

#### 4. Discussion

In the present study, the aqueous extract of mango pulp (Namdokmai variety) can attenuate the cognitive impairment and neurodegeneration in hippocampus.

It has been shown that different types of memory are associated with numerous neurotransmitters to a different degree. Previous studies showed that the performance of rats in Morris water maze test involved the function of acetylcholine (Myhrer, 2003). Therefore, we also determined the effect of a mango pulp extract on the acetylcholinesterase activity in hippocampus. The results showed that the pulp extract could inhibit the activity of acetylcholinesterase enzyme in hippocampus, an area contributing the important role on spatial memory. In accompany with the inhibition of acetylcholinesterase activity, we also found the reduction of malondialdehyde, a lipid peroxidation product in hippocampus. The changes of malondialdehyde indirectly indicated the improvement of oxidative stress which in turn decreased neurodegeneration in hippocampus. Recent findings also demonstrated that neurodegeneration in hippocampus was associated with the severity of memory impairment (Cassel et al., 2008). Thus, the increased neurons density in various subregions of hippocampus in rats subjected to mango pulp extract observed in this study were corresponding with previous data. Based on these pieces of information, the possible underlying mechanism of the mango pulp extract in this study might be partly occur via the inhibition of AChE which in turn enhanced the available ACh in the hippocampus leading to the enhanced learning and memory. Moreover, the decreased oxidative stress in hippocampal area also increased the neuron density in the mentioned area and resulting in the enhanced learning and memory capability. Our results also showed the differences in area vulnerability to the extract. The possible explanation might be related to the differences in metabolic activity among various subregions of hippocampus which gave rise to the difference in free radicals formation. In addition, the differences in the distribution of iron and scavenger enzymes. Moreover, the current data also failed to show the dose dependent response study. This might be associated with the following phenomena 1) the masking effect of other ingredients 2) the complex relationship between the cognitive function and the concentration of active substance existing in the mango pulp extract.

The previous study had demonstrated that gallic acid, a polyphenolic compound, is a ferric (Fe<sup>3+</sup>) chelator which in turn could attenuate the oxidative damage (Perron, Brumaghim, 2009). In addition, recent findings showed that long term administration of beta carotene also improve cognitive decline in men (Grodstein et al., 2007). Therefore, it was also possible that the neuroprotective effect of the pulp extract might be associated with the phenolic and beta carotene contents or the interaction of various active compounds in the mango pulp extract. The precise understanding is still required further investigation.

#### Conclusion

Mango or *Mangifera indica* (Namdokmai variety) one of the premier tropical fruits in Thailand clearly demonstrates the neuroprotective and cognitive enhancing effect in cognitive deficit conditions associated with the cholinergic function such as aging and Alzheimer's disease. Therefore, Namdokmai is the potential functional food which provides the beneficial effect to attenuate the cognitive decline and neurodegeneration commonly found in the

elderly. Thus, the aqueous mango pulp extract can be implement as functional beverage for the elderly. However, further clinical trial study is also required.

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#### **Conflict of interest**

None