

Use of Tilapia Skin for Burn Treatment in both Humans and Animals

¹Indhuja R.B, ² Mahalakshmi A

^{1,2}*Veltech Multitech Dr Rangarajan Dr Sankunthala engineering college*

Abstract - The fifth most common nonfatal injuries are burns, they are caused due to various reasons, for example, electric shocks, fire accidents. Burns doesn't seem to be common only in humans even animals endure the severe pain as humans experience. Normally the healing period for superficial partial-thickness burns is three weeks whereas partial-thickness burns take over three weeks to heal. Since the healing time is too long it is considered as one of the major drawbacks. Tilapia fish skin has been used to treat burns because of its bioactive properties. Humans and animals are treated and cured with Tilapia skin when it is used as a therapeutic option. The utilization of Tilapia skin as a xenograft for animals and humans cuts down the curing time and minimizes the usage of pain medication. Tilapia skin was used on humans and animals like ponies, dogs, cats, lions, and bears. when these species were treated with Tilapia skin, the healing time was observed to be reduced by several weeks. It was also found that the Tilapia skin had good adherence to the wound bed and no adverse and complicated side effects were observed.

Index Terms - Bioactive properties, healing period, Nile tilapia (*Oreochromis niloticus*), pain medications, xenograft.

Purpose of the Review--- To create an awareness of using Tilapia skin as an alternate treatment option for burns in humans and animals and also this paper would tell about the employment of Tilapia skin in bears, dogs, lions, ponies, and humans for treating their burns.

I.INTRODUCTION

According to the world health organization, 180,000 deaths are caused because of burns. The majority of burn injuries occur in low and middle-class countries.¹ Burns is not only common in humans even animals die because of burns caused due to forest fire. If these burns are treated properly and if good medication is provided they can be cured in no time. Earlier human skin was used for treating burned tissues but it was

costly and its availability was difficult therefore as an alternate pig's skin was preferred. Using pigskin also had its cons. Some of them are, it was important to ensure that the pig doesn't eat anything overnight

before surgery to avoid vomiting and aspiration. Also, the supplication of anesthesia was a tedious process.⁵ The use of Tilapia's skin for treating burns won't cause such difficulty. It is more resistant when compared to pigskin and doesn't require any preoperative measures. The use of Tilapia's skin for treating burns has many advantages. This fish contains high moisture content and collagen proteins at levels akin to human skin. The healing period was also reduced when burns were treated using this fish's skin.^{2,3} Many of them are not aware that this fish skin is used as a treatment option even for animals. This paper aims to provide sufficient evidence for the use of Tilapia skin in humans and animals. This paper also tells about the pros and cons of using this skin.

Once an 18-year-old gypsy pony was scarred by full-thickness chemical burns. The worst part of this burn was that the pony was not able to open her eyes and she was starving. She was taken to the local veterinarians by a Samaritan, there the doctors decided to treat the pony by using the skin from Tilapia fish. The veterinarians who were treating that pony knew that this treatment was already used by Dr. Peyton on mountain lions and two black bears during the forest fires.⁶ So the local veterinarians thought of using the same method on that gypsy pony. The local veterinarians informed Peyton about the pony's condition, within a few days she was there to help that pony. The surgery was successful and the crew created a little fish face for the pony. After the pony woke up from anesthesia doctors understood that she was slowly recovering and also she was able to eat again.⁶ Dr. Jamie Peyton also treated two female bears who were rescued from the wildfires that occurred in

California. These bears had third-degree burns in their paw which caused it difficult for them to walk.⁶ When these bears were admitted, Peyton primarily treated them with pain medications to ease their pain. Later, she came across the article telling about the use of Tilapia skin to treat burns in humans in Brazil.⁶ She thought why not use the same procedure. When these bears were treated with the Nile Tilapia fish skin and it was observed that the post-surgery success rate was high. It was found that the paws started to heal within a week of surgery.⁶

In Brazil, a 3-year-old boy was admitted for superficial partial thickness burn. This burn happened because he poured hot boiling water on him. The doctors thought of treating the boy with Tilapia skin for the first time.² They started the procedure by incorporating Tilapia skin on the boy's wound. Post-treatment, he was continuously monitored. After a few weeks, the Tilapia skin from the boy was removed to know the healing. The healing rate was quite high. Within days, re-epithelialization occurred completely and the Tilapia skin from the boy was removed soon.²

II. MATERIALS AND PREPARATION METHODS

The Tilapia skin which was going to be used for treatment or which was going to be stored for future use has to undergo rigorous chemical sterilization, glycerolization, irradiation, and microbiological tests to ensure that there is no bacteria or fungi present in the fish skin.⁴ There are three sterilizing agents used, chlorhexidine gluconate, povidone-iodine, silver nanoparticles. Among the three agents, silver nanoparticles were found to be more effective and they did not affect the collagen content and cellular structure in the skin.⁷ The following paragraphs tell us about the preparation of the Tilapia skin and the preparation of the patient before the treatment begins.

PREPARATION OF TILAPIA SKIN:

When the physicians decided to treat the 3-year-old boy with Tilapia skin, firstly, the fish skin was bought from the market and then, the skin was washed with tap water to get rid of the blood and other impurities like dust, sand. Then the fish skin was stowed inside isothermal boxes to take them to the laboratory for the further sterilization process. In the laboratory, the skin was cut into pieces of required dimensions and was again cleansed with saline solution, then it was placed

in a sterile container with chlorhexidine gluconate for an hour.² Later the skin was taken from the previously used container and washed again with saline and this time the skin was placed in a hermetically sealed container with glycerol and saline.² After 60 minutes the same procedure was repeated but this time it was stored with full glycerol and was kept inside the water bath for 3 hours in a centrifuge at 37°C. After that, the skin was packed in a double-sealed container and was stored at 4°C for future use.² The fish skin can be stored for up to two years inside these plastic containers. The last step in the sterilization process is gamma radiation. Finally, tests for the presence of bacteria and fungi were done.²

PREPARATION OF THE PATIENT:

Before the skin was used on patients it was washed 3 times with saline for 5 minutes. When it comes to the preparation of the patient, the wound should be cleaned with tap water and chlorhexidine gluconate.⁴ Then the dead tissues and blisters are removed. The removal of blisters and tissues is a very imperative step because it allows maximum adherence of the biomaterial with the wound bed. Finally, the tilapia skin is applied and it is covered with regular dry gauze and bandage.^{2,4}

Application of the Tilapia skin on the animals will need an extra step to be followed. When the fish skin is to be applied on animals it is important to remove the smell of the fish from the skin. So in the cleaning process, even the removal of fish smell is also considered to be crucial.⁶ Though the tilapia skin undergoes these many sterilization steps it won't lose its healing capacity and its bioactive properties.⁷

III. PROS USING TILAPIA SKIN FOR TREATMENT

- *AVAILABILITY:* Tilapia fish is easily available in the market. There is no demand for these fishes in the market. Usually, Tilapia fish's skin is thrown away and most of them don't consume it. If the doctors prefer treating the patient with this skin, they don't have to try hard to find them.
- *PRESENCE OF BIOACTIVE PROPERTIES:* Tilapia fish skin contains more amount of moisture and collagen proteins (type 3 collagen) which is akin to human skin. The presence of

collagen in the skin helps to prevent scarring in human skin. These bioactive properties also give good adherence to the wounded region. Also, there is no side effect when tilapia skin is used.^{2,3,4}

- **REDUCED HEALING TIME:** It is found that the use of Tilapia skin for burns has reduced the healing time by several days when compared to the traditional process.^{2,3,4} The use of Tilapia skin also reduces the use of pain medications.
- **DRESSING:** When doctors treat the burn victims with bandages and ointments, frequent cleaning in the wounded region is required which causes pain to the patient. But the use of Tilapia skin won't need any cleaning post-treatment and the skin is not required to remove until the burn heals. Therefore, no dressing is needed.
- **RESISTANCE:** The use of tilapia skin on burns has high-level resistance to infections and any microbial attack. This kind of resistance is not found in pigskin. Because of the high resistance level, Tilapia skin can be preferred for treatment.
- **COST EFFECTIVE:** This fish is available easily in the market there is no need to spend any amount on transportation. Since there are no extra charges imposed except for buying the fish this method is cheap and viable.
- **NO PREPARATION REQUIRED:** When pigskin is used for treatment that pig should not eat anything the whole night. Making sure that the pig doesn't eat anything is a difficult job, but such monitoring is not required when tilapia skin is used for treatment.
- **ANESTHESIA:** Pigs are required to be anesthetized before the surgery but such a process is not required when we use Tilapia fish.
- **TABLETS TO ANIMALS:** Making the animals eat pain tablets is a very tedious task. Instead of doing that difficult job, doctors can treat the animals with fish skin. Even frequent bandage removal and giving them new bandages is also difficult.

When Tilapia skin is used frequent changing is not required.

IV. CONS OF USING TILAPIA SKIN FOR TREATMENT

For every good thing, there is a bad thing. Despite the advantages of using Tilapia skin for treatment, there are a few disadvantages also. Some of them are listed below.

- **EXTRA CARE:** when Tilapia fish is used for treatment in animals there is a chance that animals would eat them because of the fish smell so extra protection is required to safeguard the fish skin bandage.
- **STERILISATION:** Fish skin obtained from the market might have muscles still attached to them it is important to clear everything and proper sterilization has to be done. Cleaning is an extra effort that has to be put in, to use the skin for treatment.
- **ADHERENCE ISSUES:** when patients had burn injuries in their face, groin region, buttocks, neck, genitalia, and axillae it was difficult for the fish's skin to stick on those areas.

V. CONCLUSION

From this review paper, it is concluded that the use of Tilapia skin can treat burns in animals as well as in humans. The perfect evidence for the above claim is mentioned in this paper. It is also mentioned that Dr. Peyton successfully treated a pony, mountain lion, and bears using Nile tilapia for the injuries caused due to burns. It was observed that the Tilapia skin had good adherence to the wound bed and no serious side effects were evident. It is also proved that the utilization of pain medications and healing

REFERENCES

- [1] World Health Organization. Burns, accessed August 31, 2019. Available from [http:// www.who.int/news-room/fact-sheets/ detail/burns](http://www.who.int/news-room/fact-sheets/detail/burns)
- [2] Bruno Almeida Costa, MBBS, Edmar Maciel Lima Júnior, MD, MS, Manoel Odorico de Moraes Filho, MD, PhD, Francisco Vagnaldo

- Fechine, MD, PhD, Maria Elisabete Amaral de Moraes, MD, PhD, Francisco Raimundo Silva Júnior, BSN, Maria Flaviane Araújo do Nascimento Soares, BSN, Marina Becker Sales Rocha, BSNut, PhD, Use of Tilapia Skin as a Xenograft for Pediatric Burn Treatment: A Case Report, *Journal of Burn Care & Research*, Volume 40, Issue 5, September/October 2019, Pages 714–717.
- [3] Lima-Verde, M.E.Q., Parthiban, S.P., Junior, A.E.C.F. et al. Nile Tilapia Fish Skin, Scales, and Spine as Naturally Derived Biomaterials for Tissue Regeneration. *Curr Oral Health Rep* 7, 335–343 (2020).
- [4] Edmar Maciel Lima Júnior, MD, MS, Manoel Odorico De Moraes Filho, MD, PhD, Bruno Almeida Costa, MBBS, Andréa Vieira Pontes Rohleder, BSPHarm, PhD, Marina Becker Sales Rocha, BSNut, PhD, Francisco Vagnaldo Fechine, MD, PhD, Antonio Jorge Forte, MD, PhD, Ana Paula Negreiros Nunes Alves, BDEnt, PhD, Francisco Raimundo Silva Júnior, BSN, Camila Barroso Martins, BSN, Mônica Beatriz Mathor, BSPHarm, PhD, Maria Elisabete Amaral de Moraes, MD, PhD, Innovative Burn Treatment Using Tilapia Skin as a Xenograft: A Phase II Randomized Controlled Trial, *Journal of Burn Care & Research*, Volume 41, Issue 3, May/June 2020, Pages 585–592
- [5] Tilapia skin and other burn treatment techniques. *Bio dermis the science of skin* 2021 <https://www.biodermis.com/blogs/biodermis-blog/tilapia-skin-and-other-burn-treatment-techniques-biodermis-com>
- [6] Amy Quinton. Healing burned animals with fish skin. Innovative treatment could help solve the global public health crisis.2018. <https://www.ucdavis.edu/health/news/healing-animals-with-fish-skins>
- [7] Ibrahim, Ahmed; Hassan, Dalia; Kelany, Noura; Kotb, Saber; Soliman, Mahmoud. Validation of Three Different Sterilization Methods of Tilapia Skin Dressing: Impact on Microbiological Enumeration and Collagen Content. *Frontiers in Veterinary Science*. (2020)
- [8] Rama S, Chandrakasan G. Distribution of different molecular species of collagen in the vertebral cartilage of shark (*Carcharias acutus*). *Connect Tissue Res*. 1984;12:111–8.
- [9] Yu D, Chi CF, Wang B, Ding GF, Li ZR. Characterization of acidand pepsin-soluble collagens from spines and skulls of skipjack tuna (*Katsuwonus pelamis*). *Chin J Nat Med*. 2014;12:712–20
- [10] Costa BA, Lima Júnior EM, de Moraes Filho MO, et al. Use of tilapia skin as a xenograft for pediatric burn treatment: a case report. *J Burn Care Res* 2019;40:714–717
- [11] Weinstein RA, Mayhall CG. The epidemiology of burn wound infections: then and now. *Clin Infect Dis* 2003;37:543–50.
- [12] Zhou C, Hong P, Li S, Hu Z, Yang P. Marine collagen peptides from the skin of Nile tilapia (*Oreochromis niloticus*): characterization and wound healing evaluation. *Mar Drugs* 2017;15:102.
- [13] Treatment Using Tilapia Skin as a Xenograft for Superficial-Partial Thickness Wounds: a Pilot Study. *J Burn Care Res* 2019. doi:10.1093/jbcr/irz149
- [14] Alves APNN, Lima Júnior EM, Piccolo NS, et al. Study of tensiometric properties, microbiological and collagen content in Nile tilapia skin submitted to different sterilization methods. *Cell Tissue Bank* 2018;19:373–382.
- [15] Chen J, Gao K, Liu S, Wang S, Elango J, Bao B, et al. Fish collagen surgical compress repairing characteristics on wound healing process in vivo. *Mar Drugs* 2019;17:1–12
- [16] Wang N, Ding T, Zhou T, Liu X, Sun J, Xue Y, et al. Electrospun tilapia collagen nanofibers accelerating wound healing via inducing keratinocytes proliferation and differentiation. *Colloids Surfaces B: Biointerfaces* 2016;143:415–22.
- [17] Zidan SM, Eleowa SA. Banking and use of glycerol preserved fullthickness skin allograft harvested from body contouring procedures. *Burns* 2014;40:641–647
- [18] Richardson P, Mustard L. The management of pain in the burns unit. *Burns* 2009;35:921–936.
- [19] Laycock H, Valente J, Bantel C, Nagy I. Peripheral mechanisms of burn injury-associated pain. *Eur J Pharmacol* 2013;716:169–178.
- [20] Chiu T, Burd A. “Xenograft” dressing in the treatment of burns. *Clin Dermatol* 2005;23:419–423.