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Original research article

ANTIOXIDANT ASSESSMENT OF SOME THERAPEUTICALLY IMPORTANT PLANTS AS ANTI-AGING AGENTS

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Abstract: *Skin, the protective outer covering of the body, acts as an insulator between internal and external environments. Skin diseases are a significant concern today, primarily due to oxidative stress. Although synthetic compounds and drugs are available, they often contain toxic and carcinogenic compounds, leading to cancer. Herbal and natural products, rich in natural antioxidants, are preferred as remedies.* ***Objective:*** *To evaluate the antioxidant potential of different solvent extracts at various concentrations from five plants: Aloe barbadensis, Camellia sinensis, Cocos nucifera, Ficus carica, and Rosa indica, using DPPH, Total Phenolic Content (TPC), and Total Antioxidant Assay.* ***Methods:*** *This experimental study was conducted over six months in a laboratory setting. Various solvent extracts (100% v/v) of the five selected plants were prepared, and their antioxidant potentials were evaluated using DPPH radical scavenging assay, TPC assay, and Total Antioxidant Assay. Data were analyzed using ANOVA, and results were expressed as mean ± standard deviation (SD).* ***Results:*** *Among all the plant extracts, the 100% v/v Petroleum ether extract of Aloe barbadensis showed the highest radical scavenging value, i.e., 98.6±0.55. Following the evaluation through DPPH, TPC, and Total Antioxidant Assays, a combination of the five plant extracts was proposed as a potent source of natural antioxidants.* ***Conclusion:*** *The study concluded that the selected plant extracts, particularly the Petroleum ether extract of Aloe barbadensis, possess significant antioxidant potential. These extracts can be utilized in cosmetics and other industries as natural antioxidant sources, offering a safer alternative to synthetic compounds.*

Keywords: Antioxidants, Camellia sinensis, Cocos nucifera, Ficus carica, Oxidative stress, Skin diseases, Total Phenolic Content (TPC), 2,2-diphenyl-1-picrylhydrazyl (DPPH).

Introduction

Skin is the dynamic organ comprising about one-sixth of the body weight (1). It is the body's outermost layer and integument and acts as a barrier between the internal and external environment. The skin protects against serious injuries caused by microbial and chemical agents. It also serves the functions of thermoregulation, absorption, secretion, and sensory (2). Skin diseases are more common nowadays and majorly impact people's quality of life. More than 60% of the general population, including almost all age groups, is now suffering from different skin diseases (3). The most common and general skin problems dermatologists and physicians face nowadays are acne, atopic dermatitis, and psoriasis (4). Some other skin problems like photosensitivity, itching, allergies, eczema, Tinea infections, skin eruptions, pigmentation, folliculitis, pigmentary disorders like vitiligo, and other disorders, including keloid and xerosis, are also in literature. (5).

A large number of skin problems are raised due to oxidative stress. The disorders of oxidative stress are psoriasis, polymyositis, atopic dermatitis, eczema, mycosis fungoides, acne, lupus, scleroderma, seborrheic, vasculitis, pemphigoid, and most importantly, photoaging (aging) (2). Uncontrolled release of the reactive oxygen species (ROS) due to skin exposure to ultraviolet radiation also causes human skin disorders

Including cutaneous neoplasia (6). The most common inflammatory and chronic disease caused by oxidation is psoriasis, which affects about 2% of the population by showing symptoms like itching, thickening, and skin scaling. (7). Generally, synthetic drugs are used to cure skin infections. However, synthetic drugs /creams contain chemical compounds that have hazardous effects. Among these effects, severe allergy is caused due to the presence of chemicals like zinc oxide. At the same time, using these creams may increase the skin's oiliness due to the presence of excessive chemical emulsifiers, so natural drugs are preferred. For example, fairness creams contain harmful ingredients such as parabens. Its exposure estimates the risk assessment to the creams and has a carcinogenic nature, causing breast cancer (8). They also contain the comedogenic ingredient isopropyl myristate, which increases the formation of blackheads.

Most of the creams for fairness that are sold in the market contain certain chemicals like steroids and hydroquinone, and long-term use of these creams leads to lethal health issues like permanent pigmentation, skin cancer, and skin burning. To prevent side effects of synthetic drugs plant, plant-based products are the best option to tackle skin

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problems. Plants are the major source of natural antioxidants and thus are helpful in the treatment of skin diseases that are caused by oxidative stress (2). Natural antioxidants are used for the prevention of photo aging and contact dermatitis (2). The extract of *Andrographis paniculata, Glycyrrhiza glabra, Ocimum sanctum*, and *Azadirachta* indica possess the ability to treat and prevent acne (9). Acne can also be cured with other plants like *Calendula, Lavender* and Citrus. *Amaranthus* is used to treat various skin problems like acne, psoriasis, and eczema (10). These plants contain active compounds like saponins, flavonoids, phenolics, terpenoids, tannins, linalool, linaloyl acetate, polysaccharides, and anthocyanins (10) that contribute to the antioxidant effect and treatment of skin problems due to the oxidative stress. The present study is planned to evaluate the natural antioxidants from plants to cure skin diseases caused by oxidative stress and make a suitable combination of medicinally important plants to avoid synthetic chemicals' harmful aspects.

The present study aims to analyze different combinations of medicinally important plants for their antioxidant ability and to classify the best combination of rose, aloe vera, green tea, fig, and coconut extracts for the medicated creams.

Methodology

This experimental study was designed using a Split-Block Randomized Complete Block Design (RCBD) and conducted in a laboratory setting over six months. Seeds of the experimental plants, including *Aloe barbadensis* (aloe vera), *Camellia sinensis* (green tea), *Cocos nucifera* (coconut), *Ficus carica* (fig), and *Rosa indica* (rose), were obtained from local herbalists and the Punjab Seed Corporation in Lahore.

Four solvents were used for the extraction: petroleum ether, Chloroform, Methanol, and Water. The extraction process was performed using the maceration method, in which plant materials were soaked in the respective solvents at room temperature for a specified period to ensure thorough extraction of the bioactive compounds.

The radical scavenging activity of the plant extracts was determined using the DPPH (2,2-diphenyl-1-picrylhydrazyl) assay, following the methodology described by Erasto et al. (2004). The DPPH assay involves measuring the reduction in absorbance at 517 nm, indicating the scavenging of the DPPH radical by antioxidants in the plant extracts.

The total antioxidant capacity of the extracts was assessed using the method outlined by Prieto et al. (1999). Antioxidant activity was expressed as the sample absorption at 695 nm. This method quantifies the ability of the extracts to reduce Mo(VI) to Mo(V) and form a green phosphate/Mo(V) complex at acidic pH.

The total phenolic content of the plant extracts was determined using the Folin-Ciocalteu method, as described by Makkar et al. (1993). This assay measures the phenolic compounds' ability to reduce the Folin-Ciocalteu reagent, with results expressed as gallic acid equivalents (GAE).

Data were analyzed using Co-Stat software. Standard deviation (SD) was calculated for each set of measurements. Mean separation was conducted using the Least Significance Difference (LSD) test with a significance level of $p < 0.05$. The analysis was further refined using Duncan's Multiple Range Test (DMRT) to identify statistically significant differences among the treatments. (Bliss, 1967).

Results

Radical scavenging activity by DPPH Assay

Radical scavenging activity by DPPH assay was accomplished with different concentrations of 30%, 50%, 70%, and 100% v/v of petroleum ether, chloroform, methanol, and distilled water extracts of ethnomedicinally important plants, i.e., *Aloe barbadensis*, *Camellia sinensis*, *Cocos nucifera*, *Ficus carica* and *Rosa indica*; to inspect them quantitatively. The radical scavenging activity of the plant extracts was compared to the available standard antioxidants, i.e., BHT and α-tocopherol.

Various extracts of *A. barbadensis* showed the maximum antioxidant activity. 100% v/v Petroleum ether extract of *A .barbadensis* showed the highest antioxidant value of 98.6±0.55d whereas 70% v/v methanol, 30% v/v distilled water, and 100% v/v distilled water extracts also showed maximum percentage scavenging value, i.e. 98.5±0.971d, 98.5±0.776b and 98.3±0.608a respectively. Thus, they can be compared with the standard antioxidants α- tocopherol and BHT and set as standards as their values were much closer to the standard ones. The 70% v/v Chloroform extract showed the lowest value, i.e., 44.4±1.205b.

In *Camellia sinensis* (green tea), 100% v/v Chloroform extract showed the maximum radical scavenging value, i.e. 98.3±0.754a while the 100% v/v Methanol extract has the minimum percentage scavenging value, i.e. 11.9±0.888e. All the radical scavenging values of different extracts of C. sinensis lie between 11.9±0.888e and 98±0.754a. 100% v/v Chloroform, 50% v/v Methanol and 100% v/v Distilled water extracts showed the great radical scavenging values i.e. 98.3±0.754a, 96.0±0.624g and 91.0±1.201a respectively that can be compared with the standards. These extracts can be set as a standard for antioxidant potential as their radical scavenging values were much nearer to the standard antioxidants taken.

In *C. nucifera*, 70% v/v Methanol extract showed the highest radical scavenging value, i.e. 94.8±1.201e. This value can be compared with the standard antioxidant and set as a standard for others. 100% v/v Methanol extract of C. nucifera had the lowest value, i.e., 34.2±0.709d. All other various extracts of *C. nucifera* showed values between 34.2±0.709d and 94.8±1.201e.

In *F. carica*, 30% v/v Petroleum ether extract showed the highest radical scavenging activity, with a value of 94.5±0.950d, whereas 100% v/v Methanol and 50% v/v showed the lowest value of 48.3±1.050b and 48.3±1.026c, respectively.

In R. indica, 30% v/v Petroleum ether extract had the maximum radical scavenging value, i.e. 98.5±1.001f, whereas 100% v/v Chloroform extract had the minimum value, i.e. 36.8±0.953a. All other extracts of R. indica had values between 36.8±0.953a and 98.5±1.001f. 100% v/v Petroleum ether and 100% v/v Distilled water extracts of R. indica also showed the values

i.e., 98.2±0.680d and 91.9±0.875a, respectively, which are close to the highest values and can be compared.

Total Phenolic Content (TPC) Assay

TPC Assay was performed based on results determined from the DPPH Assay with some selected extracts of petroleum ether, chloroform, methanol, and distilled water

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with variable concentrations. For this purpose, gallic acid was set as the standard, and from the generated curve, an equation was derived to quantify the phenolic contents in all samples.

This equation calculated phenolic contents as µg/gram of Gallic acid in all the samples.

The highest TPC value of A. barbadensis extracts is shown by the 100% v/v Petroleum ether extract, i.e., 637.7±6.3d, and 30% v/v Methanol extract showed the lowest TPC value, i.e., 32±1e.

The highest TPC value, 843.3±4.2e, among all the extracts of C. sinensis, is shown by the 100% v/v Petroleum ether extract, while the TPC value of the 70% v/v Methanol extract was the lowest at 43±10.8e. The TPC value of C. nucifera extracts is highest in the 70% v/v Methanol extract, 344.6±6.3d, and lowest in the 100% v/v Petroleum ether extract, with 15±5c.

In *F. carica*, 100% v/v, Distilled water extract showed the highest value of total phenolics, i.e., 436.3±12.7a. 70% v/v Chloroform extract of F. carica has the lowest phenolic contents, i.e. 25±1b. 30% v/v Chloroform extract of R. indica showed the greatest total phenolic value, i.e., 578.0±6.3d, while 70% v/v Distilled water extract of R. indica showed the lowest value, i.e., 19±2.3b.

Total Antioxidant Assay

The results obtained from the total phenolic Assay were further screened to analyze them quantitatively for the Total Antioxidant Assay, and consequently, some of the selected samples were run. The results of various plant extracts and the available standard antioxidants, i.e., a-tocopherol and BHT, have been compared.

In *A. barbadensis*, 30% v/v and 50% v/v of distilled water extracts showed the maximum antioxidant values, i.e., 0.240±0.0005b and 0.220±0.001g, respectively. These values are very close to the standard ones. Hence, these extracts of A. barbadensis can be used as standard antioxidants by others. In C. sinensis (green tea), 30% v/v Petroleum ether extract showed the highest antioxidant potential, having a value of 0.801±0.001g. Numerous extracts showed great antioxidant values, e.g., 50% v/v Methanol, 50% v/v Petroleum ether, 30% v/v Methanol, and 70% v/v Petroleum ether extracts showed the values 0.796±0.002f, 0.740±0.01g, 0.729±0.002f and 0.628±0.002f respectively. These antioxidant values are much closer to the standard antioxidants, i.e., a-tocopherol and BHT. Thus, these extracts can be set as standard antioxidants.

70% v/v Petroleum ether extract of C. nucifera has the highest antioxidant value, i.e., 0.211±0.002e among all the other extracts of *C. nucifera*.

In *F. carica*, 100% v/v Methanol extract showed the highest antioxidant value 0.520±0.01e. This value is very close to the standard antioxidant. The values of 50% v/v and 70% v/v methanol extract are 0.465±0.002g and 0.304±0.002g, respectively. These extracts can be set as standard. The highest antioxidant value among the various extracts of R. indica is 0.332±0.0015f of 70% v/v Methanol extract

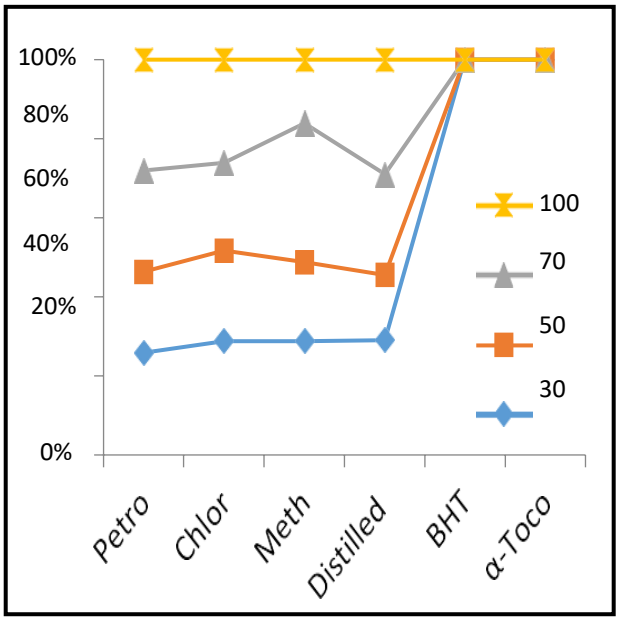

Fig. 1: Antioxidant Evaluation of Various Extracts at Different Conc. of *Aloe barbadensis* (Aloe vera) through DPPH Assay

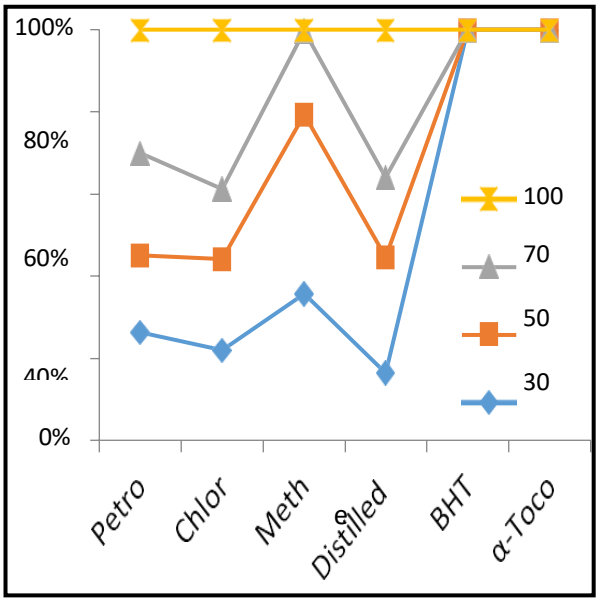

Fig. 2: Antioxidant Evaluation of Various Extracts at Different Conc. of *Camellia sinensis* (Green Tea) through DPPH Assay

[Citation: Urooj, F., Iftikhar, A., Mazhar, K., Altaf, R., Gondal, M., Rafaqat, A., Shabbir., N. (2024). Antioxidant assessment of some therapeutically important plants as anti-aging agents. *Biol. Clin. Sci. Res. J.*, **2024***: 969*. doi: https://doi.org/10.54112/bcsrj.v2024i1.969]

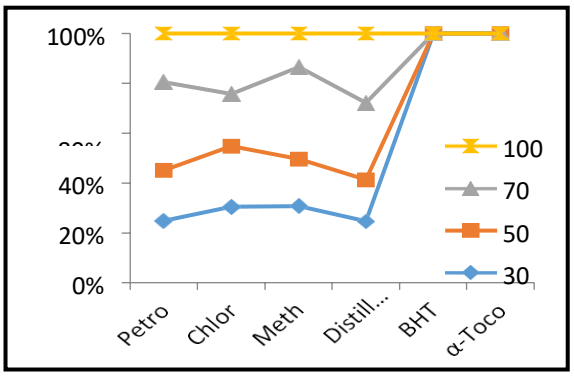

Fig. 3: Antioxidant Evaluation of Various Extracts at Different Conc. of *Cocos nucifera* (Coconut) through DPPH Assay

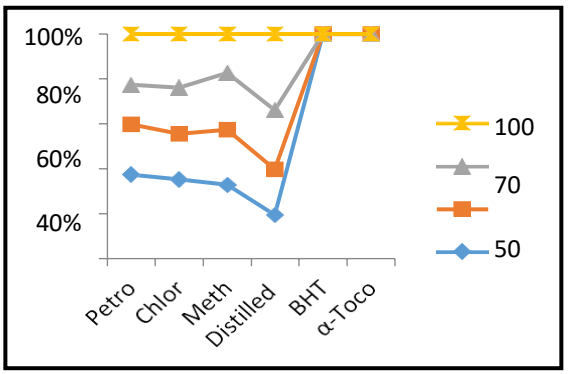

Fig. 4: Antioxidant Evaluation of Various Extracts at Different Conc. of *Ficus caria* (Fig) through DPPH Assay

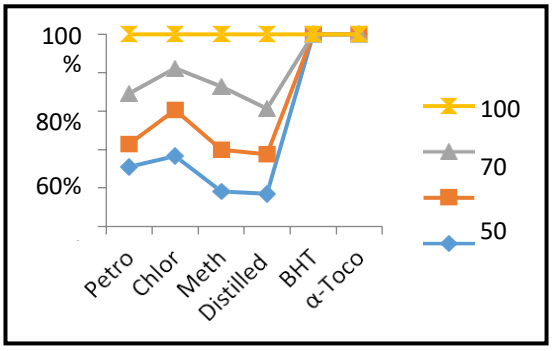

Fig. 5: Antioxidant Evaluation of Various Extracts at Different Conc. of *Rosa indica* (Rose) through DPPH Assay

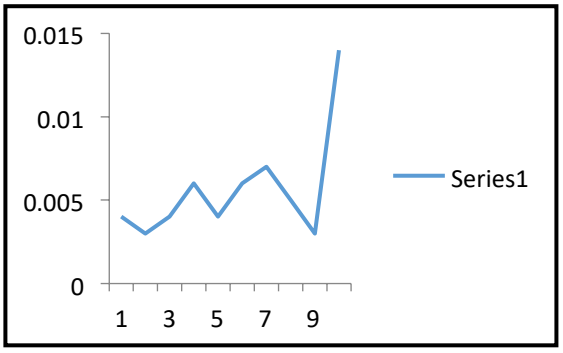

Fig. 6: Graph Showing the Curve of Gallic Acid

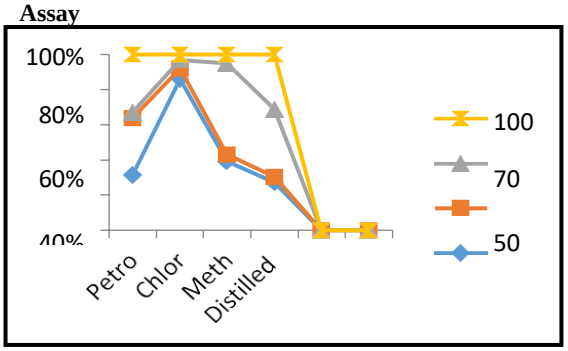

Fig. 7: Total Phenolic Contents Estimation of Various Extracts at Difference Conc. of *Aloe barbadensis* (Aloe vera) by TPC Assay

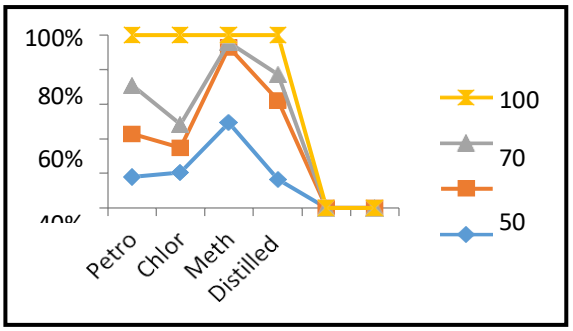

Fig. 8: Total Phenolic Contents Estimation of Various Extracts at Difference Conc. of *Camellia sinensis* (Green Tea) by TPC Assay

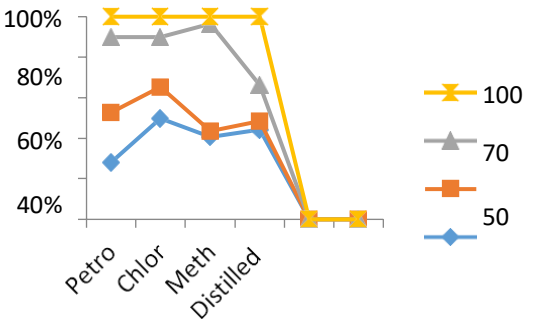

Fig. 9: Total Phenolic Contents Estimation of Various Extracts at Difference Conc. of *Cocos nucifera* (Coconut) by TPC Assay

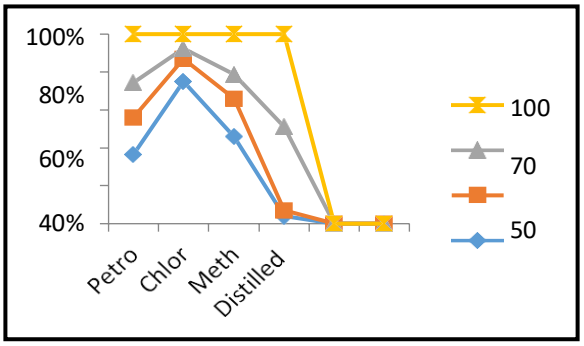

Fig. 10: Total Phenolic Contents Estimation of Various Extracts at Difference Conc. of *Ficus caria* (Fig) by TPC Assay

[Citation: Urooj, F., Iftikhar, A., Mazhar, K., Altaf, R., Gondal, M., Rafaqat, A., Shabbir., N. (2024). Antioxidant assessment of some therapeutically important plants as anti-aging agents. *Biol. Clin. Sci. Res. J.*, **2024***: 969*. doi: https://doi.org/10.54112/bcsrj.v2024i1.969]

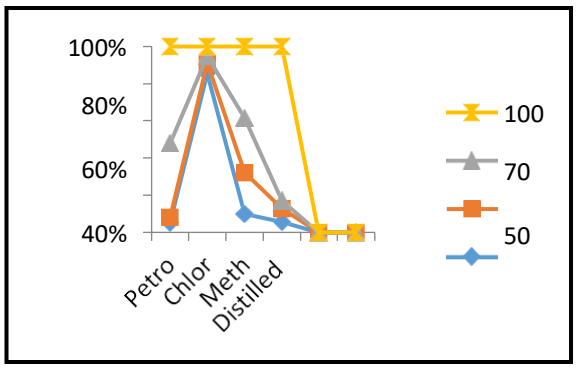

Fig. 11: Total Phenolic Contents Estimation of Various Extracts at Difference Conc. of *Rosaindica* (Rose) by TPC Assay

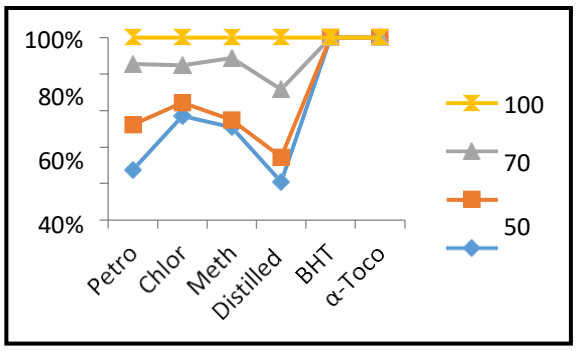

Fig. 12: Antioxidant Evaluation of Various Extracts at Different Conc. of *Aloe barbadensis* (Aloe vera) by Total Antioxidant Assay

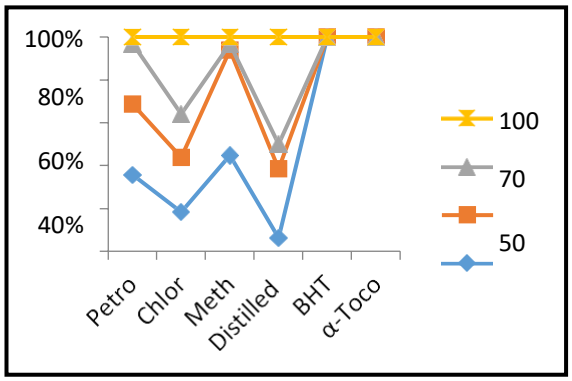

Fig. 13: Antioxidant Evaluation of Various Extracts at Different Conc. of *Camellia sinensis* (Green Tea) by Total Antioxidant Assay

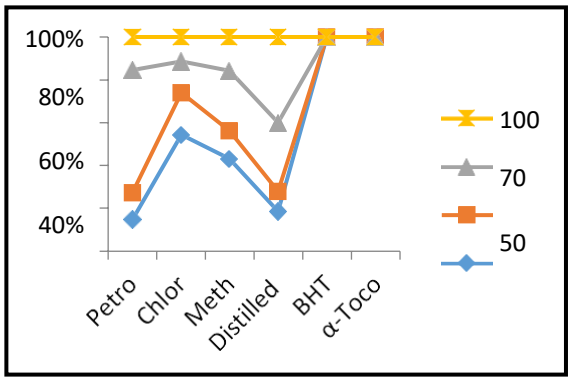

Fig. 14: Antioxidant Evaluation of Various Extracts at Different Conc. of *Cocos nucifera*(Coconut) by Total Antioxidant Assay

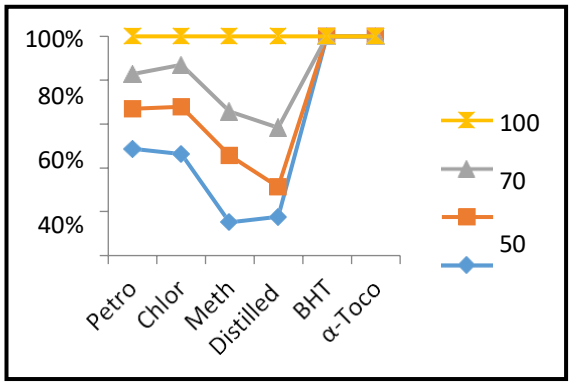

Fig. 15: Antioxidant Evaluation of Various Extracts at Different Conc. of *Ficus caria* (Fig) by Total Antioxidant Assay

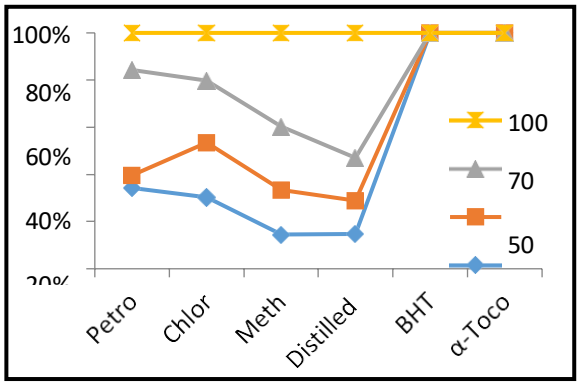

Fig. 16: Antioxidant Evaluation of Various Extracts at Different Conc. of *Rosa indica* (Rose) by Total Antioxidant Assay

Discussion

Antioxidants are helpful as they protect living organisms from the damage caused by reactive oxygen species. Many skin, inflammatory, and chronic diseases also arise due to oxidative stress. Antioxidants are also helpful in increasing the shelf life of many food and cosmetic products (11). Antioxidants also play an essential role in aging (12). This need for antioxidants can be fulfilled by artificial synthetic antioxidants such as butylated hydroxytoluene (BHT), butylated hydroxyanisole (BHA), and tertiary butylhydroquinone (TBHQ) (13). However, these synthetic chemicals used by different industries contain toxic compounds and are carcinogenic. Thus, natural antioxidants are preferred in the food and cosmetic industry as they do not have any side effects and are not toxic.

The DPPH Assay, along with Ferric Thio Cyanate (FTC) and linoleic acid system method, was performed on the ethanol extracts of Aloe barbadensis. (13, 22, 23) Ethanolic extracts of *Aloe barbadensis* showed significant antioxidant

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activity, and the results were compared with BHT and α-tocopherol, which are standard antioxidants. The wide domain of antioxidants will be analyzed if solvents with a polarity range have been used as both standards taken and ethanol extracts are non-polar. In the present study, the antioxidant activity of *A. barbadensis* in different solvents with a range of polarity is evaluated and compared with the standard antioxidants. 100% v/v petroleum ether, 70% v/v methanol, 30% and 100% v/v distilled water showed the results of 98.6±0.55d, 98.5±0.971d, 98.5±0.77b and 98.3±0.608a respectively by DPPH Assay. Thus, on the basis of present results and the results of (13, 22), it is observed that *A. barbadensis* extracts provided higher or equivalent antioxidant activity as compared to BHT and α-tocopherol. Thus, A. barbadensis can be used as a natural antioxidant in food, medicine, and cosmetics.

The antioxidant capacity of methanolic and aqueous extracts of *Camellia sinensis* by DPPH, FRAP, FIC, and Total Phenolic Assay was evaluated (14, 24, 25). Methanolic extracts have eminent antioxidant activity. The results include only the polar fraction of the solvent.

Examination of the scavenging ability of distilled water and 70% ethanol extracts with chloroform, ethyl acetate, and n-butanol of *Camellia sinensis* has been done by DPPH Assay (15). Ethanol extracts have shown higher phenol content. The results are more genuine as solvents having a range of polarity are used to investigate the antioxidant potential

In the current study, a range of solvents, i.e., petroleum ether, chloroform, methanol, and distilled water at various concentrations, are used to evaluate the antioxidant capacity of *Camellia sinensis* by DPPH, TPC, and Total Antioxidant Assay. 100% v/v Chloroform, 50% v/v Methanol, and 100% Distilled water extracts showed higher radical scavenging values, i.e., 98.3±0.754a, 96.0±0.624g, and 91.0±1.201a respectively. Maximum phenolic contents lie in the 100% Petroleum ether extract, having a value of 843.3±4.2e. These values resemble, to a great extent, the standard antioxidants taken. Thus, C. sinensis can be used to control the diseases caused by oxidative stress. These polyphenols present in the *C. sinensis* are the anti-aging agents (16)

Free radical scavenging properties of aqueous extracts of *Cocos nucifera* were revealed by the in vitro experiments using the DPPH Assay and the HPLC technique (17, 26). This technique is beneficial to identify different phytochemicals. In the present study, 70% v/v Methanol extract has the highest antioxidant capacity among polar and non-polar extracts of C. nucifera by DPPH Assay, having a value of 94.8 (27, 28)
±1.201e. This radical scavenging value of *C. nucifera is* very near to the BHT and α- tocopherol, taken as standard.

An investigation of the in vitro antioxidant activity of the screened methanolic extracts of Ficus carica was conducted using a DPPH Assay (18). Purification of these extracts requires the thin layer chromatography. This technique provides a better approach to the studies as components present in the extract that are responsible for the antioxidant activity are isolated. In the present study, various solvents with a wide range of polarity are used for extraction to explore the range of bio-constituents accountable for the antioxidant activity. Among all the extracts of *F. carica* in different solvents, 30% v/v Petroleum ether extract has the highest radical scavenging activity, having a value of 94.5±0.950d. A comparison of the antioxidant potential of 30% v/v Petroleum ether extract with the standard antioxidants BHT and α-tocopherol shows that this extract can replace synthetic artificial
antioxidants. *F. carica* can be used in cosmetics, food, and medicine as a natural antioxidant and is helpful in protecting the skin from inflammatory diseases.

The antioxidant activity of 80% ethanol extracts of *Azadirachta indica* has been evaluated through DPPH and Total Antioxidant Assay. (19, 20, 21) The root bark extract of A. indica possesses strong antioxidant potential. The Phospho-molybdenum Assay further affirmed the results. In the current study, polarity solvents are used to investigate the bioavailability responsible for the antioxidant capacity of Rosa indica (29, 30). 30% v/v Petroleum ether extract of R. indica showed the maximum radical scavenging activity of 98.5±1.001f. The antioxidant values by DPPH Assay of 100% v/v Petroleum ether and 100% v/v Distilled water, i.e., 98.2±0.680d and 91.9±0.875a, respectively, are closely comparable to the standard antioxidants. 70% v/v Methanol extract contained maximum antioxidant capacity, i.e., 0.332±0.0015f calculated by the Total Antioxidant Assay. The results showed that both polar and non-polar extracts of *R. indica* have the maximum antioxidant potential.

Conclusion

The present study infers that these plant extracts mentioned above have shown remarkable antioxidant activity and were comparable to the standard antioxidants selected. Hence, they can easily fulfill the need for natural antioxidants in cosmetics and other industries in the near future.

Declarations

Data Availability statement
All data generated or analyzed during the study are included in the manuscript.
Ethics approval and consent to participate.
Approved by the department concerned.
Consent for publication
Approved
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Conflict of interest

The authors declared an absence of conflict of interest.

Authors Contribution

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References

1. Chikenji T, Elwyn DH, Kinney JM. Protein synthesis rates in rat muscle and skin based on lysyl-tRNA radioactivity. Journal of Surgical Research. 1983;34(1):68-82.
2. Chanda S, Baravalia Y. Screening of some plant extracts against some skin diseases caused by oxidative stress and microorganisms. African Journal of Biotechnology. 2010;9(21):3210-7.
3. Akash MSH, Haq MEu, Qader A, Rehman K. Biochemical investigation of human exposure to aflatoxin M1 and its association with risk factors of diabetes mellitus. Environmental Science and Pollution Research. 2021;28(44):62907-18.
4. Barankin B, DeKoven J. Psychosocial effect of common skin diseases. Canadian Family Physician. 2002;48(4):712-6.
5. Joel JJ, Neethu Jose NJ, Shastry C. Patterns of skin disease and prescribing trends in rural India. 2013.
6. Bickers DR, Athar M. Oxidative stress in the pathogenesis of skin disease. Journal of investigative dermatology. 2006;126(12):2565-75.
7. Priya R, Kumar U, Saran A, Kumari R, Kishore C. Brief Communication Oxidative stress in psoriasis. Biomedical Research. 2013;25(1):132-4.
8. Crinnion WJ. Toxic effects of the easily avoidable phthalates and parabens. Alternative Medicine Review. 2010;15(3).
9. Tabassum N, Hamdani M. Plants used to treat skin diseases. Pharmacognosy reviews. 2014;8(15):52.
10. Kumar SM, Chandrasekar M, Nanjan M, Suresh B. Herbal remedies for acne. 2005.
11. Qader A, Rehman K, Akash MSH. Biochemical profiling of lead-intoxicated impaired lipid metabolism and its amelioration using plant-based bioactive compound. Environmental Science and Pollution Research. 2022;29(40):60414-25.
12. Tariq A, Reyaz A. Antioxidant activity of Camellia sinensis leaves. 2013.
13. Hu Y, Xu J, Hu Q. Evaluation of antioxidant potential of Aloe vera (Aloe barbadensis Miller) extracts. Journal of agricultural and food chemistry. 2003;51(26):7788-91.
14. Qader A, Rehman K, Akash MSH. Genetic susceptibility of δ-ALAD associated with lead (Pb) intoxication: sources of exposure, preventive measures, and treatment interventions. Environmental Science and Pollution Research. 2021;28:44818-32.
15. Yang Z, Xu Y, Jie G, He P, Tu Y. Study on the antioxidant activity of tea flowers (Camellia sinensis). Asia Pacific journal of clinical nutrition. 2007;16.
16. Mendhekar SY, Dangat SD, Phalke PK, Jadhav S, Gaikwad D. Development and evaluation of cream contain green tea extract, aloe gel and vitamin E: As skin toner. Indo American Journal of Pharmaceutical Sciences. 2017;4(12):4265-71.
17. Alviano DS, Rodrigues KF, Leitão SG, Rodrigues ML, Matheus ME, Fernandes PcD, et al. Antinociceptive and free radical scavenging activities of Cocos nucifera L.(Palmae) husk fiber aqueous extract. Journal of Ethnopharmacology. 2004;92(2-3):269-73.
18. Javed Ahmad JA, Iffat Khan IK, Salman Khan SK, Danish Iqbal DI. Evaluation of antioxidant and antimicrobial activity of Ficus carica leaves: an in vitro approach. 2013.
19. Afnan, Qader A, Haris M. Phytochemical-induced thyroid hormones disruption. 2023.
20. Hayat, A. Q., & Akash, M. S. H. (2020). Effect of Novel COVID-19 Infection on Different Organs of Human Body: A Narrative Review. *Journal of Islamabad Medical & Dental College*, *9*(4), 303-306.
21. Batool, J. A., Rehman, K., Qader, A., & Akash, M. S. (2022). Biomedical applications of carbohydrate-based polyurethane: from biosynthesis to degradation. *Current Pharmaceutical Design*, *28*(20), 1669-1687.
22. Akash, M. S. H., Qader, A., & Rehman, K. (2022). Insulin resistance susceptibility is associated with BPA exposure. *Metabolism-Clinical and Experimental*, *128*.
23. Rafique, S., Sattar, F., Qader, A., Davis, M., Khan, M. U. I., Haris, M., & Tariq, H. (2023). Gel Formulation and an In-vitro Kinetic Permeation Release Study of Cefixime Trihydrate and Chlorpheniramine Maleate (CCM): Cefixime Trihydrate and Chlorpheniramine Maleate (CCM). *Pakistan Journal of Health Sciences*, 109-114.
24. Tariq, H., Habib, A., Qader, A., Shafi, A., Rafique, S., Afzal, Z., ... & Rehman, Q. (2023). A Mechanistic Approach Elaborating the Association of Heavy Metals-Induced Oxidative Stress with Insulin Resistance Susceptibility: A Mechanistic Approach Elaborating the Association of Heavy Metals-Induced Oxidative Stress with Insulin Resistance Susceptibility. *Journal of Survey in Fisheries Sciences*, 16357-16362.
25. Shabbir, I., Qader, A., Ahmad, Z., Tariq, H., Davis, M., Rafique, S., & Zia, A. (2023). Monkeypox Virus a Rising Concern in Current age: A Mini Review on Epidemiology, Clinical Manifestations and Therapeutic interventions. *The Journal of Medical Research*, *9*(3), 58-62.
26. Qader, A. (2024). LEAD INTOXICATION AND ITS SOURCES OF EXPOSURE: A PERSPECTIVE STUDY. *Health Notions*, *8*(1), 22.
27. Rehman, K., Qader, A., ul Haq, M. E., & Akash, M. S. H. (2022). Long-term exposure of Bisphenol A impairs metabolism and develop insulin resistance. *Metabolism-Clinical and Experimental*, *128*.
28. Hayat, A. Q. (2020). Impact of Thyroid Hormones Disrupting Potential of Environmental Polychlorinated Biphenyls and Heavy Metals on Brain Functions: A Review Article. *Life Science Journal of Pakistan*, *2*(1), 20-28.
29. Qader, A. (2023). A literature Study on Association of Environmental Toxic Compounds with Thyroid Disruption. *The Journal of Medical Research*, *9*(4), 80-83.
30. Qader, A., Batool, Z., & Tariq, H. (2023). Induction of Thyroid Hormones Disruption by Exposure of Dioxins and Phthalates: A Comprehensive Review. *The Journal of Medical Research*, *9*(3), 72-75.

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