The Effects of Fenucure® Toothpaste on Patients with Gingivitis: A Double-blind, Randomized, Placebo-Controlled, Clinical Trial

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Abstract

Background: Gingivitis is a common form of periodontal disease that causes redness, inflammation and bleeding in the gingiva, the part of the gum that surrounds the teeth. Fenugreek or *triogonella foenum-gaucum L., leguminosae* is an herb that has been used as a spice and for its medicinal properties for thousands of years. Fenucure® toothpaste utilizes fenugreek extract, which is obtained through a patented process. The purpose of this clinical trial was to study the efficacy of toothpaste containing fenugreek extract (Trigonella foenum-graecum L.) on patients with gingival inflammation.

Methods: This was a double-blind, randomized, placebo-controlled, clinical trial. Fifty-six patients with gingival inflammation were randomly assigned to either the study group or the control group. The control group consisted of 28 patients who used generic fluoridated toothpaste not containing fenugreek and the study group consisted of 28 patients who used Fenucure® toothpaste, containing fenugreek extract. Patients were followed weekly for 4 weeks, at which times bleeding, inflammation and plaque indices were recorded. Statistical analyses were performed to identify differences between the control group and the study group.

Results: The participants' reporting of pain upon probing, measured on a scale of 1-10, was less in the group that used the Fenucure® Toothpaste than in the group that used the placebo toothpaste. Bleeding upon probing decreased more significantly in the Fenucure® Toothpaste group than in the placebo group. Plaque levels decreased in the Fenucure® Toothpaste group in weeks 2-4 as compared to the group that used the placebo toothpaste. Gingival inflammation, as measured weekly by the Gingival Index of Loe and Silness, showed a consistent decrease weekly in the Fenucure® Toothpaste group, while in the placebo group the inflammation decrease was not nearly as significant in weeks 1-3 and inflammation actually increased in weeks 3-4.

Keywords: Fenugreek, gingivitis, Fenucure®

The Effects of Fenucure® Toothpaste on Patients with Gingivitis:
A Double-Blind, Randomized, Placebo-Controlled, Clinical Trial

Introduction

The purpose of the study was to study the efficacy of Fenucure® toothpaste containing fenugreek (Trigonella foenum-graecum L.) extract on patients with gingivitis. Fenugreek or *triogonella foenum-gaucum L., leguminosae,* belongs to the plant family *fabacaceae.* It has been used in many countries, including Asia, Europe, India, Iran, and the United States as a spice, an anti-inflammatory, an antibacterial, and to treat numerous illnesses. Most commonly, its medicinal uses include lowering blood sugar; increasing milk supply in lactating women, and as a skin-soothing agent to heal burns.[1,2,3] It is considered a safe product, with only two documented cases of allergic reaction and no cases of anaphylactic reaction found in the literature. In both cases of allergic reaction, the individuals were allergic to chickpeas.[4]

The other ingredients in the toothpaste, none of which are known to be harmful, are as follows:

1) Water;
2) Hydrated silica- common abrasive in toothpaste;
3) Sorbitol- sugar alcohol; common in toothpaste;
4) Propylene Glycol- pharmaceutical grade surfactant, commonly used in toothpaste;
5) Sodium C 14-16 Olefin Sulfonat.Aroma- lime essential oil and spearmint essential oil for taste;
6) Cellulose Gum- common thickening agent in toothpaste;
7) Sodium fluoride (1400 ppm)- typical amount of fluoride in fluoridated toothpaste; and
8) Sodium saccharin- common sweetening agent.

Research participants were informed that, as will all toothpaste, it should not be ingested. However, in an abundance of caution, this study excluded study participants who were on blood thinning medications and who had uncontrolled diabetes, since the ingested form of fenugreek has shown to have minor blood-thinning and blood sugar lowering effects.[1,2,3]

Methods

Null Hypothesis. H_O There will be no statistically significant difference in the level of gingival disease improvement between the study participants who use the herbal toothpaste and those who use the placebo.

Research Design. This study was a double blind, randomized, placebo-controlled, clinical trial.

Selection Criteria for Research Participants.

Inclusion Criteria

- Gingivitis/periodontitis (bleeding and inflammation of the gums)
- Over the age of 18
- At least 20 teeth present
- Willingness to participate and sign the consent
- Willingness to attend four, successive, weekly appointments

Exclusion Criteria

- Gross oral pathology
- Known allergy to oral care products
- Known allergy to peanuts or chickpeas
- Need for antibiotic pre-medication for dental treatment
- Pregnancy/lactating
- On blood-thinning medications

- Uncontrolled diabetes (HBa1c > 7)
- Removable dentures (full or partial)

Potential Benefits and Harm. Receiving a dental cleaning may cause some discomfort. All reasonable care was taken to contribute to the research participant's comfort during the procedures, including the provision of "numbing gel" or anesthetic as needed. No procedures beyond what is typically done in the clinic were performed. The potential benefits associated with improved oral care include improved breath, decreased bleeding in the gums, maintenance of healthy teeth, and improved overall health due to decreased bacteria in the bloodstream.

Confidentiality and Anonymity. As with all patients in the Dental Hygiene Clinic, HIPAA is adhered to by students and faculty. Therefore, patient privacy is normally protected. Furthermore, once the patient enrolled in the study as a participant, he/she was assigned a number and all identifying information having to do with the study utilized that number. In addition, as the information was transcribed into the SPA Data Analysis System, no personal identifying information was entered. All information data is maintained in the director's locked office. Patient charts are locked and our EHR are only accessible by our student clinicians and faculty.

Medical or other Potentially Troubling Condition. The first time the product (either Fenucure® Toothpaste or placebo) was used was when the research participant was demonstrating proper tooth brushing technique in the University clinic with the researcher present. This was done in the beginning of the appointment. If an allergic reaction did occur, it would have occurred when the patient was with clinicians and the necessary emergency protocol would have been enacted. At the end of all dental hygiene appointments at the University of New Haven, the patient is routinely asked if he/she is experiencing any burning, itching, or tingling, in the event that the

patient is allergic to any products, such as fluoride, used that day. The patient was further instructed during the consent process, about the previously listed symptoms and signs of allergy in the oral cavity and to be aware of this when using any new product, such as toothpaste. No allergic reactions were experienced during the course of this study.

The patients were read the HIPAA policy, school consent for treatment, and photo release policy, as is standard for any patient treated in the University dental hygiene clinic and given the opportunity for refusal of treatment. If the patient agreed, after the routine medical history screening and oral examination process was conducted to rule out any pathology, potential study participants that fit the previously named inclusion criteria and did not meet the exclusion criteria were invited to participate in the study. They then reviewed the consent with one of the researchers. The only exclusion criterion that was not specifically addressed in the dental hygiene clinic's standard medical history was: "Are you allergic to peanuts or chickpeas?" This was included on the consent form and all researchers asked this question of the research participants. All other exclusion criteria, including the HBa1c of patients with diabetes, were standard information gathered in the Dental Hygiene Clinic. HBa1c is the measure of the glycated hemoglobin in the patient with diabetes. It is a more accurate measure of the patient's blood sugar than daily testing because it is an average of the blood sugar over a 3-month period. An HBa1c under 7% is typically cited as the desirable range for the person with diabetes. If the participant's HBa1c was over 7%, we sought medical clearance from his physician to inquire if he could safely be treated in the clinic if he wished, but he was excluded from the research study.

Fifty-six (N=56) participants were recruited for the study, with 28 being given Fenucure® toothpaste, which contains plant extract from the fenugreek plant and 28 given a placebo, which has the same ingredients with the exception of the fenugreek extract. The unmarked toothpaste tubes were in numbered bags and were distributed to study participants with the same number.

The Dental Hygiene Program's administrative assistant placed the tubes in the bags and marked them. She was also responsible for allocating the toothpaste to the study participants at a 1:1 ratio and tracking which participant received the Fenucure® and who received the placebo. Researchers collecting the clinical data were blinded to the group allocation of the study participants.

The oral examination included: dental x-rays (if necessitated by the patient); intraoral photos; periodontal assessment, which included a written description of oral conditions of the gums and measurements of gum pocket depths with a periodontal probe; indication of bleeding sites; and plaque index scoring, utilizing the teeth identified in the Simplified Oral Hygiene Index (OHI-S) and disclosing solution. The OHI-S examines teeth numbers: 3, 8, 14, 19, 24 and 30. As indicated in the index, if the assigned tooth was not present, the researcher chose the closest available, most similar type of tooth. For example, a molar was substituted for a molar; a premolar for a premolar; or an incisor for an incisor. Six sites were utilized for each tooth: DL, L, ML, DB, B, and MB. OHI-S indicators were as follows:

0- No debris or stain present;

1- Soft debris not more than 1/3 of the tooth surface, or presence of extrinsic stains without other debris regardless of surface area covered;

2- Soft debris covering more than 1/3 but not more than 2/3, of the exposed tooth surface; and

3- Soft debris covering more than 2/3 of the exposed tooth surface.

All examiners were calibrated during a calibration session for standardization in probing, bleeding measurement, and plaque index measurements prior to the commencement of the study. Clinical faculty calibration is a common occurrence in dental hygiene education and this was achieved by reviewing the indices utilized and by reviewing the chapter on probing in the textbook: Nield-Gehrig, J.S. *Fundamentals of Periodontal Instrumentation*, 7th ed. Bleeding was

assessed as either present or not present within fifteen seconds of removing the periodontal probe from the gingival pocket. On the first visit, oral hygiene instruction was reviewed and the Modified Bass Tooth Brushing Method and flossing was taught and demonstrated back by the research participant to show understanding and ability to reproduce what was taught. Dental prophylaxis or cleaning was performed on visit one.

On each weekly return visit, researchers utilized the simplified Oral Hygiene Index (OHI-S) to identify the presence and amount of plaque and debris present; took intraoral photos of the same area; and probed the same areas to check for any differences in the pocket depths, inflammation and bleeding.

Analysis of data was done using SPS Statistical Analysis Software. For each visit, the 6 sites of measurement for each tooth were averaged. Each parameter was measured at baseline, one, two, three, and four weeks. All data and materials regarding the study were kept in the director's locked cabinet in a locked office.

Results and Discussion

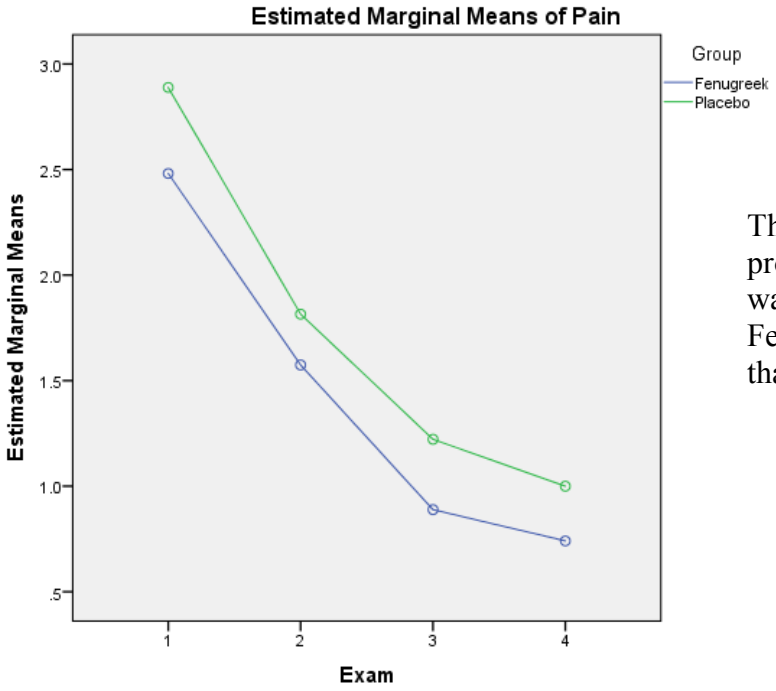
The participants' reporting of pain upon probing, measured on a scale of 1-10, was less in the group that used the Fenucure® Toothpaste than in the group that used the placebo toothpaste. Bleeding upon probing decreased more significantly in the Fenucure® Toothpaste group than in the placebo group. Plaque levels decreased in the Fenucure® Toothpaste group in weeks 2-4 as compared to the group that used the placebo toothpaste. Gingival inflammation, as measured weekly by the Gingival Index of Loe and Silness, showed a consistent decrease weekly in the Fenucure® Toothpaste group, while in the placebo group the inflammation decrease was not nearly as significant in weeks 1-3 and inflammation actually increased in weeks 3-4.

Although the charted data reveals a greater improvement in the condition of the gingiva in the study (Fenucure®) group over the course of 4 weeks than in the control group, the difference

between the two groups is not statistically significant in most categories, as demonstrated by Table 2. It should also be noted that all study participants received a dental prophylaxis in Week 1. Therefore, all participants demonstrated an initial improvement in the overall condition of their gingiva. However, the study (Fenucure®) group continued to show more of an improvement than the placebo group, suggesting that the toothpaste may have been the responsible variable for the continued improvement.

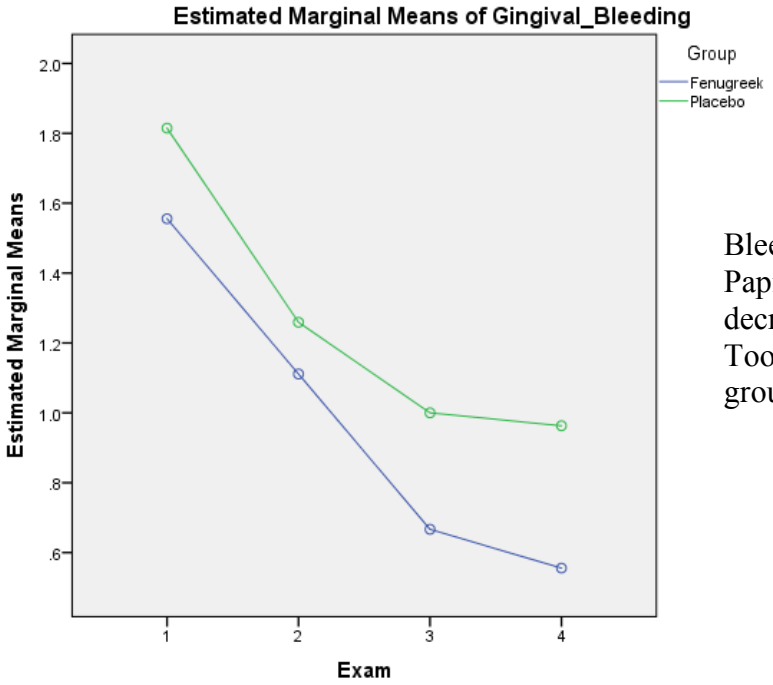
It is a suggestion for future research that this study be repeated with a larger sample size and with participants who present with a more similar state of gingival disease. The time limitation of an ending college clinical semester prevented that from occurring in this study.

Figure 1. Pain index. Plots: The horizontal axis ("Exam") is exam number (1-4). Means for each outcome measure are on the Y-axis.



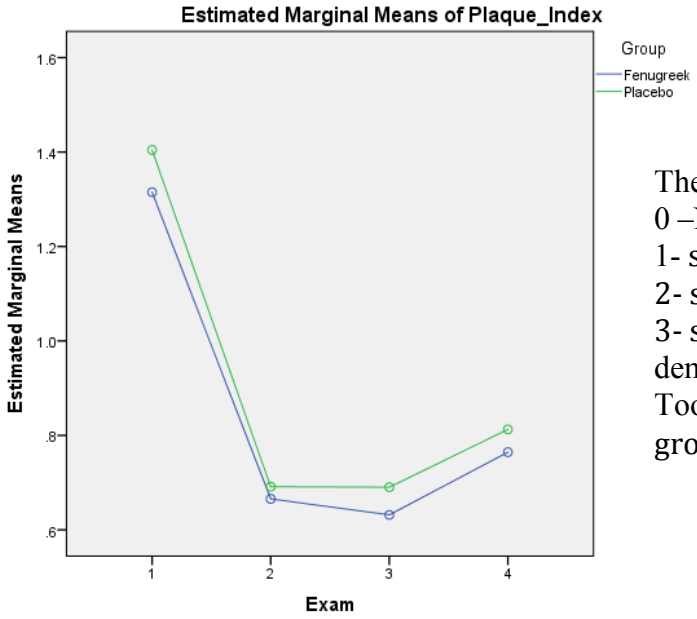
The participants' reporting of pain upon probing, measured on a scale of 1-10, was less in the group that used the Fenucure Toothpaste than in the group that used the placebo toothpaste.

Figure 2. Bleeding index.



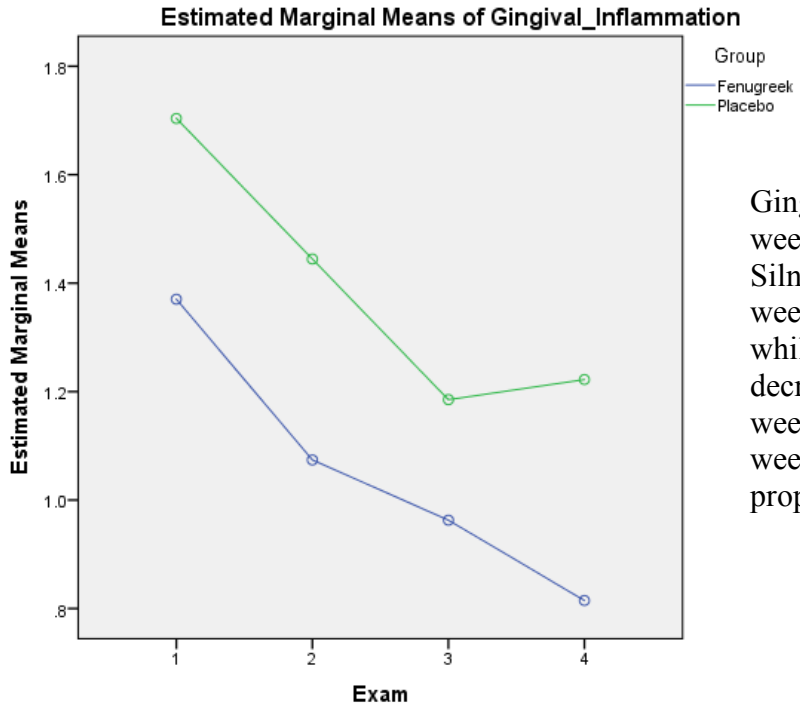
Bleeding upon probing, as measured by the Papillary Index of Muhlemann, on a scale of 0-4, decreased more significantly in the Fenucure Toothpaste group than in the placebo group. group.

Figure 3. Plaque index.



The plaque index, as indicated by:
0 –No debris present;
1- soft debris not more than 1/3 of the tooth surface;
2- soft debris 1/3-2/3 of tooth surface and
3- soft debris covering more than 2/3 of tooth;
demonstrated a decrease in plaque in the Fenucure Toothpaste group in weeks 2-4 as compared to the group that used the placebo toothpaste.

Figure 4. Gingival inflammation.



Gingival inflammation, as measured weekly by the Gingival Index of Loe and Silness, showed a consistent decrease weekly in the Fenucure Toothpaste group, while in the placebo group the infla-mation decrease was not nearly as significant in weeks 1-3 and inflammation increased in weeks 3-4. Note that participants had a prophylaxis in Week 1.

Table 1.
Descriptive Statistics by Group (Fenucure® vs. Placebo) – The number after the underscore is the Exam number.

Descriptive Statistics

Group		N	Minimum	Maximum	Mean	Std. Deviation
Fenugreek	Gingival_Inflammation_1	27	.0	3.0	1.370	.7917
	Gingival_Inflammation_2	27	.0	2.0	1.074	.7808
	Gingival_Inflammation_3	27	.0	2.0	.963	.7061
	Gingival_Inflammation_4	27	.0	2.0	.815	.7357
	Pain_1	27	.0	6.0	2.481	1.6726
	Pain_2	27	.0	4.0	1.574	1.5732
	Pain_3	27	.0	4.0	.889	1.0127
	Pain_4	27	.0	4.0	.741	1.0952
	Gingival_Bleeding_1	27	.0	4.0	1.556	1.2195
	Gingival_Bleeding_2	27	.0	3.0	1.111	1.0127
	Gingival_Bleeding_3	27	.0	3.0	.667	.8771
	Gingival_Bleeding_4	27	.0	2.0	.556	.8473
	Plaque Index Avg_1	27	.0000000000	2.555555556	1.314814815	.7007830378
	Plaque Index Avg_2	27	.0000000000	2.388888889	.6656378601	.6084090166
	Plaque Index Avg_3	27	.0000000000	2.111111111	.6316872428	.5175339995
	Plaque Index Avg_4	27	.0000000000	2.416666667	.7644032922	.5938395742
	Valid N (listwise)	27				
Placebo	Gingival_Inflammation_1	27	.0	3.0	1.704	.6688
	Gingival_Inflammation_2	27	.0	2.0	1.444	.6405
	Gingival_Inflammation_3	27	.0	2.0	1.185	.7863
	Gingival_Inflammation_4	27	.0	2.0	1.222	.6405
	Pain_1	27	.0	8.0	2.889	2.0255
	Pain_2	27	.0	4.0	1.815	1.1779
	Pain_3	27	.0	3.0	1.222	1.0127
	Pain_4	27	.0	2.0	1.000	.8321
	Gingival_Bleeding_1	27	.0	4.0	1.815	1.1448
	Gingival_Bleeding_2	27	.0	2.0	1.259	.8130
	Gingival_Bleeding_3	27	.0	2.0	1.000	.9199
	Gingival_Bleeding_4	27	.0	2.0	.963	.9398
	Plaque Index Avg_1	27	.4166666667	2.861111111	1.404320988	.5087863642
	Plaque Index Avg_2	27	.0833333333	1.472222222	.6913580247	.3653866980
	Plaque Index Avg_3	27	.0000000000	2.250000000	.6903292181	.5321849116
	Plaque Index Avg_4	27	.0000000000	2.083333333	.8127572016	.5334597758
	Valid N (listwise)	27				

Table 2.

*Repeated Measures Ancovas. Use Exam*Group section for analysis of outcome measures by group (Placebo vs. Fenugreek).*

Univariate Tests

Source	Measure		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Exam	Pain	Sphericity Assumed	108.707	3	36.236	30.806	.000	.372
		Greenhouse-Geisser	108.707	2.338	46.500	30.806	.000	.372
		Huynh-Feldt	108.707	2.502	43.453	30.806	.000	.372
		Lower-bound	108.707	1.000	108.707	30.806	.000	.372
	Gingival_Bleeding	Sphericity Assumed	28.940	3	9.647	17.848	.000	.256
		Greenhouse-Geisser	28.940	2.824	10.249	17.848	.000	.256
		Huynh-Feldt	28.940	3.000	9.647	17.848	.000	.256
		Lower-bound	28.940	1.000	28.940	17.848	.000	.256
	Gingival_Inflammation	Sphericity Assumed	8.852	3	2.951	10.488	.000	.168
		Greenhouse-Geisser	8.852	2.948	3.002	10.488	.000	.168
		Huynh-Feldt	8.852	3.000	2.951	10.488	.000	.168
		Lower-bound	8.852	1.000	8.852	10.488	.002	.168
	Plaque_Index	Sphericity Assumed	17.639	3	5.880	33.703	.000	.393
		Greenhouse-Geisser	17.639	2.755	6.402	33.703	.000	.393
		Huynh-Feldt	17.639	2.981	5.918	33.703	.000	.393
		Lower-bound	17.639	1.000	17.639	33.703	.000	.393
Exam * Group	Pain	Sphericity Assumed	.235	3	.078	.067	.978	.001
		Greenhouse-Geisser	.235	2.338	.101	.067	.955	.001
		Huynh-Feldt	.235	2.502	.094	.067	.962	.001
		Lower-bound	.235	1.000	.235	.067	.797	.001
	Gingival_Bleeding	Sphericity Assumed	.495	3	.165	.306	.821	.006
		Greenhouse-Geisser	.495	2.824	.175	.306	.809	.006
		Huynh-Feldt	.495	3.000	.165	.306	.821	.006
		Lower-bound	.495	1.000	.495	.306	.583	.006
	Gingival_Inflammation	Sphericity Assumed	.259	3	.086	.307	.820	.006
		Greenhouse-Geisser	.259	2.948	.088	.307	.817	.006
		Huynh-Feldt	.259	3.000	.086	.307	.820	.006
		Lower-bound	.259	1.000	.259	.307	.582	.006
	Plaque_Index	Sphericity Assumed	.028	3	.009	.054	.983	.001
		Greenhouse-Geisser	.028	2.755	.010	.054	.978	.001
		Huynh-Feldt	.028	2.981	.010	.054	.983	.001
		Lower-bound	.028	1.000	.028	.054	.817	.001
Error(Exam)	Pain	Sphericity Assumed	183.495	156	1.176			
		Greenhouse-Geisser	183.495	121.565	1.509			
		Huynh-Feldt	183.495	130.090	1.411			
		Lower-bound	183.495	52.000	3.529			
	Gingival_Bleeding	Sphericity Assumed	84.315	156	.540			
		Greenhouse-Geisser	84.315	146.834	.574			
		Huynh-Feldt	84.315	156.000	.540			
		Lower-bound	84.315	52.000	1.621			

References

1. Al-Okbi, A. (2014). Nutraceuticals of anti-inflammatory activity as complementary therapy for rheumatoid arthritis. *Journal of Toxicology and Industrial Health, 30* (8);738-749. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/23104728
2. Bahmani, M. Shirzad, H., Mirhosseini, M., Mesripour, A., & Rafieian-Kopaei, M. (2016). A review on ethnobotanical and therapeutic uses of fenugreek (Trigonella foenum-graceum L). *Journal of Evidence-Based Complementary & Alternative Medicine; 21*(1) 53-62. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/25922446
3. National Institutes of Health (2012). A review of the hypoglycemic effects of the five most commonly used herbal food supplements. *Recent Patents on Food, Nutrition, and Agriculture,1* 4(1); 50-60. Retrieved from:https://www.ncbi.nlm.nih.gov/pubmed/22329631
4. Patil S.P., Niphadkar P.V., Bapat M.M. (1997). Allergy to fenugreek (Trigonella foenum graecum). *Annals of Allergy, Asthma & Immunology*, *78*(3); 297-300. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed

Appendix A
Data Collection Sheet

Study participant # _____
Date of Exam: _____
Exam # (Circle): 1 2 3 4
Allergic to peanuts or chickpeas? Yes_____ No _____ (If Yes, cannot participate in study.)
If after week 1, has study participant been using toothpaste as recommended? Yes__No___
Explanation if needed :
_____
Photo Taken _____ Indicate area_____

Plaque Index

Tooth #'s	Surface	Value	Tooth #'s	Surface	Value
3	DB		19	DB	
	B			B	
	MB			MB	
	DL			DL	
	L			L	
	ML			ML	
8	DB		24	DB	
	B			B	
	MB			MB	
	DL			DL	
	L			L	
	ML			ML	
14	DB		30	DB	
	B			B	
	MB			MB	
	DL			DL	
	L			L	
	ML			ML	

0- No debris or stain present;
1- Soft debris not more than 1/3 of the tooth surface, or presence of extrinsic stains without other debris regardless of surface area covered;
2- Soft debris covering more than 1/3 but not more than 2/3, of the exposed tooth surface; and
3- Soft debris covering more than 2/3 of the exposed tooth surface.

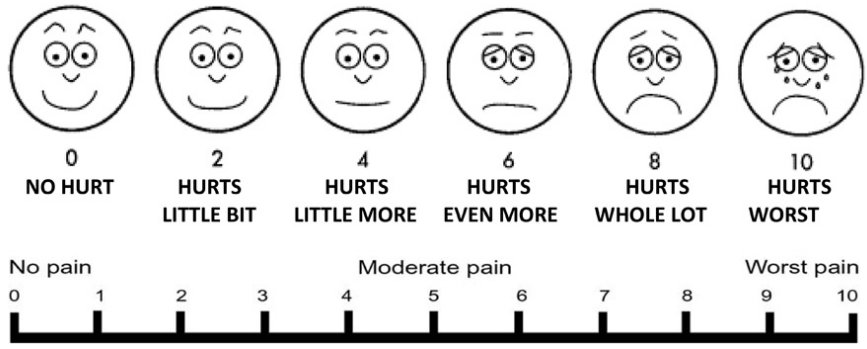
Gingival Inflammation (Circle number to indicate choice)
The Gingival Index of Loe and Silness

0	Normal gingiva/no inflammation.
1	Mild inflammation- slight change in color, slight edema. No bleeding on probing.
2	Moderate inflammation- redness, edema and bleeding in probing.
3	Severe inflammation-marked redness and edema. Ulceration. Tendency to spontaneous bleeding.

Probe Depths/Circle in Red to indicate Bleeding

Tooth #'s	Surface	Value	Tooth #'s	Surface	Value
3	DB		19	DB	
	B			B	
	MB			MB	
	DL			DL	
	L			L	
	ML			ML	
8	DB		24	DB	
	B			B	
	MB			MB	
	DL			DL	
	L			L	
	ML			ML	
14	DB		30	DB	
	B			B	
	MB			MB	
	DL			DL	
	L			L	
	ML			ML	

Pain upon probing as reported by patient:
(Circle number to indicate choice)



Gingival Color: Pink Red Purple

Gingival Bleeding (Circle number to indicate choice)
Papillary Index of Muhlemann

0	No bleeding
1	Only 1 bleeding point appearing
2	Several isolated bleeding points or a small blood area appearing
3	Interdental triangle filled with blood soon after probing
4	Profuse bleeding when probing, blood spreads towards the marginal gingiva