A COMPARATIVE ANALYSIS OF *Camellia sinensis* EXTRACT AND SALICYLIC ACID IN THE MANAGEMENT OF ACNE VULGARIS IN STUDENTS

ABSTRACT

Purpose: This study aims to compare the efficacy of *Camellia sinensis* extract serum with salicylic acid gel in treating acne vulgaris.

Method: The bioactive compounds from the *Camellia sinensis* leaf extract were extracted using distilled water and formulated into a serum for topical application. Salicylic acid was also formulated into a gel-based cream for topical application, and the effect on acne was investigated over the course of two weeks. This entails a longitudinal, open-label, and random treatment of six selected subjects with *Camellia sinensis* bioactive compound serum and others with salicylic acid gel for 14 days under close observation.

Results: The *Camellia sinensis* gel-based cream was found to be effective in the treatment of certain types of acne vulgaris. The salicylic acid gel (standard) effectively treated all types of acne. The effect of salicylic acid on various forms of acne as presented on test subjects in Group A didn't peak until the second week, with a visible reduction in blackheads (open comedones). While *Camellia sinensis* peaked in the first week of treatment, there was little to no reduction in blackheads, but there was a visible reduction in pore size, indicating that it may have preventive properties against acne formation. Subjects treated with *Camellia sinensis* experienced no adverse effects, while others experienced slight tingling, dryness, and irritation while using salicylic acid.

Conclusion: Based on this study, the treatment that showed faster results within the short period allocated to the study shows promising use as a standard form of treatment for acne vulgaris as compared to salicylic acid because no adverse effect was experienced with *Camellia sinensis*.

Keywords: acne treatment, *Camellia sinensis* extract, salicylic acid, anti-inflammatory, acne vulgaris, keratolytic.

1.0 INTRODUCTION

Nature has offered a rich source of potent and effective therapeutic compounds. Many modern medicines have been derived from natural sources, thanks to the utilization of natural items in traditional medicine [1]. Herbal remedies have been widely used for the treatment of acnes and injuries since ancient civilizations. While a mere 1-3% of contemporary pharmaceuticals are utilized for treating wounds and skin problems, a significant proportion of traditional remedies, approximately one-third, are dedicated to addressing these conditions [2].

Acne vulgaris is a dermatological disorder that manifests as scaly red skin (seborrhea), small papules, blackheads, and whiteheads (comedones), huge papules (nodules), and occasionally scarring (pimples) [3]. Hormones trigger the inflammation of the sebaceous glands and hair follicles, causing this condition [4]. *Propionibacterium acnes* is the bacteria that causes acne when it penetrates the skin [5]. There are two types of acne vulgaris: inflammatory and non-inflammatory. Comedones are characteristic of non-inflammatory acne, while papules, pustules, nodules, and cysts are indicative of inflammatory acne [6]. Depending on the quantity of lesions on the skin, acne vulgaris can also be classified as mild, moderate, or severe [7]. Cysts and nodules may cause pain in the areas where they are located. Increased sebum production, irregular follicular desquamation, *Propionibacterium acnes* proliferation, and localized inflammation are the four main pathogenic elements that contribute to the development of acne [8,9]. Hyperkeratinization and excessive sebum

production exacerbate pore blockage, while aerobic bacteria (mostly P. acnes) multiply and release inflammatory mediators [10].

Salicylic acid is known as a keratolytic agent because it dissolves the intercellular cement that holds the epithelium's cells together. It has a minor anti-inflammatory effect, enhances penetration of certain substances, and, at low concentrations, is fungistatic and bacteriostatic [11]. Salicylic acid works by causing the epidermis cells to slough off more readily, preventing pores from clogging up, and allowing room for new cell growth. Salicylic has keratolytic and comedolytic properties, although the exact mechanisms involved are not clear [12]. Salicylic acid also decreases sebum secretion in acne patients, which adds to its therapeutic effect.

Camellia sinensis is a species of tiny tree or evergreen shrub belonging to the Theaceae family of flowering plants. The Tea is usually made from its stems, leaves, and leaf buds. (Unrelated to *Melaleuca alternifolia*, the source of tea tree oil, or the species Leptospermum frequently termed tea tree) Common names include tea plant, tea shrub, and tea tree [13].The plant is a well-known herbal beverage that is highly regarded for its antioxidant properties and several health advantages [13]. It is widely consumed worldwide and renowned for its potential positive effects on health [14]. Traditional Chinese medicine uses *Camillia sinensis* leaves in the form of green, black, or oolong tea to improve digestion, enhance cognitive function, reduce inflammation, and also act as an anti-aging and anti-cancer agent [15].

Numerous studies conducted both in laboratory settings and in living organisms have indicated that *Camillia sinensis* possesses advantageous health benefits [16].

However, few studies have tried to ascertain the effectiveness of the plant in treating acne. The tea has exhibited substantial antioxidant and anticarcinogenic characteristics. Therefore, this research was undertaken to evaluate the effectiveness of topical application of *Camillia sinensis* extract on the rate of treatment of acne vulgaris in comparison with salicylic acid.

2.0 MATERIALS AND METHOD

2.1 PLANT COLLECTION AND IDENTIFICATION:

The dried leaves of *Camellia sinensis* were obtained for the preparation of a *Camellia sinensis* extract serum. The dried *Camellia sinensis* leaves were obtained from processed tea bags (Green Life) obtained from Elele Market, Rivers State, Nigeria. A taxonomist from the Department of Pharmacognosy at Madonna University performed the botanical identification.

2.2 Chemical / drugs used:

The formulation consists of several key ingredients, each serving a specific purpose. Salicylic acid and *Camellia sinensis* extract act as active ingredients, providing the primary therapeutic benefits. Sodium hyaluronate serves as a gelling agent and humectant, helping to retain moisture. Allantoin is included as an anti-irritant to soothe the skin. Distilled water, sodium lactate, and glycerin function as solvents, ensuring the ingredients are effectively delivered and mixed. EDTA acts as a stabilizer and chelator, maintaining the formulation's integrity. Liquid Germal Plus is used as a preservative to extend the product's shelf life. Panthenol provides moisturizing properties, while xanthan gum is utilized as a thickening agent to achieve the desired consistency.

2.3. EXPERIMENTAL PROCEDURE:

Camellia sinensis extracts serum Formulation

10 grams of glycerin were measured out into a 50-ml beaker, and 1 gram of xanthan gum was dissolved in the 10 grams of glycerin to form a slurry. This allows for the simple dispersion of xanthan gum in the mixture. In a 500-ml beaker, 451 ml of distilled water was measured. 7.5 grams of Panthenol and 5.0 grams of Allantoin were added to the distilled water and stirred until completely dissolved using a glass rod. 5.0 grams of sodium hyaluronate were added to the mixture. The immersion blender was used to evenly disperse the sodium hyaluronate gel, as it readily gels when in contact with water. Next, we add xanthan gum and a glycerin mixture to the solution to thicken it. This process forms a gel-like consistency that is characteristic of a serum. After the gelling process, an immersion blender incorporated 10 grams of *Camellia sinensis* extract, 0.5 grams of disodium EDTA, and 2.5 grams of the preservative (Liquid Germal Plus). The immersion blender is used to further ensure that all ingredients are incorporated together. The pH was measured to be 6, which is the pH required to be effective in the skin. It was then left for four hours before being bottled in an amber dropper bottle.

Salicylic acid gel formulation

20 ml of sodium lactate and 18 ml of glycerin were measured into a 50 ml beaker, after which 10 grams of salicylic acid were added to the 50 ml beaker and mixed. The beaker was covered with foil to prevent moisture loss and particles from entering, then placed in water to heat at 60 degrees Celsius until completely dissolved and let cool. In another 50-ml beaker, 2 ml of glycerin was added to dissolve 1 gram of xanthan gum. In a 500-ml beaker, 426 ml of water was measured out, and the glycerin

and xanthan gum were added to it, which was then stirred with a glass rod. 5 grams of sodium hyaluronate were added, followed by 7.5 grams of panthenol and 7.5 grams of allantoin. The dissolved salicylic acid mixture was added and stirred with a glass rod, followed by 0.5 grams of disodium EDTA. 2.5 grams of preservative were added and stirred, and the formulation was let sit for a few hours before being bottled in an amber dropper bottle.

2.4 STUDY AREA AND POPULATION:

Six Young female students with acne vulgaris gave their consent and consented to participate in the study. The study was conducted at Madonna University, Elele campus between September and December 2020.

2.5 STUDY APPROACH:

In two weeks, we divided six members of the population of young female adults into two groups, each consisting of three female adults. Group A was put on salicylic acid, and Group B was put on *Camellia sinensis*. The subjects were given the formulation in a dropper bottle for easy application. Subjects in Group A used the Salicylic acid serum (topical gel) every morning and night. They conducted close observation with pictures taken on Day 0, Day 7, and Day 14 to document the results. Subjects in Group B also used *Camellia sinensis* extract serum (topical gel) twice a day. They were also put under close observation, with pictures taken on Day 0, Day 7, and Day 14. The protocols for the study were approved by the National Health Research Ethics Committee of Nigeria (ref no. NHREC/01/01/2007).

3.0. RESULTS AND DISCUSSION

The results for the activities of *Camelia sinensis* and salicylic acid Topical gelon Acne vulgaris as tested on selected subjects on Day 0, Day 7, and Day 14.

3.1.0 THE RESULTS OF THE ACTIVITIES OF Camellia sinensis ON ACNE VULGARIS

3.1.1 NUMBER OF ACNE LESIONS AT DAY 0

TABLE 1 ON THE GROUPING OF SUBJECTS FOR THE STUDY

PATIENTS	FOREHEAD	LEFT CHEEKS	RIGHT CHEEKS	CHIN	TOTAL LESION COUNT
A1	8	4	4	6	22
A2	2	8	4	6	20
A3	4	3	1	2	10

3.1.2 NO. OF ACNE LESIONS AT DAY 7

TABLE 2 ON THE GROUPING OF SUBJECTS FOR THE STUDY

PATIENTS	FOREHEAD	LEFT CHEEKS	RIGHT CHEEKS	CHIN	TOTAL LESION COUNT
A1	6	3	3	3	15
A2	1	4	2	2	9
A3	1	2	0	1	4

3.1.3 NO. OF ACNE LESIONS AT DAY 14

TABLE 3 ON THE GROUPING OF SUBJECTS FOR THE STUDY

PATIENTS	FOREHEAD	LEFT CHEEKS	RIGHT CHEEKS	CHIN	TOTAL LESION COUNT
A1	2	1	2	1	6
A2	1	4	1	0	6
A3	0	0	0	0	0

3.1.4 GRAPH OF TOTAL LESION COUNT AGAINST DAY

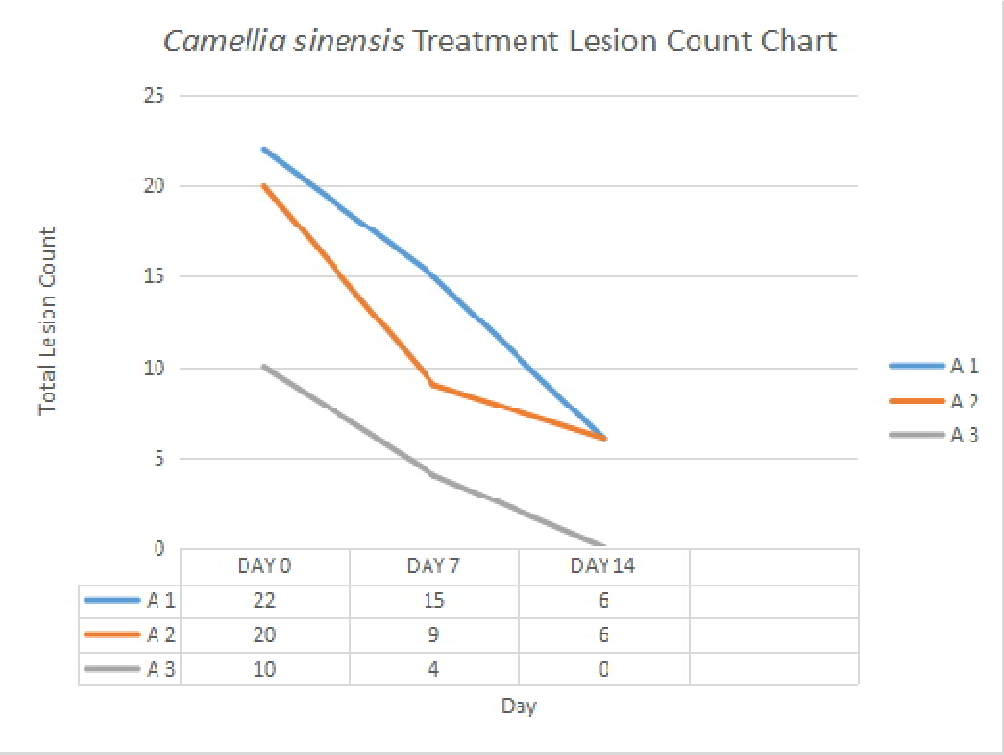

Fig. 1. Graph of total lesion count against Day

3.2.0 THE RESULT OF THE ACTIVITIES OF SALICYLIC ACID ONACNE VULGARIS

3.2.1 NO. OF ACNE LESIONS AT DAY 0

TABLE 4 ON THE GROUPING OF SUBJECTS FOR THE STUDY

PATIENTS	FOREHEAD	LEFT CHEEKS	RIGHT CHEEKS	CHIN	TOTAL LESION COUNT
B1	8	7	4	4	23
B2	12	13	14	10	49
B3	6	12	15	8	41

3.2.2 NO. OF ACNE LESIONS AT DAY 7

TABLE 5 ON THE GROUPING OF SUBJECTS FOR THE STUDY

PATIENTS	FOREHEAD	LEFT CHEEKS	RIGHT CHEEKS	CHIN	TOTAL LESION COUNT
B1	3	4	2	0	9
B2	5	7	4	5	21
B3	5	10	14	5	34

3.2.3 NO. OF ACNE LESIONS AT DAY 14

TABLE 6 ON THE GROUPING OF SUBJECTS FOR THE STUDY

PATIENTS	FOREHEAD	LEFT CHEEKS	RIGHT CHEEKS	CHIN	TOTAL LESION COUNT
B1	2	2	1	0	6
B2	1	2	2	4	9
B3	4	5	12	5	26

3.2.4 GRAPH OF TOTAL LESION COUNT AGAINST DAY

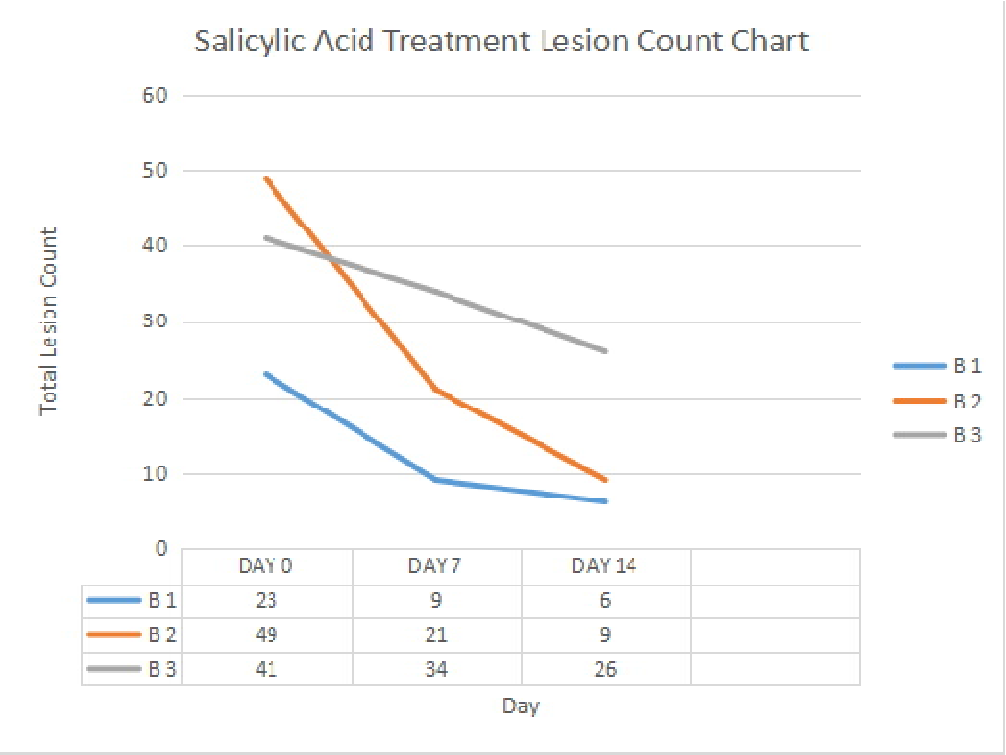

Fig. 2. Graph of total lesion count against Day

3.3.0 COMPARISON OF TREATMENT OUTCOMES BETWEEN GROUP A AND GROUP B

TABLE

3.4.0 SUBJECT TREATMENT OBSERVATIONS

TABLE 7 ON THE GROUPING OF SUBJECTS FOR THE STUDY

SUBJECT	TREATMENT	TREATMENT PERIOD OR DAY	OBSERVATION
A 1	*Camellia sinensis* Topical gel (Serum)	Day 5	Significant reduction on inflamed lesion
		Day 8	No new lesions formed
		Day 12	Pores were minimized which made the skin appear smoother.
A 2	*Camellia sinensis* Topical gel (Serum)	Day 5	Dry up of pus-filled lesions
		Day 8	No new lesions formed
		Day 12	No visible reduction in blackheads (closed comedones)

A 3	*Camellia sinensis* Topical gel (Serum)	Day 5	Reduction in painful inflamed acne lesion
		Day 8	Dry up of pus-filled lesions. The oiliness of the skin is reduced to a minimum.
		Day 12	Minimizing the appearance of pore size.
B 1	Salicylic acid Topical gel (Serum)	Day 5	Stinging sensation on application persists but stops in about a minute or less
		Day 8	No visible effect observed
		Day 12	Reduction in the size of lesions
B 2	Salicylic acid Topical gel (Serum)	Day 5	Slightly irritated skin but no new lesions formed.
		Day 8	New lesions formed but pus-filled lesions shrunk in size.
		Day 12	Visible effect on blackheads (open comedones) observed

B 3	Salicylic acid Topical gel (Serum)	Day 5	Stinging sensation on application persists but stops in about a minute or less
		Day 8	Less active lesions observed. Skin felt dry.
		Day 12	Visible reduction of lesions, pore size appeared smaller.

The purpose of this research was to compare the effects of salicylic acid as a topical medicament used in the treatment of acne and a lotion made from the extract of *Camellia sinensis* to investigate the effectiveness of both treatments against acne and highlight the adverse effects of using synthetic drugs to treat acne. According to our research, salicylic acid has comedolytic and keratolytic properties [18]. In a 12-week double-blind randomized study, 0.5% salicylic acid was used twice daily on individuals with mild-to-moderate acne vulgaris. The group receiving active treatment showed a greater reduction in both inflammatory lesions and open comedones [18].

From our research on topical tea polyphenols, we found seven trials on the effect of tea polyphenols; one of the studies looked at investigating tea polyphenols in the body [19]. None of the research examined tea polyphenols both topically and internally. Green tea and tea of unknown type were the sources of tea polyphenols in six studies. Green tea polyphenol was found to have antibacterial properties against P. acnes. The

use of 2% lotion of green tea (*Camellia sinensis*) topically during a six-week study among 20 patients suffering from mild to moderate acne was found to be effective compared with treatment [19]. Tannins and flavonoids in green tea may have an anti-acne effect because they appear to have an antiseptic effect, whereas tannins also have an anti-inflammatory effect [20].

There is no doubt that medicinal plants have fewer side effects in the treatment of acne, making them advantageous over synthetic drugs. Although synthetic drugs are also as effective, the problem comes with the persistent side effects and sometimes addictive properties they possess, thereby reducing their usage [20].

In our study, the *Camellia sinensis* extract topical gel was found to be effective in the treatment of certain types of acne vulgaris, which include white heads, papules, and pustles, due to its anti-inflammatory, anti-bacterial, and antioxidative properties, while the salicylic acid topical gel was also found to be effective in all types of acne due to its keratolytic and comedolytic properties. The effect of salicylic acid on various forms of acne as present on test subjects in Group A didn't peak until the second week, with a visible reduction in blackheads (open comedones).

Whereas the treatment with the extract of *Camellia sinensis* peaked in the first week of treatment, although there was little to no reduction in blackheads, there was a visible reduction in pore size, which indicates the preventive properties of *Camellia sinensis* against the formation of acne. Subjects put on *Camellia sinensis* experienced no adverse effect, while some experienced slight tingling, dryness, and irritation while using salicylic acid. Further research is needed to isolate the active compound responsible for the treatment of acne in *Camelia sinensis.*

5.0. CONCLUSION

The results from this study showed that *Camellia sinensis* extract serum gave faster efficacy in subjects within a week than the salicylic acid serum, but the salicylic acid serum would offer a more radical cure for acne within a course of one to two months in most of the subjects because it can target the common forms of acne.

It may be concluded that *Camellia sinensis* extract serum is suitable for the treatment of mild-to-moderate forms of acne, while salicylic acid is suitable for moderate-to-severe forms of acne. *Camellia sinensis* extract serum treatment showed overall faster results, making it a promising standard form of treatment for acne vulgaris as opposed to salicylic acid, which had some adverse effects. Although these results are not conclusive due to the limited sample size, further research with a larger sample size is necessary to further confirm these findings.

Disclaimer

This paper is an extended version of a preprint document of the same author.

The preprint document is available in this link: https://chemrxiv.org/engage/chemrxiv/article-details/652cfa658bab5d205573bd37[As per journal policy, preprint articlecan be published as a journal article, provided it is not published in any other journal]

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

The author(s) affirm that they did not utilize any generative AI technologies, such as Large Language Models (ChatGPT, COPILOT, etc.) or text-to-image generators, throughout the process of writing or revising the manuscripts.

REFERENCES

1. Cragg GM, Newman DJ. Drugs from nature: past achievements, future prospects. In: Ethnomedicine and Drug Discovery. Amsterdam, The Netherlands: Elsevier Science; 2002. p. 23–37.
2. Mantle D, Gok MA, Lennard TWJ. Adverse and beneficial effects of plant extracts on skin and skin disorders. Adverse Drug React Toxicol Rev. 2001;20(2):89–103.
3. Witkam WCAM, Dal Belo SE, Pourhamidi S, Raynaud E, Moreau M, Aguilar L, et al. The epidemiology of acne vulgaris in a multiethnic adolescent population from Rotterdam, the Netherlands: A cross-sectional study. J Am AcadDermatol. 2024;90(3):552–60. doi:10.1016/j.jaad.2023.10.062.
4. Tuchayi SM, Makrantonaki E, Ganceviciene R, Dessinioti C, Feldman SR, Zouboulis CC. Acne vulgaris. Nat Rev Dis Primers. 2015 Sep;1.
5. Bhate K, Williams HC. Epidemiology of acne vulgaris. Br J Dermatol. 2013 Mar;168(3):474–85. doi:10.1111/bjd.12149.
6. Layton AM, Zouboulis CC, Whitehouse H. Acne. In: Rook's Textbook of Dermatology. 2024;1-91. doi:10.1002/9781119709268.rook088.
7. Dawson AL, Dellavalle RP. Acne vulgaris. BMJ. 2013 May;346(5):30–33. doi:10.1136/bmj.f2634.

8. Bienenfeld A, Nagler AR, Orlow SJ. Oral antibacterial therapy for acne vulgaris: An evidence-based review. Am J Clin Dermatol. 2017;18(4):469–90. doi:10.1007/s40257-017-0267-z.
9. Olutunmbi Y, Paley K, English JC. Adolescent female acne: etiology and management. J PediatrAdolesc Gynecol. 2008;21:171–6. doi:10.1016/j.jpag.2007.07.004.
10. Gollnick H, Cunliffe W, Berson D, Dreno B, Finlay A, Leyden JJ, et al. Management of acne: A report from a global alliance to improve outcomes in acne. J Am AcadDermatol. 2003;49 –S37. doi:10.1067/mjd.2003.618.
11. Krautheim A, Gollnick HPM. Acne: Topical treatment. Clin Dermatol. 2004;22:398–407. doi:10.1016/j.clindermatol.2004.03.009.
12. Marczyk B, Mucha P, Budzisz E, Rotsztejn H. Comparative study of the effect of 50% pyruvic and 30% salicylic peels on the skin lipid film in patients with acne vulgaris. J CosmetDermatol. 2014;13:15–21.
13. Perumalla AVS, Hettiarachchy NS. Green tea and grape seed extracts—potential applications in food safety and quality: A review. Food Res Int. 2011;44(4):827–39.
14. Delwing-Dal Magro D, Delwing-Dal Magro V, da Silva WC, Coelho de Souza AN, Broetto SG, de Carvalho NR, et al. Protective effect of green tea extract against proline-induced oxidative damage in the rat kidney. Biomed Pharmacother. 2016;83:1286–94.
15. Sharangi AB. Medicinal and therapeutic potentialities of tea (Camellia sinensis L.): A review. Food Res Int. 2009;42(5–6):529–35. doi:10.1016/j.foodres.2009.01.007.
16. Turan SK, Süloğlu AK, İde S, Türkeş T, Barlas N. In vitro and in vivo investigation of Argiope bruennichi spider silk-based novel biomaterial for medical use. Biopolymers. 2024;115(3). doi:10.1002/bip.23572.
17. Ueda S, Mitsugi K, Ichige K, et al. New formulation of chemical peeling agent: 30% salicylic acid in polyethylene glycol. Absorption and distribution of 14C-salicylic acid in polyethylene glycol applied topically to skin of hairless mice. J Dermatol Sci. 2002;28:211–8.
18. Mahmood T, Akhtar N, Khan BA, Khan HM, Saeed T. Outcomes of 3% green tea emulsion on skin sebum production in male volunteers. Bosn J Basic Med Sci. 2010;10:260–4.
19. Zaveri NT. Green tea and its polyphenolic catechins: Medicinal uses in cancer and noncancer application. Life Sci. 2006;78:2073–80. doi:10.1016/j.lfs.2005.12.006.

20. Gaur S, Agnihotri R. Green tea: A novel functional food for the oral health of older adults. GeriatrGerontol Int. 2014;14:238–50. doi:10.1111/ggi.12194.

APPENDIX