56.0)	11 (44.0)		
Several times a month	6 (85.7)	1 (14.3)		
Once a week	3 (60.0)	2 (40.0)		
Several times a week	11 (84.6)	2 (15.4)		
Everyday	12 (75.0)	4 (25.0)		
Several times a day	4 (100)	0 (0)		
Sweets/candy			7.59 (5)	0.150
Seldom	14 (56.0)	11 (44.0)		
Several times a month	7 (58.3)	5 (41.7)		
Once a week	5 (83.3)	1 (16.7)		
Several times a week	13 (86.7)	2 (13.3)		

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Everyday **Several times a day**	9 (90.0) 2 (100)	1 (10.0) 0 (0)		
Lemonade, Coca Cola or other soft drinks **Seldom** **Several times a month** **Once a week** **Several times a week** **Everyday** **Several times a day**	10 (62.5) 9 (64.3) 3 (60.0) 14 (77.8) 9 (75.0) 5 (100)	6 (37.5) 5 (35.7) 2 (40.0) 4 (22.2) 3 (25.0) 0 (0)	3.63 (5)	0.632
Tea with sugar **Seldom** **Several times a month** **Once a week** **Several times a week** **Everyday** **Several times a day**	7 (77.8) 1 (50.0) 2 (100) 4 (80.0) 21 (70.0) 15 (68.2)	2 (22.2) 1 (50.0) 0 (0) 1 (20.0) 9 (30.0) 7 (31.8)	1.75 (5)	0.966
Coffee with sugar **Seldom** **Several times a month** **Once a week** **Several times a week** **Everyday** **Several times a day**	21 (70.0) 3 (75.0) 2 (100) 4 (57.1) 13 (72.2) 7 (77.8)	9 (30.0) 1 (25.0) 0 (0) 3 (42.9) 5 (27.8) 2 (22.2)	1.63 (5)	0.959

5.4 Dental visits

Almost all of the pre-menopause group had visited a dentist in the last five years. About 46% of this group believed that the dentist should be visited every six months. In the postmenopausal group, 17 participants visited the dentist in the last five years, and 8 believed the dentist should be visited every six months (Table 4).

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Table 3: shows how often participants visited a dentist

How often do you visit the dentist		
	Pre-menopause	Post menopause
Less than six month	46%	40%
6-12 months	14%	15%
1 – 2 years	6%	0
2-5 years	16%	30%
5 years or more	10%	0
Never received dental care	8%	15%

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5.5 Dental visit history

The main reason for visiting the dentist was pain in the teeth or gingiva pre-menopause group 54%, post-menopause group, 35% (Table 3).

5.6 Oral health status

5.6.1 Periodontal health

Healthy periodontium appeared only in pre-menopause group, and none of the post-menopause had a healthy periodontal status.The prevalence of CPI 1 was higher among the pre-menopause (61.5%) than the post-menopause (38.5%) groups, P = 0.405. The prevalence of CPI 2 was higher among the pre-menopause (60.0%) than the post-menopause (40.0%) groups, P = 0.273. The prevalence of CPI 3 was higher among the post-menopause (75.0%) than the pre-menopause (25.0%), P = 0.317. Finally, participants with a CPI 4 were all in pre-menopause (100%), and none of the post-menopause had a CPI 4 (0%) Table 5.

Table 4 The prevalence of CPI across pre-menopause and post-menopause

CPI	Pre-menopause	Post-menopause	P value
CPI 0	21 (100%)	0 (0%)	-
CPI 1	8 (61.5%)	5 (38.5%)	0.405
CPI 2	18 (60.0%)	12 (40.0%)	0.273
CPI 3	1 (25.0%)	3 (75.0%)	0.317
CPI 4	2 (100%)	0 (%)	-

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5.6.2 Dentition status

The mean of decay was higher in postmenopausal group (0.65) than in the premenopausal group (0.58), P = 0.595. The mean of missing teeth was significantly higher among the postmenopausal females (5.50) than the premenopausal participants (2.98), P < 0.001. The mean of filled teeth was lower among the post-menopause (0.15) than the pre-menopause (0.38), P = 0.262. The mean of total DMFT was significantly higher among the post-menopause (6.30) than the pre-menopause (3.94), P < 0.001 (Table 6).

Table 5 Mean of DMFT across menopause status

DMFT	Pre-menopause (n = 50)	Post-menopause (n = 20)	P value
Decay	0.58±0.50	0.65±0.49	0.595
Missing	2.98±2.38	5.50±2.12	< 0.001
Filled	0.38±0.97	0.15±0.67	0.262
Total	3.94±2.63	6.30±2.18	< 0.001

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CHAPTER 6: DISCUSSION

The sample comprised seventy subjects divided into two groups: pre-menopause women 20-35 and post-menopause women 50-70 years old. Women from the same socioeconomic backgrounds were included in the study.

Oral health and socioeconomic status (SES) have a strong relationship, and its one of the factors to improve oral health if well established (Sabbah et al., 2007; Petersen et al., 2005). The most common SES indicators are income, education and occupation (Sabbah et al., 2007). Therefore, in the present study, education was chosen.

Tooth brushing with fluoride toothpaste was the most common reported oral hygiene practice. In a recent study, the prevalence of periodontal disease was higher among postmenopausal women (30%) than the pre-menopause women (18%). These results concur with a Portuguese study that reported a high prevalence of periodontal disease among postmenopausal women (Alves et al., 2015).

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In our recent study, there was a significant association between educational level and periodontal status (P = 0.023). Furthermore, the prevalence of severe periodontal was much higher among those with non-formal education and in primary (100%), followed by the secondary level (83.3%).

Our study showed no significant association between menopause and caries status (P = 0.381). However, the prevalence of caries is higher among post-menopause women (85%) than pre-menopause women (78%).

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Our study reported that postmenopausal women had fewer teeth than the premenopausal group, similar to a study conducted on a Portuguese population showing the same results (Alves et al., 2015).

Almost half of the participants from the premenopausal group visited the dentist less than 6 months ago, while 40% from the postmenopausal group visited the dentist less than 6 months ago. In contrast, other participants visited a dentist within 5 years. Furthermore, only 8% of the premenopausal group and 15% of the postmenopausal group never visited a dentist. These findings contradict a study conducted on Sudanese pregnant women and a study conducted in the US reporting that half of the participants did not visit a dentist at all (Gaffield et al., 2001; Abdelseed, 2012).

All participants in the study from the two groups brushed their teeth daily, and almost 70 % of both groups reported that they brush twice daily. This finding was higher than a study conducted in Sudan among pregnant women (Abdelseed, 2012) and in Zanzibar (Petersen et al., 2005).

The mean total DMFT score was significantly higher among the post-menopause (6.30) than the pre-menopause (3.94). The pre-menopause group results were similar to those in a study conducted on Sudanese pregnant women showing DMFT 3.35 (Abdelseed, 2012), which is very low when compared to a Hungarian population (Randi et al., 2007) and an Australian population (Amarasena et al., 2021). According to WHO, Sudan is categorised under 5-9 DMFT (Petersen et al., 2005) and our results from this study is still lower than WHO classification.

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Our results showed good oral hygiene, with few participants with periodontal pockets and most with gingival bleeding. When compared with other studies, the current findings are better than those reported from Tanzania (Mumghamba et al., 2006), Japan (Miyazaki et al., 1991) and UK (Davenport et al., 2002).

Healthier sextants were significantly related to age - increasing age showed decreasing healthy sextants. This finding concurred with a study conducted in Uganda (Wandera et al., 2009).

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6.1 Conclusions

The oral health attitude among the two groups, pre and post-menopause, was extraordinary as they brushed their teeth twice per day using toothpaste.

The pre-menopause group showed a high prevalence of healthy sextants, a very low prevalence of shallow pockets, absence of severe periodontal problems. In contrast, the post-menopause group showed the presence of periodontal pockets with minimal periodontal problems.

There was an increasing prevalence of caries and periodontal diseases with increasing age. However, considering DMFT, it was low in the pre-menopause group compared with the post-menopause group.

It was noticed that visiting the dentist is extremely important as both groups visited the dentist in less than six months. Furthermore, the most common cause for visiting the dentist was a pain for both groups.

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6.2 Recommendations

There is an urgent need to institute early oral health education and encourage the use of dental services during pregnancy.

The oral health directorate in Sudan should emphasise the importance of developing an oral health programme for postmenopausal women to screen and detect any early changes.

Education of Sudanese women about oral health and oral hygiene measures should be done through the oral health directorate

The same research should be conducted with a large sample size to determine the exact reasons for increasing caries and periodontal diseases in women postmenopausal women in Sudan.

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REFERENCES:

1. Abdelseed Ibrahim (2012). *Oral Health Status, Knowledge, Attitudes and Practice among Pregnant Women attending Omdurman Maternity Hospital, Khartoum, Sudan*. University of Western Cape.
2. Alves, R. C., Félix, S. A., Rodriguez-Archilla, A., Oliveira, P., Brito, J., & Dos Santos, J. M. (2015). Relationship between menopause and periodontal disease: a cross-sectional study in a Portuguese population. *International Journal of Clinical and Experimental Medicine*, *8*(7), 11412.
3. Amarasena, N., Chrisopoulos, S., Jamieson, L. M., & Luzzi, L. (2021). Oral health of Australian adults: distribution and time trends of dental caries, periodontal disease and tooth loss. *International Journal of Environmental Research and Public Health*, *18*(21), 11539.
4. Bergdahl M, Bergdahl J. (1999). Burning mouth syndrome: Prevalence and associated factors. *Journal of Oral Pathology & Medicine*, 28:350–354
5. Bullon P, Chandler L, Segura Egea JJ, Perez Cano R, Martinez Sahuquillo A. (2007). Osteocalcin in serum, saliva and gingival crevicular fluid: Their relation with periodontal treatment outcome in postmenopausal women. *Med Oral Patol Oral Cir Bucal.*, 12: 193–197
6. Calves R , Felix S, Archilla A,Oliveira P, Brito J , Santos J. (2015). Relationship between menopause and periodontal disease: a cross-sectional study in a Portuguese population,*Intertional Journal of Clin Exp Med*. 8(7):11412-11419.
7. Cheng G, Yeater KM, Hoyer LL (2006). Cellular and molecular biology of Candida albicans estrogen response. *Eukaryot Cell*, 5:180–191.
8. Dahiya P, Kamal R, Kumar M, Niti, Gupta R, Chaudhary K. (2013). Burning mouth Syndrome and menopause. *International Journal Prev Med*icine ,4(1):15-20.
9. Deepa D, Jain G. (2016). Assessment of periodontal health status in postmenopausal women visiting dental hospitals from around Meerut city: Cross-sectional observational study. *Journal Midlife Health*, 7(4):175-179.

http://etd.uwc.ac.za/

10. Davenport ES, Williams CE, Sterne JA, Murad S, Sivapathasundram V, Curtis MA (2002). Maternal periodontal disease and preterm low birth weight: case-control study. *Journal Dental Research*, 81(5):313-8.
11. Devillard E, Burton JP, Hammond JA, Lam D, Reid G. (2004). Novel insight into the vaginal microflora in postmenopausal women under hormone replacement therapy as analysed by PCR-denaturing gradient gel electrophoresis. *Europe Journal Obstet Gynecol Reprod Biol*ogy, 10:76–81
12. Dutt, P., Chaudhary, S., & Kumar, P. (2013). Oral health and menopause: a comprehensive review on current knowledge and associated dental management. *Annals of medical and health sciences research*, *3*(3), 320–323.
13. Etetafia, O. M., & Azodo, C. C. (2019). Gender and oral health in Africa. *Indian Journal of Oral Health and Research*, *5*(1), 1.
14. Falagas ME, Betsi GI, Athanasiou S. (2007). Probiotics for the treatment of women with bacterial vaginosis. *Clinical Microbiol Infect*, 13:657–64.
15. Friedlander AH. (2002). The physiology, medical management and oral implications of menopause. *Journal of American Dental Association*, 133:73–81
16. Gaffield ML, Gilbert BJ, Malvitz DM, Romaguera R (2001). Oral health during pregnancy: an analysis of information collected by the pregnancy risk, assessment monitoring system. *Journal American Dental Association*, 1342(7):1009-1016.
17. Giuca, M. R., Carli, E., Pasini, M., Bonfigli, D., & Cappè, M. R. (2009). Evaluation of efficacy of estrogen and phytotherapy in oral cavity alterations of women in menopause. *Minerva ginecologica*, *61*(1), 13-22.
18. Güncü GN, Tözüm TF, Cağlayan F. (2005). Effects of endogenous sex hormones on the periodontium: Review of literature. *Australian Dental Jornal*,50:138–144.
19. Greenberg MS, Glick M, Ship JA. (2008). *Burket's Oral Medicine*. 11th ed. Hamilton: BC Decker Inc.
20. Han, K., & Park, J. B. (2017). Association between oral health behavior and periodontal disease among Korean adults. *The Korea national health and nutrition examination survey*. 96(7).

http://etd.uwc.ac.za/

21. Hillman, E.T., Lu, H., Yao, T. and Nakatsu, C.H. (2017). Microbial ecology along the gastrointestinal tract. *Microbes and environments*, p.ME17017.
22. Hoffmann, J. N., You, H. M., Hedberg, E. C., Jordan, J. A., & McClintock, M. K. (2014). Prevalence of bacterial vaginosis and Candida among postmenopausal women in the United States. *Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, *69*(Suppl_2), S205-S214.
23. Klinger G., Eick S., Klinger G., (1998).Influence of hormonal contraceptives on microbial flora of gingival sulcus. *Contraception*. 57:381–4.
24. Laine MA (2002). Effect of pregnancy on periodontal and dental health. *Acta Odontalgia Scandinavica,* 60(5): 257-264.
25. Li Y, Caufield PW, (1995). The fidelity of initial acquisition of mutans streptococci by infants from their mothers. Journal of Dental Research, 74:681–5.
26. Locker D (2000). Deprivation and oral health: a review. *Community Dent Oral Epidemiology*, 28:161-9.
27. Loe H, Sillness J (1963). Periodontal Disease in Pregnancy.1 .Prevalence and Severity. *Acta Odontologica Scandiniavca*, 21:533-551.
28. Lopez-Marcos JF, García-Valle S, García-Iglesias AA. (2005). Periodontal aspects in menopausal women undergoing hormone replacement therapy. *Med Oral Patol Oral Cir Bucal*, 10:132–41.
29. Lopez Jornet, M. P., Camacho Alonso, F., Andujar Mateos, P., Sánchez Siles, M. A., & Gómez García, F. J. (2010). Burning mouth syndrome: an update. *Med Oral Patol Oral Cir Bucal*, 15 (4):e562-8.
30. Leimola-Virtanen R, Salo T, Toikkanen S, Pulkkinen J, Syrjänen S. (200). Expression of estrogen receptor (ER) in oral mucosa and salivary glands. Maturitas, 36:131–7.
31. Meurman JH, Tarkkila L, Tiitinen A, (2009). The menopause and oral health. *Maturitas*, 20;63(1):56-62
32. Meisel P, Reifenberger J, Haase R, Nauck M, Bandt C, Kocher T, (2008). Women are periodontally healthier than men, but why don't they have more teeth than men? *Menopause*, 15:270–5.

http://etd.uwc.ac.za/

33. Merskey, H. E. (1986). Classification of chronic pain: Descriptions of chronic pain syndromes and definitions of pain terms. *Pain, American Psychological Association*, 3,226.
34. Miyamoto, S. A., & Ziccardi, V. B. (1998). Burning mouth syndrome. *The Mount Sinai Journal of Medicine, New York*, *65*(5-6), 343-347.
35. Mirzaii-Dizgah I, Agha-Hosseini F, (2011). Stimulated and unstimulated saliva progesterone in menopausal women with oral dryness feeling. *Clin Oral Investig,* 15:859–862
36. Miyazaki H, Yamashita Y, Shirahama R, Goto-Kimura K, ShimadaN et al. (1991). Periodontal condition of pregnant women assessed by CPITN. *Journal of Clinical Periodontology,* 18:751-4.
37. Mumghamba E, Manj K, Michael J (2006). Oral hygiene practices, periodontal conditions dentition status and self–reported bad mouth breath among young mothers, Tanzania. *International Journal of Dental Hygiene*, 4:166-73.
38. Mutneja P, Dhawan P, Raina A, Sharma G, (2012). Menopause and the oral cavity. *Indian J Endocr Metab*, 16:548-51
39. Nidhi RK (2014). Periodontal diseases in menopausal women. *Journal of Pharm Sci Research.,* 6:423–4.
40. Norderyd, O. M., Grossi, S. G., Machtei, E. E., Zambon, J. J., Hausmann, E., Dunford, R. G., & Genco, R. J. (1993). Periodontal status of women taking postmenopausal estrogen supplementation. *Journal of periodontology*, *64*(10), 957-962.
41. North American Menopause Society on Access (2019). Hormone therapy and menopause, frequently asked questions. *North American Menopause Society*.
42. Pabich WL, Fihn SD, Stamm WE, Scholes D, Boyko EJ, Gupta K, (2003). Prevalence and determinants of vaginal flora alterations in postmenopausal women. *J Infect Dis*, 188:1054–1058
43. Paganini-Hill A, (2007). Hormone therapy and oral health. *Menopause Manage* , p. 31-40
44. Petersen PE, Ogawa H (2005). Strengthening the prevention of periodontal disease: the WHO approach. *Journal of Periodontology* 76: 2187-93.

http://etd.uwc.ac.za/

45. Petersen PE, Bourgeois D, Ogawa H, Estupinan-Day S, Ndiaye C (2005).The global burden of oral diseases and risks to oral health. *Bulletin of the World Health Organization*, 83:661-69.
46. Portillo GM, (2002). Oral manifestations and dental treatment in menopause. *Med Oral*, 7:31-5
47. Randi M, Gorzo I, Nagy Erzsebet, Urban E, Eller J, Novak T, and Pal Attila (2007). The oral health status of postpartum mothers in South-East Hungary. *Community Dental Health*, 24:111-16.
48. Raviraj, J., Sunil, V., & Charitha, M. (2016). Influence of menopause on oral health: a cross-sectional study. *Int J Health Sci Res*, *6*, 232-5.
49. Rukmini JN, Sachan R, Sibi N, Meghana A, Malar CI, (2018). Effect of menopause on saliva and dental health. *J Int Soc Prevent Communit Dent*, 8:529-533.
50. Sabbah, W. (2007). *Exploring pathways towards social gradients in oral and general health*. University of London, University College London (United Kingdom).
51. Sewón L, Laine M, Karjalainen S, Leimola-Virtanen R, Hiidenkari T, Helenius H, (2000). The effect of hormone replacement therapy on salivary calcium concentrations in menopausal women. *Arch Oral Biol*, 45:201–206.
52. Shu L, Guan SM, Fu SM, Guo T, Cao M, Ding Y, (2008). Estrogen modulates cytokine expression in human periodontal ligament cells. *Journal of Dent Res*., 87:142–7.
53. Suri V, Suri V, (2014). Menopause and oral health. *J Mid-life Health*, 5(3):115-120.
54. Steinberg BJ, (2000). Women's oral health issues. *J California Dent Assoc*., 28:663-7.
55. Streckfus CF, Baur U, Brown LJ, Bacal C, Metter J, Nick T, (1998). Effects of estrogen status and aging on salivary flow rates in healthy Caucasian women. *Gerontology*, 44:32–39.
56. Tarkkila L, Furuholm J, Tiitinen A, Meurman JH, (2008). Oral health in perimenopausal and early postmenopausal women from baseline to 2 years of follow-up with reference to hormone replacement therapy. *Clin Oral Investig*, 12:271–7.
57. Tarkkila, L., Kari, K., Furuholm, J., Tiitinen, A., & Meurman, J. H. (2010). Periodontal disease-associated microorganismsmicroorganismsmicroorganisms in perimenopausal and postmenopausal women using or not using hormone replacement therapy. A two-year follow-up study. *BMC Oral Health*, *10*, 1-8.

http://etd.uwc.ac.za/

58. Teanpaisan R, Dahlen G., (2006). Use of polymerase chain reaction techniques and sodium dodecyl sulphate-polyacrylamide get electrophoresis for differentiation of oral Lactobacillus species. *Oral Micob Immunol*, 21:79–83.
59. Thompson IO, Van der Bijl, van Wyk Cw, van Eyk ADA, (2001). Comparative light microscopic, electron microscopic and chemical study of humal vaginal and buccal epithelium. *Arch Oral Biol*, 46:1091-1098
60. Trivedi, H., Sharma, S., Kumar Sharma, V., & Gupta, N. D. (2016). Behavioral factors and periodontal diseases. *Eur J Pharm Med Res, 3*(7), 207-13.
61. Volpe A, Lucenti V, Forabosco A, (1991). Oral discomfort and hormone replacement therapy in the post-menopause. *Maturitas*, 13:1–5.
62. Wandera M, Engebresten MS, Okullo I, Tumwine J, Astrom A (2009). Socio-demographic factors related to periodontal status and tooth loss of pregnant women in Mbale district, Uganda. *Bio Med Cent Oral Health*, 9:18.
63. Wardropa RW, Hailesb J, Burgerc H, Reade PC, (1989). Oral discomfort at menopause. *Oral Surg Oral Med Oral Pathol*, 67:535-40
64. Zakrzewska JM, Hamlyn PJ, (1999). Facial pain. In: Crombie IK, editor. *Epidemiology of pain.* Seattle (WA): IASP press. pp. 175–82

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APPENDIX 1

INFORMED CONSENT FOR ORAL EXAMINATION

Dear .....…….....

I am Dr Duoaa Elmubarak, a post-graduate student studying for the MSc (Dent) in Dental Public Health at the Faculty of Dentistry, University of the Western Cape (South Africa).

I would like to ask you a few questions about yourself, examine your mouth and teeth to look for any oral problems. I am doing this to see if there are ways to prevent or help with any problems.

The procedure will take about 10-15 minutes. After that, you are entirely free to take part or not to take part in the study.

Thank you for your cooperation

Yours sincerely

I understand the information that has been provided to me, and I agree to participate in the study.

Name: ....

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Appendix 2

World Health Organization

Oral Health Questionnaire for Adults

Identification number	Sex		Location		
	Male	Female	Urban	Periurban	Rural
1. ☐☐☐☐	☐	☐	☐	☐	☐
1 4	1	2	1	2	3

2. **How old are you today?**
(Years)

3. **How many natural teeth do you have?**

No natural teeth ..... □ 0
1–9 teeth ..... □ 1
10–19 teeth ..... □ 2
20 teeth or more ..... □ 3

4. **During the past 12 months, did your teeth or mouth cause anypain or discomfort?**

Yes ..... □ 1
No ..... □ 2
Don't know ..... □ 9
No answer ..... □ 0

5. **Do you have any removable dentures?**

	Yes	No
	1	2
A partial denture?	□	□
A full upper denture?	□	□
A full lower denture?	□	□

6. **How would you describe the state of your teeth and gums? Isit "excellent", "very good", "good", "average", "poor", or "very poor"?**

	Teeth	Gums
Excellent	□ 1	□ 1
Very good	□ 2	□ 2
Good	□ 3	□ 3
Average	□ 4	□ 4
Poor	□ 5	□ 5
Very poor	□ 6	□ 6
Don't know	□ 9	□ 9

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7. **How often do you clean your teeth?**

Never ..... □ 1
Once a month ..... □ 2
2–3 times a month ..... □ 3
Once a week ..... □ 4
2–6 times a week ..... □ 5
Once a day ..... □ 6
Twice or more a day ..... □ 7

8. **Do you use any of the following to clean your teeth?**
(Read each item)

	Yes	No
	1	2
Toothbrush	□	□
Wooden toothpicks	□	□
Plastic toothpicks?	□	□
Thread (dental floss)	□	□
Charcoal	□	□
Chewstick/miswak	□	□
Other	□	□
Please specify	□	□

9.

	Yes	No
a) Do you use toothpaste to clean your teeth	□ 1	□ 2
b) Do you use a toothpaste that contains fluoride?	□ 1	□ 2

Don't know ..... □ 9

10. **How long is it since you last saw a dentist?**

Less than 6 months ..... □ 1
6–12 months ..... □ 2
More than 1 year but less than 2 years ..... □ 3
2 years or more but less than 5 years ..... □ 4
5 years or more ..... □ 5
Never received dental care ..... □ 6

11. **What was the reason of your last visit to the dentist?**

Consultation/advise ..... □ 1
Pain or trouble with teeth, gums or mouth ..... □ 2
Treatment/ follow-up treatment ..... □ 3
Routine check-up/treatment ..... □ 4
Don't know/don't remember ..... □ 5

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12. **Because of the state of your teeth or mouth, how often have you experienced any of the following problems during the past 12 months?**

	Very often 4	Fairly often 3	Some-times 2	No 1	Don't know 0
(a) Difficulty in biting foods	□	□	□	□	□
(b) Difficulty chewing foods.....	□	□	□	□	□
(c) Difficulty with speech/trouble pronouncing words	□	□	□	□	□
(d) Dry mouth.....	□	□	□	□	□
(e) Felt embarrassed due to appearance of teeth.....	□	□	□	□	□
(f) Felt tense because of problems with teeth or mouth	□	□	□	□	□
(g) Have avoided smiling because of teeth.....	□	□	□	□	□
(h) Had sleep that is often interrupted	□	□	□	□	□
(i) Have taken days off work	□	□	□	□	□
(j) Difficulty doing usual activities..	□	□	□	□	□
(k) Felt less tolerant of spouse or people who are close to you.....	□	□	□	□	□
(l) Have reduced participation in social activities.....	□	□	□	□	□

13. **How often do you eat or drink any of the following foods, even in small quantities?**
(Read each item)

	Several times a day 6	Every day 5	Several times a week 4	Once a week 3	Several times a month 2	Seldom /never 1
Fresh fruit.....	□	□	□	□	□	□
Biscuits, cakes, cream cakes	□	□	□	□	□	□
Sweet pies, buns.....	□	□	□	□	□	□
Jam or honey	□	□	□	□	□	□
Chewing gum containing sugar	□	□	□	□	□	□
Sweets/candy.....	□	□	□	□	□	□

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Lemonade, Coca Cola or other soft drinks ..	□	□	□	□	□	□
Tea with sugar	□	□	□	□	□	□
Coffee with sugar	□	□	□	□	□	□

(Insert country-specific items)

14. **How often do you use any of the following types of tobacco?**
(Read each item)

	Every day 6	Several times a week 5	Once a week 4	Several times a month 3	Seldom 2	Never 1
Cigarettes	□	□	□	□	□	□
Cigars	□	□	□	□	□	□
A pipe	□	□	□	□	□	□
Chewing tobacco	□	□	□	□	□	□
Use snuff.....	□	□	□	□	□	□
Other	□	□	□	□	□	□

Please specify _____

15. **During the past 30 days, on the days you drank alcohol, how many drinks did you *usually drink per day*?**

Less than 1 drink	□ 0
1 drink	□ 1
2 drinks	□ 2
3 drinks	□ 3
4 drinks	□ 4
5 or more drinks	□ 5
Did not drink alcohol during the past 30 days	□ 9

16. **What level of education have you completed?**

No formal schooling.....	□ 1
Less than primary school.....	□ 2
Primary school completed	□ 3
Secondary school completed	□ 4
High school completed	□ 5
College/university completed	□ 6
Postgraduate degree	□ 7

(Insert country-specific categories)

That completes our questionnaire
Thank you very much for your cooperation!

Year	Month	Day	Interviewer	District	Country
□□	□□	□□	□□	□□	□□□□

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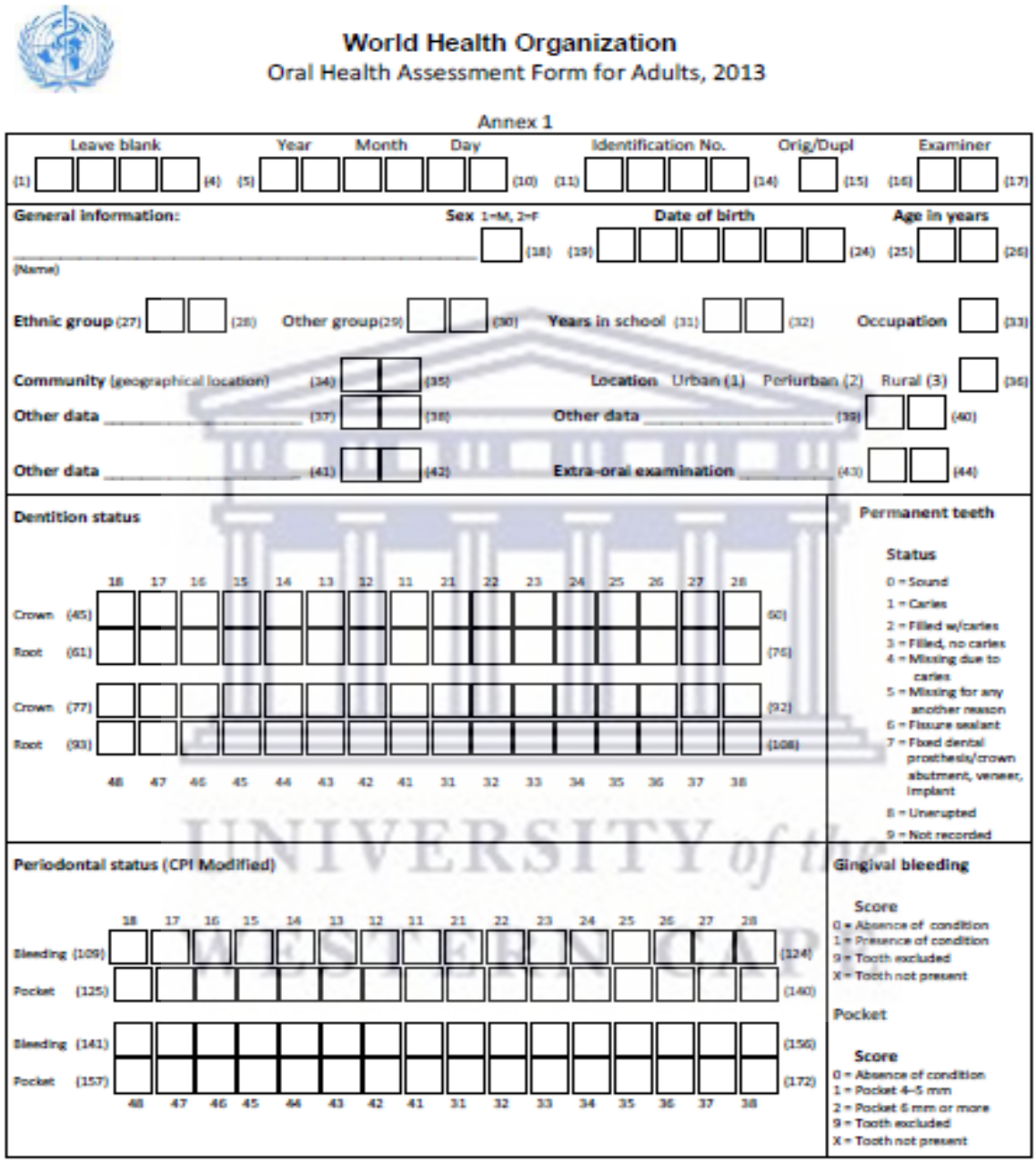
Appendix 3



World Health Organization

Oral Health Assessment Form for Adults, 2013

Annex 1

Leave blank (1) (4) | Year Month Day (5) (10) | Identification No. (11) (14) | Orig/Dupl (15) | Examiner (16) (17)

General information: Sex 1=M, 2=F (18) | Date of birth (19) (24) | Age in years (25) (26)

(Name) _____

Ethnic group (27) (28) | Other group (29) (30) | Years in school (31) (32) | Occupation (33)

Community (geographical location) (34) (35) | Location Urban (1) Periurban (2) Rural (3) (36)

Other data _____ (37) (38) | **Other data** _____ (39) (40)

Other data _____ (41) (42) | **Extra-oral examination** _____ (43) (44)

Dentition status

	18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28	
Crown (45)																	(60)
Root (61)																	(76)
Crown (77)																	(92)
Root (93)																	(108)
	48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38	

Permanent teeth

Status

0 = Sound
1 = Caries
2 = Filled w/caries
3 = Filled, no caries
4 = Missing due to caries
5 = Missing for any another reason
6 = Fissure sealant
7 = Fixed dental prosthesis/crown abutment, veneer, implant
8 = Unerupted
9 = Not recorded

Periodontal status (CPI Modified)

	18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28	
Bleeding (109)																	(124)
Pocket (125)																	(140)
Bleeding (141)																	(156)
Pocket (157)																	(172)
	48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38	

Gingival bleeding

Score

0 = Absence of condition
1 = Presence of condition
9 = Tooth excluded
X = Tooth not present

Pocket

Score

0 = Absence of condition
1 = Pocket 4–5 mm
2 = Pocket 6 mm or more
9 = Tooth excluded
X = Tooth not present

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World Health Organization
Oral Health Assessment Form for Adults, 2013

Loss of attachment

Severity
0 = 0–3 mm
1 = 4–5 mm Cemento-enamel junction (CEJ) within black band
2 = 6–8 mm CEJ between upper limit of black band and 8.5 mm ring
3 = 9–11 mm CEJ between 8.5 mm and 11.5 mm ring
4 = 12 mm or more CEJ beyond 11.5 mm ring
X = Excluded sextant
9 = Not recorded

* Not recorded under 15 years of age

Index teeth

17/16 11 26/27
(173) [ ][ ][ ] (175)
(176) [ ][ ][ ] (178)
47/46 31 36/37

Enamel fluorosis [ ] (179)

Severity
0 = Normal
1 = Questionable
2 = Very mild
3 = Mild
4 = Moderate
5 = Severe
8 = Excluded (crown, restoration, "bracket")
9 = Not recorded (unerupted tooth)

Dental erosion

Severity [ ] (180)

0 = No sign of erosion
1 = Enamel lesion
2 = Dentinal lesion
3 = Pulp involvement

Number of teeth affected

(181) [ ][ ] (182)

Dental trauma

Status [ ] (183)

0 = No sign of injury
1 = Treated injury
2 = Enamel fracture only
3 = Enamel and dentine fracture
4 = Pulp involvement
5 = Missing tooth due to trauma
6 = Other damage
9 = Excluded tooth

Number of teeth affected

(184) [ ][ ] (185)

Oral mucosal lesions

[ ] (186)
[ ] (187)
[ ] (188)

[ ] (189)
[ ] (190)
[ ] (191)

Condition

0 = No abnormal condition
1 = Malignant tumour (oral cancer)
2 = Leukoplakia
3 = Lichen planus
4 = Ulceration (aphthous, herpetic, traumatic)
5 = Acute necrotizing ulcerative gingivitis (ANUG)
6 = Candidiasis
7 = Abscess
8 = Other condition (specify if possible)
9 = Not recorded

Location

0 = Vermillion border
1 = Commissures
2 = Lips
3 = Sulci
4 = Buccal mucosa
5 = Floor of the mouth
6 = Tongue
7 = Hard and/or soft palate
8 = Alveolar ridges/gingiva
9 = Not recorded

Denture(s)

Upper [ ] (192) **Lower** [ ] (193)

Status
0 = No denture
1 = Partial denture
2 = Complete denture
9 = Not recorded

Intervention urgency [ ] (194)

0 = No treatment needed
1 = Preventive or routine treatment needed
2 = Prompt treatment (including scaling) needed
3 = Immediate (urgent) treatment needed due to pain or infection of dental and/or oral origin
4 = Referred for comprehensive evaluation or medical/dental treatment (systemic condition)

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Appendix 4

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60 YEARS of hope, action & knowledge

09 February 2022

Dr DB Elmubarak
Community Oral Health
Faculty of Dentistry

Ethics Reference Number: BM21/7/7

Project Title: Comparison of periodontal health between menopause and part-menopause women in Sudan.

Approval Period: **20 August 2021 – 20 August 2024**

I hereby certify that the Biomedical Science Research Ethics Committee of the University of the Western Cape approved the scientific methodology and ethics of the above mentioned research project and the requested amendment to the project.

Any further amendments, extension or other modifications to the protocol must be submitted to the Ethics Committee for approval.

Please remember to submit a progress report annually by 30 November for the duration of the project.

For permission to conduct research using student and/or staff data or to distribute research surveys/questionnaires please apply via:
https://sites.google.com/uwc.ac.za/permissionresearch/home

The permission letter must then be submitted to BMREC for record keeping purposes.

The Committee must be informed of any serious adverse event and/or termination of the study.

Ms Patricia Josias
Research Ethics Committee Officer
University of the Western Cape O

NHREC Registration Number: BMREC-130416-050

FROM HOPE TO ACTION THROUGH KNOWLEDGE.

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