10.21608/ADJC.2023.216208.1336 Advanced Dental Journal
Volume 5(2023) | Issue 4 | Pages 901 - 915

Original Article

The Efficacy of Topical Sesame Oil in Orabase Versus Topical Triamcinolone in Orabase on Oral Lichen Planus and Salivary Level of Oxidative Stress Biomarker (MDA): Randomized Clinical Trial

Mona Taha Mohammed[1], Noha Adel Azab[1], Olfat Gamil Shaker[2], Amal Ali Husseine[1]

[1]Oral Medicine and Periodontology Department, Faculty of Dentistry, Cairo University, Egypt.
[2]Medical Biochemistry and Molecular Biology, Faculty of Medicine, Cairo University, Egypt.

Submitted: 7-6-2023
Accepted: 10-11-2023

E-mail: mona.taha @dentistry.cu.edu.eg

ABSTRACT

Objectives: To compare the efficacy of topical sesame oil in the formulation of a gel and topical triamcinolone acetonide 0.1% in dealing with the signs and symptoms of OLP. **Patients and Methods:** This randomized, controlled trial had thirty four patients who were randomized into two groups to receive either sesame oil oral gel or triamcinolone acetonide 0.1% oral gel thrice daily for 4 weeks. We assessed pain using the visual analogue scale and erythema and ulceration using the Thongprasom score and salivary MDA by ELISA. **Results:** Patients improved significantly in both groups, however change in the triamcinolone group occurred significantly faster than the sesame oil group. The Thongprasom score differed significantly between both groups ($p< 0.001$) favoring the triamcinolone group. The MDA level was statistically insignificant between both groups. **Conclusion:** Sesame oil can relieve pain but not as quickly as triamcinolone acetonide, additionally, it has no detectable effect on improving the clinical picture of OLP.

Keywords: Triamcinolone acetonide; Sesame oil; Thongprasome scale; Visual Analogue Scale

Introduction:

Oral lichen planus (OLP) is a chronic inflammatory mucosal disease of uncertain etiology (Abbas et al., 2014). It affects about 0.4% to 5% of the world population (Alrashdan et al., 2016). OLP is classified as a potentially malignant disorder by the WHO with a rate of malignant transformation of 1.09% particularly in erythematous and erosive OLP (Alrashdan et al., 2016; Iqbal et al., 2020).

In Egypt, the prevalence of oral lichen planus is reported to be 1.43% with 2.2:1 female to male ratio particularly in the 4th and 6th decade of life. The percentage of the symptomatic forms in Egyptian patients is 59.37% atrophic and 20.3% erosive OLP (Mostafa and Ahmed, 2015). Patients usually complain of symptoms that range from mild discomfort to severe pain causing difficulty in eating, speech and oral hygiene. Additionally, the premalignant nature of this

disease causes anxiety, stress and cancerphobia for patients. It also affects their quality of life and may even worsen their symptoms (Radwan-Oczko et al., 2017).

The goal of OLP management is not curative but symptomatic relief, acceleration of healing and reducing the chances of malignant transformation (Gupta and Jawanda, 2015). Corticosteroids are the gold standard and the first line of treatment of OLP as they reduce inflammation and pain due to their potent anti-inflammatory and immunomodulatory effects (Gorouhi et al., 2007; Gupta et al., 2017).

The chronic nature of OLP mandates a prolonged course of treatment. Moreover, the repeated episodes of exacerbation increase the incidence of facing corticosteroids' side effects which range from mucosal thinning, burning sensation, hyperpigmentation, delayed wound healing and secondary candidiasis to more serious systemic side effects as adrenal insufficiency, hypertension and osteoporosis (Al-Maweri et al., 2017). Based on the role of oxidative stress in the pathogenesis of OLP, there are currently trends towards using natural or herbal drugs with anti-inflammatory and antioxidant properties, as a replacement or an adjunct to corticosteroids to overcome their long-term side effects (Keshari et al., 2015; Amirchaghmaghi et al., 2016).

Sesame oil was used as a unique natural oil rich in lignans (sesamin, sesamol, and sesamolin) and tocopherols which are responsible for antioxidant and anti-inflammatory activities as they down-regulate oxidative stress, lipid peroxidation and Malondialdehyde levels. Sesamin and sesamolin suppress NFκB activation (Geetha et al., 2009) via suppressing IκB-kinase which degrades IκB. IκB is an inhibitory protein responsible for preventing NFκB binding to DNA (Harikumar et al., 2010 and Woo et al., 2019).

Due to the antioxidant and anti-inflammatory effects of sesame oil, it can be suggested as a suitable therapeutic candidate for OLP treatment. Furthermore, sesame oil has anticancer properties through lignans and tocopherols' anti-mutagenic ability (Hsu et al., 2013; Monteiro et al., 2014). Sesame oil has been proven in several trials as a safe and cost-effective drug. This is besides its ease of application, palatable taste and acceptable mouth feel even in patients who may have nausea (Anilakumar et al., 201; Dharmavaram et al., 2015; Okada et al.,2015; Bigdeli Shamloo et al., 2015; Khaira et al., 2020).

This study aimed at assessing topical Sesame oil in comparison to Triamcinolone acetonide (TA) for the management of OLP regarding pain relief, clinical improvement and antioxidant effect.

Subjects and Methods

Study Design:

This is a phase III, two-armed superiority randomized controlled clinical trial. The study protocol is available on clinicaltrias.gov under identifier NCT03738176.

Study Settings:

The study was conducted at the Department of Oral Medicine and Periodontology, Faculty of Dentistry, Cairo University. The study duration was from September 2018 till November 2021.

Ethical Approval:

The study was approved by the ethical committee of scientific research – faculty of Dentistry – Cairo University (Registration Number: 19/3/14) and was conducted according to the declaration of Helsinki. The details of the study were explained to all patients, and written informed consent was obtained before a patient entered the study. Patients were first assessed for eligibility, then those eligible had the details of the study explained to them. The patients signed a written Arabic informed consent that had all the pertinent information and complications prior to entering the study.

Sample Size Calculation:

The required sample size for this study was determined according to the effect size found by

Thomas et al. (1.1272141) (Thomas et al., 2017) using a two tailed test , α=0.05 and power =0.8 yielding 14 patients in each group. A 20% increase in sample size to avoid attrition bias gave a total of 17 patients per group.

Participants:

Eligibility Criteria:

Patients were recruited from the Diagnostic Center, Faculty of Dentistry, Cairo University, where the attending patients were screened until reaching the target sample. We included medically free patients with symptomatic (atrophic or erosive) oral lichen planus who had no history of taking corticosteroids or immunosuppressive drugs within 1 month before the study**.** We excluded patients with lichenoid reaction, or those having other lesions than OLP and pregnant and lactating females.

Intervention :

Sesame oil Preparation:

The Sesame oil gel was prepared from raw sesame seeds, 70% Carboxymethylcellulose,10%gelatin and 100% distilled water and Methyl para and propyl parapen as a preservative. Several trials were carried out to determine the maximum loading capacity of orabase without showing any signs of separation which was12 mg (20%). Sesame oil used in this study was cold pressed from raw white Egyptian sesame seeds .

Procedure:

Full medical history, intra and extra oral examination and consent were obtained from all subjects participating in the study . Patients were randomly allocated into two groups of 17 :

Group A: Subjects received topical sesame oil in orabase 3 times /day for a month.

Group B: Subjects received topical Kenacort in orabase (0.1% Triamcinolone) 3 times /day for a month (Bristol-Myers Squibb Company).

The patients in both groups had to apply a thin layer of their assigned treatment. The patients were asked not to eat, drink or smoke for 30 minutes after each application. We instructed the patients to report any side effects at any time during the study. We assessed patients for any possible side effects at each appointment along with their compliance to their given treatments.

Outcomes:

Pain Intensity:

Intensity of pain was measured for each patient using the visual analogue scale (VAS) which is a 10-cm ruler where each patient reports the degree of pain to a number on this scale where a zero score indicated "no pain" and a score of ten indicated "extremely severe pain."

The VAS was measured at baseline and at each follow-up visit (weeks 2 and 4) by the principal investigator.

Clinical Improvement:

Clinical Improvement and reduction in size of the lesion were measured using a periodontal probe and the area of the erosive and atrophic parts were calculated. The lesion was photographed at each visit at a standard distance parallel to the lesion site at a standard angle for documentation. Reduction in clinical sign score was assessed objectively using the Thongprasom score (Thongprasom et al., 1992). These measurements were done at baseline and at the end of the second and fourth weeks.

Salivary Malondialdehyde (MDA) Level:

Salivary sample collection:

Whole unstimulated saliva was collected at baseline and after one month of treatment in the two groups using standard techniques **(Navazesh, 1993)**. Samples were collected for 5 min where the subject leant forward and spat saliva into a graded sampling tube.

Determination of Human Malondialdehyde (MDA) in saliva :

Saliva samples were centrifuged for 10 min at 4000xg. The Supernatant was used for determination of MDA level using the "Double Antibody Sandwich" technique via ELISA Kit Cat No. MBS263626. Provided by My Biosource (USA, NY).

Sequence Generation and Allocation Concealment :

Random sequence was generated using Microsoft Excel and was implemented by N.A. as was the allocation concealment which was done using the telephone after the primary investigator enrolled each participant.

Blinding:

The principal investigator acted as the outcome assessor and was not blind to the allocated treatment nor was the patient due to the nature of the treatment.

Statistical methods

Data analysis was done using the Statistical Package for Social Sciences (SPSS) version 24. Data were explored for normality by checking the data distribution and using Kolmogorov-Smirnov and Shapiro-Wilk tests. Normally distributed data were summarized using mean and standard deviation while non-normal distributions were explored using median and range. Categorical data were summarized as percentages. We used the t-test to compare between groups with normally distributed variables. Non normally distributed variables were compared using the Mann-Whitney test. Comparisons of numerical variables over time were done using the repeated measure ANOVA, Friedman test and Wilcoxon test as appropriate. Categorical variables were analyzed using the Chi square (***X2***) test and Fisher's exact test when appropriate. All p-values are two-sided. P-value ≤ 0.05 was considered significant.

Results:

From September 2018 till November 2021, 34 patients were included in the study. The CONSORT flow diagram is presented in Figure (1). Table 1 demonstrated the clinical characteristics of the study participants.

Comparing median VAS scores over time in each single group was statistically significant for both groups with superiority for group B (table 2).

Comparing mean size over time in each single group was statistically insignificant for group A while a significant reduction in lesion size was seen in group B ($p<0.001$) throughout the three time intervals (table 3). Figures 1 and 2 show clinical pictures for patients receiving treatment A and B respectively.

Before treatment, the median and range of MDA level was 3.5(2.4-10.6) for Group A and 3.2(1.2-8.6) for Group B with no statistically significant difference between both groups ($p= 0.357$). After treatment, the median and range for MDA was 3.5(1.2-25.9) for Group A and 2.4 (1.2-8.7) for Group B with no statistically significant difference between both groups ($p= 0.838$). Additionally, change in median MDA over time in each single group was statistically insignificant ($p>0.05$). Patients in group B did not complain of any side effects. In group A, two patients complained of burning sensation, while three patients complained on unpalatable taste.

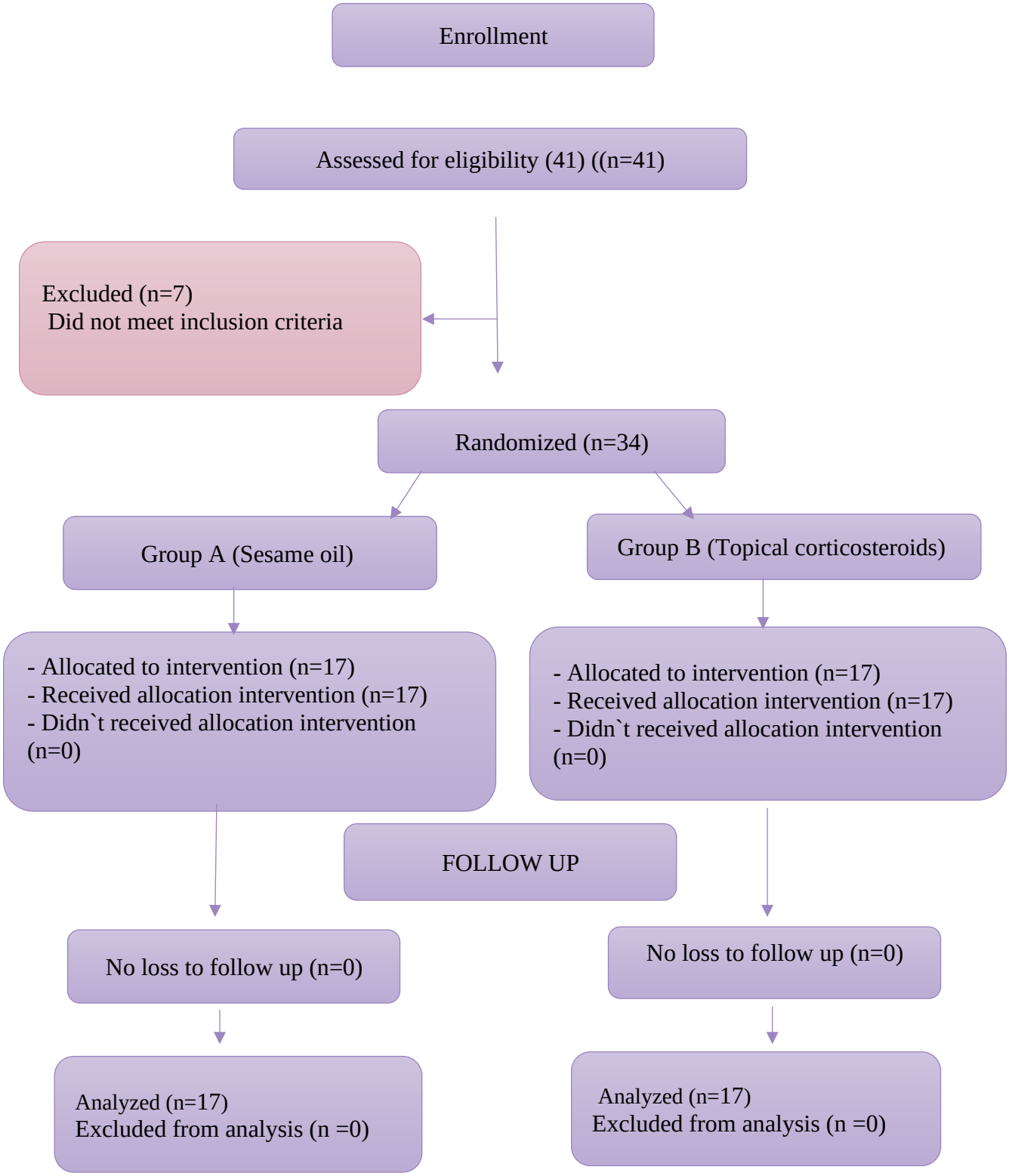

Figure (1): CONSORT Flowchart

Table (1): Clinical characteristics of included patients

Variables	Group	Group A(n=17)		Group B (n=17)		P value
		No	%	No	%	
Age (yrs.)	**Mean± SD**	52.7±11.9		48.4±9.6		0.21
	Range	34-75		32-66		
Sex	**Male (%)**	3(17.6)		2(11.8)		1.0
	Female (%)	14 (82.4)		15 (88.2)		
Types of OLP	**Erosive**	7		8		
	Atrophic	10		9		
Site Distribution	**Cutaneous lesion**	5		3		
	Buccal mucosa	16		16		
	Tongue	7		6		
	Gingiva	2		1		
	Labial mucosa	3		0		

Table (2): Median and range of VAS score at different time points in both groups

	Group A			**Group B**			
	Median	**Min.**	**Max.**	**Median**	**Min.**	**Max**	**P[1] value**
Baseline	7[a]	5	9	7*	6	9	0.394
Week 2	6	4	9	6	5	8	0.454
Week 4	5[a]	0	8	2	0	6	**0.003**
P[2] value	**<0.001**			**<0.001**			

P≤0.05 is statically significant; P1: for comparison between 2 groups. P2: for comparison over time in each group separately, similar lower case letters are statistically significant ,: all time interval are statistically significant from each other.*

Table (3): Mean and SD of size at different time points in both groups

	Group A		**Group B**		
SIZE	**Mean**	**SD**	**Mean**	**SD**	**P[1] value**
Baseline	3.2	1.2	3.4*	0.7	0.456
Week 2	2.9	1.2	2.9	0.8	0.833
Week 4	2.8	1.3	1.2	0.9	**<0.001**
P[2] value	0.218		**<0.001**		

P≤0.05 is statically significant; P1: for comparison between 2 groups. P2: for comparison over time in each group separately,: all time intervals are statistically significant*

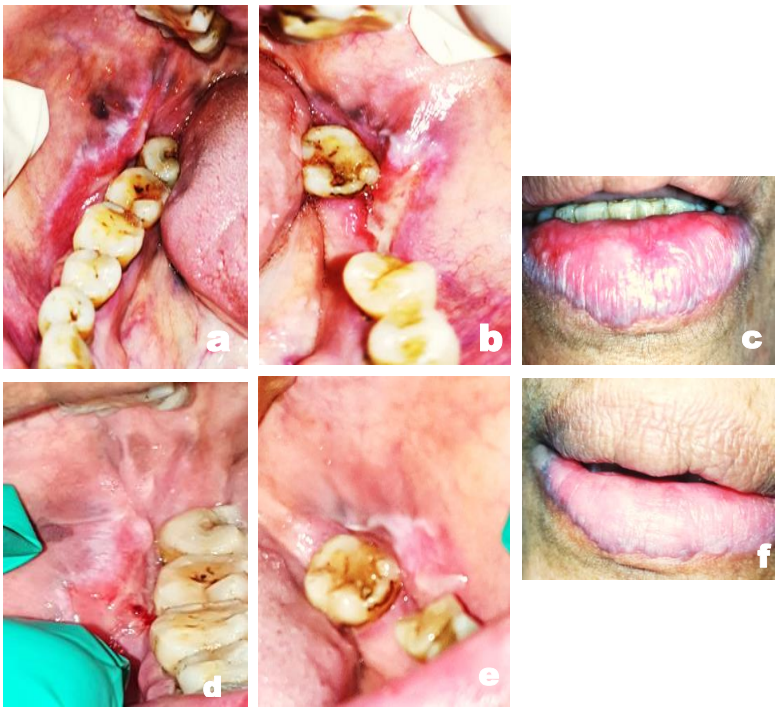

Figure (2): a, b, c: Clinical photograph of a 74-year-old female patient showing atrophic OLP on the right side of the buccal mucosa, erosive OLP on the left side of buccal mucosa and on the lower vermilion border.(Thongprasom score:4,VAS:8). **d,e,f:** Clinical photograph of the same patient showing partial healing(Thongprasom score:2,VAS:1) after receiving treatment A

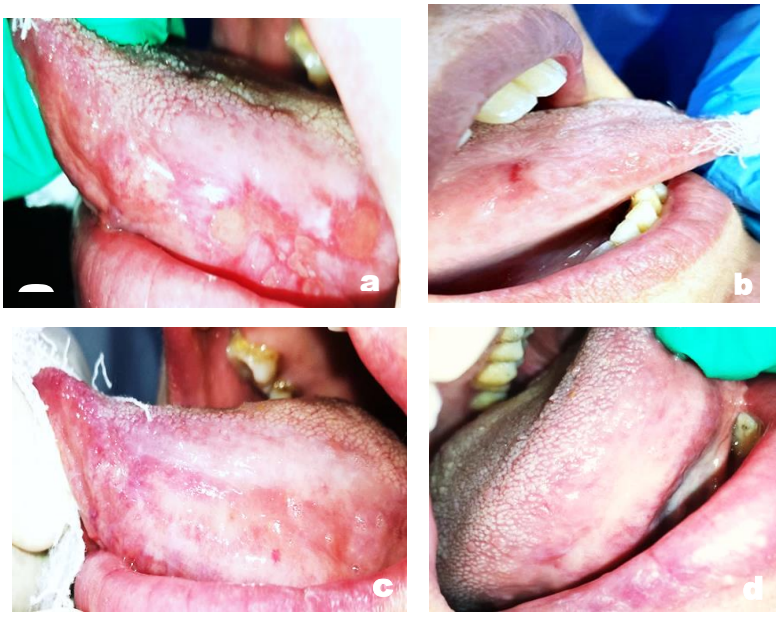

Figure (3): **a,b:** Clinical photograph of a 46-year-old female patients showing atrophic and erosive OLP on the right and left sides of the tongue.(Thongprasom score:5,VAS:8**). c,d:** Clinical photograph of the same patient showing partial healing (Thongprasom score:1,VAS:0) after receiving treatment B.

Discussion

Up to our knowledge, the current study is the first clinical trial to evaluate the effectiveness of topical Sesame oil as a gel in the management of symptomatic OLP. Consequently, no similar previous studies are available for comparison with our results.

Sesame oil is one of the most used oils in the practice of ayurvedic oil pulling that involves swishing of oil in the mouth for oral and systemic health benefits (Dhaliwal et al., 2017), which made it a perfect candidate for the treatment of OLP. The current study found that Sesame oil can significantly reduce pain over a period of 4 weeks. Sesame oil contains gamma Tocopherol and α-tocopherol which are the two major constituents of vitamin E. Vitamin E has anti-inflammatory activity where it can down regulate dendritic cells migration, cyclooxygenase (Cox)-2 activity and production of prostaglandinE2 (PGE2) and interleukin (IL-12). Also, vitamin E can regulate T-cell function via suppression of tumor necrosis factor (TNF)-α, IL-6and IL-1β release (Lee et al., 2018; Lewis et al.,2019). Furthermore, vitamin E has chemo-preventive activity where it can inhibit cancer cell growth and differentiation (Iqubal et al., 2014). Many observational studies assessed the serum and salivary levels of Vitamin E in OLP (Raietal, 2008; Abdolsamadi et al., 2014; Mohammed and Diajil, 2019). Nagao et al. measured the level of salivary vitamin E in OLP patients compared to control and reported that it was lower in OLP patients compared to healthy controls. Moreover, serum levels of Vitamin E were lower in erosive/atrophic OLP compared to the reticular type (Nagao et al., 2001). This justifies the use of vitamin E containing compounds in patients with OLP.

However, the present study found that Sesame oil could not bring about a significant reduction of lesion size over the treatment duration. Moreover, TA had a higher statistically significant effect in reducing lesion size and pain than Sesame oil. In our results, Triamcinolone was effective and safe, where the patients did not complain from any side effects.

On the other hand, studies using formulations that contained Vitamin E produced promising results. Inamdar et al, 2015 conducted a study on 30 patients with OLP and treated them with aloe vera, licorice and sesame oil in the form of a gargle which was swished twice daily for six weeks. They found that there was a decrease in pain, erythema, burning sensation, and functional disturbance after using the prepared formulation.

Dayem et al (2020) used Vitamin E for the treatment of OLP. They used vitamin E systemically as an adjunctive treatment to topical triamcinolone acetonide. They found that the group treated with Vitamin E capsules and topical triamcinolone acetonide showed greater improvement in pain, clinical scores with decrease in salivary total antioxidant capacity.

Topical sesame oil has been researched in other diseases. Dharmavaram et al (2015) used topical Sesame oil for the treatment of recurrent aphthous stomatitis which is an inflammatory disease mediated by immune dysregulation like OLP. They found that topical sesame oil showed statistically significant reduction in pain and lesion size. Sharquie et al. (2020) compared the effect of sesame oil and pumpkin oil in the management of recurrent aphthous ulcer and their prophylactic effect. They found that sesame oil showed higher statistically significant effect in the healing of recurrent aphthous ulcer and prophylactic effect after 1, 2 and 3 months from starting therapy.

This finding highlights the role of antioxidants in the treatment of OLP and the validity of pursuing this research venue. Contrary to this belief, sesame oil did not have favorable results in the current study where there was no significant lesion size reduction in the Sesame oil group. Possible explanations, would be that the

current study used sesame oil from raw sesame seeds which contain small amounts of sesamol as opposed to that present in roasted sesame oil where sesamolin is converted to sesamol after roasting (Kumar et al., 2015; Islam et al., 2016). Additionally, the ability of Sesame oil to resist rancidity is mainly due to sesamol and sesamol dimer, which might be the cause of the unpalatable taste experienced by the patients in group A as the seeds were not roasted (Mostashari and Khaneghah).

Sesamol is generally regarded as the main anti-oxidative and anti-inflammatory component of sesame oil (Hsu et al., 2013). Sesamol can suppress the production of TNF-α and down regulate cytokine release from dendritic cells in concentration lower than sesame oil and with stronger effects than sesame oil (Khorrami et al., 2018). Another explanation would be the use of local sesame seeds to manufacture the oils which could be contaminated with heavy metals (Pb, As, Cu, Cd, Zn). These metals could be from the soil, fertilizers, and even geographical conditions encountered during seed transport. The percentage of heavy metals in the oil differs according to the method of extraction. These include: grinding roasted sesame seed including Ardeh oil; or cold pressed using virgin oil and refined oil, where the refined oil has the lowest amount of heavy metals (De Leonardis et al., 2000; Pehlivan et al., 2008; Rounizi et al., 2020). Moreover, cold pressed Sesame oil may contain aflatoxins due to fungal infection during harvest, transportation, and storage (Li et al., 2009). Sebaei et al. (2020). Found that 37 % of the Egyptian sesame samples included in their study had large amounts of aflatoxin of up to 20 µg/kg.

On the other hand, studies by Hegde et al (2017) and Sawair et al. (2010) investigated alternative treatments used by patients for treatment of recurrent aphthous ulcers. They found that Tahini is the major alternative treatment where all subjects who applied Tahini believed that Tahini was effective in relieving pain and reducing the duration and frequency of ulceration. These results may be due to the difference in composition where Tahini is made from milled and roasted sesame seeds which contain high levels of beneficial nutrients such as calcium, iron, potassium and phosphorus, antioxidants and vitamins (B, C and E) not to mention a high amount of sesamol(more than 50%) (Gholami et al., 2020).

Under physiological conditions, there are low lipid peroxidations rates (sub toxic conditions) and the cells can survive via activation of signaling pathways that increase the antioxidant proteins and, ultimately, the adaptive stress response. However, under pathological conditions, there are medium or high lipid peroxidation rates (toxic conditions), so oxidative damage overrides cells regeneration, and induces apoptosis (Ayala et al., 2014). Serum markers besides local markers of oxidative stress can be found in saliva so it is used in the surveillance of diseases in response to treatment (Mansourian et al., 2016).

Malondialdehyde is the principal end product of lipid (long chain of polyunsaturated fatty acid) peroxidation, thus, it can be used as a marker for oxidative stress (Shirzad et al., 2013). Results of salivary MDA in our study revealed that no statistically significant difference was found in each study group as well as when comparing both groups. Mansourian et al. (2016) evaluated the level of MDA in patients with OLP before and after TA treatment and found that there was no significant difference in the reduction of salivary MDA levels before and after treatment which is in accordance with our results. MDA may not be a specific marker for oxidative stress levels. This might be justified by the chronic nature of the disease, where return to physiologic lipid peroxidations rates takes longer than a month.

In conclusion, the palliative effect of sesame seed products is undeniable through-out

numerous studies (Hsu et al., 2008; Wichitsranoi et al., 2011; Roghani et al., 2013; Haidari et al., 2016) Seeds rich in vitamin E have continuously proven to be effective in many mucosal diseases (Iqubal et al., 2013; Bacci et al., 2017; Lewis et al., 2019; Dayem et al., 2020). The findings of the current study suggest that sesame oil alone is not enough to achieve a better therapeutic effect in OLP patients than TA. It can, however, be used to reduce pain experienced by patients and can act as a safe adjunctive drug in treatment of OLP.

Conflict of Interest:

The authors declare no conflict of interest.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

References:

1. Abbas, A.W. Zaidan,T.F, Y. Abbood Al-Barrak,A. (2014). Assessment of Serum and Salivary Malondialdehyde in Patients with Oral lichen planus. J Bagh College Dentistry . https://doi.org/10.12816/0015203.

2. Abdolsamadi, H., Rafieian, N., Goodarzi, M. T., Feradmal, J., & Ahmadi-motamayel, F. (2014). Levels of Salivary Antioxidant Vitamins and Lipid Peroxidation in Patients with Oral Lichen Planus and Healthy Individuals. Chonnam Medical Journal,58–62. http://dx.doi.org/10.4068/cmj.2014.50.2.58.
3. Al-Maweri, S. A., Kalakonda, B., Al-Soneidar, W. A., Al-Shamiri, H. M., Alakhali, M. S., & Alaizari, N. Efficacy of low-level laser therapy in management of symptomatic oral lichen planus: a systematic review. Lasers in medical science, (2017). 32(6), 1429-1437.
4. Alrashdan, M. S., Cirillo, N. and McCullough, M. 'Oral lichen planus: a literature review and update', Archives of Dermatological Research. Springer Berlin Heidelberg, (2016):308(8), pp. 539–551.
5. Amirchaghmaghi, M., Pakfetrat, A., Delavarian, Z., Ghalavani, H., & Ghazi, A. (2016). Evaluation of the Efficacy of Curcumin in the Treatment of Oral Lichen Planus :ARandomizedControlledTrial.10(5), 134–137. https://doi.org/10.7860/JCDR/2016/16338.7870

6. Anilakumar,K.R.,PAL,A., Khanum ,F.,Bawpal, A. S.,(2010). Nutritional , Medicinal and Industrial Uses of Sesame (Sesamum indicum L .) Seeds - An Overview. Agriculturae Conspectus Scientificus .75-4. antioxidant profile in patients with oral Lichen planus. J. Oral Pathol. Med. 40, 286–293

7. Ayala, A., Muñoz, M. F., & Argüelles, S. (2014). Lipid Peroxidation: Production, Metabolism, and Signaling Mechanisms of Malondialdehyde and 4-Hydroxy-2-Nonenal. 2014.

8. Bacci C, Vanzo V, Frigo AC, Stellini E, Sbricoli L, Valente M. Topical tocopherol for treatment of reticular oral lichen planus: a randomized, double- blind, crossover study. Oral Dis. 2017; 23 (1): 62- 68. doi: 10.1111/odi.12573.

9. Bigdeli Shamloo MB, Nasiri M, Dabirian A, Bakhtiyari A, Mojab F, Alavi Majd H. The Effects of Topical Sesame (Sesamum indicum) Oil on Pain Severity and Amount of Received Non-Steroid Anti- Inflammatory Drugs in Patients With Upper or Lower Extremities Trauma. Anesth Pain Med. 2015;5(3):e25085
10. Dayem, E. A., Abd, W., Mohamad, E., Shaker, O. G., & Ali, S. (2020). Effect of adjunctive systemic vitamin E on clinical parameters and salivary total antioxidant capacity in symptomatic oral lichen planus patients : Randomized controlled clinical trial. 2(1).
11. Dhaliwal, Jagjit Singh, Ramandeep Singh Gambhir, Sachinjeet Kaur Sodhi, Gursanjyot Shaheed, D. K. N. Binti, and Kifli M. HajiPG. "Herbs and their use in oral care: A Review." *Brunei Darussalam Journal of Health* 7, no. 1 (2017): 5-17.
12. Dharmavaram.A,T. , Reddy.R.S.Nallakunt .R. " Ozone " – The New Nemesis of Canker Sore. (2015). 16–19. https://doi.org/10.7860/JCDR/2015/11911.5617
13. Geetha T, Rohit B, Pal KI. Sesamol: an efficient antioxidant with potential therapeutic benefits. Med Chem. 2009. 5:367-371.
14. Gholami,M.Davan,S.T.Gholami,M.,Bolandparvaz,S.,Gholami,M.,Chamanpara,P.,Shayan,L.(2020). Effects of Topical Sesame Oil Extracted from Tahini (. 8(3), 179–185. https://doi.org/10.30476/BEAT.2020.82561.Journal.
15. Gorouhi F, Solhpour A, Beitollahi JM, Afshar S, Davari P, Hashemi P, et al. Randomized trial of pimecrolimus cream versus triamcinolone acetonide paste in the treatment of oral lichen planus. J Am Acad Dermatol 2007;57(5):806-13.
16. Gupta, S., & Jawanda, M. K. (2015). Oral Lichen Planus : An Update on Etiology , Pathogenesis , Clinical Presentation , Diagnosis and Management. 60(3), 222–229.
17. Gupta, S., Ghosh, S., & Gupta, S. Interventions for the management of oral lichen planus: a review of the conventional and novel therapies. Oral Diseases, (2017):23(8), 1029-1042.
18. Haidari F, Mohammadshahi M, Zarei M, Gorji Z (2016) Efects of sesame butter (Ardeh) versus sesame oil on metabolic and oxidative stress markers in streptozotocin-induced diabetic rats. Iran JMed Sci 41(2):102–109
19. Harikumar KB, Sung B, Tharakan ST, Pandey MK, Joy B, Guha S, et al. Sesamin manifests chemopreventive effects through the suppression of NF-?B-regulated cell survival, proliferation, in- vasion, and angiogenic gene products. Mol Cancer Res. 2010. 8:1541-7786.
20. Hegde, S., Ajila, V., Babu, S., & Rai, S. (2017). Traditional methods used by patients for the management of recurrent aphthous stomatitis. Journal of Intercultural Ethno pharmacology 6(4), 10–12. https://doi.org/10.5455/jice.20171110112326
21. Hsu, D., Chen, S., Chu, P., & Liu, M. (2013). Therapeutic effects of sesame

oil on monosodium urate crystal-induced acute inflammatory response in rats. (Il), 1–10.2.659.

22. Hsu, D.-Z., Chien, S.-P., Li, Y.-H., Chuang, Y.-C., Chang, Y.-C., & Liu, M.-Y. (2008). Sesame oil attenuates hepatic lipid peroxidation by inhibiting nitric oxide and superoxide anion generation in septic rats. Journal of Parenteral and Enteral Nutrition, 32(2), 154–159. https://doi.org/10.1177/0148607108314766.

23. Inamdar, H., Sable, D. M., Subramaniam, A. V, Subramaniam, T., & Choudhery, A. (2015). Evaluation of efficacy of indigenously prepared formulation of Aloe vera , licorice and sesame oil in treatment of oral lichen planus : An in vivo study. Journal of Advanced Clinical & Research Insights, 2, 237–241. https://doi.org/10.15713/ins.jcri.86

24. Iqbal, M. A., Yesmin, S., Maaisha, F., Ibrahim, S., & Gotame, P. (2020). Oral lichen planus and its recent management : A review, UpDCJ; 10 (2): 29-34,DOI: https://doi.org/10.3329/updcj.v10i2.50179.

25. Iqubal MA, Khan M, Kumar P, Kumar A, Ajai K,Role of vitamin e in prevention of oral cancer:-areview. J Clin Diagn Res. 2014; 8 (10): ZE05-7. doi786010,7860 /JCDR/2014/9166.4958

26. Islam F, Gill RA, Ali B, Farooq MA, Xu L, Najeeb U, Zhou W (2016) Sesame. Ch. 6. In:Gupta SK (ed) Breeding oilseeds crops for sustainable production opportunities and constraints. Academic press is an imprint of Elsevier, pp 135–147. https://doi.org/10.1016/B978-0-12-801309-0.00006-9.

27. Keshari, D., Patil, K., & Mahima, V. G. (2015). Efficacy of topical curcumin in the management of oral lichen planus : A randomized controlled-trial. 2(May 2014), 197–203. https://doi.org/10.15713/ins.jcri.78

28. Khaira, S., Verma, P., & Gupta, S. (2020). Role of Sesame Oil Pulling in the Management of Oral Submucous Fibrosis : A Pilot Study. Acta Scientific Dental Sciences :4(8), 109–113. https://doi.org/10.31080/ASDS.2020.04.0897

29. Khorrami, S., Daneshmandi, S., & Mosayebi, G. (2018). Sesame seeds essential oil and Sesamol modulate the pro-inflammatory function of macrophages and dendritic cells and promote Th2 response. Medical Journal of the Islamic Republic of Iran (MJIRI). 32.98. https://doi.org/10.14196/mjiri.32.98

30. Kumar, C. M., & Singh, S. A. (2015). Bioactive lignans from sesame (Sesamum indicum L .): evaluation of their antioxidant and antibacterial effects for food applications. J Food Sci Technol 52(5), 2934–2941.

https://doi.org/10.1007/s13197-014-1334-6

31. Lee GY, Han SN. The Role of Vitamin E in Immunity. Nutrients. 2018; 10 (11): E1614. doi: 10.3390/nu10111614.

32. Lewis ED, Meydani SN, Wu D. Regulatory role of vitamin E in the immune system and inflammation. IUBMB Life. 2019; 71 (4): 487-494. doi: 10.1002 /iub.1976.

33. Li, F.Q., Li, Y.W., Wang, Y.R., Luo, X.Y., 2009. Natural occurrence of aflatoxins in Chinese peanut butter and sesame paste. J. Agric. Food Chem. 57 (9), 3519–3524.

34. Mansourian, A., Hosseini, F. A., Kazemi, H. H., Mortazavi, N., & Moosavi, M. S. (2017). Salivary oxidative stress in oral lichen planus treated with triamcinolone mouthrinse. Dental Research Journal Original. 104–110

35. Mohammed,A.J& Diajil, A. R . (2019). Salivary vitamin E and uric acid in patients with OLP and healthy individuals. J Bagh College Dentistry. 39–43.

36. Monteiro, É., Chibli, L., Yamamoto, C., Pereira, M., Vilela, F., Rodarte, M., … da Luz André de Araújo, A. (2014). Antinociceptive and anti-inflammatory activities of the sesame oil and sesamin. Nutrients, 6(5), 1931–1944. https://doi.org/10.3390/nu6051931

37. Mostafa, B., & Ahmed, E. (2015). Prevalence of oral lichen planus among a sample of the Egyptian population. Journal of clinical and experimental dentistry ,7(1). https://doi.org/10.4317/jced.

38. Mostashari, Parisa, and Amin Mousavi Khaneghah. "Sesame Seeds: A Nutrient-Rich Superfood." *Foods* 13, no. 8 (2024): 1153.

39. Nagao T, Warnakulasuriya S, Ikeda N, Fukano H, Yamamoto S, Yano M, Miyazaki H, Ito Y. Serum antioxidant micronutrient levels in oral lichen planus. J Oral Pathol Med. 2001; 30 (5): 264-267.

40. Navazesh M. "Methods for collecting saliva," Annals of the New York Academy of Sciences1993; 694: 72–77.

41. Okada, S., Sudo, A., & Nishio, J. (2015). Topical Application of Sesame Oil for the Prevention of Chemotherapy- Induced Oral Mucositis : Pilot Study in Seven Hematopoietic Cancer Patients International Journal of Nursing & Clinical Practices. 2, 1–6.

42. Pehlivan, E., Arslan, G., Gode, F., Altun, T., & Özcan, M. M. (2008). Determination of some inorganic metals in edible vegetable oils by inductively coupled plasma atomic emission spectroscopy (ICP- AES),Grasas Y Aceites, 59, 239– 244.

43. Radwan-Oczko, M. et al. (2017)'Psychopathological profile and

quality of life of patients with oral lichen planus', Journal of Applied Oral Science, 26, pp. 1–9. doi: 10.1590/1678-7757-2017-0146.

44. Rai B, Kharb S. Salivary lipid peroxidation product malondialdehyde in pre-cancer and cancer. Adv Med Dent Sci 2008;2:7-8.

45. Rödström PO, Hakeberg M, Jontell M, Nordin P. Erosive oral lichen planus treated with clobetasol propionate and triamcinolone acetonide in orabase: a double-blind clinical trial. J Dermatol Treat. 1994. https:// doi. org/ 10. 3109/ 09546 63940 90818 37

46. Roghani M, Jalali-Nadoushan MR, Baluchnejadmojarad T, Vaez Mahdavi MR, Naderi G, Roghani Dehkordi F, et al. Endothelium-dependent Effect of Sesame Seed Feeding on Vascular Reactivity of Streptozotocin-diabetic Rats: Underlying Mechanisms. Iran J Pharm Res. 2013;12:377-85. PubMed PMID: 24250645.

47. Rounizi ,K. S., Fateme, R., Mohajeri, A., Moshtaghi, H., Fatemeh, B., Sara, P., … Khalili, E. (2020). The chemical composition and heavy metal content of sesame oil produced by different methods: A risk assessment study. Food Sci Nutr. 2021;9:2886–2893.

48. Sawair, F. (2010). Recurrent Aphthous Stomatitis: Do We Know What Patients Are Using to Treat the Ulcers : THE JOURNAL OF ALTERNATIVE AND COMPLEMENTARY MEDICINE , 16- 6. https://doi.org/10.1089/acm.2009.0555.

49. Sebaei, A. S., Refai, H. M., Elbadry, H. T., & Armeya, S. M. (2020). First risk assessment report of a flatoxins in Egyptian tahini. Journal of Food Composition and Analysis, 92(October 2019), 103550. https://doi.org/10.1016/j.jfca.2020.103550

50. Sharquie, K. E., Noaimi, A. A., & Ahmed, D. S. (2020). Topical Sesame Seed and Pumpkin Seed Oils have Therapeutic and Prophylactic Role in the Management of Recurrent Aphthous Stomatitis. American Journal of Dermatology and Venereology 2020, 9(3): 38-42 9(3), 38–42. https://doi.org/10.5923/j.ajdv.20200903.02.

51. Shirzad, A., Pouramir, M., Seyedmajidi, M., Jenabian, N., Bijani, A., & Motallebnejad, M. Salivary total antioxidant capacity and lipid peroxidation in patients with erosive oral lichen planus. Journal of dental research, dental clinics, dental prospects, (2013):8(1), 35.

52. Thomas AE, Varma B, Kurup S, et al. Evaluation of Efficacy of 1% Curcuminoids as Local Application in Management of Oral Lichen Planus - Interventional Study. J Clin Diagn Res. 2017; 11(4): 89–93.

53. Thongprasom, K. et al. (1992) 'Relative efficacy of fluocinolone acetonide compared with triamcinolone acetonide in treatment of oral lichen planus', Journal of Oral Pathology & Medicine, 21(10), pp. 456–458. doi: 10.1111/j.1600-0714.1992.tb00974.

54. Wichitsranoi J, Weerapreeyakul N, Boonsiri P, Settasatian C, Settasatian N, Komanasin N, et al. Antihypertensive and antioxidant effects of dietary black sesame meal in pre-hypertensive humans. Nutr J. 2011;10:82. doi: 10.1186/1475-2891-10-82. PubMed PMID: 21827664; PubMed Central PMCID: PMC3173298.

55. Woo, M., Han, S., & Song, Y. O. (2019). Sesame Oil Attenuates Renal Oxidative Stress Induced by a High Fat Diet . Nutr. Food Sci. 2019;24(2):114-120, 114–120. https://doi.org/10.3746/pnf.2019.24.2.114 .