Association between Cerebral Blood Flow and Cognitive Improvement Effect by *B. mori* Extracted Component

Sang-Hyung Lee, Yong-Sik Kim¹, Sung-Su Kim², Yong Koo Kang², Moo-Yeol Lee³, Kwang-Gill Lee⁴, Joo-Hong Yeo⁴*, Won-Bok Lee² and Dae-Kyong Kim⁵*

Department of Neurosurgery, ¹Department of Pharmacology, College of Medicine, Seoul National University.
Department of ²Anatomy, ³Physiology, College of Medicine, Chung-Ang University, Seoul, Korea
⁴Sericulture and Apiculture Division, National Institute of Agricultural Science and Technology, Suwon, Korea
⁵Department of Phamacy, College of Phamacy, Chung-Ang University, Seoul, Korea

**ABSTRACT**

To investigate whether BF-7, extracted from *Bombyx mori*, improved learning and memory of ordinary people, K-WAIS (Korean version of Wechsler adult intelligence scale) was performed in 4 normal students. Treatment with 400 mg of BF-7 increased mean IQ from 103 to 114. To know how BF-7 plays such a positive role, we measured blood flow to the brain, especially in the area concerned with learning and memory, with Single Photon Emission Computed Tomography (SPECT). Our results showed that blood flow to parahippocampal gyrus and medial temporal areas was increased. Also, our results showed images representing increased blood supply in these areas. Our results suggest that BF-7 effectively helps brain function concerning learning and memory.

**Key words**: *B. mori* fibroin and memory, BF-7, SPECT, Blood flow

**Introduction**

The brain consists of more than 10 billion neurons and many more neuroblasts (Chklovskii et al., 2004; Montgomery and Madison, 2004). These neurons mutually form synapses to perform higher cerebral functions. In order to effectively maintain higher cerebral functions such as memory and learning ability, it requires health of neurons and exchange and integration of mutual information. Therefore, it can be said that the maintenance and development of memory and learning ability are important for maintaining brain health. (Riekkinen et al., 1998; Gibbs et al., 2004; Seeger et al., 2004).

Recently, there have been reports that silk fibroin hydrolysatate BF-7 enhanced memory and learning ability (Chae et al., 2004; Lee et al., 2004). Moreover, results have shown that BF-7 protects the brain from various forms of daily stress. Brain physiological protection and functional improvement have great medical value.

In order to medically verify the effects of BF-7, this study was conducted on four volunteers in their early 20s to investigate whether BF-7 improved memory and learning ability and how it has such effects if it really does. For these purposes, this study confirmed the active brain regions related to memory and learning ability using single photon emission computed tomography (SPECT) to measure local cerebral blood flow.

*Corresponding author. E-mail: dkkim@cau.ac.kr, y610525@rda.go.kr
Materials and Methods

1. Silk Fibroin Hydrolysate
The silk fibroin hydrolysate was provided by National Institute of Agricultural Science and Technology. It was prepared by the method previously represented (Yeo et al., 2004).

2. Examinees and Brain Function Tests
The 4 volunteers (2 males and 2 females) in their early 20s were administrated 2 capsules of BF-7 twice a day (400mg per day) for 3 weeks. K-WAIS (Korean version of Wechsler adult intelligence scale) for measuring intelligence and SPECT for investigating brain blood flow was tested before and after taking BF-7.

3. SPECT Scanning
Siemens MultiSPECT III (Siemens Medical Systems, Inc. Hoffman Estates, Ill, USA) was used to obtain Tc-99m ECD SPECT images. With regard to the image acquisition, 120 frames were obtained by rotating 360 degrees at 3-degree intervals with the use of a low energy high resolution collimator. Scanning was performed 30 minutes after administering Tc-99m ECD 11.1 MBq/kg (0.3 mCi/kg) to the subjects. During the scanning, they minimized the movement of their heads in a comfortable position. Scanning was performed again after administration of BF-7 for 3 weeks.

4. Analysis of SPECT Images
Statistical parametric maps consisting of cerebral blood flow SPECT images were created by analyzing SPECT images in SPM99 (Statistical Parametric Mapping 99) using Matlab (Mathworks Inc. USA).

Results and Discussion

Students in their early 20s were used to investigate whether BF-7 improved memory and learning ability and how it has such effects if it really does. For these purposes, this study confirmed the active brain regions related to memory and learning ability using single photon emission computed tomography (SPECT) to measure local cerebral blood flow. The average age of four volunteers (2 males and 2 females) participated in this study was 23 years. The mean IQ was 103 before taking BF-7 and increased to 114 after daily administration of 400 mg of BF-7 for 3 weeks (Table 1). This agrees with the results in many various reports that BF-7 improved memory and learning ability.

Table 1. Demographic and psychometric variables in patients and controls

<table>
<thead>
<tr>
<th>Variables / groups</th>
<th>Pre-Treatment</th>
<th>Post-Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Male : Female</td>
<td>2 : 2</td>
<td></td>
</tr>
<tr>
<td>Age (yrs)</td>
<td>23</td>
<td></td>
</tr>
<tr>
<td>K-WAIS score</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Range</td>
<td>98-107</td>
<td>109-122</td>
</tr>
<tr>
<td></td>
<td>103</td>
<td>114*</td>
</tr>
</tbody>
</table>

K-WAIS: Korean version of Wechsler intelligence adult scale *

Table 2. Comparison of Tc uptake(%) before and after BF-7 administration

<table>
<thead>
<tr>
<th>Regions</th>
<th>Pre-Treatment</th>
<th>Post-Treatment</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>parahippocampal gyrus</td>
<td>101.1</td>
<td>105.4</td>
<td>p &lt; 0.05</td>
</tr>
<tr>
<td>medial temporal area</td>
<td>95.2</td>
<td>104.4</td>
<td>p &lt; 0.05</td>
</tr>
</tbody>
</table>
blood flow and glucose consumption. According to the results of this study, an increase in glucose consumption colored in yellow was found in the parahippocampal gyrus and medial temporal areas. This means that the regions controlling cognition, memory, and learning ability effectively function by administration of BF-7 and there is an increase in blood supply and glucose consumption.

References


