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**Astaxanthin improves the proliferative capacity as well as the osteogenic and adipogenic differentiation potential in neural stem cells.**

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### **Abstract**

In the present study, the effect of astaxanthin on improvement of the proliferative capacity as well as the osteogenic and adipogenic differentiation potential in neural stem cells (NSCs) was evaluated. Treatment of astaxanthin-induced activates cell growth in a dose-dependent and time-dependent manner. Results from a clonogenic assay clearly indicated that astaxanthin can actively stimulate proliferation of NSCs. Astaxanthin-induced improvement in the proliferative capacity of NSCs resulted in overexpression of several proliferation-related proteins. Astaxanthin-induced activation of PI3K and its downstream mediators, p-MEK, p-ERK, and p-Stat3 in NSCs resulted in subsequent induction of expression of proliferation-related transcription factors (Rex1, CDK1, and CDK2) and stemness genes (OCT4, SOX2, Nanog, and KLF4). Astaxanthin also improved the osteogenic and adipogenic differentiation potential of NSCs. Astaxanthin-treated NSCs showed prominent calcium deposits and fat formation. These results were consistent with overexpression of osteogenesis-related genes (osteonectin, RXR, and osteopontin) and adipogenesis-related genes (AP and PPAR-gamma) after astaxanthin treatment. These findings clearly demonstrated that astaxanthin acts synergistically on the regulatory circuitry that controls proliferation and differentiation of NSCs. Copyright 2010 Elsevier Ltd. All rights reserved.

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