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An alternative for healing through the use of lectins: an overview

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Abstract: The lectins are proteins or glycoproteins, present one or more domain for reversible bonds of high specificity for carbohydrates. These proteins have a wide distribution in nature and can be found in plants, animals and micro-organisms. The lectins have different biological activities, with importance in different areas, this potential is a result of the ability of their domains. Based on this assumption, the work aims to report the lectins that have healing activity and in this way are targets for synthesis of natural products. The healing process becomes therapeutic target in the treatment of patients with diseases in which the tissue repair is slow or flawed. The lectins are studied with pharmaceutical interest, in order to induce the reepithelization process and accelerate healing. From lectins isolated from red algae, it was seen the decrease of areas of subcutaneous lesions and the increase of healing in the skin of animals tested. During the administration of Hydrogel containing Cramoll, the treated groups showed complete reepithelization of skin wounds. While the Frutapin showed high affinity for structures that contains glucose and mannose, presented low cytotoxicity and stimulated cell migration. The Galectins are involved in endogenous regulatory processes of inflammation and tissue repair. Cell-cell contact is a cellular phenomenon that mediates healing and is correlated with Galectin-3 expression, is also associated with the activation of cells that deposit collagen and constitute the dermis. The Galectin-1 accelerated the healing process by activation of the Smad3/NOX4 pathway by the predominant receptor NRP-1 in myofibroblasts. It is known that patients with hypertrophic scars, have low levels of the protein profile of Galectin-7. The lectins have a potential as healing agents and assistants of cell repair, being, therefore an alternative therapeutic source for the synthesis of natural products with healing action.

Keywords: Galectin; Pharmaceutical interest; Skin wounds; Tissue repair.

1. Introduction

The lectins are a heterogeneous group of proteins, able to establish specific and reversible bonds with mono and oligosaccharides (Lis; Sharon, 1986). Carbohydrate binding specificity allows the lectins to act as recognition molecules that are found from simpler organisms until the most complex.

The plants are considered the major source of lectins, being possible to extract and isolate these proteins of virtually the entire plant, including the seeds, bark, leaves, fruits, roots and tubers (Santos *et al.*, 2014).

Several studies describe the biological activities related to lectins, antinociceptive, anti-inflammatory and antihemolytic activity (Lacerda *et al.*, 2015), healing of skin wounds (Brustein *et al.*, 2012) and antifungal activity (Chen *et al.*, 2009). Such activities are related to the main feature of this protein.

Thus, the lectins are a target pharmacist and biotechnology for the production of natural products, based on this assumption, the present study aims to analyze the healing activity assigned the lectins in the literature during the period of 2012 to 2018.

2. Results and Discussion

The healing process becomes therapeutic target in the treatment of patients with diseases in which the tissue repair is slow or flawed, what causes chronic wounds or subcutaneous skin. Natural compounds, such as lectins, are studied with pharmaceutical interest, in order to induce the reepithelization process and speed up healing (Coelho *et al*., 2017).

From the lectin isolated from the red seaweed *Bryothamnion seaforthii*, was seen to decrease areas of injuries and increased healing in the skin of animals tested. It is noteworthy that this lectin has enabled the proliferation of fibroblasts and promoted collagen deposit about the derm (Nascimento-Neto *et al*., 2012).

The lectin called Cramoll 1,4 (pCramoll), is extracted from *Cratylia mollis*, a plant native to caatinga brazilian used popularly in the treatment of wounds. When administered a hydrogel based on pCramoll in models *in vivo,* the groups showed healing of skin wounds due to increased grainy and high production of tissue and collagen fibers (Silva *et al*., 2014).

Sousa *et al.* (2017) used the technique of cell vector, through *Escherichia coli*, to synthesize the lectin Frutapin, from the *Artocarpus incisa.* The same showed high affinity for structures that contains glucose and mannose, based on molecular dynamics simulations. The Frutapin also introduced low cytotoxicity and stimulated cell migration in fibroblasts murinos cells culture 3T3 (Sousa *et al*., 2017).

The Galectins form a class of animal lectins, which are present in mammals, involved in endogenous regulatory processes of inflammation and tissue repair. Cell-cell contact is a cellular phenomenon that mediates healing and is correlated with Galectin-3 expression (Mauris *et al*., 2014). The same is associated with the activation of cells that deposit collagen and forms the derm, as macrophages, fibroblasts and keratinocytes (Brinchmann *et al.*, 2018).

In animal models, was done using knockout for the Galectin-3 gene, and one can observe the lack of tissue fibrosis formation in kidneys, liver, lungs and heart (Gehlken *et al*., 2018).

While Galectin-1 models *in vitro* and *in vivo*, accelerated the healing process by activating Smad3/NOX4 pathway (Figura 1). This process was mediated by the predominant receiver NRP-1 located on the cell surface of myofibroblasts (Lin *et al.*, 2015).

It is known that patients with hypertrophic scars present difficulties to heal skin wounds. As of proteomics analyses, it has been seen that in these patients the protein Galectin-7 presented low levels in dermal tissue, compared to healthy controls. Thus, the pathogenic processes of hypertrophic scars present direct correlation to low levels of Galectin-7 in the derm (Cho *et al.*, 2013).

The prospects promising new therapeutic approaches for the treatment of wounds not healed or slow, such as the Galectins demonstrate potential to promote re-epithelialization skin wounds (Panjwani *et al*., 2014).

Therefore, the lectins are a group of molecules involved, in several immunological processes of healing and cell repair. With more studies on elucidation of the cellular and molecular mechanisms that involve the lectins in this context, it will be possible to trace new therapeutic targets.

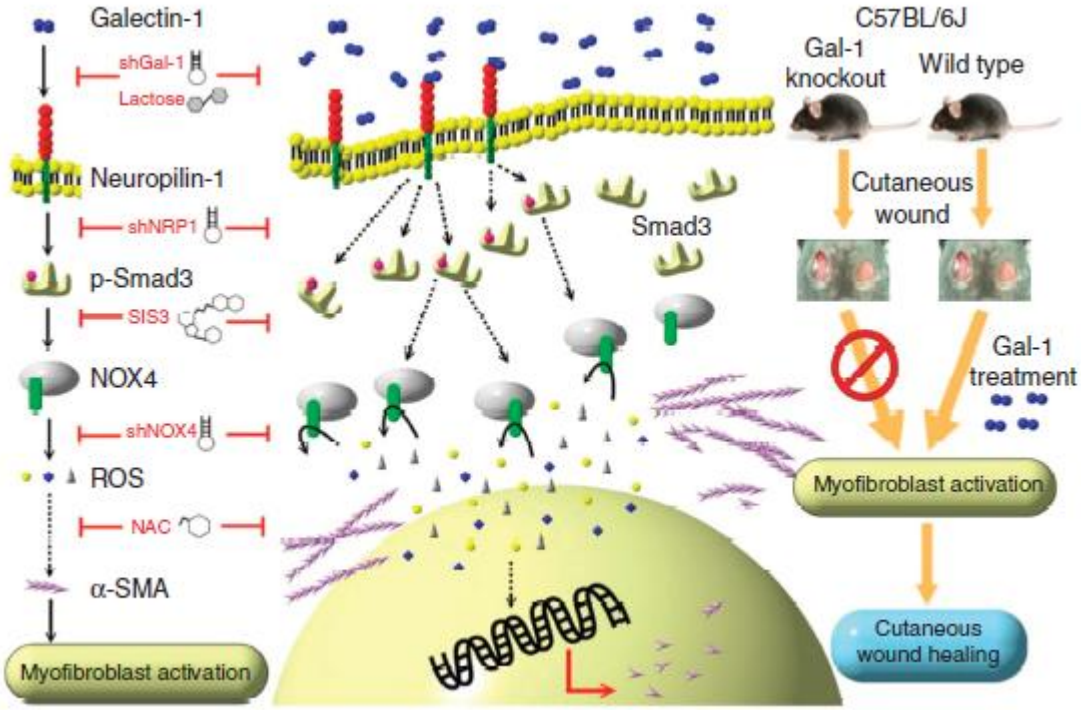

Figure 1. Diagram shows a working model of how Galectina-1 promotes the healing of wounds in mice with excisional wound through the regulation of signaling Smad3 / NOX4 pathway in myofibroblasts. Source: Lin *et al.*, 2015.

3. Conclusions

The lectins are proteins that participate in immunological healing in humans. The plant lectins also showed healing action, which demonstrates the possible potential as healing agents and auxiliaries of cell repair, and therefore a therapeutic alternative source for the synthesis of natural products with healing action.

Conflicts of Interest

The authors declare no conflict of interest.

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