

# Potency of Pegagan (*Centella asiatica*) as Braintonic to Improve Intelligence of Young Generations in Indonesia

Astrisia Artanti and Diana Lo

Department of Food Science and Technology  
Bogor Agricultural University, Indonesia

## Abstract

Pegagan (*Centella asiatica*) is a small herbaceous plant belongs to the family *Mackinlayaceae* or the subfamily *Mackinlayoideae* of family *Apiaceae*. It is one of the indigenous crops from Indonesia. However, Indonesian people rarely use pegagan in their daily consumption. Only local community in West Java and Mataram consume pegagan as fresh vegetables or extract powder. It is believed that pegagan can modulate dendritic branching pattern, increase endogenous antioxidant enzymes, and increases the number of possible synaptic connections with the neurons. Those benefits had been observed by the improvement of learning and memory on the treated mice with pegagan. Pegagan acts as a powerful "brain food" and is known for its ability to enhance mental ability. Pegagan fits to be applied in Indonesia to solve human resources problem to develop school-age children and bring forward this nation. Previous studies show that daily consumption with pegagan brain tonic, also known as jamu, can improve memory ability on 50 years old adults with ratio 70% to 30%. Treatment during developmental stage of brain with pegagan extract can influence the neuronal morphology and promote the higher brain function of juvenile and young adult mice.

The stimulation of neurosecretory activity of the cholinergic neurons appears to be involved, but the exact mechanism of this nootropic effect still not understood. Because of the great potential to grow in Indonesia and as brain tonic, pegagan can be applied to improve intelligence of Indonesian community especially young generations through school-age children.

## Introduction

Human resources development play important role in long term national development. If it is compared to other developing countries, Indonesia's human resources are still low and need to be improved to compete

in the global era. Indonesian development index in 2005 showed that Indonesia has human development index (HDI) about 0,728 and it is lower than Vietnam and Occupied Palestinian Territories (Table 1).

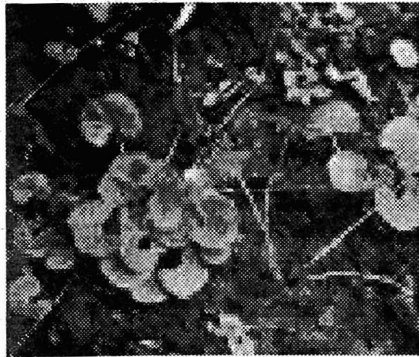
**Table 1. Indonesia's human development index 2005**

HDI value	Life expectancy at birth (years)	Adult literacy rate (% ages 15 and older)	Combined primary, secondary and tertiary gross enrollment ratio (%)	GDP per capita (PPP US\$)
1. Iceland (0.968)	1. Japan (82.3)	1. Georgia (100.0)	1. Australia (113.0)	1. Luxembourg (60,228)
105. Viet Nam (0.733)	98. Saint Kitts and Nevis (70.0)	54. China (90.9)	108. Turkey (68.7)	111. Egypt (4,337)
106. Occupied Palestinian Territories (0.731)	99. Guatemala (69.7)	55. Sri Lanka (90.7)	109. Albania (68.6)	112. Jamaica (4,291)
<b>107. Indonesia (0.728)</b>	<b>100. Indonesia (69.7)</b>	<b>56. Indonesia (90.4)</b>	<b>110. Indonesia (68.2)</b>	<b>113. Indonesia (3,843)</b>
108. Syrian Arab Republic (0.724)	101. Suriname (69.6)	57. Viet Nam (90.3)	111. Guatemala (67.3)	114. Turkmenistan (3,838)
109. Turkmenistan (0.713)	102. Thailand (69.6)	58. Myanmar (89.9)	112. Azerbaijan (67.1)	115. Syrian Arab Republic (3,808)
177. Sierra Leone (0.336)	177. Zambia (40.5)	139. Burkina Faso (23.6)	172. Nigeria (22.7)	174. Malawi (667)

Young generation is the main point to bring forward this nation to be a better country through development of school-age children. However, the fact shows that the capacity of Indonesia's school-age children still needs to be improved, because not all of them could pass the national exam. Government notice this problem and try to cope it with some programs in education,

funding, healthcare, and also child nutrition. Recently, the Government has conducted some programs to improve the quality of children nutrition. However, the Government hasn't provided foods that can improve brain ability especially brain memory.

One of food that is believed could act as brain tonic in Indonesia is pegagan. This myth is believed by people near Java and Bali. Pegagan is indigenous plant from Indonesia (Figure 1). However, Indonesian people are rare to use pegagan in their daily consumption. Only local community in West Java and Mataram consume pegagan as fresh vegetables or extract powder. The composition of pegagan is shown on Table 2. The objective is to study the potency of pegagan as brain tonic to improve intelligence of Indonesian young generations.



**Figure 1.** Pegagan (*Centella asiatica*)

## **Methodology**

Literature is gathered by searching books, thesis, and electronic journal to get more data in understanding the problem. The data that was gathered, selected and analyzed.

**Table 2.** Composition of Pegagan

Component	Content
	per 100g wet basis
Energy	52 kkal
Water	88 g
Protein	3 g
Fat	2.7 g
Fiber	1.92 g
Ash	2.54 g
Carbohydrate	3.81 g
Mineral	per 100 gram dry basis
Calcium	2425 mg
Phosphor	327 mg
Sodium	16 mg
Manganese	23 mg
Copper	7 mg
Zink	20 mg
Magnesium	271 mg
Iron	18 mg

Source: Odhav *et al.* 2007

## Results and Discussion

### Pegagan's Availability in Indonesia

Pegagan (*Centella asiatica*) grows in humid area under trees to provide medium light intensity and other wild areas. Environment factor is important role for pegagan growth and production. Pegagan grow optimum in 200 – 800 meters above sea level also known as low land areas. But pegagan also grows well until 2500 meters above sea level. Indonesia is country that has wide area between 200 – 2500 meters above sea level which means there was still an opportunity to enlarge the pegagan production in Indonesia. Table 3 shows the areas which potential to grow pegagan in Indonesia.

Pegagan usually have optimum growth in medium humid, nutritious, and survive in dry land. Pegagan also depend on climate and rainfall. Good conditions of pegagan in regulate the light intensity around 30-40%. Its growth position under trees significantly improved because the medium light intensity helps pegagan leaves prevent their water component stay inside and fresh.

**Table 3.** Areas appropriate to grow pegagan in Indonesia

Island	Wet Climate (ha)	Dry Climate (Ha)
Sumatera	22,369,665	517,826
Jawa	4,566,395	1.073,195
Bali & Nusa Tenggara	161,500	2,813,580
Kalimantan	25,427,745	-
Sulawesi	3,469,540	1,106,460
Maluku + Irian	12,288,920	582,825
Total	68,283,790	6,850,050

Source: Puslitbangtanak, 2002

### **Mechanism of Pegagan (*Centella asiatica*) in Improving Learning and Memory Ability**

Pegagan consist of asiaticoside, thankunside, isothankunside, madecassoside, brahmoisde, brahminoside, brahmic acid, madasitic acid, hydrocotyline, mesoinositol, centellose, caretenoids, mineral (such as potassium, sodium, magnesium, calcium, iron), and vellarine. Glycoside triterpenoida (asiaticoside) is predicted has roles in recovering from disease. Asiaticoside also has a role as anti-lepra. Generally, pegagan can be *hepatoprotector* that protect heart cell from toxics (Katare *et al.*, 2001).

Administration of pegagan also increased the performance in the radial arm maze test (Rao *et al.* 2005). The early postnatal stage of rodents is a vulnerable period in brain development and treatment with external agents at this period can bring about significant changes in the cognitive behavior. The hippocampus is a critical integrative center involved in the regulation of exploratory activities and for incorporating spatial information. The CA3 region forms an essential link in the hippocampal trisynaptic circuit and is implicated as substrate for learning and memory, and CA3 field appears to be the major focus of integration of intrahippocampal activity. An increase in the dendritic arborization synapses in CA3 pyramidal neurons of the hippocampus results in the facilitation of acquisition and performance in the spatial learning tasks. Administration of the extract during early postnatal stages significantly increased dendritic arborization of CA3 pyramidal neurons of mouse hippocampus. The increase in dendritic arborization increases the number of possible synaptic connections with the neurons (Rao *et al.*, 1999).

Hippocampal acetylcholine (ACh) release increases during performance of a learned spatial memory task and improvement of radial arm maze performance was positively correlated to increase in ACh release (Rao *et al.* 2005). Up-regulations of ACh are sufficient to reverse the memory deficits. Increased AChE levels might reflect the enhancement of ACh release, which could facilitate the synaptic transmission of CA3 pyramidal neurons. Increase in the AChE activity might modulate the dendritic branching pattern in specific brain regions. Treatment during postnatal development with *C. asiatica* increased the AChE level as well as enhanced the arborization of apical and basal dendrites of CA3 pyramidal neurons of the hippocampus, which, in turn, could have led to the higher cognitive performance of the treated animals. The results of studies at 6 months of age demonstrate that the treatment during developmental stages improves the cognitive function not only in the juveniles, but also in the adult mice. Tang (2001) reported that early environmental manipulation could result in enhanced hippocampal dependent learning not only during infancy but during aging as well and suggested that the early life stimulation-induced learning enhancement also persists into adulthood. The increase in the neuronal connections in CA3 neurons of hippocampus and AChE activity induced by administration of *C. asiatica* during developmental stages persisted to adulthood and enhanced the learning and memory in adult mice. This fact has also been proved in the research done by Wibisono and Dwiyani (2005) on 35 persons that always consume pegagan and 35 persons that had never consumed pegagan that was 65 years old. This result shows the persons that consume pegagan could solve the memory test better than the persons that did not consume pegagan. The persons that consume pegagan could get the score about 77% and the person that had never consumed pegagan get a score about 33%. In a similar type of study, Brady *et al.* (1989) observed that perinatal supplementation of choline alters the neurogenesis and influences their later synaptogenesis in hippocampal and cortical regions of the adult mice leading to enhanced learning and memory.

Treatment with *C. asiatica* extract during the early postnatal developmental stages, when the higher brain centers are maturing, can produce long lasting beneficial effects on the mouse brain. Beneficial effects on cognitive functions are probably mediated through their effect on cholinergic system and by influencing the neuronal morphology. The exact mechanism of this nootropic effect has not been understood yet. However, stimulation of

neurosecretory activity of the cholinergic neurons appears to be involved. Extract of *C. asiatica* (whole plant) has also been reported to increase the endogenous antioxidant enzymes in the rat brain (Kumar et al., 2002). But their role in the nootropic effect of the plant has to be investigated. The present results provide scientific evidence to support the traditional use of *C. asiatica* to enhance learning and memory in children and adults.

### **Potency of Pegagan (*Centella asiatica*) in Young Generation**

Previous study shows that treatment during developmental stage of brain with *C. asiatica* extract can influence the neuronal morphology and promote the higher brain function of juvenile and young adult mice (Rao et al. 2005). This result of study related with school-age children, especially elementary school student whom still undergo brain development.

Pegagan, which contains potential compounds to improve intelligence through learning and memory ability, has to be processed to make a product either food or beverage that can attract elementary school student to consume it. Pegagan can be processed to brain tonic as solution to intelligence problem in Indonesia. Elementary school students fit as the target of the program because they are still in a development brain stage and allowed to consume variety of food and beverages. *Brain tonic* is a drink which gives positive effect to the brain, like improve retrieve, learning, and memory ability. Children in this stage already can receive brain tonic product.

### **Conclusion**

Pegagan (*Centella asiatica*) have a great potential as brain tonic to improve brain memory of Indonesian youth generation because it is indigenous and suitable to grow in Indonesian climate, not already exploring yet. Pegagan also has been proved in improvement of brain memory in rats. Pegagan give significant effect to the developing brain so it can be claimed as brain tonic for young generation, such as elementary school students.

---

## Suggestion

- Socialization to mothers about the important role of pegagan in improving children brain memory is needed. This will help promoting the usage of pegagan as traditional herbal brain tonic.
- Need appearance and flavor modification in pegagan brain tonic processing in order to make it acceptable by children.

## References

- Brady DR, Phelps PE, Vaughn JE.1989. Neurogenesis of basal forebrain cholinergic neurons in the rats. *Dev Brain Res* 47: 81– 92.
- Januwati M and Yusron M. 2005. Cultivation of Pegagan Plant. Circular No. 11. Balai Penelitian Tanaman Obat dan Aromatika, Bogor. (in Indonesian)
- Katare SS and Ganachari MS. 2001. Effect of *Centella asiatica* on hypoxia induced convulsions and lithium-pilocarpine induced status epilepticus and anti lipid peroxidative activity. *Ind J Pharmacol* 33:128.
- Kumar MHV, Gupta YK. 2002. Effect of different extracts of *Centella asiatica* on cognition and markers of oxidative stress in rats. *J Ethnopharmacol* 79:253–60.
- Puslitbangtanak. 2002. Determination of location and land preparation in <http://www.indobiofuel.com>. (in Indonesian)
- Rao MKG, Rao MS, Karanth S, Rao GM. 1999. Effect of *Centella asiatica* extract on rat CNS — a functional and morphological correlation. *Indian J Pharmacol* 31:56.
- Rao Sulochana, Chetana M, and Devi Uma. 2005. *Centella asiatica* treatment during postnatal period enhances learning and memory in mice. *Journal Physiology & Behavior* 86: 449 – 457.
- Tang AC. 2001. Neonatal exposure to novel environment enhances hippocampal- dependent memory function during infancy and adulthood. *Learn Memory* 8:257 – 64.
- Wibisono and Dwiyani .2005. Analyzing the benefit of Pegagan Brain Tonic as a form of a wisdom local. Medicine Paper, Mataram. (in Indonesian)
-