

## The effect of using pineapple fresh juice to improve post-surgical pain, ecchymosis and swelling in maxillofacial region

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### ABSTRACT

**Background:** Facial plastic surgeries are usually associated with various post-surgical undesirable symptoms, particularly pain, Swelling, and ecchymosis. Depending on the nature of the procedures, these symptoms could last for days, sometimes over a week or more. Considering the optimal efficacy of Bromelain, this study is used to justify the benefits of pre-operative use of Bromelain found in pineapple using fresh pineapple juice to reduce such complications.

**Materials and Methods:** A randomized clinical study was performed among 100 patients undergoing various facial surgical operations; the patients were randomly divided into two groups; fifty patients received the pre-operative fresh pineapple juice (350ml glass) twice every day, a week before and continued for seven days after surgery. The pain level was determined using a visual analog scale, Swelling, and ecchymosis judged by visual inspection. Average scores for all symptoms were added to obtain the clinical sum score for each visit.

**Results:** Pre-operative use of fresh pineapple juice was significantly reduced post-surgical pain, swelling, and ecchymosis with statistically significant results ( $p < 0.005$ ) in each pineapple groups.

**Conclusion:** Bromelain found in pineapple fruit can be used as a successful therapy before various facial surgical procedures to minimize and provide faster recovery from undesirable post-operative symptoms.

**Keywords:** Facial surgeries; Bromelain; Pineapple juice; Wound healing; Complications.

### Introduction

In preparation for an operation, taking appropriate pre-operative measures can help to speed up post-operative healing. Whether planning a minor elective procedure or major surgery, skincare management after the procedure is of great concern to physicians [1]. Pain, ecchymosis, and edema are common temporary side effects after the operation. Understanding the body's reaction to surgery and helping the healing process is part of an overall treatment plan [2]. Many patients ask about supplements that may speed up the healing process. One

surprising healing aid that doctors often recommend is the consumption of pineapple within the days before and after surgery [1-4]. Bromelain is a type of enzyme found in high concentrations in pineapple plants (and other plants of the Bromeliaceae plant family). Animal studies and anecdotal proof of the healing properties of pineapple plant extracts have revealed its therapeutic importance. Bromelain has also been shown to have low toxicity and causes little to no unpleasant side effects [5-7].

The crude aqueous extract from the pineapple stem and the core of the pineapple fruit is called Bromelain. It is a mix of various thiol endopeptidases and other elements like phosphatases, glucosidases, peroxidases, cellulases, glycoproteins, carbohydrates, and several protease inhibitors [8]. It contains a range of closely related proteins, which are good anti-inflammatory, antithrombotic and fibrinolytic agents. The active fractions are characterized biochemically and appear to be effective after oral administration [8,9]. It has gained universal acceptance as a phytotherapeutic drug due to its history of safe use and zero side effects. This communication deals with the biochemistry and therapeutic applications of bromelain [9].

Current evidence suggests that Bromelain could also be a promising candidate for the development of future oral enzyme therapies with various therapeutic benefits, such as the effect of Bromelain on blood coagulation and fibrinolysis [6,10]. Bromelain affects blood coagulation by increasing the serum fibrinolytic capacity and inhibiting the synthesis of protein fibrin, which is involved in blood clotting [11]. In rats, the reduction of serum fibrinogen level by Bromelain is dose-dependent; at a higher bromelain concentration, prothrombin time (PT), and activated partial thromboplastin time (APTT) are markedly prolonged. In vitro and in vivo studies have suggested that Bromelain is an effective fibrinolytic agent because it promotes the conversion of plasminogen into plasmin, which increases fibrinolysis by degrading fibrin [6,11]. Pre-operative administration of Bromelain can shorten the average number of days for the complete disappearance of post-operative pain and inflammation. Trials show that Bromelain may effectively reduce swelling, bruising, and pain in women having an episiotomy. Bromelain is currently used to treat acute inflammation and sports injuries [8,12]. Statistically significant results must be given in more controlled clinical trials before accepting Bromelain for therapeutic use. The extent of its effectiveness and the methods by which it operates need to be better understood. However, due to its potential, Bromelain attracts the attention of the medical community and will be the subject of future research [5,13-15].

## **Materials and Methods**

A prospective randomized clinical study was conducted among 100 randomly selected patients from different regions of Kurdistan/Iraq, treated at the Department of Oral and Maxillofacial Surgery, Sulaymaniyah Teaching Hospital, from March to August 2020. The present study has been carried out in accordance with

the Declaration of Helsinki. Patients were registered only after receiving sufficient information and providing written consent to participate in the study. Enrolled patients in the study were over 20 years of age undergoing various facial surgical procedures. Whereas children, patients with systemic diseases, patients with a history of chemotherapy or radiation therapy, pregnant or lactating women, smokers, patients taking medications that affect wound healing, and anticoagulant drugs, hypersensitivity to the active substance bromelain, pineapple, or any of the excipients of the product represented a contraindication to the intake are excluded from this study. The registered patients underwent different surgical procedures on their faces, such as facelift, rhinoplasty, upper and lower lid blepharoplasty, and submental liposuctions.

The patients were randomly divided into two groups; fifty patients received the pre-operative pineapple juice, and the other fifty were considered as the control group. For the first group, patients were instructed to take fresh pineapple juice (350ml glass) twice every day, morning and evening. This regimen began seven days before the surgical operation and continued for seven days post-surgery. Surgical site pain, swelling, and ecchymosis with the variables were assessed during this study using a questionnaire. Each enrolled patient was subject to initial, follow-up, and final examination sessions. The pain level was determined using a visual analog scale (1-10) based on the severity of the pain, taking into account the number of analgesic medications taken within three days postoperatively. Post-operative photographs were taken 3,7 and 10 days after surgery with a Canon Rebel T3 DSLR camera.

The photos were then analyzed by two blinded reviewers. Swelling and ecchymosis judged by visual inspection were evaluated on a gradual scale of 1 to 5 (1=none, 2=mild, 3=moderate, 4=strong, 5=very strong), and individual values were added to obtain a median score for every symptom and visit. Average scores for all symptoms were added to obtain the clinical sum score for each visit. Both treatment and control patients received the same instructions regarding post-operative care concerning ice application, head elevation, and activity limits. Patients were guided to use an ice pack for 20 minutes every hour while awake for three days. They were also encouraged to keep their heads up for ten days, especially at bedtime. All patients were advised to refrain from heavy activities such as bending, lifting, or straining for a total of 10 days. All 100 patients were examined in the post-operative period. No patients were lost to follow-up, and there

were no patients having adverse reactions to the regimen requiring discontinuation of the fruit. Data were analyzed using SPSS software (Version 25; SPSS Inc) through descriptive (mean and frequency) and inferential statistics (T-test) for pain, swelling, and ecchymosis at the significance level of 0.05.

## Result

Of those 100 patients, 18 were men, and 82 were women. Female dominance in the study groups may indicate that women are more cautious of their aesthetic appearance than men. Patients ranged in age from 20 to 65, with an average age of 39.19 years. More demographic data are shown in Table 1. Operations performed under local or general anesthesia. Depending on the difficulty of the procedure, the type of anesthesia was selected. Table 2. Demographic data, surgical interventions are given in Table 3. No clinically relevant differences in average bromelain doses were observed when comparing different surgical indications. The clinical sum scores (sum of average symptom scores for pain, edema, ecchymosis) for the initial, follow-up and final examinations are given in Tables 4,5 and 6.

All patients in the control group received placebo, and all patients in each group completed three post-operative photographs on the day 3,7 and 10 after surgery to assess the degree of swelling and ecchymosis in both groups, every attempt was made to standardize lighting conditions for post-operative photos, some variability between photos exist. It is possible this slight variability may have affected the outcome of bruising measurements by blinded reviewers. Visual analog scale (VAS) pain was calculated between the two groups. In the control group, the majority of the cases (29=58%) experienced very mild pain scoring two out of ten degrees of VAS, with analgesics taken by the same group within three days post-treatment as described in Table 4. While most of the cases in the pineapple group fell into the first category of the pain scale, around (31=62%) had no pain, and (18=36%) experienced very slight pain. This shows a significant reduction of pain in patients consuming pineapple fruit with a statistically significant result ( $p<0.005$ ). Figure 1. The swelling was determined by visual inspection and assessed on a scale of (1-5). In the control group, assessment categories number 2 and 3 (22=44%, 21=42% respectively) made up most patients. This meant that patients developed mild to moderate swelling but severe swelling (4=8%) in some cases after the operation. All patients were healthy and did not have any health conditions that could have affected the post-opera-

tive outcomes. In the pineapple group, score categories 1 and 2 comprised 92% of the cases, meaning that (27=54%) did not experience any sort of swelling, and about (19=38%) developed mild swelling after the operation. Only (4=8%) cases had moderate swelling, and none of the patients had severe swelling. This outcome is statistically significant because of the presence of huge contrasts between the two groups in the reduction of post-operative swellings with a ( $p<0.005$ ): table 5, Figure 2.

Ecchymosis was also observed by visual inspection on an ordinal scale of 1 to 5 from mild to very strong ecchymosis. Average scores for all symptoms were added to obtain a clinical sum score for each visit. Individual values were also added to obtain mean scores for each symptom and each visit. In the control group, (23=46%) of the cases developed a moderate ecchymosis at various facial sites. Another (15=30%) experienced strong facial ecchymosis, and (1=2%) had very strong ecchymosis post-procedure Figure 3. While in the pineapple group, out of (50) patients (23=46%) showed no signs of facial ecchymosis. Mild facial bruising was developed by (26=52%) of the patients, and only (1=2%) of the cases had moderate ecchymosis. These results are also statistically significant in reducing the post-operative ecchymosis among the pineapple group patients ( $p<0.005$ ). Table 6, Figure 4,5 and 6.

Table 1. Distribution by age in both groups.

Age Groups	Control Group			Pineapple Group		
	Male	Famale	Total	Male	Famale	Total
20-29 Years	2 (4%)	12 (24%)	14 (28%)	0 (0%)	10 (20%)	10 (20%)
30-39 Years	1 (2%)	14 (28%)	15 (30%)	3 (6%)	13 (26%)	16 (32%)
40-49 Years	6 (12%)	9 (18%)	15 (30%)	3 (6%)	6 (12%)	9 (18%)
More than 49 Years	2 (4%)	4 (8%)	6 (12%)	1 (2%)	14 (28%)	15 (30%)

Table 2. Type of Anesthesia used in each group.

	Control Group			Pineapple Group		
	Male	Famale	Total	Male	Famale	Total
Local Anesthesia	11 (22%)	31 (62%)	42 (84%)	6 (12%)	38 (76%)	44 (88%)
General Anesthesia	0 (0%)	8 (16%)	8 (16%)	1 (2%)	5 (10%)	6 (12%)

Table 3. Type of operative procedure performed between both groups.

	Control Group			Pineapple Group		
	Male	Famale	Total	Male	Famale	Total
Upper lid Blepharoplasty	5 (10%)	18 (36%)	23 (46%)	3 (6%)	20 (40%)	23 (46%)
Lower lid Blepharoplasty	1 (2%)	3 (6%)	4 (8%)	3 (6%)	2 (4%)	5 (10%)
Temporal lift	3 (4%)	9 (18%)	12 (24%)	0 (0%)	11 (22%)	11 (22%)
Facelift	0 (0%)	1 (2%)	1 (2%)	1 (2%)	1 (2%)	2 (4%)
Brow lift	2 (4%)	0 (0%)	2 (4%)	0 (0%)	1 (2%)	1 (2%)
Lip lift	0 (0%)	1 (2%)	1 (2%)	0 (0%)	1 (2%)	1 (2%)

Table 4. Pain perception for both control and pineapple groups and the difference between them.

Pain VAS score	1	2	3	Total	t-test (significance)
Patient No. (%)					
Control Group	11 (22%)	29 (58%)	10 (20%)	50 (100%)	
Pineapple Group	31 (62%)	18 (36%)	1 (2%)	50 (100%)	0.000
Total	42%	47%	11%	100%	

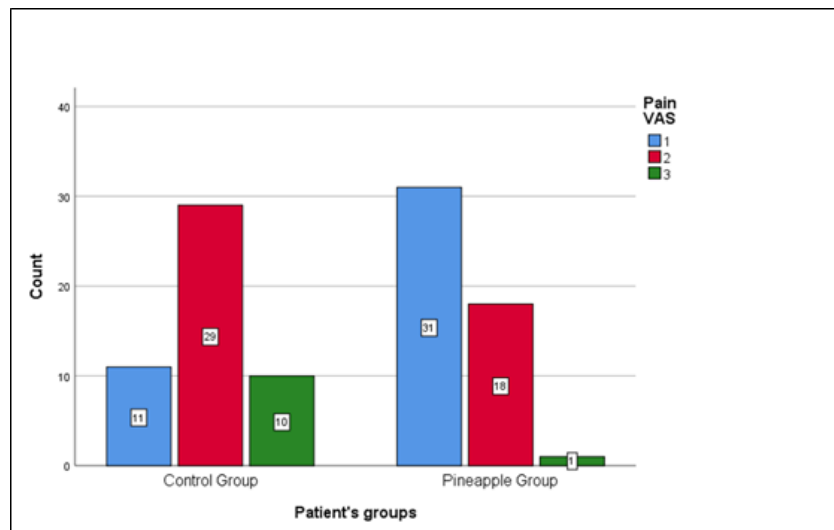


Figure 1. Frequency distribution of the pain VAS score for both groups.

Table 5. Swelling experience for both control and pineapple groups and the difference between them.

Pain VAS score	1	2	3	Total	t-test (significance)
Patient No. (%)					
Control Group	3 (6%)	22 (44%)	10 (20%)	50 (100%)	
Pineapple Group	54 (62%)	38 (36%)	1 (2%)	50 (100%)	0.000
Total	30%	41%	11%	100%	

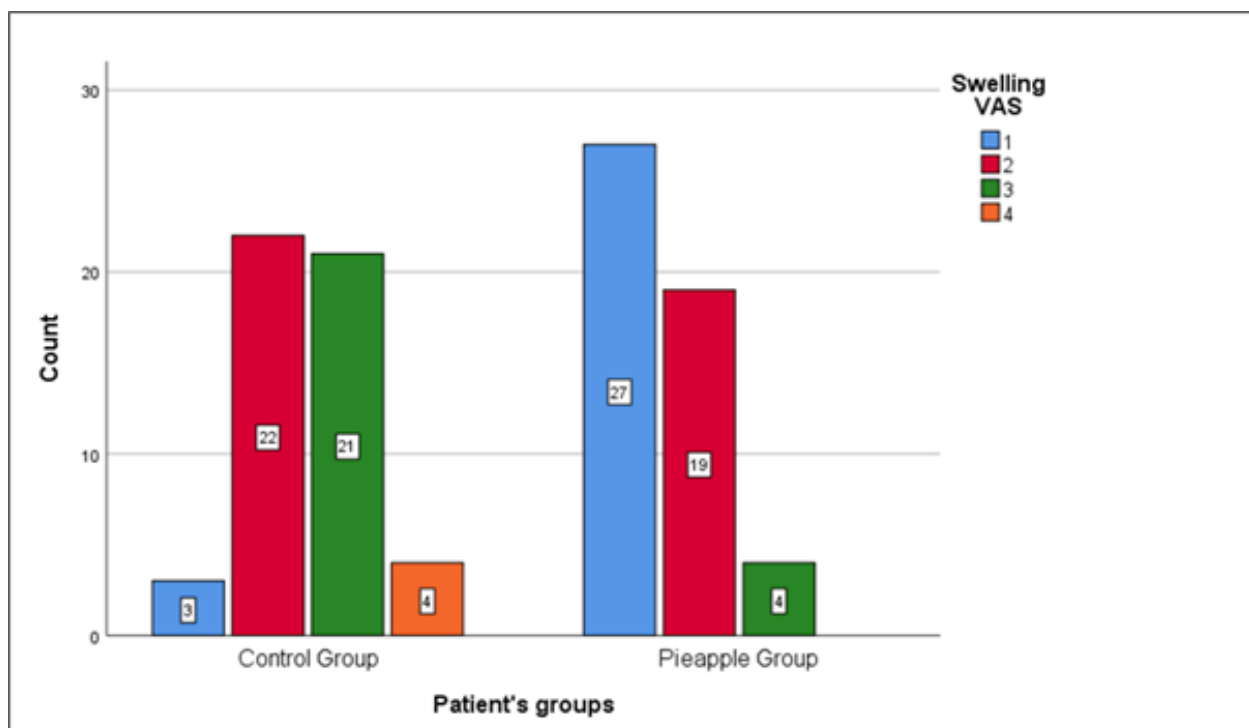


Figure 2. Frequency distribution of the swelling VAS score for both groups.



Figure 3. The patient is in the control group. She underwent an upper lid blepharoplasty procedure. Photographs are taken on the (a) 3rd, (b) 7th, and (c) 10th post-operative days, the extent of periorbital swelling and ecchymosis was measured.

Table 6. Ecchymosis experience for both control and pineapple groups and the difference between them.

Pain VAS score	1	2	3	4	5	Total	t-test (significance)
Patient No. (%)							
Control Group	1 (2%)	10 (20%)	23 (46%)	15 (30%)	1 (2%)	50 (100%)	0.000
Pineapple Group	23 (46%)	26 (52%)	1 (2%)	0 (%)	0 (0%)	50 (100%)	
Total	24%	36%	24%	15%	1 (1%)	100%	

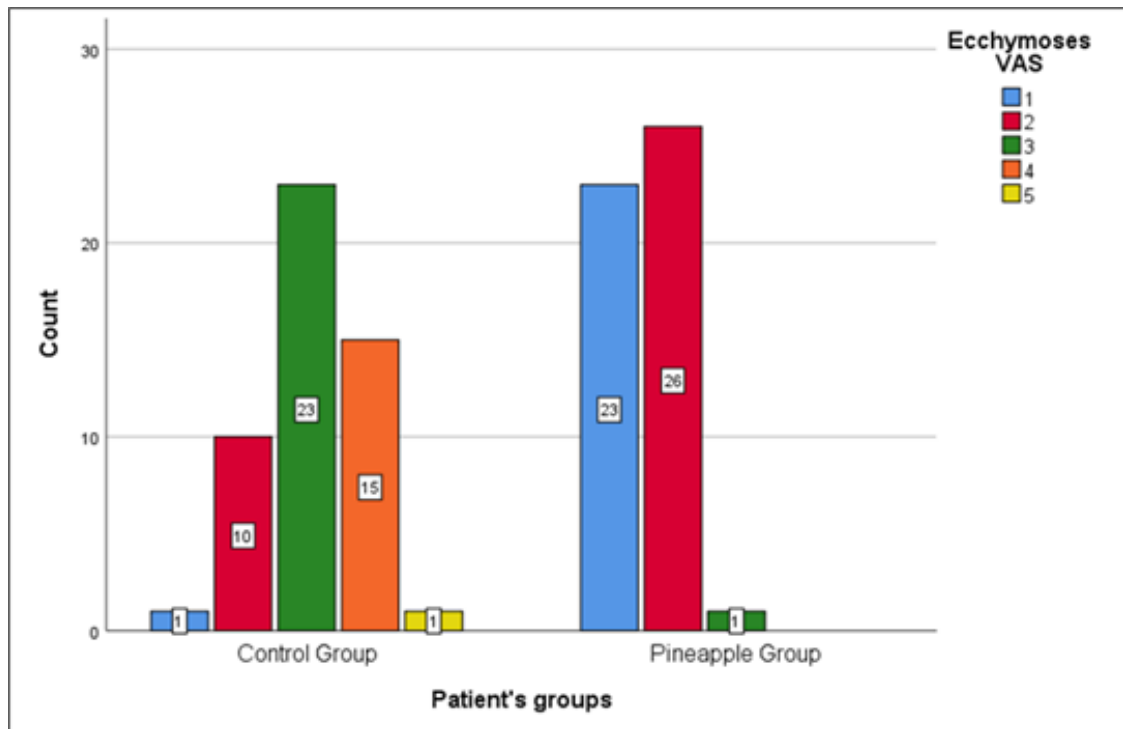


Figure 4. Frequency distribution of the ecchymosis VAS score for both groups.





*Figure 5.* The patient is among the pineapple group, who underwent lower lid blepharoplasty with a face and neck lift procedure. Photographs are taken on the (a) 3rd, (b) 7th, and (c) 10th post-operative days, measuring the extent of swelling and ecchymosis. Notice minor facial swelling and ecchymosis. Notice minor facial swelling and slight bruising under the eyes on days 3 and 7, but these are completely absent on day 10.



*Figure 6.* The patient is among the pineapple group. She had a lateral temporal brow lift procedure. Photographs are taken on the (a) 3rd, (b) 7th, and (c) 10th post-operative days. Upon measuring the degree of swelling and ecchymosis, notice the resolution of the surgical site and absence of swelling and ecchymosis at 10th post-operative day.

## Discussion

Although the natural process of healing after most of the facial surgical procedures typically involves bruising for 1 to 2 weeks as well as pain and swelling, patients and physicians are usually searching for ways to minimize these outcomes and accelerate its resolution by using various methods such as using pain killers, and vasoconstrictor contained local anesthetic, external pressure, and cold application [15]. The present study evaluated the effect of preoperatively taken fresh pineapple juice on the post-operative outcomes depending on the pre-operative effect of Bromelain extracted pineapple to minimize or prevent the aforementioned outcomes as the status of these patients were shown. The main finding in the present study was that the pineapple has some sort of analgesic effects. In addition, it showed a significant effect in minimizing post-operative swelling and ecchymosis in the surgical site of operation during the early post-operative period, which is agreed with some other researches that support the pre-operative beneficial effects of Bromelain contained pineapple [6,14-17]; however, some randomized controlled trials have also

shown no significant difference [1,4,16]. In addition, pineapple is a natural product and essentially nontoxic and showed a significant analgesic effect during the first post-operative week compared with control group [4,18]. Bromelain's (Pineapple) mode of action as an analgesic agent is multifaceted and thought to be both as a direct influence on pain mediators, such as bradykinin<sup>17</sup> and/or secondary effect of reducing pain-inducing factors, such as edema, debris, and immune complexes [19]. The anti-edematous action of Bromelain (pineapple) is presumably the most important therapeutic benefit during the post-operative recovery period. This pharmacodynamic effect is well described in various clinical and experimental studies [1,4,5,7,16], even though the mechanism on which this effect is based is not yet entirely clear [4,7]. The proteolytic activity of Bromelain containing pineapple, however, is essential, and a lowering of the kininogen concentration in the plasma following treatment with Bromelain (pineapple) also appears to play a role in minimizing post-surgical ecchymosis [1,3,7,18,20,21].

The major aim of this study was to investigate the routine use of fresh pineapple juice in pre and post-surgical facial surgical interventions as this was not previously mentioned, and only few researches are available regarding the use of bromelain tablets which is a natural product within the pineapple fruit. During the observation period, the intensity of pain significantly declined from the beginning till the final examination, as well as edema and ecchymosis. We believe that pineapple derivatives are useful in surgery that involves major soft tissue trauma. Using a similar argument, there may be an increased probability of detecting a difference with more surgical trauma inflicted such as after rhytidectomy surgery, in which there is a higher intensity of ecchymosis at the onset, upon the use of pineapple, our study displayed lower intensity of ecchymosis, or only a few diffuse yellow-colored bruises may have contributed to outlying data points. Although we found statistically significant changes, larger studies may be necessary to support our findings. Future studies should also incorporate some subjective assessments to correlate clinical impact with the objective findings.

## Conclusion

The results showed that pre-operative use of fresh pineapple juice could be effective in the reduction of pain, swelling and ecchymosis. Thus, taking together the observed benefits of pineapple within this study and with more recent studies confirming the efficacious and safe use of this drug in other surgical indications of the face. Pineapple extracted Bromelain may be used as a therapeutic agent in surgical care. In surgical practice, further exploration of such a product's role as a therapeutic agent remains to be established through a greater number of randomized controlled clinical trials.

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## Conflict of Interest

There is no conflict of interest to declare.

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