OB 3 - Effect of N-Acetylglucosamine on Hyaluronan Production in the Skin Cells

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Hyaluronan, a high-molecular-weight linear glycosaminoglycan consisting of altering glucuronic acid and N-acetylglucosamine (NAG), is well known to hold water, maintain the extracellular space, and facilitate the transport of ion solutes and nutrients. The hyaluronan content in the skin is reported to decline with age, which may contribute to wrinkle formation and the decrease in elasticity of the skin. Chemicals that modulate the synthesis and degradation of hyaluronan are thought to hold potential as new anti-aging ingredients. Our previous study indicated that long-term oral NAG (chitin-derived natural type NAG) supplementation increased the skin hyaluronan content and improved the skin conditions. In this study, we found that NAG increased the production of hyaluronan in cultured normal human keratinocytes. Other monosaccharides, such as glucose, galactose, mannose, N-acetylmannosamine, and glucuronic acid did not affect the hyaluronan production. Moreover, the effect of NAG was found to be specific for hyaluronan, as there was no change in sulfated glycosaminoglycan production. However, the addition of exogenous NAG affected neither hyaluronan syntase (HAS) gene expression nor HAS activity.
It is known that NAG is converted into N-acetylglucosamine 6-phosphate by the action of NAG kinase, and once converted it can enter a pathway to hexosamine metabolism and finally lead to the formation of UDP-N-acetylglucosamine (UDP-NAG), a precursor for synthesis of hyaluronan. Our study showed that keratinocytes expressed NAG kinase constitutively in transcriptional, and the intracellular pool of UDP-NAG was increased by the addition of NAG, suggesting that NAG may act as a precursor in the biosynthesis of hyaluronan in skin cells. Taken together, our findings suggest that NAG is a potential modulator of hyaluronan synthesis of the skin not only by oral supplementation but also by topical application.