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A Review on Investigation of Pharmacological Actions of Cucurbita Pepo (Pumpkin) in Acceleration of Wound-Healing by Anti-oxidant, Anti-Inflammatory, Anti-Microbial and Tissue Regeneration properties

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Abstract: ***Pumpkin (Cucurbita pepo) is an annual plant. It belongs to the family Cucurbitaceae. Nutritionally, C. pepo is rich in vitamins, minerals, carbohydrates, proteins, and fats, making it an important food source with significant health benefits and therapeutic potential. Historically, people in Africa and Asia have widely used herbal remedies made from Cucurbita species to treat various diseases. These include fever, whooping cough, urinary issues, scurvy, prostatic hyperplasia, rheumatism, hemorrhoids, miscarriage, prostate cancer, constipation, and even blindness. Pumpkin is also known as a functional food because it offers a high number of calories, proteins, carotenoids, minerals, fiber, and phytosterols. These nutrients help manage support overall health. Most of research shows that C. pepo has various biological effects including anti-diabetic, anti-viral, anti-parasite, anti-inflammatory, antibacterial, antioxidant, anthelmintic and also supports urinary and prostate health and skin health. The review of this study revealed that the C. pepo extract has shown wound healing property by anti-inflammatory, anti-oxidant, anti-microbial and tissue regeneration properties.***

Keywords: Cucurbita pepo, Nutrient rich, Wound healing, Antioxidant, Anti-inflammation, Antibacterial

1. Introduction

Before this study of review on Investigation of wound healing property, we must know about the pumpkin.

Pumpkin is an annual herbaceous plant that produces different types,

- Winter squash (such as pumpkin and acorn squash)
- Summer squash (such as zucchini and pattypan squash)

Nowadays the Pumpkins are eaten raw, baked or as a snack. But almost all parts of the pumpkin plant (Cucurbita pepo) including the seeds, fruit, and leave have medicinal uses for humans i.e.

- Supporting the Urinary and Prostate Health
- Support Heart Health
- Anti-diabetic
- Anti-parasitic/ Anti-malarial activity
- Anthelmintic
- Anti-bacterial
- Anti-fungal
- Treatment of Rheumatism
- Treatment of ulcer.
- Treatment of Facial Acne

2. Literature Review of Pumpkin

Synonyms:
Pumpkin, Squash, Zucchini, Gourd.

Botanical source:
Cucurbita pepo

Family:
Cucurbitaceae

Geographical source:
Origin: Native to Central America and Mexico.
Major Producers: China, India, Ukraine, Brazil.

Phyto chemical constituents:

Components	Key Constituents
Lipids and Fatty Acids	Linoleic acid, linolenic acid, oleic acid, stearic acid, omega 3,6 fatty acid and palmitic acid.
Phyto Sterols	Squalene and Sterols
Carotenoids and Terpinoids Pigments	Alpha carotene, Beta carotene, Lutein, Zeaxanthin and violaxanthin.
Proteins And Amino Acids	Aspartic acid, Glutamic acid, Leucine, Lysine, Valine and arginine
Vitamins	Vitamin A, Vitamin C and Vitamin E
Minerals	Zinc, Iron, Copper, Magnesium, Potassium and Phosphorus
Others	Phenolic compounds, Flavonoids, Alkaloids and Saponins

Hence, Cucurbita pepo offers a variety of nutrients and natural phytochemicals. These components work together promote overall Healthcare and shows the following Pharmacological action.

Pharmacological Actions:
The Cucurbita pepo having amore therapeutic benefit,

1) Anti-cancer activity
Cucurbita pepo contains Ribosome inactivating proteins (RIPs) e.g., Moschatin blocks the protein synthesis leads to cancer cell death and Cucurmosin shows strong cytotoxic action. Carotenoids also reduce the Tumour by anti-oxidant activity.

2) Urinary and Prostate Health
C.Pepo controls the prostate cell growth and reduces chronic inflammation which recuts in inhibition of Benign Prostatic Hyperplasia (BPH) and aids in managing urinary dysfunction.

3) Anthelmintic
It used as a vermifuge to expel intestinal worms like tapeworm.

4) Antioxidant
Pumpkin rich in Tocopherol (vitamin E) which is a natural anti-oxidant. CP serves superoxide dismutase and glutathione peroxidase which reduce the harmful reactive oxygen species and prevents the oxidative damage of Tissues.

5) Anti-inflammatory
Cucurbita pepo inhibits the inflammatory mediators such asIL-6, TNF-alfa, iNOS and COX-2 enzyme and prevents inflammation.

6) Cardio protective
Cucurbita pepo lowering the LDL cholesterol and reduce the risk of Atherosclerosis. The Arginine and magnesium content of C. pepo increases the nitric oxide production and causes vasodilation; it improves the endothelium function and decreases the blood pressure. The anti-inflammatory actionreduces the vascular inflammation and improves the blood flow. Hence the pumpkin supports the heart health.

7) Anti-microbial
Cucurbita pepo shows broad spectrum activity against many pathogens. CP inhibits the bacteria such as Acinetobacter baumannii, Aeromonas veronii, Enterococcus faecalis, Escherichia coli, Klebsiella pneumoniae, Pseudomonas aeruginosa, Salmonella typhimurium, Serratia marcescens, Staphylococcus aureus. Peptides present in CP inhibit the growth of yeast like Candida albicans. The Peptides and alpha and beta moschin proteins present in CP inhibit the protein synthesis of fungus like Botrytis cinerea, Fusarium oxysporum, Mycosphaerella arachidicola.

8) Diuretic
It improves the bladder functions and Promotes urination.

9) Ant diabetic
Cucurbita pepocontains D-chiro inositol which increases the insulin sensitivity. CP also inhibits the alpha- amylase and beta-amylase, so prevent the digestion of carbohydrate into glucose. Protein bounded polysaccharides in CP improves the glucose tolerance and insulin level in blood.

10) Anti- malarial
Used to treat malarial fever by Anti-parasite action.

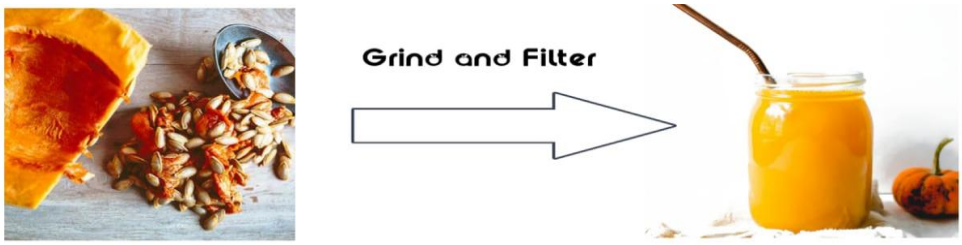
11) Anti-parasitic
It Controls the growth of parasites.

12) Wound healing
Cucurbita pepoheals the wounds by reduce the swelling and resistance to microbes. The natural phyto-constituents of C.pepo faster the tissue regeneration and make the favourable environment for wound to heal faster.

Available Formulations of Pumpkin:
Pumpkin Seed oil: Blending the pumpkin seed with small amount of water and mashing to release oil.
Paste: Cooking the flesh until tender and blending it to get smooth paste consistence.
Powder: Dry the pumpkin Leaves or fruits and grind to get powder.
Decoction: Decoction prepared from the extraction of Fruits and leaves of pumpkin plant.

Extraction of C. Pepo (Pumpkin):

1) Fresh Juice:
Thoroughly wash and Peel the Pumpkin fruits, remove large stems and cut produce into pieces. Grind it to get fresh juice. Filter with mesh or cotton swab. Store in air tight container at cool place.



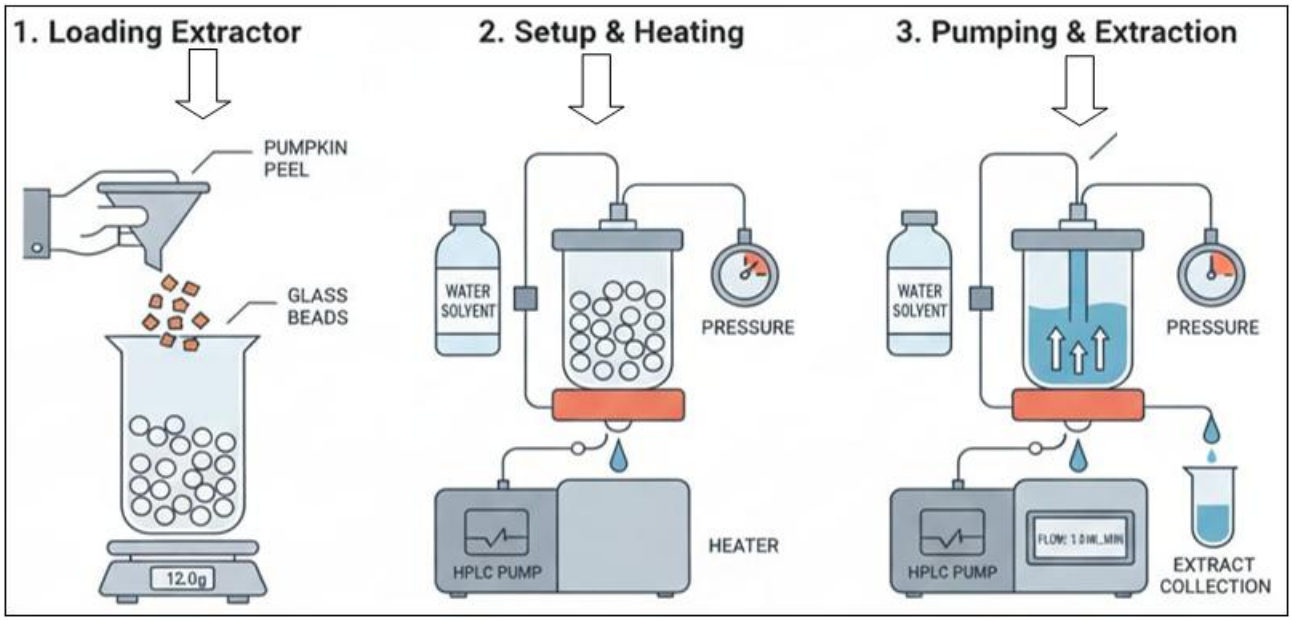
2) Alcoholic extraction:
The dried flesh and peel of pumpkin were mixed with 80% ethanol for 1 day. For another day, the beaker contains ethanolic pumpkin placed on shaker. Filter and use.

3) Subcritical extraction:
The extraction of pumpkin was done by the *Subcritical water extraction (SWE)* method,

First, 12 g pumpkin peel was put inside the extractor with glass beads.

The extractor was installed on the heater.

Water as a solvent was pumped at a flow rate of 1 ml/min using a HPLC (High Performance Liquid Chromatography) pump to achieve the desired pressure.



Is Curcubita Having Wound Healing Property?
Yes, *Cucurbita pepo* extracts have been studied for their wound healing properties and the results are generally **positive**.

3. Mechanisms of Action

Action 1: Hemostasis
The presence ofreactive oxygen species (ROS) like hydrogen peroxide (H2O2 at the site of injury may also be the reason for the slowing down of coagulation, because more H2O2 is found at the site upon damage to the tissue which inactive the thrombin. However, the antioxidants in the pumpkin would prevent the inactivation of thrombin by inhibiting ROS. So increase the activity of thrombin, more fibrin is generated, which means the blood clot develops faster and effective than normal.
Outcome:
Faster clot formation → early sealing of wound.

Action 2: Prevent Inflammation
During the Wound formation, The Inflammation is produced as a natural defensive process. But the excessive inflammation delaying the wound healing. Pumpkin has contained several bioactive compounds that exhibit anti-inflammatory activity. These compounds may help reduce the inflammatory response in a wound by suppressing the release and activation of inflammatory mediators. It ultimately decreases the swelling, redness, and pain of the wound area. By controlling inflammation, pumpkin may create a more favourable environment for wound healing and promote faster and more effective tissue repair and regeneration.

Outcome:
Prevention of Inflammation → Faster wound healing.

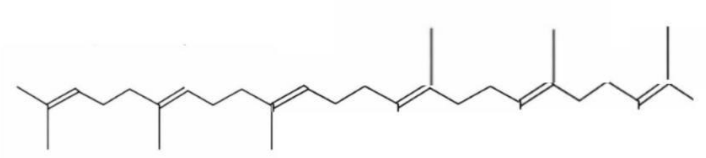
Action 3: Proliferation
The phyto-constituents and nutrients present in the pumpkin support the process of epithelialisation and collagen formation. Thereby acting as adjuncts to easing the growth of cells to regenerate tissue and promote wound healing. Therefore, the pumpkin acts as a substance that enables healthy, strong and resilient skin.

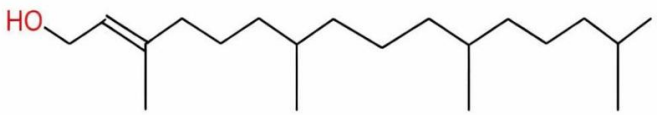
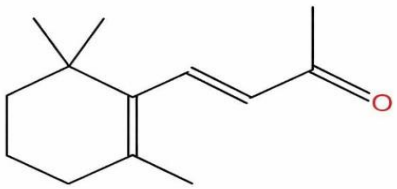
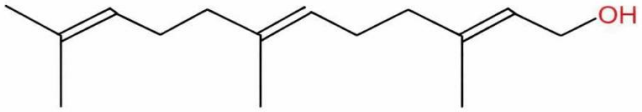
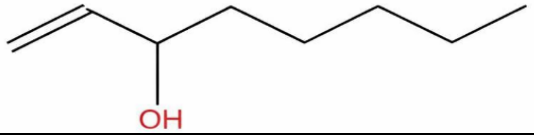
Outcome:
Faster tissue regeneration → Faster wound healing.

Action 4: Antimicrobial Action
Pumpkin exhibits antimicrobial action, which helps reduce the risk of infection by inhibiting the growth of harmful microorganisms. This property is especially beneficial in wound care, as it prevents microbial contamination at the wound site. This effect make pumpkin a valuable natural agent in preventing infections and enhancing the healing process.

Outcome:
Lower infection risk → faster wound healing.

Compounds present in Cucurbita pepo and their known pharmacological action:

Anti-oxidant:	
Squalene	
Anti-inflammatory and Anti-oxidant:	

Phytol	
Anti-inflammatory and Anti-microbial	
Trans-beta-Ionone	
Trans-Farnesol	
Anti-microbial:	
1-octen-3-ol	

4. Review of Research (Evidence):

Research: Accelerating Effect of Cucurbita pepo Extract on Excisional Wound Healing in Depressed Rats Is Mediated through Its Anti-Inflammatory and Antioxidant Effects.

Requirements:
- **Animal**: Healthy male albino rats.
- **Standard drug**: 5% w/w Povidone Iodide
- **Test sample**: Cucurbita pepo extract

5. Methodology

Rats with wounds were separated into three groups:

Groups	Sampling	Drug Used
Group 1	Control	No Treatment
Group 2	Standard	5% Povidone Iodide
Group 3	Test	Cucurbita Pepo Extract

They used rats and deliberately created two types of wounds:
- Incision wounds (cut and stitched wounds)
- Excision wounds (open, circular wounds)

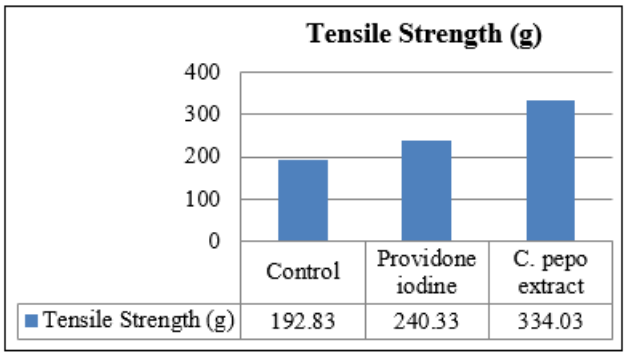
1. Incision wound model (stitched wound healing)

Procedure:
- A 5 cm long surgical cut on the back.
- Close the cut with stitches.
- Applied treatments for 7 days (control, standard, test).
- Stitches removed on day 8.
- On day 10, measured wound breaking strength.

Measurement:
wound breaking strength:
It measures how strong the healed skin is how much force the wound can withstand before reopening.

Tensile strength = breaking strength (g)/ Cross section area of skin (mm2)

Observation:

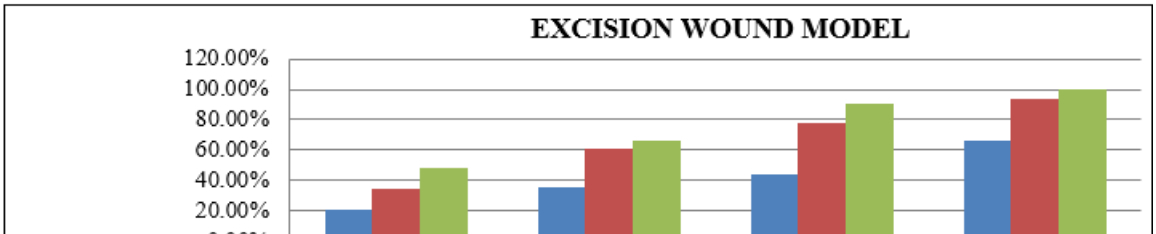


Result: Higher breaking strength of C.pepo shows that the stronger collagen formation and better healing.

2. Excision wound model (open wound healing)

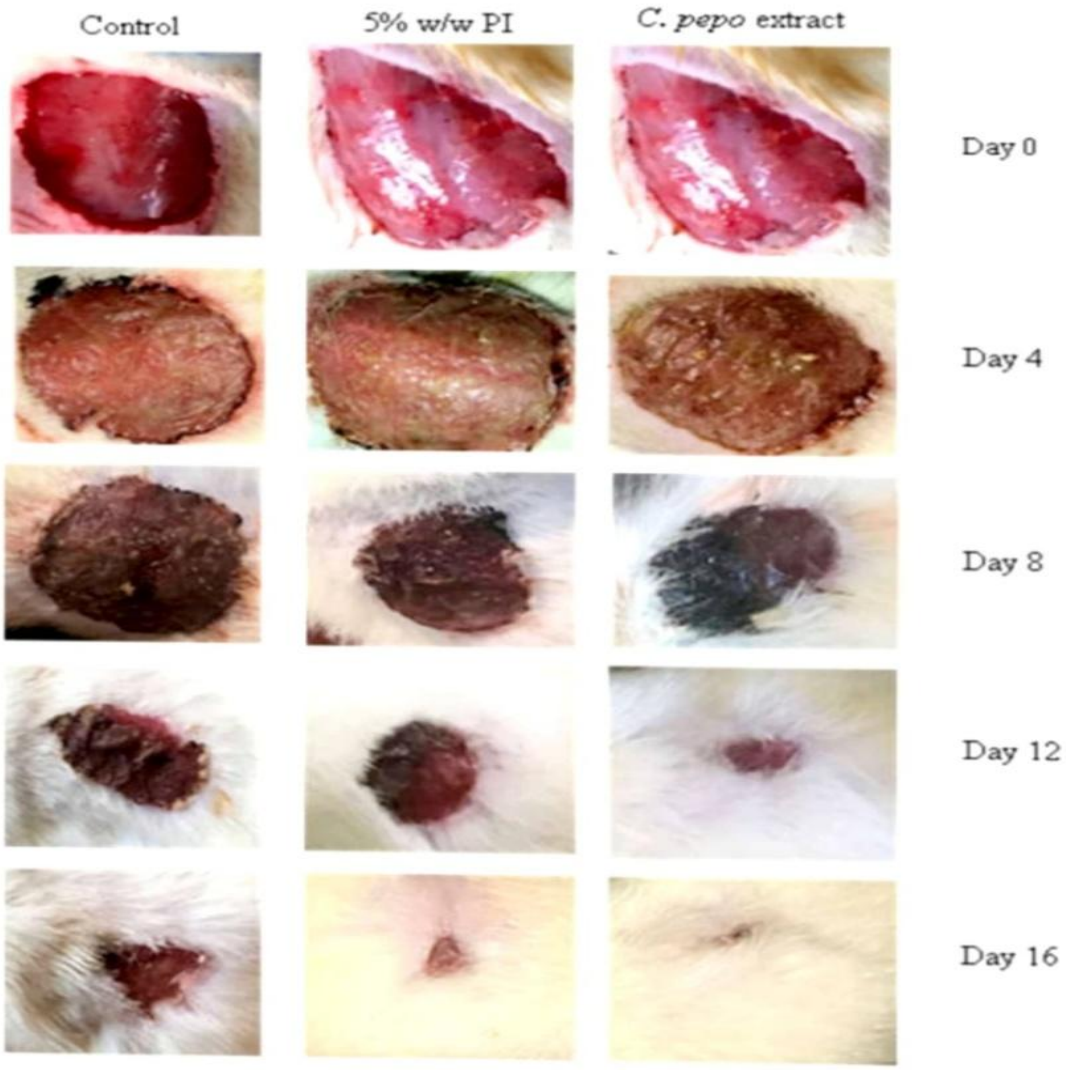
Procedure:
- Rats are anesthetized so they feel no pain.
- Hair on the rat's back was shaved.
- A round open wound (~500 mm², 2 mm deep) was created.
- Treatments were applied daily for 16 days.
- The wound size was measured every 4 days (days 4, 8, 12, 16, 20).

Observation:



	Day 4	Day 8	Day 12	Day 20
Control	20.46%	36.25%	44.64%	65.88%
5% w/w povidone iodide	35.10%	61.54%	78.34%	94.06%
C.pepo extract	48.66%	65.93%	90.05%	100%

The sequential process of wound healing is depicted on the following image, shows the comparison between the control, standard (5% w/w PI) and test (C. pepo extract-treated group) from Day 0–Day 16.



6. Result

Application of C. pepo extract on the post excision wound shows higher rate of wound healing in comparison to the standard group and control group. It represents that the Cucurbita pepo has the ability to accelerate the wound healing process.

7. Conclusion

Cucurbita pepo demonstrates promising wound healing potential through its antioxidant, anti-inflammatory, antimicrobial and tissue regenerative properties. Evidence from animal studies supports its ability to enhance clot formation, reduce oxidative damage and promote collagen

development. These findings indicate that C. pepo may serve as an effective natural adjunct in wound management. Further research is needed to isolate its most active components and evaluate their clinical applicability.

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