



Clinical Study

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Solanum xanthocarpum and *Acacia catechu* Willd- An Ayurvedic Soothe: A Randomized Clinical Trial

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ABSTRACT

Background: Periodontitis is mainly a microbial disease which commences on accumulation of plaque. Conventional mechanical therapy comprising of scaling in addition to chemical plaque control offers greater benefits to reduce plaque and associated gingivitis. Hence, in our study we have considered the use of relatively safe herbal compounds as an adjunct to scaling. **Aims & Objectives** of the study were, 1.To assess the antibacterial and anti-inflammatory properties of two herbal mouthrinses (*Solanum xanthocarpum* and *Acacia catechu* Willd) and 2. Compare the efficacy of herbal mouthrinses with Chlorhexidine (Gold standard). **Methods:** A total of 75 patients diagnosed with moderate to severe gingivitis were randomly assigned to 3 groups. The three groups were group A, Chlorhexidine mouthrinse, group B *Solanum xanthocarpum* mouthrinse and group C, *Acacia catechu* mouthrinse. This was a triple blinded study where random allocation was done by coin method. After scaling the clinical parameters namely plaque index, gingival index and sulcus bleeding index were recorded for all the three groups. Individuals were instructed to rinse with their respective mouthwash twice daily. The PI, GI and Sulcus Bleeding Index were recorded at baseline, 14th day and 21st day. **Results:** There was statistical significant difference in three groups in relation to GI, PI and SBI indices. Group C showed statistically significant difference in all the parameters. **Conclusion:** *Acacia catechu* and *Solanum xanthocarpum* were effective as antibacterial and anti-inflammatory agents. *Acacia catechu* showed better results than Chlorhexidine.

Keywords: Clinical Trial, Ayurvedic Soothe, *Solanum xanthocarpum*, *Acacia catechu*.

INTRODUCTION

Ayurveda is a traditional system of Indian medicine evolved around 5000 years ago in India that offers medications using herbs [1]. As, Oral cavity reflects the health of the whole body; mouth is often referred as “mirror of the whole body” and hence one should be aware of the various oral lesions and their management using traditional medicines [2]. In dental sciences bacterial plaque is the paramount in the etiology of periodontal diseases, the extent and severity of which depends on the interaction of host to microbial burden [3]. Regular plaque control measures are used as a main stay to maintain oral hygiene which helps in preventing and controlling the progression of the disease. Scaling and root planing forms the first and indispensable phase of periodontal therapy, but factors such as inaccessibility or plaque retentive areas, can compromise clinical and microbiologic outcomes [4]. Thus chemical agents are advocated as adjuncts to mechanical methods to augment plaque control. Several antibacterial chemicals, such as chlorhexidine (CHX), have been successfully used in prevention and treatment of gingivitis [5]. However, there are some limiting factors in the extended use of these substances, which demonstrate a need for an antiplaque agent with minimal side effects that can be used as an effective adjunct to mechanical plaque control [6]. Hence, the natural phytochemicals isolated from plants used in traditional medicine are considered as good alternatives to synthetic chemicals [7].

Solanum xanthocarpum, one of the members of Dasamula (ten roots) of the Ayurveda, also recognized as Indian night shade has been used against various diseases like cough, chest pain, vomiting etc and in dentistry the fumigations are used against caries which also helps in wound healing [8]. Dried fruit extracts possesses anti-inflammatory, antimicrobial, antioxidant and antifungal properties. The unsaponifiable

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matter of fruits contain two sterols, one of which is carpesterol [9]. Kusano *et al*, reported the following steroidal constituents namely, cycloartanol, sitosterol, stigmasterol, carpesterol, clolesterol, sitosteryl glucoside, stigmasteryl glucoside, soalmargine and beta-solamargine from fruit extracts [10]. Manye *et al*, showed that fruits have more alkaloids than other organs in the plant species and alkaloid productivity vary under different organic solvents [11].

Acacia catechu Willd, known as Khadira in Sanskrit means that which stabilizes the body and diseases. Also known as Dantadhavana in Ayurveda, is useful for cleansing the teeth [12]. It has many properties like antibacterial, anti-inflammatory, astringent, antifungal, antimicrobial, anticancer properties and also helps in wound healing. The bark of the tree contains flavanoids like catechin, epicatechin, epigallocatechin, alkaloids and tannins that act as antioxidants. Khadira heartwood extract is found to be an effective antibacterial agent. A study conducted in ethanolic and aqueous heartwood extract of khadira, proved its efficacy as a potent antibacterial agent. It is also used as mouthwash for gingivitis, sore throat, dental and oral infections, as stated by David S *et al*, in the year 1987. As mentioned by Chino K, it is used as a topical agent for mouth ulcers. Antioxidant and astringent are the cardinal properties of *Acacia catechu*. *Acacia* species produces gum exudates, traditionally called as gum Arabic or gum acacia which is widely used in food industry. Katha used as a chewing ingredient is a resin part of *Acacia catechu* used in Ayurveda preparations [13]. Since the dried fruits of *Solanum xanthocarpum* contain antimicrobial and anti-inflammatory properties and to the best of our knowledge, as there were no studies that have used *Solanum xanthocarpum* in a mouthwash we, in our study aimed to assess and compare the antibacterial and anti-inflammatory effects of two herbal mouthrinses (*Solanum xanthocarpum* and *Acacia catechu* Willd) and to compare the anti-inflammatory and antibacterial effects of two herbal mouthrinses (*Solanum xanthocarpum* and *Acacia catechu* Willd) with Chlorhexidine.

MATERIALS AND METHODS

Ethical approval was obtained by the Institutional Review Board of the SDM College of Dental Sciences and Hospital, Dharwad. The randomized trial was registered under the Clinical Trials protocol registration system (CTRI/2019/08/020707). Informed consent was obtained from all the individuals. The null hypothesis H_0 – *Acacia catechu* and *Solanum xanthocarpum* were not effective.

A total of 75 patients with chronic generalized gingivitis in the age group of 18-55 years were recruited from Outpatient Department of Periodontics, SDM College of Dental Sciences and Hospital, Dharwad, India from February 2019 to April 2019. Group sample sizes were decided by power analysis with 95% power and a significance level of 0.05, based on the formula $n=f(\alpha/2,\beta)\times\sigma^2/(\mu_1-\mu_2)^2$. Allocation was done using coin toss method. Tossing was done randomly by the assistant. In each group 25 subjects were allocated. The operator, patient and the statistician were blinded. Patients who were systemically healthy with moderate or severe gingivitis (gingival scores of 1.1-2.0 / 2.1-3.0) were included in the study. Extraneous factors like patients seeking any type of antibacterial mouthwash within 4 weeks of commencement of study, history of any systemic disease, or past illness, history of smoking, tobacco chewing, pregnant and lactating women, use of antibiotics and anti-inflammatory drugs in previous 6 months and

subjects who have undergone periodontal treatment in the past 6 months were excluded from the study. A total of 79 individuals were assessed for eligibility, of them 75 met the inclusion criteria and were randomly assigned to one of the three groups using consecutive sampling. Allocation was done using coin toss method of randomization. Scaling was performed for subjects who participated in the study. The clinical parameters were recorded after scaling which included Plaque index (Silness and Loe, 1964), Gingival index (Loe and Silness 1963) and Sulcus bleeding index (Muhlemann and Son's, 1973) followed by oral hygiene instructions were given. Prior to the distribution of mouthwashes palatability was checked. Individuals were instructed to use 10 ml of mouthwash twice daily for 30 seconds for a period of 14 days and advised not to rinse with water or drink anything for half an hour [15]. Clinical parameters were also recorded during the follow up visits on 14th day and 21st day respectively. Chlorhexidine was distributed to group A, *Solanum xanthocarpum* to B and *Acacia catechu* to group C respectively.

Method of Preparation

The herbal extract was prepared in Ayurved Mahavidyalaya, Heggeri, Hubli. The preparation was done in accordance with the standard principles described under *Kwatha kalpana* by Sharangadhara Acharya in his classic text "Sharangadhara Samhita" [14]. The dried fruits of *Solanum xanthocarpum* was available in the local market. It was ground into fine powder and one part of this powder was mixed with 16 parts of water in an earthen pot and boiled over medium flame to reduce the mixture to one eighth part. The mixture was cooled to room temperature and filtered thoroughly after which it was packed and stored. To make it palatable 1% camphor was added and to preserve for longer duration, 0.1% of sodium benzoate was added as a preservative.

The same method was utilized for the preparation of *Acacia catechu* mouthwash which was commercially available in the form of powder. Commercially available 0.2% Chlorhexidine was used.

Scaling and root planing was performed for subjects who participated in the study. The clinical parameters were recorded later which included Plaque index (Silness and Loe, 1964), Gingival index (Loe and Silness 1963) and Sulcus bleeding index (Muhlemann and Son's, 1973) followed by oral hygiene instructions. Prior to the distribution of mouthwashes palatability was checked. Individuals were instructed to use 10 ml of mouthwash twice daily for 30 seconds for a period of 14 days and advised not to rinse with water or drink anything for half an hour. Similar duration and amount was followed in a study by Axelsson and Lindhe [15]. Clinical parameters were also recorded during the follow up visits on 14th day and 21st day respectively.

Patient evaluation was performed to assess for any adverse effects related to use of respective mouthwashes at the time of follow up visits.

Statistical Analysis

Analysis of data were carried out using statistical software 23 and Microsoft office 2007. Values of different parameters collected are expressed as mean \pm standard deviation. Chi – square test was used for intergroup comparison of Plaque Index, Gingival Index and Sulcus

Bleeding Index. Repeated measures analysis of variance (ANOVA) and F test was performed for comparison of differences among the three groups.

RESULTS

Changes in Gingival Index, Plaque Index and Sulcus Bleeding Index among groups

Table 1:

GINGIVAL INDEX	Group-A	Group-B	Group-C	P value
Baseline	1.74±0.18	1.72±0.21	1.86±0.29	0.058
14 th day	0.43±0.44	0.74±0.3	0.53±0.42	0.018*
21 st day	0.19±0.29	0.26±0.22	0.17±0.2	0.423
PLAQUE INDEX				
Baseline	0±0	0±0	0±0	-
14 th day	0.66±0.36	0.85±0.27	0.65±0.38	0.085
21 st day	0.54±0.35	0.63±0.32	0.47±0.31	0.249
SULCUS BLEEDING INDEX				
Baseline	2.42±0.49	2.39±0.45	2.64±0.7	0.235
14 th day	0.63±0.67	0.95±0.59	0.85±0.76	0.225
21 st day	0.2±0.39	0.27±0.34	0.1±0.23	0.197

Changes in Gingival Index, Plaque Index and Sulcus Bleeding Index over time

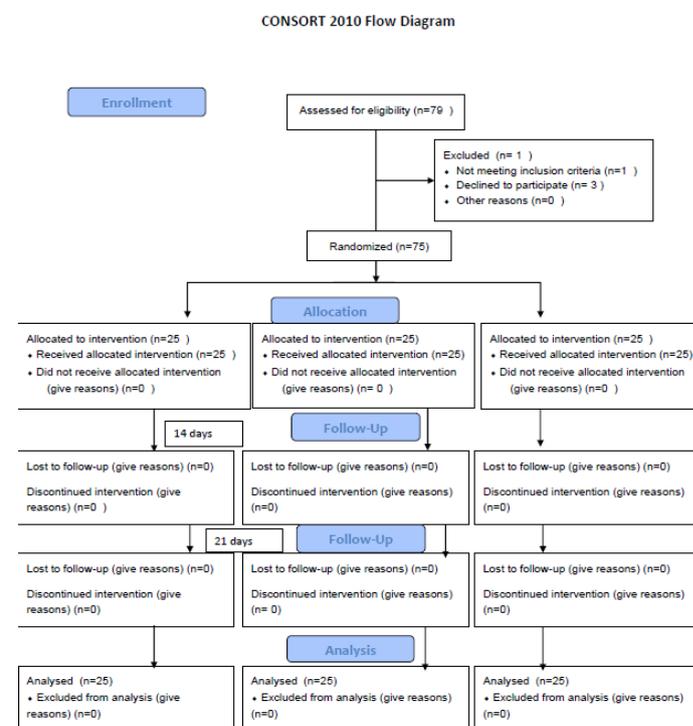
Table 2:

GINGIVAL INDEX	Baseline	14 th day	21 st day	P value
Group-A	1.74±0.18	0.43±0.44	0.19±0.29	<0.001*
Group-B	1.72±0.21	0.74±0.3	0.26±0.22	<0.001*
Group-C	1.86±0.29	0.53±0.42	0.17±0.2	<0.001*
PLAQUE INDEX				
Group-A	0±0	0.66±0.36	0.54±0.35	<0.001*
Group-B	0±0	0.85±0.27	0.63±0.32	<0.001*
Group-C	0±0	0.65±0.38	0.47±0.31	<0.001*
SULCUS BLEEDING INDEX				
Group-A	2.42±0.49	0.63±0.67	0.2±0.39	<0.001*
Group-B	2.39±0.45	0.95±0.59	0.27±0.34	<0.001*
Group-C	2.64±0.7	0.85±0.76	0.1±0.23	<0.001*

There was a difference in plaque index, gingival index and sulcus bleeding index in group A, group B and group C at three intervals. The results were not statistically significant. Intergroup comparison showed statistical significant difference in relation to all the three parameters. Group C showed statistically significant values compared to group A.

Table 1 presents mean ± Standard deviation values of gingival index, plaque index and sulcus bleeding index at different time intervals among groups. It shows the gingival index values of F test, where we can observe statistically significant difference in gingival values from baseline to 14th day and more reduction in values can be noted in group A and group C as compared to group B. There was no statistically

significant difference noted in plaque index and sulcus bleeding index. Table II presents mean ± standard deviation values of gingival index, plaque index and sulcus bleeding index at different time intervals over time. All the three groups showed gradual decrease in Gingival index, Plaque index and Sulcus bleeding index values from baseline to follow up visits at 14th day and 21st day respectively. Therefore the results of our study showed that both the test mouthwashes were equally effective as that of Chlorhexidine suggesting that these mouthwashes can be used safely.



DISCUSSION

The current study was aimed to assess and compare the antibacterial and anti-inflammatory properties of two herbal mouthrinses (*Solanum xanthocarpum* and *Acacia catechu Willd*) with 0.2% Chlorhexidine in individuals with generalized gingivitis.

Solanum xanthocarpum, a prickly perennial herb is useful against various diseases like cough, chest pain, vomiting and also in wound healing. As mentioned by Anvikar *et al*, the dried fruits are smoked in the form of cigarettes to cure dental infection or toothache [16] and this anti-inflammatory effect is due to the presence of a rare sterol i.e, carpesterol [17]. Lupeol also acted as a multi-target agent with immense anti-inflammatory properties [18].

The other herb taken in our study was *Acacia catechu*, which is beneficial both internally as well as externally. The extract was found to be equally effective against gram positive and gram negative bacteria. A study done by Pawar *et al*, 2009 stated that herbal dentifrice containing *Acacia catechu* as a key ingredient helped in the reduction of plaque, gingivitis and calculus within 15 days. The chief major active chemical components of *Khadir* (*Acacia catechu willd*) are flavonoids like catechin which is responsible for dual inhibition of Cyclooxygenase and 5-Lipoxygenase known to decrease the inflammation [19]. Ethanolic and aqueous heartwood extract of *Acacia catechu*, proved its efficacy as a potent anti-bacterial agent and the

presence of Taxifolin in Acacia was responsible for its antibacterial activity [20]. Agarwal *et al*, 2015 conducted a study where Acacia catechu mouthwash was found to be equally effective as an antiplaque and antigingivitis agent in fixed orthodontic appliance patients with no side effects. A herbal oil Irimedadi taila containing Acacia catechu as the key ingredient is equally effective in reducing plaque induced gingivitis, as Chlorhexidine gluconate, used as an adjunct to mechanical plaque control [21]. Acacia catechu can be prescribed to people of all ages and is beneficial and safe even when ingested which is definitely an advantage over Chlorhexidine.

In our study we found that Acacia Catechu (Group C) was better antibacterial and anti-inflammatory compared to Chlorhexidine and Solanum xanthocarpum. A study was conducted by Agarwal *et al*, where Acacia catechu was compared with 0.2% CHX in patients with fixed orthodontic appliances and both showed to be equally effective.

Limitations

1. Small sample size
2. Two patients who received Solanum xanthocarpum (group B) expressed that the taste was bitter. Four patients who received Acacia catechu (group C) reported staining of teeth and hence needs to be investigated further.

CONCLUSION

In modern times because of the awareness amongst people regarding healthy lifestyle, natural products are in demand. Therefore, it becomes necessary to switch on to herbal formulations and relate its efficacy. In our study, *Acacia catechu* definitely showed better results than Chlorhexidine and *Solanum xanthocarpum* was same as Chlorhexidine.

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