Effectiveness of *clove leave extract* in preventing pregnancy-induced gingival swelling

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Abstract:

Background: During pregnancy, high hormonal levels and improper oral hygiene can help in the deterioration of periodontal tissues that might lead to the production of various infectious microbes and inflammatory mediators. In this regard Clove extract has also been reported for having an effective antimicrobial activity against oral pathogens like *S. mutans*. Thus, the rationale of our study is to assess the efficacy of clove extract, in comparison to chlorhexidine, against pregnancy-induced gingival hyperplasia.

Methodology: It was an experimental study conducted at the tertiary care hospital of Karachi from June 2021 to May 2022. The total calculated sample size was 30 and the inclusion criteria were pregnant females reporting to dental OPD for seeking treatment in 1st trimester and were ready to give consent. The exclusion criteria were pregnant females reporting OPD after 1st trimester and those who refused to become participants of the study. The pregnant females were divided into two groups such as group 1 was given chlorhexidine mouth rinse in an unlabeled covered bottle and the same procedure was used for participants of group 2 who were given diluted clove leave extract. The gingival pocket depth from the labial and lingual side was recorded pre and post experimentally from mesial, central, and distal sites by a periodontal probe. The data was divided into upper and lower anterior (canine to canine) teeth and upper and lower posterior teeth (1st premolar to 3rd molar or the last present tooth in the jaw).

Results: There was no significant difference in the pocket depth of both the groups which highlighted the equal effectiveness of both the experimental liquids (table 2). The paired t-test analysis showed that during treatment there was an increase in gingival pocket depth

Conclusion: There was an increase in pocket depth during the study however, both the experimental liquids (chlorhexidine and clove leave extract) seemed to be equally effective. The frequency of pain, bleeding and bad breath was the same in both groups.

Keywords: *Clove leave extract,* prevention, pregnancy, gingival swelling

Introduction:

The whole process of a complete pregnancy consists of various complex events causing alterations in different systems of the body including one of the most important systems, that is the immune system. So, a balance is required between maternal-fetal immune tolerance and resistance to infections to prevent complications (Xu et al., 2021). In a pregnant woman, estrogen is reported to be increased 10 folds and progesterone is said to be increased 30 folds which plays a vital role in the progression of gingivitis or gingival hyperplasia (Agarwal et al., 2020). The disturbance in the immune response occurs in both the peripheral blood and at the feto-maternal interface which is associated with a significantly increased risk of multiple types of infections (Jakovljevic et al., 2021). An undeniable relationship has been indicated in various studies between progressing periodontal disease and adverse pregnancy outcomes. Oral microbes may directly affect the fetal-placenta unit or they can produce mediators in the oral cavity that may affect the fetal-placenta unit (Xu and Han, 2022). During pregnancy, high hormonal levels and improper oral hygiene can help in the deterioration of periodontal tissues that might lead to the production of various infectious microbes and inflammatory mediators (Foratori-Junior et al., 2020). Apart from gingival hyperplasia in pregnant women with substandard oral hygiene, the periodontal microorganisms and produced mediators have been reported in causing premature and low-weight births (Opacic et al., 2019).

Gingival hyperplasia or gingivitis is primarily caused by supragingival and subgingival plaque accumulation (Thariny et al., 2021). Various methods adopted for oral cleanliness are brushing, flossing, and mainly, rinsing with an antibacterial mouth wash (Wang et al., 2022). The chief component of most mouthwashes is chlorhexidine for their antibacterial activity. Therefore, chlorhexidine is recognized as the gold standard in preventing infections due to various oral pathogens that can lead to gingivitis or periodontitis (Chye et al., 2019). FDA has listed chlorhexidine-containing mouth rinses as category B, which demonstrates there are no major risks

to the fetus or the pregnant woman in using chlorhexidine rinses (CHX, 2019). Literature has reported that chlorhexidine mouthwashes are more effective as compared to gels. Chlorhexidine is the best choice for antibacterial cleansing when there is a lesser possibility of mechanical debridement. Apart from its substantial bactericidal and bacteriostatic properties, it has various general adverse effects like numbness in the mouth and tongue, taste alteration, xerostomia, and discoloration of teeth, prosthesis, and soft tissue of the oral cavity (Deus and Ouanounou, 2022). Chlorhexidine-induced xerostomia may decrease salivary nitrate levels which may seriously affect hypertensive patients over prolong use. Few other adverse effects like burning sensation, type 1 hypersensitivity reactions, parotid gland swelling, ulceration of oral mucosa, and paresthesia have also been reported in multiple other studies (Pałka et al., 2022). These numerous adverse effects would affect patient compliance and may increase the risk of bacterial overgrowth that would lead to gingival hyperplasia and inflammation of the periodontal tissues (Chye et al., 2019).

Various standard drugs, for having a wide adverse profile, are now being replaced with herbal drugs having the same efficacy with minimum toxicities (Shakib et al., 2019). *Syzygium aromaticum*, commonly known as clove or eugenol has reported a diverse therapeutic activity including its antibacterial effects (Takahashi et al., 2021, Yu et al., 2021, Purkait et al., 2020). Clove oil has also been reported for having an effective antimicrobial activity against oral pathogens like *S. mutans* (Suresh and Geetha, 2019). Thus, the rationale of our study is to assess the efficacy of clove extract, in comparison to chlorhexidine, against pregnancy-induced gingival hyperplasia.

Methodology:

It was an experimental study conducted at the tertiary care hospital of Karachi from June 2021 to May 2022. The total calculated sample size was 30 and the sample was recruited via simple random selection. The inclusion criteria were pregnant females reporting to dental OPD for seeking treatment in 1st trimester and were ready to give consent. The exclusion criteria were pregnant females reporting OPD after 1st trimester and those who refused to become participants of the study. The leaves of the clove plant were air dried at room temperature for 15 days to constant weight. The dried leaves were then blended to powder, the powder was weighed and kept airtight before extract preparation. 500g powdered clove leaves were extracted in 1.5 liters of ethanol for 72 hours with intermittent shaking. The solutions obtained were then filtered with Whatman

Number 1 filter paper and the filtrate was concentrated using a rotary evaporator at 40°C. The concentrated filter was diluted by adding distilled water at 1:3 (clove leave extract: distilled water) concentration to maintain the exact composition of the extract and to reduce the hardness of the concentrated extract. The pregnant females who gave consent for the study were divided into two groups by sealed envelop technique group 1 was given chlorhexidine mouth rinse in an unlabeled covered bottle and the same procedure was used for participants of group 2 who were given diluted clove leave extract. The scaling was performed at the start of the experiment in participants of both groups. The participants were instructed to rinse their mouths with the experimental liquid after every meal and in case of need (to report unwanted effects or to ask about the instructions) they can contact the principal investigator during the duration of the study. They were asked to visit OPD on the 30th day and reminders were sent to them at their contacts so that they could not miss the visit. The participants were followed for 3 months. Their gingival pocket depth from the labial and lingual side was recorded from mesial, central, and distal sites by a periodontal probe. The data was divided into upper and lower anterior (canine to canine) teeth and upper and lower posterior teeth (1st premolar to 3rd molar or the last present tooth in the jaw). SPSS v.22 was used for data analysis, Shapiro wilk test was applied to check the normality of the data. The data according to the analysis was normally distributed hence student t-test was applied to compare both the groups and paired t-test was applied to analyze the pre and post-experimental differences in the variables. The study was approved by the ethical committee of the university.

Results:

The mean age of study participants was 27.5 ± 2.3 years, and most of the participants visited the OPD in the 3rd month at 11.7±3.1 weeks. The 1st scaling was performed on the participants who agreed on the consent and on 3rd day the initial data was collected. On the 3rd day of evaluation the gingival pocket depth of participants was equal i.e. non-significant (p-value = >0.05) as shown in table 1.

Table 1. The t-test analysis of gingival pocket depth at the beginning of the procedure

Study variables	Group 1	Group 2	p-value
Age (years)	26.3 ± 2.1	27.9 ± 3.2	0.156
Gestational week	11.9 ± 1.1	10.4 ± 2.5	0.182

Mean pocket depth of upper anterior teeth (mm)	1.1 ± 0.6	0.9 ± 0.73	0.137
Mean pocket depth of upper posterior teeth (mm)	0.8 ± 0.9	1.4 ± 0.43	0.142
Mean pocket depth of lower anterior teeth (mm)	0.7 ± 0.5	0.9 ± 0.8	0.391
Mean pocket depth of lower posterior teeth (mm)	0.98 ± 0.5	1.0±0.42	0.162

At the end of treatment, the same parameters were evaluated to look for the efficacy of the treatment. There was no significant difference in the pocket depth of both the groups which highlighted the equal effectiveness of both the experimental liquids (table 2). The paired t-test analysis showed that during treatment there was an increase in gingival pocket depth (table 3). However, when asked about the pain, bleeding and bad breath (halitosis) majority of participants responded as no figure 1. Shows the responses of the participants.

Table 2. The t-test analysis of gingival pocket depth after treatment

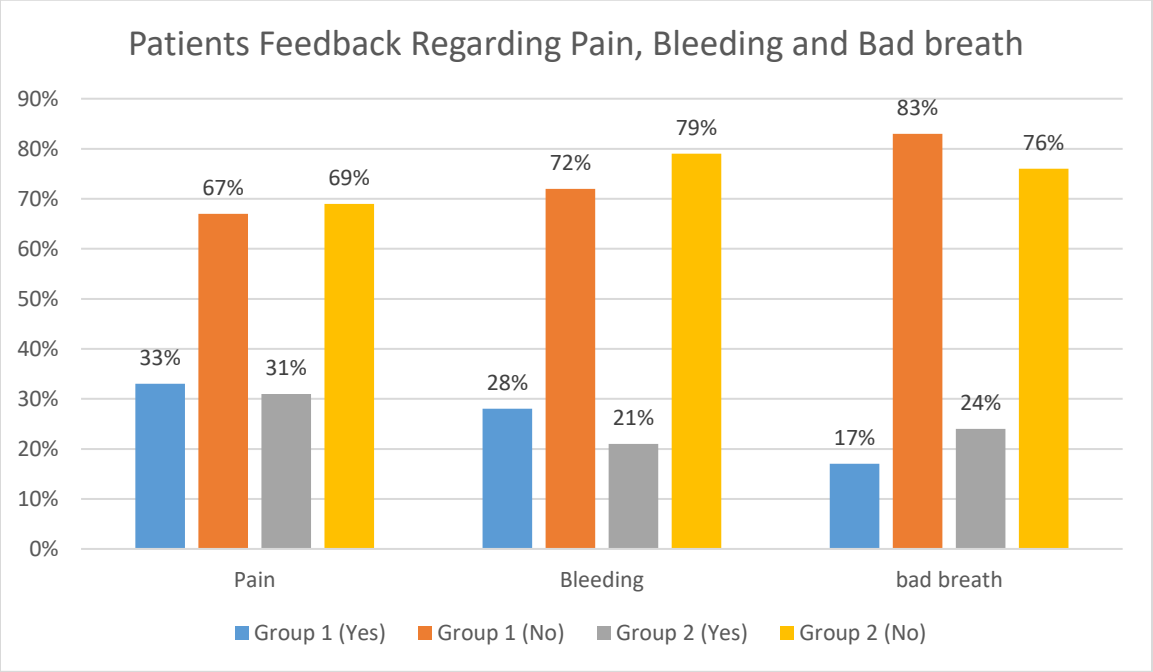
Study variables	**Group 1**	**Group 2**	**p-value**
Mean pocket depth of upper anterior teeth (mm)	2.4 ± 0.2	1.6 ± 0.91	0.129
Mean pocket depth of upper posterior teeth (mm)	1.2 ± 1	1.8 ± 0.5	0.272
Mean pocket depth of lower anterior teeth (mm)	1.7 ± 0.7	1.3 ± 0.9	0.191
Mean pocket depth of lower posterior teeth (mm)	0.97 ± 0.5	0.82±0.12	0.137

Table 3. The gingival pocket depth before and after treatment (paired t-test analysis)

Study variables		**Group 1**	**Group 2**
Mean pocket depth of upper anterior teeth (mm)	Before	1.1 ± 0.6	0.9 ± 0.73
	After	2.4 ± 0.2	1.6 ± 0.91
	p-value	**0.012***	**0.001***
Mean pocket depth of upper posterior teeth (mm)	Before	0.8 ± 0.9	1.4 ± 0.43
	After	1.2 ± 1	1.8 ± 0.5
	p-value	**0.021***	0.081
Mean pocket depth of lower anterior teeth (mm)	Before	0.7 ± 0.5	0.9 ± 0.8

	After	1.7 ± 0.7	1.3 ± 0.9
	p-value	**0.001***	**0.033***
Mean pocket depth of lower posterior teeth (mm)	Before	0.98 ± 0.5	1.0±0.42
	After	0.97 ± 0.5	0.82±0.12
	p-value	0.198	0.812

Figure 1. Patients' feedback regarding the pain, bleeding, and bad breath during the study.



Discussion:

Different parameters like probing depth, gingival pain, gingival bleeding, and bad breath are assessed to measure the severity of gingival hyperplasia (Vohra et al., 2020). These all parameters were evaluated in both, chlorhexidine (Group-1) and diluted clove leave extract (Group-2), groups.

Pocket depth of all maxillary and mandibular teeth was measured before and after the treatment. The results of our study revealed that the pocket depth was continuously increasing in both the CHX and clove leave extract groups. Although, there was a slightly slower increase of pocket depth in the clove leave extract group. another study has also demonstrated that there is no additional reduction in probing depth by using chlorhexidine or a control solution (Solderer et al., 2019). The constant increase in probing depth, despite being treated with both CHX and clove leave extract carrying antibacterial and anti-inflammatory properties, shows the impact of pregnancy-related hormonal changes on gingiva causing gingival hyperplasia and increased probing depth. Multiple other studies also express a relationship between pregnancy-related

hormonal changes and gingival hyperplasia leading to an increased periodontal depth that is independent of bacterial infection or inflammation (Chaparro et al., 2021, Yarkac et al., 2018, Gil et al., 2019, Morelli et al., 2018). So, further studies are recommended to explore the treatment of increasing gingival inflammation in pregnancy.

While evaluating other parameters, like gingival pain, bleeding, and halitosis, both CHX and clove leave extract showed equal and significant improvement. Gingival pain and bleeding were equally reduced in both groups showing a significant efficacy of clove leave extract. Previous literature has also reported antimicrobial and anti-inflammatory activity of clove oil against common microbes present in the oral cavity (Nagarajappa et al., 2018, Unalan et al., 2019, Vijayakumar et al., 2019). A study reported that clove oil extract has better efficacy when compared with standard antibiotics (Younis and Saleh, 2020). Another study has reported that highly concentrated and inappropriate use of clove oil products may cause oral mucosal burn (Sulaksana and Soegyanto, 2022). These antimicrobial properties of clove leave extract can help us in obtaining the desired antibacterial effects without having the common adverse effects associated with CHX. Our results also show that bad breath or halitosis was also significantly reduced in both groups. Many other studies have reported that multiple herbal extracts, especially the clove leave extract, have the capacity to reduce bad breath equally as antibacterial CHX (Veloso et al., 2020, Masriadi et al., 2021, Dobler et al., 2020). Halitosis is induced by oral microbes and using an antibacterial agent increases the chances of its reduction (Sun et al., 2019). Therefore, as clove leave exhibit antimicrobial properties, it will cause a reduction in all bacteria-induced signs and symptoms of gingivitis like gingival pain, bleeding, and halitosis.

The results of our study and previous literature report significant antimicrobial activity of clove oil extract that is equal to standard antibacterial CHX mouthwash. Incorporating herbal extracts in mouthwashes instead of CHX will produce equal antibacterial activity and minimum adverse effects like taste alteration, discoloration of teeth, burning sensation, xerostomia, or numbness of the tongue.

Conclusion: There was an increase in pocket depth during the study however, both the experimental liquids (chlorhexidine and clove leave extract) seemed to be equally effective. The frequency of pain, bleeding and bad breath was the same in both groups. Results of clove leave extract seemed to be comparable with the chlorhexidine.

Limitation: Due to ethical reasons no placebo group was compared.

Conflict of interest: None.

Ethical consideration: The study was approved by the ethics review board of the University.

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