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Original Research Article

Evaluation of the Therapeutic Role of Using the Oil Extract of the Leaves and Stems of the Astragalus Spinosus Plant on Wound Healing in Adult Female Albino Mice

Wurood M. Mutar[1*]

[1]Department of Biology, College of Science, University of Tikrit, Iraq

***Corresponding Author:** Wurood M. Mutar
Department of Biology, College of Science, University of Tikrit, Iraq

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Abstract: Skin wounds are a major disaster in health care due to the more number of traumas and pathological conditions. Natural wound healing involves a well- organized operation, consist of a chain of proceedings like hemostasis, inflammation, proliferation, and extracellular matrix remodeling. Five groups of adult female albino mice were used, and the dorsal region was clipped to a length (1 cm) after hair removal by shaving. She was treated with an ointment extracted from the oil extract of the leaves and stems of the astragalus plant at a concentration of (5% - 10%) for 14 days. The groups were treated for 7 days and half of them were dissected, then the rest of the groups were dissected after 14 days with continued treatment twice daily. The most notable results were wound healing and the return of skin tissue to its normal state, especially in the groups treated with the highest concentration of tree leaf oil extract ointment. The results showed that the skin tissues underwent cellular repair, the cell layers appeared in their natural shape, the keratin threads appeared in the form of ribbons and did not peel, and the dermis also contained fibers. Colloids, sebaceous glands and hair follicles.

Keywords: *Astragalus Spinosus* Plant, Stems, Leaves, Oil Extract, Wound Healing.

INTRODUCTION

The skin is an external organ that coating the body and provides many vital functions, included protecting organs, assimilation through the skin, maintaining body shape, maintaining fluids, temperature control, and sensory control (Malik *et al*., 2019; Roux *et al*., 2021). Therefore, a wound is a disruption of the cellular, anatomical, and functional integrity of living tissue due to chemical, physical, electrical, or microbial blusters to the tissue (Weick, 2016). Wound healing is known as a complex operation that occurs by regenerating or rebuilding destroyed tissue (Celina *et al*., 2019).

An injury triggers a set of coordinated actions that normally result in wound healing. The healing cascade starts when platelets bring into communicate with collagen. This causes platelet aggregation and the release of clotting factors, which eventually results in the creation of a fibrin clot at the location of the lesion. The fibrin clot acts as a interim factor that determines the efficacy that accompanies healing (De Luca *et al*., 2021). Inflammatory cells and platelets provide essential allusions recognized as cytokines or growth factors. Fibroblast cells in connective tissue also reach the site of injury, which are responsible for the deposition of collagen necessary to repair tissue destroy. Collagen provides force and structural integrity in natural tissue. Collagen is necessary to remedy the trouble and restore anatomic structure and function when tissue is damaged after injury. If healing does not progress gradually in the usual way, it may occur. This leads to chronic development of wounds. Patents and reported essay indicate that assorted herbal forming assist in accelerating the wound healing process and are beneficial in their handling (Kisiel and Klar 2019; Chen *et al*., 2022).

Medicinal plants are the ancient forms of health care known to people. Medicinal plants have been utilized by all cultures during history. Plants are a valuable origin of a broad ambit of secondary metabolites, which are utilized as medicines, agrochemicals, flavours, perfumes, colours, biocides and food additives. In the beginning 19th century, several

ticklish components were isolated and introduced into medical pursuit (Kus and Kuis, 2020). Plants are also used to treat wounds and burns by numerous traditional practitioners around the universe. ointments removed from medicinal plants have been utilized as therapeutic factors due to the diversity of their assort ingredient, such as alkaloids, essential oils, flavonoids, tannins, terpenoids, saponins, fatty acids and phenolic ingredient, all of which are able to promote the healing of the burn process (Bahramsoltani *et al.*, 2014). The entity of bioactive components in plants has prompted researchers to screen medicinal plants to identify potential wound healing activities and insulate chemical compounds correlated with wound healing (Kumar *et al.*, 2007). Astragalus spinosus belongs to the Fabaceae family and due to its active ingredient composition, it is traditionally utilized to treat different diseases. In addition, many astragalus-based nutritional supplements have been sold to support the immune system and cardiovascular system (EL-Demerdash, 2022). Astragalus spinosus contains flavones, flavonols, flavanones, flavanonols, chalcones, uronates, isoflavones, isoflavanes, and pterocarbanes (Ibrahim *et al.*, 2013). As well as kaempferol, amino acids, chloroquine, fumaric acid, saponins, sugars, and cinnamic acid (Peng *et al.*, 2022). Abd Elkader *et al.*, (2021) found that Astragalus spinosus exerts neuroprotective effects and that synthesis of this plant can be used as therapeutic strategies versus neuropsychiatric symptoms.

As the skin is the first line of defense between the human body and the outside world, it is vulnerable to damage resulting from the external environment. The major goal of this expirment is to evaluate the ability of wound healing using the ointment produced from the stems and leaves of the Astragalus spinosus plant, because there is a possibility of obtaining the plants by patients.

MATERIAL AND METHODS

Plant Collection

Astragalus spinosus plant was collected from the nursery area in the Abbasiya district of Saladin Governorate / Iraq, and the area was identified using the global positioning system and the Arc Gis 10.8.2 program, as shown in (Figure 1). It is considered a wild plant, as shown in (Figure 2), by taking the aerial parts of the plant, inclusive the stems and leaves, at the beginning of January and until the end of February 2023.

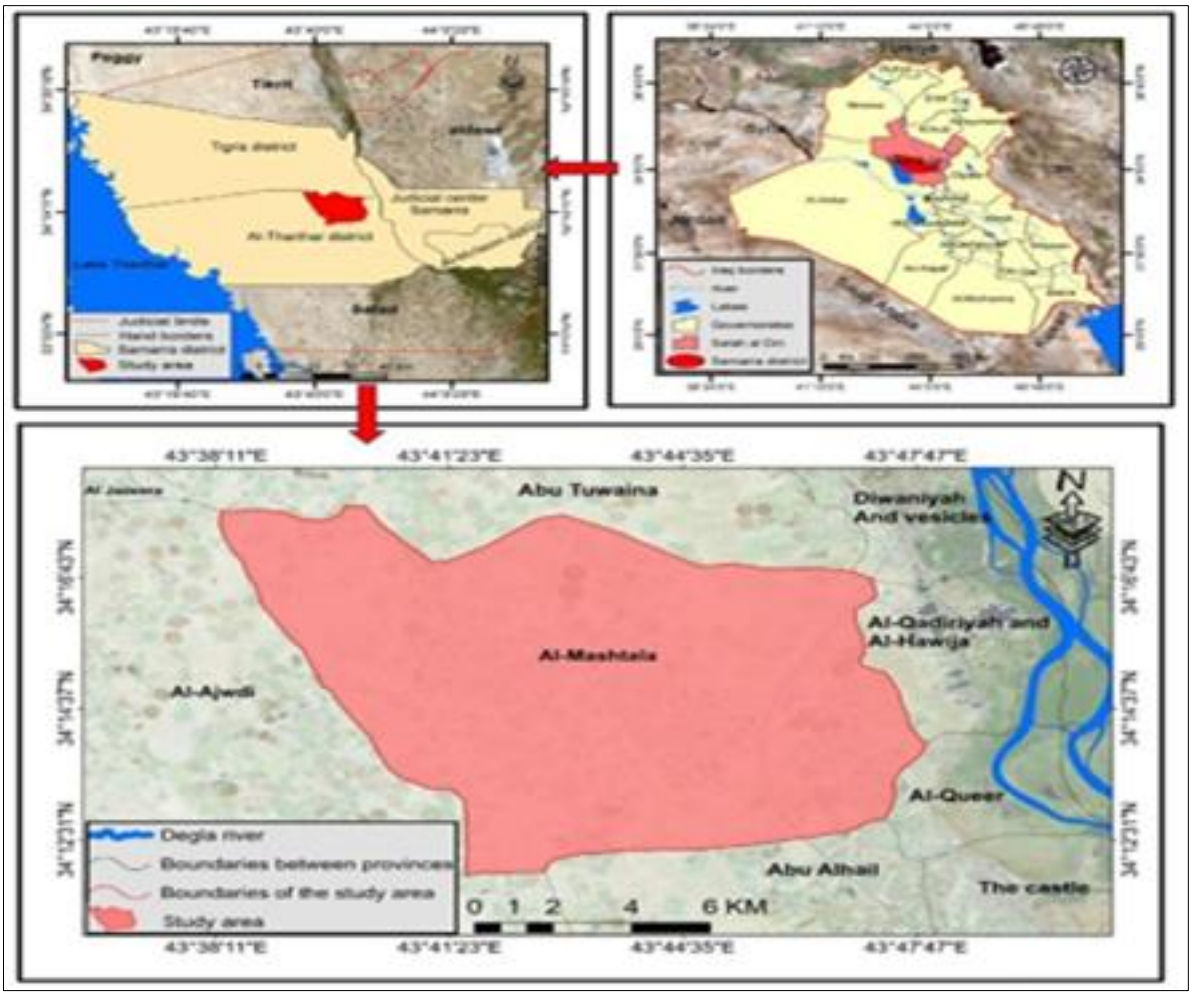

Figure 1: The study area from which the plant was collected

Figure 2: Astragalus spinosus collected from the selected area

Preparation of the Oil Extract

The oil extract was prepared to extract the active components of this plant using the hot extraction method, where the samples of the Astragalus plant, including the leaves and stems, were ground. After washing the plant well with distilled water several times to get rid of any stuck-on dust, the plant parts were then dehydrated in an electric oven at a heat of 40°C. The plant parts were placed in the electric grinder and ground for one minute. Then 37 grams of powdered plant material was weighed and 150 milliliters of petroleum ether, seethe point 40-60 °C, was added to it to preserve the volatile oils. The material was placed in sucsolite and worked until the color disappeared from the descending solution. The petroleum ether was taken away with a rotary vacuum beneath rarefied pressure. The producing quantity was weighed and melted with molten medical Vaseline at a temperature of 40°C (which was used as a base material for making the ointment. It was mixed together under the same temperature with a magnetic stirrer, then left at a temperature. Room temperature for use on animals.

Preparation of Animals

The experiment was made in line with moral guidelines adopted by Iraqi Society to protect animal rights, it was accepted by the Biological Society Committee for Animal Research Ethics in Iraq. Fifty adult female laboratory mice were used, and their weights ranged from (30-38 grams). The animals were divided into 5 groups, each group containing (n=10), The hair was shaveding from the dorsal surface of the mice, and a (1 cm) incision was made for all the groups using a scalpel, which penetrated the epidermis and dermis until the muscle layer appeared (Dunn *et al*., 2013) , Then the groups were divided into:

First Group (G1): The control group, injured in the dorsal area by (1 cm).

Second Group (G2): The wound was treated with the oil extract of Astragalus spinosus leaves at a concentration of 5% for 14 days.

Third Group (G3): The wound was treated with the oil extract of Astragalus spinosus leaves at a concentration of 10% for 14 days.

Fourth Group (G4): The wound was treated with the oil extract of the stems of the Astragalus spinosus plant at a concentration of 5% for 14 days.

Fifth Group (G5): The wound was treated with the oil extract of the stems of the Astragalus spinosus plant at a concentration of 10% for 14 days (Paswan *et al*., 2020).

All groups were fed with the standard diet and drinking water. The experimental period was 14 days, and the ointment was applied to the affected areas only twice a day using Cotton swabs. Half of the groups, which numbered 5 animals, were anesthetized and killed after 7 days of the experiment, while the rest of the groups were anesthetized and killed after day 14. In both cases, the damaged area of skin was removed.

Histological Study

After removing the skin, it was placed in a diluted formalin solution at a focus of (10%) for 24 hours by immersion method, Then wash it with running water for half an hour, after which we performed dehydration, where the skin sample was immersed in increasing ethyl alcohol (70-80-90%) for an hour and placed twice with alcohol. 100% absolute ethyl

alcohol twice for an hour, then a clearing process was applied by immersing it in xylene, then embedding it with paraffin wax with a melting point of 58-62, and it was cut with an electric cutter (Slee Germany) to a thickness of 5 micrometers. They were stained with Hematoxylin-Eosin (Feldman and Wolfe, 2014).

RESULTS

The results of this current study offer that there were histological changes in the skin sections that were taken from the area that was wounded and healing occurred. The results were as follows:

G1: The changes showed that after 7 days of wounding the animals without any treatment, the skin tissue contains epidermal cells that are atrophy and surrounded on the outside by fibrous tissue that contains an increase in bundles of colloidal fibers and infiltration of white blood cells, which are found in a mass above and around the epidermis. Hyperplasia of spiny epidermal cells and degeneration of the cytoplasm of most of these cells was also found. (Figure 3). While the histological changes after 14 days of conducting the experiment showed that the skin epidermis consisted of two or three layers of epithelial cells with dark-pigmented nuclei and keratin on the surface of the skin appeared in the form of scattered threads. Bundles of thick colloidal fibers and large numbers of macrophages and white blood cells (WBCs) were present in the skin's dermis. In certain dermal regions, necrosis was also discovered, which appeared in the form of pits and cavities, some of which contained cell debris (Figure 4).

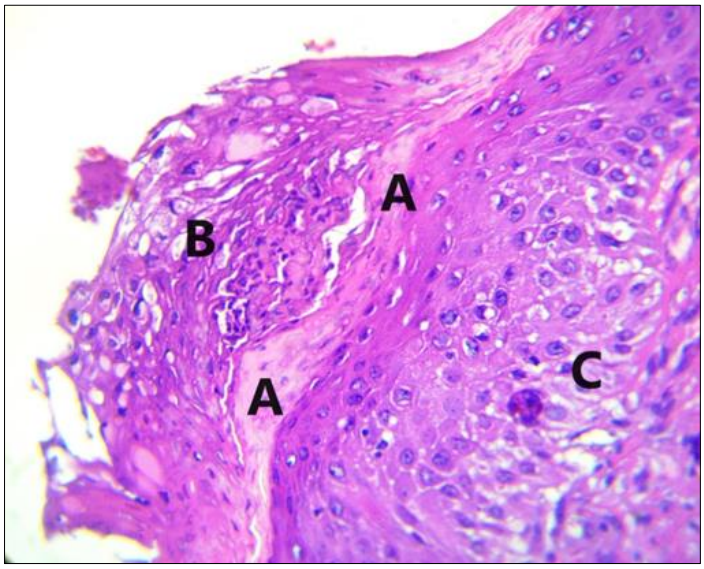

Figure 3: Skin tissue, control group for 7 days, atrophy of epidermal cells (A), a mass of colloidal fibers with infiltration of white blood cells and fibroblasts (B), hyperplasia of spiny epidermal cells with degeneration of those cells (C) (H & E 40x).

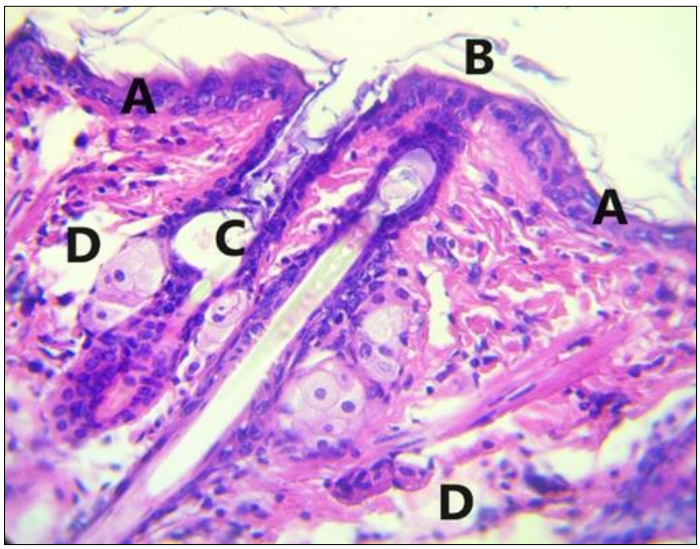

Figure 4: Skin tissue, control group for 14 days, thin skin epidermis (A), epidermal folds (B), thin keratin filaments (C), dermis necrosis (D), white blood cells (E) (H &E 40x).

G2: The results of this group, in which the ointment containing a 5% concentration of the oil extract of the leaves of the Astragalus spinosus plant was used, 7 days after the wound was made, revealed that the skin's dermis has a variety of sweat glands and hair follicles, and that (WBCs) and macrophages have infiltrated the dense colloidal bundles. The epidermis of the skin has multiple rows of stratified epithelial cells encircled by keratin filaments on the outside. While the histological changes of the skin after 14 days of the experiment and the completion of the treatment of the rest of the group with the same focus showed that there was a clear change heading towards repairing the skin tissue, in which the dermis of the skin appeared, containing of dense sheaves colloidal fibers with the existence of fibroblasts. Some sebaceous glands were also found associated with the hair sheath towards the skin. In its normal state, in addition to nodular lymphatic clusters deep in the dermis adjacent to many capillary blood vessels and some fat cells (Figure 6).

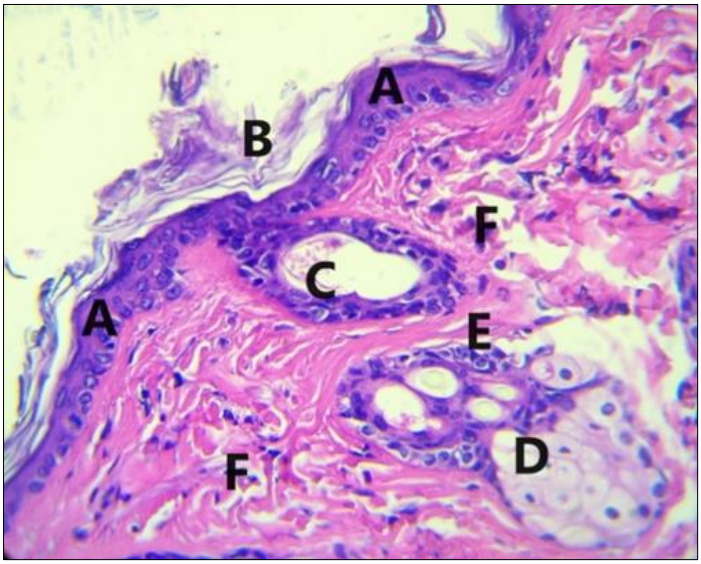

Figure 5: Skin tissue, group treated with oil extract of plant leaves at a concentration of 5% for 7 days, skin epidermis (A), keratin filaments (B), hair follicles in dermis (C), sebaceous glands (D), colloidal fiber sheaves (E), white blood cells (F) (H &E 40x).

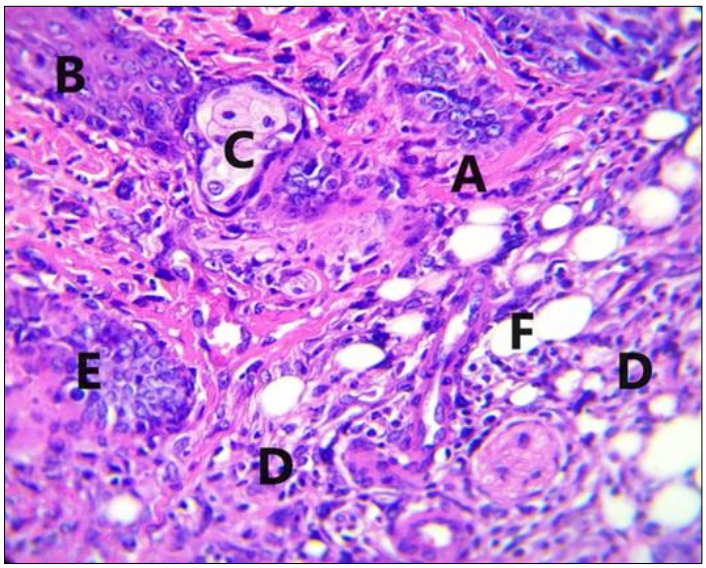

Figure 6: Skin tissue, group treated with the oil extract of plant leaves at a concentration of 5% for 14 days. The dermis of the skin contains dense colloidal fiber bundles (A), hair follicles (B), sebaceous glands (C), massive infiltration of white blood cells and macrophages (D), lymph nodules (E), fat cells (F) (H &E 40x).

G3: The results of this group, in which a concentration of 10% of the ointment of the oily extract of the Astragalus spinosus plant leaves was used, 7 days after the experiment was conducted, showed that the skin's epidermis is composed of epithelial cells, the surface of the epidermis contains dispersed keratinized filaments, and the subdermal layer contains large fat cells and massive leakage of (WBCs). In the dermis zone (Figure 7). While the results of the rest of the group, which was treated with the plant's oil extract ointment for 14 days, showed that the skin tissue had repaired through the

presence of several rows of skin cells that appeared normal, two layers of darkly pigmented granular cells encased in a coat of keratin that encircles them from the outside. The dermis of the skin also contains hair follicles associated with sebaceous glands, and the dermis is composed of dense colloidal bundles (Figure 8).

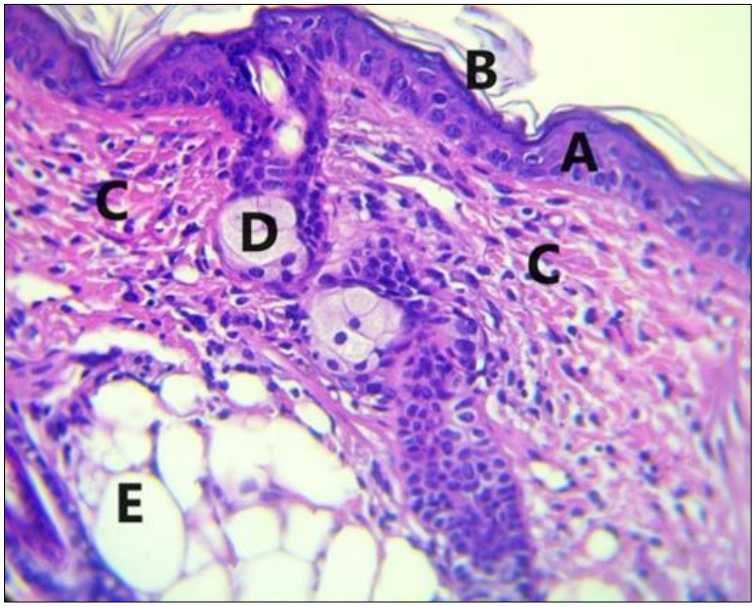

Figure 7: Skin tissue, group treated with the oil extract of plant leaves at a concentration of 10% for 7 days, skin epidermis (A), keratin filaments (B), massive infiltration of (WBCs) in the dermis (C), sebaceous glands (D), tissue Fatty(E) (H &E 40x)

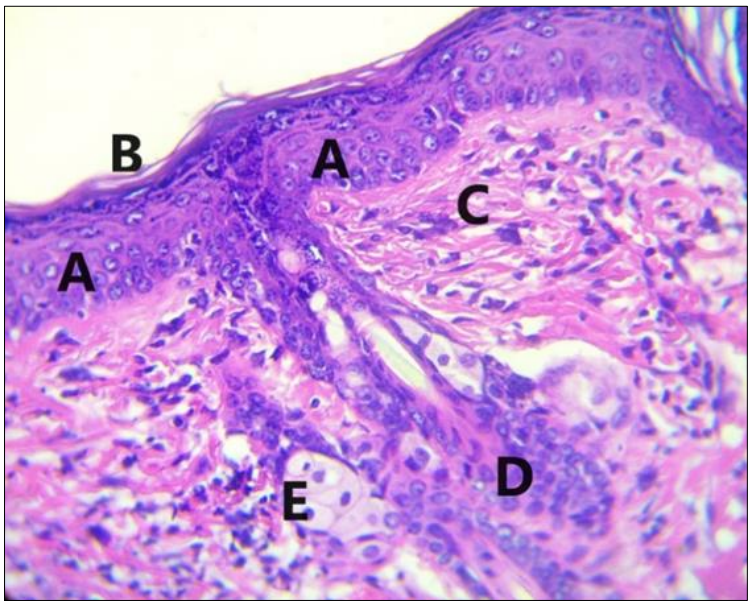

Figure 8: Skin tissue, group treated with the oil extract of plant leaves at a concentration of 10% for 14 days, normal skin epidermis (A), keratin filaments (B), colloidal fiber sheaves in dermis (C), hair follicles (D), sebaceous glands (E) (H &E 40x)

G4: Results of this group, in which a concentration of 5% of the oily extract of the Astragalus spinosus plant stems was used, 7 days after the start of the experiment, showed that the skin tissue in the dermis included global hyperplasia of bundles of colloidal fibers, accompanied by the infiltration of large numbers of white blood cells and macrophages. It was also observed that large numbers of blood-free capillaries spread (Figure 9). While the results of the rest of the group, which was treated with an ointment extracted from the oily stems of the plant for a period of 14 days, showed that the skin dermis contained dense fibrous tissue with massive infiltration of white blood cells and fibroblasts, and the fibrosis extended deep into the dermis with various blood cells (Figure 10).

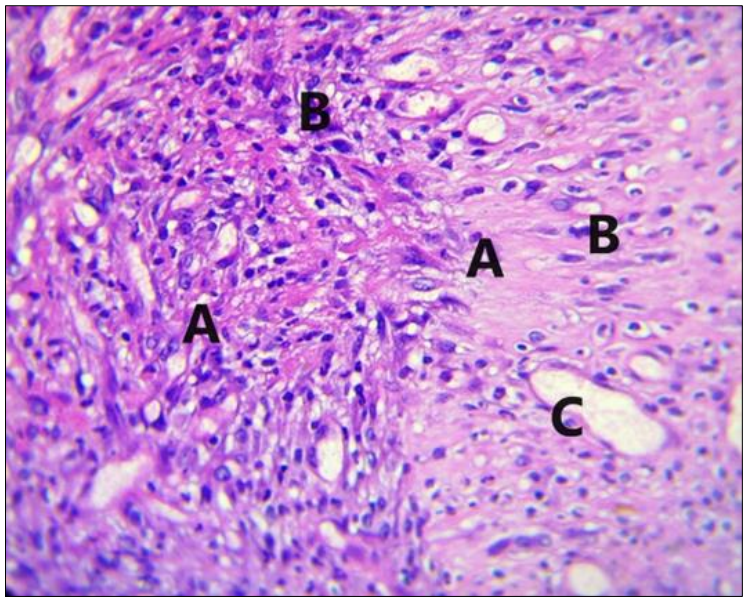

Figure 9: Skin tissue, group treated with the oil extract of plant stems at a concentration of 5% for 7 days, hyperfibrosis of the dermis (A), leakage of (WBCs) and macrophages (B), proliferation of blood-free capillaries (C) (H & E 40x)

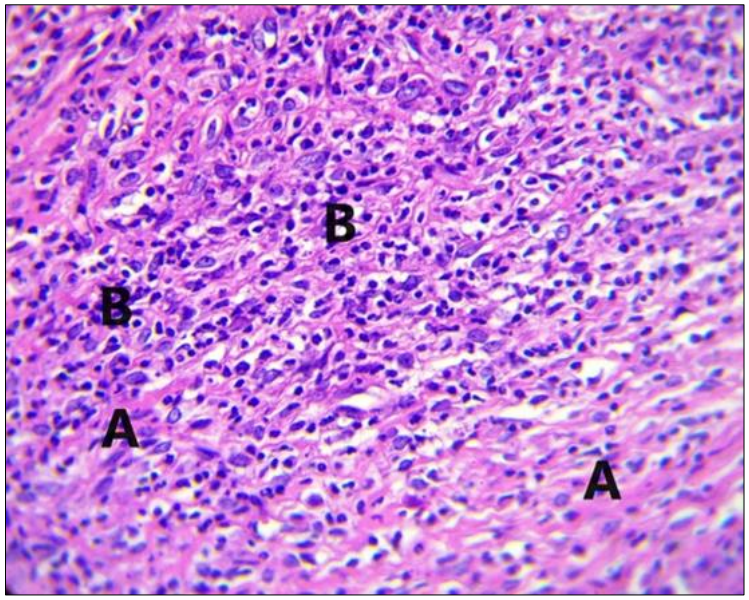

Figure 10: Skin tissue, group treated with the oil extract of plant stems at a concentration of 5% for 14 days, dermis, fibrosis of colloidal bundles in the dermis (A), leakage of (WBCs) and macrophages (B). (H &E 40x)

G5: The results of this group, in which a 10% concentration of the oil extract of the Astragalus spinosus plant stems was used, appeared 7 days after the start of the experiment. The epidermis of the skin consisted of two of lines winding epithelial cells surrounded on the outside by several strands of keratin. The dermis contained bundles of dense colloidal fibers containing leakage of some an (WBCs) d macrophages. The depth of the dermis contained sebaceous sacs for the sebaceous glands associated with the hair follicles, in addition to the presence of numbers of glands. The sweat cells are in the form of ducts lined with two layers of sweat cells and the subdermis is composed of fatty tissue separated from the dermis by a dense fibrous band (Figure 11). While the results of the rest of the group, which was treated with an ointment extracted from the oily stems of the plant for a period of 14 days, showed that the skin was thin and composed of two rows of dark in colored epithelial cells. The dermis contained plentiful bundles of colloidal fibers surrounding the hair follicles, and leakage of (WBCs) and macrophages was also found in the dermis (Figure 12).

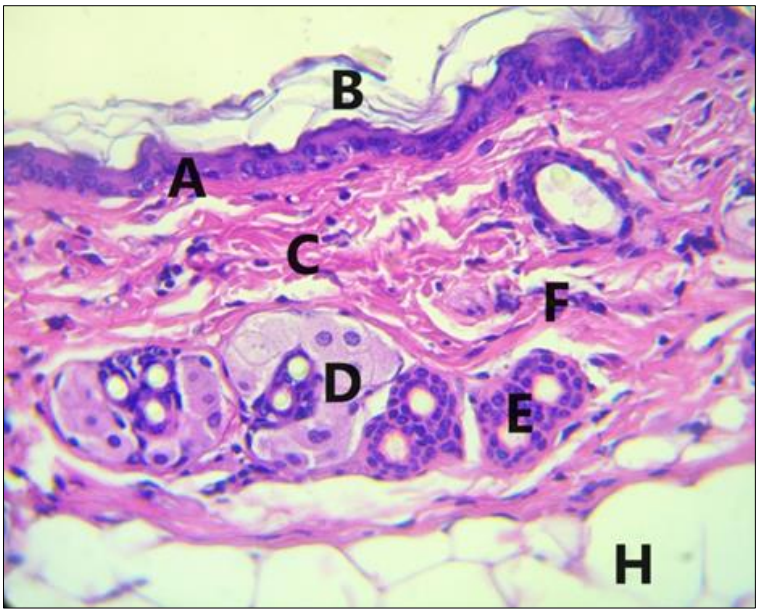

Figure 11: Skin tissue, group treated with 10% plant stem oil extract for 7 days, skin epidermis thin and wrinkled (A), sloughed keratin filaments (B), Colloidal fiber bundles in the dermis (C), sebaceous glands (D), hair follicles (E), white blood cells (F), adipose tissue (H) (H &E 40x)

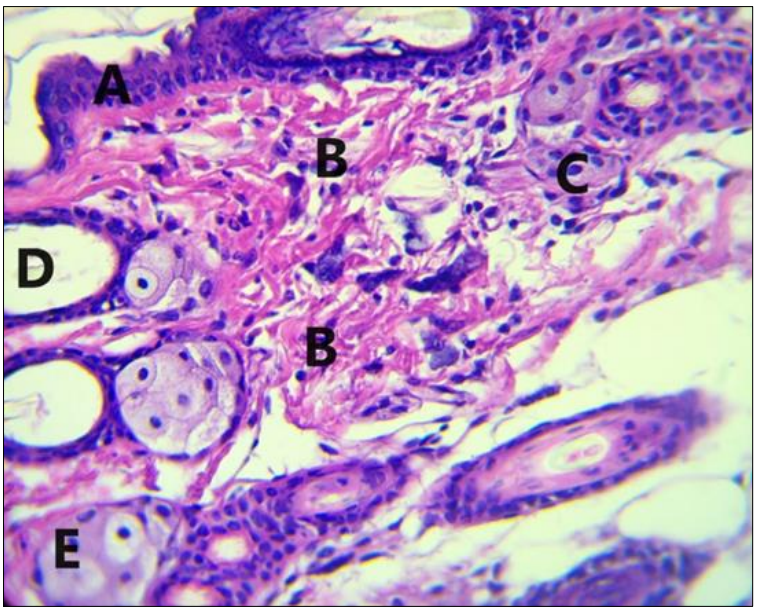

Figure 12: Skin tissue. The group treated with the oil extract of the plant stems at a concentration of 10% for 14 days. The skin's epidermis is thin, composed of dark-colored epithelial cells (A), bundles of colloidal fibers in the dermis (B), infiltration of white blood cells and macrophages (C). Hair follicles (D), sebaceous glands (E). (H &E 40x)

DISCUSSION

Healing skin wounds is of great importance in the health sector in general because skin wounds affect a large number of members of society and have an impact on their quality of life, require a long time in hospitals, and represent a large amount of health care expenditure. In addition, scientific information on the possibility impact of topical factors on skin wound healing is sparse (Rizzi *et al*., 2010). However, skin wound healing is a complex molecular and cellular process that involves four stages inclusive coagulation, inflammation, proliferation, and regeneration that lead to the restoration of the authentic structural and functional properties of the destroy tissue. The starting of this operation is the constriction of blood vessels and the activation of the coagulation cascade in the affected zone, and it occurs immediately after the injury. The inflammatory phase in wound healing is accompanied by local vasodilation (Yu *et al*., 2023). When a wound happen, there are various kinds of cells that are recruited to share in the healing process. For instance, neutrophils, monocytes, and mast cells penetrate the location of lesion and manufacture cytokines, and then fibroblasts, endothelial cells, and keratinocytes replicate and immigrate because the stimulation of the released cytokines. Fibroblasts, one of the most

popular connective tissue cells, are essential in wound healing. Through wound healing, fibroblasts react with besetment cells inclusive adipocytes, mast cells, and keratinocytes, however they as well make extracellular matrix, glycoprotein, adhesive molecules, and different cytokines. During direct cell-to-cell touch and indirect cell-to-cytokine contact, fibroblasts participate to wound reform (Werner and Grose, 2003; Zhao *et al*., 2017). There has been widespread scientific concern in the pharmacological evaluation of the biological properties of phytotherapy products. In addition, many studies have concentrate on evaluating the wound healing efficiency of medicinal plants. Normal products have always been an substantial exporter of therapeutic agents, so we evaluated and likened the topical efficiency of Astragalus leaves on skin injuries (Balbani *et al*., 2009; Calixto, 2005). Studies have shown that plant medicine had a role in early wound healing operations. This impact can be imputed to synthesis removed from plants, which revealed important anti-inflammatory and anti-pain characteristic. Researchers in the study conducted by Wang *et al*., (2022) found that the Astragalus plant enhanced the properties of cells in reducing the duration of wound healing and also reducing the scars that appeared on the skin. This is due to the active compounds contained in this plant, which contributed to the mechanism of rapid healing. Recent pharmacological studies have also shown that the primary pharmacological components of the astragalus plant in wound healing are polysaccharides and saponins, which have a significant effect in improving immune function and stimulating metabolism and cell physiology (Yi *et al*., 2012). Wild astragalus species belong to the Fabaceae family and are said to contain polysaccharides, saponins, isoflavonoids (Wang, 2017; Butkutė, 2018). Many species have been used due to their immunomodulatory activity in the treatment of inflammatory disorders. Studies have determined that immune activity in this family is linked to isoflavonoids, especially sugars. Furthermore, isoflavonoids are a group of compounds that have estrogen-like activity and give the plant estrogen-related properties. Studies have shown that the rate of wound healing in the elderly decreases. Furthermore, the wound healing rate was higher in females compared to males. Other studies have acquaint that this observation is directly associated to estrogen (Mara *et al*., 2020). Then research has shown that estrogen increases mitotic activity in the epidermis (Karim & Aryani, 2021). Other studies have evaluated the plant's effect on wound healing in the laboratory and in the living body, and in both cases, demonstrated wound healing efficacy (Ayubi-Rad *et al*., 2020). The medication transmission rate of the ointment was metriced via the contain of flavonoids crossing the skin. A petrolatum-based ointment pass the skin in a stable amount or, in other words, zero kinetic absorption. Because the fact that Vaseline cannot be easily removed from the dorsal skin of rats, the duration of communicate of the active substance with the wound is lengthy and the healing operation is done preferable (Sevimli-Gür, 2011). In an experiment conducted by Jawad *et al*., (2023) used astragalus roots to treat skin ulcers caused by the Leishmania parasite. It has been shown that Astragalus extract has a role in healing skin tissue infected with the Leishmania parasite, as it reduces inflammation and stimulates the immune system. This is leads to the active chemical compounds found in Astragalus spinosus, like flavonoids and terpenoids, which possess anti-inflammatory and antioxidant properties. These characteristic make it operative in curing skin harms.

CONCLUSION

In this trial, topical application of an ointment containing astragalus oil extract significantly the reinforced proportion of wound healing as seen through an raise in collagen-forming injury tissue. Histological findings also showed enhanced fibroblast proliferation. The results of the study offered a therapeutic effect of using the oil extract of the leaves and stems of the Astragalus spinosus plant in healing wounds in female albino mice. The plant leaves, not the stems, had the greatest treatment effect, because they contain compounds that have antioxidant and anti-inflammatory properties.

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