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Anti-cholinesterase activity of bark and leaf extracts of Ceylon cinnamon (*Cinnamomum zeylanicum* Blume) *in vitro*

W P K M Abeysekara,[1] G A S Premakumara[1*] and W D Ratnasooriya[2]

[1]*Industrial Technology Institute (ITI), 363, Bauddhaloka Mawatha, Colombo 07*
[2]*Department of Zoology, Faculty of Science, University of Colombo, Colombo 03*

Ceylon cinnamon (CC) (*Cinnamomum zeylanicum* Blume) known as 'true cinnamon' in the world has been used as a spice in Sri Lanka for centuries. Although cinnamon bark is reported to have many biological activities, its anti-cholinesterase activity is less investigated worldwide. Further, anti-cholinesterase activity of leaf of CC is not reported to date. The present study therefore, evaluates the anti-cholinesterase activity of bark and leaf of Ceylon cinnamon *in vitro*.

Freeze dried 95 % ethanolic and 1:1 (v/v) dichloromethane: methanol (DCM:M) extracts of mature bark and leaf of authenticated CC were used in this study. Anti-cholinesterase activity was evaluated using acetylcholine esterase (AChE: 50, 100, 200, 400, 800 µg/ml; n = 4) and butyrylcholine esterase (BChE: bark 6.25, 12.5, 25, 50, 100 µg/ml; n = 4; BChE: leaf 25, 50, 100, 200, 400 µg/ml; n = 4) enzyme inhibitory assays described by Elman *et al,* 1970 with some modifications in 96-well micro plates *in vitro.* Galantamine was used as the reference drug (AChE: 0.39, 0.78, 1.56, 3.12, 6.25, 25 µg/ml; n = 4; BChE: 12.5, 25, 50, 100, 200 µg/ml; n = 4).

Both bark and leaf extracts of CC showed dose dependant AChE and BChE inhibitory activity. However, BChE inhibitory activity is significantly high ($p < 0.05$) compared to AChE inhibitory activity both in bark and leaf extracts. The IC_{50} values of ethanol and DCM:M bark extracts for BChE inhibitory activity were 36.09 ± 0.83 and 26.62 ± 1.66 µg/ml respectively and it is significantly high ($p < 0.05$) compared to the reference drug galantamine (74.80 ± 3.53 µg/ml). The IC_{50} values of ethanol and DCM:M leaf extracts for BChE inhibitory activity were 340.60 ± 18.23 and 261.96 ± 11.56 µg/ml respectively. Both ethanolic and DCM:M extracts of bark and leaf demonstrated significantly low ($p < 0.05$) AChE inhibition compared to the reference drug galantamine (IC_{50}: ethanol bark: 804.88 ± 48.69; DCM:M bark: 966.68 ± 63.18; ethanol leaf: 810.96 ± 79.98; DCM:M leaf: 879.35 ± 68.00; galantamine : 2.52 ± 0.17 µg/ml respectively).

It is concluded that both bark and leaf of CC possess AChE and BChE inhibitory activity and BChE inhibitory activity is more prominent compared to AChE inhibitory activity. Further, anti-cholinesterase activity of bark is high compared to leaf. Properties observed indicate the possibility of using CC in functional foods for prevention and dietary management of Alzheimer's disease. Interestingly, this is the first study to report anti-cholinesterase activity of leaf of any cinnamon species worldwide.

Keywords: Ceylon cinnamon, anti-cholinesterase activity, bark and leaf extracts

gasp@iti.lk Tel: +94 777316563