Efficacy of *Pimenta dioica* leaf powder in the management of chronic generalized gingivitis: A clinical trial

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Abstract

**Background:** Inflammation of gingival or gingivitis is most prevalent in general population. Long-term usage of other adjunctive chemotherapeutic agents such as chlorhexidine which shows side effects such as discoloration of teeth has made the use of various herbal preparations as an adjunct to oral prophylaxis because of their reduced unwanted side effects and can be incorporated in our daily oral hygiene practice.

**Objective:** The aim of this study is to evaluate the ant gingivitis effect of a powder prepared from *Pimenta dioica* L. (”Allspice”) leaves in a 21-day experimental clinical trial consisting of patients with chronic generalized gingivitis.

**Materials and Methods:** A randomized clinical trial consisted of 40 patients was carried out over a period of 21 days. Forty patients were randomly divided into two groups: First group (Group A) consisted of 20 patients who were treated with oral prophylaxis only and the second group (Group B) consisted of 20 patients who were treated with experimental powder only. Both groups were subjected to different clinical parameters to evaluate the antiplaque and antigingivitis effect of the *P. dioica* leaf powder.

**Introduction**

Most prevalent gingival disease affecting humans is gingivitis. More than 90% of the general population, regardless of age, sex, or race, are affected by gingivitis.[3] Dental plaque is a biofilm of bacteria which accumulates around the gingiva, tongue, teeth, and dental restorations. Accumulation of plaque on the teeth and gingiva will lead to gingival and periodontal diseases.

Gingivitis is defined as inflammation of the gingiva in which the junctional epithelium remains attached to the tooth at its origin level. It is a chronic inflammatory disease limited to gingival tissue. Regular daily cleansing of teeth and periodontal areas help to reduce plaque accumulation.[2]

Even though oral prophylactic aids help to maintain adequate levels of oral hygiene, large number of people do not employ it accurately.[3]

Therefore, various chemotherapeutic agents have been used to control bacterial plaque, which improves the efficacy of daily oral hygiene control measures. Recent researches using herbal formulations with anti-inflammatory and antibacterial activities have increased to minimize the consequence of problems associated with the wide-scale usage of chemotherapeutic agents that may induce microbial drug resistance. Herbal preparations such as *Curcuma zedoaria* calendula, *Astronium urundeuva*, *Aloe vera*, and other herbs were used effectively since ages in Ayurveda are been tested for their effectiveness in the management of oral diseases with improved results.[4]

*Pimenta dioica* is Caribbean tropical tree [Figure 1], generally known as Allspice has been used in various human needs, such as a natural pesticide, perfumery industry, and food spice and in folk medicine to treat several disorders. Pimenta leaves and its raw berries contain aromatic compounds, mostly glycosides and polyphenols which show analgesic, antimicrobial, antipsychotic, and antihypertensive properties.[5]

The essential oils extracted from *P. dioica* leaves [Figure 1a] and berries have been used in food industry - mainly canning and meat industries and also in perfumery industries and cosmetic products. Essential oil derived from *P. dioica* leaves has showed analgesic, antioxidant, anesthetic, antimicrobial, antiseptic, muscle relaxant, carminative tonic, and stimulant properties. Extracted oils from Pimenta leaves have been used for treating diarrhea, muscle cramps, flatulence, digestive problems, and nausea. It has similar compounds which are found in clove oil.[6]

Recent researches have shown two of the known compounds isolated from *P. dioica*, eugenol and Gallic acid have selective
antitumor and antiproliferative properties on human cancerous cells and also on animal study models. Compounds like Ericifolin from the hydraulic extract of Allspice berries show potent anti-breast cancer and anti-prostate cancer properties that are verified in vitro as well as in vivo.\(^6\)

A study done by Meeker and Linke showed that microorganisms do not appear to develop resistance to the antibacterial effects of essential oils such as clove oil (eugenol) and thyme oil (thymol).\(^7\) An essential oil mouthwash has also been shown to have a good reduction of plaque accumulation and inflammation but without the side effects of chlorhexidine.\(^8\)

The essential oil extract of \(P.\ dioica\) leaves showed a potent antifungal activity against \(Aspergillus\) niger and effective antibacterial activity against coagulase negative \(Staphylococci\) and \(Pseudomonas\) species.\(^8\)

According to a study by George, the presence of alkaloids, saponins, tannins, flavonoids, proteins, and triterpenoids is indicated by phytochemical screening of aqueous alcoholic extract of Pimento leaves.\(^8\)

The purpose of the experimental clinical trial was to evaluate the efficacy of \(P.\ dioica\) (Allspice) leaf powder in plaque formation and on chronic generalized gingivitis.

**Materials and Methods**

**Preparation of the \(P.\ dioica\) leaf powder**

Mature leaves of \(P.\ dioica\) were collected from its cultivators in Puttur Taluk, South Canara District, Karnataka. The leaves were cleaned and dried under shade.

Dried leaves were pulverized into fine powder (120 mesh) and stored in airtight food grade plastic pouches (10 g each) for dispensing to the patients [Figure 1b].

**Subjects**

After obtaining clearance from the institutional ethical committee and consent from the patients, a total of 40 patients of 20-45 years age group with chronic generalized gingivitis from the outpatient Department of Oral Medicine and Radiology were selected for this study.

Inclusion criteria included patients with minimum 24 natural teeth showed clinical signs of gingivitis. All patients were informed about the nature and type of study, and written consent was obtained. Patients with a probing depth of ≥4 mm in any tooth, history of antibiotic coverage in the past 6 months preceding the study or on long-term exposure to anti-inflammatory drugs, and history of periodontal treatment including oral prophylaxis in the past 6 months, and also smokers, pregnant women, and those who were allergic to the \(P.\ dioica\) were excluded from the study.

**Method of research**

The study was randomized clinical trial with 2 groups for 21 days. Each group consisted of 20 subjects.

- Group A: Patients received scaling only.
- Group B: Patients received \(P.\ dioica\) leaf powder sample.

During each visit of the 21-day experimental period, that is on baseline, day 7, day 14, and day 21, the plaque index (PI),\(^5\) gingival index (GI),\(^6\) and papillary bleeding index (PBI)\(^9\) were recorded.

During each visit (day 0, 7, and 14), Group B patients were provided with fresh sample powder of \(P.\ dioica\), sufficient for next 7 days. They were instructed to massage the provided powder, about one-fourth teaspoon (approximately 500 mg) onto their gingival 2 times a day, morning, and night, for about 3-5 min and to be rinsed with water. No other oral hygiene instructions were given to the volunteers, and they were asked to follow their routine oral hygiene method. Powder was delivered during first 3 visits.

**Statistical analysis**

For the recorded PI (Silness and Loe), GI (Loe and Silness), and PBI (Mulhemann), intergroup comparisons were done using unpaired \(t\)-test, and intragroup comparisons were done by one-way analysis of variance. For all the tests, a \(P\) value of 0.05 or less was considered for statistical significance.

**Results**

All 40 patients completed the clinical trial. On subjective evaluation, adverse reactions such as discoloration of teeth, alteration of taste, or paresthesia were not reported during usage. However, 3-4 subjects reported an unpleasant taste and feeling of numbness of mucosa following the use of \(P.\ dioica\) leaf powder. Patient compliance was checked by taking history on each visit, and instructions were also reinforced at each visit.

Before the treatment, the patients of Group A showed symptoms of gingival inflammation (PI = 1.84 ± 0.15, GI = 1.71 ± 0.15, and PBI = 0.63 ± 0.06). There was a significant reduction in all indices (PI = 0.93 ± 0.12, GI = 0.84 ± 0.12, and PBI = 0.48 ± 0.04) when observed 21 days after the treatment. Group B also showed a reduction in plaque accumulation (PI = 1.25 ± 0.19,
GI = 1.05 ± 0.12, and PBI = 0.48 ± 0.02) [Figure 2a and b], with a statistical significance after 21-day treatment compare to the baseline values (PI = 1.63 ± 0.23, GI = 1.59 ± 0.23, and PBI = 0.56 ± 0.02) [Figures 3 and 4].

All the individuals in this study showed considerable improvement in gingival health determined by the clinical parametric analysis which is shown in Table 1.

It was evident that on using *P. dioica* powder three times a day for a period of 3 weeks shows an appreciable reduction in inflammation and accumulation of plaque [Figure 2a and b], which in the future would influence the treatment by decreasing the bleeding on probing leading to easy handling of tissues, thereby enabling us to arrest any further disease progression. This study was unique in its way that anti-inflammatory properties of *P. dioica* leaf powder were evaluated from patients with gingivitis without any mechanical debridement.

**Discussion**

Accumulation of plaque or food debris is responsible for inflammation of gingival tissues. Regular removal of plaque accumulation is essential for the prevention of periodontal diseases. Various modalities have been established, and search is going on to reduce the bacterial load. Herbal formulations are one group of drugs which have been used extensively in reducing the bacterial population.[9]

Aqueous extract of *P. dioica* leaves was found to inhibit *Staphylococcus aureus* and *P. aeruginosa*.[10] The essential oil of *P. dioica* berries was found to inhibit *Pseudomonas putida*, *Escherichia coli*, *Listeria monocytogenes*, *Salmonella typhimurium*, and *S. aureus*.[11]

This study was done to evaluate the clinical effects of powder of *P. dioica* (Allspice) leaves on plaque accumulation and inflammation of gingiva in subjects with chronic generalized gingivitis and to compare with the mechanical oral prophylaxis.

*P. dioica* powder showed significant improvement in the PI, PBI, and gingival indice scores at all-time intervals in a group of

![Figure 2: Comparison of gingival health of a Group B patient on baseline day (a) and 21 days (b)](image)

**Table 1:** Comparison of various indices of chronic generalized gingivitis before and after treatment in groups received only scaling (Group A) and *P. dioica* powder (Group B)

<table>
<thead>
<tr>
<th>Days of treatment/group</th>
<th>PI</th>
<th>GI</th>
<th>PBI</th>
</tr>
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<tbody>
<tr>
<td>Group A</td>
<td>Group B</td>
<td>Group A</td>
<td>Group B</td>
</tr>
<tr>
<td>Baseline</td>
<td>1.84±0.15</td>
<td>1.63±0.23</td>
<td>1.71±0.15</td>
</tr>
<tr>
<td>7th day</td>
<td>1.39±0.15</td>
<td>1.50±0.18</td>
<td>1.42±0.15</td>
</tr>
<tr>
<td>14th day</td>
<td>1.10±0.22</td>
<td>1.38±0.18</td>
<td>1.14±0.23</td>
</tr>
<tr>
<td>21st day</td>
<td>0.93±0.12</td>
<td>1.25±0.19</td>
<td>0.84±0.12</td>
</tr>
<tr>
<td>Mean difference (SD)</td>
<td>0.91***</td>
<td>0.38***</td>
<td>0.87***</td>
</tr>
</tbody>
</table>

Values represented as mean±SD, statistical significance of Group B values, when compared to the Group A values on 14th and 21st days treatment (***represents P<0.0001), *P. dioica*: *Pimenta dioica*, SD: Standard deviation, PI: Plaque index, GI: Gingival index, PBI: Papillary bleeding index.
patient who did not undergo oral prophylaxis. There was also a significant reduction in supragingival plaque accumulation.

**Conclusion**

Within the limits of this clinical study, it can be concluded that the powder of *P. dioica* leaves was efficient in treating gingivitis. Further research is necessary to identify the real benefits of *P. dioica* (Allspice) as a therapeutic and preventive agent for gingivitis, in addition to its other uses in herbal preparations.

**References**
