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USE OF TILAPIA SKIN XENGRAFT IN THE TREATMENT OF BURNS: A LITERATURE REVIEW

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Abstract: Introduction: Burn is an injury to organic tissues as a result of thermal trauma. The use of tilapia skin as a biological dressing, which has been shown to be a promising, innovative and effective treatment for the treatment of extensive burns. **Goal:** To analyze the difference in the use of tilapia skin xenograft in burn healing, as well as the risk factors and final result. **Method:** Bibliographic review carried out from October to November 2022, using 12 articles in the PubMed database to compose the collection. **Review:** It is known that the lipid composition of tilapia skin acts positively as an immunoregulator, antimicrobial and scar modulator. Appropriate management is needed, both in skin removal and in sterilization and storage. Compared to the hydrofiber solution with silver, the use of Nile tilapia skin resulted in a decrease in pain and in the number of dressing changes, at the same time providing less possibility of infection. Therefore, it results in less use of pain medication, generating better recovery for the patient and less workload for the team. The tilapia xenograft presented limitations in the treatment of extensive burns and skin fold sites, being contraindicated in these cases. **Conclusion:** In view of its benefits, Nile tilapia skin can benefit patients with indication and public health systems due to its low cost and high effectiveness.
Keywords: Heterografts; Tilapia, Burn; wound healing.

INTRODUCTION

Burn is an injury to organic tissues as a result of thermal trauma that can manifest as a small blister to more severe forms, having the power to trigger systemic responses directly related to its extension and depth. In extreme situations it can lead to disfigurement, disability and even death (LIMA JÚNIOR E.M et al., 2017). Such injuries are a serious public health problem in Brazil, with an incidence of

1 million cases every year, of which 100,000 seek hospital care and 2,500 die (LIMA JÚNIOR E.M. et al., 2020c). Due to the high costs of synthetic or biosynthetic occlusive dressings, alternative biological materials have been sought for the local treatment of wounds caused by burns (LIMA JÚNIOR E.M et al., 2017).

In recent years, several studies have been carried out on the use of tilapia skin as a biological dressing, showing it to be a promising, innovative and effective approach for the treatment of extensive burns (GE B. et al., 2020). Furthermore, it was presented as a safe, effective technique with great potential as a biocurative. In clinical studies, it is evident that the microscopic characteristics of tilapia skin are similar to the morphological structure of human skin, with high resistance and a large amount of type I collagen (LIMA JÚNIOR E.M. et al., 2020c). The extraction and application of tilapia collagen has also generated extensive studies, which prove that the administration of type I tilapia collagen has low toxicity, thus confirming in vivo biocompatibility for its wide application in biomedical purposes (GE B. et al., 2020).

Given this context, the objective of this review study is to analyze the differential in the use of tilapia skin xenograft in the healing of burns, as well as its risk factors and final result, in order to bring a treatment with a lower rate of complications, greater efficiency and speed in the healing process, seeking to provide the best possible care to patients affected by burns.

METHODOLOGY

This is a bibliographic review, carried out between October and November 2022, developed according to the criteria of the PVO strategy, an acronym that represents: population or research problem, variables and outcome. This strategy was used to elaborate the guiding question of the present study: "What are the advantages of using tilapia skin xenografts in patients with burns compared to traditional methods?". In this sense, according to the parameters mentioned above, the variable of this research refers to the differential use of tilapia skin xenograft in healing; the population would be patients with burns; the outcome would be the search to show improvement in the prognosis and satisfactory aesthetic results of its use. The searches were carried out through searches in the PubMed Central (PMC) database. The descriptors were used in different combinations with the Boolean term "AND": Heterografts, Tilapia, Burns, Wound Healing. Inclusion criteria were: articles in English and Portuguese, published from 2017 to 2022 and that addressed the themes proposed for this research, review type studies, meta-analysis and original articles, available in full. Exclusion criteria were: duplicate articles, available in summary form, which did not directly address the studied proposal and which did not meet the other inclusion criteria. After applying the inclusion and exclusion criteria, 12 articles were selected from the PubMed database for the final collection. The types of studies included were original and available in full. Then, a careful analysis of the articles was carried out in order to collect relevant and didactic information about the desired content. The results were approached descriptively through the categories: indication and contraindication of tilapia skin in burn patients; preparation and technique; comparison of tilapia skin results with traditional methods, based on healing, risk of infection and aesthetic result.

RESULTS

The management of major burns still presents certain objections, especially when referring to the issue of healing of the affected

regions and their challenges in coverage and healing process (OUYANG Q.-Q. et al., 2018). In view of the coverage of large burned areas, autologous skin grafts have limited availability, leading to the indication of the use of tilapia skin xenografts, which also demonstrate success in the treatment of vascular and diabetic ulcers complicated with exposed tendons and bones. (WALLNER C. et al., 2022; MIRANDA M.J.B and BRANDT C.T., 2019). The benefits presented by the xenograft come from its greater resemblance to the skin of mammals due to its conserved protein structure. Its lipid constituents - including omega 3 fatty acids, eicosapentaenoic acid and docosahexaenoic acid - are highly effective as antimicrobial agents and in modulating the healing response, which confers the success in the use of this technique (HU Z. et al., 2017).

The use of such therapy has been shown to reduce the number of days for re-epithelialization of the wound bed by favoring the formation of epithelization tissue, with less intensity of pain and use of analgesics/anesthetics, in addition to less need to change dressings - comparing to silver sulfadiazine (LIMA JÚNIOR E.M. et al., 2020a). In addition, the property of re-epithelialization and integration into the wound bed, without increasing contraction, allows for less exposure of the wound to infectious agents (WALLNER C. et al., 2022)

The preparatory technique for the application of tilapia skin xenografts consists of sterilization and preservation of Nile tilapia (Oreochromis niloticus) samples (OUYANG Q.-Q. et al., 2018). After collection from the fish farm, the skin is subjected to a rigorous sterilization process in order to remove any impurities and exclusively preserve the skin to be used. Subsequently, it is frozen using the lyophilization technique for storage. This freezing technique consists of frozen water sublimation processes and is intended to maintain the morphological appearance of the material, maintaining the protein content of the tissue and the elastic performance of the dermis. Glycerolization can also be applied: a more economical technique that consists of placing the skin of the aquatic animal in increasing concentrations of glycerol solution, in order to fix the water contained in the intra and extracellular spaces of the tissue (LIMA JÚNIOR E.M. et al., 2020a).

Sterilization processes, despite their importance, can interfere with the final quality of xenografts. Different sterilization processes, such as chemical sterilization and irradiation, observed in optical and scanning electron microscopy, show the visualization of alterations in the structural collagen fibers of the xenograft tissue, demonstrating a drop in the levels of type 1 collagen in the submitted tilapia skins for both irradiation and chemical sterilization techniques (LIMA JÚNIOR et al., 2020b).

Furthermore, the xenograft proved to be promising due to its characteristics that encourage tissue proliferation and protection against bacterial infections. According to Ouyang Q. Q. et al. (2018), through a case-control study, the application of the hydrogel, consisting of the association of marine peptides extracted from tilapia skin with chitosan, a linear amino polysaccharide, showed a propensity for microbial degradation due to instability of isolated marine peptides. In addition, he pointed out the advantages of the inherent properties of chitosan such as immunoregulation, promotion of the formation of granulation tissue, stimulation of the remodeling of collagen fibers of the extracellular matrix, drug carrier and antimicrobial attributes (OUYANG Q.-Q. et al., 2018).

The comparison between the treatment with Nile tilapia skin and the dressing based on hydrofiber with silver (Aquacel AG®), shows

that the average number of days of treatment and the pain felt during and after the dressing were similar between the two managements.. However, in the clinical process of applying the dressing, patients reported feeling less pain with the use of Nile tilapia skin and also a smaller number of dressing replacements, which leads to a lower risk of infection. In addition, it is evident that the greater the number of dressing changes, the greater the cost of treatment and the greater the possibility of the patient experiencing pain (MIRANDA M.J.B and BRANDT C.T., 2019).

Recent studies also describe a new treatment method for deep dermal burns from the skin of acellular fish (Kerecis®Omega3 Wound, Isafjordur, Iceland) by processing North Atlantic cod (Gadus morhua). Superior results were obtained from the use of fish skin when compared to the partial thickness skin graft, with a reduction in the healing time of burn wounds, as well as superiority in terms of hydration of the stratum corneum (WALLNER C. et al, 2022). The outcomes were similar in other studies using tilapia skin to treat wounds in burn patients. However, it is worth mentioning the biomolecular superiority of tilapia skin components compared to other fish, since Nile tilapia skin collagen has greater thermal stability (VERDE M.E.Q.L. et al., 2021).

Added to this, the benefits of using tilapia skin xenografts go beyond the patient, consequently reducing the workload of health professionals in burn units due to the speed of re-epithelialization, especially in patients with thick burns. partial, which also implies the reduction of analgesic and anesthetic needs. (LIMA JÚNIOR E.M. et al., 2021). However, the xenograft has limitations, since it does not have adequate fixation in regions of skin folds, such as the neck, face, genitalia, perineum, armpits, groin and buttocks, and in these cases the use of other treatment methods is indicated (LUZE H. et al., 2022).

FINAL CONSIDERATIONS

The use of tilapia skin xenografts for healing burns presents differentials associated with the reduction of pain during the process of changing dressings and also in the number of changes, consequently leading to a reduction in the risk of infections, in addition to contributing to the healing process due to the inherent properties of its structure. However, there are limitations regarding the location of fixation - such as skin folds - and adversities in the sterilization process. It appears, therefore, that, given its many benefits, low cost and high effectiveness, Nile tilapia skin can benefit not only patients with indication for its use, but also the public health system.

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