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Aloe Vera for Protects Skin Tissues from The Damaging Impacts of Ultraviolet Radiation

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Abstract: ***When Overexposure to sun UV radiation leads to skin damage and increases the risk of skin cancer; thus, it is a factor in aging, which accelerate skin aging and increases the risk of skin cancer. To determine the Photoprotective potential was evaluated by biomechanical measurements of tissue and histopathological examination of the skin. Showed The skin group irradiated with exposed for 4 h to UV (UV lamps, wavelength 365 nm, power 6 W) without Aloe vera showed significant biomechanical measurements of tissues and histopathological change and showed skin necrosis of dermal collagen. The Treatment with Aloe vera protected skin tissues against UV exposure for 4 h to UV light (UV lamps, wavelength 365 nm, power 6 W damage by biomechanical measurements of tissues restoring histopathological changes. The extracted Aloe vera is shown.***

Keywords: 'Ultraviolet radiation, Skin damage, Aloe vera, Histopathological, Stress, Strain'.

I. INTRODUCTION

Exposure of human skins to ultraviolet (UV) radiation is increasing because of depletion of the stratospheric ozone layer. Chronic exposure to UV may cause sunburn, skin cancer, oxidative stress as well as photoaging [1-4]. Studies have shown that Aloe vera is suitable for burns caused by radiation or by sunlight. This is for its calming and cooling effect. In some studies, confirm that its beneficial effect is by using it at a rate of 100%. The Aloe vera contains polysaccharides, mannose-6-phosphate, and complex anthraquinones. In addition to enzymes, salicylic acid, minerals, lignin, saponins, sterols, and vitamins [5]. Aloe vera are a cactus-like plant that grows in hot, dry climates. It is cultivated in subtropical regions around the world, including the southern border areas of Texas, New Mexico, Arizona, and California. In silico studies have shown that anthraquinones including chrysophanol, aloe emodin, aloeresin, aloin A & B, 7-O-methylaloeresin, 9-dihydroxyl-2-O-(z)-cinnamoyl-7-methoxy-aloesin, and isoaloeresin are potential SARS-CoV-2 3CLpro protease inhibitors [6].

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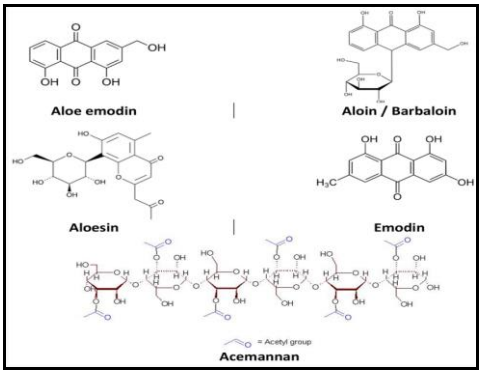

Figure 1: Chemical structure of compounds isolated from *Aloe vera* with pharmacological activity

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II. PROCEDURE FOR PAPER SUBMISSION

1- Aloe vera preparation: -

Aloe vera was collected from a herbal garden from Egypt and chemicals were used in this research procured from Sigma-Aldrich (Germany). Methanol was used to extract the Aloe vera. Aloe vera extraction was done [7].

2-Animal grouping: -

Forty male Swiss albino mice weighting 8-12 (gm) obtained from National Research Centre, Dokki, Giza, Egypt. Swiss albino mice were maintained at a temperature of 22–25 °C with a 12-hours light/dark cycle and were allowed free access to water and standard pelleted diet ad libitum in the Animal House of Zoology Department, Faculty of Science, Cairo University, Egypt. Skin hairs have been removed with shuffling. Skin was cut into parts of about (3 x 3 cm) and divided into 4 groups each group has 10 number of animals [8].

Table (1): The experimental design

Groups	Number of Animals	Treatment
Gp1	10	Control (non Exposed).
Gp2	10	Exposed for 4 hours to UV (UV lamps, wavelength 365 nm, power 6 W).
Gp3	10	Treated with Aloe vera (20 mg).
Gp4	10	Exposed for 4 hours to UV (UV lamps, wavelength 365 nm, power 6 W) and treated with Aloe vera (20 mg).

3-UV radiation:

The dorsal skin of Swiss albino mice was exposed to UV irradiation in three treatment group using UV lamp - wavelength 365 nm, power 6 W) instrument (Zorbig, German) for three days.

4-Biomechanical Measurement: -

Biomechanical property measurements of biomaterials such as tissue are ascertained by performing carefully designed laboratory instruments that replicate the service conditions as closely as possible. Many factors should be considered during the test, such as the nature of the biomaterial, type of applied stress and its duration, and the environmental conditions. The main role of this instrumental structure was to determine the stress-strain behavior curves of the tissue specimens and their load-unload hysteresis loops. The system consists of an electronic digital input circuit connected to a rotating capacitor that is coaxial with a frictionless wheel. A special rope with negligible expansion was wrapped around the wheel with two free ends; one end was connected to the pan of the loads and the other end was fastened to the tissue specimen which was clamped to a fixed point **[**9**].**

5-Stress-Strain Behavior: -

Each bone specimen diameter was measured at three levels using a Vernier caliper (mm± 0.01mm) and the average diameter was calculated **[**10**]-**The mass of the loads (in kg) is multiplied by the acceleration due to gravity 9.80m/s^2 to obtain the axial applied force. The axial stress was calculated by dividing the axial force by the cross-sectional area $(A = \pi r^2)$ of the bone specimen as given by the following equation.

Tensile Stress (σ) =Force /area (N/m^2) (1)

The tensile force was applied by uploading the loads on the pan and calculating its stress value. This applied stress led to the extension of the bone specimen length, and owing to this extension, the wheel rotated and changed the effective area of the capacitor, and in turn, the frequency was also changed. The longitudinal strain can be obtained by calculating the axial changes in the bone specimen length in terms of frequency and by dividing this value by the original length in terms of frequency. It is produced by the tensile stress and is given by equation: -

Longitudinal Strain (€) = Change in length/original length € = $\Delta L/L_0$ (2)

The stress-strain behavior for each tissue sample is performed by applying tensile stress on tissue specimen till the breaking point and measure the strain then plotting the stress values on y-axis and its corresponding strain values on the x-axis

6-Histopathological study: -

After the animals were sacrificed, their skin was collected, and fixed in 10% neutral buffered formalin. Later, the tissues were embedded in paraffin, divided by microtone and stained with hematoxylin and eosin (H&E) [11,12]. The tissues were observed under a light microscope (BX50, Olympus microscope, Tokyo, Japan).

7-Statistical Analysis: -

Microsoft Excel was used for data analysis, and a P value of 0.05 or was considered (*P < 0.05, **P < 0.01, ***P < 0.001) for all statistical tests (Student's t-test).

III. RESULTS

1-Effects of UV lamps, wavelength 365 nm, power 6 W, Aloe vera and their Mixed on the average value of break points of tissue for each group: -

Long term exposure to UV radiation is harmful to the skin. Recently, natural extracts have been approved as sunscreens owing toas their low toxicity to skin [13].(Table 1) and (Figure 2) show the effects of (Gp1) Control Group (No UV), (Gp2) exposed for 4 h to UV (UV lamps, wavelength 365 nm, power 6 W), (Gp3) treated with Aloe vera (20 mg),and (Gp4) their mixed (exposed for 4 hours to UV light (UV lamps, wavelength 365 nm, power 6 W) and treated with Aloe vera (20 mg) on the average value of break points of tissue for all animals of groups and listed in (Table 2). The average value of break points of tissue for all animals from groups was calculated from the measured values and found to be Tensile Stress/10^5 (N/m^2) (F/A) (1.88±0.088 N/m^2), (1.07±0.09 N/m^2), (0.80±0.01 N/m^2), and (1.90±0.08 N/m^2), group (Gp1, Gp2, Gp3 - Gp4) respectively. The average value of the break points of tissues for all animals from groups was calculated from the measured values and found to be Axial Strain x10^3 (2.77±0.2), (1.59±0.09), (0.99±0.07), and (1.87±0.06), group (Gp1, Gp2, Gp3 - Gp4) respectively. The average value of break points of tissues for all animals from groups was calculated from the measured values and found to be average area enclosed load unload (J/m^3) (0.17±0.01 J/m^3), (1.30±0.02 J/m^3), (1.34±0.02 J/m^3), and (1.56±0.07 J/m^3), group (Gp1, Gp2, Gp3&Gp4) respectively. (Table 1) shows a significant decrease in the average value of Tensile Stress/10^5 (N/m^2) (F/A) ($p<0.05$) in mice exposed to (Gp2) Exposed for 4 h to UV (UV lamps, wavelength 365 nm, power 6 W), (Gp3) treated with Aloe vera and (Gp4) their mixed (Exposed for 4 h to UV (UV lamps, wavelength 365 nm, power 6 W) and treated with Aloe vera (20 mg).) compared to the control group. (Table 1) shows a significant decrease in Axial Strain x10^3 ($p<0.05$) in mice exposed to (Gp2) Exposed for 4 h to UV light (UV lamps, wavelength 365 nm, power 6 W), (Gp3) treated with Aloe vera (20 mg) and (Gp4) their mixed (Exposed for 4 h to UV (UV lamps, wavelength 365 nm, power 6 W) and treated with Aloe vera (20 mg)) compared to the control group. (Table 1) shows a significant decrease in.

Average area enclosed load unload (J/m^3) ($p<0.05$) in rats exposed to (Gp2) exposed for 4 h to UV light (UV lamps, wavelength 365 nm, power 6 W), G(Gp3) Treated with Aloe vera (20 mg) and (Gp4) mixed (Exposed for 4 hours to UV light (UV lamps, wavelength 365 nm, power 6 W) and treated with Aloe vera (20 mg)) compared to the control group.

Table (2): Average break point values, average area enclosed load unload (J/m^3) for each group

Groups	Tensile Stress (F/A) (N/m^2)	Strain	Average area enclosed load unload (J/m^3)
	Average	Average	
Gp1	1.88±0.088	2.77±0.2	0.17±0.01
Gp2	1.07±0.09	1.59±0.09	1.30±0.02
Gp3	0.80±0.01	0.99±0.07	1.34±0.02
Gp4	1.90±0.08	1.87±0.06	1.56±0.07

Data are presented as mean ± SEM, n = 10/group. * and # indicate significant changes from control and all groups respectively at $P \leq 0.05$ using ANOVA followed by Tukey-Kramer as a post ANOVA test.

IV. HISTOPATHOLOGICAL EXAMINATION

(Figure 3) shows the histopathological examinations of skin tissues, (Fig.2-a) shows normal dermal and epidermal layers in control samples. (Fig.2 b) (exposed for 4 h to UV light (UV lamps, wavelength 365 nm, power 6 W), showed focal hyperplasia with hypertrophy of the epidermal cells and necrosis of the dermal collagen. (Fig.2 c) treated with Aloe vera, shows normal dermal and epidermal layers in this group. (Fig.2 d) (exposed for 4 h to UV light (UV lamps, wavelength 365 nm, power 6 W) and treated with Aloe vera, increase in collagen fibers and hypertrophy of the epidermal cell layer.

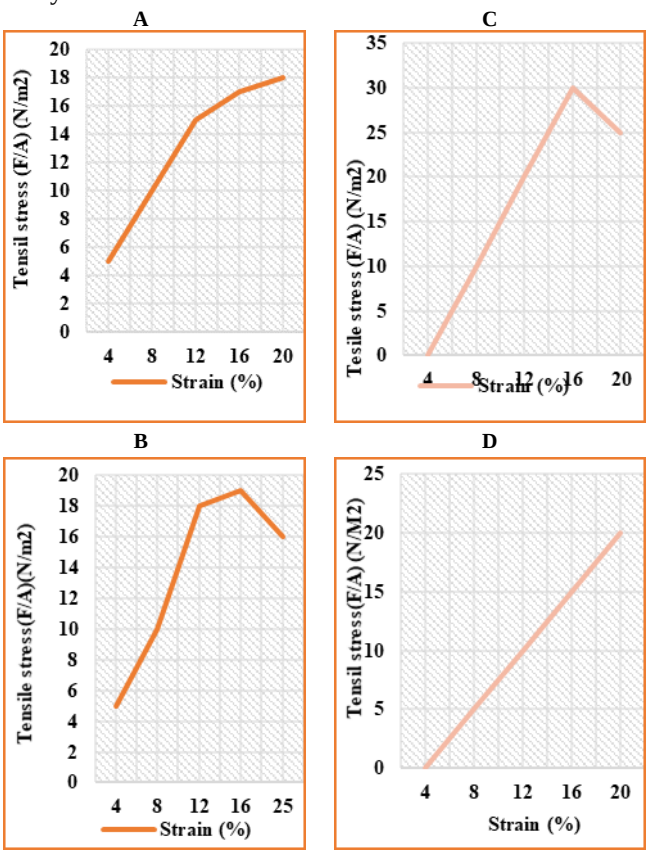

Figure 2: Mechanical testing the effects of (Gp1) Control Group (No UV), (Gp2) Exposed for 4 hours to UV light (UV lamps, wavelength 365 nm, power 6 W), (Gp3) treated with Aloe vera (20 mg), and (Gp4) their mixed (exposed for 4 hours to UV light (UV lamps, wavelength 365 nm, power 6 W) and treated with Aloe vera (20 mg) on the average value of break points of tissue for all animals of groups.

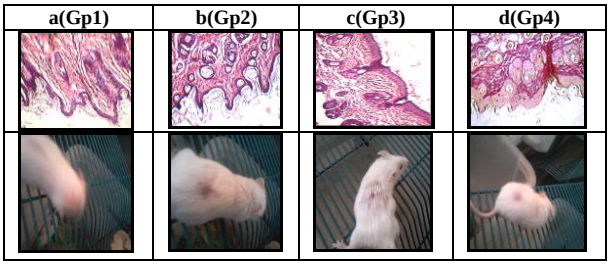

Figure 3. Histopathological examination of H&E stained skin tissue sections (a) Gp1 control Normal epithelium and subepithelial collagen (H.& E. stain, X 100 ,(b) Gp2 (exposed for 4 hours to UV light (UV lamps, wavelength 365 nm, power 6 W), (c) Gp3 (Treated with Aloe vera (20 mg), (d) Gp4 (exposed for 4 hours to UV (UV lamps, wavelength 365 nm, power 6 W) and treated with Aloe vera (20 mg) increase in collagen fibers (H. & E. , with a magnification ×100

V. DISCUSSION

Historically, aloe has been used to treat skin conditions and thought to improve baldness and promote wound healing. Some studies have shown that Aloe vera can protect the skin from UV exposure by scavenging free radical [14-15]. The results of mechanical testing show the relationship between the tensile stress (Force/Area) (Newton/m^2) and strain (change in the elongation /Original) (unitless). In our data concerning any changes in the mechanical properties and mechanical measurements of the tissues after exposure of mice to exposed for 4 h to UV light (UV lamps, wavelength 365 nm, power 6 W) and treated with Aloe vera (20 mg), based on their interactions with biological systems. This may be due to the interaction of exposed for 4 h to UV light (UV lamps, wavelength 365 nm, power 6 W) and treatment with Aloe vera (20 mg). Histamine is produced and released by mast cells and keratinocytes in the dermis. Increased histamine release that caused by UVB exposure has been previously reported. [16]. Aloe vera has found significant popularity in dermatology, for a wide range of reasons, including hydration, UV exposure, burns, and aging. The application of aloe gel appeared to shorten the duration of wound healing for first- and second-degree burns. Aloe gel may also promote wound healing.

The antioxidative properties of Aloe vera are known to combat the oxidizing biomolecules and free radicals that harm the skin from radiation damage. It further induces fibroblasts to produce extracellular matrix, such as collagen and elastin, and hence is a commonly used additive in anti-aging creams. Aloe vera components, such as amino acids and zinc, have cohesive effects on epidermal cells, thereby inducing softening [17].

Aloe extract cream might reduce redness, scaling, itching and inflammation caused by mild to moderate psoriasis. You may need to use the cream several times a day for a month or more to see improvements in your skin.[18]

Additionally, Aloe vera has a significant impact on modulating keratinocytes [19] and the cytokine milieu of tissues and has been applied in wound healing[20-21]. Aloe gel is generally considered safe when appropriately applied to the skin. It might be safe to administer appropriate doses orally for a short time.[22]This has inspired the design of several biomaterials for burn and wound healing to incorporate Aloe vera as a strategy [23-24].

VI. CONCLUSION

The results showed, highly significant and Aloe vera to induce inflammation in mice skin. From the current study, it can be concluded that benefits of Aloe vera can be effective for photoprotection and can be used as an alternative of the chemical sunscreen agent in a way decreasing the side effects.

DECLARATION

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Conflicts of Interest/ Competing Interests	No conflicts of interest to the best of our knowledge
Ethical Approval and Consent to Participate	No, the article does not require ethical approval and consent to participate with evidence
Availability of Data and Material/ Data Access Statement	Not relevant
Authors Contributions	All authors have equal participation in this article.

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