Chapter 198

Use of xenograft in the treatment of 2nd degree burns: A literature review

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ABSTRACT
The quantity of human skin in Brazilian's skin center is insufficient to attend less than 1% of treatments of burning. Therefore, new studies were appointed to use biological bandages based on aquatic animals with a choice of treatment of 2° degree burns. Initiated the study of the use of xenograft of tilapia on second-degree burns about therapeutics and clinical surgical results. This is a systemic review of literature realized through article surveys on a database of Revista Brasileira de Burns, Revista Brasileira de Cirurgia Plastica, LILACS, and PubMed. Through the search on identified bases, 19 articles were considered eligible and underpin the construction of this review. In addition, the present study was based on literary works on semiology and dermatology and the Ministry of Health booklet on the emergency treatment of burns. Comparative research between human and Nile tilapia skin proves good results in histological, histochemical aspects, tensiometric properties, and manipulation related to the characteristics of this material. In addition, studies show that the use of biological occlusive dressings should reduce hydro electrolytic losses, avoid bacterial contamination, and promote reepithelialization of burned skin. Thus, it is concluded that xenografts be considered a solution in the therapeutic and socioeconomic scope of burns. It is, therefore, an innovative product, of easy application and high availability, which may become the first animal skin nationally studied and registered by the National Health Surveillance Agency.

Keywords: Biological dressing, Burns, Nile Tilapia, Xenografts.

1 INTRODUCTION

A burn is an injury that affects the lining tissue of the body, denatured cellular proteins, which can reach muscles, tendons, and bones. In addition, the severity of the injuries caused by the burn is variable and can generate from small blisters to the destruction of the skin and adjacent tissues, depending on the depth of the lesions (SILVA et al., 2018).

Approximately one million people suffer burns in Brazil each year. In most of these patients, the prevailing diagnosis is superficial and/or deep second-degree burns (MIRANDA; BRANDT, 2019).

Considering that burns represent a public health problem in Brazil due to their high incidence, morbidity, and mortality, there must be advances in the treatment of burn patients.

According to the Ministry of Health, Brazil should have 13 skin banks, however, there are only four in operation, being them in São Paulo, Rio Grande do Sul, Paraná, and Rio de Janeiro, which, together, do not supply 1% of the country's skin requirement. It is thus concluded that without the use of skin, our country is 60 years behind in the local treatment of burns (LIMA JUNIOR et al., 2019a).

In the search for new therapeutic alternatives for burns, numerous studies have been conducted seeking effective, low-cost methods that favor the healing process of the lesion. Given this, the Nile Tilapia skin has been studied as an option, because when compared to human skin it presents satisfactory results, in addition to having adequate tensile and compression resistance (ALVES et al., 2018).

Therefore, knowing that burns are a public health problem, is xenograft a promising alternative for the treatment of burns and resolution of the problem of lack of skin donations?

Therefore, the general objective of the present research is to analyze the xenograft method for the treatment of second-degree burns through a systematic review of the literature.

To this end, the following specific objectives were outlined: to evaluate the efficacy of the Nile Tilapia skin for the management and treatment of second-degree burns; to verify the benefits of using the xenograft and to characterize the morphological structure of the skin of Nile Tilapia to prove its efficacy as a source of material for grafting.

2 MATERIAL AND METHODS

This study consists of a systematized review of the literature of a descriptive nature with a qualitative approach. A query was made in selected scientific articles through a search in the database of the Brazilian Journal of Burns, Brazilian Journal of Plastic Surgery, LILACS (Latin American and Caribbean Literature in Health Sciences), and PubMed. The selection of articles was based on criteria such as original studies, published between 2017 and 2022, available in the languages Portuguese and English, and that addressed the topic of interest. From the research in the identified databases, 55 studies were found, of this total, 19 articles were considered eligible and supported the construction of this review. In addition, the present study was based on literary works of semiology and dermatology and the Ministry of Health's booklet on the emergency treatment of burns.

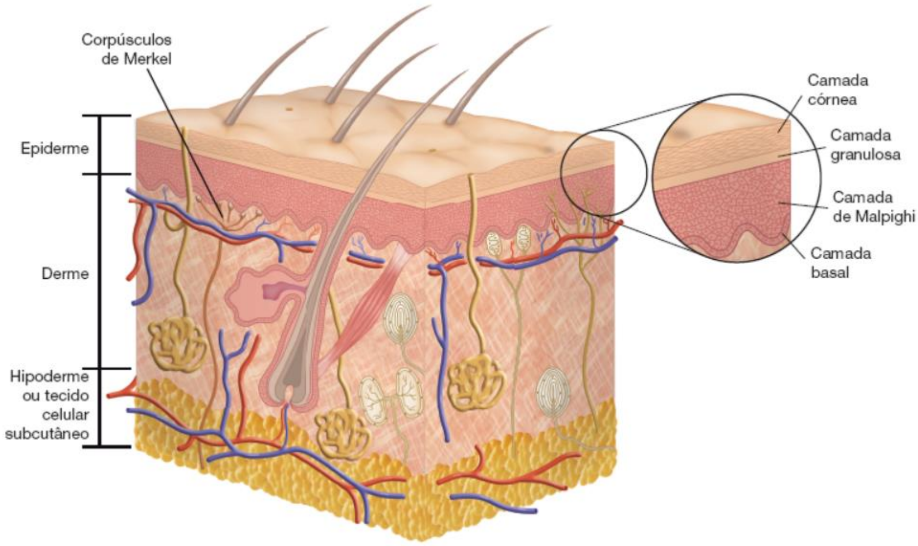
3 RESULTS AND DISCUSSIONS

3.1 SKIN ANATOMY

According to Azulay (2017), the skin is an organ that represents 15% of body weight, and it constitutes the lining of the organism and protects it against harmful physical, chemical, or biological agents, as well as providing sensory information about the surrounding environment.

It consists of three layers represented in Figure 1: epidermis, dermis, and impotence (PORTO; PORTO, 2019).

Figure 1 – Skin components



Source: Porto and Porto (2019).

3.1.1 Epidermis

According to Porto and Porto (2019), the epidermis consists of a thin and external layer of the skin, composed of the layers: basal or germinative, spinous or Malpighi, granulosa, and cornea.

- The germinative is the deepest cell layer, formed by basal and melanocytic cells. Basal or keratinoid cells have constant reproduction and give rise to the other epidermal layers. On the other hand, melanocytes contribute essentially to the coloration of the integument, exerting the protective function against the penetration of ultraviolet rays into the skin.
- The spinous layer consists of keratinocytes that undergo morphological, molecular, and histochemical modifications, acquiring a spine-like configuration. The number of cases varies from 4 to 5 rows and the cells are progressively flattened towards the epidermis.
- The granulosa layer is composed of a group of dark, flattened cells that express keratinization of the epidermis.
- The corneal layer is the outermost, formed by keratin. The successive transformation of keratinocytes into corneal cells is called keratinization and lasts on average 26 to 28 days, the time required for skin renewal.

3.1.2 Dermis

According to Azulay (2017), the dermis is formed of connective tissue, rich in mucopolysaccharides and fibrillar material, in which vessels, nerves, and epidermal appendages are accommodated. Its characteristics are flexibility and elasticity, as well as defense against harmful agents that have overcome the first protective barrier. It is divided into three parts:

- Superficial, in which thin bundles of collagen and large numbers of cells prevail;
- Deep, consisting of dense bundles of collagen;
- Adventitial, consisting of thin bundles of collagen arranged around appendages and vessels.

3.1.3 Hypodermis

The hypodermis is located just below the dermis, is rich in adipose tissue, and represents an important caloric reserve for the body, in addition to functioning as a cushion, protecting against trauma. It consists of connective bundles, elastic fibers, part of the hair follicles, sweat glands, and a large number of fat cells (PORTO; PORTO, 2019).

3.1.4 Skin appendages

The hairs originate in the dermis, and are distributed almost throughout the body, with the function of protecting the skin, and are made up of keratinized cells produced by the hair follicles (PORTO; PORTO, 2019).

The sebaceous glands are attached to the hairs, are located n the dermis, and have the function of lubrication of the skin, and bactericidal action, in addition to the function of regulating body temperature (AZULAY, 2017).

There are two types of sweat glands: eccrine and apocrine. The eccrine sweat glands are located throughout the entire length of the skin, in particular in the palmoplantar and armpit areas. The apocrine sweat glands are located in the axillary, anoperineal, and inguinal regions, in the mount of Venus, and around the nipples (PORTO PORTO, 2019).

The nails are keratin plates located on the last phalanx of the fingers, fixed on the nail bed (PORTO; PORTO, 2019).

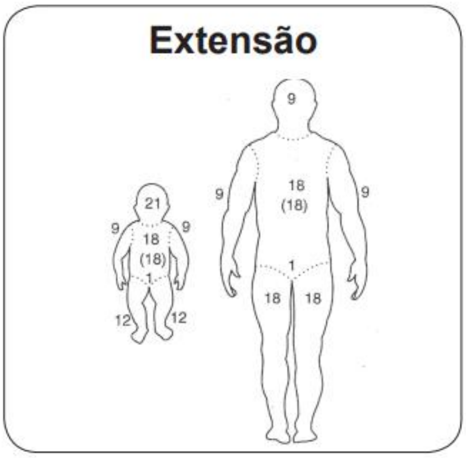
3.2 CLASSIFICATION OF BURNS

The burn consists of a tissue injury as a result of a trauma of thermal origin and is considered one of the greatest aggressions that the body can suffer. It can range from hyperemia and small blisters to severe forms, capable of triggering systemic responses proportional to the extent and depth of the lesion. Thus, they can result in disfigurement, disability, and even death (LIMA; SILVA; COSTA, 2021).

Considering the depth, the mature can be classified into lesions of 1st degree when it reaches m the epidermis and presents with redness, without blisters, slight local edema, and pain is present, 2nd degree, when it reaches the epidermis and part of the dermis, there is the presence of blisters and the pain is accentuated and 3rd degree, when it reaches all layers of the skin, damaging muscles, and bones, generating necrosis of the skin, in this case, pain is absent due to the depth of burns, which damage the nerve endings (VALENTE et al., 2018).

Regarding the calculation of the extension, the rule of nine, elaborated by Wallace and Pulask, is used, which considers m the burned body surface (SCQ). For children, the use of the Lund-Browder diagram is the choice, as a consequence of the different proportions in which the body is subdivided (MARQUES; FAIR; GUIMARAES, 2021). Ambas are represented in Figure 2.

Figure 2 – Rule of Nine in child and adult



Source: Brazil. Ministry of Health (2012).

Another classification is used to define the severity of the burn according to the SCQ and consists of small burns (those with burns of 1st and 2nd degrees with up to 10% of the body area affected), medium burns (have burns of 1st and 2nd degrees, with body area reached between 10% and 25%, or burns of 3rd degree with up to 10% of the body area affected, or hand and/or foot burn) and large burnt (those with 1st and 2nd-degree burns, with body area, affected greater than 26%, or 3rd-degree burns, with more than 10% of the body area affected, or perineum burn) (SANTOS et al., 2017).

3.3 PATHOPHYSIOLOGY OF THE BURN

As described by Lima Junior et al. (2017), these wounds resulting from the burn characterize themselves because it is a solution of continuity produced in a tissue, giving rise to an abnormal space, the interruption of blood flow, the alteration of sensitivity, the accumulation of dead cell elements and a greater or lesser degree of contamination, with or without infection. In the event of tissue damage, the organism initiates a set of events in an attempt to restore its morphophysiological. Thus, an acute inflammatory process is initiated, induced by the lesion itself, followed by the regeneration of parenchymal cells, migration, proliferation, and remodeling of connective tissue, protein synthesis, collagenization, and acquisition of tensile strength.

According to Miranda (2018), the physiological process of tissue repair is divided into five phases: inflammatory, cell proliferation, connective tissue formation, wound contraction, and remodeling.

Phase can be divided into three: acute inflammation, immune response, and chronic inflammation. Acute inflammation consists of an initial response to tissue injury, influenced by the release of inflammatory mediators such as histamine, bradykinin, and prostaglandins, and usually precedes the disinvolvement of the immune response. Chronic inflammation involves the release of several mediators, which are not prominent in the acute response (MIRANDA, 2018).

The burn initially causes local vasoconstriction, followed by the release of numerous vases at and chemotactic mediators which result in the activation of the coagulation cascade and complement. Then, there is vasodilation that promotes the increase in vascular permeability with a displacement of fluids from the intravascular medium to the interstitium, which results in hypovolemia and edema in the burned region. Neutrophils migrate into the lesion, phagocytic microorganisms, and devitalized tissues. Linfocytes act by releasing lymphokines, which mediate the activity of fibroblasts and antibodies, which act to control infections. After five hours of injury, attracted by the degradation products of fibrin, lymphocytes act by killing bacteria, releasing vasoactive mediators and activating growth factors (MARQUES; FAIR; GUIMARAES, 2021).

The proliferative phase consists of angiogenesis, fibroblast proliferation, and epithelialization. Healing only happens when blood flow is restored. The decrease in O2 tension and the accumulation of lactic acid in the wound induce the release of angiogenic factors, which attract mesothelial and endothelial cells. These form tissue meshes, merge, building a new capillary bed, which joins the adjacent ones, revascularizing the wounded tissue, being called granulation tissue (MIRANDA, 2018).

Hypoxia and increased lactate stimulate the formation of collagen by fibroblasts leading to the development of connective tissue. Macrophages and platelets participate by releasing chemokines. The concentration of collagen in the healing area reaches near-normal levels between the seventh and tenth day. On the other hand, the interstitial matrix, produced by fibroblasts and other mesenchymal cells, promotes a homogeneous distribution and tension of the collagen fibers, after which, the wound contraction occurs when myofibroblasts promote the approximation of the edges of the lesion (LIMA JUNIOR et al., 2017).

Around the third week after the trauma, the process of scar maturation begins, with the remodeling of the wound. Collagenase acts by metabolizing the excess accumulated collagen and the metabolic demand are decreased by the regression of the capillary weave. Part of the matrix is disregarded by the net loss of the wound. Depending on the site and structures injured, this process can persist for months or even years (LIMA JUNIOR et al., 2017).

In addition, numerous factors, systemic and local, can interfere with the process of tissue repair. Good blood flow is essential for effective healing because the inflammatory and collagen synthesis phases are dependent on adequate perfusion infections generating a delay in tissue regeneration (LIMA et al., 2017).

3.4 OCCLUSIVE DRESSINGS IN THE TREATMENT OF BURNS

According to Mola et al. (2018), the burn is an infectable wound because it is commonly contaminated by the presence of microorganisms at the site of occurrence of the injury and by its rapid proliferation due to a large amount of devitalized tissue.

In addition, the time required for wound healing is one of the main determinants of the development of complications, and infection is one of the leading causes of death in burn patients (LIMA JUNIOR et al., 2020B). Therefore, the burn site needs precise techniques of cleaning and debridement of non-viable tissues, in addition to other conditions that provide an ideal environment for tissue repair (SILVA et al., 2021).

Miranda and Brandt (2019) state that the ideal dressing for these lesions is the one easily acquired, which has good flexibility and adherence to the bed, resistance to stretching, which is easy to manage, capable of suppressing pain, low cost, is simple storage and, mainly, prevents hydro electrolytic losses, bacterial contamination, favors the reepithelialization of burns and provides the adequate formation of the tissue of Grain.

According to Lima Junior (2017), n the Brazilian public network, the treatment of burns is carried out with silver sulfadiazine ointment, is performed daily dressings or on alternate days, mostly the burns services. In Europe, the United States, and some South American countries, this same treatment is carried out with allograft or xenograft. While there was no Brasil, there was never a record of animal skin in the National Health Surveillance Agency (ANVISA), nor the availability of it by SUS, for use in burn patients.

In second burns the treatment is interdisciplinary. Clinically, adequate water replacement, nutritional support, antibiotic therapy, dressing change, or debridement under analgesia are performed. The occlusive dressings are part of the surgical treatment and aim to prevent hydro electrolytic losses, avoid bacterial contamination, promote epithelialization, or favor the formation of granulation tissue for grafting (MIRANDA, 2018).

In occlusive dressings, temporary skin substitutes can be used, as effective materials in the treatment of burns, these can be changed at regular intervals or maintained until healing, if adherence is good or there is no infection (SANTOS et al., 2017).

Grafts are skin fragments taken from a donor area and moved to the receiving area, which will provide the blood supply. There are several types of grafts about their thickness, such as total, partial, and compound skin grafts; and with their origin as the autograft, coming from the patient himself, the isograft, from one uni vitelline twin to the other, the allograft, between individuals of the same species, and the xenograft, between different species. Another way of occluding the wound is through flaps, which, unlike grafts, have their vascularization through vessels of a pedicle that exerts communication between the rectum and the receiving bed. For it to be performed there must be skin leftovers and mobility in the donor region, so that the pedicle is not pulled with the positioning of the flap (MARQUES; FAIR; GUIMARAES, 2021).

Although the allograft is often considered the gold standard in temporary coverage of the skin, the supply is insufficient to distribute to the more than 30 tertiary burn centers registered in our country, and in addition, there are particular concerns with viral transmission. Correspondingly, one of the difficulties with human skin allograft in Brazil is the presence of only four available skin banks, being them in São Paulo, Rio Grande do Sul, Paraná, and Rio de Janeiro, which, together, do not supply 1% of the country's skin need (COSTA et al., 2019).

Other therapeutic options used are temporary skin substitutes and synthetic/biosynthetic dressings, as they contribute to the reduction in the frequency of dressing changes. However, these materials are not effective in deep burns and have a high cost (MIRANDA; BRANDT, 2019).

In the cases of xenografts, the in that frog skin has previously been used as a treatment for burns in Brazil, it has never been registered by ANVISA. Porcine skin has not been nationally registered for use in burns and presents scarce availability in specialized centers (COSTA et al., 2019).

Therefore, all have been carried out seeking to find curatives that reduce contamination in lesions, favor the healing process and offer better aesthetic results, in addition to presenting low cost and wide availability. Investigations in this sense have been made in Nile tilapia skin (ALVES et al., 2018).

In this scenario, xenograft can be a solution from both a therapeutic and socioeconomic point of view. In addition, the use of Nile tilapia skin has been increasingly studied and has several benefits in the treatment of burns. In Brazil, the wide production of this fish enables access to its skin due to the disposal of this by-product (MARQUES; FAIR; GUIMARAES, 2021).

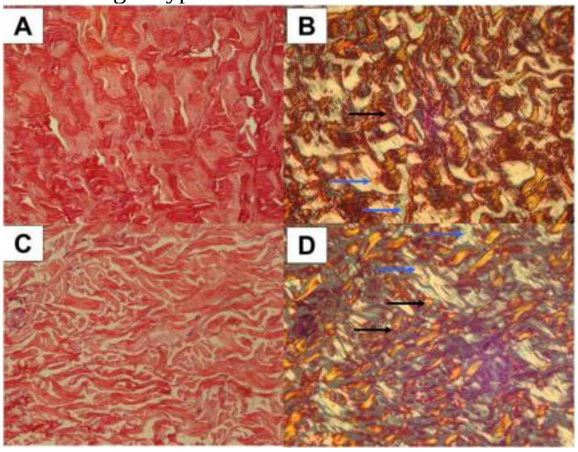
3.5 SKIN OF NILE TILAPIA

The Nile Tilapia (*Oreochromis niloticus*), belongs to the cichlid family and originates from the Nile River basin in West Africa. It is widely disseminated in the tropical and subtropical regions of the world. It has fast growth, easy management, a high yield index, and meat of excellent quality. It was introduced in Brazil in 1971 through the National Department of Works Against Drought (DNOCS) in the dams of the Northeast, later spreading throughout the country. In addition, fish is abundantly found in the state of Ceará, where it is an important commercial product for its availability and low cost (VERDE et al., 2021).

According to Miranda (2018), tilapia skin is a discarded product and only 1% is used in handicrafts. Its resistance and usefulness to the manufacture of accessories have awakened in researchers the possibility of its use as a substitute for human skin in the therapy of burn patients.

The characterization of Nile tilapia skin, from its histomorphological properties, collagen typification, and physical properties was performed by Lima Junior et al. (2017). The researchers concluded that the microscopic characteristics of tilapia skin are analogous to the morphological structure of human skin, as shown in Figure 3, consisting of a dermis composed of compacted, long, and organized collagen bundles, in parallel/horizontal and transverse/vertical arrangement, predominantly of type I. The skin still demonstrated high resistance to traction and extension.

Figure 3 - Collagen profile of tilapia skin (A and B) and human skin (C and D) without (A and C) and with (B and D) light polarization (Picrosirius Red, 400x), showing the distribution of type I (yellow-reddish) and type III (whitish-green) collagen. Black arrow: collagen type I. Blue arrow: collagen type III.



Source: Alves et al. (2018).

The tilapia xenograft has a high concentration of type I collagen and is antimicrobial, anti-inflammatory, antioxidant, antihypertensive, nerve-protective, and stimulating activity for granulation tissue due to its diverse amino acid content. From these peptide properties, it can express epithelial and fibroblast growth factors, which induce differentiation, reepithelialization, and cell proliferation, according to its hydrophilic characteristics, thus accelerating the wound healing process (MARQUES; FAIR; GUIMARAES, 2021).

Research conducted by Lima Junior et al. (2020 a), at the Dr. José Frota Institute, a public hospital in Fortaleza, in stage 2 of the clinical trial on the use of tilapia in the grafting of superficial and deep second-degree burns, presented results such as excellent adherence to the wound, which served as a protective factor against infections and fluid loss, decreased pain and hospital costs. It was also observed the permanence of the graft until complete healing in superficial second-degree lesions, and it was not necessary to change the dressing. Thus, the researcher concluded that these results may indicate a decrease in the incidence of depression or post-traumatic stress disorder in burn patients.

Lima Junior et al. (2020c), conducted a case study of a patient with deep second-degree burns involving mainly the inguinal and genital regions after thermal injury by fire flames, shown in Figure 4. The patient had 13.5% of the body surface burned. The study proved that when tilapia was used, a period of 16 days was required for the re-epithelialization of the burned areas, as shown in Figure 5, while if conventional treatment had been used, it would have taken an average of 3 weeks for total healing. In addition, the use of this xenograft showed results such as the absence of side effects, antigenicity, and toxicity in addition to benefits such as flexibility, adhesion, moisture conservation, reduction of entry of microorganisms, and decrease of dressing exchange. Thus, it was possible to observe good results with tilapia skin, even in regions of the body little explored from this treatment such as the genital and inguinal region, even with the need for skin replacement as in the case report.

Figure 4 – Appearance of the burn before the application of tilapia skin

Source: Lima Junior et al. (2020c).

Figure 5 –Icatrization after removal of tilapia skin on the 14th day of treatment

Source: Lima Junior et al. (2020).

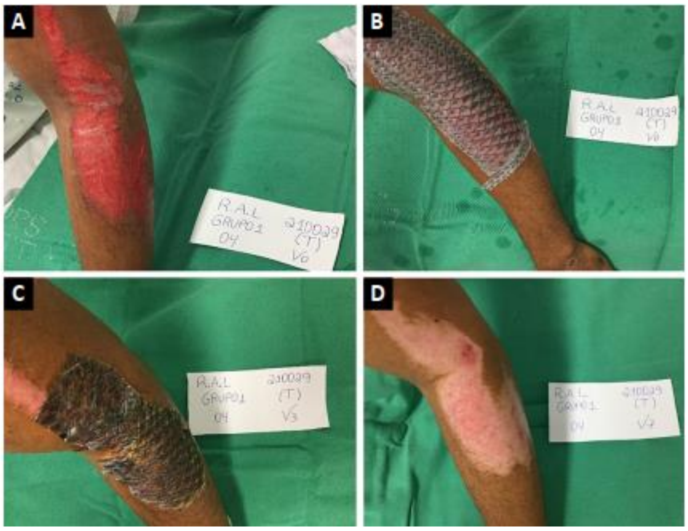
In agreement with the previously mentioned studies, the study by Costa et al. (2019), conducted with a 3-year-old male pediatric patient, showed that treatment with tilapia skin brought good adherence to the wound bed, illustrated in Figure 6. The patient was discharged from the hospital within a total of 10 days, necessary for the complete reepithelialization of the superficial partial thickness burn and no adverse effects were noted. In addition, the author also suggested pain reduction due to the low use of analgesics and low dressing changes in this patient.

Figure 6 – A. Pediatric patient with burns on the left side of the face, neck, anterior chest, abdomen, and left arm; B. Appearance of the wound after removal of necrotic tissue; C. Appearance of the wound after application of tilapia skin; D. Sixth day of treatment, being detected good adherence of tilapia skin to the wound bed; E. Appearance of the wound after removal of tilapia skin, with a total of 10 days required for complete reepithelialization of the wound; F. Result after 1 week of dressing removal.

Source: Costa et al. (2019).

The study by Miranda and Brandt (2019), conducted on 30 adult patients in Recife who suffered superficial and deep 2nd degree burns, ratified that the treatment of burns with Nile Tilapia skin is effective as an occlusive biological dressing, compared to conventional treatment, noting that, the average days of treatment were similar to those treated with dressing with Aquacel AG® for the complete healing or reepithelialization of the wound, as shown in Figures 7 and 8, and the use of the tilapia xenograft showed the lowest occurrence of dressing replacement. Concluding thus, tilapia skin is effective in the management/treatment of 2nd-degree burns.

Figure 7 – Patient treated with occlusive biological dressing with Nile Tilapia skin. A: Evaluation, wound cleaning; B: Curative with Nile Tilapia skin in the 1st clinical care; C: Evaluation of the dressing after 7 days; D: Complete reepithelialization of the wound after 16 days.



Source: Miranda and Brandt (2019).

Figure 8 – Patient submitted to conventional treatment with Hydrofiber with a silver (Aquacel AG).® A: Evaluation, wound cleaning; B: Dressing with Aquacel AG® in the 1st clinical care; C: Evaluation of the dressing after 7 days; D: Complete reepithelialization of the wound after 18 days.

Source: Miranda and Brandt (2019).

Lima Junior et al. (2020b), conducted a study, in which 30 children were selected, half of whom were allocated to the tilapia skin group and the other half to the silver sulfadiazine group. The groups were similar concerning the following baseline variables: age, sex, body mass index, total body surface area (TSA) involved, number of affected segments, and burn mechanism. In this study, it was concluded that the number of dressings and anesthetics was significantly reduced in the group in which tilapia skin was used. In addition, side effects of the use of silver sulfadiazine cream, such as allergic reactions, although unusual and usually mild, are a possibility, while no side effects have been recorded with the use of tilapia skin. In addition, the raw material referred to is a by-product of the processing of tilde, which reflects another benefit in its use, since it generates less cost for the treatment of burns when compared to conventional treatment with silver sulfadiazine (LIMA JUNIOR et al, 2020b).

In a case study conducted on a 23-year-old male patient after a thermal injury in the right and left upper limbs caused by a gunpowder explosion, Lima Junior et al. (2019c), concluded that there was no need to change dressings in the areas covered by tilapia skin, due to the good adherence of the biomaterial to the wound bed, thus contributing to the reduction of patient pain, hospital costs and the overall workload of the health team.

According to Miranda and Brandt (2019), depending on the amount of exudate, the dressing changes are evaluated. However, the more exchanges, the greater the risk of infection, the higher the cost of treatment, and the greater the possibility of the patient feeling pain. Considering these aspects, it is noteworthy that in the cases treated with the skin of Nile-tilapia, there was a lower number of dressing replacements.

3.5.1 Safety data

According to Lima Junior et al. (2019 a), the Aquatic Animal Skin Bank must meet the standards required by the governing bodies, since ANVISA uses the Resolution of the Collegiate Board No. 55, of December 11, 2015, which provides for Good Practices in Human Tissues for therapeutic use, as a guideline to ensure the quality and safety of the tissues that are supplied for therapeutic use. This applies to all Tissue Banks, of any nature, that perform activities with one or more types of tissues of human origin for therapeutic purposes.

The Aquatic Animal Skin Bank of the Center for Research and Development of Medicines has processed more than 5000 Nile tilapia skins since the beginning of its operation. This demonstrates that there is an increasingly viable alternative to meet the country's skin demand in the treatment of burns (LIMA JUNIOR et al, 2019a).

Miranda (2018), states that tilapia skin may contain microorganisms with potential pathogenic effects, facilitating the occurrence of infections. Therefore, for its use as an occlusive dressing, a strict disinfection and sterilization protocol is necessary that does not modify its microscopic and tensiometric properties.

In this context, Lima Junior et al. (2020b), concluded in their research, that the Colony Forming Units found in tilapia skin samples indicated the presence of normal and non-infectious microbiota.

In addition, recent research, carried out by Alves et al. (2018), indicates that the use of chemical sterilization and radiosterilization is effective for the preparation of the skin of Nile Tilapia, as it did not result in variations in the microscopic and tensiometric structure of tilapia skin, which recovered its natural consistency after the rehydration process. The skins used were provided by the Center for Research and Development of Medicines of the Federal University of Ceará, which is responsible for sterilization processing.

4 CONCLUSION

It can be concluded that the use of tilapia skin is a great therapeutic alternative in 2nd-degree burn injuries because it presents good adherence to the wound bed, reduces the number of contamination in the lesions and favors improvements in healing, is a promising method to solve the problem of lack of skin in skin banks in Brazil.

In addition, from the results of the present systematic review, it was possible to verify that the use of tilapia skin as an occlusive dressing contributed to the reduction of the number of days until the complete reepithelialization of the burn and also reduced the number of analgesics used in the treatment of these burns, proving to be a great option to reduce the costs of the treatment of burns.

In addition, tilapia skin has characteristics similar to the morphological structure of human skin and has demonstrated high tensile strength and extension, being proven to be an effective biomaterial for grafting sources.

However, more research is needed in this area to be able to develop better applicability of tilapia skin and for it to be widely disseminated throughout the country.

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