

Report of “Research Award of Oral Sciences”

Department: Medical Pharmacology

Name: Tomasz Pieczonka

Title: Long-term administration of whey alters atrophy, gene expression profiles and dysfunction of salivary glands in elderly rats

1. Aim of research and results obtained:

A decline in the function of salivary glands, associated with aging is considered to reduce the quality of life by disrupting the normal homeostasis of the oral cavity and increasing the risk of oral and systemic disease. A number of studies have considered whey, a natural by-product of cheese making process, as a source of valuable constituents that possess important nutritional and biological properties – particularly with regard to prevention of diseases and promotion of health during aging.

In the present study we examined the effects of whey supplementation on age-related changes in morphology, gene expression and function of rat salivary glands. Long-term (4-week) drinking of whey prevented and/or restored age-dependent decline of salivary volume, protein concentration, and atrophy of sublingual glands (SLGs) significantly in 88-week-old rats. The transcripts of 42 genes were up-regulated and 7 genes were down-regulated by more than 1.5-fold change with FDR ≤ 0.1 after whey-drinking. The expression levels of genes associated with salivary proteins, tissue repair and salivary gland homeostasis were significantly increased, while those associated with lipid metabolism, transcription regulation, cancer and senescence were decreased. Overexpression of transcription factor AP-2 β (*Tcfap2b*) and androgen-binding protein alpha (*Abpa*), as well as presence of their binding sites (Ap-2 BS and AREs) in the promoter regions of almost all genes altered after whey administration, suggesting that androgen-dependent transcription programmes functioned together with a tissue-specific collaborating factor, AP-2, in sublingual glands (SLGs) of whey-drinking rats.

This is the first study to report that whey administration alters gene expression, thereby preventing and/or restoring age-dependent atrophy and functional decline in the SLGs of aged rats. Our studies will allow the development of new easy applicable and natural product-based method that will be preventative against the onset of atrophy and help to ameliorate age-related declines in the salivary glands function.

2. Self-evaluation of research achievement:

Support from the “Research Award of Oral Sciences” allowed me to cover the costs of manuscript proofreading which was published in the Journal of Functional Foods. Additionally, I was awarded a "Young Research Award" for the presentation entitled "Restoration of physiological age-dependent salivary glands atrophy by whey supplementation in senescent rat model" at Tokushima Bioscience Retreat, Shodoshima, Japan, September 2015.

3. Meeting presentation:

- “Restoration of physiological age-dependent salivary glands atrophy by whey supplementation in senescent rat model”, The 11th Tokushima Bioscience Retreat, Shodoshima, Japan, September 17-19, 2015. Tomasz Pieczonka, Aneta Bragiel, Kana Fukuda, Hideaki Horikawa, Masami Yoshioka, Yasuko Ishikawa. (oral)
- “Mechanisms underlying the activation of $\alpha 1$ -adrenergic receptor-induced AQP5 trafficking in rat salivary glands”, The 11th Tokushima Bioscience Retreat, Shodoshima, Japan, September 17-19, 2015. Aneta Bragiel, Tomasz Pieczonka, Yasuko Ishikawa. (oral)
- “Development of artificial saliva using whey”, The 57th Annual Meeting of Japanese Association for Oral Biology, Satellite Symposia. Niigata. September 11, 2015. Ishikawa Y, Pieczonka T, Bragiel A, Yabuuchi S, Takeuchi Y, Yanagisawa S, Fukuta K, Kim J, Kim D, Yoshioka M. (oral)
- “Muscarinic receptor-induced trafficking of AQP5 to nuclei and its role in rat parotid glands”, The 57th Annual Meeting of Japanese Association for Oral Biology. Niigata. September 13, 2015. Bragiel Aneta, Pieczonka Tomasz and Yasuko Ishikawa. (poster)

4. Journal publication:

- “Long-term administration of whey alters atrophy, gene expression profiles and dysfunction of salivary glands in elderly rats”, Journal of Functional Foods, Volume 21, March 2016, pages 349-358; Tomasz D Pieczonka, Aneta M Bragiel, Hideaki Horikawa, Kana Fukuta, Masami Yoshioka, Yasuko Ishikawa.