THE INFLUENCE OF COLLAGEN FROM VARIOUS SOURCES ON SKIN PARAMETERS

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Introduction

Collagen, as the main component in extracellular matrix and connective tissue, is the most abundant protein in mammals [1]. Currently, at least 29 types of collagen have been discovered [2,3]. The various types of collagen differ in amino acid sequence, structure and function. Collagen proteins are characterized by a triple-helix structure in which three polypeptide chains are supercoiled into a triple helix. These chains are formed of a repeating triplet: Gly-X-Y, where Gly is glycine, X is generally proline and Y is hydroxyproline [3].

This biopolymer provides the structural integrity and elasticity of the connective tissue and its tensile strength. The skin contain mainly type I, III and V collagen, which determine the tension, elasticity, durability and hydration of skin [4].

Type I collagen is distributed in bone, skin, tendon, ligaments, cornea and other organs [1]. For that reason, it is usually extracted from many natural sources like rat tail tendons or fish wastes.

The aim of this work was to compare the influence of collagen extracted from different species (rat tail tendons, fish scales of northern pike (*Esox lucius)* and skin of *Brama australis*) on skin parameters such hydration, colour, pH and skin's barrier quality.

Materials and Methods

Collagen from rat tail tendons [5] as well as collagens from fish tissues – scales of *Esox lucius* [6] and skin of *Brama australis* [7] were prepared in our laboratory.

Afterwards, 0,1% solutions of each collagen were prepared and applied on the forearm skin. Then, the evaluation of skin condition after application of collagen solutions was made, including hydration, pH, colour and skin's barrier quality.

The hydration level of the skin surface (*stratum corneum*) was determined using Corneometer CM 825 (Courage+Khazaka, Germany). Skin's pH was tested using pH-meter (Elmetron, Poland), skin's barrier quality (TEWL-Transepidermal Water Loss) was examined using Tewameter TM 300 (Courage+Khazaka, Germany) and skin colour was measured by Skin-Colorimeter CL 400 (Courage+Khazaka, Germany).

The measurements had been taken on the skin surface in three places before application and after 10, 20, 30, 60, 120 and 180 minutes from application of the collagens solutions. The results of this measurements were averaged and standard deviation was calculated. All measurements were performed in the laboratory in controlled temperature and humidity conditions (20-22°C, relative humidity 40-60%).

Results and Discussion

The application of obtained collagen from rat tail tendons and fish tissues (marine *Brama australis* and fresh water *Esox lucius*) had initially deteriorated the skin's barrier quality manifesting itself as increase in TEWL. The highest TEWL value was observed after application of collagen from rat tail tendons. The level of TEWL had returned to the initial level 120 minutes after application of collagen solutions from rat tail tendons and *Esox lucius* scales and after 180 minutes in the case of collagen from the skin of *Brama australis*. The solution of collagen extracted from the scales of *Esox lucius* improved the skin's barrier quality – 180 minutes after application of this solution the level of TEWL decreased below the preliminary level.

A slight redness of skin appeared after the application of collagen solutions. Collagen from rat tail tendons made the skin the most red and irritated. Solely after 120 minutes from the application of collagen solution from *Esox lucius* scales the skin colour had returned to the initial level.

The application of collagens solution had improved the hydration of the outer skin layers. After 30 minutes the level of hydration of the skin surface decreased, however, within three hours of the study it remained at a higher level than the initial one regardless of the source of collagen. The solution of collagen from *Esox lucius* scales have the best long-term moisturizing properties. The increase in TEWL could have an indirect impact on corneometric measurements.

Application of rat collagen solution had increased the skin pH, while solution of fish scale collagen had slightly decreased the pH of skin.

The most harmful effect on skin parameters was observed after application of rat tails collagen solution. Collagen extracted from scales of *Esox lucius* showed the most favourable effect on the skin parameters.

Conclusions

The source of collagen have the significant influence on its effectiveness. The greatest virtues for human body were observed in the case of fish collagen extracted from *Esox lucius* scales.

Collagen, due to its biocompatibility, biodegradability and non-toxicity, is widely used for cosmetic, pharmaceutical and biomedical applications. Fish collagen may be a good base for the production of collagen matrices for the skin applications (e.g. for wound dressings), because it exhibit a positive active effect on the skin. Moreover, other active substances can be incorporated into this matrices. For that reasons, fish collagen may be an attractive alternative to mammalian collagen for biomaterials.

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