FEASIBILITY OF NILE TILAPIA (*OREOCHROMIS NILOTICUS*) SKIN AS A BIOLOGICAL DRESSING FOR BURN TREATMENT: A LITERATURE REVIEW

*VIABILIDADE DA PELE DE TILÁPIA DO NILO (*OREOCHROMIS NILOTICUS*) COMO CURATIVO BIOLÓGICO NO TRATAMENTO DE QUEIMADURAS: REVISÃO DA LITERATURA*

Marcelo José Borges de Miranda[1]

[1] MD, Associate Professor of Plastic Surgery – Faculdade de Medicina de Olinda

ABSTRACT

The use of biological occlusive dressings should prevent hydroelectrolytic losses, prevent bacterial contamination, promote epithelization or assist in the formation of granulation tissue for grafting. Recent studies point to the use of biological dressing based on aquatic animals as biomaterial in regenerative medicine. It is reviewed the state of the art of using Nile Tilapia (*Oreochromis niloticus*) as a biological dressing in the treatment of burns. Comparative researches between human skin and Nile Tilapia show favorable results regarding histological, histochemical, tensiometric and handling properties related to the characteristics of this material.

Keywords: Oreochromis niloticus. Nile Tilapia. Burns. Occlusive dressings.

RESUMO

O uso de curativos oclusivos biológicos deve prevenir as perdas hidroeletrolíticas, evitar a contaminação bacteriana, promover a epitelização ou auxiliar na formação do tecido de granulação para enxertia. Estudos recentes apontam a utilização de curativo biológico com base em animais aquáticos como biomaterial na medicina regenerativa. Neste artigo, é feita uma revisão bibliográfica, descrevendo o estado da arte do uso da pele da Tilápia do Nilo (*Oreochromis niloticus*) como curativo biológico no tratamento de queimaduras. Pesquisas comparativas entre a pele humana e a da Tilápia do Nilo comprovam resultados favoráveis quanto aos aspectos histológicos, histoquímicos, propriedades tensiométricas e manuseio relacionados às características desse material.

Palavras-chave: Tilápia do Nilo; Oreochromis niloticus; Queimadura; Curativo biológico

INTRODUCTION

The Brazilian Society of Burns defines burns as traumatic injuries often caused by thermal, chemical, electrical, or radioactive agents. These injuries affect organic tissues and may trigger systemic responses proportional to their extent and depth.

Management of second- and third-degree burns requires an interdisciplinary approach, encompassing fluid resuscitation, enteral nutritional support, analgesia, and antibiotic therapy. Dressings also play a crucial role in the surgical management of burn injuries.

Biological dressings prevent hydroelectrolytic loss, reduce bacterial contamination, and promote epithelialization or facilitate granulation tissue formation for grafting. Animal-derived biological tissues, including porcine or frog skin, bovine pericardium, and porcine intestinal submucosa, are used for dressings1.

Recent studies have explored the use of Nile Tilapia (Oreochromis niloticus) skin, an aquatic animal-derived biological dressing, as a biomaterial in regenerative medicine, demonstrating good adherence to wounds in experimental rat models[1,2]. Comparative analyses with human skin showed favorable biological behavior regarding histological, histochemical, and tensile properties[2].

Each year, about one million people suffer burn injuries in Brazil, and the Unified Health System allocates around 55 million reais annually for their treatment3.

Tilapia skin is typically discarded as waste, with only 1% used in handicrafts. The durability and sensitivity of tilapia skin for accessory production have prompted researchers to investigate its potential as a substitute for human skin in burn treatment.

According to the Brazilian Agricultural Research Corporation, tilapia accounts for 45.4% of the total fish production in Brazil, representing 68,000 tons. Between 2005 and 2015, the production increased by 223%, highlighting the abundance of this raw material4.

This literature review aimed to describe the current research on using Nile Tilapia skin as a biological dressing in burn treatment.

METHODS

The present study is a narrative, exploratory, and secondary literature review. The bibliographic search was conducted using national and international indexed journals. Relevant literature was identified using the Virtual Health Library, a database aggregator.

The search strategy included the descriptors "queimaduras," "curativos," and "Tilápia do Nilo" from the Health Sciences Descriptors to broaden the identification of studies addressing the topic. Selected studies were critically evaluated for their direct relevance to the theme.

The present review did not follow a chronological order of publication. Instead, it presents a logical and coherent synthesis and integrates perspectives from different authors to enhance understanding of the theme.

COMMENTS

Burn injuries represent a significant public health challenge, and their physical, psychological, and social consequences affect the patient and their family. Awareness campaigns and educational programs grounded in epidemiological principles should be integrated into public health policy[3,5].

In Brazil, of the one million annual burn victims, about 10% require hospital care; most belong to low-income populations and rely on public healthcare services[1,6].

Burn treatment is costly and involves prolonged rehabilitation, primarily affecting children and young adults, with a mean age between 25 and 26 years. Among younger individuals, alcohol is the leading etiological agent, and the upper limbs are the most affected body region1,5.

Burn incidents in economically active individuals aged 20 to 30 often occur in the workplace, particularly during activities involving high-voltage electricity[7].

At the tissue level, burns trigger a cascade of physiological responses aimed at restoring integrity. This process begins with acute inflammation, followed by cellular regeneration and tissue remodeling, culminating in the recovery of tensile strength. Effective wound management requires a multidisciplinary team within a hospital.

Various occlusive dressings are available, including silver-based dressings, hydrogels, and others[8].

Silver dressings may accelerate healing, possess antimicrobial properties, and promote faster reepithelialization. Hydrogels have bactericidal effects, enhance wound healing, and reduce the risk of hypertrophic scarring, which improves aesthetic and functional outcomes. Their high moisture content also contributes to pain reduction by creating an optimal environment for tissue repair[8].

The other dressings include foam, moist, petrolatum gel-based, and skin substitutes, which contribute to reduced healing time. Foam dressings are recommended for joint areas due to their flexibility and support for mobility. The moist environment accelerates reepithelialization. Petrolatum gel-based dressings are indicated for superficial partial-thickness burns[8].

Although research indicates that an ideal temporary skin substitute has yet to be developed, biological skin alternatives have shown promising aesthetic results in the treatment[1,8]. However, they must undergo rigorous scientific validation to assess their biological behavior in human applications.

Human and animal-derived biological materials require thorough evaluation to ensure efficacy and biocompatibility as burn dressings. Studies comparing human skin with Nile Tilapia skin have demonstrated favorable results regarding histological and histochemical properties, tensile strength, and handling characteristics[1,2,8].

Tilapia skin exhibits morphological similarities to human skin, including compact, long, and organized collagen bundles, as well as a predominance of type I collagen. These characteristics provide sa-

tisfactory elasticity and facilitate surgical manipulation[1,9-11].

Burn management involves local and systemic care, depending on the depth, location, and extent of the injury8. Burned skin is highly susceptible to contamination, and biological dressings must possess antimicrobial properties to prevent infection.

Animal skin may harbor microorganisms with pathogenic potential, necessitating strict disinfection and sterilization protocols that preserve its microscopic and mechanical properties. Recent research supports the effectiveness of chemical and radiation sterilization methods in preparing Nile Tilapia skin for clinical use[10].

In private burn treatment centers, biosynthetic and artificial skin substitutes are commonly used, but they are expensive. In contrast, public healthcare centers typically employ sequential debridement, topical antimicrobials, and wound bed preparation for skin grafting[1,2,6].

Conventional burn treatment using antimicrobial creams or ointments often causes discomfort and pain during dressing changes. Daily dressing replacement requires the complete removal of the ointment, causing pain and delaying healing.

Tilapia skin dressings provide wound protection and reduce the need for frequent dressing changes, as they remain in place until complete healing.

A comparative analysis of analgesic use in patients treated with silver sulfadiazine versus Tilapia skin showed reduced pain and decreased analgesic requirements in 20 patients at a burn center in Fortaleza[12]. These findings underscore the importance of pain management in burn care, a key goal for all healthcare professionals involved in the treatment.

A holistic approach to burn patient care should prioritize comfort and quality of life. Humanized care and the accessibility of Tilapia skin reflect on treatment costs.

The skin adherence to the wound bed further supports patient comfort. This treatment prevents external contamination and fluid loss, and the patient remains in place until complete healing, as demonstrated in a 2016 study conducted at the Dr. José Frota Institute[6].

Tilapia skin used for dressings is prepared by the Drug Research and Development Center at the Federal University of Ceará, where it undergoes cleaning, cutting, and sterilization. Additional irradiation is performed at the Nuclear and Energy Research Institute in São Paulo[1,6].

Each fish yields two skins measuring 15 cm by 5 cm, and the amount required depends on the wound size. Given the substantial Tilapia production in Brazil, its use in medical applications is feasible, provided that industrial-scale processing is implemented for broader social benefit.

Several medical specialties have begun exploring the use of Tilapia skin beyond burn treatment, including urology, dentistry, and gynecology[6].

CONCLUSION

Ongoing research efforts[1,2,6] continue to support the widespread adoption of Nile Tilapia skin as an innovative, safe, domestically sourced, and cost-effective dressing for burn patients, coming as an ideal wound care solution.

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