BABU BANARASI DAS UNIVERSITY

BABU BANARASI DAS COLLEGE OF DENTAL SCIENCES, LUCKNOW

EFFICACY OF OIL PULLING ON HALITOSIS AND PLAQUE INDUCED GINGIVITIS: A RANDOMISED CLINICAL STUDY

DISSERTATION

Submitted to

BABU BANARASI DAS UNIVERSITY,

LUCKNOW, UTTAR PRADESH

In the partial fulfilment of the requirements for the degree

of

MASTER OF DENTAL SURGERY

in

PERIODONTOLOGY

By

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Under the guidance of

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Batch 2020-2023

Year of submission - 2023

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Document Information

Analyzed document	sumati merged thesis 2.pdf (D158130740)
Submitted	2023-02-08 09:28:00
Submitted by	Dr Mona Sharma
Submitter email	mariona2@bbdu.ac.in
Similarity	4%
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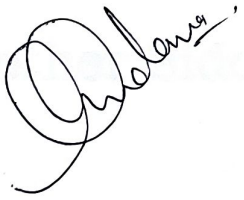

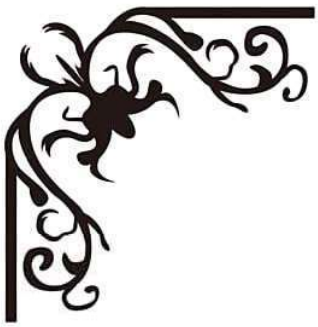

Dedicated To my Parents

Mr. Subodh Kumar & Mrs Soma Kumar

&

my Brother Siddharth Patel

Acknowledgement

॥ "दुग्धेन धेनुः कु सुमेन वल्ली शीलेन भार्गा कमलेन तोर्म् । गुरुं ववना भावत न चौव वशष्युः शमेन ववद्या नगरी जनेन ॥

Almighty GOD, we acknowledge our dependence on Thee and we beg Thy blessings upon us, our parents, our teachers and humanity.

I think human beings make life beautiful. There's a lot of beauty in everything. I think what makes life beautiful is the ability to ACKNOWLEDGE them.

Any dissertation is like a dream, the success of which depends largely on the encouragement and guidelines of many others. The dream begins with a teacher who believes in you, who tugs and pushes and leads you to the next plateau, sometimes poking you with a sharp stick called "truth". I found such great teachers in ***Dr Vandana A Pant*** *(Professor, Department of Periodontology, Babu Banarasi Das college of dental sciences). I can't say thank you enough for their tremendous support and help. I am amazinglyfortunate to have an advisor like her who taught me to explore on my own, and at the same time gave the guidance to recover when my steps faltered. I feel motivated and encouraged by your mere presence. She taught me how to question thoughts and express ideas. It's an honour to have such teachers and I shall forever be indebted to them for their critical evaluation towards perfection which has sculptured me and made me do things better. Their patience and support helped me overcome many crisis situations and finish this dissertation.*

I owe my most sincere gratitude to my respected ***Dr Sunil C Verma, Reader****, Babu Banarasi Das College of dental Sciences for his valuable suggestions, constant encouragement and support all the times.*

I take this opportunity to sincerely thank ***Dr Puneet Ahuja****, Principal, Babu Banarasi Das college of dental sciences for their timely advice, practical assistance during my post-graduation& providing the necessary facilities to carry out this dissertation work. I would also thank to* ***Dr Puneet Ahuja sir*** *Principal, Babu Banarasi Das College of dental sciences for their support and guide to carry out this dissertation work.*

My deepest gratitude is to ***Dr Mona Sharma,*** *Professor Department of periodontics, Babu Banarasi Das College of Dental Science for their patience and support that helped me to overcome many crisis situations and finish this dissertation.*

I also take this opportunity to express a deep sense of gratitude to ***Dr Suraj and Dr Neelesh Singh, Reader****, Department of periodontics, Babu Banarasi Das College of Dental Science for their insightful observations and constructive criticism were thoughts provoking and they helped me focus my ideas. Their perpetual energy and enthusiasm have motivated me not to mention he ever willingness to help me in dissertation.*

I am also thankful to the generosity of ***Dr Akanksha kashyap, senior Lecturer, Dr Meghna Nigam , Dr Md Aamir, Dr Piyush Gaurav, Dr Akansha Pandey & Dr Shlagha*** *senior Lecturer for their eternal and persistent navigation.*

I must of course extend my thanks to my co-pg. ***Dr Ankit Bhadani, Dr Shaifali, Dr Jigme P Dengzopa, Dr Rahul Anand & Dr Snigdha Biswas*** *for their timely help and moral support during my moments of despair. A very special mention about my seniors* ***Dr Dilip Maurya, Dr Pallavi Goswami & Dr Chetan Choudhary for*** *their invaluable guidance and suggestions****. Also, to my Juniors Dr Akriti, DrArti, Dr Bhibhuti, Dr Deepika, Dr Dikishita and Dr Hiya.***

Very Special thanks to my colleague ***Dr Shahnika, Dr Rakhee, Dr Roopali, Dr Bhanu, Dr Rajatava, Dr Piyush and Dr Bibhav*** *for their constant support and I appreciate them for their unfazed affection.*

It would be blasphemous if I do not remember my family at this juncture. As they say: "Callit clan, call it network, call it a tribe, call it a family. Whatever you call it, whoever you are, you need one." I am grateful to God for giving me such a wonderful family. Words cannot suffice to express my gratitude to my parents, ***Mr. Subodh Kumar, Mrs. Soma Kumar and my brother Siddharth Patel who*** *always stood by me in difficult time, & for making me what I am today, for their perseverance, constant struggle and for being inspiration of my life since my childhood.*

I convey my deep love and thank to The Almighty God for giving me this blissful life where I can make a significant change in people's lives. Thank you all for being there and staying put.

REGARDS,

Dr. SUMATI PATEL

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S No.	Abbreviations	Full form
1.	CHX	Chlorhexidine
2.	OPD	Out Patient department
3.	PI	Plaque index
4.	GI	Gingival index
5.	VSC	Volatile Sulphur compounds
6.	PHP	Patient hygiene performance
7.	ORG	Organoleptic breath assessment
8.	BOP	Bleeding on probing
9.	CFU	Colony forming Units
10.	BI	Bleeding index
11.	MUFA	Monounsaturated fatty acids
12.	PUFA	Polyunsaturated fatty acids
13.	LA	Linolenic acid
14.	ALA	Alphalinolenic acid
15.	FFA	Free fattyacids
16.	SI	Stain index
17.	VCO	Virgin Coconut Oil
18.	PO	Palm Oil
19.	SRP	Scaling & Root Planing
20.	MS	Mutans Streptococci
21.	SD	Standard Deviation
22.	VAS	Visual Analogue Scale
23.	DI	Debris Index
24.	OHI	Oral Hygiene Index
25.	ABC	Anaerobic Bacterial Colony
26.	ANOVA	Analysis Of Variance

ABSTRACT

ABSTRACT

Objectives: Edible oils have been found to be effective in reducing gingivitis and other periodontal problems. This present study has been taken up to study the effect of most commonly used edible oils in our country i.e. mustard oil & coconut oil for its effect on gingivitis, plaque & halitosis. The results were compared with 0.2% CHX mouthwash.

Materials & methods: Thirty volunteers were selected on the basis of inclusion & exclusion criteria. Three groups were made with 10 subjects each.
Group A- 10 subjects using mustard oil pulling
Group B- 10 subjects using coconut oil pulling
Control group- 10 subjects using 0.2% CHX mouth rinse.

The GI, PI & halitosis were measured at baseline, 7, 14 & 21 days. The effects were compared with 0.2% CHX. The statistical analysis was carried out using t-test & ANOVA.

Results: There was significant reduction in all the parameters of all the groups at 7^{th}, 14^{th} & 21^{st} days from baseline.($p<0.001$)

Conclusions: Both the oils i.e. mustard oil & coconut oil showed significant improvement in gingival health, oral hygiene & halitosis. The results were comparable to that of 0.2% CHX.

INTRODUCTION

INTRODUCTION

The mouth is thought of as a reflection of the body's general health. Innumerable number of microorganisms reside in the mouth cavity, some of which lead to development of systemic diseases like cardiovascular conditions, diabetes mellitus, etc[1]. There are connections between oral and overall health[2]. Therefore, it is imperative to preserve oral health. Scientists are investigating natural products as a result of antibiotic resistance, side effects, and toxicity of contemporary medications.

The terms halitosis, breath malodor, or bad breath are used to denote unpleasant breath odor. These terms are not synonymous with oral malodor, which has its origin only from the oral cavity. Halitosis is a significant social problem but most patients who complain about the problem seek proper advice and treatment after several months or years. One in four persons usually experience bad breath at some point in his/her life. It has a significant socioeconomic impact but unfortunately is neglected by a large section of society.

Halitosis can lead to personal discomfort & social embarrassment & is still considered as one of the biggest taboos of society. Nearly 85% of the cases of halitosis have the cause originating from the oral cavity. It mainly occurs due to volatile sulphur compounds present in food. The main contributing factors[3] include tongue coating, periodontitis and gingivitis. Pathologies of the ear, nose, and throat, systemic conditions such diabetic, metabolic, hormonal, renal, or hepatic abnormalities, bronchial carcinoma, or gastroenterologic pathologies are examples of causes occurring outside oral cavity[4].

Gingivitis is a common and the mildest form of the periodontal disease[5] usually caused due to inadequate oral hygiene. It is characterized by inflammation, bleeding, and swelling of the gums. The main etiology of gingivitis is an accumulation of plaque on the surface of teeth and gums.

Plaque-induced gingivitis is an infection of the gums brought on by bacteria on the margins of the gum. In gingivitis induced by plaque, premature modification of the gingival health status cannot be clinically assessed; however, when gingivitis progresses, clinical symptoms and indicators become more noticeable. The inflammatory process may manifest as either an acute or chronic condition. When the pathogenic harm is not eliminated and/or when the

organism's defences are not able to quickly remove the cause of the damage or the harm caused, the condition becomes chronic.

In a global scenario, gingivitis begins in early childhood aged 3–11 years, and the prevalence rises to 70–90% at puberty.[6] Oral hygiene maintenance is very important for all individual and it includes mechanical tooth cleaning with the additional adjunctive use of chemical/herbal agent for reducing the plaque formation.

Various chemical plaque control agents like mouthwash have their own disadvantages like brown staining of teeth and oral appliances, temporary alteration of taste, oral dryness, and burning sensation of oral mucosa. Mouthwash containing alcohol has the potential to aggravate halitosis[7] and cause dry mouth.

Alcohol-containing mouth rinses also induces some level of greater cell damage when compared with alcohol-free mouth rinses hence they should be used judiciously during and after surgical procedures. However, Gupta V et al[8] conducted a study to investigate the oral mucosal safety of widely used alcohol- and non-alcohol-based mouth rinses and found no statistically as well as biologically significant adverse responses of both alcohol-based and alcohol-free mouth rinses at clinical and cytological level.

Herbal mouthwashes, derived from botanical sources, have been applied in dental practice since a long time to inhibit microorganisms, reduce inflammation, soothe irritation, and relieve pain[9]. Compared with the antimicrobial mechanisms by synthetic chemicals, herbal mouthwashes have additional anti-inflammatory and antioxidant properties, which may further improve gingival health[10]. They are designed and prepared with extracts and essential oils from phyto therapeutic plants, containing a mixture of active agents such as catechins, tannins, and sterols. The blend of natural compounds inside the herb- or plant-derived substances usually performs gentle remedial effects.

Most of herbal mouthwashes have been shown to potentially aid in reducing plaque and inflammation for gingivitis patients as adjunct to daily oral hygiene. The other advantage of using herbal mouthwashes is that they can be used for more than four weeks when compared to CHX mouthwashes as their long term use is not recommended due to its side-effects like

teeth staining, etc. However herbal mouthwashes also have few side effects ranging from some degree of hypogeusia, lightheadedness, and an unpleasant taste in some patients.

Oil pulling is an ancient ayurvedic therapy which has claimed to improve oral hygiene Oil pulling is referred to as Kavala Gandoosha or kavala Graha in the Samhita by Charak and in Arthashastra by Sushrut. Gargling is not possible in the process of Gandoosha as the mouth is entirely filled with oil, but it is conceivable in Kavala Graha because the oil used is present in smaller amount. Oil pulling has been used significantly as a a long-standing traditional treatment for Indian folk for dental problems such as decay, oral malodour, bleeding gums, strengthening teeth, throat dryness and cracked lips. In Ayurveda this process is said to cure about 30 systemic diseases ranging from headache, migraine to hypertension, diabetes, asthma etc. It basically slows down the ageing process.[11]

Dr. F. Karach introduced the idea of oil pulling therapy for the first time in 1990. The oil must be held in the mouth for 5 to 20 minutes during the oil pulling technique, especially in the morning before breakfast. The serving size for adults is one tablespoon and for children it is a equal to a teaspoon. It is necessary to force the oil used for rinsing between each tooth and bring it into touch with every area of the mouth. If the process is done correctly, the finished oil should be thin, viscous, and milky in appearance. It must then be spit out and washed out of the mouth with warm water. It can be carried out by using a variety of oils, including sunflower oil, coconut oil[12], and sesame oil[13] easily at home.

The oil after pulling may contain toxins & microorganisms of oral cavity, it is best to spit it out & avoid swallowing [14] . The ideal position for carrying out oil pulling is in a seated position with the chin held up. Oil pulling is an effective method for maintaining oral hygiene in situations where brushing is a challenge or even dangerous, such as those involving mouth ulcers, fever, a propensity for vomiting, asthma, and other medical disorders.

Various studies have been carried out by many investigators which shows the efficacy of oil pulling. However, there is still paucity of scientific proof to prove them as a treatment adjunct to reduce halitosis and plaque induced gingivitis.

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OBJECTIVES

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The aim of the present study is to evaluate the efficacy of oil pulling in reducing halitosis & plaque induced gingival inflammation.

OBJECTIVES

- To study the effect of oil pulling with coconut oil and mustard oil in reducing the halitosis at different time interval.
- To study the effect of oil pulling with coconut oil and mustard oil in reducing plaque and gingival inflammation at different time interval.
- To study the effect of 0.2% chlorhexidine (control group) in reducing the halitosis, plaque and gingival inflammation at different time interval.
- To compare the efficacy of various oils with that of 0.2% chlorhexidine mouthwash.

REVIEW OF LITERATURE

REVIEW OF LITERATURE

Amit HV et al (2007)[15] conducted a 45 days study to assess the effect of oil pulling on plaque & gingivitis. The study also monitored its safety on oral soft & hard tissues.10 subjects in the age group of 19-21 years performed oil pulling using refined sunflower oil along with their other oral hygiene measures such as brushing & flossing for 45 days. Their plaque & gingival scores were assessed periodically by modified patient hygiene performance index i.e. PHP index & gingival index. Plaque & gingival indices were performed on subjects at baseline 15,30 & 45 days of oil pulling & changes in index scores during study period were compared. Significant reduction in plaque & gingival scores from baseline to 45 days were noted. Also no adverse reactions to any hard & soft tissues of the oral cavity were noticed during the study.

Anand DT et al (2008)[16] conducted a 40 days study to assess the effect of oil pulling on dental caries causing bacteria.10 subjects were asked to swish their mouth with sesame oil for 3-20 minutes. The effect of oil pulling on the susceptibility of a host to dental caries was determined by Snyder method (Snyder, 1941). The test was performed after 40 days of oil-pulling. They observed 20% reduction in bacterial count upon 40 days of oil pulling using sesame oil. Also they observed reductions in the severity of dental caries. Sesame oil was observed to possess moderate antimicrobial activity against S. mutans and L. acidophilus.It was also observed that toxins and bacteria from the body might be expelled through the tongue and trapped in the oil and removed from the body.

Asokan S et al (2009)[17] conducted a 10 days study to evaluate the effect of oil pulling with sesame oil on plaque-induced gingivitis and compared its efficacy with chlorhexidine mouthwash. A total of 20 subjects with plaque-induced gingivitis were selected for this study. They were divided randomly into 2 groups: The study or oil pulling group (Group I) and the control or chlorhexidine group (Group II). Plaque index and modified gingival index scores were recorded and baseline plaque samples were collected. The plaque samples were used to identify the microorganisms and to measure the total colony count of the aerobic microorganisms present. Reassessment of the index scores and collection of plaque for measuring the colony count of the aerobic microorganisms was done after 10 days. There was a statistically significant reduction of the pre- and post-values of the plaque and modified

gingival index scores in both the study and control groups (P < 0.001 in both). There was a considerable reduction in the total colony count of aerobic microorganisms present in both the groups. The study concluded that the oil pulling therapy showed a reduction in the plaque index, modified gingival scores, and total colony count of aerobic microorganisms in the plaque of adolescents with plaque-induced gingivitis.

Asokan S et al (2011)[18] conducted a 14 days study to evaluate the effect of oil pulling with sesame oil on halitosis and the microorganisms that could be responsible for it and compared its efficacy with chlorhexidine mouthwash. 20 healthy adolescents having mild to moderate plaque induced gingivitis were taken & divided into two groups. First group performed oil pulling with sesame oil for 15 mins before brushing every morning for 14 days & second group performed swishing with 0.2% chlorhexidine mouthwash for 1 min every morning for 14 days. The following parameters were assessed: marginal gingival index, plaque index, organoleptic breath assessment (ORG 1), self-assessment of breath (ORG 2), and BANA test from tongue coating samples on days 0 and 14 of the experimental period. There was a definite reduction in the ORG 1, ORG 2 scores, and BANA test score in both group I and II. But only the self-assessment breath score (ORG 2) showed statistically significant reduction in group I.

Sood P et al (2014)[19] conducted a three weeks study to compare the efficacy of oil pulling and chlorhexidine in reducing oral malodor and microbes on 60 participants. The study was randomized into two intervention groups namely chlorhexidine group, sesame oil and one control (placebo) group. The parameters recorded at the baseline (day 0) and post intervention on day 22 were plaque index (PI), gingival index (GI), objective (ORG1) and subjective (ORG2) organoleptic scores and anaerobic bacterial colony (ABC) count. There was significant reduction ($p<0.05$) in the mean scores of all the parameters within sesame oil and chlorhexidine group. Post hoc test showed significant difference ($p<0.001$) in mean organoleptic scores of sesame oil and placebo and chlorhexidine and placebo group. No significant difference ($p<0.05$) was observed between sesame oil and chlorhexidine group. It was concluded that oil pulling with sesame oil is equally efficacious as chlorhexidine in reducing oral malodor and microbes causing it.

Peedikayil FC et al (2014)[20] conducted a 30 days study to check efficacy of coconut oil on plaque induced gingivitis.60 adolescents of age group 16-18 years performed oil pulling with coconut oil in early morning at empty stomach in addition to their routine oral hygiene measures. Modified gingival index & plaque index by Sillness & Loe were measured at baseline & on day 1,7,15 & 30 days. Steady declines in indices was found from day 7. Plaque & gingival indices significantly decreased after 30 days of oil pulling. The study observed 50% decrease in gingival & plaque indices after 4 weeks which is comparatively similar to results produced by Chlorhexidine. They concluded that oil pulling with coconut oil is helpful in reducing plaque formation & plaque induced gingivitis.

Dani et al (2015)[21]conducted a 14 days study to evaluate the anti-plaque effect of sesame oil pulling & its influence on plaque induced gingivitis as compared to Chlorhexidine mouthwash. 40 subjects with plaque induced gingivitis were treated with scaling & root planning prior to conducting the study. Following this randomly 20 subjects performed oil pulling procedure with sesame oil for 14 days (test group) on empty stomach every morning & the rest 20 subjects used Chlorhexidine mouthwash for 14 days (Control group) for 30 seconds twice a day. Plaque scores using Plaque & Gingival index & Colony forming unit count of bacteria were assessed at baseline & after 14 days. Significant reduction in plaque index scores, gingival index scores & total colony counts of aerobic microorganisms in patients with plaque induced gingivitis was observed. The study concluded that oil pulling is quite effective against plaque induced gingivitis in adjunct to scaling & root planning.

Jauhari D et al (2015)[22] conducted a 2 weeks study to evaluate and compare the antimicrobial activity of oil pulling, herbal mouth rinses and fluoride mouthwash on the caries activity and S. mutans counts in the saliva of children, using Oratest and Dentocult SM kit. Fifty-two healthy children between the age group of 6 to 12 years were selected for the study and divided into four groups based on the mouth rinse used as group 1: fluoride, group 2: herbal, group 3: oil pulling and group 4: control. The estimation of caries activity and S. mutans was done prior to and after the subjects were instructed to use the mouth rinse twice daily for a period of 2 weeks. The comparisons were made by applying paired 't' test with the level of significance set at $p < 0.05$. The efficacy of fluoride and herbal mouth rinses was found to be comparable while oil pulling did not provide any additional benefit to be used as an effective antimicrobial agent in reducing the bacterial colonization of an individual.

Sheikh F et al (2016)[23] conducted a 14 days study to evaluate the effects of oil pulling with rice bran oil, sesame oil, and chlorhexidine mouth rinsing on reducing halitosis among pregnant women.30 pregnant women were selected & divided into 3 groups comprising of 10 pregnant women each. First two groups comprising 20 women were given 15ml of rice bran & sesame oil respectively & were asked to swish mouth with it for 10 mins & then expectorate it. Third group comprising 10 women were asked to swish mouth with 0.2% chlorhexidine mouthwash. Halitosis was measured at baseline and after 14 days of intervention using TANITA breath checker HC-212M-BL. There was a statistically significant reduction in the grades of halitosis at baseline and 14 days after intervention for all the three groups. No statistically significant difference between chlorhexidine mouth rinsing, oil pulling with sesame oil, and with rice bran oil in halitosis reduction was observed. It was concluded that rice bran oil when used in oil pulling was effective in reducing halitosis.

Kaushik M et al (2016)[24] conducted a 14 days study to evaluate the effect of coconut oil pulling on the count of Streptococcus mutans in saliva and to compare its efficacy with that of Chlorhexidine mouthwash: in vivo. A randomized controlled study was planned and 60 subjects were selected. The subjects were divided into three groups, Group A: Oil pulling, Group B: Chlorhexidine, and Group C: Control group: Distilled water. Group A subjects rinsed mouth with 10 ml of coconut oil for 10 minutes. Group B subjects rinsed mouth with 5 ml Chlorhexidine mouthwash for 1 minute and Group C with 5 ml distilled water for 1 minute in the morning before brushing. Saliva samples were collected and cultured on 1st day and after 2 weeks from all subjects. Colonies were counted to compare the efficacy of coconut oil and Chlorhexidine with distilled water. Statistically significant reduction in S. mutans count was seen in both the coconut oil pulling and Chlorhexidine group. The study concluded that oil pulling can be explored as a safe and effective alternative to Chlorhexidine.

Indurkar MS et al (2016)[25] conducted a 3 weeks study to evaluate the effect of ozonated oil on plaque induced gingivitis and to compare its efficacy with chlorhexidine. 20 subjects, with plaque-induced gingivitis were selected for this study. They were divided randomly into the test or ozonated oil group (Group I) and the control or chlorhexidine group (Group II) with 10 subjects in each group. Subjects were randomly assigned to swish thrice a day for 3 weeks with ozonated oil (test), and chlorhexidine (control). Plaque index and gingival index scores were recorded for the 20 subjects at baseline and after 3 weeks. Ozonated oil (Group I) and chlorhexidine (Group II) groups showed statistically significant differences with respect to

plaque index and gingival index, from the baseline to 3 weeks($P < 0.001$ in both). But the difference between Group I and Group II, at the end of the study period, was not statistically significant with respect to the plaque index and gingival index. It was concluded that the ozonated oil and chlorhexidine mouthwash, both can be used as an effective agent in maintaining and improving gingival health.

Chalke et al (2017)[26] conducted a 30 days study to evaluate the efficacy of coconut oil pulling on plaque induced gingivitis.75 Participants were instructed to use one tablespoon (5 ml) of edible coconut oil for mouth swishing on empty stomach in the morning before brushing. They were asked to swish till the initially viscous oil becomes thin and milky white. Most widely used indices in clinical trials for therapeutic agents, i.e., gingival index by Loe and Sillness and plaque index by Sillness and Loe were used for clinical assessment in the study. Subjects were instructed to perform the procedure once daily in the morning for 30 consecutive days. All the study subjects were recalled at the interval of 15th day and 30th day for a reassessment of clinical parameters and reinforcement of oral hygiene instructions. A gradual statistical significant decrease in pre- and post-treatment scores of plaque and gingival index was noticed from baseline to 15th and 30th day. It was concluded that coconut oil pulling used as an adjunctive oral hygiene aid is effective in decreasing plaque formation and subsequent plaque-induced gingivitis.

Nagilla J et al (2017)[27] conducted a 7 days study to compare and evaluate antiplaque efficacy of coconut oil pulling with a placebo among 40 dental students. Subjects in the study group were given the coconut oil and control group a placebo, and advised to rinse for 10 minutes, once daily in the morning for a period of seven days. Plaque levels were assessed on day zero, third and seventh day using Turesky-Gilmore-Glickman Modification of the Quigley-Hein Plaque Index (1970) for both the groups. The mean plaque scores showed a significant difference at baseline, third day and seventh day among both study ($p<0.001$) and control groups ($p<0.001$). Group wise comparison revealed, though the mean plaque scores were low among study group on third day and seventh day on comparison with the control group, significant difference was noticed only on the seventh day. Furthermore, the mean percentage reduction of plaque scores were also significant only on the seventh day with a high mean plaque reduction among study groups ($p<0.001$). It was concluded that oil pulling is effective in controlling plaque levels.

Kandaswamy S et al (2018)[28] conducted a 30 days study to evaluate the effectiveness of a probiotic mouthwash, sesame oil pulling therapy, and chlorhexidine-based mouth-wash on plaque accumulation and gingival inflammation in 45 schoolchildren aged 10 to 12 years. 15 children in taken in each group as follows: group I: probiotic mouthwash; group II: chlorhexidine mouthwash; and group III: sesame oil. Baseline scores of plaque index (PI) and modified gingival index (GI) were recorded followed by a full mouth oral prophylaxis. Children's acceptance of their plaque control method was assessed using a modified facial image scale. Intragroup comparisons for both the GI and PI scores were statistically significant ($p \leq 0.001$) in all the three groups. Difference in the GI scores between the 15th and 30th day was statistically significant for chlorhexidine group alone ($p = 0.024$). Intergroup comparisons between the three groups were not statistically significant. It was concluded that Probiotic mouthwash, chlorhexidine mouthwash, and sesame oil were equally effective in reducing plaque and in improving the gingival status of children. The difference between the gingival scores on the 15th and 30th day was statistically significant in the chlorhexidine group.

Yasemin Sezgin et al (2019)[29] conducted a 4 days study to evaluate the plaque- inhibiting effects of oil pulling using plaque regrowth study model compared to 0.2% chlorhexidine gluconate (CHX) containing mouth rinse. The study involved 29 volunteers to compare 0.2% CHX and oil pulling therapy in a 4- day plaque regrowth model. After the preparatory period, in which the subjects received professional prophylaxis, the subjects commenced rinsing with their allocated rinsed. On day 5 plaque index (PI), gingival index (GI), stain index (SI), bleeding on probing (BOP) were recorded from the subjects. Oil pulling therapy presented similar inhibitory activity on plaque regrowth compared with CHX ($PI = 1.67 \pm 0.24$, 1.61 ± 0.20, respectively) with less staining ($SI = 0.21 \pm 0.13$, 0.47 ± 0.27, respectively). In addition, GI and BOP was similar in both groups ($p > 0.05$). The study concluded that oil pulling with coconut oil seems to have similar plaque inhibition activity as CHX. In addition it caused less tooth staining than CHX. These findings suggest that oil pulling therapy may be an alternative to CHX rinse.

Vandhana VC et al (2019)[30] conducted a 1 month study to evaluate the effectiveness of sesame oil (SO), ozonated SO (OSO), and chlorhexidine (CHX) mouthwash on the oral health status of adolescents. A total of 75 adolescents aged 12-14 years with decay-missing-filled index ≤ 3 were randomly assigned to three groups ($n = 25$): Group I (SO), Group II (OSO),

and Group III (CHX mouthwash). Baseline (T1) Debris Index (DI-S), Calculus Index (CI-S), Oral Hygiene Index-Simplified (OHI-S), Plaque Index (PI), and salivary Streptococcus mutans count were recorded. All the groups were subjected to intervention with the respective mouth rinses for 15 days. The index scores and the salivary S. mutans count were reassessed after 15 days (T2) and 1 month (T3), and the results were statistically analyzed. The statistical analysis was done using IBM SPSS Statistics for Windows. The statistical significance was set at $P \leq 0.05$ All the groups showed statistically significant reduction in DI-S, CI-S, OHI-S, PI, and S. mutans count after 15 days.

Salian V et al (2019)[31] conducted a 21 days pilot study to evaluate the efficacy of oil pulling therapy using virgin coconut oil (VCO) in reducing *S. mutans* counts, plaque, and gingival indices, and to compare it with the gold standard chlorhexidine. 20 subjects (study) using VCO and 20 subjects using chlorhexidine (control) were chosen for the study. The gingival and plaque indices (baseline) in both groups were recorded following which unstimulated whole saliva samples were collected by spit method and sent for microbial count.3 weeks post-intervention, the recording of indices was repeated for both groups along with the microbial count. It was found that the mean values of gingival and plaque indices pre- and post-intervention showed a statistically significant reduction in the control population compared with the study group, while there was no statistically significant reduction in the bacterial count seen. The difference in the scores of plaque index pre- and post-intervention was more in control group while the difference in the gingival index was similar in both groups, but statistically insignificant. It was concluded that Virgin coconut oil may not be as effective as chlorhexidine in reducing plaque while it may be as effective as chlorhexidine in reducing gingival index.

Kode S et al (2019)[32] conducted a 15 days study to evaluate the efficacy of Coconut Oil as an adjunct to scaling in diabetic patients with chronic gingivitis. 60 Diabetic patients with Chronic Gingivitis were divided into 3 groups: Group A:Scaling and root planing only (n=20), Group B: Scaling and root planing followed by Coconut Oil Pulling Therapy (n=20) and Group C: Scaling and root planning followed by rinsing with 0.2% Chlorhexidine mouthwash (n=20). The following clinical parameters were recorded at baseline after SRP and 15 days post-treatment : Plaque index (P.I.), Gingival index (G.I.) & Total colony forming units (CFU/ml). The method used for statistical analysis was repeated measure ANOVA followed by post-hoc test. The results of the study demonstrated the difference in the

reduction of all the scores to be clinically significant and not statistically significant. Thus, the study shows the positive effects of coconut oil pulling in the control and prevention of progression of gingival disease.

Ripari F et al (2020)[33]conducted a pilot study to evaluate the coconut oil pulling efficacy as adjuvant in reducing plaque formation and in treating plaque-induced gingivitis. A sample of 20 patients was divided into two groups: a study and a control group. In the study group, coconut oil, in form of mouthwash, was administered to a sample of patients affected by gingivitis, aged between 18 and 35. The protocol established a daily application of the product for 30 days, where clinical parameters for plaque formation and gingivitis-plaque index (PI), bleeding index (BI)-will be evaluated during the recalls on a specific periodontal chart. The control group did not associate a co adjuvant to the normal daily oral health procedures and the same clinical parameters were evaluated at t0 and after 30 days (t1). The data were statistically analyzed using Student's *t*-test, establishing the significance level as $p < 0.05$. PI and BI decreased in both groups, with a more relevant and significant drop in the study group, from a mean value of PI of 58.0 to 19.3 and a mean value of BI of 33.5 to 5.0. In the control group, the values decreased, respectively, from 53.9 to 29.1 for PI, and from 33.5 to 16.2. Furthermore, no significant side effect was reported during coconut oil pulling therapy. The study showed significant and promising improvements in reducing plaque formation and gingivitis. However, further researches have to be performed to have more consistent and statistically significant data on larger samples and to fully understand the mechanisms of action and effectiveness.

Greissl T et al (2021)[34] conducted a pilot study aimed at the high-resolution examination of the oral microbiome depending on oil pulling, compared it with saline pulling, and analyzed whether the method is capable of reducing the overall microbial burden of the oral cavity. The study was a cohort study with three healthy subjects. Oil pulling samples, saline pulling samples, and saliva samples were microscoped and cultured under microaerophilic and anaerobic conditions; colony-forming units were counted; and cultivated bacteria were identified employing MALDI-TOF MS. Microscopy revealed that oral epithelial cells are ensheathed with distinct oil droplets during oil pulling. Oil pulling induced a higher production of saliva and the oil/saliva emulsion contained more bacteria than saline pulling samples. Oil pulling resulted in a significant and transient reduction of the overall microbial burden in comparison to saliva examined prior to and after pulling. It was concluded that oil

pulling can be considered as an enlargement of standard oral hygiene techniques since it has the characteristic of an oral massage, enwrapping epithelial cells carrying bacteria in oil vesicles and reaching almost all unique habitats in oral cavity.

Ludwar L et al (2022)[35] conducted a one week study to determine the subjective effectiveness of oil pulling on medication-induced xerostomia with regard to symptom relief, quality of life, taste, mucosal moisture and oral parameters. They investigated oil pulling efficacy (sunflower oil) versus mineral water after one-week use on 26 participants. Xerostomic burden (visual analogue scale, VAS), symptom relief and oral examinations (gingivitis index, plaque index, whole stimulated and unstimulated salivation rates) were investigated at baseline and the end of the follow-up. Oil pulling reduced the xerostomic burden (baseline value 6.46 (SD 1.80), decreasing to 4.93 (SD 2.97)) (p = .003), without difference between oil versus water (p = .067). Compared to water, oil made swallowing easier (p = .031), caused a pleasant mouthfeel (p = .031) and caused less waking up at night (p = .031). Effectiveness (p = .002) and duration (p = .007) of symptom relief showed differences between products in favour of oil. It was concluded that oil pulling alleviated the overall xerostomic burden.

Siripaiboonpong N et al (2022)[36]conducted a 28 days study to compare the microbiological effects of virgin coconut oil(VCO) with palm oil (PO) pulling when used as an adjunctive oral hygiene care. Thirty-six volunteers with gingival inflammation were randomly assigned to start with (1) VCO (test) and (2) PO (control) interventions in a crossover design. Oil pulling was performed for 28 days adjunctively to oral hygiene routine. The total, aerobic, and anaerobic bacteria and *Mutans streptococci* (MS) counts were recorded. PO pulling demonstrated a significant reduction from baseline of MS count ($P = 0.010$), while VCO pulling showed no significant reduction. There was no statistically significant difference in the mean changes of any microbiological parameters between the two treatments. It was concluded that VCO pulling did not show statistically significant superior benefit against plaque bacteria over PO pulling. Using PO pulling as an adjunctive oral hygiene care may reduce the number of MS, but this requires further investigations.

MATERIALS
&
METHODOLOGY

MATERIALS & METHODS

The current study was carried out at Babu Banarsi Das College of Dental Sciences (BBDCODS), Lucknow, in the Department of Periodontology.

Based on the inclusion and exclusion criteria listed below, 30 patients were chosen from the OPD, Department of Periodontology, BBDCODS. They were split into two groups at random.

I) Test group

GROUP A- 10 subjects performing oil pulling with mustard oil.

GROUP B-10 subjects performing oil pulling with coconut oil.

II) Control group

10 subjects swishing their mouth with 0.2% chlorhexidine mouthwash.

Eligibility Criteria:

- **Inclusion criteria**

1. Subjects with plaque induced generalized mild to moderate gingivitis.
2. Subjects in the age group from 18 to 50 years.
3. Subjects having at least 20 permanent teeth.
4. Systemically healthy patients.
5. Subjects ready to give consent.

- **Exclusion criteria**

1. Subjects with generalized periodontitis.
2. Subjects with systemic diseases.

3. Subjects with dental emergency conditions which needs prompt professional attention. (abscess, swelling , pain, etc)
4. Subjects having history of antibiotic intake since last 3 months.
5. Subjects with systemic conditions that can lead to periodontal problems.
6. Pregnant/lactating women
7. Smokers(past/current)
8. Subjects wearing orthodontic appliances, intraoral artificial prosthesis or with clinically unacceptable bridges or restorations.
9. Subjects having allergy to oil used.

Materials and Equipments Used

1. Coconut oil
2. Mustard oil
3. 0.2% Chlorhexidine mouthwash (Hexidine, ICPA)
4. Mouth mask
5. Mouth mirror
6. Explorer
7. Probe
8. Tweezer
9. Kidney Tray
10. Halimeter (Tanita HC-312F)
11. Tooth picks

Fig 1: Armentarium for the study

Fig 2: Materials used

Plate No 1

Fig 3: Samples Given

Fig 4:Tanita Halimeter HC-312F

Plate No 2

Indices used

The following clinical parameters were assessed at baseline and at 7,14 & 21 days:

1. Plaque Index (PI) of Loe and Sillness 1964

2. Gingival Index (GI)of Silness and Loe 1963

3. Halitosis assessment using halimeter

All clinical measurements were made at four sites per tooth: mesiofacial, mid-facial,

disto-facial, palatal/lingual by the same examiner.

Methodology

At Babu Banarsi Das College of Dental Sciences in Lucknow, the Department of Periodontology undertook a randomised clinical research. To take part in the trial, 30 patients who met the inclusion and exclusion criteria and were systemically healthy were chosen. Each subjects were assigned a specific number and simple random sampling was done using a table of random numbers. Ethical clearance was obtained from Institutional Ethical Committee of Babu Banarsi Das dental college. (BBDCODS/IEC/PERIO/20).

All the patients were informed about the study and its outcome in local language. After this written consent was taken from each subject. The patients were randomly divided into two groups: Test groups & Control group. The test groups were further subdivided into two groups. Group A who performed oil pulling with mustard oil & group B who performed oil pulling with coconut oil. Similarly control group swished their oral cavity with 0.2% chlorhexidine mouthwash.

The study commenced by measurements of baseline Plaque scores and Gingival index scores of all subjects. Halitosis was also checked via Tanita halimeter HC-312F. Supragingival scaling was performed on all patients to remove plaque & calculus. The oil pulling procedure was explained to the patients. The test groups were instructed to perform oil pulling with mustard oil and coconut oil respectively with 10 ml quantity immediately after brushing in the morning for 1 minute daily for a period of 21 days. Similarly, control group were told to swish their mouth with 10 ml of 0.2% Chlorhexidine mouthwash for 1 minute daily for the next 21 days.

Tanita halimeter HC-312 F is a portable sulphide monitor used for detection of volatile sulphur compounds (VSC) present in breath of the patient. Volatile sulphur compounds are generally present in food items like garlic, onion, meat, eggs, radish ,etc. It displays the information below: 0 indicates no odour, 1 is a slight odour, 2 is a moderate odour, 3 is a heavy odour, 4 is a strong odour, and 5 is an intense odour; e: error. Please try again. The display readings are in an ordinal scale, with the reading proportional to the intensity of volatile sulfur compounds when one breathes into the sensor in the device at a distance of 1 cm from the sensor. The time of breathing is regulated by a beep sound. Readings were taken approx. 2 hours after oil pulling procedure. In case of any discrepancy in reading, re-readings was done to improve the reliability of the instrument. Organoleptic assessment was also carried out using toothpicks for each patient to authenticate the halimeter.

The patients were educated & motivated regarding the benefits of performing oil pulling. Plaque accumulation were measured via Plaque Index (PI) of Loe H and Sillness J (1964). Similarly Gingival index by Loe H & Silness J (1963) was used to assess the severity of gingivitis. Plaque & gingival scores were re-assessed after 7, 14 & 21 days of study. Halitosis was also recorded after 7,14 & 21 days.

At the conclusion of the study, a statistician statistically analysed all the data that had been gathered, and the results were then evaluated.

RESULTS

RESULTS

I) MUSTARD OIL

A) MEAN OF AGE

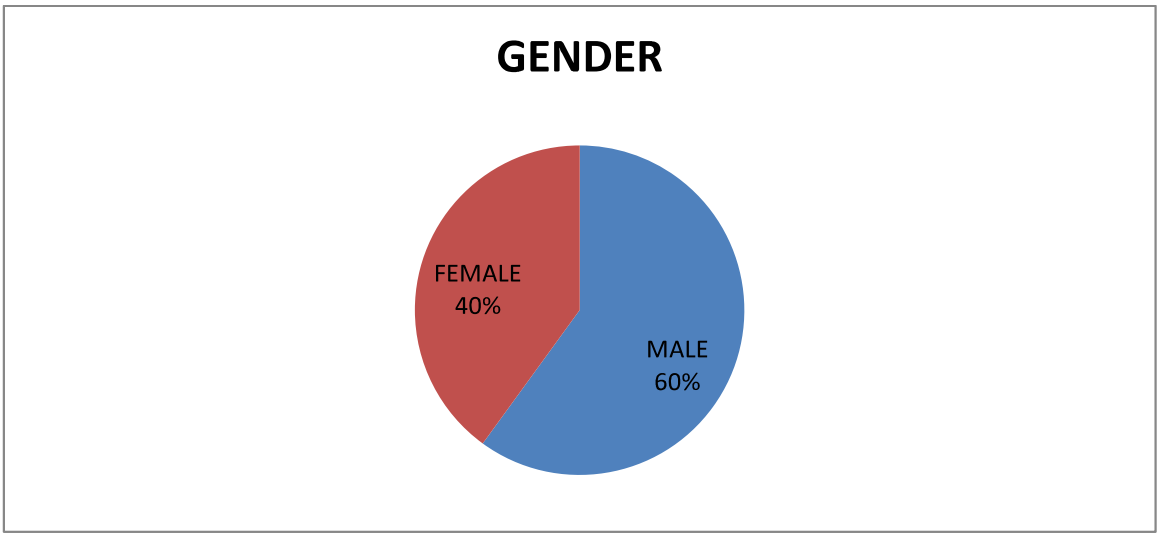
AGE	Mean	Std. Deviation
	32.60	5.103

Mean ± SD age of subjects was 32.60±5.103

B) DISTRIBUTION OF GENDER

GENDER	Frequency	Percent
MALE	6	60.0
FEMALE	4	40.0
TOTAL	10	100.0

FIG-11 Gender distribution for mustard oil



Among the total subjects, maximum 6(60%) subjects were males and 4(40%) subjects were females.

TABLE 1) COMPARISON OF MUSTARD OIL PULLING ON PLAQUE INDEX AT DIFFERENT TIME INTERVAL

TIME INTERVAL	Mean	Std. Deviation	MEAN DIFFERENCE	pvalue
BASELINE	1.6030	.10573	.24000	0.001
7TH DAY	1.3630	.08667		
BASELINE	1.6030	.10573	.31700	0.001
14TH DAY	1.2860	.05481		
BASELINE	1.6030	.10573	.48500	0.001
21ST DAY	1.1180	.08904		

Test – paired t test, $p<0.001$ highly significant

GRAPH- A

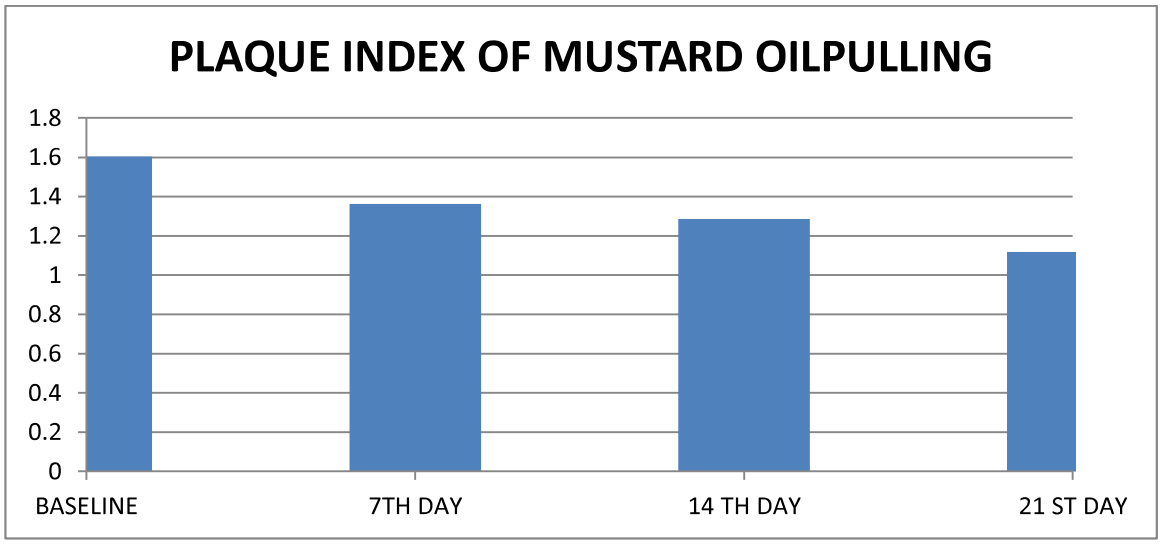


Table 1 and graph A shows the comparison of mustard oil pulling on plaque index at different time interval. Plaque index at baseline, 7th day, 14th day and 21st day was 1.6030±.10573, 1.3630±0.8667, 1.2860±.05481 and 1.1180±.08904 respectively. Results were found to be statistically significant when comparing mustard oil pulling on plaque index at different time interval by using paired t test

TABLE 2) COMPARISON OF MUSTARD OIL PULLING ON GINGIVAL INDEX AT DIFFERENT TIME INTERVAL

TIME INTERVAL	Mean	Std. Deviation	MEAN DIFFERENCE	pvalue
BASELINE	1.7380	.21317	.19000	0.001
7TH DAY	1.5480	.16335		
BASELINE	1.7380	.21317	.34300	0.001
14TH DAY	1.3950	.13125		
BASELINE	1.7380	.21317	.47700	0.001
21ST DAY	1.2610	.11695		

Test – paired t test, $p<0.001$ highly significant

GRAPH- B

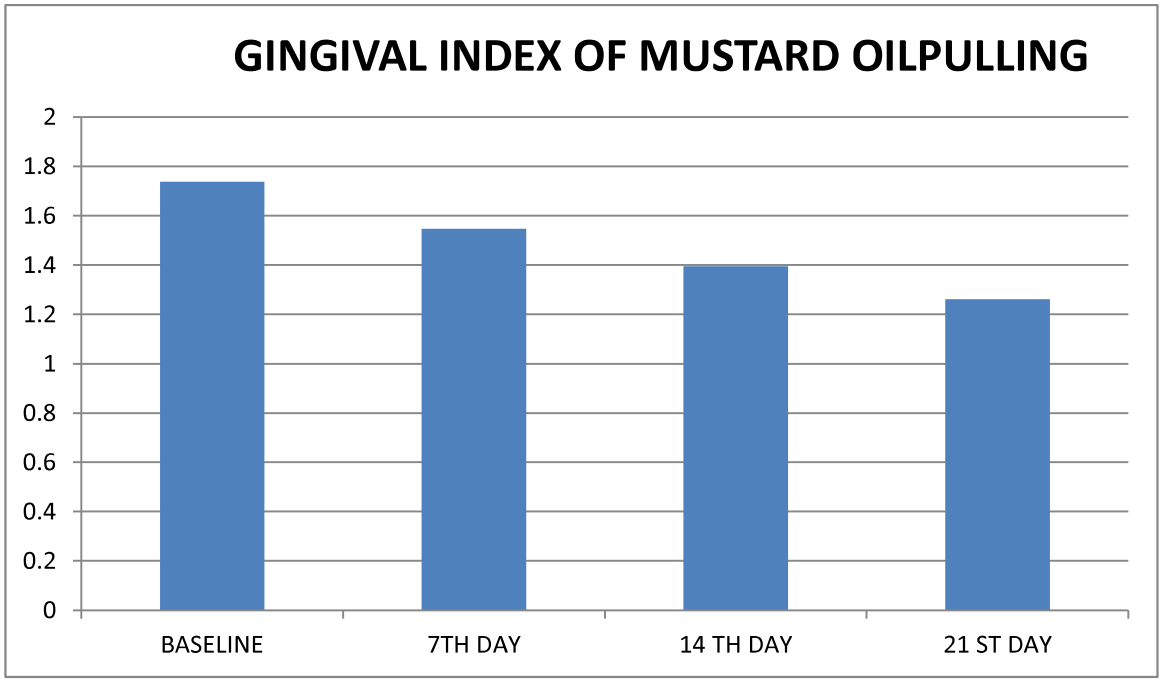


Table 2 and graph B shows the comparison of mustard oil pulling on gingival index at different time interval. Gingival index at baseline, 7th day, 14th day and 21st day was 1.7380±.21317, 1.5480±0.16335, 1.3950±.13125 and 1.2610±.11695 respectively. Results were found to be statistically significant when comparing mustard oil pulling on gingival index at different time interval by using paired t test.

TABLE 3) COMPARISON OF MUSTARD OIL PULLING ON HALITOSIS AT DIFFERENT TIME INTERVAL

TIME INTERVAL	Mean	Std. Deviation	MEAN DIFFERENCE	pvalue
BASELINE	4.40	.699	1.600	0.001
7TH DAY	2.80	.632		
BASELINE	4.40	.699	2.700	0.001
14TH DAY	1.70	.675		
BASELINE	4.40	.699	3.800	0.001
21ST DAY	.60	.516		

Test – paired t test, $p<0.001$ highly significant

GRAPH- C

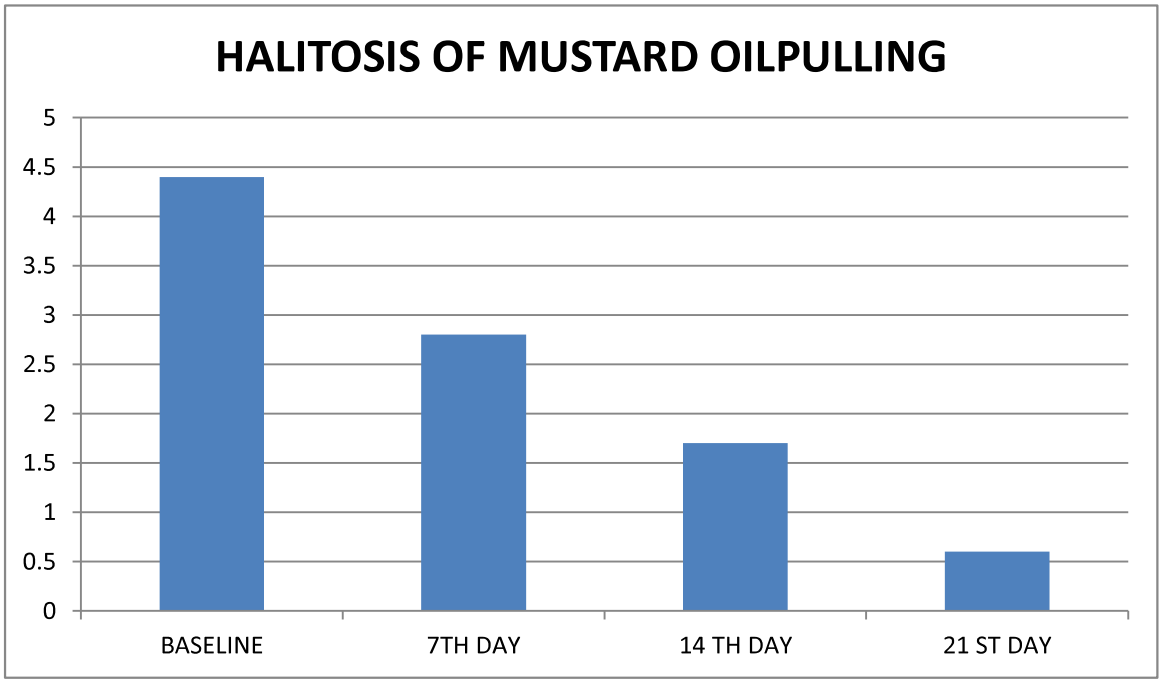


Table 3 and graph C shows the comparison of mustard oil pulling on halitosis at different time interval. Halitosis at baseline, 7th day, 14th day and 21st day was 4.40±.699, 2.80±.632, 1.70±.675 and .60±.516 respectively. Results were found to be statistically significant when comparing mustard oil pulling on halitosis at different time interval by using paired t test.

II) COCONUT OIL

A) MEAN OF AGE

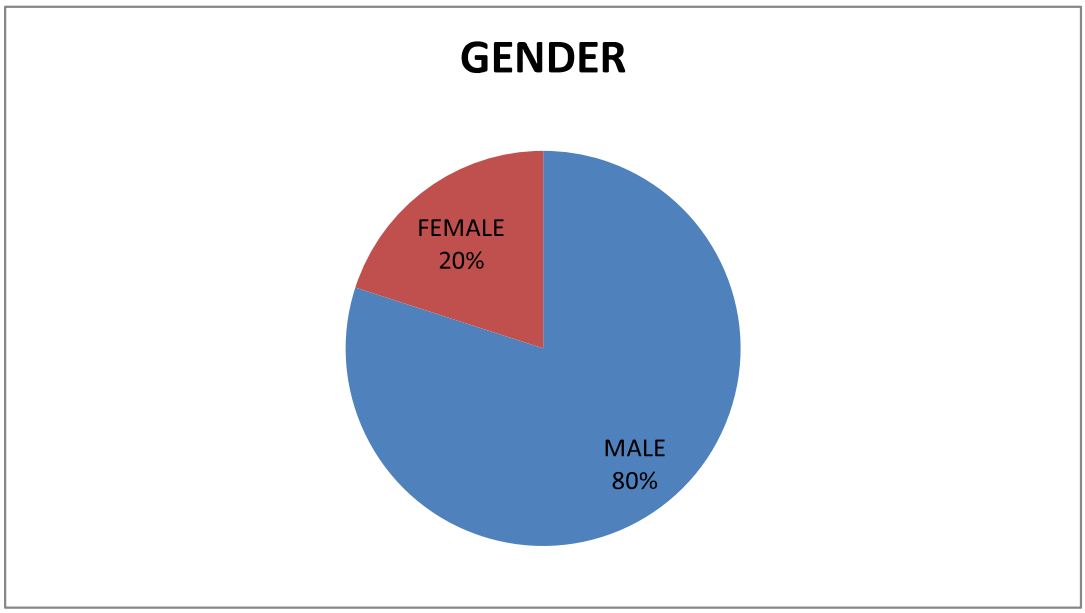
AGE	Mean	Std. Deviation
	30.10	5.705

Mean ± SD age of subjects was 30.10±5.705

B) DISTRIBUTION OF GENDER

GENDER	Frequency	Percent
MALE	8	80.0
FEMALE	2	20.0
TOTAL	10	100.0

FIG-12 Gender distribution for coconut oil



Among the total subjects, maximum 8(80%) subjects were males and 2(20%) subjects were females.

TABLE 4) COMPARISON OF COCONUT OIL PULLING ON PLAQUE INDEX AT DIFFERENT TIME INTERVAL

TIME INTERVAL	Mean	Std. Deviation	MEAN DIFFERENCE	pvalue
BASELINE	2.0380	.13448	.30100	0.001
7TH DAY	1.7370	.10584		
BASELINE	2.0380	.13448	.44100	0.001
14TH DAY	1.5970	.10995		
BASELINE	2.0380	.13448	.65600	0.001
21ST DAY	1.3820	.18335		

Test – paired t test, $p<0.001$ highly significant

GRAPH D

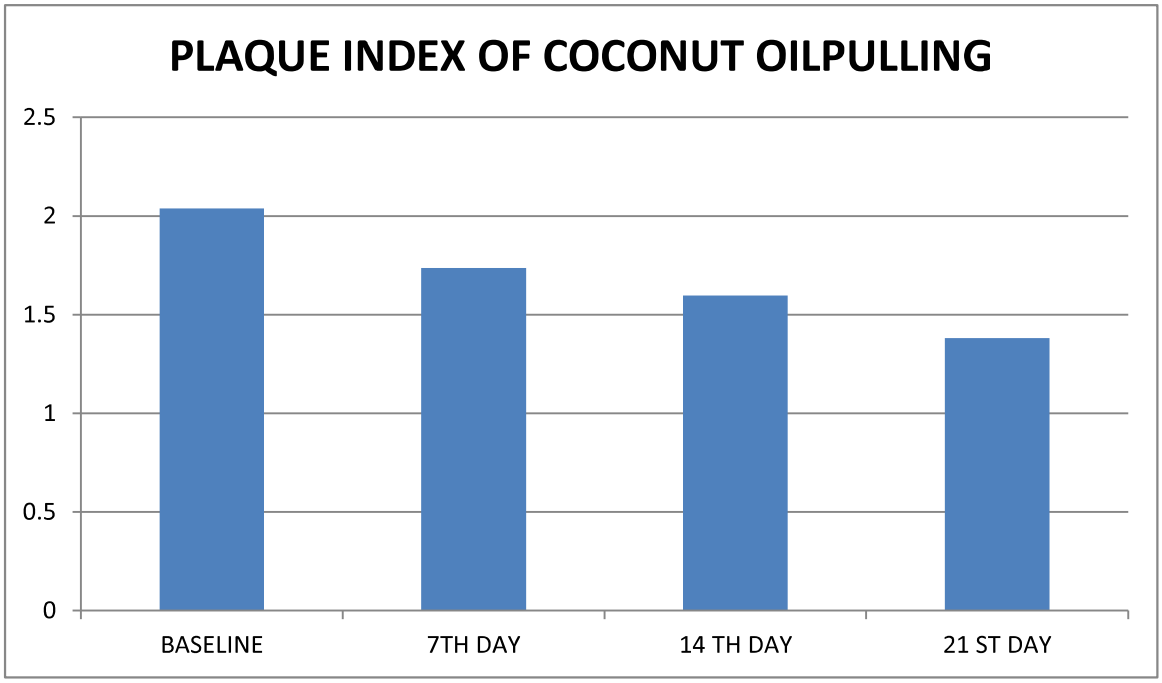


Table 4 and graph D shows the comparison of coconut oil pulling on plaque index at different time interval. Plaque index at baseline, 7th day, 14th day and 21st day was 2.0380±.13448, 1.7370±0.10584, 1.5970±.10995 and 1.3820±.18335 respectively. Results were found to be statistically significant when comparing coconut oil pulling on plaque index at different time interval by using paired t test.

TABLE 5) COMPARISON OF COCONUT OIL PULLING ON GINGIVAL INDEX AT DIFFERENT TIME INTERVAL

TIME INTERVAL	Mean	Std. Deviation	MEAN DIFFERENCE	pvalue
BASELINE	1.8710	.17960	.18400	0.001
7^{TH} DAY	1.6870	.15910		
BASELINE	1.8710	.17960	.34300	0.001
14^{TH} DAY	1.5280	.15598		
BASELINE	1.8710	.17960	.53600	0.001
21^{ST} DAY	1.3350	.18435		

Test – paired t test, $p<0.001$ highly significant

GRAPH E

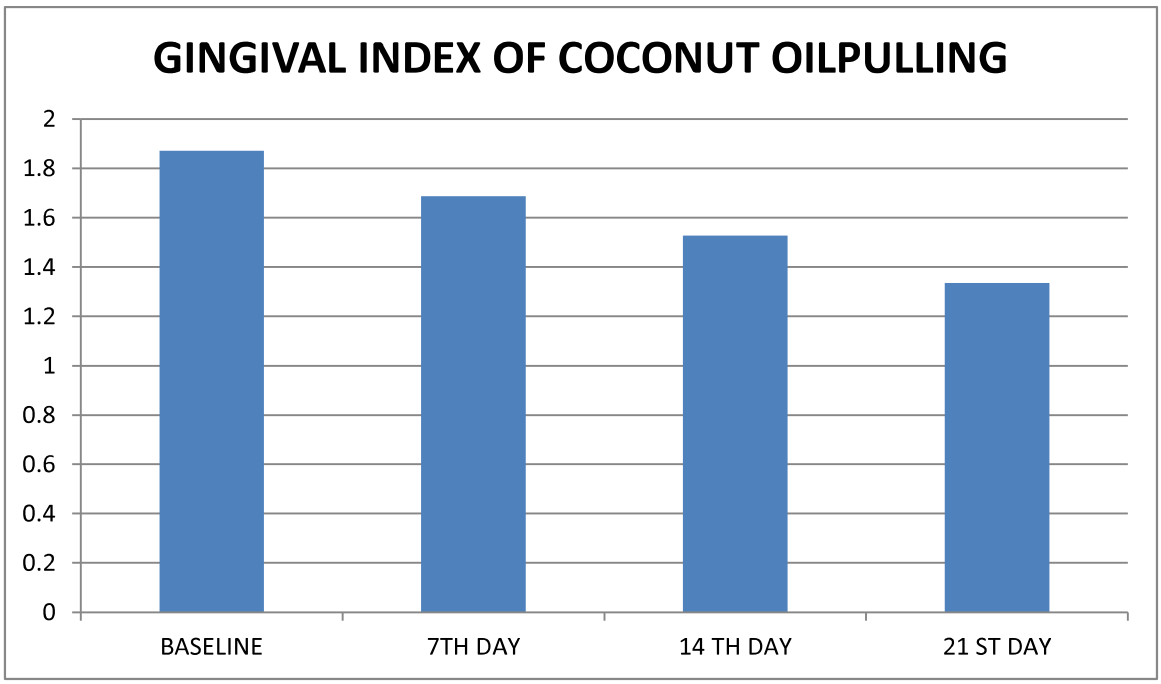


Table 5 and graph E shows the comparison of coconut oil pulling on gingival index at different time interval. Gingival index at baseline, 7^{th} day, 14^{th} day and 21^{st} day was 1.8710±.17960, 1.6870±0.15910, 1.5280±.15598 and 1.3350±.18435 respectively. Results were found to be statistically significant when comparing coconut oil pulling on gingival index at different time interval by using paired t test.

TABLE 6) COMPARISON OF COCONUT OIL PULLING ON HALITOSIS AT DIFFERENT TIME INTERVAL

TIME INTERVAL	Mean	Std. Deviation	MEAN DIFFERENCE	pvalue
BASELINE	4.20	.422	1.200	0.001
7^{TH} DAY	3.00	.471		
BASELINE	4.20	.422	2.300	0.001
14^{TH} DAY	1.90	.568		
BASELINE	4.20	.422	3.400	0.001
21^{ST} DAY	.80	.422		

Test – paired t test, $p<0.001$ highly significant

GRAPH F

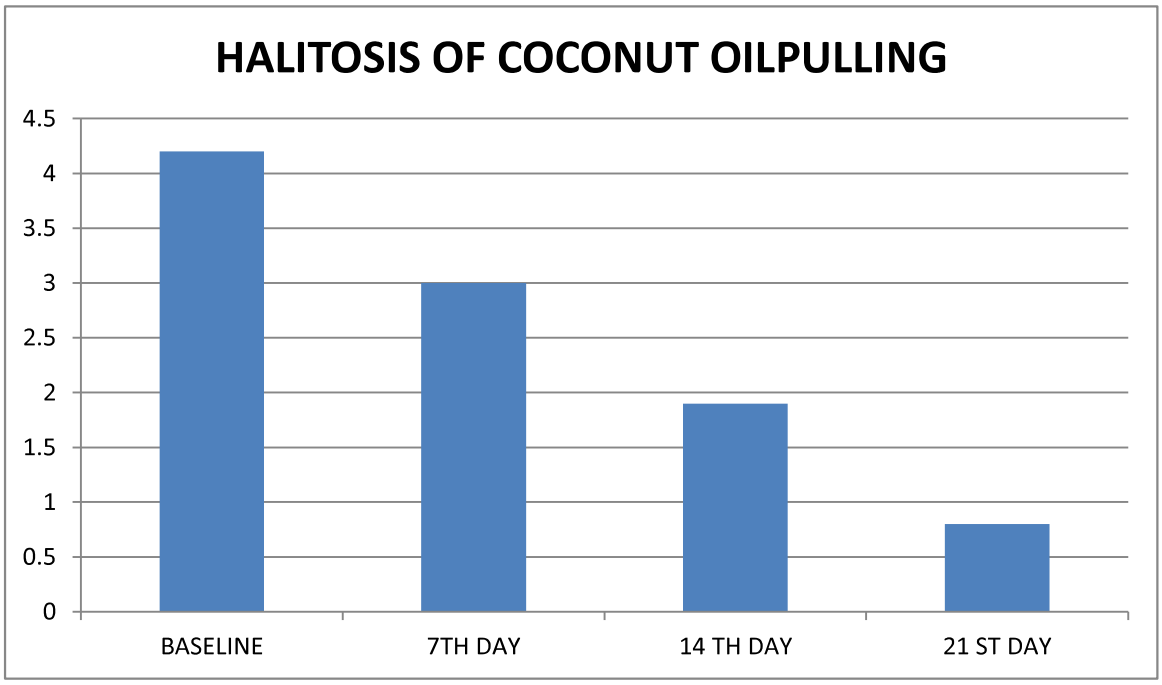


Table 6 and graph F shows the comparison of coconut oil pulling on halitosis at different time interval. Halitosis at baseline, 7^{th} day, 14^{th} day and 21^{st} day was 4.20±.422, 3.00±0.471, 1.90±.568 and .80±.422 respectively. Results were found to be statistically significant when comparing coconut oil pulling on halitosis at different time interval by using paired t test.

III) CHLORHEXIDINE MOUTH WASH

A) MEAN OF AGE

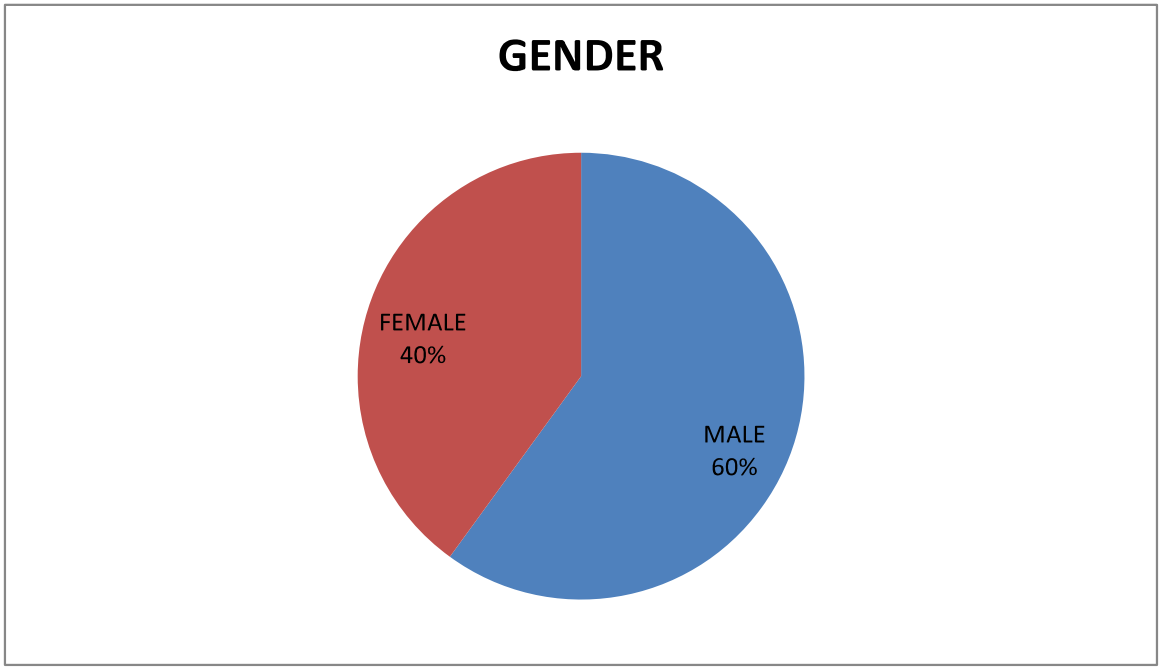
AGE	Mean	Std. Deviation
	28.90	7.490

Mean ± SD age of subjects was 28.90±7.490

B) DISTRIBUTION OF GENDER

GENDER	Frequency	Percent
MALE	6	60.0
FEMALE	4	40.0
TOTAL	10	100.0

FIG-13 Gender distribution for CHX Mouthwash



Among the total subjects, maximum 6(60%) subjects were males and 4(40%) subjects were females.

TABLE 7) COMPARISON OF CHLORHEXIDINE MOUTH WASH ON PLAQUE INDEX AT DIFFERENT TIME INTERVAL

TIME INTERVAL	Mean	Std. Deviation	MEAN DIFFERENCE	pvalue
BASELINE	1.9790	.27420	.22500	0.001
7TH DAY	1.7540	.23415		
BASELINE	1.9790	.27420	.46800	0.001
14TH DAY	1.5110	.21916		
BASELINE	1.9790	.27420	.74300	0.001
21ST DAY	1.2360	.19834		

Test – paired t test, $p<0.001$ highly significant

GRAPH G

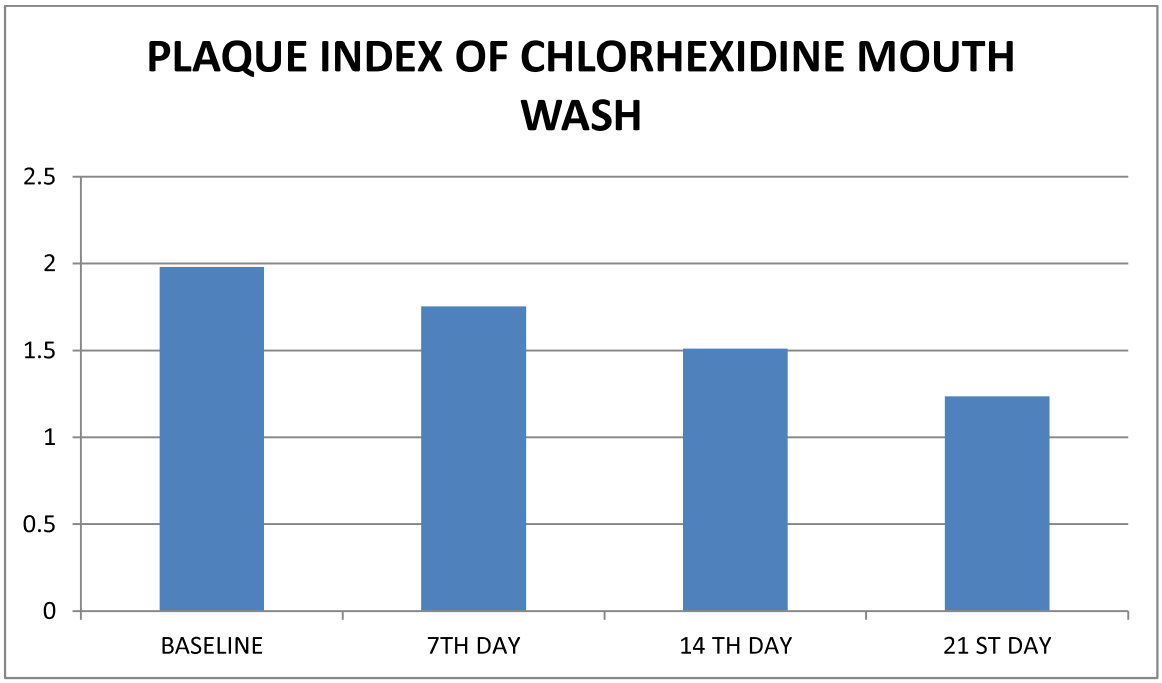


Table 7 and graph G shows the comparison of chlorhexidine mouth wash on plaque at different time interval. Plaque index at baseline, 7th day, 14th day and 21st day was 1.9790±.27420, 1.7540±0.23415, 1.5110±.219160 and 1.2360±.19834 respectively. Results were found to be statistically significant when comparing chlorhexidine mouth wash on plaque index at different time interval by using paired t test.

TABLE 8) COMPARISON OF CHLORHEXIDINE MOUTH WASH ON GINGIVAL INDEX AT DIFFERENT TIME INTERVAL

TIME INTERVAL	Mean	Std. Deviation	MEAN DIFFERENCE	pvalue
BASELINE	1.9410	.16769	.29600	0.001
7TH DAY	1.6450	.16002		
BASELINE	1.9410	.16769	.58300	0.001
14TH DAY	1.3580	.11915		
BASELINE	1.9410	.16769	.83000	0.001
21ST DAY	1.1110	.05446		

Test – paired t test, $p<0.001$ highl significant

GRAPH H

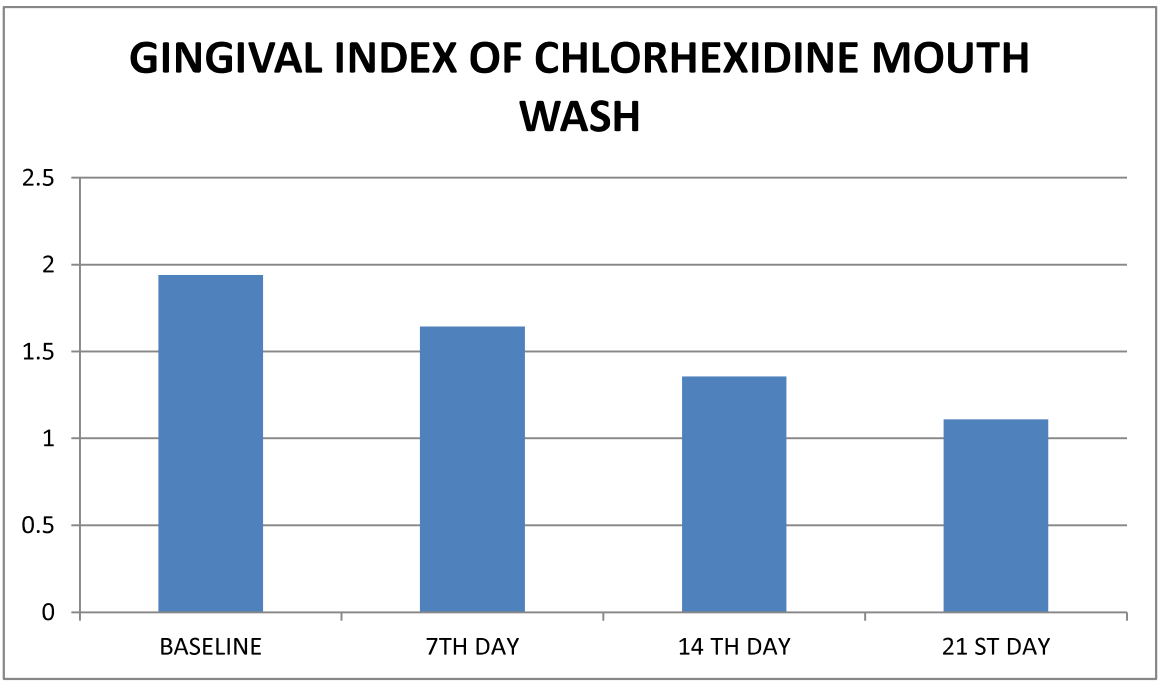


Table 8 and graph H shows the comparison of chlorhexidine mouth wash on gingival index at different time interval. Gingival index at baseline, 7th day, 14th day and 21st day was 1.9410±.16769, 1.6450±0.16002, 1.3580±.11915 and 1.1110±.05446 respectively. Results was found to be highly statistically significant when comparing chlorhexidine mouth wash on gingival index at different time interval by using paired t test.

TABLE 9) COMPARISON OF CHLORHEXIDINE OILPULLING ON HALITOSIS AT DIFFERENT TIME INTERVAL

TIME INTERVAL	Mean	Std. Deviation	MEAN DIFFERENCE	pvalue
BASELINE	4.50	.527	1.600	0.001
7^{TH} DAY	2.90	.568		
BASELINE	4.50	.527	2.600	0.001
14^{TH} DAY	1.90	.568		
BASELINE	4.50	.527	3.800	0.001
21^{ST} DAY	.70	.483		

Test – paired t test, $p<0.001$ highly significant

GRAPH-I

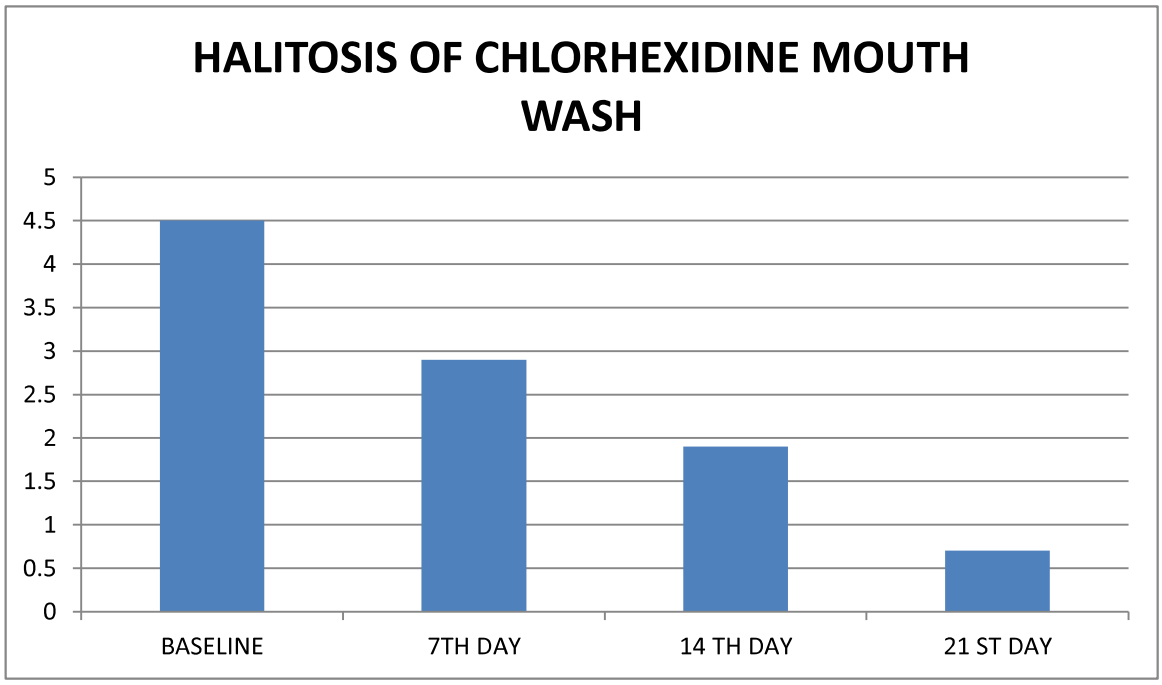


Table 9 and graph I shows the comparison of chlorhexidine mouth wash on halitosis at different time interval. Halitosis at baseline, 7^{th} day, 14^{th} day and 21^{st} day was 4.50±.527, 2.90±0.568, 1.90±.568 and .70±.483 respectively. Results were found to be highly statistically significant when comparing chlorhexidine mouth wash on halitosis at different time interval by using paired t test.

IV) Comparing efficacy of chlorhexidine mouth wash with mustard oil and coconut oil at different time interval

TABLE 10) Comparison of plaque index, gingival index and halitosis of chlorhexidine mouth wash, mustard oil and coconut oil at 7th day

INDEX	GROUP	Mean	Std. Deviation	P value
PLAQUE INDEX	Chlorhexidine mouth wash	1.7540	.23415	0.057
	Mustard oil	1.3630	.08667	
	Coconut oil	1.7370	.10584	
GINGIVAL INDEX	Chlorhexidine mouth wash	1.6450	.16002	0.160
	Mustard oil	1.5480	.16335	
	Coconut oil	1.6870	.15910	
HALITOSIS	Chlorhexidine mouth wash	2.90	.568	0.731
	Mustard oil	2.80	.632	
	Coconut oil	3.00	.471	

Test used- ANOVA, P>0.05 insignificant

GRAPH J

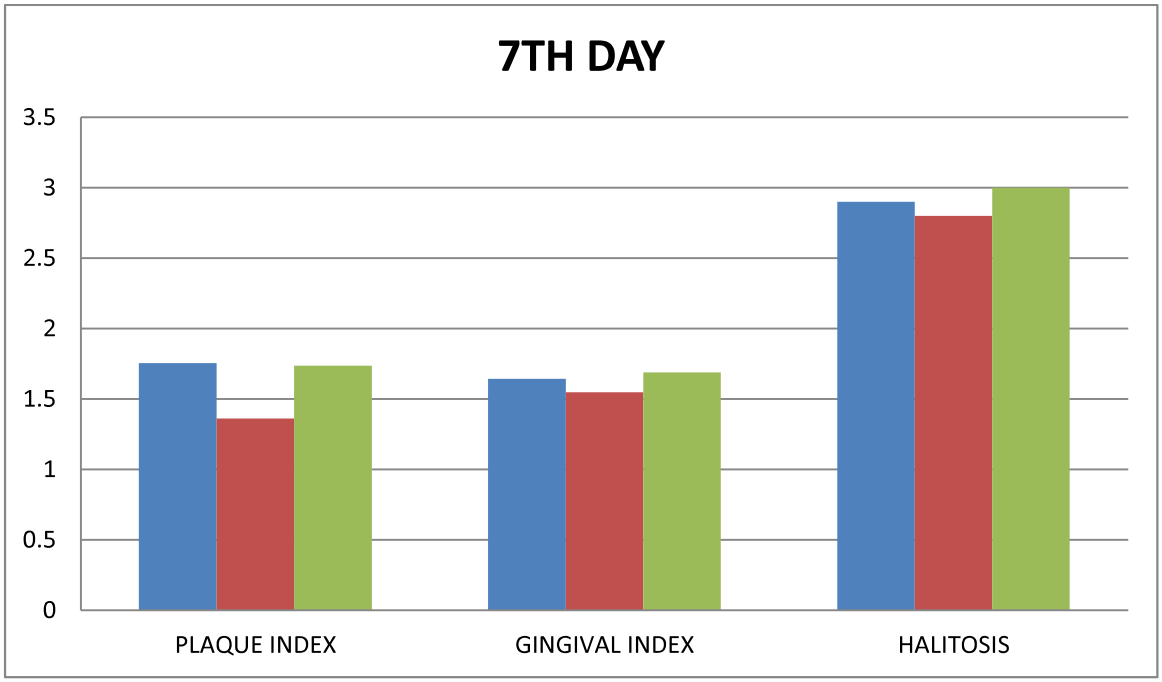


Table 10 and graph J shows comparison of Plaque index, Gingival index and halitosis of chlorhexidine mouth wash, mustard oil and coconut oil. Plaque index of Chlorhexidine mouth wash, mustard oil and coconut oil at 7th day was 1.75450±.23415, 1.3630±.08667,

1.7370±.10584 respectively. Results were found to be insignificant on comparing plaque index of chlorhexidine mouth wash, mustard oil and coconut oil by using ANOVA test. Gingival index of Chlorhexidine mouth wash, mustard oil and coconut oil at 7th day was 1.6450±.16002, 1.5480±.16635, 1.6870±.15910 respectively. Results were found to be insignificant on comparing gingival index of chlorhexidine mouth wash, mustard oil and coconut oil by using ANOVA test. Halitosis of Chlorhexidine mouth wash, mustard oil and coconut oil at 7th day was 2.90±.568, 2.80±.632, 3.00±.471 respectively. Results were found to be insignificant on comparing halitosis of chlorhexidine mouth wash, mustard oil and coconut oil by using ANOVA test.

TABLE 11) Multiple Comparison of plaque index, gingival index and halitosis of chlorhexidine mouth wash with mustard oil and coconut oil at 7th day

INDEX	CONTROL	CASE	Mean difference	pvalue
Plaque index	Chlorhexidine mouth wash	Mustard oil	.39100	0.067
		Coconut oil	.01700	1.00
Gingival index	Chlorhexidine mouth wash	Mustard oil	.09700	.566
		Coconut oil	-.04200	1
Halitosis	Chlorhexidine mouth wash	Mustard oil	.100	1
		Coconut oil	-.100	1

Test used- post hoc boneferroni, p>0.05 insignificant

Results were found to be insignificant when comparing plaque index, gingival index and halitosis at 7th day of chlorhexidine mouthwash with mustard oil and coconut oil by using multiple comparison post hoc Boneferroni test.

TABLE 12) Comparison of plaque index, gingival index and halitosis of chlorhexidine mouth wash, mustard oil and coconut oil at 14th day

INDEX	GROUP	Mean	Std. Deviation	P value
PLAQUE INDEX	Chlorhexidine mouth wash	1.5110	.21916	0.057
	Mustard oil	1.2860	.05481	
	Coconut oil	1.5970	.10995	
GINGIVAL INDEX	Chlorhexidine mouth wash	1.3580	.11915	.059
	Mustard oil	1.3950	.13125	
	Coconut oil	1.5280	.15598	
HALIMETER	Chlorhexidine mouth wash	1.90	.568	.698
	Mustard oil	1.70	.675	
	Coconut oil	1.90	.568	

Test used- ANOVA, P>0.05 insignificant

GRAPH K

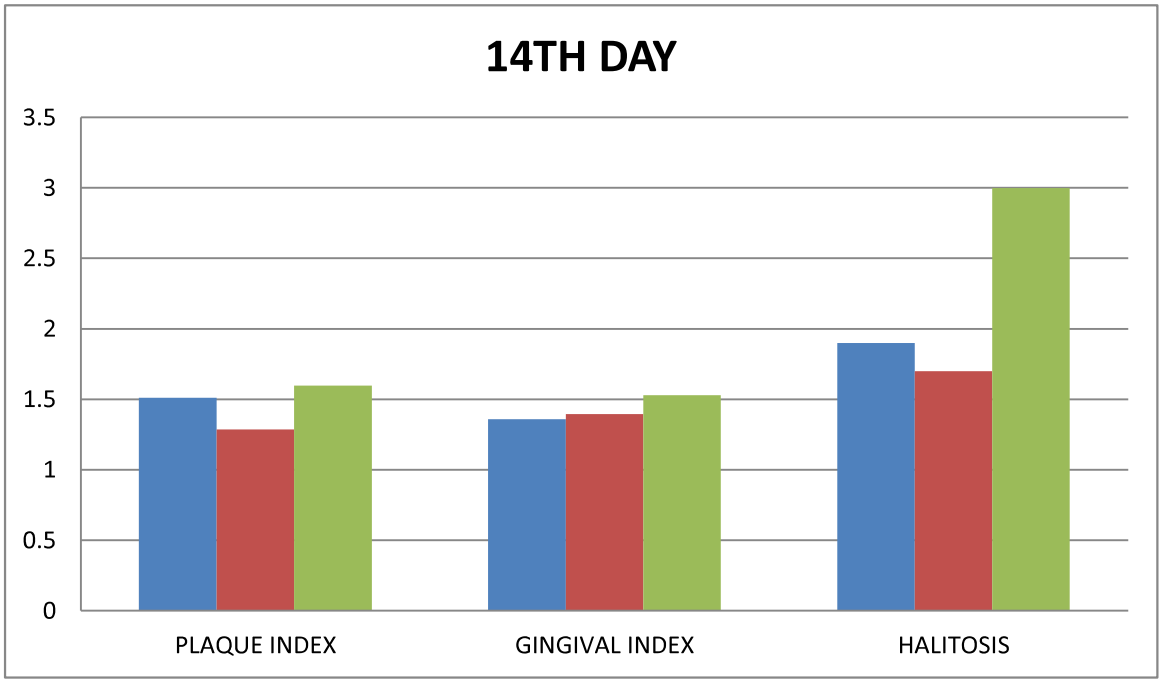


Table 12 and graph K shows Comparison of plaque index, gingival index and halitosis of chlorhexidine mouth wash, mustard oil and coconut oil . Plaque index of Chlorhexidine mouth wash, mustard oil and coconut oil at 14th day was 1.5110±.21916, 1.2860±.05481, 1.5970±.10995 respectively. Results were found to be insignificant on comparing plaque index of chlorhexidine mouth wash, mustard oil and coconut oil by using ANOVA test. gingival index of Chlorhexidine mouth wash, mustard oil and coconut oil at 14th day was

1.3580±.11915, 1.3950±.13125, 1.5280±.15598 respectively. Results were found to be insignificant on comparing gingival index of chlorhexidine mouth wash, mustard oil and coconut oil by using ANOVA test. Halitosis of Chlorhexidine mouth wash, mustard oil and coconut oil at 14th day was 1.90±.568, 1.70±.675, 1.90±.568 respectively. Results were found to be insignificant on comparing halitosis of chlorhexidine mouth wash, mustard oil and coconut oil by using ANOVA test.

TABLE 13) Multiple Comparison of plaque index, gingival index and halitosis of chlorhexidine mouth wash with mustard oil and coconut oil at 14th day

INDEX	CONTROL	CASE	Mean difference	pvalue
Plaque index	Chlorhexidine mouth wash	Mustard oil	.22500	0.511
		Coconut oil	-.08600	.588
Gingival index	Chlorhexidine mouth wash	Mustard oil	-.03700	1
		Coconut oil	-.17000	.212
Halitosis	Chlorhexidine mouth wash	Mustard oil	.200	1
		Coconut oil	.100	1

Test used- post hoc boneferroni, p>0.05 insignificant

Results were found to be insignificant when comparing plaque index, gingival index and halitosis at 14th day of chlorhexidine mouthwash with mustard oil and coconut oil by using multiple comparison post hoc Boneferroni test.

TABLE 14) Comparison of plaque index, gingival index and halitosis of chlorhexidine mouth wash, mustard oil and coconut oil at 21st day

INDEX	GROUP	Mean	Std. Deviation	P value
PLAQUE INDEX	Chlorhexidine mouth wash	1.2360	.19834	0.056
	Mustard oil	1.1180	.08904	
	Coconut oil	1.3820	.18335	
GINGIVAL INDEX	Chlorhexidine mouth wash	1.1110	.05446	.124
	Mustard oil	1.2610	.11695	
	Coconut oil	1.3350	.18435	
HALITOSIS	Chlorhexidine mouth wash	.70	.483	.698
	Mustard oil	.60	.516	
	Coconut oil	.80	.422	

Test used- ANOVA, p>0.05 insignificant

GRAPH L

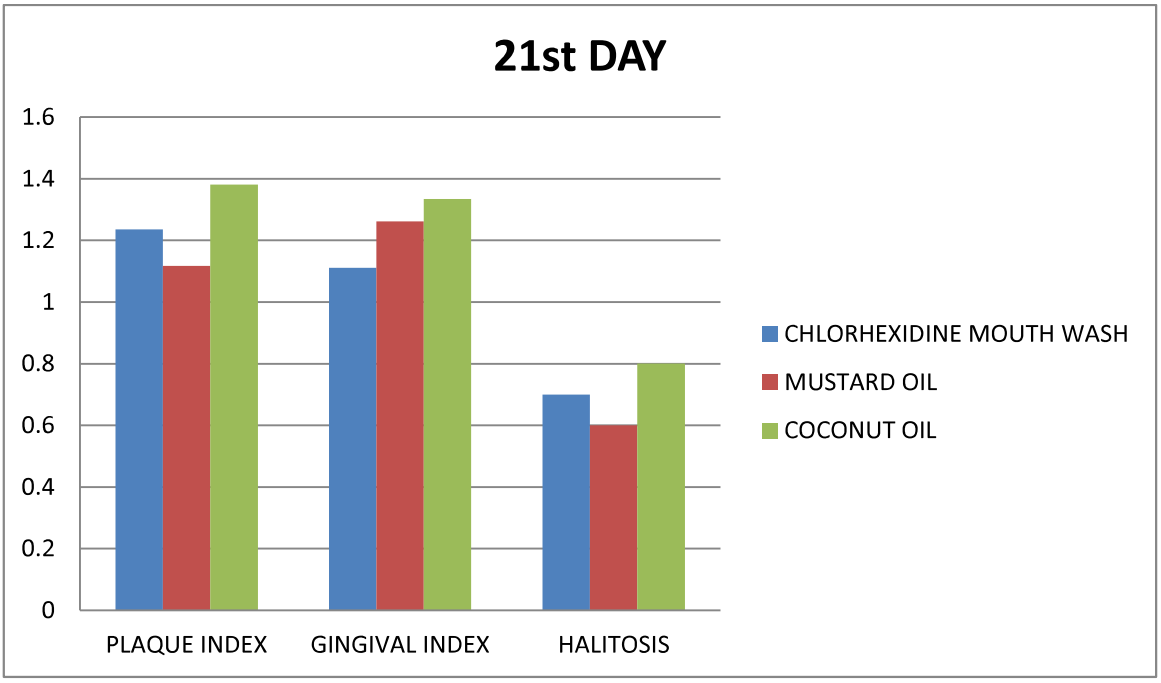


Table 14 and graph L shows Comparison of plaque index, gingival index and halitosis of chlorhexidine mouth wash, mustard oil and coconut oil . Plaque index of Chlorhexidine mouth wash, mustard oil and coconut oil at 21st day was 1.2360±.19834, 1.1180±.08904, 1.3820±.18335 respectively. Results were found to be insignificant on comparing plaque index of chlorhexidine mouth wash, mustard oil and coconut oil by using ANOVA test. gingival index of Chlorhexidine mouth wash, mustard oil and coconut oil at 21st day was 1.1110±.05446, 1.2160±.11695, 1.3350±.18435 respectively. Results were found to be insignificant on comparing gingival index of chlorhexidine mouth wash, mustard oil and coconut oil by using ANOVA test. Halitosis of Chlorhexidine mouth wash, mustard oil and coconut oil at 21st day was .70±.483, .60±.516, .80±.422 respectively. Results were found to be insignificant on comparing halitosis of chlorhexidine mouth wash, mustard oil and coconut oil by using ANOVA test.

TABLE 15) Multiple Comparison of plaque index, gingival index and halitosis of chlorhexidine mouth wash with mustard oil and coconut oil at 21st day

INDEX	CONTROL	CASE	Mean difference	pvalue
Plaque index	Chlorhexidine mouth wash	Mustard oil	.11800	.359
		Coconut oil	-.14600	.171
Gingival index	Chlorhexidine mouth wash	Mustard oil	-.15000	.151
		Coconut oil	-.22400	.056
Halitosis	Chlorhexidine mouth wash	Mustard oil	.100	1
		Coconut oil	-.100	1

Test used- post hoc boneferroni, p>0.05 insignificant

Results were found to be insignificant when comparing plaque index, gingival index and halitosis at 21st day of chlorhexidine mouthwash with mustard oil and coconut oil by using multiple comparison post hoc Boneferroni test.

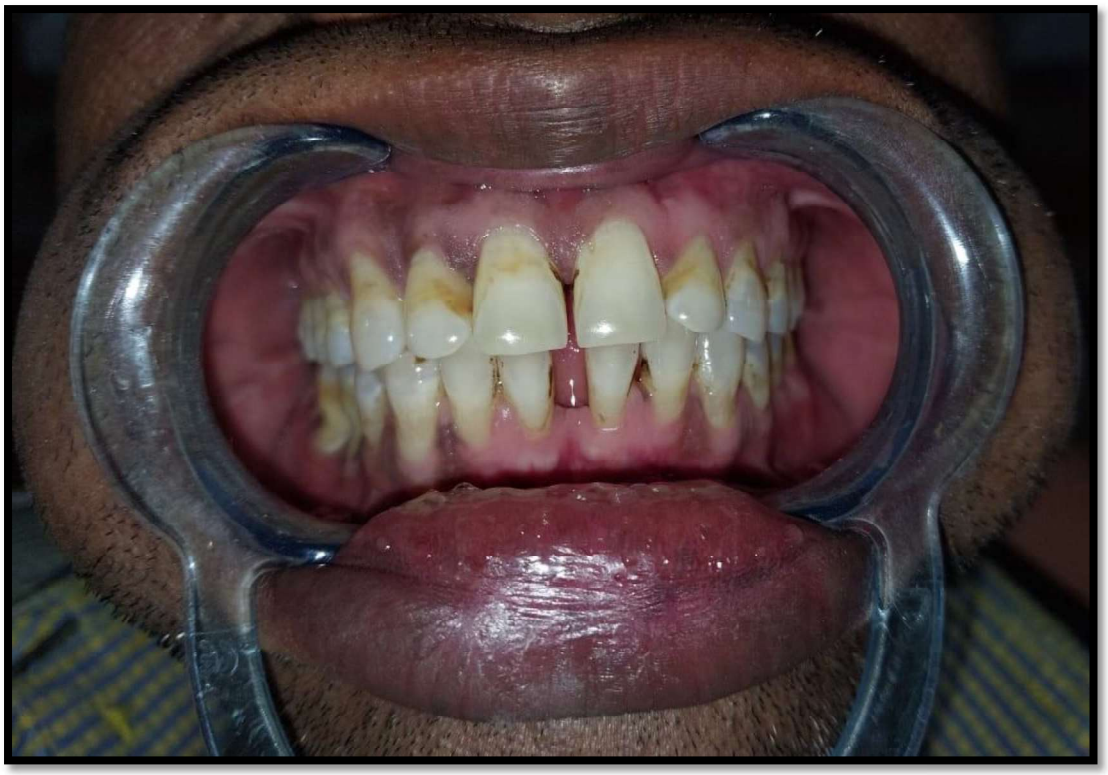


Fig 5: Group Mustard Oil at Baseline

Fig 6: Group Mustard Oil at 21 days

Plate No 3

Fig 9: CHX Mouthwash at baseline

Fig 10: CHX Mouthwash at 21 days

Plate No 5

Fig 7 : Group Coconut Oil at Baseline

Fig 8 : Group Coconut Oil at 21 days

Plate No 4

DISCUSSION

DISCUSSION

This randomized clinical longitudinal prospective study was done to check the efficacy of oil pulling via two oils i.e. mustard oil & coconut oil on halitosis, plaque and gingivitis.

It is a common belief that oral health serves as a gateway to general health. This suggests that an individual's overall health and wellbeing are strongly impacted by their oral health.[37] In recent years, various studies have provided unequivocal evidence on the strong relationship between systemic and oral diseases. It is believed that this relationship is due to common risk factors shared between various diseases.

Without needing to take any particular precautions, oil pulling therapy is an easy and affordable way to maintain and improve dental health. In comparison to other detoxification techniques, it is quick, easy, and risk-free. Morever, it does not require any specialised oil & any household oil can be used. Furthermore, it is not associated with any alteration of taste perception and sensation.

It is unclear what exactly causes mustard oil pulling therapy to work. The beneficial activity resulting in controlling plaque formation and gingivitis can be attributed to medicinal properties of mustard oil. Mustard oil is one of the most commonly used oil in North Indian homes. Mustard oil has about 60% monounsaturated fatty acids(MUFA)(42% erucic acid and 12% oleic acid); it has about 21% polyunsaturated fats(PUFA) (6% the omega-3 alpha-linolenic acid(ALA) and 15% omega-6 linoleic acid(LA)) and it has about 12% saturated fats.[38] The unique composition of fatty acids in mustard oil was determined in the following quantity: palmitic - 4%, stearic - 3%, eicosenic - 2%, linoleic - 32%, linolenic - 8%, oleic - 47%.Vitamins A, E, K, β-carotene and α, β + γ, δ tocopherols are also found in mustard oil. Vitamins A, E, K increase immunity and strengthen blood vessels walls. They have anti-inflammatory properties as well. The presence of tocopherols benefits the skin.

Saponification index[39] of coconut oil is high. It includes lauric acid, which can combine with salivary alkalis like sodium hydroxide and bicarbonates to produce a compound that resembles sodium laureate soap, which has a cleansing action[40] and it lessens plaque adhesion and accumulation. Lauric acid reduces dental cavities, has antibacterial and anti-inflammatory properties, and is good for oral health. It also has a good taste in addition to all of this. In an in vitro biofilm model, coconut oil shows antimicrobial action and is effective against

Streptococcus mutans and Candida albicans[41]. Additionally, coconut oil contains antiseptic qualities and is safe to be used as an emollient and moisturiser. The negative effects of chlorhexidine, such as brown stains and impaired taste perception[42], are not present in coconut oil.

Antioxidants produced by oil pulling break down the cell walls of bacteria, killing them.[43] These oils will pull the lipid layer of bacterial cell membranes to the oil and cause it to cling to the oil. The oil used is emulsified and its surface area is enhanced during oil pulling procedure [44]. This oil coats the teeth and gums and prevents plaque development by preventing bacterial co-aggregation. Thus, the oral cavity is cleansed of the plaque-building bacteria that cause tooth cavities, gingivitis, periodontitis, and foul breath. Gums get pink, gets healthier, and the gum bleeding issue is fixed. Chapped lips[45], dry mouth, and throat symptoms can all be treated with oil pulling. Oil pulling helps to relieve tooth discomfort, fixes mobile teeth, and accomplish robust oral cleanliness[46] in addition to preventing dental caries, gingivitis, oral candidiasis, and periodontitis. When done regularly, oil pulling is thought to improve the senses and refresh and excite the mind. Additionally helpful for anorexia[47], dry skin, eyesight problems, taste loss, and sore throats.

The study also used chlorhexidine mouthwash which is considered as a gold standard mouthwash as a comparison group to evaluate and contrast how oil pulling therapy affects conditions like halitosis, plaque and gingivitis. With two positive charges and a strong base at pH levels over 3.5[48], chlorhexidine is a broad range bis-biguanide antiseptic. As a result of preventing the buildup of plaque, it is an antiplaque and antigingivitis agent. Its bacteriostatic (0.02-0.06) or bactericidal effects depend on the dose (0.2-0.12) [49]. The use of chlorhexidine for chemical plaque control has been authorised by the American Dental Association's council on dental medicines. However, it disadvantages include brown staining of teeth on prolonged use and unpleasant taste. Additionally, low socioeconomic groups may not be able to buy or have easy access to chlorhexidine.

Oil pulling is a traditional remedy which is not widely practised, furthermore it lacks scientific basis. Through this study we can evaluate whether oil pulling can be developed as an oral hygiene habit through its effect on plaque, gingivitis and halitosis. This randomized controlled trial aimed to examine whether mustard oil and coconut oil which contains high amount of erucic acid and lauric acid as an active ingredient respectively, are effective against dental plaque microorganisms in comparison to chlorhexidine when used in oil pulling.

The study was designed to evaluate the efficacy of oil pulling of mustard oil & coconut oil (Test groups) and compared it with chlorhexidine (control group) on clinical parameters i.e, GI, PI and halitosis. For statistical analysis, the measurement means and standard deviation were used. Comparison of oil pulling and chlorhexidine swishing on various clinical parameters at different time intervals was determined using a student's t-test, and $p< 0.001$ was chosen as the criterion of significance. The analysis of the results is as follows:

Effect & Comparison of Group A, Group B & Control group

Effect & comparison of Group A, Group B & control group on Plaque index

Mustard oil (Group A) was studied and it was found that there was a statistically significant reduction in plaque index ($P<0.001$) at 7^{th} ,14^{th} & 21^{st} day when compared to baseline. (Table 1, Graph A). Similar results were found with coconut oil(Group B) (Table 4, Graph D) and chlorhexidine (control group)($P<0.001$). (Table 7, Graph G). From the above results it is clear that effect of oil pulling with mustard oil, coconut oil and chlorhexidine all result in statistically significant reduction in plaque index.

The comparison among the three showed **insignificant difference** ($P>0.05$) at different time intervals i.e. at 7^{th} day (Table 10, Graph J), at 14^{th} day (Table 12, Graph K) and at 21^{st} day (Table 14, Graph L) using ANOVA. Similarly multiple comparison among three also showed insignificant difference ($P>0.05$) at different time intervals i.e. at 7^{th} day (Table 11), at 14^{th} day(Table 13) and at 21^{st} day (Table 15) using post hoc boneferroni. From all these analysis it can be inferred that mustard oil & coconut oil are as efficacious as chlorhexidine in reducing plaque.

Effect & comparison of Group A, Group B & control group on Gingival index

Mustard oil (Group A) was studied and it was found that there was a statistically significant reduction in gingival index ($P<0.001$) at 7^{th} ,14^{th} & 21^{st} day when compared to baseline. (Table 2, Graph B). Similar results were found with coconut oil(Group B) (Table 5, Graph E). and chlorhexidine (control group)($P<0.001$) (Table 8, Graph H). From the above results it is

clear that effect of oil pulling with mustard oil, coconut oil and chlorhexidine all result in statistically significant reduction in gingival index.

The comparison among the three showed **insignificant difference** (P>0.05) at different time intervals i.e. at 7th ,14th and at 21st day for gingival index using ANOVA. Similarly multiple comparison among three also showed insignificant difference (P>0.05) at different time intervals i.e. at 7th ,14th and at 21st day using post hoc boneferroni. From all these analysis it can be inferred that mustard oil & coconut oil are as efficacious as chlorhexidine in reducing gingivitis.

Amit HV[15] et al reported a study which concluded that 45 days of coconut oil pulling significantly reduced plaque and gingival scores compared to baseline. Our study also found significant declines in plaque & gingival scores from baseline to 21 days of oil pulling with coconut oil. Peedikayil FC[20] et al reported a study which concluded that after 30 days of oil pulling, there was a statistically significant decrease in plaque and gingivitis. After four weeks, the study found 50% decreases in gingival and plaque indices, which is comparable to the effects of chlorhexidine. In our study also there was stastically significant reduction in plaque and gingival indices on using coconut oil after 21 days of oil pulling. Steady declines in indices were found from day seven. Chalke et al [25]et al reported a study which concluded that coconut oil pulling, used as an additional method of dental care, is beneficial in reducing the development of plaque and the ensuing gingivitis brought on by plaque. Our study also found out coconut oil pulling to be efficacious in reducing plaque & gingival inflammation.(P>0.001). Nagilla J et al [26] conducted a 7 days study & concluded that oil pulling with coconut oil was effective in reducing plaque levels. The mean plaque scores showed a significant difference at baseline, third day and seventh day among both groups i.e. study group(p<0.001) and control group (p<0.001). Our study also found significant decrease in plaque & gingival scores using oil pulling via coconut oil in 21 days(P<0.001) Salian et al[29] conducted a 21 days pilot study and concluded that coconut oil was as effective as chlorhexidine in reducing gingival index. Our study also found significant reduction in gingival scores while performing oil pulling with coconut oil for 21 days. Ripari F et al [31] reported a study which concluded that plaque-induced gingivitis might be treated and plaque development decreased with coconut oil pulling when used as an adjuvant. Additionally, no notable negative effects from the coconut oil pulling therapy were detected. Our study also found coconut oil to be efficacious in reducing plaque, gingival inflammation &

halitosis(P<0.001) & recommended daily application of coconut oil for 21 days. Also there was no significant side effects reported during coconut oil pulling therapy.

Extensive literature research was done for studies on mustard oil. However we couldn't find any study with mustard oil to show it's effect on oral tissues & oral health.

Effect & comparison of Group A, Group B & control group on Halitosis

Mustard oil (Group A) was studied and it was found that there was a statistically significant reduction in halitosis (P<0.001) at 7^{th} ,14^{th} & 21^{st} day when compared to baseline. (Table 3, Graph C). Similar results were found with coconut oil (Group B) (Table 6, Graph F) and chlorhexidine (control group)(P<0.001)(Table 9, Graph I). From the above results it is clear that effect of oil pulling with mustard oil, coconut oil and chlorhexidine all result in statistically significant reduction in halitosis.

The comparison among the three showed **insignificant difference** (P>0.05) at different time intervals i.e. at 7^{th} ,14^{th} and at 21^{st} day for halitosis using ANOVA. Similarly multiple comparison among three also showed insignificant difference (P>0.05) at different time intervals i.e. at 7^{th} ,14^{th} and at 21^{st} day using post hoc boneferroni. From all these analysis it can be inferred that mustard oil & coconut oil are as efficacious as chlorhexidine in reducing halitosis.

Sood P et al [19] et al reported a study which concluded oil pulling to be equally efficacious as chlorhexidine in reducing oral malodour & microbes. Our study also found oil pulling to be as efficacious as chlorhexidine in reducing maldour(P<0.001).

Sheikh F et al[23] et al reported a study which concluded that the levels of halitosis at baseline and 14 days later were statistically significantly lower with oil pulling and with chlorhexidine. Utilizing a halimeter, halitosis was assessed at baseline and 14 days after the intervention. Our study also used halimeter to measure halitosis. It also found statistically significant reduction in the grades of halitosis after 21 days of oil pulling.

The mechanism of oil pulling involves swishing mouth with a suitable oil. Triglycerides, which have three fatty acid side chains and a glycerol nucleus for each molecule, are the predominant type of fat found in edible oils like mustard and coconut oil. The action begins by agitating the oil inside mouth which leads to emulsification of fats present in oil. When acted upon by lingual lipase enzyme, the emulsified oil is broken down into two monoglycerides and FFAs. Free fatty acids combine with salivary alkalis like sodium hydroxide and bicarbonates to create a compound that resembles sodium laureate soap & the process is called saponification. During oil-pulling therapy, this potential saponification and emulsification process is what produces the cleansing effect [47] of the various oils used during oil-pulling therapy. It can be said that these oils have chemical as well as mechanical action on plaque.

The best thing about oil pulling is that it can be done with any oil with ease usually available at homes. Mustard oil, coconut oil or any other cooking oil for that matter is a common house hold commodity found in most of the Indian homes. Mustard oil is generally used in north Indian homes whereas coconut oil is generally used in south Indian households. Mustard oil also has an added advantage that it doesn't solidifies in winters unlike coconut oil which does. This is a therapy that can be practiced right at home, is economically compliable, and has a huge storehouse of benefits.[48]

This study demonstrated that oil pulling is as efficacious as chlorhexidine mouthwash. Additionally, it showed that oil pulling, as opposed to chlorhexidine, avoided many of the negative consequences. In light of this, oil pulling appears to be a promising alternative to chlorhexidine as a complementary chemical plaque control therapy in addition to conventional mechanical plaque management techniques.

CONCLUSION

CONCLUSION

Within the limits of this clinical longitudinal prospective study, following is the conclusion:

Mustard & coconut oil pulling has significant effect in reducing plaque, gingivitis & halitosis at different time interval. These oils are as efficacious as 0.2% chlorhexidine (gold standard) with respect to above said parameter.

Since mustard oil is widely available edible oil throughout Indian subcontinent, it can effectively & easily be used as an adjunct to brushing by every common person.

Halitosis is an unpleasant experience and can effectively be overcomed by regular oil pulling by mustard oil.

The limitations of this study is a smaller sample size and short follow up period. Therefore further clinical studies with larger sample size and a longer follow up period are required to further substantiate the results of the present study.

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BIBLOGRAPHY

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Annexure- I

BABU BANARASI DAS COLLEGE OF DENTAL SCIENCES (FACULTY OF BBD UNIVERSITY), LUCKNOW

INSTITUTIONAL RESEARCH COMMITTEE APPROVAL

The project titled **"Efficacy of Oil Pulling on Halitosis & Plaque induced Gingivitis: A Randomised Clinical Study"** submitted by **Dr Sumati Patel** Post graduate student from the **Department of Periodontology** as part of MDS Curriculum for the academic year 2020-2023 with the accompanying proforma was reviewed by the Institutional Research Committee present on **11th October 2021** at BBDCODS.

The Committee has granted approval on the scientific content of the project. The proposal may now be reviewed by the Institutional Ethics Committee for granting ethical approval.

Prof. Vandana A Pant
Co-Chairperson

Prof. B. Rajkumar
Chairperson

Annexure- II

Babu Banarasi Das University
Babu Banarasi Das College of Dental Sciences,
BBD City, Faizabad Road, Lucknow – 226028 (INDIA)

Dr. Lakshmi Bala
Professor and Head Biochemistry and
Member-Secretary, Institutional Ethics Committee

Communication of the Decision of the IXth Institutional Ethics Sub-Committee

IEC Code: 20 **BBDCODS/04/2022**

Title of the Project: Efficacy of oil pulling on halitosis & plaque induced gingivitis: A randomised clinical study.

Principal Investigator: Dr Sumati Patel **Department:** Periodontology

Name and Address of the Institution: BBD College of Dental Sciences Lucknow.

Type of Submission: New, MDS Project Protocol

Dear Dr Sumati Patel,

The Institutional Ethics Sub-Committee meeting comprising following four members was held on 07th April, 2022.

1.	Dr. Lakshmi Bala Member Secretary	Prof. and Head, Department of Biochemistry, BBDCODS, Lucknow
2.	Dr. Amrit Tandan Member	Prof. & Head, Department of Prosthodontics and Crown & Bridge, BBDCODS, Lucknow
3.	Dr. Rana Pratap Maurya Member	Reader, Department of Orthodontics, BBDCODS, Lucknow
4.	Dr. Akanksha Bhatt Member	Reader, Department of Conservative Dentistry & Endodontics, BBDCODS, Lucknow

The committee reviewed and discussed your submitted documents of the current MDS Project Protocol in the meeting.
The comments were communicated to PI thereafter it was revised.

Decisions: The committee approved the above protocol from ethics point of view.

Forwarded by:

Lakshmi Bala

(Dr. Lakshmi Bala)
Member-Secretary
IEC

Member-Secretary
Institutional Ethic Committee
BBD College of Dental Sciences
BBD University
Faizabad Road, Lucknow-226028

(Dr. Puneet Ahuja)
Principal
PRINCIPAL BBDCODS
Babu Banarasi Das College of Dental Sciences
(Babu Banarasi Das University)
BBD City, Faizabad Road, Lucknow-226028

Annexure- III

Babu Banarasi Das College of Dental Sciences

(Babu Banarasi Das University)
BBD City, Faizabad Road, Lucknow – 227105 (INDIA)

Consent Form (English)

Title of the Study: EFFECT OF OIL PULLING ON HALITOSIS AND PLAQUE INDUCED GINGIVITIS: A RANDOMISED CLINICAL STUDY

Study Number……..
Subject's Full Name : Dr Sumati Patel
Date of Birth/Age :26/01/90
Address of the Subject: 570/s-225,Sainik nagar, Alambagh,Lucknow-226005
Phone no. and e-mail address: 9451571445
sumatiptl@gmail.com
Qualification: PG 2nd year
Occupation: Student / Self Employed / Service / Housewife/
Other (Please tick as appropriate)
Annual income of the Subject……
Name and of the nominees(s) and his relation to the subject…… (For the purpose of compensation in case of trial related death).

1. I confirm that I have read and understood the Participant Information Document dated …….. for the above study and have had the opportunity to ask questions. **OR** I have beenexplained the nature of the study by the Investigator and had the opportunity to ask questions.
2. I understand that my participation in the study is voluntary and given with free will without any duress and that I am free to withdraw at any time, without giving any reason and without my medical care or legal rights being affected.
3. I understand that the sponsor of the project, others working on the Sponsor's behalf, the Ethics Committee and the regulatory authorities will not need my permission to look at my health records both in respect of the current study and any further research that may be conducted in relation to it, even if I withdraw from the trial. However, I understand that my identity will not be revealed in any information released to third parties or published.
4. I agree not to restrict the use of any data or results that arise from this study provided such a use is only for scientific purpose(s).
5. I permit the use of stored sample (tooth/tissue/blood) for future research. **Yes [ ] No [ ] Not Applicable [ ]**
6. I agree to participate in the above study. I have been explained about the complications and side effects, if any, and have fully understood them. I have also read and understood the participant/volunteer's Information document given to me.

Signature (or Thumb impression) of the Subject/Legally Acceptable Representative:……..
Signatory's Name……. Date …….
Signature of the Investigator…… Date……..
Study Investigator's Name: Dr. Sumati Patel Date……..
Signature of the witness…… Date……..
Name of the witness……
Received a signed copy of the PID and duly filled consent form
Signature/thumb impression of the subject or legally Date……..

Annexure- IV

Babu Banarasi Das College of Dental Sciences

(Babu Banarasi Das University)
BBD City, Faizabad Road, Lucknow – 227105 (INDIA)

सहमति पत्र

अध्ययन शीर्षक: मुंह से दुर्गंध और पट्टिका पर तेल खींचने का प्रभाव प्रेरित मसूड़े की सूजन: एक यादृच्छिक नैदानिक

अध्ययन संख्या.....

प्रतिभागी केपूर्ण नाम: : डॉ सुमति पटेल.

जन्म तिथि / आयु: 26.01.90

प्रतिभागी का पता : 570/एस-225, सैनिक नगर, आलमबाग, लखनऊ-226005..

फोन नं. और ई-मेल पता :9451571445

sumatiptl@gmail.com

योग्यता : पीजी द्वितीय वर्ष

व्यवसाय: छात्र / स्व कार्यरत / सेवा / ग्रहिणी .....

अन्य (उचितरुप मेटिक करें) ..... प्रतिभागी की

वार्षिक आय .....

प्रत्याशीयोकेनाम और प्रतिभागी सेसंबंध...(परीक्षण सेसंबंधित मौत केमामलेमेमुआवजेकेप्रयोजन केलिए)

या मुझे अध्ययन अन्वेषक नेसभी तथ्यों कोसमझा दिया है तथा मुझेप्रश्न पुछनेकेसमान अवसर प्रदान किए गये।

2मैंनेयहॉ समझ लिया कि अध्ययन में मेरी भागीदारी पूर्णतः स्वैच्छिक है और किसी भी दबाव केबिना स्वतंत्र इच्छा केसाथ दिया है किसी भी समय किसी भी कारण केबिना , मेरेइलाज या कानूनी अधिकारोकोप्रभावित किए बिना , अध्ययन में भाग न लेने केलिए स्वतंत्र हुँ ।

3मैंने यह समझ लिया है कि अध्ययन के प्रायोजक , प्रायोजक की तरफ से काम करने वाले लोग, आचार समिति और नियामक अधिकारियों कोमेरेस्वास्थ्य रिकार्डकोवर्तमान अध्ययन या आगेकेअध्ययन केसन्दर्भदेखनेकेलिए मेरी अनुमति की जरूरत नही है, चाहेमैनेइस अध्ययन सेनाम वापस लेलिया है। हॉलाकि मै यह समझता हुँ कि मेरी पहचान कोकिसी भी तीसरेपक्ष या प्रकाशित माध्यम में नही दी जायेगी।

4मै इससेसहमत हूँ कि कोईभी डेटा या परिणाम जोइस अध्ययन सेप्राप्त होता है उसका वैज्ञानिक उद्देश्य (ओं) केउपयोग केलिए मेरी तरफ सेकोईप्रतिबंध नही है।

5. भविष्य के अनुसंधान के लिए भंडारित नमूना (ऊतक/रक्त) पर अध्ययन केलिए अपनी सहमति देता हुँ।

हॉ [ ] नही [ ] अनउपयुक्त [ ]

6मै परीक्षण की अनुमति देता हुँ। मुझेइसकेद्वारा यदि कोईपरेशानी होती है, इसकेबारेमें जानकारी देदी गई है। मैनेरोगी जानकारी सूचना पत्र कोपढ तथा समझ लिया है।

प्रतिभागी / कानूनी तौर पर स्वीकार्य प्रतिनिधि का हस्ताक्षर (या अंगूठेका निशान.....

हस्ताक्षरकर्ता का नाम..... दिनांक .....अन्वेषक के हस्ताक्षर ..... दिनांक .....

अध्ययन अन्वेषक का नं डॉ. सुमति पटेल .....

गवाह केहस्ताक्षर ..... दिनांक .....गवाह के नाम .....

मैनें पीआईडी और विधिवत भरेसहमति फार्मका एक हस्ताक्षर की नकल प्राप्त की.

प्रतिभागी कानूनी तौर पर प्रतिनिधि का हस्ताक्षर/ अगूंठेका निशान ..... दिनांक.....

Annexure- V

Babu Banarasi Das College of Dental Sciences
(A constituent institution of Babu Banarasi Das University)
BBD City, Faizabad Road, Lucknow – 227105 (INDIA)

Participant Information Document (PID)

1. **Study title**

   EFFICACY OF OIL PULLING ON HALITOSIS AND PLAQUE INDUCED GINGIVITIS: A RANDOMISED CLINICAL STUDY

2. **Invitation paragraph**

   You are being invited to take part in a research study, it is therefore important for you to understand why the study is being done and what it will involve. Please take time to read the following information carefully. Ask us for any clarifications or further information. Whether or not you wish to take part is your decision.

3. **What is the purpose of the study?**

   The purpose of this study is to compare the efficacy of oil pulling on halitosis & plaque induced gingivitis with that of chlorhexidine mouthwash.

4. **Why have I been chosen?**

   You have been chosen for this study as you are fulfilling the required criteria for this study.

5. **Do I have to take part?**

   Your participation in the research is entirely voluntary. If you do, you will be given this information sheet to keep and will be asked to sign a consent form. During the study you still are free to withdraw at any time and without giving a reason.

6. **What will happen to me if I take part?**

   You will be one of 30 patients enrolled in the study. These patients will be divided in to three groups with each group comprising 10 patients. Group A will perform oil pulling with mustard oil. Group B will perform oil pulling with coconut oil & control group will swish their mouth with 0.2% chlorhexidine mouthwash.

7. **What do I have to do?**

   You do not have to change your regular lifestyles for the investigation of the study.

8. What is the procedure that is being tested?

The procedure will involve the evaluation of the efficacy of oil pulling on halitosis and plaque induced gingivitis with that of chlorhexidine mouthwash.

9. What are the interventions for the study?

Systematically healthy patients having mild to moderate plaque induced gingivitis will be taken in the study.

10. What are the side effects of taking part?

There are no side effects on patients for this study.

11. What are the possible disadvantages and risks of taking part?

There is no risk or disadvantages of taking part in this study.

12. What are the possible benefits of taking part?

This study will help us to evaluate the efficacy of oil pulling on halitosis & plaque induced gingivitis with that of chlorhexidine mouthwash.

13. What if new information becomes available?

If additional information becomes available during the course of the research you will be told about these and you are free to discuss it with your researcher, your researcher will tell you whether you want to continue in the study. If you decide to withdraw, your researcher will make arrangements for your withdrawal. If you decide to continue in the study, you may be asked to sign an updated consent form.

14. What happens when the research study stops?

If the study stops/finishes before the stipulated time, this will be explained to the patient/volunteer.

15. What if something goes wrong?

If any severe adverse event occurs, or something goes wrong during the study, the complaints will be handled by reporting to the institution (s), and Institutional ethical community.

16. Will my taking part in this study be kept confidential?

Yes it will be kept confidential.

17. What will happen to the results of the research study?

The results of the study will be used to compare clinical success . Your identity will be kept confidential in case of any report/publications.

18. Who is organizing the research?

This research study is organized by the academic institution (BBDCODS).

19. Will the results of the study be made available after study is over?

Yes.

20. Who has reviewed the study?

The study has been reviewed and approved by the Head of the Dept, and the IEC/IRC of the institution.

21. Contact for further information

Dr. Sumati Patel

Department of Periodontology and Implantology

Babu Banarasi College of Dental Sciences.

Lucknow-227105

Mob-9451571445

Dr. Vandana A Pant (Professor)

Department of Periodontology and Implantology

Babu Banarasi College of Dental Sciences.

Lucknow-227105

Mob-9935957775

Dr. Mona Sharma (HOD)

Department of Periodontology and Implantology

Babu Banarasi College of Dental Sciences.

Lucknow

Mob-9984110444

bbdcods.iec@gmail.com

Annexure- VI

बाबू बनारसीदास कॉलेजऑफ डेंटल साइंसेज
(बाबू बनारसीदास विश्वविद्यालय का एक घटक संस्थान)
बीबीडी सिटी, फैजाबाद रोड, लखनऊ - 227105 (भारत)

प्रतिभागी सूचना दस्तावेज (पीआईडी)

1-अध्ययन शीर्षक

मुंह से दुर्गंध और पट्टिका प्रेरित मसूड़े की सूजन पर तेल खींचने की प्रभावकारिता: एक यादृच्छिक नैदानिक अध्ययन।

2- आमंत्रण अनुच्छेद**?**

आपको एक शोध अध्ययन में भाग लेने के लिए आमंत्रित किया जा रहा है, इसलिए आपके लिए यह समझना महत्वपूर्ण है कि अध्ययन क्यों किया जा रहा है और इसमें क्या शामिल होगा। कृपया निम्नलिखित जानकारी को ध्यान से पढ़ने के लिए समय निकालें। हमसे कोई स्पष्टीकरण या अधिक जानकारी के लिए पूछें। आप हिस्सा लेना चाहते हैं या नहीं यह आपका निर्णय है।

3- अध्ययन का उद्देश्य क्या है**?**

इस अध्ययन का उद्देश्य मुंह से दुर्गंध और पट्टिका प्रेरित मसूड़े की सूजन को कम करने में तेल खींचने की प्रभावकारिता का मूल्यांकन करना है।

4-मुझे क्यों चुना गया है**?**

आपको इस अध्ययन के लिए चुना गया है क्योंकि आप इस अध्ययन के लिए आवश्यक मानदंडों को पूरा कर रहे हैं।

5- क्या मुझे भाग लेना है**?**

अनुसंधान में आपकी भागीदारी पूरी तरह से स्वैच्छिक है। यदि आप करते हैं, तो आपको रखने के लिए यह सूचना पत्र दिया जाएगा और सहमति पत्र पर हस्ताक्षर करने के लिए कहा जाएगा। अध्ययन के दौरान आप अभी भी किसी भी समय और बिना कारण बताए वापस लेने के लिए स्वतंत्र हैं।

6- अगर मैं भाग लेता हूं तो मेरे साथ क्या होगा**?**

आप अध्ययन में नामांकित 30 रोगियों में से एक होंगे। इन मरीजों को बांटा जाएगा

प्रत्येक समूह के साथ तीन समूह जिसमें 10 रोगी शामिल हैं। ग्रुप ए सरसों के तेल से ऑयल पुलिंग का प्रदर्शन करेगा। ग्रुप बी नारियल के तेल से ऑयल पुलिंग करेगा और कंट्रोल ग्रुप 0.2% क्लोरहेक्सिडिन माउथवॉश से अपना मुंह घुमाएगा।

7- मुझे क्या करना है**?**

अध्ययन की जांच के लिए आपको अपने नियमित जीवन शैली को बदल ने की ज़रूरत नहीं है।

8- परीक्षण की जारही प्रक्रिया क्या है**?**

प्रक्रिया में क्लोरहेक्सिडिन माउथवॉश के साथ मुंह से दुर्गंध और पट्टिका प्रेरित मसूड़े की सूजन पर तेल खींचने की प्रभावकारिता का मूल्यांकन शामिल होगा।

9- अध्ययन के लिए हस्तक्षेप क्या हैं**?**

अध्ययन में हल्के से मध्यम प्लाक प्रेरित मसूड़े की सूजन वाले व्यवस्थित रूप से स्वस्थ रोगियों को लिया जाएगा।

10- भाग लेने के दुष्प्रभाव क्या हैं**?**

इस अध्ययन के कोई दुष्प्रभाव नहीं हैं।

11- भाग लेने के संभावित नुकसान और जोखिम क्या हैं**?**

इस अध्ययन में भाग लेने का कोई जोखिम या नुकसान नहीं है। लेकिन हम प्रत्यारोपण के साथ 100% सफलता की गारंटी नहीं देते हैं। यह व्यक्ति के शरीर की स्वीकृति और अस्वीकृति की प्रतिक्रिया पर निर्भर करता है; प्रत्यारोपण उपचार कभी-कभी विफल हो सकता है।

12- भाग लेने के संभावित लाभ क्या हैं**?**

यह अध्ययन हमें क्लोरहेक्सिडिन माउथवॉश के साथ मुंह से दुर्गंध और पट्टिका प्रेरित मसूड़े की सूजन पर तेल खींचने की प्रभावकारिता का मूल्यांकन करने में मदद करेगा।

13- क्या होगा अगर नई जानकारी उपलब्ध हो जाए**?**

यदि अनुसंधान के दौरान अतिरिक्त जानकारी उपलब्ध हो जाती है, तो आपको इन के बारे में बताया जाएगा और आप अपने शोधकर्ता के साथ इस पर चर्चा करने के लिए स्वतंत्र हैं, आपका शोधकर्ता

आपको बताएगा कि क्या आप अध्ययन जारी रखना चाहते हैं। यदि आप वापस लेने का निर्णय लेते हैं, तो आपका शोधकर्ता आपकी वापसी की व्यवस्था करेगा। यदि आप अध्ययन जारी रखने का निर्णय लेते हैं, तो आपको एक अद्यतन सहमति पत्र पर हस्ताक्षर करने के लिए कहा जा सकता है।

14- शोध अध्ययन बंद होने पर क्या होता है**?**

यदि अध्ययन निर्धारित समय से पहले बंद / खत्म हो जाता है, तो यह रोगी / स्वयंसेवक को समझाया जाएगा।

15- क्या होगा अगर कुछ गलत हो जाए**?**

यदि कोई गंभीर प्रतिकूल घटना होती है, या अध्ययन के दौरान कुछ गलत होता है, तो संस्थान (एस), और संस्थागत नैतिक समुदाय को रिपोर्ट करके शिकायतों को नियंत्रित किया जाएगा।

16- क्या इस अध्ययन में मेरा हिस्सा गोपनीय रखा जाएगा**?**
हां इसे गोपनीय रखा जाएगा।

17- शोध अध्ययन के नतीजों का क्या होगा**?**

नैदानिक सफलता की तुलना करने के लिए अध्ययन के परिणामों का उपयोग किया जाएगा। किसी भी रिपोर्ट/प्रकाशन के मामले में आपकी पहचान गोपनीय रखी जाएगी।

18- शोध का आयोजन कौन कर रहा है**?**

यह शोध अध्ययन शैक्षणिक संस्थान (BBDCODS) द्वारा आयोजित किया जाता है।

19 क्या अध्ययन के परिणाम अध्ययन के बाद उपलब्ध कराए जाएंगे?

हाँ।

20- अध्ययन की समीक्षा किसने की है**?**

अध्ययन की समीक्षा की गई है और संस्थान के प्रमुख, और आईईसी / आईआरसी द्वारा अनुमोदित किया गया है।

21- अधिक जानकारी के लिए संपर्क करें

डॉ. सुमति पटेल
पीरियोडोंटोलॉजी और इम्प्लांटोलॉजी विभाग
बाबू बनारसी कॉलेज ऑफ डेंटल साइंसेज।
लखनऊ-227105
मोब- 9451571445

डॉ वंदना ए पंत (प्रोफेसर)
पीरियोडोंटोलॉजी और इम्प्लांटोलॉजी विभाग
बाबू बनारसी कॉलेज ऑफ डेंटल साइंसेज।
लखनऊ-227105
मोब- 9935957775

डॉ. मोना शर्मा (HOD)
पीरियोडोंटोलॉजी और इम्प्लांटोलॉजी विभाग
बाबू बनारसी कॉलेज ऑफ डेंटल साइंसेज।
लखनऊ-227105
मोब- 9984110444
bbdcods.iec@gmail.com

पीआईकाहस्ताक्षर .....
नाम .....
दिनांक.....

Annexure- VII

DEPARTMENT OF PERIODONTICS

PATIENT'S CASE SHEET

Date: O.P.D. No.

Name: Age: Sex: Occupation

Address: Mobile No. :

CHIEF COMPLAINT(S):

HISTORY OF PRESENT ILLNESS

HISTORY OF PAST ILLNESS

A. Past Medical History

B. Past Dental History

(a) Periodontal Treatment Region

(b) **Other dental therapy**

Conservative

Prosthetics

Orthodontics

Oral Surgery

Any Other

C. Present Medical History

(a) General health

1. Bleeding Tendencies
2. Allergy
3. Cardiovascular Diseases
4. Endocrinal Diseases
5. Gastro Intestinal Diseases
6. Neurological Disorder
7. Respiratory Diseases
8. Genito Urinary Diseases
9. Hereditary/Genetic Disorder
10. Puberty/ Pregnancy/ Menopause
11. Any Infectious Disease(s)
12. Medication
13. Any other abnormality

(b) Nutritional Status: i) Well Built /Average /Poor
ii) Non Vegetarian / Vegetarian

D. PRESENT DENTAL HISTORY

(a) **Oral Hygiene Maintenance:** Brush/ Finger/ Stick / Paste/ Powder
Frequency: Once/ Twice/ Thrice
Direction

(b) **HABITS**

1.	Awareness of any Traumatising habits	Yes	No
2.	Grinding of Teeth	Yes	No
3.	Masticatory Muscle Tiredness	Morning	Evening
4.	Biting Habits	Lip/ Tongue/ Cheek/ Misc	
5.	Chewing	Betel/ Tobacco/ Mis.	
6.	Smoking	Beedi/ Cigarette/ Misc.	
7.	Mouth Breathing/ Tongue Thrusting		

CLINICAL EXAMINATION

EXTRA ORAL EXAMINATION

Face

Lips:	Competency
Skin:	Color: Normal or Palor
Neck	Swellings- Unilateral or Bilateral
Jaws:	Symmetry- Antero- Posterior relationship & movements Temporo-Mandibular Joint

INTRA ORAL EXAMINATION:

A. Soft Tissue

Labial & Buccal Mucosa:		Colour, texture
Cheek:		Colour, Stretchability, Consistency
Tongue:		Colour, Size, Mobility, Texture
Floor of the Mouth:		
Palate:	Hard: Soft:	Colour, Defect, Depth, Rougae, Tori. Color, Defect
Vestibule:		
Saliva:		Flow: heavy/ diminished/ Normal Viscosity: thin/thick
Frenum/ Frenii		Number, Size, Attachment
Perio- Endo Problem		

B. Gingival Status

1. Colour
2. Contour
3. Consistency
4. Surface Texture
5. Position
6. Size
7. Exudate

C. Hard Tissue

1. No. of teeth present
2. Hypersensitivity
3. Missing teeth (why, when)
4. Caries / Non-vital
5. Supernumerary
6. Proximal contact relationship
7. Plunger cusp
8. Crown size and Colour
9. Pathologic Tooth Migration
10. Mobility — Grade I / II / III
11. Hypoplasia
12. Occlusion — Angle's Classification : Class I / II / III
    Bite: Normal /Open/ Deep/Cross/Crowding
13. Retained / Impacted
14. Attrition/ Erosion/ Abrasion
15. Furcation Involvement
16. Trauma from Occlusion
17. Halitosis
18. Any dental anatomic factors
19. Calculus - Mild / Moderate / Severe
20. Stains - Mild / Moderate / Severe

19. Probing depth

8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8

INDICES

1. Plaque Index (Silness & Loe / Turesky-Gilmore-Glickman Modication of Quigley-Hein

8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8

2. Gingival index (Loe & Silness / Modified Gingival Index)

8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8

3. Calculus index

8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8

4. Clinical attachment Level

8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8

DIFFERENTIAL DIAGNOSIS :

INVESTIGATION

1. ROENTENOGRAPHIC EXAMINATION :

OPG/IOPA/BITE WING/OCCLUSAL

	DESCRIPTION	REGION
1. Lamina dura		
2. Periodontal ligament space		
3. Root form		
4. Bone loss	Vertical	
	Horizontal	
	Infra bony crater	
	Miscellaneous	
5. Periapical pathology		
6. Any other finding		

2. LAB INVESTIGATIONS

Date	Investigation	Result
	BLOOD	
	Hb%	
	RBC	
	TLC	
	DLC	
	ESR	
	Random Sugar	
	Bleeding time	
	Clotting time	
	HbS Ag Status : Positive / Negative	
	HIV Status : Positive / Negative	

DIAGNOSIS

PROGNOSIS

TREATMENT PLAN

EMERGENCY -

PHASE I -

PHASE II -

PHASE III -

PHASE IV -

S.No.	Date	Procedure Done	Next Appointment	Staff Signature

ANNEXURE-VIII

Tools for statistical analysis

Frequency distribution

Raw data are organized in table form by class and frequency.

Consist of number of observation in each category

% = f/N*100

% = percent

f = frequency

N = number of cases

Arithmetic Mean

The most widely used measure of central tendency is arithmetic mean, usually referred to simply as the mean, calculated as

$$\bar{X} = \frac{\sum_{i=1}^{n} X_i}{n}$$

Standard deviation and Standard error

The standard deviation (SD) is the positive square root of the variance, and calculated as

$$SD = \sqrt{\frac{\sum X_i^2 - \frac{(\sum X_i)^2}{n}}{n-1}}$$

and SE (standard error of the mean) is calculated as

$$SE = \frac{SD}{\sqrt{n}}$$

where, n= no. of observations

Minimum and Maximum

Minimum and maximum are the minimum and maximum values respectively in the measure data and range may be dented as below

Range = Min to Max

and also evaluated by subtracting minimum value from maximum value as below

Range = Maximum value-Minimum value

Median

The median is generally defined as the middle measurement in an ordered set of data. That is, there are just as many observations larger than the median as there are smaller. The median (M) of a sample of data may be found by third arranging the measurements in order of magnitude (preferably ascending). For even and odd number of measurements, the median is evaluated as

$M = [(n+1)/2]^{th}$ observation- odd number

$M = [n(n+1)/2]^{th}$ observation – even number

Student's t-test

Student's t-test was used to calculate the differences between the means of two groups

$$t = \frac{\bar{X}_1 - \bar{X}_2}{SE}$$

$$SE = \sqrt{S^2_X \left(\frac{1}{n_1} + \frac{1}{n_2} \right)}$$

S^2 is the pooled variance and n_1 and n_2 are number of observations in group 1 and 2 respectively. The degrees of freedom (DF) is calculated as

DF = n1 + n2 – 2

Analysis of Variance

Analysis of variance (ANOVA) is used when we compare more than two groups simultaneously. The purpose of one-way ANOVA is to find out whether data from several groups have a constant mean. That is, to determine whether the groups are actually different in the measured characteristic. One way ANOVA is a simple special case of the linear model. For more than two independent groups, simple parametric ANOVA is used when variables under consideration follows Continuous exercise group distribution and groups variances are homogeneous otherwise non parametric alternative Kruskal-Wallis (H) ANOVA by ranks is used. The one way ANOVA form of the model is

$Y_{ij} = \alpha_{.j} + \varepsilon_{ij}$

where; Y_{ij} is a matrix of observations in which each column represents a different group.

- $\alpha_{.j}$ is a matrix whose columns are the group means (the "dot j" notation means that α applies to all rows of the j^{th} column i.e. the value α_{ij} is the same for all i).
- ε_{ij} is a matrix of random disturbances.

The model posits that the columns of Y are a constant plus a random disturbance. We want to know if the constants are all the same.

BONFERRONI POST HOC TEST

The Bonferroni test is a type of multiple comparison test used in statistical analysis. The Bonferroni test attempts to prevent data from incorrectly appearing to be statistically significant like this by making an adjustment during comparison testing

To determine which means are significantly different, we must compare all pairs.

There are k = (a) (a-1)/2 possible pairs where a = the number of treatments.

Statistical level of significance: "p" the level of significance signifies as below:

p>0.05 - Not significant (ns)

p<0.05 - Just significant (*)

p<0.01 - Moderate significant (**)

p<0.001- Highly significant (***)

PLAGIARISM REPORT

Ouriginal

Document Information

Analyzed document	sumati merged thesis 2.pdf (D158130740)
Submitted	2023-02-08 09:28:00
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