(REVIEW ARTICLE)

Anti-gingivitis natural products: Aloe vera gel, tea tree oil mouthwash, turmeric gel, myrrh extract/mouthwash

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Abstract

Gingivitis is an inflammatory gum disease which occurs around the cervical portion of the gum and is classified by its clinical appearance. Gingivitis is very common, and anyone can be affected including but not limited to poor oral care habits. This paper reviews the potential of Aloe Vera, Tea Tree Oil Mouthwash, Turmeric Gel, and Myrrh Extract/Mouthwash. The study also assessed the knowledge and opinions of first-year pharmacy students. The survey part of the study included 5 knowledge-based and 5 opinion-based questions, focusing on the four herbal remedies. The knowledge-based questions showed a 65.7% correct response rate, with the question on turmeric receiving the highest accuracy (94.3%), while the question surveying the participants' knowledge about the source of information for herbal products received the lowest correct answer rate at 31.4%. Opinion-based questions revealed a positive attitude towards herbal remedies, with about 67.6% to 94.3% strongly agreeing, or agreeing with the potential benefits of the products. The highest agreement rate at 94.3% was obtained for the statement that myrrh can help reduce inflammation in the gums and inhibit the growth of bacteria, thus assisting in the management of gingivitis. Disagreement of opinions was minimal, ranging from 5.7% to 32.3%, indicating a widespread inclination towards positive agreement.

Keywords: Gingivitis; Survey; Aloe Vera; Tea Tree Oil; Turmeric; Myrrh

1 Introduction

1.1 Disease Mechanism

Gingivitis is an inflammatory condition of the gingival tissue that is restricted to the soft-tissue region of the gingival epithelium and connective tissue. It is commonly caused by bacterial infection. There are various forms of gingivitis based on clinical appearance, duration of infection, severity, and etiology. Plaque-induced gingivitis is the most frequent chronic form of gingivitis. Swelling, redness, tenderness, a shiny surface, and bleeding of gingival tissues upon gentle probing characterize gingivitis. Because gingivitis does not often cause spontaneous bleeding and is commonly painless, patients do not recognize it as a disease to seek medical attention [1].

Plaque is a thin film that forms on the tooth surface due to poor oral hygiene. If not regularly removed, it can harden up and form calculus. As plaque harbors many bacteria, inflammation can occur in the gingival tissue [2].

Most cases of gingivitis arise from poor oral hygiene which leads to the formation of dental plaque and calculus; however, many other factors can affect the gingiva's susceptibility to the oral flora. Factors associated with gingivitis include hormonal changes, stress, poor nutrition, certain medications such as phenytoin, calcium channel blockers, and

cyclosporine, diabetes mellitus, immune dysfunction, local trauma, dental caries and tooth crowding with overlapping. The frequency of gingivitis appears to be high in all age groups [3].

1.2   Prevalence and Impact

Periodontal diseases affect 90% of the global population, making it the most common oral disease. In the United States alone about 50% of adults have some form of gingivitis, and up to 80% have experienced some form of periodontal disease in their life. The incidence is higher in older individuals, males, and African Americans. Low income and education levels are associated with severe forms of periodontitis [4]. Findings demonstrate gingivitis has a range of perceived impacts on quality of life. It can negatively affect quality of life in children and adolescents. The impacts include oral symptoms, functional limitations, and emotional and social wellbeing. Pain, difficulties while brushing, and wearing dentures cause inconveniences [5].

2   Review of Herbs

Several plants and plant products have been used to treat gingivitis. Rani et al (2018) have reviewed 17 plant species, including Aloe vera and Curcuma longa (turmeric) that are used in the treatment of gingivitis [6]. In the present paper, four plants used in the survey are reviewed briefly.

2.1   Aloe Vera Gel

Aloe vera (synonym: *Aloe barbadensis*) is a cactus-like plant that grows readily in hot, dry climates and is also cultivated. Aloe vera gel is used to make cosmetics and medicinal products. It has anti-inflammatory, anti-arthritic antibacterial and hypoglycemic effects. It contains vitamins, enzymes, minerals, sugars, lignins, saponins, salicylic acids, and amino acids, with polysaccharides thought to be the active ingredients of its anti-inflammation and immune-modulation effects. The anti-inflammatory property of aloe vera gel is useful in treating plaque-induced gingivitis. Forty-five patients who were diagnosed with plaque-induced gingivitis were included in the study. They were divided into three groups of 15 individuals in each group. Group 1 rinsed with aloe vera mouthwash twice daily for three months. Group 2 were treated with scaling only. Group 3 rinsed with aloe vera mouthwash and scaling was done. Comparison of improvement of gingivitis among the three groups, as measured by gingival and sulcus bleeding indices, showed an anti-inflammatory effect in all three groups. Reduction in gingival inflammation was more in Group 3, who used both Aloe vera mouthwash and scaling. The results of the gingival index and sulcus bleeding index of the scaling only and aloe vera mouthwash only groups are suggestive of a decrease in gingival inflammation at the end of the first and third months. According to the authors of the study, both groups had a similar degree of reduction, suggesting that the aloe vera mouthwash can be used as an adjunct to scaling with better resolution of the inflammation [7].

In a study published by Sayar and colleagues, it was shown that the effect of aloe vera toothpaste on periodontal and gingivitis diseases was like that of fluoride toothpaste and the authors suggested aloe vera toothpaste can be used as an alternative to a chemical toothpaste. The number of study subjects was only twenty, and the authors stress the need for additional long-term prospective studies to confirm the results of their study [8].

2.2   Tea Tree Oil Mouthwash

Tea tree oil, also known as oil of the Tea tree, or Melaleuca essential oil is derived from the distillation of the leaves of the Melaleuca alternifolia tree. It has been reported to have antimicrobial activity. Ripari et al. (2020) evaluated the efficacy of tea tree oil for the treatment of gingivitis. The study compared the effect of tea tree oil mouthwash with chlorhexidine 0.12% mouthwash. The pilot study divided 42 patients into two groups: group A (n =22) were treated with 100% teat tree oil group, while group B (n=20) were treated with chlorhexidine 0.12% mouthwash. The treatment lasted for 14 days. In both groups, reduced plaque presence as well as reduced bleeding on probing were achieved. In group A, the mean plaque index decreased to 5.5%, while in group B, the mean Plaque Index (PI) decreased to 2.37%. In group A, the gum status improved, with a reduction in bleeding, redness and edema in the gums [9].

2.3   Turmeric Gel

Turmeric (*Curcuma longa*), commonly known as Indian Saffron, has been used for a long time to treat a wide range of illnesses. The main compound curcumin is obtained from the root of the plant. Traditionally turmeric has been used to treat eye infections, burns, acne, and skin diseases, and is also used as a digestive and carminative. The plant has antioxidant, anti-inflammatory, antibacterial, anti-carcinogenic, and anti-mutagenic properties. The powder obtained from the rhizome of *C. longa* is abundant in curcuminoids. Significant anti-inflammatory effects arise from the volatile oils and curcumin found in Curcuma longa. Turmeric finds wide application in dentistry as a mouth rinse, plaque detection, and as an irrigant for subgingival areas and in endodontics [10].

A systematic review was conducted by Terby et al., (2021) on the efficacy of curcumin as the main ingredient in mouth rinses, topical oral gel, subgingival irrigant, locally delivered gel and locally delivered chips to reduce gingival inflammation and probing pocket depth. The meta-analysis included 27 randomized controlled trials involving 963 participants. For the long-term evaluation of probing pocket depth in nine studies each with 400 participants, there was a statistical difference in the reduction when curcumin topical gel was used as compared with the control. However, in the evaluation of short-term plaque and gingival scores, the authors found no statistically significant differences in the reduction when curcumin mouth rinse was used. The authors concluded that curcumin topical and local delivery gel, mouth rinses and sub-gingival irrigants were as effective as the routinely used agents for reduction of plaque and gingival inflammation, and that curcumin local delivery gel had greater reduction in probing pocket depth [11].

2.4 Myrrh extract/mouthwash

Myrrh (*Commiphora myrrha*) has been reported to have a wide range of applications in oral and body diseases. It has been used for a long time. Its pharmacological activities include antibacterial, antifungal, anti-inflammatory, antioxidant, analgesic and antiparasitic properties. Myrrh is produced as essential oils, tincture, gargles, and mouthwashes. It is used for treating sore throats or other oral mucosal or gingival irritations and enhance wound healing. In a review article, Attia and Alqhtani suggested that *C. myrrha* extracts are effective in improving oral hygiene. They claimed the clinical effectiveness of myrrh in reducing dental plaque and gingival inflammation when used as an adjunct to mechanical plaque control and professional therapies of periodontitis patients [12].

Zahid and Alblowi (2019) assessed the effectiveness of a myrrh mouthwash in dental plaque and gingivitis control in comparison to a commercial chlorhexidine mouthwash. The pilot study was a randomized double blinded controlled clinical trial involving 12 systemically subjects, in whom experimental gingivitis was induced prior to the study. The subjects were divided into 3 groups: normal saline, 1% *Commiphora myrrh* mouthwash, and 0.12% chlorhexidine gluconate mouthwash. Plaque Index (PI), and Gingival Index (GI) were assessed before, and after the treatment with mouthwashes over 14 days. Myrrh mouthwash resulted in clinical improvement in plaque reduction and gingival inflammation parameters [13]. However, the small sample size precludes definitive conclusions.

3 Literature Gap, Study Objective, and Impact

Natural products and traditional medicines are of great importance. Traditional modalities such as Chinese medicine, Ayurveda, Kampo, traditional Korean medicine, and Unani have been practiced in some areas of the world and have blossomed into orderly regulated systems of medicine. The use of natural products as traditional medicine has increased over the years. Modern medicine has benefited considerably from two areas: drugs with similar effects as in traditional medicine and drugs with different effects from those of traditional medicine. From the history of drug development, it is evident that many drugs have been derived from traditionally used medicinal herbs.

The application of, and research into, natural products is far from satisfactory, hence a gap exists. Several problems need to be addressed in future studies. In addressing a slice of this literature gap in the context plant natural products for gingivitis, this study aims to provide valuable insights into the knowledge and opinion of pharmacy students at the early stage of their education.

4 Methods

This survey was conducted as part of the Drug Information course, a mandatory 2-credit-hour class for first-year professional pharmacy students. In the course, students received instruction on research methodology and survey administration. Each student was assigned an individual topic and tasked with crafting an introduction and developing two sets of survey questions. The first set comprised 5 knowledge-based questions, while the second set contained 5 opinion-based questions. These questions were incorporated into an online survey, and all students were invited to participate in answering them. A descriptive statistical data analysis was conducted. A Likert scale was used to collect data and record opinions: 4=strongly agree; 3=agree; 2=disagree; 1=strongly disagree. The student (AM) was then asked to integrate the results into a write-up, and this paper was the result of that exercise.

5 Results

5.1 Demographics

Table 1 presents data on the gender, age distribution, and geographical backgrounds of the survey participants. Of the 40 students who responded to the demographic questionnaire, 35 completed the knowledge-based and opinion

questions, which represented a response rate of about 87.5%. In the demographic section, one survey participant did not reveal the state she lived in prior to joining the pharmacy program. One-fourth (25%) of the participants were male and 75% female. A range of age groups is represented, with the majority falling into the 18-24 (52.5%) and 24-30 (37.5%) years-old categories. A few were in the 30-40 (7.5%) and above 40 (2.5%) age range.

Prior to joining the Howard Pharmacy Program, the surveyed participants lived in Washington, D.C. (15.4%), Maryland (38.5%), Virginia (2.6%), and most of them lived in other states (43.6%).

Table 1 Demographic data of the participants (*n*=40)

Demographic characteristics		*n* (%)
Gender	Male	10 (25)
	Female	30 (75)
Age (years)	18 -24	21 (52.5)
	24 – 30	15 (37.5)
	30 – 40	3 (7.5)
	Above 40	1 (2.5)
States you have lived in before coming to Howard Pharmacy Program*	Washington, D.C.	6 (15.4)
	Maryland	15 (38.5)
	Virginia	1 (2.5)
	Other States	16 (43.6)

*One participant did not answer the state she lived in.

5.2 Participants' work and educational background

Table 2 represents the educational background and work experience of the participants before they joined the pharmacy program. Two students (5%) never worked, while of those who had jobs 20 (52.6%) were hired in pharmacy-related areas, while 23.7% worked in nonpharmacy but other health-related fields, and a similar percentage (23.7%) had non-health-related jobs. Regarding their highest educational level, the majority (65%) held a Bachelor of Science (BSc) or Bachelor of Arts (BA) degree. A smaller number (17.5%) had a Master of Science (MSc) degree, while five (12.5%) had completed some pre-pharmacy or college work. Two (5%) had an associate degree. These findings offer a snapshot of the work experience and academic background of the surveyed students.

Table 2 Work and educational background of the participants

Question	Response	*n* (%)
How many years have you had a paying job before joining the Pharmacy program at Howard?	Never Worked	2 (5)
	1-2	12 (30)
	3-4	10 (25)
	5 or more	16 (40)
What kind of work have had?	Pharmacy Related	20 (52.6)
	Non-Pharmacy Related but other health related	9 (23.7)
	Non-health related	9 (23.7)
What is the highest educational level you have achieved before joining the pharmacy program at Howard?	Pre-Pharmacy or some college work	5 (12.5)
	Associate degree	2 (5)
	BSc or BA degree	26 (65)
	MSc/MA or higher	7 (17.5)

5.3   Knowledge-based questions

An average of 65.7% of the survey participants answered the 5 knowledge-based questions correctly. The question with the highest score pertained to the active compound of turmeric, curcumin possessing anti-inflammatory and antimicrobial properties, which received a 94.3% of correct answer rate. The question that was answered incorrectly by most participants is the question that dealt with the primary source of knowledge about herbal remedies which was answered correctly by only 31.4% of the respondents.

Table 3 The results of the knowledge-based questions (*n*=35)

Questions	Correct Answer	True (*n*)	False (*n*)	Participants with correct answers: *n* (%)	Mean correct answer rate out of 1 (±SD)	Variance
Does Aloe vera have anti-inflammatory and antimicrobial properties that can help reduce inflammation and fight the bacteria that cause gingivitis	True	31	4	31 (88.6)	0.8857±0.3182	0.1012
Aloe vera's anti-inflammatory properties can soothe irritated gums and promote healing	True	28	7	28 (80)	0.8000±0.4000	0.1600
Turmeric contains an active compound called curcumin, which has anti-inflammatory and antimicrobial properties	True	33	2	33 (94.3)	0.9429±0.2321	0.0539
Myrrh extract has only recently been discovered for its antimicrobial and anti-inflammatory properties	False	23	12	12 (34.3)	0.3429±0.4747	0.2253
The primary source of knowledge about herbal remedies, according to the provided information, is television (TV)	False	24	11	11 (31.4)	0.3143±0.4642	0.2155
Average correct answer				65.7%	0.6572±0.3378	0.1512

5.4   Opinion-Based Questions

Table 4 shows a summary of the data for the opinion-based questions. Most respondents in this survey expressed positive agreement with the potential of herbal remedies to enhance gum health and reduce signs of gum health. Over 70% strongly agreed or agreed that herbal remedies like Aloe vera could effectively reduce inflammation of gums, and a similar percentage believed that Aloe vera's healing properties make it a valuable natural remedy for improving skin texture and treating gingivitis. Over 90% agreed that myrrh can help reduce inflammation in the gums and inhibit the growth of bacteria, thus assisting in the management of gingivitis. About 85% held the belief that herbal remedies like can also help alleviate pain and discomfort associated with gum disease.

The percentage of those who strongly disagreed or disagreed with all five opinion statements was notably lower, ranging from 0% to about 29%, indicating a prevailing inclination toward positive agreement regarding the benefits of these herbal remedies for gum care.

Table 4 Opinion-based questions (*n*=35); *n*=34 for the last row

Question	SA (*n*, %)	A (*n*, %)	DA (*n*, %)	SA (*n*, %)	Mean LK ± SD	Variance
I believe herbal remedies can used as a substitute for traditional gingivitis treatment.	12 (34.3)	13 (37.1)	10 (28.6)	0 (0.0)	3.0571±0.7908	0.6253
I think Myrrh can help reduce inflammation in the gums and inhibit the growth of bacteria, thus assisting in the management of gingivitis.	12 (34.3)	21 (60.0)	2 (5.7)	0 (0.0)	3.2587±0.5642	0.3184
I agree that Aloe vera can promote the healing of damaged gum tissue and reduce pain and discomfort	10 (28.6)	19 (54.3)	4 (11.4)	2 (5.7)	3.0571±0.7908	0.6253
I believe that herbal remedies like can also help alleviate pain and discomfort associated with gum disease.	11 (31.4)	19 (54.3)	2 (5.7)	3 (8.6)	3.0857±0.8408	0.7069
I think these herbal remedies should be considered a sole or primary treatment for more severe cases.	8 (23.5)	15 (44.1)	6 (17.6)	5 (14.7)	2.7647±0.9719	0.9446
Average	30.4%	50.0%	13.8%	5.8%	3.0501±0.7503	0.6565

*SA= Strongly agree; A=agree, DA=Disagree; SD=Strongly disagree; LK=Likert Score; SD=Standard deviation

6 Discussion

An average correct response rate of 65.7% was achieved for the knowledge-based section of the survey (Table 3). The highest score of 94.3% for the anti-inflammatory and antimicrobial properties of curcumin indicated that 33 out of the 35 students had the correct knowledge about this statement. Of note is the low number of participants (*n*=11; 31.4%) who disagreed with the statement that the primary source of knowledge about herbal remedies is television. The participants were given a chance to review the literature on the topic prior to completing the survey. As can be inferred from the literature review in this study, Aloe vera is well-known for its anti-inflammatory and healing properties. Its anti-inflammatory properties can soothe irritated gums and promote healing. It is a medicinal plant with antioxidant and antibacterial properties. Aloe vera benefits can include reducing dental plaque, accelerating wound healing. Turmeric has an active compound called curcumin and is known for anti-inflammatory properties. Turmeric Powder contains antiseptic and anti-inflammatory, antimicrobial, anti-carcinogenic, and antimutagenic healing qualities. As a toothpaste, turmeric can help create an environment where gingivitis-causing bacteria do not survive in the mouth. Myrrh extract appears to contain compounds that can help reduce the chemicals that cause inflammation in the body. Myrrh mouthwash has been shown to lead to clinical improvement in plaque reduction and gingival inflammation parameters. Myrrh has been considered as a potential therapeutic agent in treating gingivitis for many years. According to generally accepted knowledge, the primary sources of knowledge about herbal remedies come from a variety of sources, including books, reputable websites, healthcare professionals, and traditional wisdom. While television may provide some information, it is not typically considered the primary source for learning about herbal remedies.

The survey data on opinion-based questions reveals a prevalent positive attitude towards the potential benefits of herbal remedies in gingivitis. The aggregate of strong agreement and agreement rate was over 80% (Table 4). The agreement trend is also reflected in the cumulative Likert score of over 3. Over 70% of respondents strongly agreed or agreed that herbal remedies like Turmeric and Aloe vera have the potential to improve gum health and reduce infection and inflammation. Additionally, nearly 82% agreed that Aloe vera treats the gums for gingivitis. The percentage of those disagreeing was notably lower, ranging from 0% to 28.6%, indicating a prevailing inclination towards positive agreement regarding the benefits of these remedies for gum care.

7 Conclusion

In this survey involving 35 participants, knowledge-based questions received 65.7% correct responses. However, in the opinion-based responses, over 80% of the participants displayed a notably positive attitude towards herbal remedies in gum health. Myrrh's anti-inflammatory and bacterial inhibitory effects garnered over 94% agreement, and the use of

Aloe vera for gingivitis received strong support from about 83% of respondents. Disagreement about the use of was minimal, ranging from 0% to 32.3%, indicating a widespread inclination towards positive agreement regarding the benefits of the products in gum health.

This study presents several limitations. The sample size of 40 participants, with 34 to 35 respondents, is relatively small and lacks diversity, limiting the generalizability of findings. Factors beyond knowledge and attitudes, such as cultural influences and personal experiences may impact overall results.

Compliance with ethical standards

Acknowledgement

Disclosure of conflict of interest

The authors declare no conflict of interest.

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