



# Potential role of phytochemicals in brain plasticity : Focus on polyunsaturated fatty acids

Ji Hwan Kim<sup>1</sup>, Na Young Kim<sup>1</sup>, Jung Woo Ahn<sup>1</sup>, Ji Su Hwang<sup>1</sup>, Hyun Jin Kim<sup>1</sup>, Min Chul Lee<sup>1</sup>

<sup>1</sup>Department of Sports Medicine, College of Health Science, CHA University, Korea.

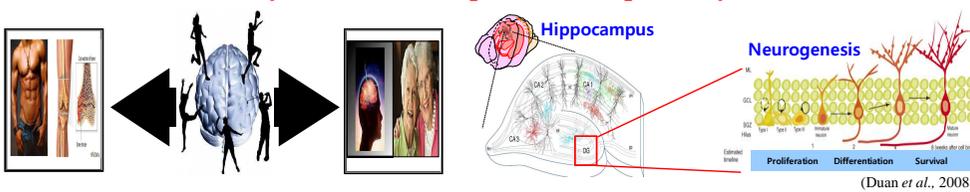


## Abstract

**BACKGROUND:** Functional foods are thought to strongly influence the structure and function of the brain. Previous studies have reported that brain-boosting diets may enhance neuroprotective functions. Certain foods are particularly rich in nutrients like phytochemicals that are known to support brain plasticity; such foods are commonly referred to as brain foods. **PURPOSE:** The purpose of this study was to systematically examine the primary issues related to phytochemicals in the brain. **METHOD:** We briefly explore the scientific evidence supporting the neuroprotective activity of a number of phytochemicals with a focus on phenols and polyunsaturated fatty acids such as flavonoid, olive oil, and omega-3 fatty acid. **RESULTS:** These include (a) the brain-gut-microbiome axis; (b) the effects of phytochemicals on gut microbiome and their potential role in brain plasticity; (c) the role of polyunsaturated fatty acids in brain health; and (d) the effects of nutrition and exercise on brain function. **CONCLUSION:** This study provides evidence supporting the view that phytochemicals from medicinal plants play a vital role in maintaining brain plasticity by influencing the brain-gut-microbiome axis. The consumption of brain foods may have neuroprotective effects, thus protecting against neurodegenerative disorders and promoting brain health.

## Introduction

### Physical exercise improves brain plasticity

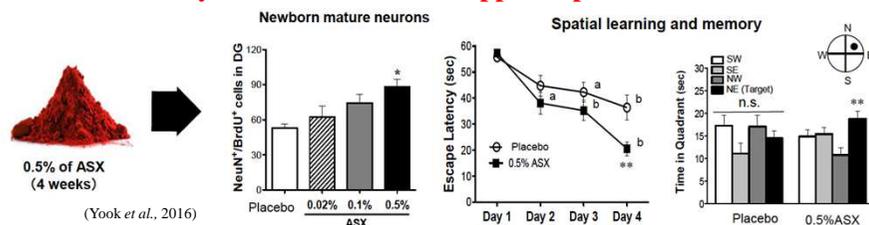


Physical exercise affects with brains and brawn, not only with regard to muscular and bone efficiency, but also our brain and mental functions.

Exercise induces synaptic plasticity and neurogenesis in hippocampus, a site critical for cognitive function.

The brain, arguably the most complex structure in the human body, can be thought of as the control tower of the body; it comprises neurons and neuroglia, which serve to selectively route signals that underlie specific cognitive functions. Cognitive functions, including learning and memory, are influenced by a variety of factors that include aging, stress, enrichments in the environment, and physical exercise. We refer to this phenome-non as brain plasticity, a process in which nutrition intake plays a critical role. Suitable diets are linked to bra-in health and neurodegenerative disorders, are required to maintain proper focus throughout the day. Scientist-ists are subsequently recognizing the strong link between food and brain health.

### Phytochemicals increase hippocampal functions



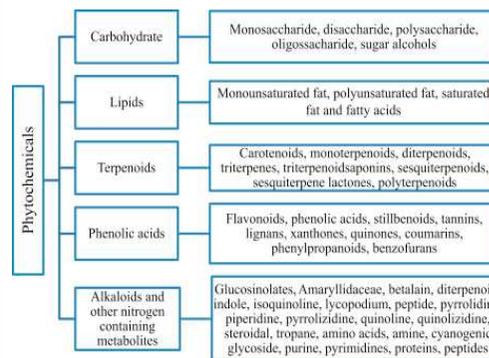
Astaxanthin(ASX) supplement enhanced learning ability and retention of spatial memory. Exercise coupled with ASX-enriched diets may be powerful intervention strategy based on the neurodegenerative diseases involving memory impairment.

## Methods

We assess the efficacy of phytochemicals, focusing on their neuroprotective actions involving changes at the structural, functional, and molecular levels that might contribute to brain plasticity. Neuroprotective actions include the ability of the central nervous system (CNS) to recover from disorders or injuries and ameliorate the effects of alterations in the structures of synapses and neurons due to internal as well as environment changes. Thus, the identification of phytochemical compounds and their multiple targets is a potentially promising therapeutic strategy for promoting health. In addition, the activation of brain plasticity in response to various stressors, by stimulating specific signal transduction pathways and transcription factors, is also discussed.

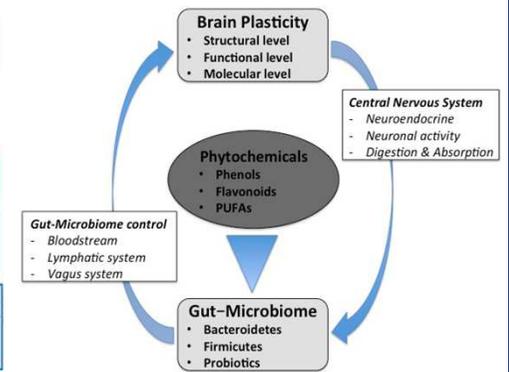
## Results & Discussion

### Categorization of phytochemicals



Phytochemicals are defined as bioactive nutrient plant chemicals in fruits, vegetables, grains, and other plant foods that may provide desirable health benefits beyond basic nutrition to reduce the risk of major chronic diseases

### The brain-gut-microbiome axis



The bidirectional brain-gut-microbiome connections and their relation to phytochemicals. Phytochemicals from medicinal plants play a vital role in maintaining brain plasticity by influencing the brain-gut-microbiome axis.

## Summary & Conclusion

1. We fulfill the potential advantages of brain food, which we believe provides useful information about maintaining proper brain health.
2. The medical community has recommended dietary adjustments as part of treatment plans for various diseases such as obesity, diabetes, hypertension, and hyperlipidemia.
3. Diets may play an important role in how our brain ages and may be involved in the risk of the development of brain diseases.