SHORT COMMUNICATION

COGNITIVE ENHANCING ACTIVITY OF DOCOSAHEXAENOIC ACID AND GAMMA-LINOLENIC ACID IN LEAD INDUCED AMNESIA

Veena Sharma¹* and Sachdev Yadav²

¹Department of Biosciences and Biotechnology, Banasthali University, Tonk-304 022, Rajasthan, India
²Department of Pharmacy, Banasthali University, Tonk-304 022, Rajasthan, India

*E-mails: drvshs@gmail.com, sachdev_y@yahoo.com
Tel.: +91-9414543808, +91-9887886762.

Received: March 4, 2012 / Revised: August 20, 2012 / Accepted: August 22, 2012

The purpose of this study was to characterize the putative cognitive enhancing activity of docosahexaenoic acid and gamma-linolenic acid in lead induced amnesia. PRO-PL dietary supplement containing docosahexaenoic acid and gamma-linolenic acid was administered to study cognitive enhancing activity using elevated-plus maze model and employing piracetam (200 mg/kg i.p.) as the standard drug. In the elevated–plus maze, there was significant increase in time spent and number of entries into the open arms at doses of 100 and 200 mg/kg. Dietary supplement containing docosahexaenoic acid and gamma-linolenic acid showed prominent cognitive enhancing activity in mice.

Key words: Docosahexaenoic acid, γ-Linolenic acid, Amnesia, Cognitive enhancing activity.

INTRODUCTION
Alzheimer’s disease is a progressive neurodegenerative brain disorder that occurs gradually and results in memory loss, unusual behavior, personality changes and ultimately death (Jewart et al 2005). It is a chronic, progressive disabling organic brain disorder characterized by disturbance of multiple cortical functions, including memory, judgment, orientation, comprehension, learning capacity and language. Nootropic agents such as piracetam (Scheuer et al 1999), pramiracetam, aniracetam (Cumin et al 1982) and choline esterase inhibitors like donepezil are presently used for improving memory, mood and behavior. As the disease progresses, people with Alzheimer’s become unable to care for themselves and loss of brain cells eventually leads to failure of other systems in body. However, the resulting adverse effects associated with these agents have limited their use (Katzman and Kawas, 1988) and it is worthwhile to explore the utility of dietary supplement containing docosahexaenoic acid and gamma-linolenic acid (Figure 1) in the prevention and treatment of various cognitive disorders.

Fig. 1. Three-dimentional models of (a) docosahexaenoic acid [DHA] (b) γ-linolenic acid [GLA]

MATERIALS AND METHODS
Drugs and Chemicals
The requirements were procured as Piracetam Injection (Nootropil, UCB India Pvt Ltd,
Mumbai), PRO-PL (British Biologicals, Bangalore). Distilled water was used throughout the studies.

**Animals**

Swiss albino mice of either sex (young, age 10-12 weeks, 20-25 g) were used for the study. Animals were housed in polypropylene cages and maintained under standard laboratory environmental conditions; temperature 25 ± 2°C, 12 h dark cycle and 50 ± 15 relative humidity with free access to food and water ad libitum. Animals were acclimatized to laboratory conditions before the test. Each group consisted of six (n=6) animals. All the experiments were carried out during light period (08:00-16:00). The studies were carried out in accordance with the guidelines given by Committee for the Purpose of Control and Supervision on Experiments on Animals (CPCSEA). The Institutional Animal Ethical Committee of Banasthali University, Rajasthan approved the protocol of the study (Ref. No. IAEC/257).

**Treatment schedule**

Animals were divided into 6 groups having 6 animals each. Group I – Control; Group II – Control + Dietary supplement; Group III – Lead nitrate (4.5%); Group IV – Lead nitrate (4.5%) + Dietary supplement; Group V – Lead acetate trihydrate (4.5%); Group VI – Lead acetate trihydrate (4.5%) + Dietary supplement.

**Experimental method**

The elevated plus maze served as the exteroceptive behavioral model (wherein the stimulus existed outside the body) to evaluate learning and memory in mice whereas, passive avoidance apparatus is a punishment based exteroceptive model used to test long-term memory (Parle and Singh, 2004). The apparatus consisted of two open arms (16 cm × 5 cm) and two covered arms (16 cm × 5 cm × 12 cm). The arms extended from a central platform (5 cm × 5 cm) and maze was elevated to a height of 25 cm from the floor.

On the first day, each mouse was placed at the end of an open arm, facing away from the central platform. Transfer latency (TL) was taken as the time taken by the mouse to move into any one of the covered arms with all its four legs. TL was recorded on the first day. If the animal did not enter into one of the covered arms within 90 sec, it was gently pushed into one of the two covered arms and the TL was assigned as 90 sec. The mouse was allowed to explore the maze for 10 sec and then returned to its home cage.

Memory retention was examined 24h after the first day of trial on the second day (Dhingra et al 2004; Itoh et al 1990; Parle and Dhingra, 2003).

**Statistical analysis**

Data obtained from pharmacological experiments are expressed as mean ± SEM. Difference between the control and the treatments in these experiments were tested for significance using ANOVA followed by Tukey’s multiple comparison test (Table 1).

**RESULTS**

In elevated-plus maze, there was significant increase in time spent and number of entries into the open arms. Dietary supplement containing docosahexaenoic acid and gamma-linolenic acid showed prominent neuroprotective and anti-amnesic effect in lead induced swiss albino mice.

<table>
<thead>
<tr>
<th>Table 1. Transfer latency (sec) showed by different groups</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Treatment</strong></td>
</tr>
<tr>
<td>Control</td>
</tr>
<tr>
<td>Control + Dietary supplement</td>
</tr>
<tr>
<td>Piracetam</td>
</tr>
<tr>
<td>Lead nitrate</td>
</tr>
<tr>
<td>Lead nitrate + Dietary supplement</td>
</tr>
<tr>
<td>Lead acetate trihydrate</td>
</tr>
<tr>
<td>Lead acetate trihydrate + Dietary supplement</td>
</tr>
</tbody>
</table>

Values are expressed as mean ± S.E.M., n=6; ANOVA followed by Tukey's multiple comparison test. *P ≤ 0.01, **P ≤ 0.5 vs Piracetam.
REFERENCES


http://lansbury.bwh.harvard.edu/3d_model_of_dha.htm
http://en.wikipedia.org/wiki/Gamma-Linolenic_acid

*****