



Higher accumulation of docosahexaenoic acid in the vermilion of the human lip than in the skin

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論文題目

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(ドコサヘキサエン酸はヒトの皮膚よりも口唇の赤色部位に多く蓄積する)

論文の内容の要旨

[Introduction]

Human lips have important role in phonation, facial expression, mastication, sensation, physical attraction, and intimacy. The vermilion, red area of the lips, shows distinguishing histological features in comparison with the skin. For example, vermilion does not contain hair, sweat glands, and sebaceous glands associated with hair follicles. The epithelium of the vermilion is less keratinized and much thicker compared to that of the skin. Consequently, it shows poor barrier functions and low water holding capacity. Given these characteristic features, the molecular distributions contributing to these intrinsic differences are likely to be distinct between the skin and the vermilion. The knowledge of the vermilion-specific molecular profile is important to identify the endogenous functional molecules in lip and to develop efficient lip care products. Free fatty acids (FFAs) are well-known to play an essential role in maintaining skin homeostasis. FFAs composition and distribution in the skin have been studied extensively. However, FFAs distributions in the vermilion have not been studied before. In this study, we aimed to gain an understanding of the FFAs distribution in the human lip, and thus, to molecularly distinguish the vermilion from the skin.

[Materials and Methods]

The study was approved by the ethical committee of the Hamamatsu University School of Medicine (Code: 18-153) and Niigata University (Code: 2015-5018). The guardians of all participating individuals signed informed consent forms. The human lip specimens (n= 3) trimmed off during cheiloplasty were embedded in carboxymethyl cellulose solution, frozen on dry ice, and stored at -80°C until analysis. The frozen tissues were cryo-sectioned and then analyzed using desorption electrospray ionization-mass spectrometry imaging. After measurement, the tissue sections were subjected to hematoxylin and eosin staining for histological analysis.

[Results]

A total of five ions associated with the FFAs were observed in the mass spectra of the human lip at m/z 253, 279, 281, 303, and 327 and were assigned as palmitoleic acid, linoleic acid, oleic acid, arachidonic acid, and docosahexaenoic acid (DHA), respectively. Oleic acid was detected as the most abundant monounsaturated fatty acids

(MUFA), followed by palmitoleic acid. The relative abundance of the polyunsaturated fatty acids (PUFA) was in the order of linoleic acid > arachidonic acid > DHA. The overall distribution pattern was different between MUFAs and PUFAs (except DHA), whereas the pattern was comparable within both MUFAs and PUFAs. Palmitoleic and oleic acids were highly accumulated in the underlying tissue of the skin in subject 1 and 2. In subject 3, these two FFAs were present notably in the epithelium of the vermilion as well. The distributions of linoleic acid and arachidonic acid were notable in both skin and epithelium of the vermilion. Interestingly, DHA showed a distinctively higher accumulation in the vermilion, particularly in the epithelium of the vermilion in all three subjects. Overlaid transparent images between the ion image and the corresponding histological image showed that DHA is distinctively rich in the viable layer of the lower epithelium of the vermilion but not in the superficial area. This study clearly demonstrated the difference in FFAs distributions between the vermilion and skin.

[Discussion]

FFAs display a highly active metabolism in the skin and are known to have multiple biological activities, including anti-inflammatory and antioxidant properties. Recently, they have emerged as a promising pharmaceutical ingredient in the treatment of skin diseases. Therefore, knowledge of the distribution of these molecules is important for developing a biocompatible drug for a target organ. This study revealed the specific and differential distributions of several FFAs in the vermilion as well as in the skin of the human lip and can thus provide a novel therapeutic strategy for the treatment of lip disorders.

DHA is well known for its multiple beneficiary effects. In the epithelium of the vermilion, DHA may have an antioxidant role and, may thus, protect the lip from aging.

We believe that the findings of this study are informative in obtaining an understanding of the role of FFAs in the function of human lip tissue.

[Conclusion]

In conclusion, the present study showed that the FFAs distributions are different in vermilion and skin. Among the five FFAs detected in this study, DHA is highly distributed in the vermilion and can thereby distinguish the vermilion from the skin. These findings can provide a new therapeutic approach in the treatment of lip disorders.