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# Gingival Inflammation Reduction Using Functional Chewing Gum- An Analytical Study

**Rutvi Jagdishbhai Upadhyay[1], Preety Prasad[2]**

[1]Graduate, Karnavati School of Dentistry

[2]Graduate, Jaipur Dental College, Jaipur

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**KEYWORDS**
Gingival Inflammation, Chewing Gum

**ABSTRACT:**

**Introduction-** Chronic and uncontrolled gingival inflammation in response to dysbiotic dental plaque accumulation is considered key factor in the onset of periodontitis.

**Methodology-** This study was a prospective, randomized, double-blind, placebo-controlled, parallel-group, singlecenter trial of 12 weeks follow-up. This study's main goal was to determine how chitosan and blackberry extract, which were administered in chewing gum as an aid to oral hygiene, affected gingival inflammation and plaque biofilm development. All patients had at least 20 natural teeth and were at least 18 years of age.

**Results-**40 of the 51 individuals who were evaluated for candidacy and who met the inclusion guidelines were randomly allocated to the control and test arms. 34 participants—17 in each arm—completedthe trial, and the results were used for data gathering. There were 20 girls in all, of whom 11 (65%) and 9 (52%) were in the experimental and control groups, respectively. 31 peoplesaid they had never smoked, and the other participants said they had smoked in the past.

**Conclusion-** This study demonstrated that a process of pathogenic plaque formation is disturbed, possibly via disruption of oral biofilm and affecting adhesive properties of the oral bacteria, resulting in a numerical decrease of plaque formation and a significant reduction of gingival bleeding compared to a placebo chewing gum.

## Introduction

Chronic and uncontrolled gingival inflammation in response to dysbiotic dental plaque accumulation is considered key factor in the onset of periodontitis.[1] Several intrinsic and extrinsic factors, such as salivary flow and composition, and frequent carbohydrate consumption, influence plaque accumulation.[2] These "disease drivers" are also crucial for the symbiotic and dysbiotic character of oral microbial biofilms. In recent years, research has focused on ways to increase resistance of the microbiota to dysbiosis.[3] However, it is also true that plaque accumulation by itself increases the risk of dental disease. During the shift from periodontal health to gingivitis, bacterial biomass increases several-fold, increasing the number of all biofilm bacteria. Yet the influence of bacteria on gingival inflammatory response is more prominent especially for enriched species in the biofilm. Therefore, since mechanical control is not always sufficient to disrupt and eliminate pathogenic biofilms, any adjuncts to the mechanical control of biofilm accumulation should help in preventing gingival inflammation.[3]

In general, chemical agents are used in toothpastes, mouthwashes, and gels. However, in some cases, the use of mouthwashes and toothpastes are difficult. Therefore, different tools are required for oral care. Chewing gums containing antiplaque agents have been tested as an additional tools for daily oral care. Steinberg et al.[4] had

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been studied the release of the chlorhexidine from chewing-gum and showed that chewing gums may be an appropriate vehicle for the release of antiplaque agents.

In many countries, chewing gum regularly practiced by many people as a habit and this application has many benefits to oral health. Indirect effects of chewing gum on oral health are saliva low stimulation[5] and mechanical tooth cleaning. In the light of this information, it can be considered that the propolis gum might be a good tool to prevent gingival inflammation and plaque accumulation.[6] The purpose of this study was to use of functional chewing gum in reduction of gingival inflammation.

**Methodology**

This study was a prospective, randomized, double-blind, placebo-controlled, parallel-group, singlecenter trial of 12 weeks follow-up. The clinical protocol was approved by the Institutional Review Board of Jaipur Dental College, Jaipur. All procedures performed in this investigation involving human participants were in accordance with the ethical standards of the aforementionedinstitutional research board and the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. This study's main goal was to determine how chitosan and blackberry extract, which were administered in chewing gum as an aid to oral hygiene, affected gingival inflammation and plaque biofilm development. All patients had at least 20 natural teeth and were at least 18 years of age. According to a minimum mean baseline gingival index (GI) of 1.5 and a lowest mean Silness-Loe plaque index (PI) of 1.5 score, eligible individuals had mild to moderate gingival inflammation when they first appeared. participants underwent a routine radiographic assessment of a whole mouth sequence or including bitewings, neither of which revealed any alveolar bone loss in interproximal locations. And Any requirement for antibiotic pre-medication prior to dental treatments was a condition for exclusion. Individuals who disclosed using a systemic antibiotic, aspirin or non-steroidal anti-inflammatory drugs for 14 days before thebaseline assessment were not included. Further exclusion criteria included having diabetes, smoking, being pregnant, or having periodontitis in the past.

Participants in the BL visit received an adult prophylaxis scaling and underwent the usual oral hygiene instructions, with a particular emphasis on brushing their teeth using a modified Bass approach. During the course of the trial, subjects were told to refrain from using any supplementaryoral rinses, such as chlorhexidine, cationic quaternary ammonium compound rinses, or mouthwash that contained essential oils. If subjects had habitually practiced interproximal oral hygiene procedures previous to research enrolment, they were permitted to continue doing so. To guaranteeequal-sized trial arms, a block randomization approach was used. After respondents were randomised to a research arm, they received information on how to use the designated chewing gum. Three times per day, participants were instructed to chew one piece of gum for at least 20 minutes. Subjects underwent a compliance diary to track their daily chewing of gum. Following the patient's involvement, the retrieved logs were utilized to determine compliance. The inverse percentage value of (missing dose/total expected doses) was used to define conformance. The experimental gum was given to subjects assigned to the test or control groups, accordingly. The gums were labelled as "1064" or "1065" by the supplier (, with the relationship to a control or testing that none of the examiners AM or HS wereaware of. Only the addition of chitosan (25 mg) and blackberry extract (25 mg) in the test gum vehicle markedly altered the composition of the chewing gum.

The residual constituents were gumbase, maltitol, sorbitol, isomalt, xylitol, vegetarian magnesiumstearate, stevia, and silicon dioxide in proprietary quantities characteristic of a chewing gum (Table1). The proprietary manufactured individual chewing gum pieces had a thickness of 4 mm and a width of 15 mm. Gum was sold in solid, opaque lockable bags that could only be recognized by its lot number and held 21 pieces, or a one-week supply. The investigators were not informed of the lot number's identity for the treated group. Re-sealable pouches were given to the participant in an adequate quantity based on the research visit in order to have an ample supply.

To detect a treatment difference of 15% it wasdetermined to have a necessary 16 minimum patients per arm, allowing for 85% power and a two-sided significance $\alpha$=0.05. Otherwise a non-parametric Mann- Whiney U,

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or similar test was utilized. In instances of two independent variables, such as intervention and time, data was analyzed by repeated measures analysis of variance (ANOVA), and Sidak's test for post-hoc comparisons. A p-value of less than or equal to 0.05 was considered statistically significant.

**Result**

40 of the 51 individuals who were evaluated for candidacy and who met the inclusion guidelines were randomly allocated to the control and test arms. 34 participants—17 in each arm—completedthe trial, and the results were used for data gathering (Figure. 2). There were 20 girls in all, of whom 11 (65%) and 9 (52%) were in the experimental and control groups, respectively. 31 people said they had never smoked, and the other participants said they had smoked in the past. Neither the test gum intervention nor the control gum intervention caused any side effects in any of the 34trial participants.

**Table 1**

**Mean/SD of PI values at timepoints**

| Time | Control | | | Test | | | comparison |
|---|---|---|---|---|---|---|---|
| | Mean | SD | N | Mean | SD | N | p value |
| Base | 2.05 | 0.35 | 17 | 1.91 | 0.34 | 17 | 0.1885 |
| 2 week | 0.95 | 0.46 | 17 | 0.84 | 0.53 | 17 | 0.6740 |
| 4 week | 1.06 | 0.39 | 17 | 0.93 | 0.41 | 17 | 0.3636 |
| 8 week | 1.25 | 0.41 | 17 | 1.20 | 0.51 | 17 | 0.7123 |
| 12 week | 1.33 | 0.39 | 17 | 1.25 | 0.47 | 17 | 0.7747 |

**Mean/SD of GI values at timepoints**

| Time | Control | | | Test | | | comparison |
|---|---|---|---|---|---|---|---|
| | Mean | SD | N | Mean | SD | N | p value |
| Base | 2.06 | 0.28 | 17 | 2.00 | 0.35 | 17 | 0.5143 |
| 2 week | 0.56 | 0.45 | 17 | 0.61 | 0.31 | 17 | 0.4053 |
| 4 week | 0.58 | 0.42 | 17 | 0.72 | 0.35 | 17 | 0.3078 |
| 8 week | 0.78 | 0.43 | 17 | 0.72 | 0.41 | 17 | 0.3615 |
| 12 week | 1.30 | 0.53 | 17 | 0.81 | 0.35 | 17 | 0.0031 * |

*SD=Standard Deviation; N=number of subjects; * = significant p<0.05*

**Table 2.** Plaque and gingival indices at 12 months

| | | ACHX | X | N (*n*Ω43) | (*n*Ω37) | (*n*Ω31) |
|---|---|---|---|---|---|---|
| PI | 0.8∫0.8* | 1.6∫1.0* | 2.6∫0.6* | GI | 0.5∫0.7* | 1.2∫1.0* | 2.2∫1.0* |

* *p*<0.001 (all significantly different from each other).

**Table 3.** Subjective questionnaire responses at baseline and at 12 months (nΩ111)

| | ACHX (*n*Ω43) | | | X (*n*Ω37) | | | N (*n*Ω31) | |
|---|---|---|---|---|---|---|---|---|
| | baseline | End | | baseline | end | | baseline | end |

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| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| chewing food difficult | 9 (21%) | 5 (11%) | | 9 (24%) | 2 (6%) | | 2 (12%) | 9 (28%)* |
| speaking difficult | 8 (20%) | 5 (11%) | | 4 (10%) | 2 (6%) | | 5 (15%) | 3 (9%) |
| carers assist with cleaning | 2 (5%) | 9 (21%)* | | 2 (5%) | 5 (14%)* | | 1 (3%) | 11 (34%)** |
| cleans 2¿ daily | 24 (54%) | 25 (58%) | | 16 (43%) | 19 (51%) | | 8 (25%) | 10 (31%) |
| clean 1¿ daily | 10 (23%) | 13 (30%) | | 12 (32%) | 12 (32%) | | 6 (19%) | 12 (38%)* |
| cleans less than 1¿ daily | 10 (23%) | 5 (11%)* | | 7 (19%) | 5 (13%) | | 16 (50%) | 6 (19%)* |
| problems with taste | 12 (28%) | 4 (9%)* | | 14 (38%) | 6 (17%)* | | 9 (28%) | 7 (22%) |

* $p<0.05$; ** $p<0.01$.

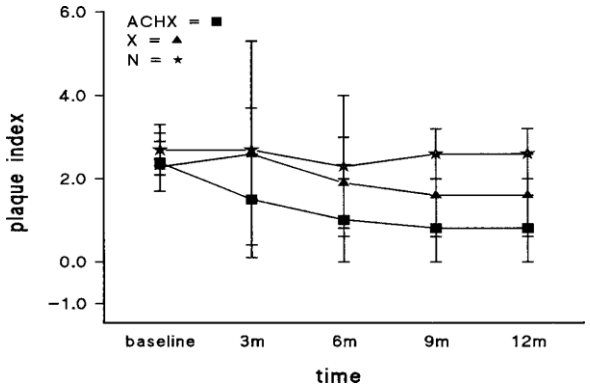


**Fig. 1.** Changes in plaque index over 12 months.

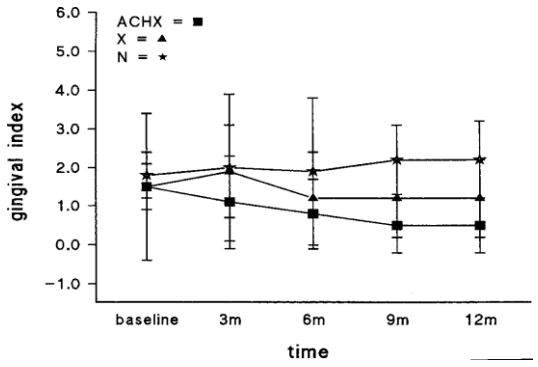


**Fig. 2.** Changes in gingival index over 12 months.

**Discussion**

In this three-month study, plaque development and gingival inflammation were evaluated in response to daily adjunctive use of chewing gum containing chitosan and blackberry extract (CBBE). To our knowledge, this is the first study to offer measurements of a CBBE administered via a practical chewing gum vehicle's anti-plaque and anti-inflammatory capabilities. According to the current findings, the experimental gum's therapy leads to a decrease in clinical gingival inflammation as determined by GI. Patients from both groups generally like the taste and comfort of the gum. Just one patient in

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the placebo group didn't like the flavour of the gum. With values above 86%, compliance was not substantially different across groups. The conformance of our participants may be a result of controlled trial activities; still, the encouraging compliance rate should be acknowledged. Functional chewing gum appears to have a significant benefit over other oral hygiene products in that it can be used consistently. Plaque deposition levels in our investigation did not differ between the experimental and control groups. Although both groups showed an improvement in mPI from baseline to week 12, both groups also showed an upward mPI trend from week 2 to week 12. By applying chitosan in the form of gel to patients with chronic periodontitis at 12 and 24 weeks, Akincibay et al.[8] showed similar consequences. In comparison, a research by Sano et al.[9] discovered a significant decrease in plaque after just 14 days. In our study both control and experimental gums had equal amount of xylitol and sorbitol. Since there was no negative control (no chewing gum) and/or xylitol/sorbitol group, the effect of xylitol and sorbitol could not be verified independently.

According to Akincibay et al., this experiment discovered that at 12 weeks, the GI was considerably lower in the chewing gum group that contained chitosan. The difference in clinical gingival inflammation, but not non-specific plaque buildup between groups, may be explained by the selective decrease of bacteria associated with gingivitis[9,10] via specialised anti- microbial activities of chitosan gum. Similar to this, it is well recognised that the management of gingival inflammation involves the destruction of pathogenic biofilm using a mix of mechanical debridement and antimicrobial medications.[11] Gonzalez et al.[12] examined the in vitro antibacterial effects of a BBE solution against oral commensals and periodontal infections. While having no effect on other oral commensals, BBE particularly reduced the metabolic activity of F. nucleatum, P. gingivalis, and Streptococcus mutans by about 40% and 30%, respectively. Instead of a decrease in plaque mass overall, a qualitative change in the makeup of a bacterial biofilm may result in a modification of the inflammatory response of the host. In fact, within the parameters of our experiment, there was evidence of a differential gingival inflammatory response, although the value of PI, an approximate of non-specific plaque amount assessment, did not differ between categories. Having identical plaque amounts, there may have been differences in the content of the plaque biofilm across the groups, which may have contributed to the experimental arm's lower GI measurement.

## Conclusion

No analysis of the effects of chitosan or blackberry extract independently can be made because these substances were not tested in separate arms in this investigation. Furthermore, there was no negative control to assess the impact of this innovative gum in comparison to standard oral hygiene practises only. Therefore, inferences about the impact of our test gum's components, both alone and collectively, might be possible from future research with substantial subject numbers, microbiological investigation, and additional control/experimental arms. Nevertheless, given the limitations of this study, we draw the conclusion that using CBBE functional chewing gum in addition to regular dental hygiene can help to reduce the clinical indications of gingival inflammation.

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